
ticketmaster
Last 100
Last 80
Last 60
Last 40
Last 30
Last 20
Last 10
SOLD OUT

Transmitter Design 3

The transmitter has an increased surface area due to the slanted base, however still may prove more difficult to attach to a stand in this shape.

Front view of the transmitter. I have included all 8 inputs into this product as this is the maximum amount I am able to insert. All choices customers are able to select are clearly displayed in 'StickaPlus' beside a push button.

Black inserts made of acrylic are fabricated to the back part of the box. The top part is able to lifted on and off to access the circuitry inside easily.

Receiver Design 3

Reset button.

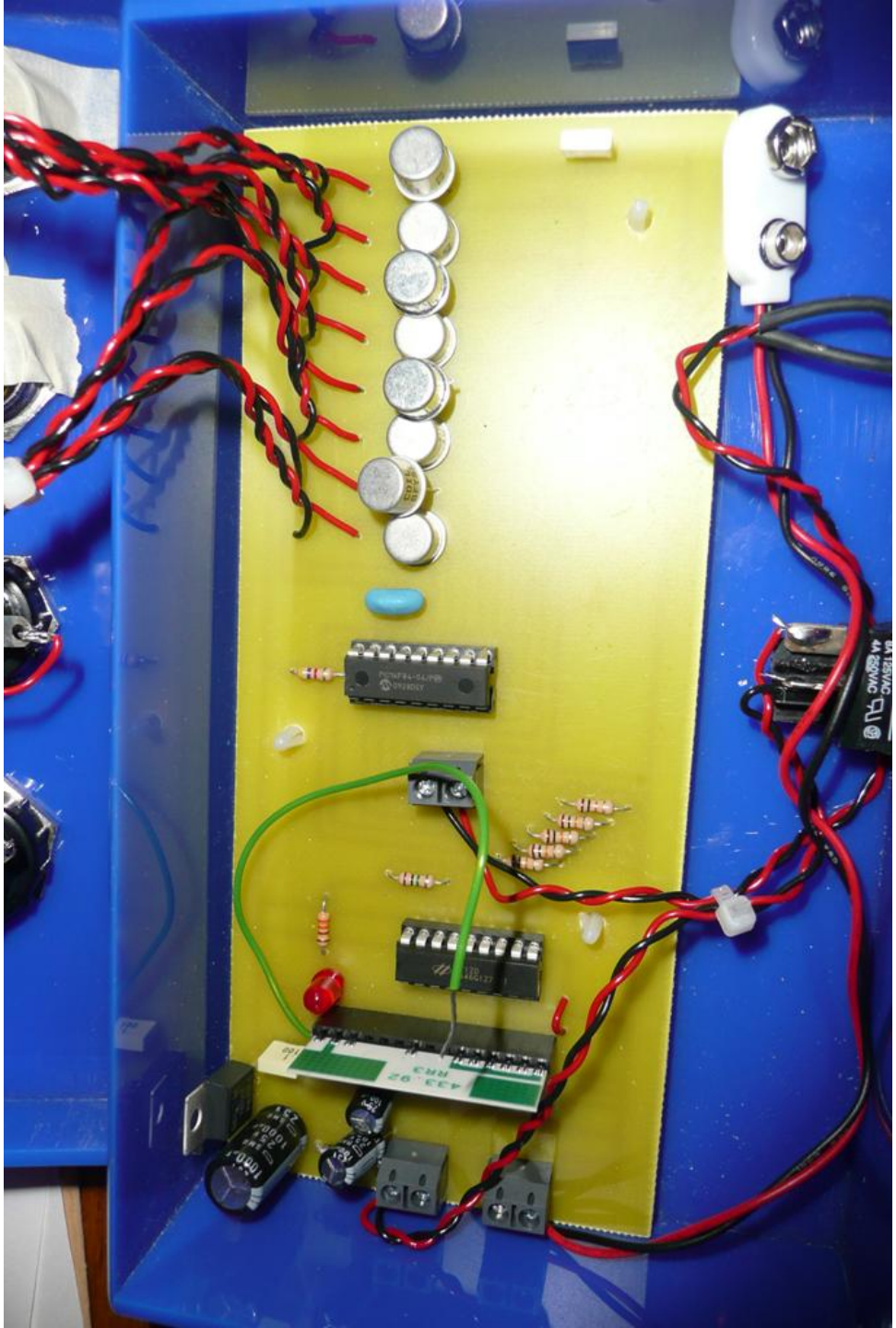
The receiver can be displayed in this postion on a wall for employees to be able to see it from a distance, or flat on it's base. (Right)

LCD screen is used as the output. It will display one of eight choices of McDonalds products.

This aluminium handle is in place to enable easy transportation of the reciever. It is fixed to two pieces of acrylic plastic with sugerglue.

Black inserts to easily open and close the receiver and access the circuitry.

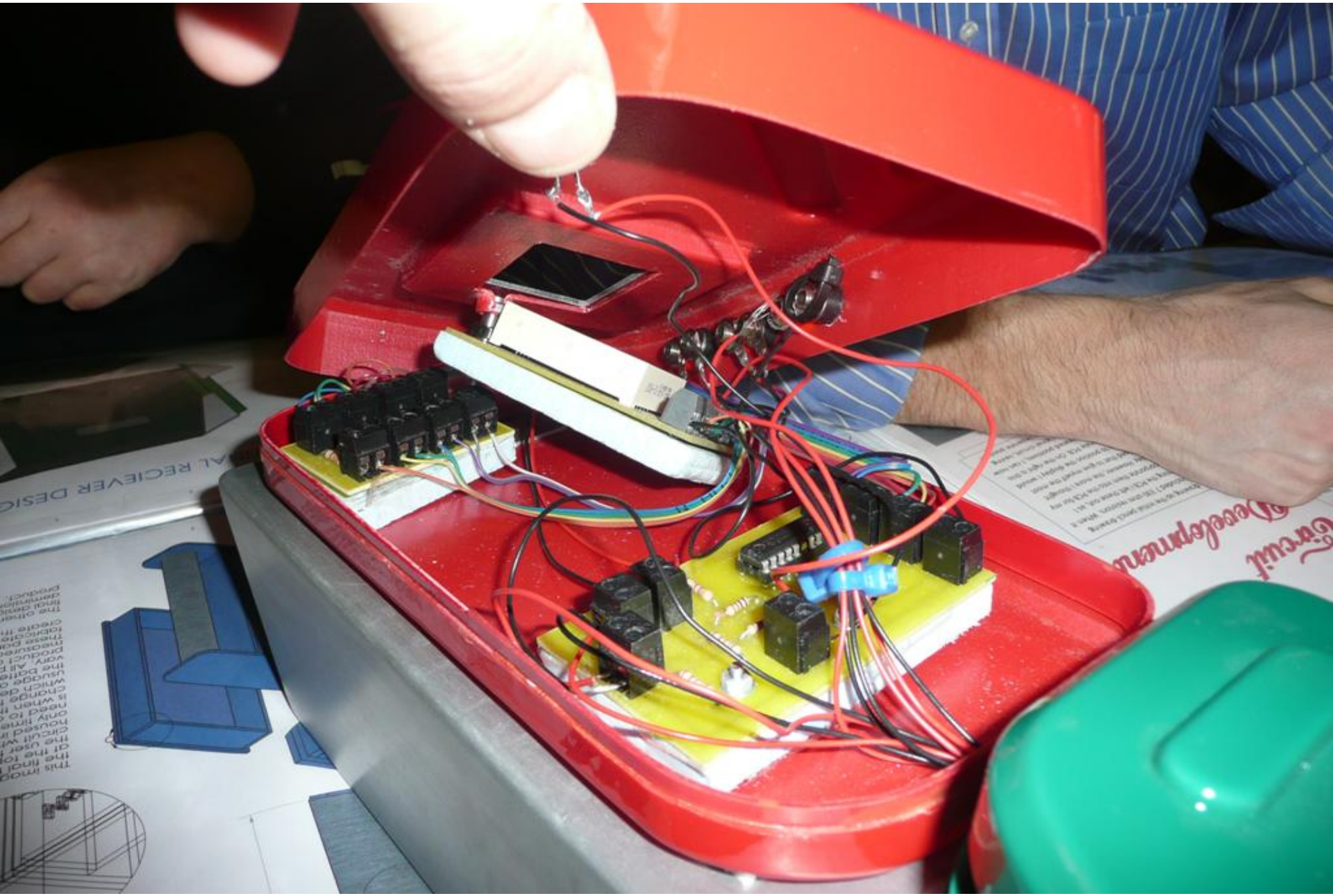
Final Receiver Product Design



David Patterson

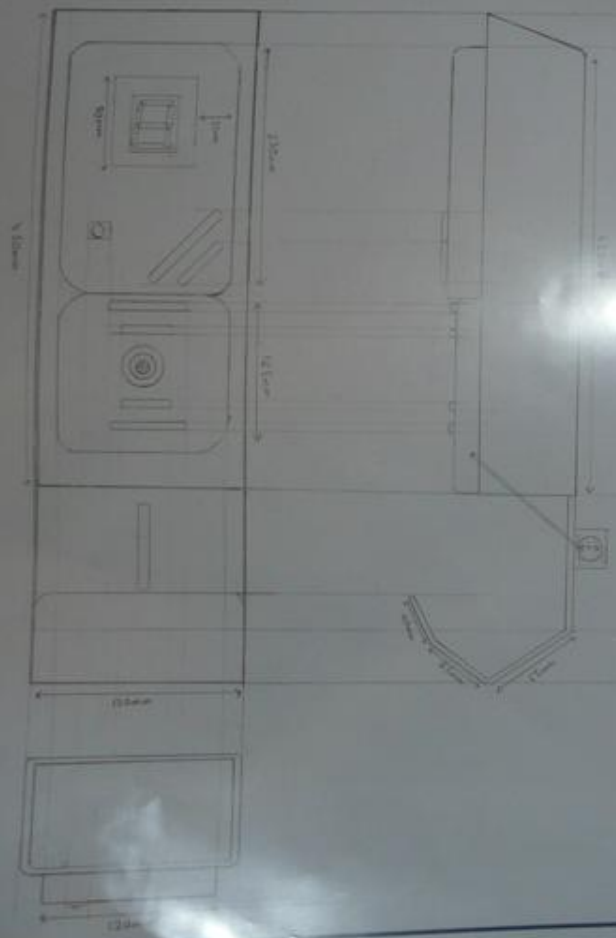
Lurgan College

	PROJECT NO.	1. IDENTIFICATION OF PROBLEM, NEED AND DESIGN SPECIFICATION (6 MARKS)	2. INITIAL IDEAS, SELECTION OF IDEAS FOR DEVELOPMENT (20 MARKS)	3. DEVELOPMENT (20 MARKS)	4. MANUFACTURE (40 MARKS)	5. TESTING AND EVALUATION (~~10~~ MARKS)	
Drill clamp	10	4	16	16	38	11	(85)
	4	3	17	14	24	8	
Ticket master	6	6	16	16	40	6	(85-90)
Light cubes	2	4	16	18	34	12 (10)	(74) 85
MC wedge	8	6	16	17	40	8	(87)
	9	3	15	15	33 (36)	10	(83)
Hospital	7	6	18	20	40	8	(96)



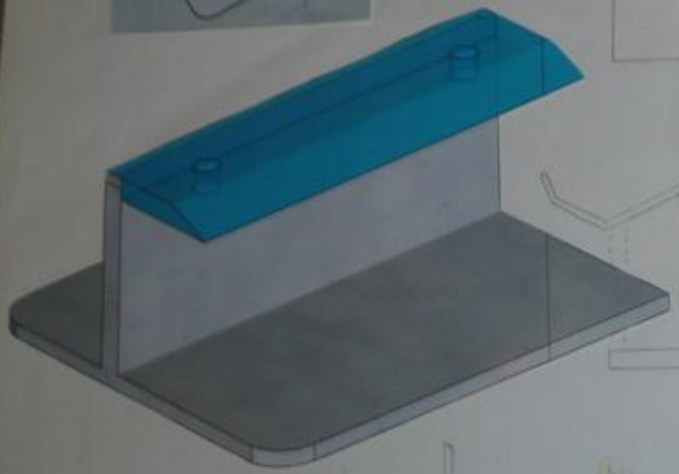

Transmitter Final Design

Working Drawing



Further Modifications

To give the option of a free standing dispenser I would manufacture a base which could be attached to the bottom of the chute. The option of wall mounting could also be integrated so it could be usable as both.



The lever arm switches which serve as inputs to the PIC would be replaced by roller arm switches. These would prevent damage to the arms as the cans roll over them much easier.

The roller arm switches would take the

this hole may require a counter weight or moving this further back

The cam which operates as the dispenser itself could be made larger to control the cans better. Or a flap could be added to ensure the cans come out one at a time and at a certain speed.

The catch area for the cans could be designed to further support the cans and minimalist further any disturbance to cans being dispensed. It could be incorporated into the stand as well.

though to remove it.

when more cans are added.

Evaluation

Here the outcome is critically evaluated against my original specification.

Ergonomics:

- The product will be self supporting, allowing it to be best positioned in an area of most convenience. ✗
- Buttons and switches will be easy and comfortable to operate. ✓
- The counter display will be clear and easy to read. ✓
- Standard vending machines have multiple buttons for multiple products, as this is a sin product dispenser, it will have just one main button. ✓

Function:

- On activation one can will be released at a time. ✓
- The counter must be able to remember the number of cans inside even if the power is disconnected. ✓
- The dispensing action must not be too violent as to shake up the cans. ✓
- The product will hold 5-10 cans at any one time. ✗
- There will be a clear display to show the number of cans held. ✓
- The counter will decrease and increase as cans are added or dispensed. ✓
- The product will not require coins or any tokens for operation. ✓
- It should have a reset switch should the counter number of cans be incorrect. ✓

Materials:

- It is important that the product is durable so circuits should be well encased to prevent damage should cans leak. ✓
- The casings will be strong and durable to give the product a longer lifespan. ✓
- The product will be made from a range of materials but it is important to keep costs down so the estimated cost should not exceed £40-50. ✓

Safety:

- The product should not have any sharp edges so as to prevent injury or damage to any cans held. ✗
- Any sensors/switches used shouldn't be too sensitive as that may release cans unexpectedly onto the floor or cause spillages. ✓
- Any heat produced as a bi-product by the circuit will not affect the components nor m any casings. ✓

Aesthetics:

- The product will be eye catching and attractive to customers. ✓
- The product should be as compact as possible to remain as practical for the owner as possible. ✗

There are a couple of points on my specification which the final outcome does not comply to. The first ergonomic point would be that the product is freestanding but the final outcome developed into a wall mounted dispenser. It could still be positioned in an area of most convenience however.

The dispensing action is perhaps a little more violent than I was hoping to achieve but it has to be taken into consideration the impact cans suffer being dispensed from a standard vending machine.

The product doesn't have any very sharp edges but I think that in the health and safety conscious retail market the general shape may need to be more rounded and soft edged.

The product has remained as compact as possible really, but I would make the front moulds for the circuits even smaller if I could so it would be better looking product.

Overall, I am quite pleased with the final outcome. There are a few changes I would make if I could redesign and remake the product and these follow in further modifications.

Testing

The product is not heavy and would easily be wall secured. The cans fit perfectly into the chute with little excess space and no tight areas. The switches press easily and operation can be performed with one hand.

The LDR on activation switches on the motor and it operates for one complete turn. The cam is a bit too small to hold the can very securely but it still works and the idea would function well.

The can catch area at the bottom works well. It catches It easily and the can doesn't want to fall out the sides. It is still easy to access the can too though to remove it.

When the can is inserted into the top of the chute the upper switch is pushed. The counter counts to 1 as the can goes down the chute. It counts up further when more cans are added.

Unfortunately one of the segments on my 7 segment display has blown but it still works well. The PIC counts up easily and down again when the lower switch is hit.

any damage to the main body.

supplies and soldering the terminals on.

I placed heat shrink on the wires to the motor to tidy them and improve the aesthetics of the product. The heat shrink also keeps the wire tight into the product and prevents excess wire pulling out.

To add another aesthetic feature to my product I added this small aluminium arrow to the top of the chute. I used a hacksaw to cut the shape and wet and dry to tidy up all of the edges.

To tidy up the seal where the wires run between the two moulds I drilled out 2 4mm holes and squeezed in two grommets. They are simple but really effective in keeping it neat.

Modification

To highlight the display and add an eye-catching design feature I added this aluminium insert. This encases the 7 segment display. I had to drill it out using a hand drill to clean out the centre and then file and wet and dry it to claean and smooth the edges.

Modification

I drilled a 13mm hole in the front on the upper mould so a surface mounted switch could be added. Its colour coded and flows well with the product.

Finally I used adhesive pads to fasten on the switches and upper and lower moulds. They were strong enough to hold it easily and then I tested the product to check its functionality.

Product Development

Product Development

I used a nail gun to attach these MDF pieces to serve as guides for the router. The area being removed is where the display will be fitting in.

These are the final MDF moulds, with the 7 segment display slot removed with the router and the extra MDF strips added on. These strip where added using wood glue and where prone to coming off during practice mouldings.

I vacuum formed both the upper and lower moulds and cleaned off excess plastic using the gerbil. This leaves a rough edge however but simply giving it a rub on a sanding board clears it off. Then I glued the HIP strips onto the bottom half of the mould using liquid solvent solution.

Next I fastened in the circuits using 16mm bolts. These go through the protective foam and do not extend far out from the circuit. I carried out a test at this point to make sure the circuits still functioned correctly before wiring them in properly.

Modification

I used much shorter 10mm bolts to attach the motor unit which has gears and a cam attached to scale down the speed. Washers are also used to prevent any damage to the main body.

The power supplies where planned simply to come out the side through small plastic grommets but instead I decided it would be more appropriate to have supplied which can be easily connected and disconnected. This involved drilling larger holes and arranging spacing more closely due to the space required for these terminals all the power supplies have to be run from the upper mould. This meant running wires down into the bottom mould from the power supplies and soldering the terminals on.

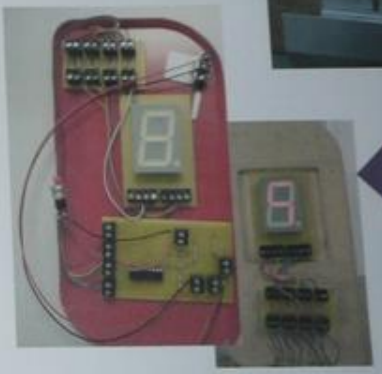
To tidy up the seal where the wires run between the

Product Development

The main body which will hold the cans was the first piece to be manufactures. I shaped it and wet and dried the edges to take away sharpness.

Using a line bender I made these folds in another piece of aluminium to form the can release area. Then I used pop rivets to attach them to the main chute.

I glued together sections of MDF and these formed the basic mould for my circuit housing. I then marked out the shape I wanted them and created it using both a tenon saw and the band facer. The router has been used on the lower mould to create a smoother shape as well. This is also done on the top mould.



Once the moulds had been shaped I then split them and vacuum formed the bottom sections. This allowed me to prepare a wiring diagram and arrange my circuits in the best way, utilising the space.

Next I drilled holes into the back of the bottom sections of the moulds. To do this I used a forstner drill bit with the pedestal drill. This allows the mould to sit flat onto the chute.

I then marked out a hole in the centre of the lower mould. Using a pedestal drill and forstner bit I was again able to drill in to allow the LDR to sit flush with the front fascia. I also marked out accurately areas to be removed with the milling machine.

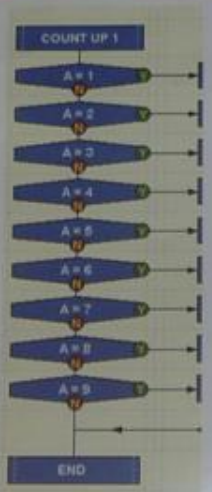
Modification

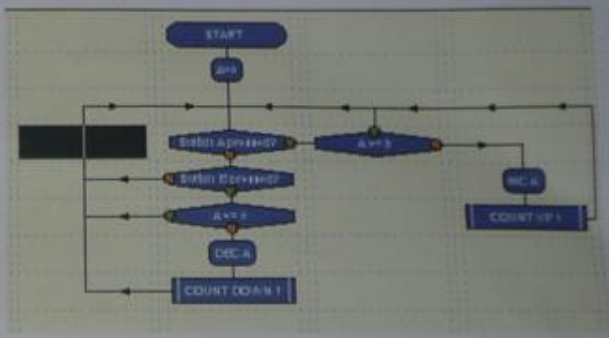
I did some practice attempts with the milling machine to remove the slots designed onto the lower mould and they weren't very successful. I decided that instead of wasting time I would build them onto my mould. This has other benefits as well as the vacuum former would have found it difficult to completely and accurately fill these sunken

13.

This is my rough plan for what I wanted my program to do. It needs to count up and down on two different switches. It requires a macro command to run both count up and count down programs. It uses a digital command to decide which macro to use.

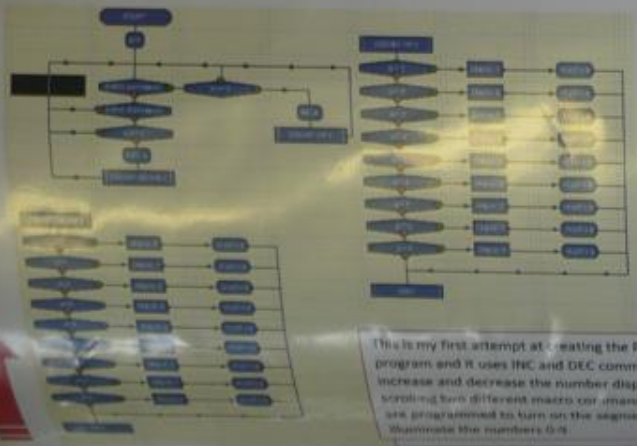
15.





By adding into the program another digital box which recognizes if A which is the variable is equal to 9 or equal to 0 the counter is unable to count down further from 0 or up from 9 and remains at that amount until the reset switch is hit.

14.

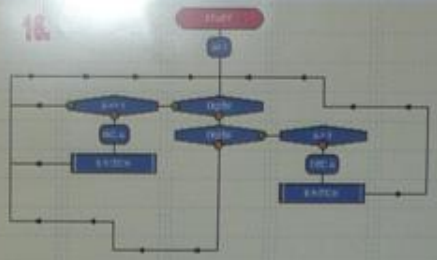


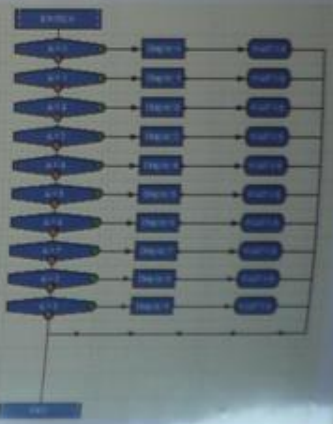
This is my first attempt at creating the PIC counting program and it uses INC and DEC commands to increase and decrease the number displayed by scrolling turn different macro commands. The outputs are programmed to turn on the segments necessary to illuminate the numbers 0-9.

What does the programme need to do?

- Count up and down between 0-9 upon the operation of two separate switches.
- Be able to be reset if the can count is wrong

16.



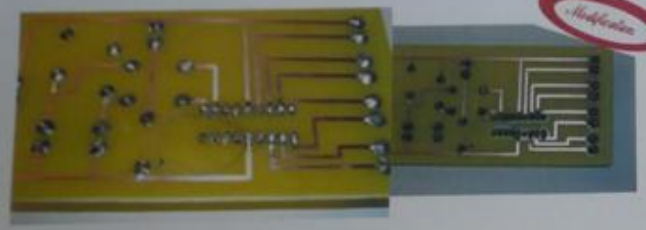


Through experimentation I found that the programme could count up and down using the same macro which allowed a significant cut in the size of the size of the program.

Circuit Development

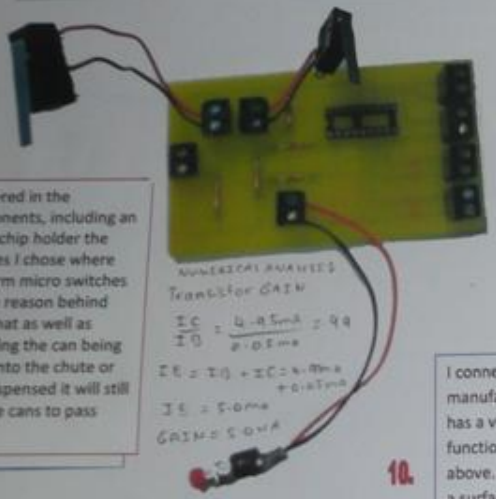
Circuit Development

8.

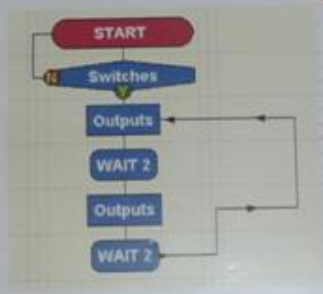


When I first made this part of my circuit for the PIC counter I encountered a problem. The reset did not transfer from the acetate to the PCB which meant the circuit would not function properly. I decided that while I was fixing this, to compact my circuit further, to make it less restrictive when it comes to creating the moulds.

9.



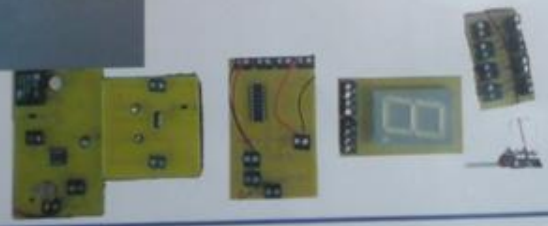
I soldered in the components, including an 18 pin chip holder the switches I chose where lever arm micro switches and the reason behind this is that as well as registering the can being placed into the chute or being dispensed it will still allow the cans to pass freely.



10.

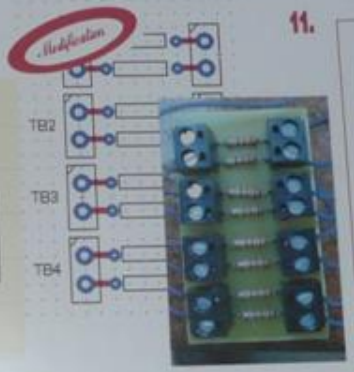
I connected up the PIC PCB to a voltage regulator I manufactured and a seven segment [illegible]. At this stage it has a very basic programme [illegible] and it functioned perfectly. The test pro[illegible] above. By this stage I had changed [illegible] to a surface mounted one to make it [illegible] appealing.

The next step was to wire up all of the circuits and arrange them to take measurements for moulds.

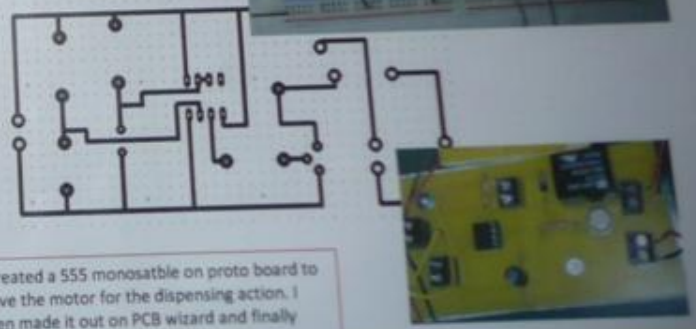


11.

When I was drawing up the initial pencil drawing for my PCB I included 7 330 ohm resistors. When it came to designing the PCB I left these out, as I intended to incorporate them into the PCB for my 7 segment display. However, the more I thought about this, I realised that to give myself the most flexibility for where to position the display I would have to design a separate PCB. On the right is this PCB and it has actually created positives. I can now position this on top of my original circuit, saving space, or even in an altogether separate position



12.



I created a 555 monosatble on proto board to drive the motor for the dispensing action. I then made it out on PCB wizard and finally onto PCB.

Circuit Development

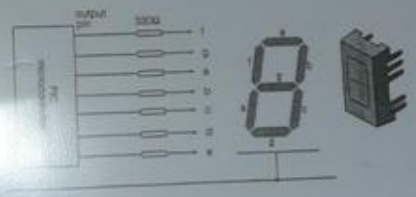
I made the decision to use the PIC counter circuit as it would be most effective especially with the switch inputs as the main body of the product will be dark and LDR's would not have been as effective.

1.

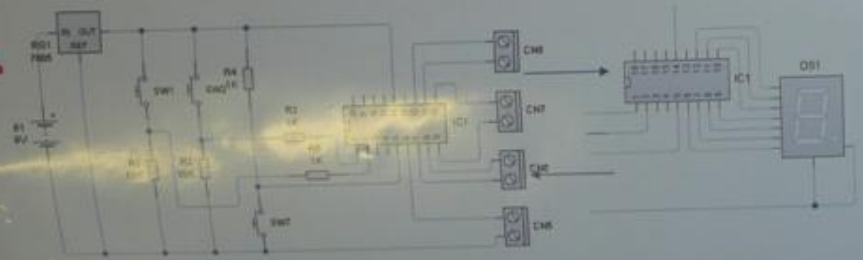
This is the original concept drawing of what my PIC counter circuit is like. I have at this point included the 7 segment display to illustrate the output.

2.

I then built the circuit onto protoboard. It was not the most difficult circuit to get working, although the program was quite difficult to create and get functioning. Here the 7 segment display is already on PCB as is my voltage regulator, required to prevent the PIC from being damaged.

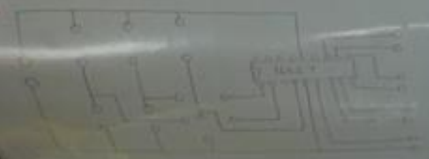


3.



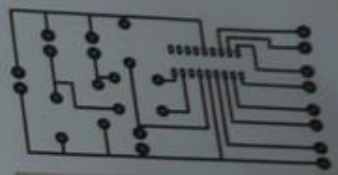
On the left is the livewire rendering of the PIC counter. I had the option of using terminal blocks for the Display or connecting it directly on the PCB. To allow greater flexibility in poisoning my display I chose terminal blocks. This way the main PIC does not have to be right beside the display.

4.

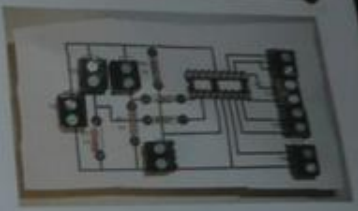


The Drawing shown is a sketch of my PCB layout, just to give myself a rough guide as to how it would be structured. Here I added in terminal blocks instead of running directly to the output. I have already decided to use the 16f27 PIC as it is best suited to the counting process.

5. This is the final PCB design, although, it took one or two minor adjustments before it got to this stage, which can be seen below.



6. Here, just to double check that the components would all fit onto the PCB with ease, and avoid wasting material I slotted them onto a paper printout of my PCB. It's an easy way to check connections are all in place as well.



7. Here the functioning proto board and voltage regulator can be seen alongside the PCB which is ready to be drilled. The reset is visibly connected on the acetate but not on the PCB however. I didn't realise this until I was drilling the component holes although it was not a difficult fix as it was simply a matter of remaking the PCB.

Numerical Analysis

OHM'S LAW CALCULATION

PEPSI

Plan of manufacture

The circuits will be manufactured first as they will be crucial in determining the size and arrangement of the moulds and it would be more complicated to go back and create circuits that fit.

Circuit

1. Draw in rough plans for the circuits, starting with the PIC counter and then 555 monosatble.
2. Draw a rough programme for the PIC which will enable it to count.
3. On proto board create a PIC counter and a separate 555 monostable.
4. Draw these up on livewire.
5. Make a PCB plan diagram.
6. Design the circuits on PCB wizard, also creating a voltage regulator and 7 segment display circuit.
7. Print out the circuits onto acetate and manufacture them in the acid baths.
8. Drill out the component holes to either 0.8 or 1.2 mm depending on the component.
9. Solder in the components.
10. Create PIC program to count up and down and programme it on using a PIC programmer.
11. Test circuits.

Product

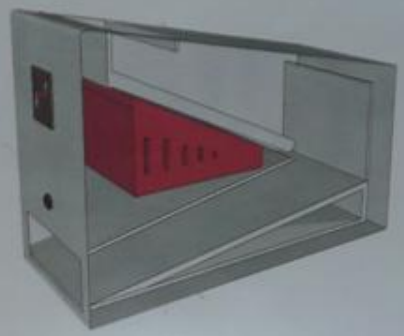
1. Manufacture the chute for the can from sheet aluminium. It will be sized to hold 5-10 cans.
2. Bend another piece of aluminium to form the bottom catchments area for the can and cut a slot in this for the cam to fit through.
3. Pop rivet the chute to the can release area.
4. Wet and dry the edges and main body to remove sharp corners and edges and improve aesthetic appeal.
5. Create two moulds by gluing MDF sheets together with paper in-between to allow separation. . These will be vacuum formed to create housings for the circuits.
6. Mark onto the moulds the curved edges and round them using the band facer. Router the edges of both moulds to allow for easier vacuum forming.
7. Place circuits onto bottom moulds and decide on their arrangement using a wiring diagram. Then drill out holes which will countersink the screws into the moulds.
8. Drill out a whole in the bottom mould using a forstner drill bit. This will countersink the LDR into the mould.
9. Vacuum form the moulds and remove excess plastic using the gerbil.
10. Using liquid solvent cement attach strips on HIP to provide a lip to hold both sections of the mould together.
11. Drill out the holes for the circuits and then attach them using 16mm bolts.
12. Drill holes in the chute for the switches to fit through to count the cans and also in the top mould for the reset switch.
13. Drill holes for the motor to attach onto the back of the aluminium body.
14. Drill out 6 8mm holes in the top mould for power supply terminals.
15. Drill 3 more holes for wires to run between the moulds and out to the motor.
16. Drill another whole in the front fascia for the 7 segment display to attach to.
17. Attach the moulds to the chute using adhesive pads or bolts of they are not strong enough.

PEPSI

Selection of idea for development

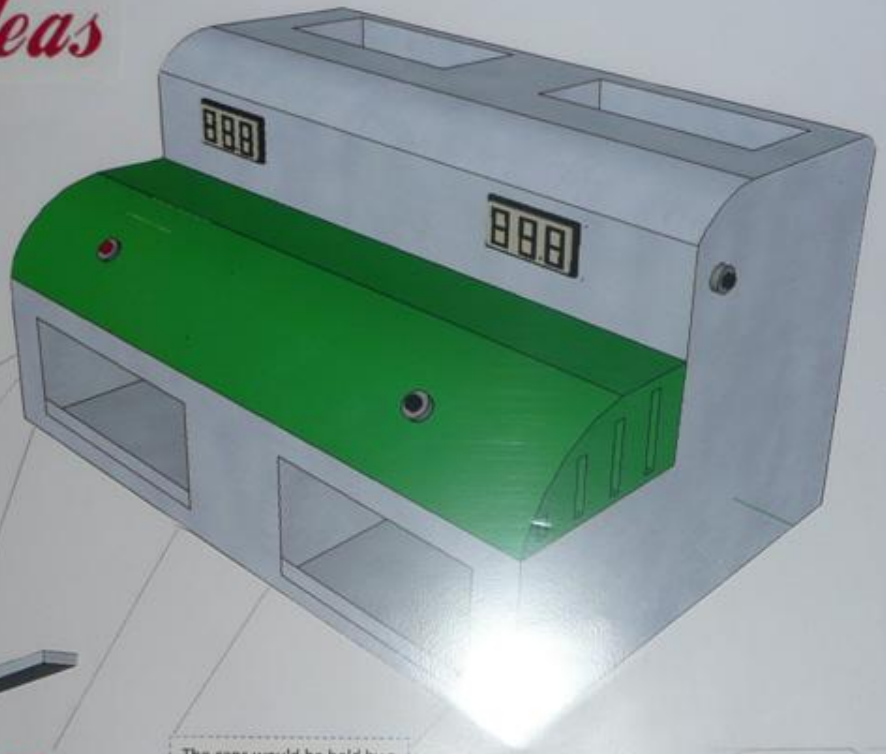
I have created these 3 potentially viable solutions but now I have to select one for development.

Idea 1 is my chosen idea for development as it has good scope for development as well as being the most practical and economic with materials.

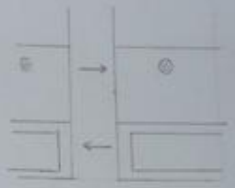
Assessment Criteria	Idea one	Idea two	Idea three
			
Aesthetics	Aesthetically this product is appealing as it features subtle designs which highlight the functioning components such as the strips running parallel to the LDR. These help to emphasise it as does the aluminium cover around the display.	Idea number 2 does not have the same slim line chute of idea 1 but it still has some good aesthetic features. The polished aluminium body would look great but it perhaps looks too industrial to appeal to the target market. The integrated mould keeps the shape compacted too.	Idea 3 is also mainly aluminium and vacuum formed HIP moulds but these could be reworked to incorporate acrylic pieces or sections. This would make it aesthetically better as it has quite a wide body and has chucky pieces. Its large fascias though would provide advertising space.
Ergonomics	Ergonomically this product is effective. It doesn't require being held by the user and the LDR is easy to operate. It is possible to use this product with one hand making it fit in well to a quick environment of beside or behind a till.	Idea 2 is quite large and would be awkward to move from one location to the next which may be problematic for retailers but it is little wider than a can which makes it better for fitting into tighter spaces. The circuitry would be hard to access if maintenance was required however	Its wide body makes it difficult to transport and it would be heavy being made from such a large amount of aluminium. The switches are again operable by one hand but the can may not be easily accessible through the small front slot.
Features	This concept has the option of wall attachment and this saves worktop/counter space which is a benefit. The area located below for catching the cans is a useful feature as well as it allows very easy access whilst still providing support for the can.	The mould housing the circuitry being incorporated into the main shape means that it remains thin and the diagonal chute allows for the storage of up to 12 cans making it more comparable to some existing solutions and also prevents the contents of the can being excessively disturbed.	The possible feature that this concept could split would make it an altogether different product to the area required to store it [illegible] ear to read [illegible]
Evaluation	This is a strong concept and it fulfils the majority of the criteria set in my specification. However it is difficult to see where a motor could be discreetly attached to the chute for the dispensing action. Overall however it outweighs any negatives and it has plenty of scope for development	This is also quite a strong concept but would require a large amount of aluminium which would not be economically viable as keeping the costs down is a crucial element. For this reason I will not be developing this product further.	Idea 3 is not as [illegible] as idea 1 or 2 but it still has large scope for development. It doesn't follow my specification as closely as the other concepts and like idea 2 it also would require a large amount of aluminium so in both the chutes [illegible]

Initial Ideas

There are two separate can chutes in this piece allowing more cans to be dispensed or for brand names to be split. The two LCD displays are used to denote the number of cans in each chute. Aluminium or acrylic would be used in the manufacture of the base and a HIP mould would case the circuits.

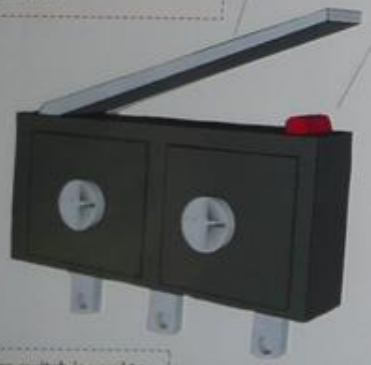


To remove any sharpened edges and aesthetically improve the product the front mould housing the circuits is rounded to blend in to the shape of the aluminium base.

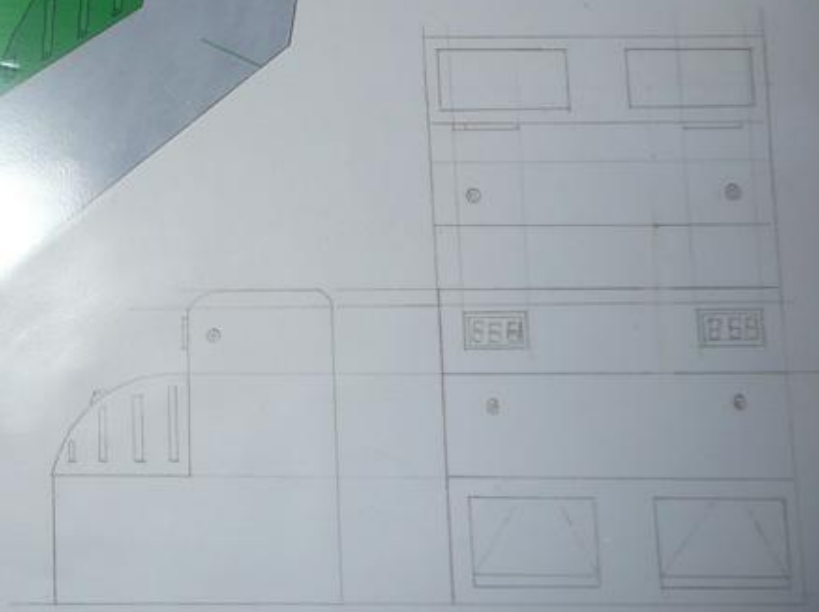


The Product could be made to split into two halves to create two separate dispensers. This would however require two power supplies but it would make the area required to place the dispenser smaller. This dispenser is designed for counter use and not for wall mounting.

The switched are colour coded and here PTM switched have been used. However LDR's or photo transistors would also work sufficiently. The switches located on the sides are the reset switches for both displays.



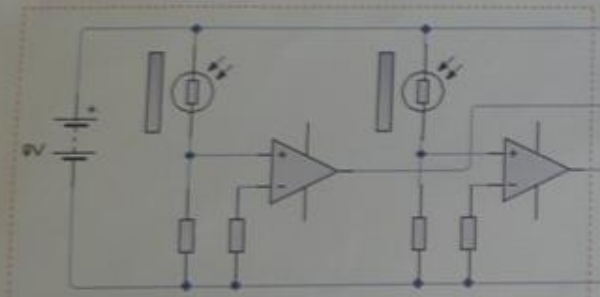
The cans would be held by a cam further up inside the chute which would rotate upon the operation of the switches. A 555 timer would be used to control this.

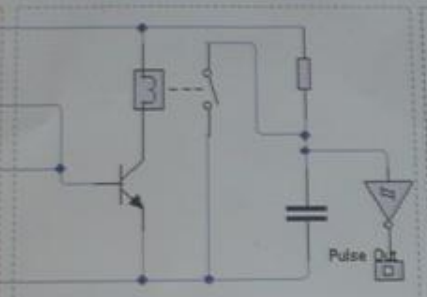


A lever arm micro-switch is used to count the cans and it would be fitted one at the top and one at the bottom of the dispensing chute.

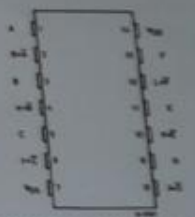
Concept Circuit

This concept circuit is has an LCD display instead of the 7 segment used in the other concepts. I doubt I would need the three separate numbers but for double figures it may prove useful.



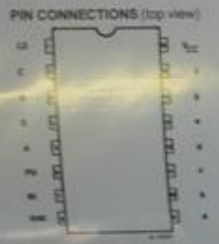


The transistor is set up with a SPST relay which switches when the transistor opens. The relay then sends an unclean pulse to the 40106 SCHMITT TRIGGER. This is used to de-bounce the pulse and make it clearer for the 4510B counting chip to read.

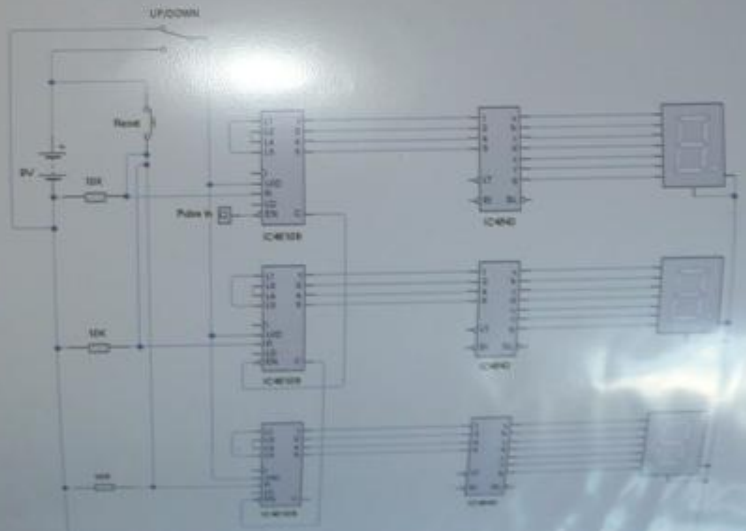


Schmitt Trigger Date

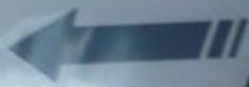
The input to the system is by two LDRs set up in an OR arrangement. Each LDR is connected to an op amp comparator which amplifies the pulse from each one so that the voltage is large enough to trigger a transistor



LCD Driver 4543



- The pulse generated from the INPUT provides count input for 45108 chip.
- Then the 4543 DECODER chip translates binary connected up to OUTPUT pins of 4543 chip.

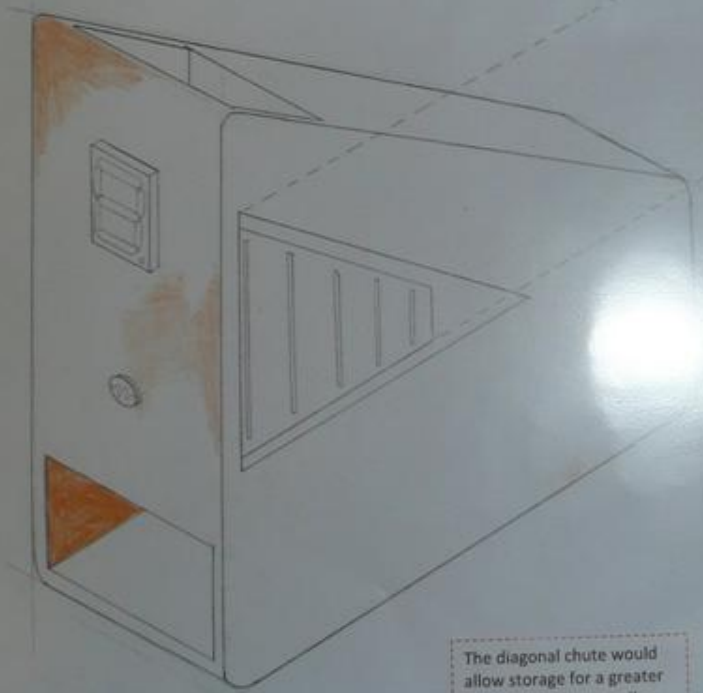


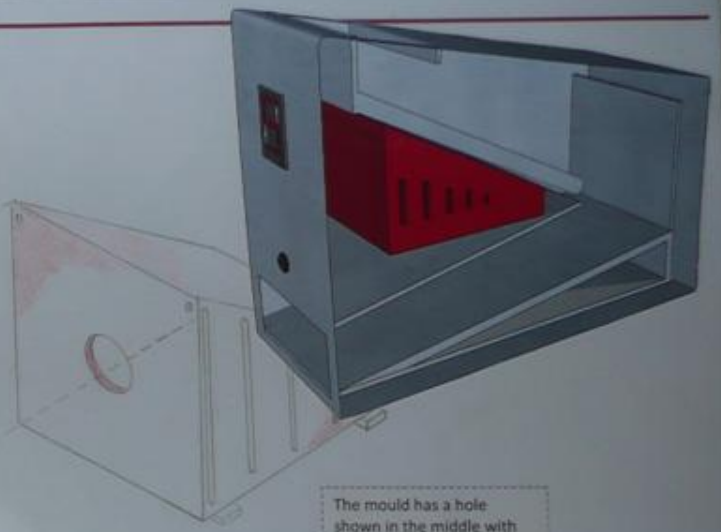
To remove any sharpened

Initial Ideas

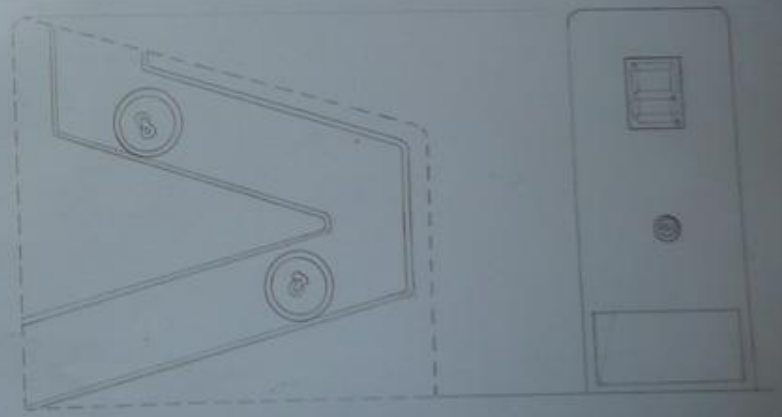
The 7 segment display illuminates the number of cans held in the chute and it's inputted by two switches. An LCD display could be used alternatively if the chute holds larger amounts of cans.

The main chute is manufactured from sheet aluminium and is designed as free standing on a counter top. There is an open section in the middle and here a mould is housed for the circuitry. The LDR is front mounted for easy access to customers. There are two slots for the cans, one located on the top of the product and one at the bottom of the front panel for the removal of the cans.





The mould has a hole shown in the middle with the purpose of running wires out from here to the LDR, switches and the 7 segment display. The most appropriate method of joining this to the main body would be by pop rivet.



The diagonal chute would allow storage for a greater number of cans as well as reducing the effect of the dispensing action on the contents of the can. It would be best suited to be made from aluminium, to keep weight down.

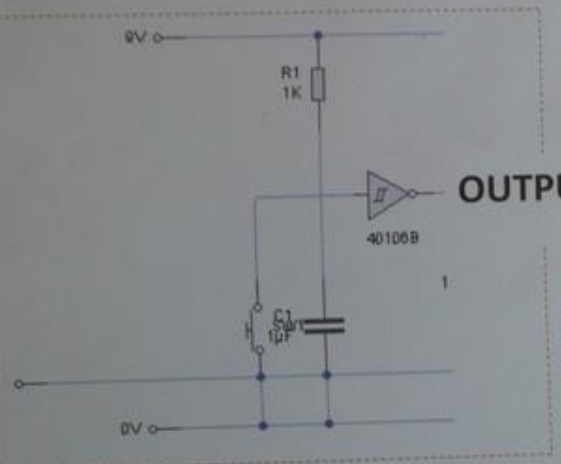
Here an LDR is used again but a PTM switch or phototransistor could be used alternatively as the main input for the motor.

Concept Circuit

This circuit features three chips and runs to a seven segment display. This could also be adapted to run an LCD display as well however if the can count is too large.

4510B pin connections

4511B pin connections

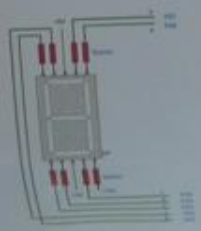


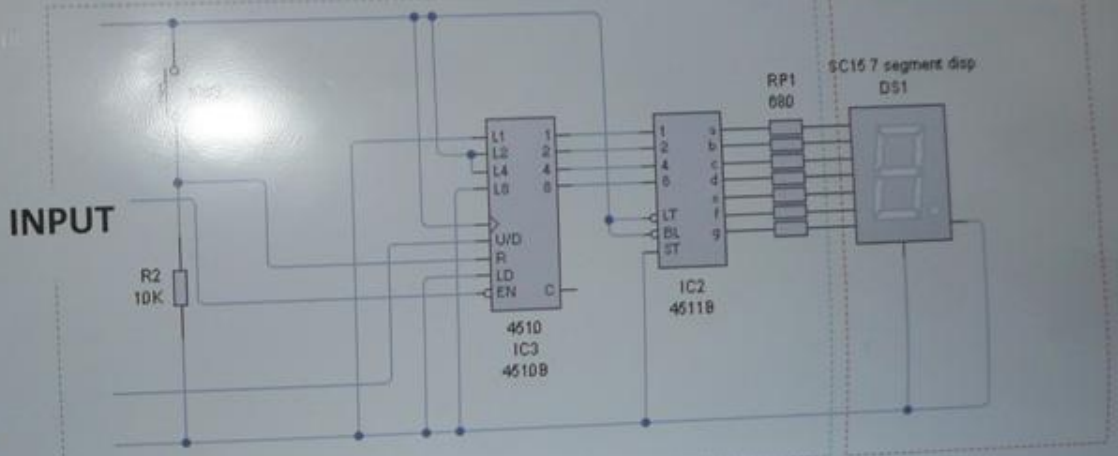
The 40106B generates a pulse each time the switch is pressed. The power supply required is 9V so a voltage regulator would not be required here. This is also known as the Hex Schmitt Trigger.

Time constant = R x C

R = Resistance in Ohms (Ω)

C = Capacitance in Farads (F)





The 4510 (counter chip) and the 4511 (decoder chip) act together to generate the correct pulses that are needed to drive the output. This is controlled by the input 40106B chip. SW2 which is shown here serves as a reset switch for the

The output used is a SC15 seven segment display and if necessary multiplexing pulses could be used to increase the can count.

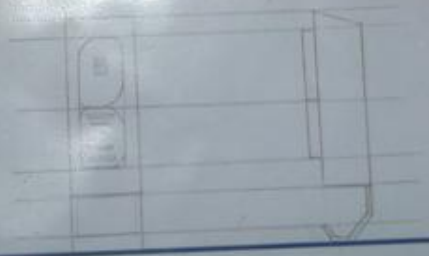
Initial Ideas

The casing for the circuits are vacuum formed in HIP and house the input switches and display outputs. As an aesthetic feature the edges are swooping and rounded to broaden customer appeal and an aluminium insert is added to emphasize the display

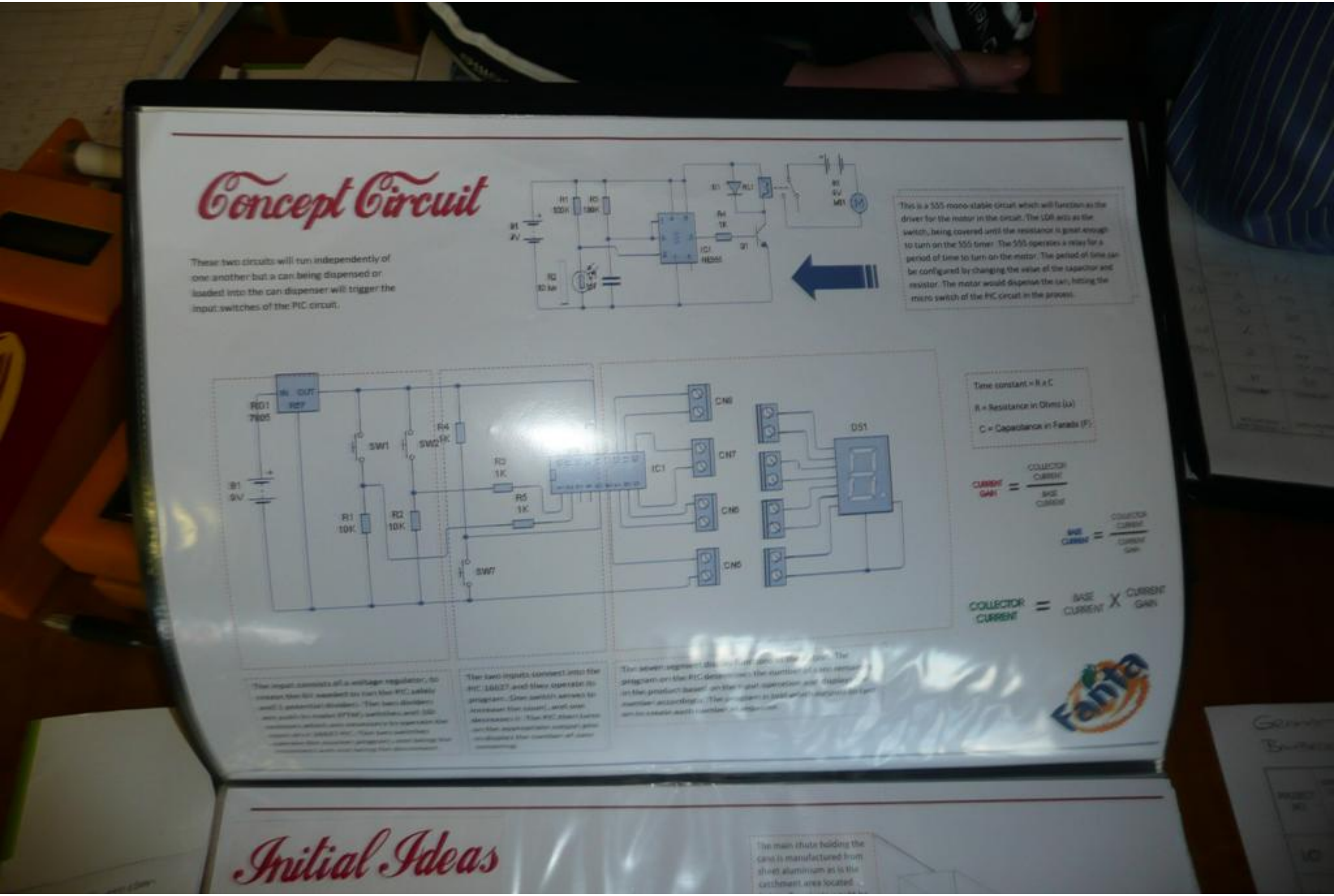
The edges are rounded to ensure safety for children and general usage as well as reducing the risk of damage to the cans. Aesthetically this is more appealing to the potential customer as well.

The LDR is inset into the bottom mould, protecting it from damage and also improving it ergonomically as it becomes easier to

The main chute holding the cans is manufactured from sheet aluminium as is the catchment area located below. Pop rivets would be the most viable solution for securing together these pieces.



A separate motor is needed for the dispensing action and this is attached onto the back. This motor has a cam attached and the motor speed is controlled by gears on the shaft being driven.


Concept Circuit
These two circuits will run independently of one another but a can being dispensed or loaded into the can dispenser will trigger the input switches of the PIC circuit.
This is a 555 mono-stable circuit which will function as the driver for the motor in the circuit. The LDR acts as the switch, being covered until the resistance is great enough to turn on the 555 timer. The 555 operates a relay for a period of time to turn on the motor. The period of time can be configured by changing the value of the capacitor and resistor. The motor would dispense the can, hitting the micro switch of the PIC circuit in the process.
RD1
7805
IN
OUT
REF
SW1
SW2
R4
1K
R3
1K
R5
1K
R1
10K
R2
10K
B1
9V
IC1
SW7
CN8
CN7
CN6
CN5
DS1
Time constant = R x C
R = Resistance in Ohms (Ω)
C = Capacitance in Farads (F)
CURRENT GAIN = COLLECTOR CURRENT / BASE CURRENT
BASE CURRENT = COLLECTOR CURRENT / CURRENT GAIN
COLLECTOR CURRENT = BASE CURRENT X CURRENT GAIN
Fanta
Initial Ideas

Specification

Ergonomics:

- The product will be self supporting, allowing it to be best positioned in an area of most convenience.
- Buttons and switches will be easy and comfortable to operate.
- The counter display will be clear and easy to read.
- Standard vending machines have multiple buttons for multiple products, as this is a single product dispenser, it will have just one main button.

Function:

- On activation one can will be released at a time.
- The counter must be able to remember the number of cans inside even if the power is disconnected.
- The dispensing action must not be too violent as to shake up the cans.
- The product will hold 5-10 cans at any one time
- There will be a clear display to show the number of cans held.
- The counter will decrease and increase as cans are added or dispensed.
- The product will not require coins or any tokens for operation
- It should have a reset switch should the counter number of cans be incorrect.

Materials:

- It is important that the product is durable so circuits should be well encased to prevent damage should cans leak.
- The casings will be strong and durable to give the product a longer lifespan.
- The product will be made from a range of materials but it is important to keep costs down so the estimated cost should not exceed £40-50.

Safety:

- The product should not have any sharp edges so as to prevent injury or damage to any cans it
- Any sensors/switches used shouldn't be too sensitive as that may release cans unexpectedly onto the floor or cause spillages.
- Any heat produced as a bi-product by the c will not affect the components nor melt any casings.

Aesthetics:

- The product will be eye catching and attractive to customers.
- The product should be as compact as possible to remain as practical for the owner as possible.

Existing Sollutions

This vintage style vending machine dispenses cans on the command of push buttons. It holds and chills up to 12 cans utilising a self contained refrigeration unit. Its made exclusively from acrylic plastic and stands approximately 500mm tall. It features a handle for opening the front face to replace stock. Aesthetically it assumes the colours of a well known brand to further attract customers. It retails at around 100 USD or around £65.

- Capacity: 12 cans
- Dimensions (cm): 35x35x50
- Weight: 9.98kg

This dispenser is called the FR5 and has a 12 can capacity. It operates off mains power supply and is designed primarily for domestic use. It incorporates 4 shelves which release cans when the corresponding button is pressed. It has a carry handle incorporated in for transportation and also comes with an in car adapter to facilitate use when travelling. It retails at 90 USD or £60 in the UK.

- Capacity: 12 cans
- Dimensions (cm): 54x39x20
- Weight: 7kg

This is an easily identifiable product, the vending machine. This particular model is for dispensing drinks and can hold multiple brands of product. All are easily visible through the glass screen and have a code which can be entered into a keypad for selection. It has proved such a popular concept that other products such as umbrellas and shoes can also be purchased from vending machines. They have room for advertising on the sides and have become a powerful marketing tool.

Capacity: 30-45 cans or 500ml bottles
Dimensions (cm) : 183x106.7x813
Weight: 283kg

Problem Identification

In modern shops or retail units there is a large amount of stock to keep track of. Often Shop keepers spend entire days performing stock checks and this uses up valuable time. Modern Vending machines dispense products to customers in a self service environment but these too have no visible display as to the amount of stock which it holds. This requires more stock taking.

Need: For a machine which dispenses cans and clearly displays the number inside, increasing and decreasing as cans are added and removed.

With the current financial climate drinks companies are fighting for their share in an ever growing market. Asides the best tasting product, aesthetics are hugely important to these companies and they have to make retail units the most attractive as possible to try and provoke that all important sale. Companies invest millions in the latest design solutions to sell more of their product, as many are located near or behind tills. Many customers rarely know what they want before they enter the shop so displays have to be appealing to sell more of the drinks to impulse buyers.

Design Brief

To design and manufacture a machine which dispenses cans and displays the total number of cans held at any one time.

Facts to consider

- It must be taken into consideration that this product will be on display in a shop, behind the counter and visible to customers.
- Will it most likely hold a single brand of tinned product?
- The cans cannot be damaged in the process.
- What size will the product be?
- Will the product be moveable? And how will it be powered?
- How many drinks will it be able to hold?

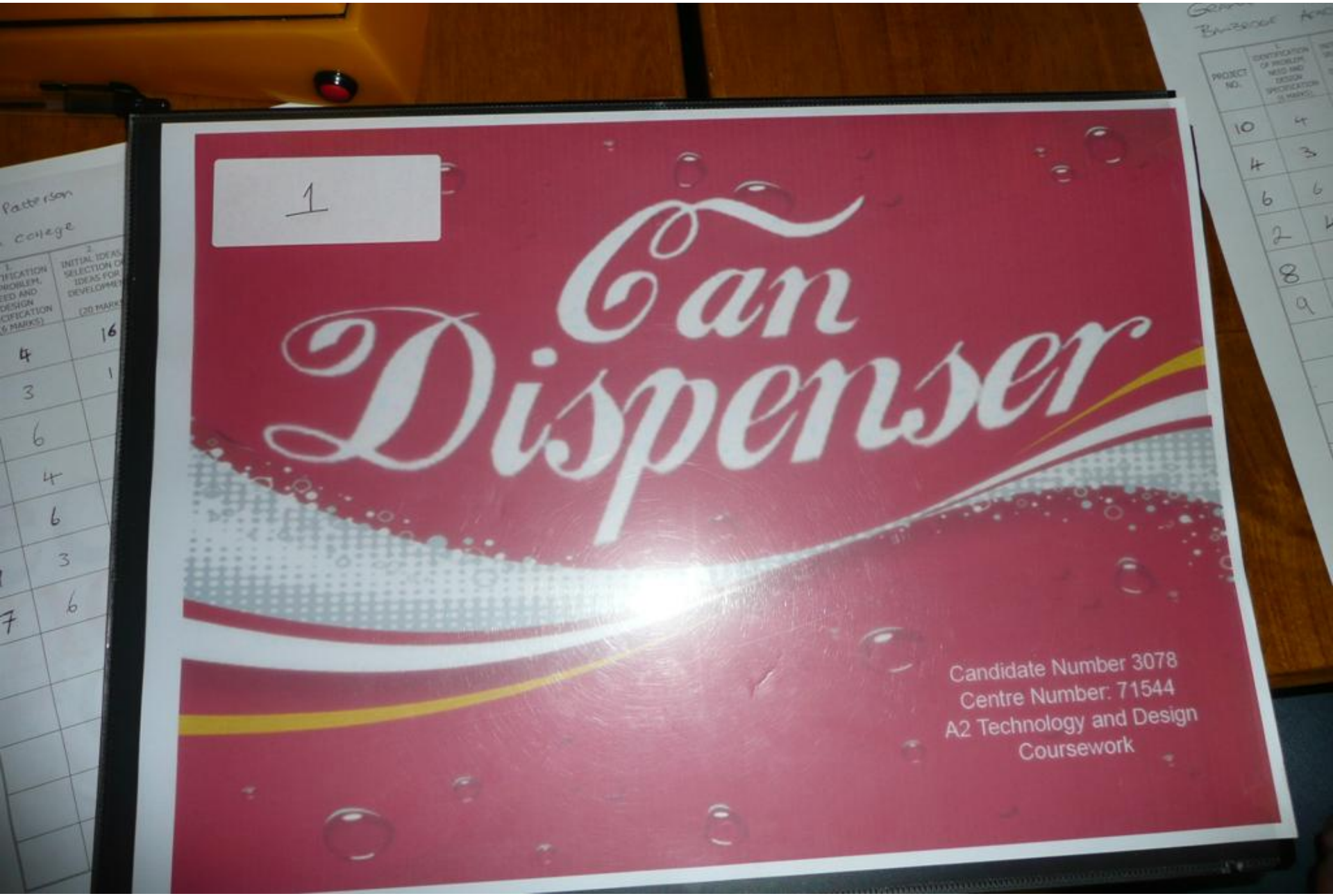
INPUT
Customer requests product

PROCESS
Can dispensed by machine and Counter decreases

OUTPUT
Customer receives product

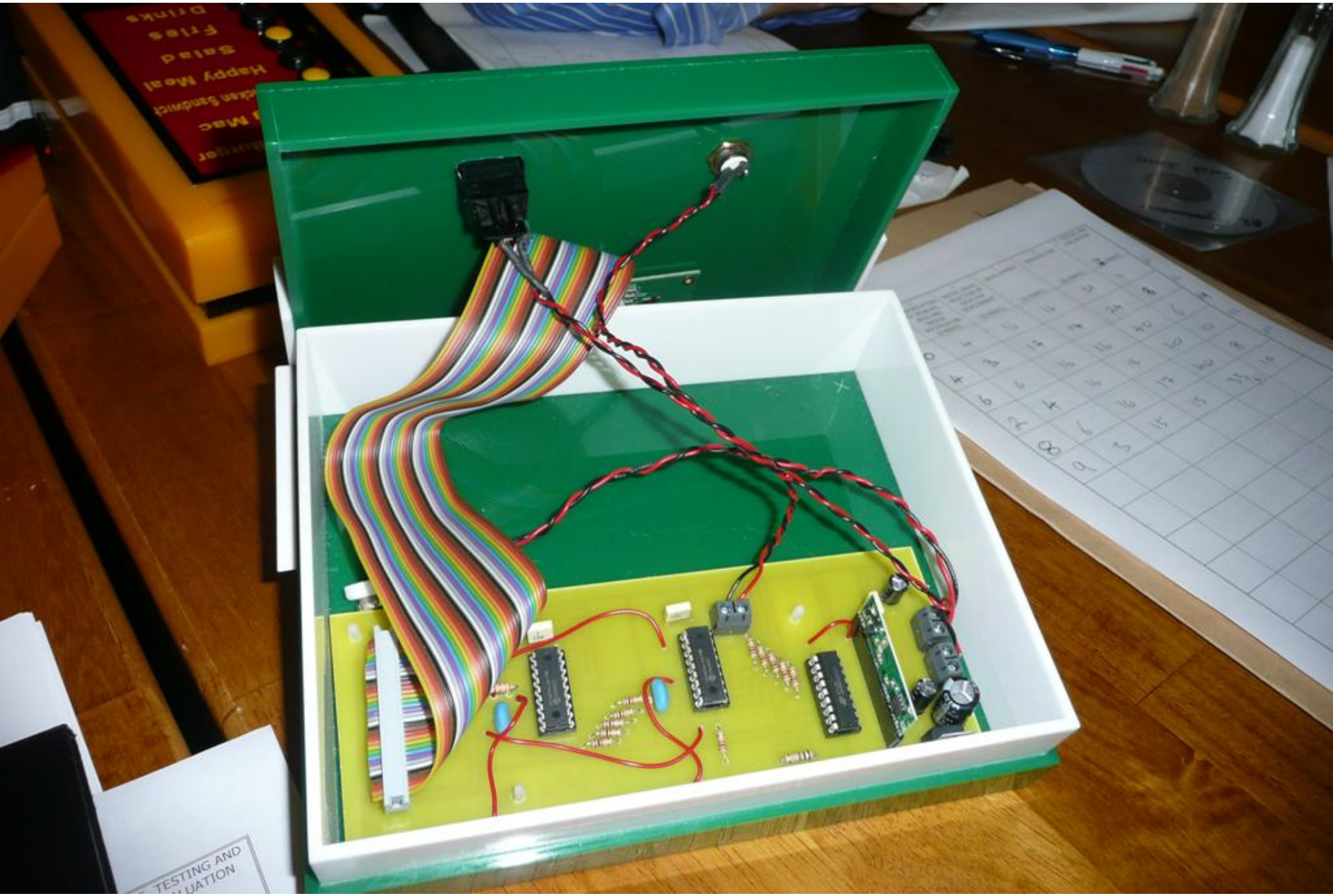
Specification

Existing Sollutions


1
Can Dispenser
Candidate Number 3078
Centre Number: 71544
A2 Technology and Design
Coursework

	PROJECT NO.	1. IDENTIFICATION OF PROBLEM, NEED AND DESIGN SPECIFICATION (6 MARKS)	2. INITIAL IDEAS, SELECTION OF IDEAS FOR DEVELOPMENT (20 MARKS)	3. DEVELOPMENT (20 MARKS)	4. MANUFACTURE (40 MARKS)	5. TESTING AND EVALUATION (10 MARKS)	
Drill clamp	10	4	16	16	38	11	(85)
	4	3	17	14	24	8	
Ticket master	6	6	16	16	40	6	(85-90)
Light crabs	2	4	16	18	34	12 (10)	74 (85)
mc wedge	8	6	16	17	40	8	(87)
	9	3	15	15	33 (36)	10	(83)
Hospital	7	6	18	20	40	8	(96)

	PROJECT NO.	1. IDENTIFICATION OF PROBLEM, NEED AND DESIGN SPECIFICATION (6 MARKS)	2. INITIAL IDEAS, SELECTION OF IDEAS FOR DEVELOPMENT (20 MARKS)	3. DEVELOPMENT (20 MARKS)	4. MANUFACTURE (40 MARKS)	5. TESTING AND EVALUATION (10 MARKS)	
Drill clamp	10	4	16	16	38	11	(85)
	4	3	17	14	24	8	
Ticket master	6	6	16	16	40	6	(85-90)
Light cubes	2	4	16	18	34	12 (10)	74 85
MC wedge	8	6	16	17	40	8	(87)
	9	3	15	15	33 (36)	10	(83)
Hospital	7	6	18	20	40	9	(96)


TESTING AND


Hospital Help

Testing and Evaluation

Function:

- The product must be easily operated
The finished easily operated, the future won't full of buttons, so there is only two more buttons and two on/off switches along with a keypad.
- The product must work reliably every time it is used
The product has no faults as regarding the working of the two systems.
- Any controls must be easily operated
As explained above the controls are so easily accessible to the user, who may be standing holding the systems or sitting at a desk.
- Any visual displays must be able to be read from a distance of 0-5 meters
The LCD screen can be easily read from this distance as there is a picture around it which will also block out any glare from lights
- The product must not cost more than £15-£20 to manufacture
The total cost for producing the two units was under £15 so which was successful
- The product must weigh between 1-1.5kg
When the circuit, battery and all components are in the casing the product ways between 1-1.5kg
- The product must be manufactured using strong acrylic which is hard-wearing and will withstand wear and tear
The main body of both cases was manufactured using strong green and white acrylic plastic, both boxes have undergone tests to test its durability and have successfully passed them.
- The product should be fabricated using acrylic with a thickness no less than 3 mm
Most of the parts in the transmitter and receiver are made using 3mm acrylic plastic, however some parts are 5mm to increase the durability
- The finished product must be made using a brightly coloured plastic so that it can be easily seen within 0-5 meters
I have made the both units green and white, I chose to use green and white as they symbolise First Aid in hospitals
- The product must be manufactured in such a way to ensure maximum stability
The units are fully stable and can stand on its own as the base is made of a flat surface
- The product must function reliably without fault
After testing the product for faults I was unable to find any faults with the function of the product.
- The product must fulfil its function for allowing instant communication between two people despite the fact that they will be in different areas of the hospital
When a signal is transmitted from the transmitter unit, the signal is instantly sent to the receiver unit and the message is displayed on the receiver LCD screen.
- The product must not have any sharp edges that could cause a health and safety risk
The two main corners in the transmitter that could come in contact with the users are curved and therefore pose no risk to health and safety of the user. The corners in the receiver are unlikely to hurt the user as it will be standing on a desk and the user will not have to lift it.
- The product must be easily cleaned as good hygiene is a major factor in hospitals
The materials that I have used are easily wiped down with a cloth or duster. To keep the hygiene levels to the highest standard.
- The product will be powered by a battery
Both circuits are powered by a 9v Battery which will need changed, but this depends on its usage.
- The operator must be able to easily access the battery compartment in able to change it when needed
The battery compartment is easily access in both cases as the top lid comes off and allows the user to change the battery when necessary
- I will design my circuit using either PCB Wizard or Circuit Wizard
I designed the circuit for the transmitter and receiver using PCB Wizard 2.7.
- The PCB will have to be compact and secured within the casing so that they do not pose a risk of shock to the operator
After two initial design of the transmitter and receiver circuit I was able to develop it and make it more compact
- The transmitter and receiver must both be clearly labelled so that they are identified as a pair
Both the transmitter and receiver units are labeled 'Hospital Help' and both have the same color schemes so they can be identified as a pair.

Aesthetics

- The product must be made using a brightly coloured material so that it can be easily seen from a distance of 0-5 metres
The product is made from green and white plastic, with shiny aluminum handles which can all be easily seen from a distance of 0-5 meters.
- The product must be aesthetically pleasing to the eye
I believe that the final design is aesthetically pleasing to the eye because of its use of the hospital first aid colors.
- Texture may also be included to improve grip when being transported
When creating the handles for the user to hold when transporting, I decided not to knurl them as it would look more visually effective if I polished them up to a chrome look.
- The product must have a smooth and sleek finish so that it can be easily cleaned
The plastic and aluminum has a very smooth and sleek finish, as I have polished it using the wax machine.
- Any controls should contrast well with the casing
I have kept the theme of white and green throughout the project and all buttons are white which contrast well with the rest of the case.
- The product must be comfortable to hold in an adult's hand
After asking a number of my peers and teachers to not holding the transmitter unit, they said that they found it comfortable to hold.

Ergonomics

- The products must be strong and be able to cope daily use by [illegible] with
The product will withstand [illegible] of time and
- [illegible]
- [illegible] when
transporting
- [illegible] included in the
[illegible] to help the user hold the product.
- The product must not occupy too much space on a desk
[illegible] on comfortably on a computer desk
or shelf.

Safety

- The product must pass all safety regulations e.g. BSI Kite mark
The transmitter and receiver pass all BSI safety regulations
- An instruction leaflet should be created to help the operator to use the system
Due to time restrictions I was unable to create a leaflet to help the user to operate the system, but I have made it as user friendly as I can.
- The battery or circuit must not be exposed in any way to liquids to avoid posing any risk
All components are housed within the case and will not pose as a risk to water or other damage.
- The product must not have any sharp edges
There are no sharp edges on the transmitter box as the main corners that will be in contact with the users are rounded off. The corners of the receiver unit will not come in contact with the user and therefore pose no risk.

Size

- The overall size of my finished product must fall within the following parameters 200-250mm L by 100-150mm W and 60 D
The finished transmitter falls between the parameters of Length, 190mm width 210mm and depth 55mm. The finished receiver falls between the parameter of length 210mm width 170mm and a depth of 50mm.
- The artifact should be able to be held in an adults hand
There are two handles that's I have incorporated into the transmitter design to enable the user to hold the product with ease. The receiver will not be held by the user.
- The finished product must be big enough to house any circuit that may be placed inside it
The circuit is easily placed into the casing with plenty of extra room to house wires and a battery.
- The over all product must be in proportion with its surroundings
The product is in proportion to the surroundings and will comfortably sit on a desk or the transmitter can be carried around.

Cost

- The product should cost no more than £15-£20
To manufacture the product the overall cost was under £15 which shows successful budgeting.
- If the product was to be mass produced the cost would be considerably reduced
If the product was to be mass produced the manufacturer would buy in the materials in bulk and therefore reduce the cost of the product.
- The cost of the product should be competitive against other similar type products
The product is competitive against other systems that perform similar commands and therefore would be a good seller on the market.

Anthropometrics

- The final product must be able to be held in an adults had so it can be easily transported in the hospital.
If the transmitter was to be carried around the hospital the user would be able to do so with ease and there are two handles that are incorporated into the design to ensure easily transportation. The receiver unit will not be carried around the hospital but will stay on the nurse's desk.
- Anthropometric data regarding the size of a range of hands will be used to establish the best size for the finished product
When designed the size of the cases I took into consideration the size of a number of users hands.

Reliability

- My product and system should work properly each time it is operated
After testing the transmitter and receiver for flaws, there hasn't been a problem when it is being operated.
- The only part of the product that will need changing is the battery
All components are board new on the circuit and therefore will not need replaced, which means that the only component that will need changed will be the battery depending on its usage.
- The product must be reliable in that it must provide instance communication between the two people.
The communication between the transmitter and receiver units are instant and when a number is pressed on the transmitter the corresponding word is displayed on the LCD screen.
- The system used with the product should not interfere with any other system within the area
Both the transmitter and receiver unit have the same address line which means that they can connect to each other, the only way for that the system would interfere with another system is if the other system had the same address line which is unlikely as there is a number of different combinations the produce

Materials

- The materials that I will be using to manufacture my product will be durable and impact resistant
The two materials that I have incorporated into the system are aluminum and acrylic plastic, Both of which are very durable materials.
- The materials that will be used will have to be easily manufactured
The acrylic plastic was able to be easily cut cut using the circular and band saw.
- The product must be able to be manufactured using tools and equipment available within the Technology and Design department
The tools and resources that were in the technology and design department were efficient in helping me manufacture the two units.
- Any controls must be strong and durable to withstand usage
The buttons, switches and key pad are all made from durable materials and will

Transmitter Box



Reciever Box



Overall I am very pleased with the final product and believe that I have fulfilled the specification and the complete project fits its purpose which is to transmit signals to a receiver unit which will the display the command to the user. Once the signal is received the user will be able to act upon the command quickly. As in a hospital situation speed is essential.

Plan of Manufacture

Materials needed to manufacture the Transmitter unit.
Green 3mm acrylic plastic. White 5mm acrylic plastic
Sizes of acrylic plastic needed:

Size of material needed	Quantity
175 x 120 GREEN	2
168 x 30 GREEN	2
105 x 30 GREEN	2
175 x 45 GREEN	2
103 x 45 GREEN	2
205 x 50 WHITE 5mm	2
Aluminium Handles	
Diameter of aluminium tube 20mm x Length of 140mm	2
White acrylic tubing diameter of 20mm and length of 18mm	2

STEP FOUR
The next stage is to make the handles for the transmitter unit. To make the handles I will use aluminium tube with a diameter of 20mm and a length of 140. I will firstly face off the ends of both sides of the aluminium so the faces will sit flush with the white tubing. Once the aluminium is sized, I will then sand the handles down using 320 wet and dry paper and then I will move up onto 600 wet and dry. This will get rid of any scratches in the material. Once this is complete I will use the polishing machine to coat the aluminium with wax and this will give it a shiny chrome finish. To finish off the handles I will need to make 4 small white ends for the handles. To do this I will use four cuts of 20mm white solid tubing and face off each end. I will then have to gradually face off the inset part that will slot into the aluminium as shown in the picture. Once this stage is complete I will use liquid solvent cement to fix the handles into position.

STEP ONE
I am going to start of my manufacturing process by cutting out all of the materials that I need in order to manufacture the sender and reciever unit.

Once I have all the materials cut out the second stage is to take one 175x120, two 175x45 and two 103x45 fabricate them all together so that they create a box shape as shown in image 1. Once this box shape is fabricated using liquid solvent cement, the next step is to cross and draw file all the edges and sides using a flat file. Cross and draw filing will eliminate all marks created when cutting the material. Next of all use 320, 600 and 1000 wet and dry sand paper, that has been wet with water and sand down all the edges. This will give a smooth finish. This box can now be buffed up using the polishing machine.

STEP TWO
Now the top of the box can be made. To fabricate the top of the box you will need one 175x120, two 186x30 and two 105x30 pieces of green acrylic plastic. Make sure and fabricate the sides 3mm in from the edges of the 175x120 piece of plastic. Once the top box is fabricated, cross and draw file all edges and sides and follow the same process for wet and drying the sides as step one

STEP THREE
Next of all I need to create the top part for Sender unit. To do this I will take two 205 x 50 pieces of 5 mm white acrylic plastic. I will then get a tube that the 50 mm in diameter and placed it at the edge of the white plastic and draw around the edge of the tube, so it will give me the curved edges. I will then use the band facer to sand down any material. The next step is to put double sided tape on one side of the 5mm plastic then align the other piece of white 5mm so I can then cross and draw file all the edges so they are exactly the same size. Once this is complete I will separate them and use the polisher to give the plastic a smooth and shiny finish. To fabricate the two white pieces of plastic to the box, I will use liquid solvent cement, ensuring that the green box is in the middle of the plastic. The white plastic will be glued to either side of the green box.

STEP FIVE
Step five is to mill [illegible] key pad to go through and [illegible] switch and reset button. To [illegible] the size of the hole needed [illegible] keypad to go through which [illegible] will use the milling machine [illegible] The the diameter of the hole needed for the reset button is 14mm. This will be cut out using the pedestal drill. The hole for the switch will be drilled using the same 14mm drill bit which was used to cut out the reset button, and I will then use a rat tailed file to make the hole rectangular and to fit the toggle switch.

Materials needed to manufacture the Receiver unit.
Green 3mm acrylic plastic. White 3mm and 5mm acrylic plastic
Sizes of acrylic plastic needed:

Size of materials needed	Quantity
200x160	1
94 x 20	2
160 x 20	2
200 x 160	1
193 x 17	2
160 x 17	2
205 x 80	1
105 x 85 x90 x 20	2
70 x 100 x 70	2

STEP ONE
To start the manufacturing process I will cut out all of the materials that I need in order to manufacture the sender and receiver unit.

Once I have all the materials cut out the second stage is to take one 200x160, two 94 x 20 and two 160 x 20 fabricate them all together so that they create a box shape as shown in image 1. Once this box shape is fabricated using liquid solvent cement, the next step is to cross and draw file all the edges and sides using a flat file. Cross and draw filing will eliminate all marks created when cutting the material. Next of all use 320, 600 and 1000 wet and dry sand paper, that has been wet with water and sand down all the edges. This will give a smooth finish. This box can now be buffed up using the polishing machine. The next step is to create the insets which are the white pieces of plastic in the image on the right, The insets will slot into the base box and fabricate them together so that the look like the image to the right. I will then cross and draw file all the edges in order to get rid of any scratches. The next stage is to use 320 wet and dry paper to sand down the edges. The insets will then be ready to by fabricated to the base of the receiver unit.

STEP THREE
Step Three is to make the two triangular stands. To do this I will use the 5mm white acrylic plastic, measuring 70 x 100 x 70 x2. I will then use double sided sticky tape so that I can stick the two pieces of plastic together temporarily while I cross and draw file all the edges so that they both match up to the same size. Once this is done I will use 320, 600 and 100 wet and dry paper to smooth off the edges. I will then be able to stick the two pieces onto the sides of the box as shown in the image above, ensuring that the edge of the stands sit flush with the edge of the box. Once this process is done I can then perish up the sides.

STEP FOUR
Step five is to mill out the hole for the wires of the key pad to go through and the holes for the On/off switch and reset button. To do this I will mark out the size of the LCD screen which is 71mm x 25mm and the diameter of the hole needed for the reset button is 14mm, the hole for the switch will be drilled using the same 14mm drill bit which was used to cut out the reset button, and I will then use a rat tailed file to make the hole rectangular and to fit the toggle switch.

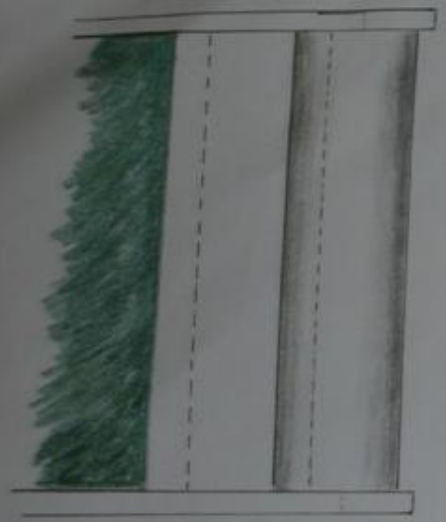
STEP TWO
To manufacture the top of the box I will need to use 200 x 160 and 193 x 17 x2 and 160 x 17 x2 and fabricate them into the box shape shown below. To fabricate these pieces together I will use liquid solvent cement which will create a permanent bond between the plastic. I will then cross and draw file all the edges and sides using a flat file. Cross and draw filing will eliminate all marks created when cutting the material. Next of all I will use 320, 600 and 1000 wet and dry sand paper, that has been wet with water and sand down all the edges. This will give a smooth finish. This box can now be buffed up using the polishing machine.

I will then need to create the Privacy guard.
To do this I will take 205 x 80 and the dimensions shown in the right, and cross and draw file all edges to get rid of any rough edges. Once this is done I will use 320, 600 and 1000 wet and dry paper to smooth off the edges. The privacy guard will then be ready to be fabricate as shown in the image to the top of the unit. The guard will be fabricated using liquid solvent cement which will create a permanent bond.

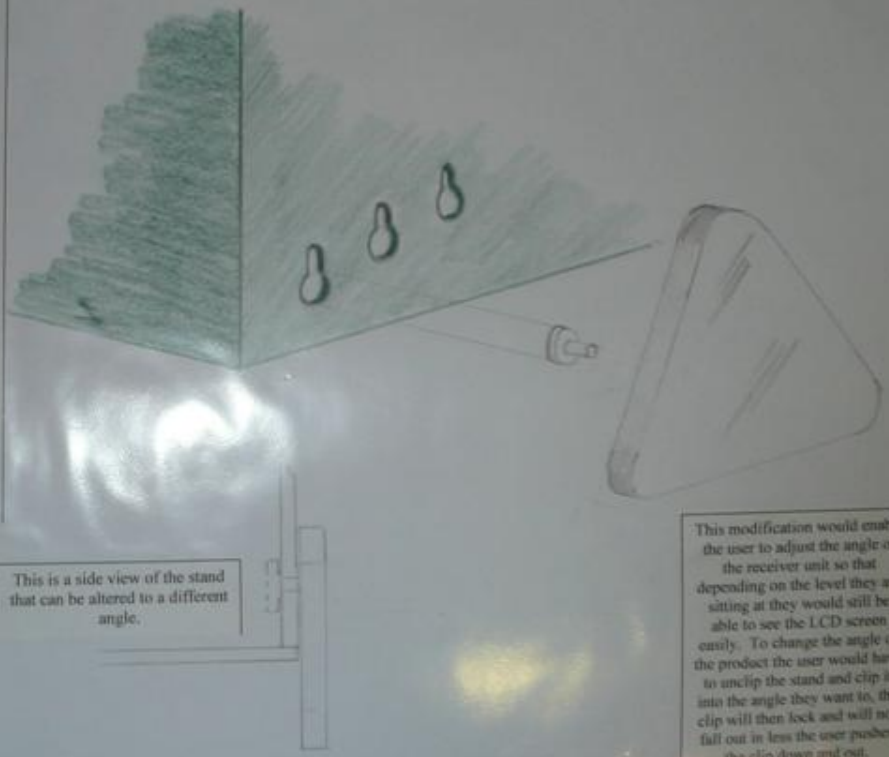
To finish off the manufacturing process and make both the transmitter and receiver more professional I used sticks plus to create the logos and I was able to then stick them on the box of each unit.

Further Development

If I was to consider re-designing my finished products to try and improve them I would make a few modifications. These modifications are shown below.



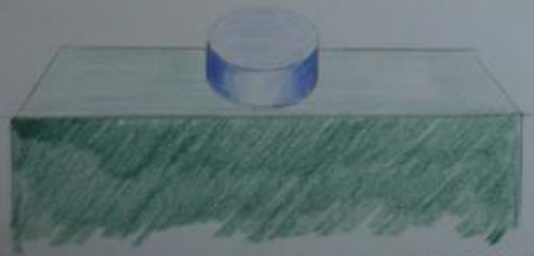
Although after testing my product with a number of different user's hands I would still want to make slight modifications to the handles. The first modification would be to have the handles completely aluminium instead of having white caps at either end of the handles on both side, as I believe it would look more visually appealing if it were all aluminium. The second modification that I would make to the handles would be the positioning of the handles on either side. As said above I texted the handles with a number of my peers to test if they could hold the product comfortably, which they could, however to make the product more universal and comfortable for users with larger hands I would like to make the distance between the side of the box and the handle greater. The dotted lines in this image illustrate the original positioning of the handles and the position of the new handle is shown in the image.



This is a side view of the stand that can be altered to a different angle.

This modification would enable the user to adjust the angle of the receiver unit so that depending on the level they are sitting at they would still be able to see the LCD screen easily. To change the angle of the product the user would have to unclip the stand and clip it into the angle they want to, the clip will then lock and will not fall out in less the user pushes the clip down and out.

This modification also includes curved edges to the stand which would increase the health and safety of the product.



This modification includes a strobe light that will flash and indicate to the user that a signal has been sent to the receiver unit and they need to see the LCD screen to see what the user who sent the signal needs done. I believe that because I have a privacy guard on the receiver if the user was to be standing behind the unit, they would not be able to see if anything was displayed, but if there was a strobe light on the system they would be able to tell if there was a signal being sent from a distance. This would in turn increase the quick response that may be needed.

Modifications made during manufacture

Transmitter Box

During the manufacturing process I decided that incorporating a keypad would suit my project better. Having a keypad makes the case less crowded and I believe looks more visually effective. The key pad will allow the user to choose from eight different numbers. Each number will have a different meaning that will depending on which key is pressed will send a signal to the receiver unit which will display the command on the LCD screen. The Table below illustrates the selections that can be made.

The Blue arrow illustrates the finished product with the Key pad.

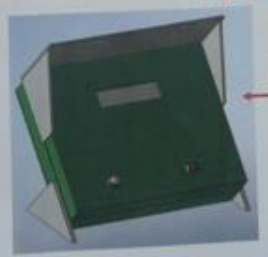
Inputs	Outputs
1. Doctor needed	A Doctor is needed
2. Wheel Chair needed	A Wheel Chair is needed
3. Emergency Assistance needed	EMERGENCY ASSISTANCE NEEDED
4. Extra nurse needed	Extra nurse needed
5. Technical assistance needed	Technical assistance
6. New bed linen needed	New bed linen needed
7. Patient lift needed	A patient lift needed
8. Porter Needed	Porter Needed

When manufacturing the transmitter unit, I originally had designed the handles to be textured by knurling them on the lathe. This would have given the user extra grip. However when I was manufacturing I decided that I would it would look more eye catching if I polished the both handles and gave them a chrome type effect. In the original design I had also made the handles so that they were full length aluminium and positioned offset to the user could only get there hand around the left handle and would use the right handle for comfort when holding the unit. Again when manufacturing the unit, I decided to add two small white plastic ends to the aluminium to increase its durability white using the top and bottom of the unit, I then wanted to make both handles even so that the users could hold the unit from both sides as they may be left or right handed. I believe that this modification was successful.

The green arrow illustrates the finished product the chrome handles that are even at both sides.

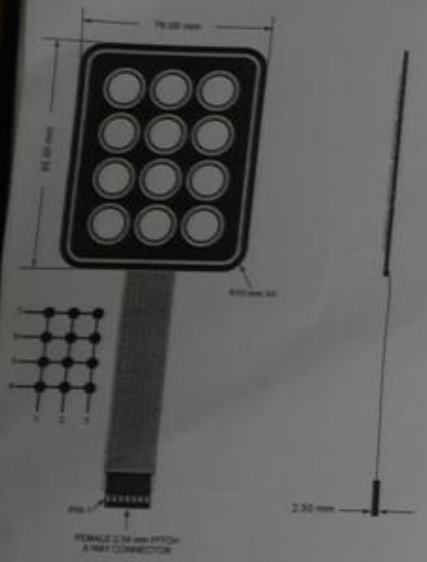
I wanted to keep my project white and green as these are the colors that are associated with first aid. So when manufacturing the transmitter I decided that it would be better if I changed the color from blue to green and white, to keep within the first aid color scheme The green arrow illustrates the new Green and white transmitter that I have manufactured.

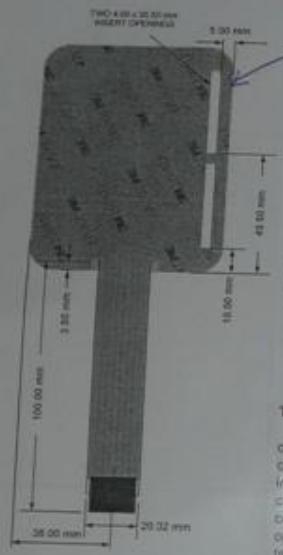
Receiver Box



I was very pleased with my design of the receiver unit, and therefore I didn't make any major modifications to it during the manufacturing process. The modification that I made to the receiver unit was the angle that the box was sitting at. I realised that at the height that the user will be sitting at the desk it would be better if it was tilted lower, so I moved the position of the side stand to the image shown in the right. The only addition that I incorporated is a sticker that I created using Stika plus on the computer. The Sticker as shown in the image on the right hand side says Hospital help. I have created this sticker for the Transmitter unit as well, so both units can be identified as a pair.

Programming





These are the measurements of the gaps that I will be using to place the numbers into the keypad. This is so that the users will know what button they are pushing.

Below is all the technical information about the keypad that I will use in the transmitter unit.

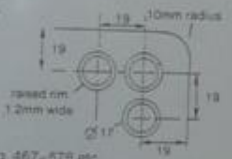
The images above illustrate the size of the key pad that I will be using in my transmitter circuit. This key pad can have up to 12 inputs, however in my project I will be using 8 inputs. This will mean that there will be 4 inputs not programmed.

Technical Specification:

current rating: 50mA at 70V d.c.
circuit resistance: 20Ω 5% max. (2 min.
insulation resistance: 1 at 100V d.c.
capacitance:
contact bounce: only two tracks (approx.)
operating life:
tactile feedback: 25% deflection
protection to: IP65 excluding connector
operating temperature: −20°C to 70°C

keypad size	4 x 1	4 x 3	4 x 4
L	95	95	95
W	38	76	95

Flexible tail and connector length 100.
Suitable mating connector, RS inter p.c.b. plug e.g. 467-578 etc.



Circuit details

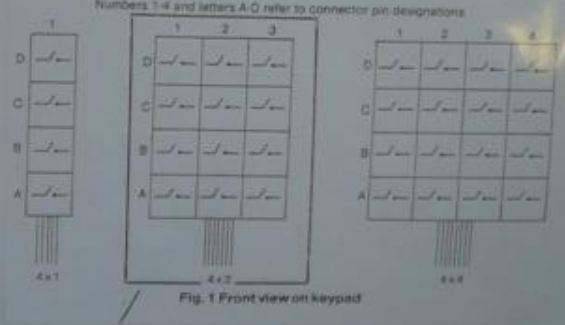


Fig. 1 Front view on keypad

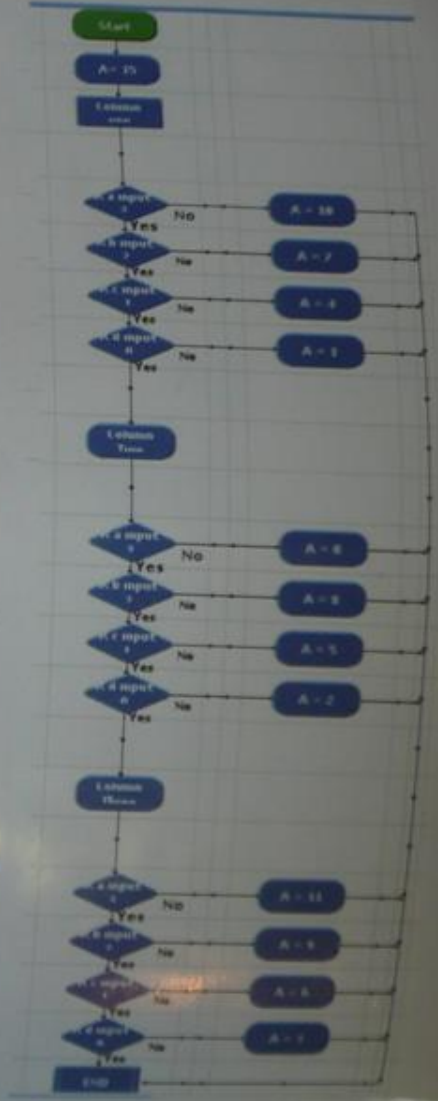
Instructions

254	tells the LCD Module that the next number it will receive is an instruction rather than a character	128	Move cursor to line 1
		192	Move cursor to line 2
1	Clear screen.		

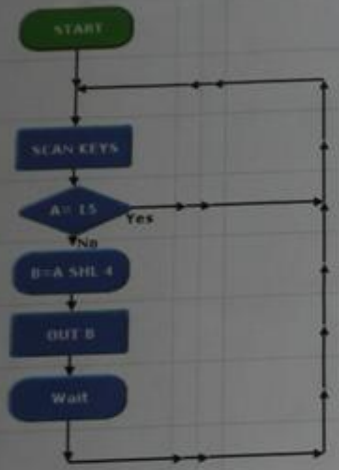
The LCD screen displays 2 lines of 16 characters each

Characters

32		43	+	54	6	65	A	76	L	87	W	98	b	109	m	120	
33	!	44	,	55	7	66	B	77	M	88	X	99	c	110	n	121	
34	"	45	-	56	8	67	C	78	N	89	Y	100	d	111	o	122	
35	#	46	.	57	9	68	D	79	O	90	Z	101	e	112	p	123	
36	$	47	/	58	:	69	E	80	P	91	[	102	f	113	q	124	
37	%	48	0	59	;	70	F	81	Q	92	\	103	g	114	r	125	
38	&	49	1	60	<	71	G	82	R	93	]	104	h	115	s		
39	'	50	2	61	=	72	H	83	S	94	^	105	i	116	t		
40	(	51	3	62	>	73	I	84	T	95	_	106	j	117	u		
41	)	52	4	63	?	74	J	85	U	96	`	107	k	118	v		
42	*	53	5	64	@	75	K	86	V	97	a	108	l	119	w		



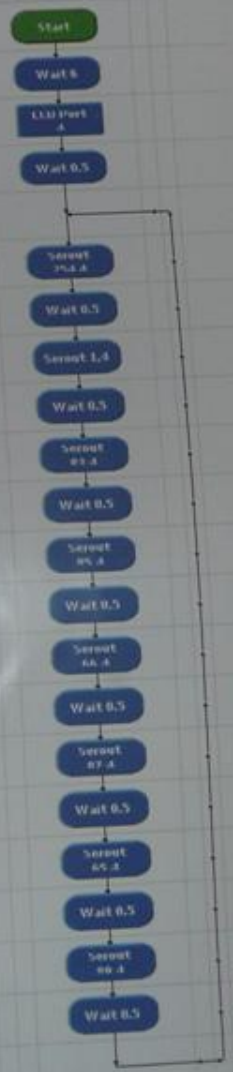
Programming

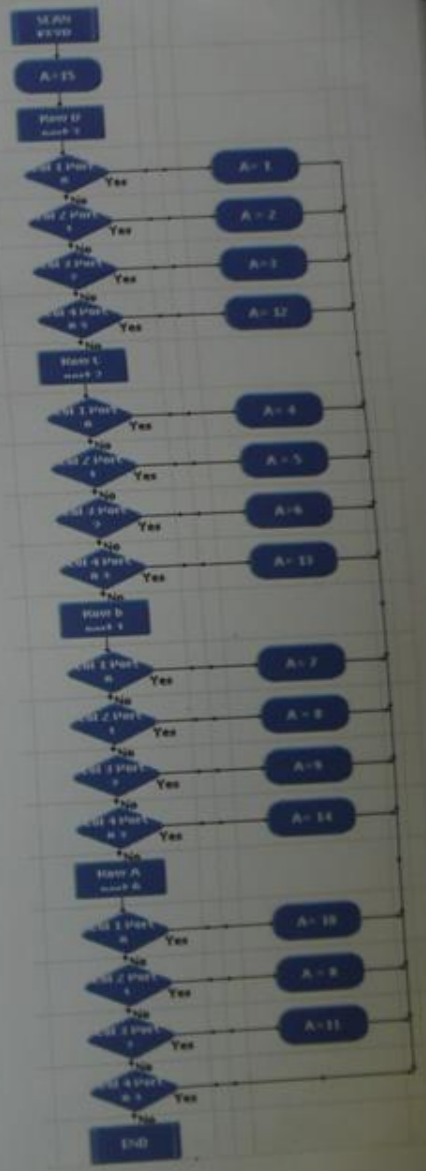


1	2	3
4	5	6
7	8	9
*	0	#

Above is the layout of my keypad which will transmit signals to the receiver.

This program will reset, and [illegible] the inputs to the receiver [illegible] will then display [illegible] the LCD Screen. The user will [illegible] be able to use the key to determine which [illegible] requested.



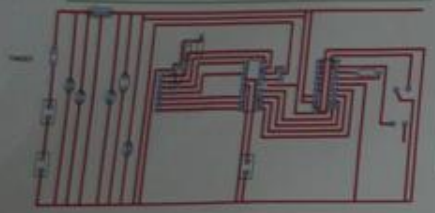


Summary of PIC-Logicator Flowsheet
File Name: KEYPAD2.PFL
Author :

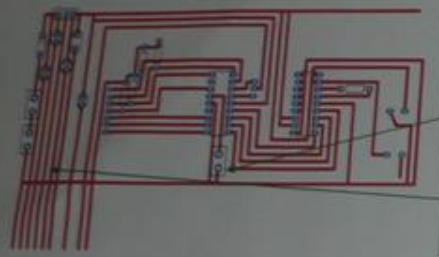
Port Decisions	Col 1 Port 0	0001
	Col 2 Port 1	0010
	Col 3 Port 2	0100
	Col 4 Port 3	1000
Port Output Functions	All LEDs On	11110000
	Row D Port 3	1000
	All LEDs Off	00000000
	Character	1111....
	Row C Port 2	0100
	Row B Port 1	0010
	Row A Port 0	0001
Macros	SCAN KEYPAD	

PCB DEVELOPMENT

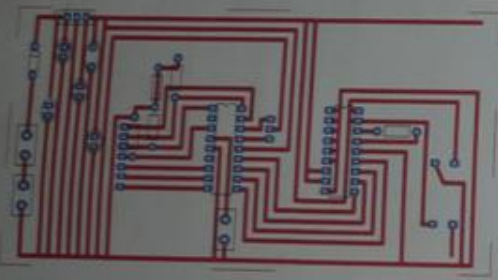
Transmitter



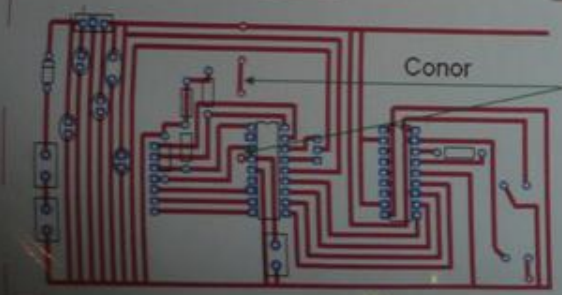
This is my first attempt at designing my circuit using Circuit wizard 2.7. I believe that this is a good first attempt, as the circuit is relatively small. However I can make it smaller again by making the wires more compact together.



To start making my circuit smaller and more compact I have compressed the capacitors by moving the position of them then moving the wires closer together. I have also moved the terminal block at the bottom of the circuit up closer to the 18 pin PIC. This has reduced the height of the circuit significantly. This image illustrates the how I have made the circuit smaller.



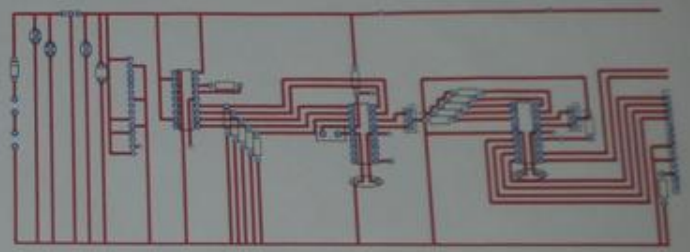
This image illustrates how I have been able to compact my circuit even more, by moving the 5th capacitor in closer to the other 4 capacitors. Now that the 5th capacitor has been moved I can now the 4 resistors closer together.



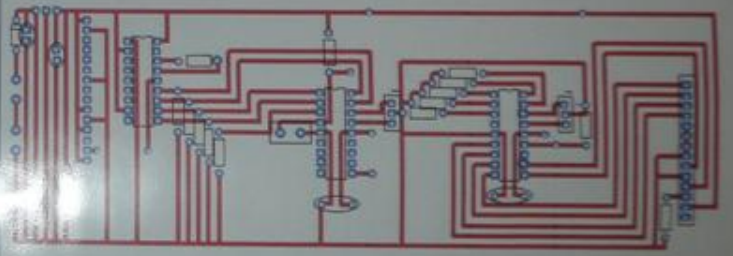
When studying my final design I noticed that I hadn't included a wire in the first 18 pin PIC that runs to the top of the circuit. I have introduced jumpers; this means that I won't have any wires crossing over one another. This final design illustrates the actual size of my final circuit.

Receiver

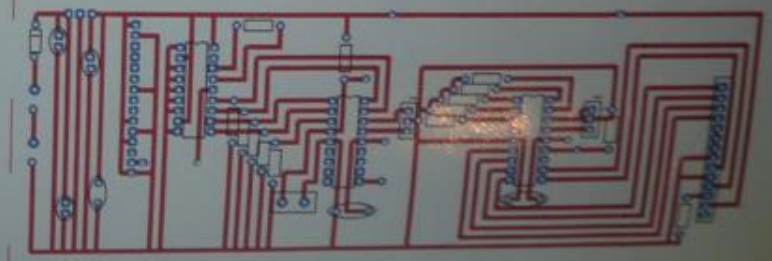
This image shows an image which is not the actual size of the circuit which is shown on Circuit wizard. The actual size of this first attempt of the receiver circuit is very big and would not fit in my designed case.



This image illustrates how I have made the capacitors more compact at the start of the circuit and moved the address line closer which has created more space to move the components closer together.

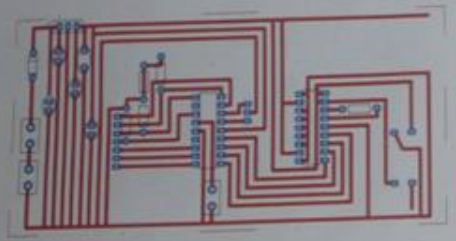


This image shows my final design of my receiver circuit. This is the actual size of my final circuit and it comfortably fits into my receiver case design, allowing room for access to the battery, when it needs changed.



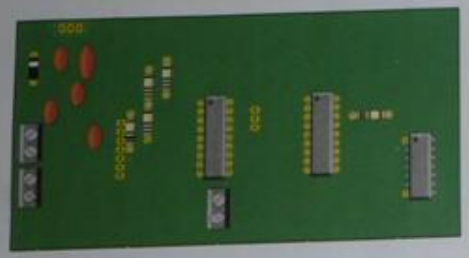
PCB Transmitter Design

This page contains different views of my final circuit board.



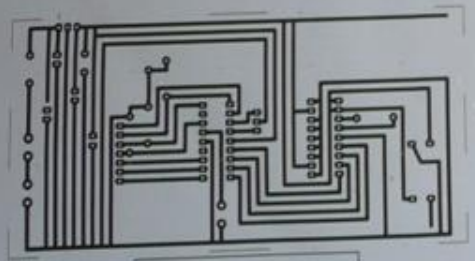
Normal View

This is the normal view that I used when designing my circuit on PCB Wizard. This view is useful when creating the design as you can see all the components, and therefore it is easy to correct mistakes.



Real World View

This is the way that both my transmitter and receiver Printed Circuit Boards will look like once all the components are placed on the circuit.



Artwork View

This is the design view that will be used when making the PCB. The black lines represent the copper tracks. The holes are there so that when drilling the PCB I will know where to drill the holes.

Parts Needed

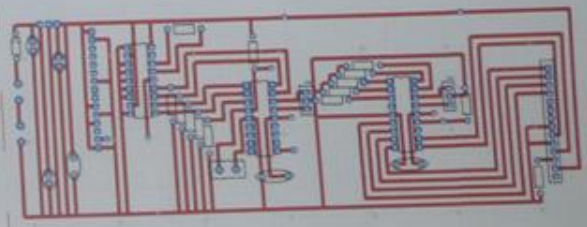
Name	Quantity
(Unamed Symbol)	1
18 pin DIL	2
2-Way 5mm Terminal Block	3
Board (126.9mm by 66.0mm)	1
Capacitor	5
Rectifier Diode	1
Resistor	5

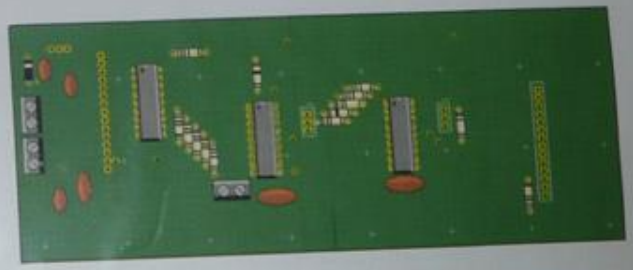
These different views of the PCB design of the transmitter and receiver circuit illustrate where all the components that are needed are positioned on the circuit.

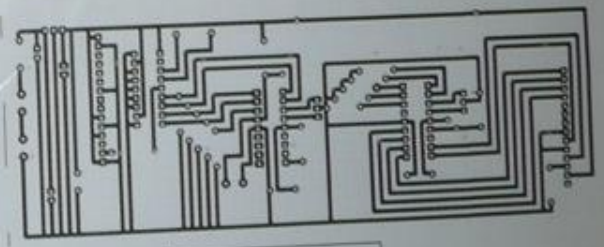
Transmitter Circuit Values:

- 1x4k7 Resistor
- 4 x 10k Resistors
- 3 x 100 uF Capacitors
- 1x 1000uF Capacitor

PCB Reciever Design







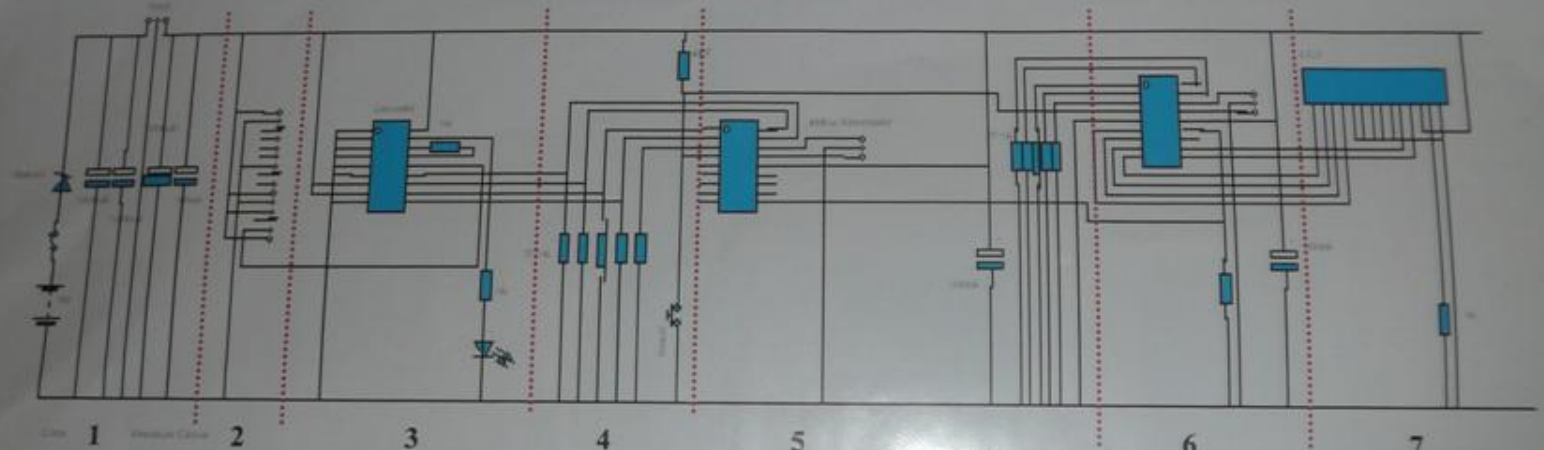
Parts Needed

Name	Quantity
18 pin DIL	3
2-Way 5mm Terminal Block	1
Board (190.4mm by 73.6mm)	1
Capacitor	6
Rectifier Diode	1
Resistor	14

Receiver Circuit Values:

- 1x4k7 Resistor
- 3 x 100 uF Capacitors
- 1x 1000uF Capacitor
- 14x 10kohm Resistors
- 1x 1Kohm Resistor

Block Diagram of Reciever Circuit



Power Supply 1

The power supply provides the circuit with the power that it needs in order for the circuit to work. The battery that is used for this circuit powers out 9Vs. This section of the circuit also includes a diode, which is used to keep the current flowing one way. The PIC that I have used in this circuit only requires 5v's so I have added a 7805 component which converts the power from 9V's to 5V's. I have placed four smoothing capacitors which will keep the current running smooth.

Reciever Module 2

The receive module is used to receive any signals that are being sent through to the receiver circuit from the transmitter circuit. The signal is received through pin 3 from the antenna. This transmitted data leaves through pin number 14.

Decoder 3

The decoder is used to decode the signal that has been received from the transmitter circuit. Just as the encoder has a specific address line the decoder will have the same address line. This is how the receiver module knows to receive that data that is being sent. The decoder receives the signal which is sent out the receiver module in pin 14.

4 Bit Binary Pattern 4

The 4 bit binary pattern transmits a series of ones and zeros in parallel from the 18 PIN PIC Chip, to the encoder.

18 Pin PIC 5

This 18 pin PIC will be programmed in a way that it will recognise which pin has been pressed. The reason is due to complex programming. The PIC takes a 4 bit Binary Pattern and produces 4 bits when the switch is pressed.

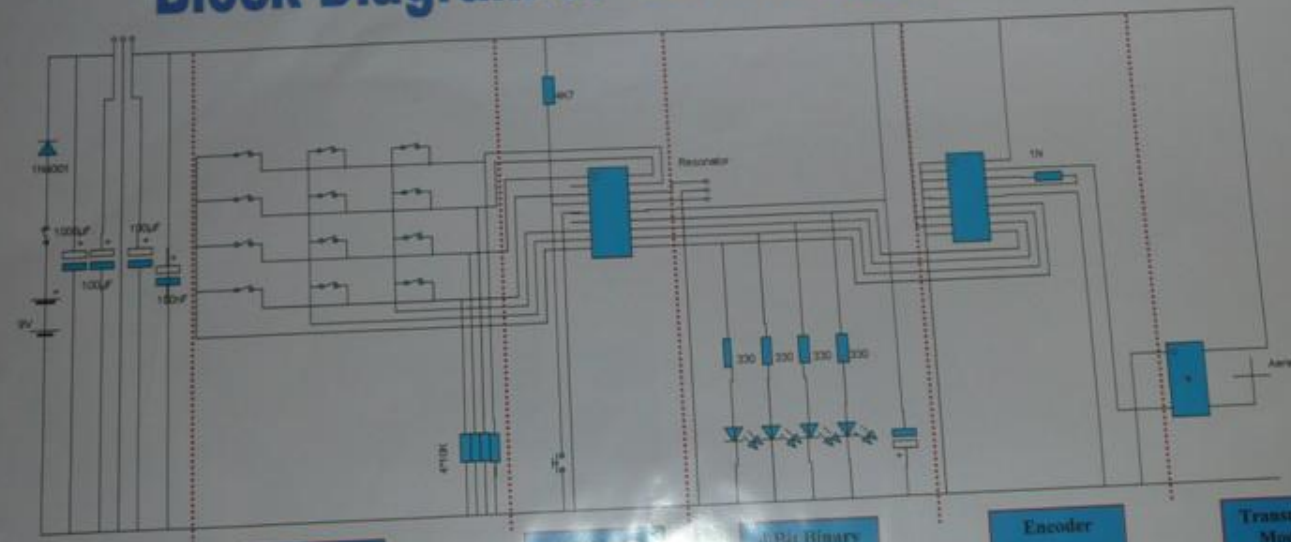
18 Pin PIC for LCD screen 6

This is another 18 pin PIC. All inputs are tided to ground via 10k resistors. The PIC uses the signal which it has received from the previous signal from pin 14 to send to the LCD using the 4 output pins.

LCD Screen 7

The LCD Display will then display the information that it has been asked to by the 18 pin PIC.

Block Diagram of Transmitter Circuit



Power Supply

The power supply provides the circuit with the power that it needs in order for the circuit to work. The battery that is used for this circuit powers out 9Vs. This section of the circuit also includes a diode, which is used to keep the current flowing one way. The PIC that I have used in this circuit only requires 5v's so I have added a 7805 component which converts the power from 9V's to 5V's. I have placed four smoothing capacitors which will keep the current running smooth.

Matrix of Switches

This section of my circuit includes a Matrix of switches which will enable the user to push different buttons depending on the outcome that they wish. All of the buttons are connected to the outputs which depending on which button is pushed a different output will appear on the LCD screen. The way the circuit has been designed means that I only have to connect 4 wires to ground. This means that the circuit will be neater and therefore more compact. Only on button can be pushed at anyone time as the software only recognised the first button that has been pushed and therefore any other buttons that is pushed at the same time will be discarded.

18 PIN PIC

An 18 PIN PIC is a device that can be programmed to store different sets of instructions in the form of a program. I need my PIC to recognise which button that has been pressed and then send the relevant information to the next stage of the circuit. If this doesn't happen then my circuit will have failed. In this part of the circuit it is essential that I put a reset switch in which is connected to ground. This switch will erase any information that has been sent to the receiver and the cycle can start again.

4 Bit Binary Pattern

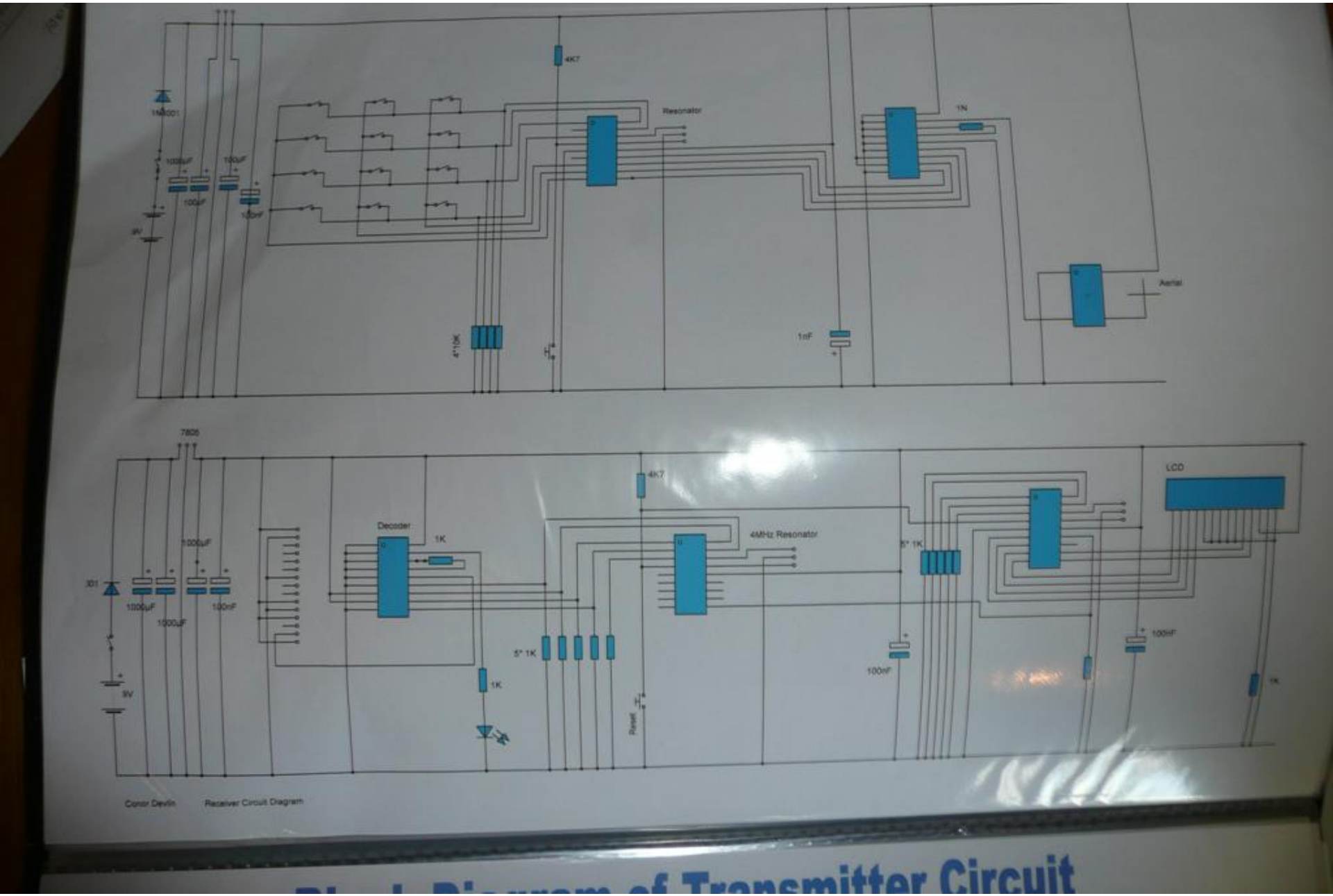
The 4 bit binary pattern transmits a series of ones and zeros in parallel from the 18 PIN PIC Chip, to the encoder.

Encoder

The encoder has an 8 bit address line in which in each different product the address line will be totally different. This is to ensure that there is no interference with two different handsets. The receiver will be the only product that will have the same code, this means that the two systems can interact with each other with out interference from other handsets.

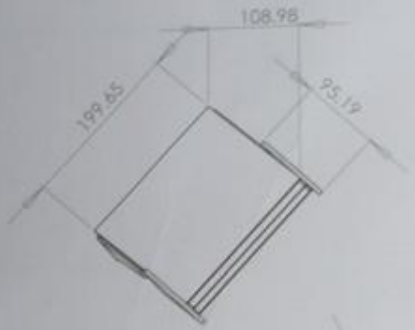
Transmitter Module

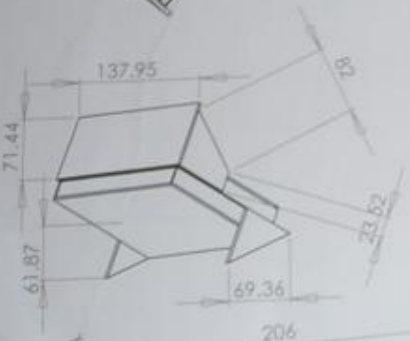
The final part of the transmitter circuit includes the transmitter. All the data that is received is from the encoder. The transmitter then sends the necessary signals to the receiver module. The signal is sent via radio waves which are transmitted through the aerial that is built into the circuit.

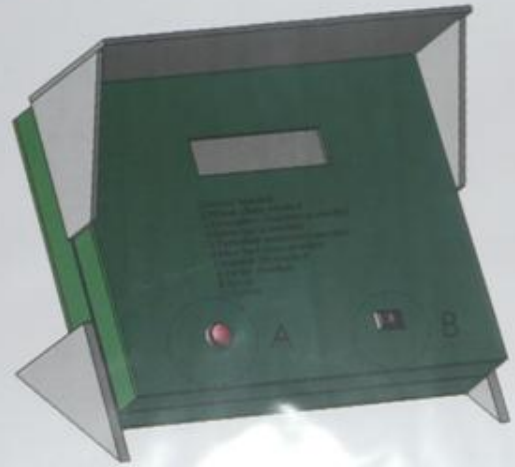


Block Diagram of Transmitter Circuit

FINAL RECIEVER DESIGN

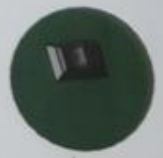






DETAIL A

This button when clicked will reset the system and enable the sender to send another signal.

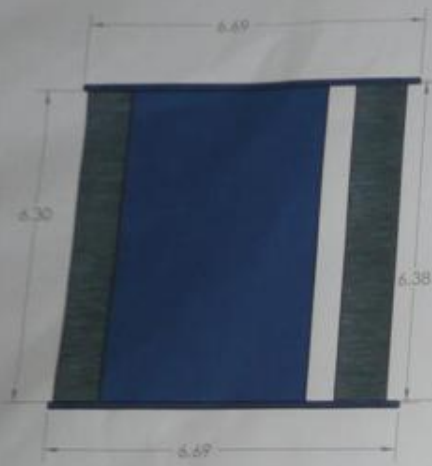


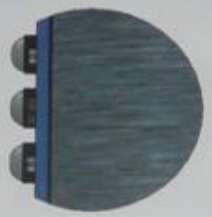
DETAIL B

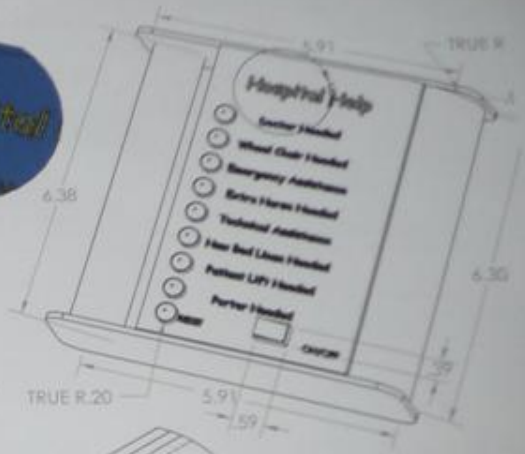
This switch will allow the user to turn the system off and on just by flicking the switch. When the system is turned off no signals will be able to be transmitted to this reciever unit.

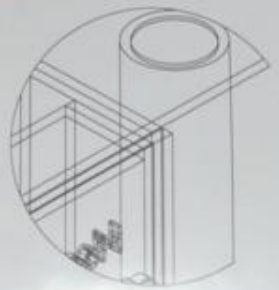
This is a screen that will add provacy to the unit. The angle that the product is at will make the LCD screen easy to read. if they are sitting down at a table. The size of the main box, will enable me to comfortably house the circuit and components such as;Battery, LCD screen and wires. The box can seperate into two parts which will also enable the user to open the box and access the circuit to change the battery when required. Depending on the amount of use will depend on when the battery will need to be changed.

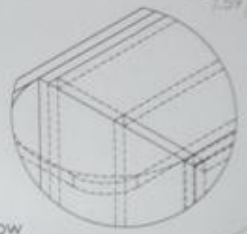
Transmitter Final Design

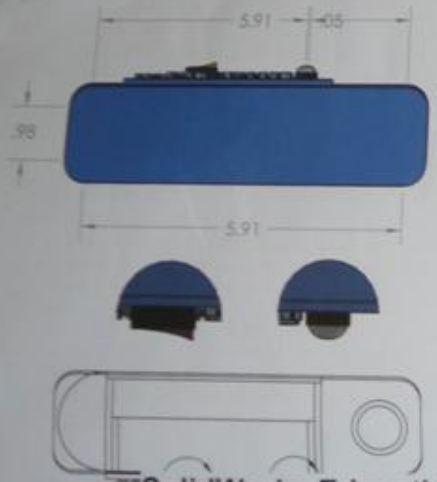


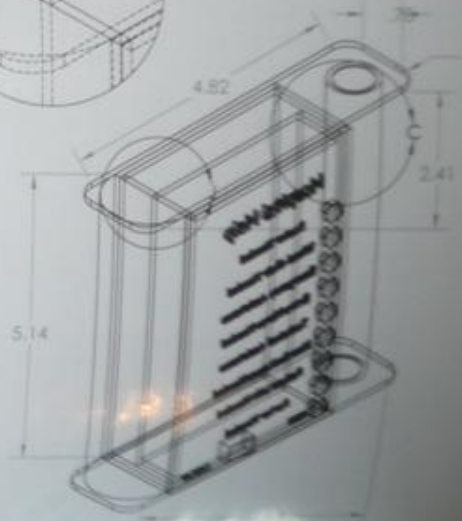












illustrates how al transmitter opens e the top. This will enable the user to access the circuit which will be housed in this box. The only time that the user will need to access the circuit is when they need to change the battery, which depending on the usuage of the transmitter the battery life span will vary. All parts in this product are seperatly measured and cut out. These parts are then fabricated together, to create the final product.

The other drawing of the final design show the deminsions of the final product.

Design 10

Design 10 is a hand held product which includes 8 commands, one reset button and one on/off switch. The user will be able to carry this product around with them in a hospital if they need to move to another area of the hospital.

Materials Used.

The materials that would be used for this product would be 5 and 3mm acrylic plastic, with two aluminium handles for ease of transport. Aluminium would be used because of its hard wearing and durable properties.

Function

The main function of this design is to send 8 different signals to a receiver unit which will then display the commands on an LCD screen or even in LED's.

Aesthetics

I believe that this design looks very aesthetically pleasing and could easily fit into the hospital environment. I believe that the curves and rounded handles make the design look comfortable to hold.

Size

The size of this design is reasonable as it has been designed so that it is comfortable to hold when pushing the buttons, to send the signals.

Storage

The size of the casing would enable a large circuit to be housed, which is essential.

Safety

There are no health and safety risks with this design as there are no sharp edges within the design that the user could hurt themselves on.

There are also no loose parts that could cause young people to choke on.

Ergonomics

The design of the handles in this design not only look effective but, is very smooth and comfortable to hold.

Cost

The final cost to produce this design would be in the region of £10-£15.

Strengths

4. The handles that are incorporated in this design enable the user to comfortably hold the product.
5. Even though the box is relatively small quite a large circuit could be housed inside it.

Weakness

2. The only weakness of this design is on the right handle it is offset, which would mean the user would only be able to hold the left side of the product comfortably.

Design 11

Design 11 includes an LCD display which will display the command that has been sent to the receiver from the transmitter.

Materials Used.

The materials that would be needed in order to manufacture this design would be 3mm Red, acrylic plastic. There are no other materials that would be needed to make this casing.

Function

The main function of this design is to display 8 different words on the screen that the user can use to determine what command needs to be carried out on the ward of the hospital, for example an extra nurse may be needed.

Aesthetics

This design I believe to look very visually attractive as it is slanted so that the user can see the LCD from most angles. The colour of this casing is also very visually attractive and it is the colour of emergency, or warning. So therefore it would be ideal in a hospital situation.

Size

Even though this product is relatively tall the base size isn't overly big and therefore it could be difficult to house a receiver circuit inside.

Storage

This design would [illegible] corner of the ward desk, which would keep it [illegible] of the way.

Safety

There are no health and safety risks with this design. There are also no loose parts that could cause young people to choke on.

Ergonomics

This product is quite uncomfortable to hold, as it doesn't include handles, however the product would rarely need to be lifted as it sits comfortably on a table.

Cost

The final cost to produce this design would be in the region of £15

Strengths

1. The Colour used for this product is eye catching and therefore would be ideal in a hospital situation.
2. The LCD screen is easily seen from a distance of 5 metres.
3. Because of the shape of the base the product will comfortable sit on a desk.

Weakness

1. A weakness to this product is the size of the casing inside as it might be difficult to make a receiver circuit that compact.

Final Chosen Designs to Develop

Transmitter

I have chosen to develop and manufacture this design for my chosen transmitter.

Aesthetics

I believe that this product is visually effective because of the layout of the buttons, as each button is not cramped together. I also choose this product because of its curved edges which also add to the aesthetics of the product.

Size

The size of this product will make it easy to fit quite a large circuit inside the casing. The casing will also house the battery which can be easily accessed by lifting the lid off the case.

Ergonomics

I also choose this design to manufacture as I believe that the handles will be comfortable to hold because of its smooth finish. The handle on the right will enable the user to hold the back of the product as well, yet still has easy access to the buttons.

Anthropometrics

The size of this casing is in proportion with the human hand as a large number of users will be able to fit their hand around the handle. The product will fit into its environment which is in a hospital ward situation.

I hope to develop this design so that it best fits its purpose which is to promptly send commands to a receiver unit.

Receiver

I have chosen to develop and manufacture this design for my chosen receiver.

However I plan to make a few changes to the design. I would like to change the LED's to an LCD screen. The second change I wish to make is to add a privacy guard which will illuminate glare on the LCD. I will also position the product at an angle so that the user will be able to easily see the screen when sitting at a desk.

Aesthetics

I believe that this product is visually effective because of the layout of the buttons, as each button is not cramped together. I also choose this product because of its curved edges which also add to the aesthetics of the product.

Size

The size of this design is big enough to hold a large receiver circuit.

Ergonomics

Because of the angle of the receiver unit, the user will be able to comfortable press the reset button and on/off switch.

Anthropometrics

The size of this casing will not cause abstraction to the user's desk as it will sit in the corner of their desk.

I hope to develop this design so that it best fits its purpose which is to promptly display information on an LCD screen.

Design 5

Design 5 is a hand held product with a keypad and a key table which illustrates to the user what each button means. When a button is pushed on the keypad a signal is sent to the receiver which will then display a message to the user.

Materials Used

The grip would be made out of soft non-slip rubber. The Main body would be made using acrylic plastic, because of its strong hardwearing properties.

Function

The Function of this design is to transmit a signal to the receiver which will then display a message on the LCD screen or light up an LED, to alert the user and get assistance.

Aesthetics

This design looks effective because of its curved edges and filleted edges. There isn't lots of single buttons but one rectangle with 12 buttons inside it.

Size

The size of this handle isn't very practical because the size of the hole through the handle may not be big enough to fit a larger hand through.

Storage

This design could be easily stored away because it is a relatively small product. When placing a circuit inside this product, the circuit would have to be cut down in width but could be made longer and therefore fit inside the product easily.

Safety

This design has no safety risks.

Ergonomics

This design is ergonomically effective as the grip would be comfortable to hold however anyone with a large hand may struggle to get a firm grip of the handle as the gap between the handle and the main body is quite slim.

Cost

The cost to manufacture this grip would be very cheap and would cost around £4 to make because the grip is realtively inexpensive the over all cost to produce this product would be around the region of £10-£13

Strengths

1. The strengths of this design are that most users can hold the product comfortably.
2. The colour of the level is eye-catching, so Green is a colour that is used a lot in hospitals along with white.

Weakness

1. The weakness to this level is that over time the grip may rip or come off.
2. The size of the hole that the user places their hand through isn't very big and therefore it would be difficult for someone who has a bigger hand to hold it.
3. Due to the nature of the curved edges it may be difficult to manufacture.

Design 6

This design is a receiver that has an LCD screen on either side so the user can hold it comfortably no matter if they are left or right handed. This product will receive the signals that are being sent to it by the Transmitter, and then will display the relevant information on the LCD screen.

Materials Used

The Main body will be made from acrylic plastic and then is covered by rubber grip, to ensure the user has a firm hold on the product.

Function

The function of this design is to allow the user to receive specific messages from the transmitter and display them on the LCD screens.

Aesthetics

I believe that this design looks aesthetically pleasing as it is a hand held product and therefore is small and compact and will easily fit in the user's hand.

Size

As mentioned before the design is small and compact and therefore it will comfortably fit in the users hand and for this reason it can be easily transported.

Storage

There wouldn't be a problem with storing this product as it is small and compact.

Safety

This design has no risks relating to safety issues.

Ergonomics

The texture of this design is effective and soft to touch. The groves cut out for the users fingers insures maximum grip.

Cost

The cost to produce this product would be around £20 as there would be quite a bit of rubber grip needed to cover the product.

Strengths

1. The grip means the user can hold the product comfortably.
2. The two LCD screens makes the product universal to people who are either right or left handed.

Weakness

1. A weakness of this product is that the On/Off switch is too big and takes away from the compactness of the product.
2. The shape of the design could mean the product would be difficult to manufacture.

Design 7

Design 7 is in the shape of a formula 1 steering wheel, with a raised centre for easy access to the buttons. This design could be made into either a sender or receiver just by changing the buttons to an LCD screen.

Materials Used

The material used for this product would be acrylic plastic with rubber grip in the handles for extra comfort.

Function

The function of this product is to send signals to the receiver which will then display information for the user.

Aesthetics

I believe that this design looks effective as the red acrylic stands out in its environment which is a busy hospital.

Size

This level is small and compact and is easy to move.

Safety

This design has no health and safety risks, and the user is less likely to drop the product as they will have a firm grip on the handle.

Ergonomics

Design 7 is ergonomically pleasing as the product is light in weight and has handles which will [illegible] user can have a comfortable grip.

Cost

I believe to produce this level it will [illegible] the reign of £8 which makes this design cost effective.

Strengths

1. The handles are of a big benefit as the user can always have a firm grip of the product.
2. Due to the product being small and compact it can be easily moved from one place to another.
3. The colour makes the product stand out within its environment.
4. The raised section which includes the LCD screen is easily seen.

Weakness

1. The disadvantage to this design is that the handles may be difficult to cut, and the gap between the two pieces of acrylic could be difficult to fill.
2. The edges of the product are not fully rounded and therefore could become uncomfortable after holding the product for a period of time.

Design 8

Design 8 is a sender which will transmit 4 different signals depending on what button the user pushes. The signal will then be sent to the receiver unit.

Materials Used

The materials used will be acrylic plastic and aluminium for the edges which join the base to the top.

Function

The function of this product is to send a signal to the receiving unit which will display a command to the user, such as doctor needed.

Aesthetics

The overall appearance of the product is aesthetically pleasing to the eye because it is small and compact and bright coloured plastic.

Size

The size is the main problem with this design as because it is so small it only has four buttons which isn't practical if you seen the system to send more different commands.

Safety

There are no health and safety risks with this design.

Ergonomics

The finish to this product is smooth and the aluminium edges also have a smooth and deck finish.

Cost

To produce this sender it would cost around £10,with most of the cost going to the aluminium edges as aluminium is an fairly expensive material.

Strengths

1. All buttons are clearly displayed and easily accessed.
2. The housing for the circuit is easily accessed.

Weakness

1. A disadvantage to this design is because it only has room for four buttons when in reality the system would need more that four buttons.

Design 9

The purpose of this design is to send signals to the receiver which will be placed in the ward office.

Materials Used

The two materials needed to produce this product are, 3mm acrylic plastic and small pieces of aluminium.

Function

The function of this product is to send signals to the receiver unit.

Aesthetics

This design I think is very plain and doesn't stand out to any of the other designs. The colour used for the plastic is quite dull and therefore could be easily misplaced.

Size

This level is very small and easily carried around.

The user can easily carry the product using the aluminium finger grips. However the gap between the finger grips are very small and therefore people with bigger fingers wouldn't not be ahie to grip the product properly.

Safety

The only safety issues with this product is because of the gap between the top and base of the product, for people with bigger hands they may not be able to get a firm grip of the product and it could fall and damage something or pose as a danger to someone.

Ergonomics

The overall finish isn't very appealing because of the dull colour of plastic. For people with smaller hands this product would be comfortable to hold, how ever this isn't makes the design not universal.

Cost

To produce this product would be in and around £7 as there is only a small amount of aluminium needed to make the finger grips.

Strengths

1. The only advantage of this product is its size for moving it, however this is also turned into a disadvantage for some users.

Weakness

1. The size of this design has a disadvantage as it would be difficult to spot in its busy environment.
2. The other disadvantage of this product is for the users who have bigger hands as they will struggle to get a firm grip of the product.

Design 11

Final Chosen Designs to Develop

Viability of Each Design

In this section I will be evaluating each product for its viability. I will be focusing on the materials used, function, aesthetics, storage, safety, ergonomics, cost, and positive and negative points.

Design 1

This Design consists of two main parts which are then joined together. The two parts can be taken apart at anytime to access the circuit or change the battery which would be housed in this space. Also incorporated into this design is two handles which will enable the user to have a firm grip on the product. The Handles have curved grooves so that the user can hold the product comfortably. The over all product is built at a slant, to make it more visible to a user that may be sitting down.

Materials Used.
The main body of each section would be made out of 3mm acrylic. I have chosen acrylic because it is durable and is easily shaped. The handles in this product would be made out of aluminium because of its hardwearing properties.

Function
The main function of this product is to alert the user of the receiver that for example the person who has sent the signal via the transmitter needs a extra nurse.

Aesthetics
This design looks aesthetically pleasing, as the handles look comfortable to hold and the colour of acrylic looks attractive, however on a messy desk the colour may be of a disadvantage as it could be difficult to see as the colour doesn't stand out as much as it would if the product was Green, Yellow or Red.

Size
The size of this design isn't very practical as it is quite big and chunky and therefore would take up to much room on a desk.

Storage
As stated before the design is quite big, which therefore makes me believe that it would be difficult to store and therefore impractical.

Safety
There are no safety issues with this design as there are a number of curved edges in the plastic and aluminium and therefore they wouldn't pose as a danger to the user.

Ergonomics
The handles on this design make the product ergonomically pleasing as they are comfortable to hold due to the fitted grooves for the users fingers to rest on.

Cost
The cost to produce this receiver would be around £10-£15. The reason that it is quite expensive is because the aluminium that would be used to make the handles is relatively expensive.

Strengths

1. The Handles that are incorporated into this design are comfortable to hold.
2. The size of the casing would fit a rage of different sizes of circuits inside it.
3. The colour that is used for the acrylic plasic is pleasing to the eye

Weakness

1. The size of this design is impractical as it is too big to sit on a desk.
2. The colour is attractive however it is not suitable for the purpose which is to attract the attention of the user immediately.

Design 2

This design of a receiver includes 8 LED's and a reset button along with an On/Off switch. Each LED is spaced out and along side each LED there is writing explaining what each LED means when it lights up. For example if the third LED lights up it means that emergency assistance is needed on the ward.

Materials Used.
The whole of this design would be made out of 3mm acrylic. Acrylic is a durable material that will withstand a large amount of force.

Function
The function of this receiver is to alert the user when something or someone is needed on the ward at anytime of the day or night.

Aesthetics
This design is very basic and is basically made up of two parts which are joined together to make a box. The sides are all curved which adds to its aesthetics.

Size
The size of this design is relatively big however in this design it doesn't really matter as it will be mounted on a wall.

Storage
Storage with this design isn't an issue as the product is quite big it will house quite a large circuit. Storing this product also isn't a problem as the two holes at the back of the product enable it to be wall mounted therefore out of the way of a crowded desk. Having the product on a wall is also of an advantage as there will never be anything blocking users view and they can therefore respond immediately.

Safety
This design is safe as there are no sharp edges that could cause damage. The only safety issue with the product is if it were to fall off the wall at any stage it could damage or hurt someone.

Ergonomics
Design 2 is ergonomically pleasing as it has a sleek and smooth finish. The corners of this level are all filleted which means that the level is smooth and easy to carry.

Cost
The cost to produce this design would be around the price of £5-£10. I have valued the materials at this price as acrylic sheets and the components needed are not overly expensive.

Strengths

1. The main strength of this design is that it can be mounted onto a wall and therefore it does not clutter up the users desk.
2. The colour of this design is very bright and therefore it draws the user's attention when passing.

Weakness

1. This design has a very basic shape however it fits its purpose.

Design 3

Design number 3 is a sender which includes 8 buttons that will transmit 8 different signals to the receiver unit which will then show the user what is needed by lighting up the relevant LED.

Materials Used.
This design is made from 3mm acrylic yellow plastic. Acrylic plastic is has a very clean and attractive finish to it when it is polished up. The extruded name at the front could be made out of aluminium. "Hospital Help"

Function
The function of this design is to transmit a signal to the receiver which will make the LED light up and therefore inform the user of the service that they need on the hospital ward.

Aesthetics
The shape of this design makes it aesthetically attractive because of the curved back and the slanted front. In the front there is an inset in which an extruded company name is inside it. This could be made using CNC (Computer Numerically Controlled)

Size
The overall size of this design is compact yet it will still house a circuit.

Storage
The size of this design makes it easily transported and can therefore be easily stored away.

Safety
There are no safety issues with design three as the majority of the edges [illegible] don't pose as a danger of hurting the user. All of the [illegible] and therefore comfortable when force is [illegible]

Ergonomics
[illegible] very comfortable to hold due to the curved edges and sloped [illegible]

Cost
The cost to manufacture this product would be relatively cheap, as there isn't a lot of aluminium in it which would bring the cost up. The over all cost to produce this design would be in the reign of £10.

Strengths

1. The materials used are very robust and hard wearing.
2. The final design looks very attractive because of its colour and curved edges and sloped sides.
3. The buttons are comfortable to press due to the dome shape.

Weakness

1. The main weakness of this design is its shape. It could be very difficult to manufacture due to the large curved back.
2. The text that is beside each button isn't very clear to read from a distance.
3. The second set of 4 buttons should be on the opposite side of the writing to show a clear division between the first set of buttons.

Design 4

Design 4 is of a receiver which includes an LCD screen in which depending on which button is pushed on the sender message corresponding with that button will be displayed the LCD screen.

Materials Used.
The two materials that would be used in the manufacture of this product will be 3mm acrylic plasic and aluminium would be used because it is a strong and hardwearing and non corrosive material.

Function
The function of design 4 is to display a message to the use to alert them of something that is needed on the ward.

Aesthetics
This design looks very aesthetically pleasing because of it simple yet effective layout. And the aluminium handles which have cut out grooves for added grip look effective.

Size
The size of this design is quite compact and is easily lifted because it is light in weight.

Storage
The design is light in weight and can therefore be easily stored. The size of the main body also comes apart and enables the user to access the circuit if they need to chang the battery.

Safety
There are no safety issues with design 4

Ergonomics
The Handles in this design are very comfortable to hold, s the second set of handles are spaced apart so the user can hold the product comfortably with ease.

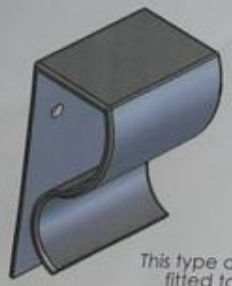
Cost
The total cost to produce this product would be quite expensive as there is a significant amount of aluminium needed to make the 4 handles.

Strengths

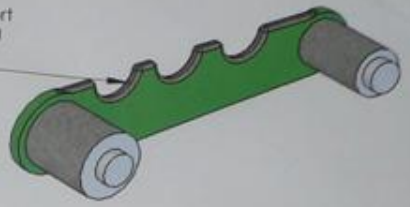
1. The main strength of this product is that it is not crowded with buttons or LED's and therefore the LCD screen can be easily seen.
2. The handles make this product very comfortable to hold.
3. The finish of the plastic is shiny and therefore looks pleasing to the eye.

Weakness

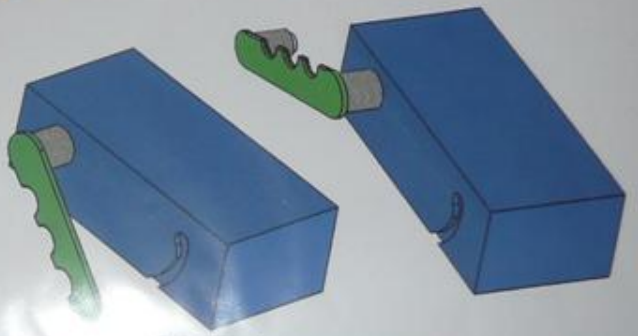
1. The handles will be difficult to manufacture because of the work needed to create the grip on the aluminium.
2. Alough the colour of the plastic used has nice, it isn't eye catching enough to be us in a situation where fast reactions are necessary.

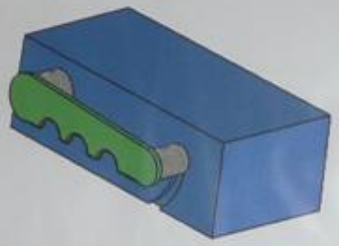


Thishandle comes with added grip for extra comfort and support when holding the device.



This type of handle can be fitted to a number of different cases.





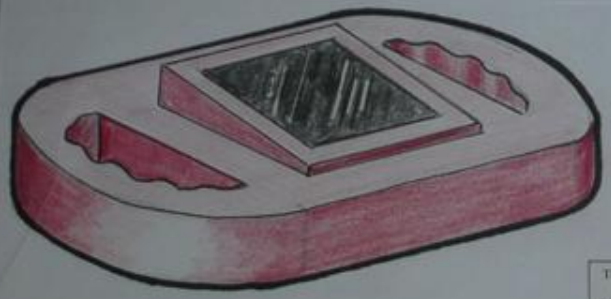
The holes at the back of the Clip Design will enable the clip to be attached to the casing and will therefore be able to be attached to the users belt which means that they can easily access the device and responde to the request immediately.

ese three images show the handle in three difference positions the first image shows the handle when it is clicked into the casing and can be used to carry the casing around. Image two illustrates the handle in motion as it moves about 170 degrees which will then act like a stand and the casing will then be at a slant which will make it easier to use and see.

This design would be added to a number o cases as the back compartment in whicl could be opened to enable the user to change batteries etc. Then to close it they ju need to push the clip back in and the back be held in place.

Initial Ideas

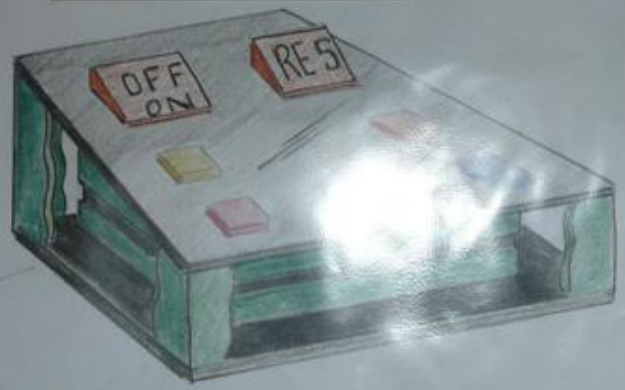
This design is based around a formula one steering wheel. A large LCD screen has been incorporated into this design, this LCD could be used for displaying information, for example to inform the user at the ward office that the staff on the ward need emergency assistance for a patient. The LCD is positioned on a slanted platform to make it easy for the user to see what information is being displayed on the screen if they are to be sitting at a desk.
On this design there is a handle at either side of the design to enable the user to comfortably hold the product when transporting it around the hospital.
I believe that the colour of this design is very attractive and eye catching. This design I also believe would sit out in a busy workplace.



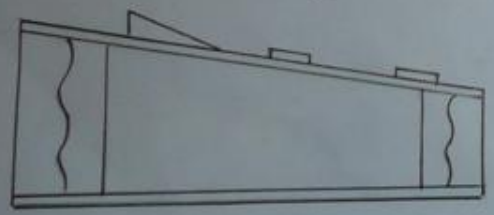
This sketch illustrates a similar unit, with colour coded buttons which depending on which one is clicked will depend on what information is displayed on the receiver unit. The colour of this design is quite dull and therefore I believe that it wouldn't be suitable in a situation where quick reactions are vital. I believe that the user might not be able to see this product on a messy desk.

This design of an alternative finger grip, shows how the tubing can be cut out to make grooves and a textured grip. This will increase the users grip on the product.

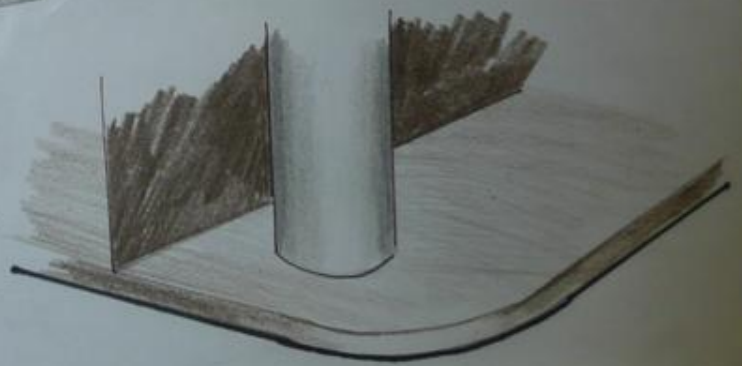
I have made the ON/OFF button and reset button on a slanted platform. This is to make it easy for the user to see the buttons. The edges on the this design are also cut out, in grooves to enable the user to hold the product when transporting.



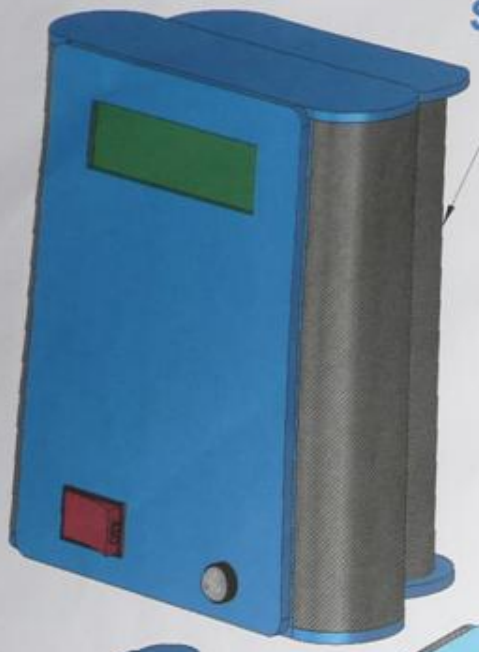
This design is created from two parts which are joined together, to create the product. At any time the user will be able to take the product apart to access the circuit which will be housed inside the casing and access the battery component to change it. The finish of this design is a high shine acrylic plastic which I have chosen because it adds to the overall aesthetics of the product. I have colour coded each button so that the users will be able to recognise which button they are pushing, and relate it to a command.



In this sketch I am illustrating how the small finger handles could be made. The image on the right shows a smooth shiny aluminium finger grip, which the user can hold when using the system.



Sender & Reciever Design Ideas



Handle Made out of grip for extra comfort

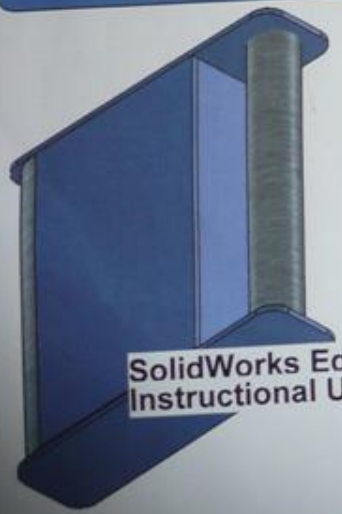
I have included a key in this design so the user will be able to look at the key and determine which button that they need to push in order to send the correct signal to the receiver unit. For example if the user wished to get new bed linen they would push number 6 on the keypad. And the command linked to number 6 would be sent to the receiver unit.

This is a design of a receiver unit, with an LCD screen which will display the command sent from the transmitter unit. The main body of the product is all curved, and the user can comfortably hold both sides of the system and also hold the back of the box with the two added comfort handles at the back. The space between both handles is design to fit a large number of user's hands.

This design is a sender unit, which includes a keypad for transmitting different signals to a receiver box. The box is large enough to hold a relatively big circuit and battery components. The handle has been incorporated to make it easy for the user to hold the product when moving around the hospital.

Designs

This handle will enable the user to continuesly have a firm hold of the product when pressing the buttons. This Handle also makes this product easily transported around the hospital.



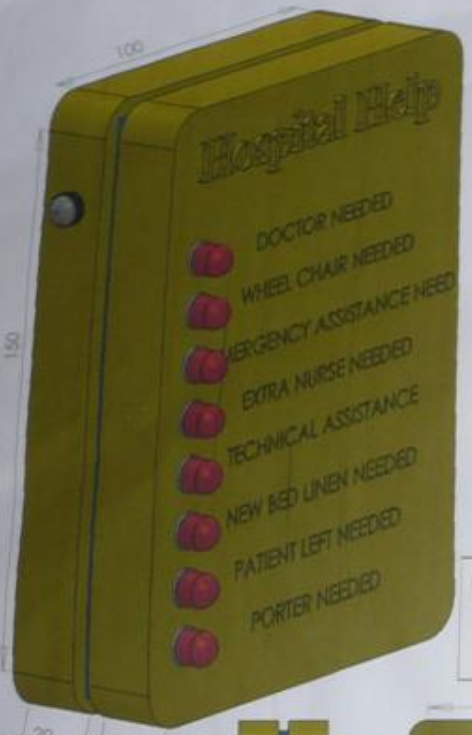
This LCD screen will display writting which will alert the user that help is needed on the ward.

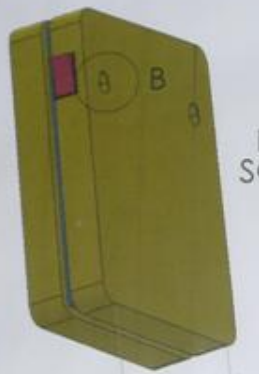
On both sides of this prodcuct there is an LCD screen and an on/off button along with two reset buttons. This means that people who are either left or right handed can hold the product with a firm girp. Which is there to make the product more comfortable to hold.

This product is made out of two main sections. Having two sections will enable the user to open the product and access the circuit, or change the battery when required.

This is mad from a textured gr which mak the produc very comfortab to hold.

Sender Design Idea's





DETAIL B
SCALE 1 : 1

Included on this design are two holes at the back of the product which will enable the user to have the product wall mounted and out of the way. An advantage of having this product wall mounted is that the user will always be able to see the system as on a desk it could get covered in paper or other materials.

I believe the simple yet effective layout of the buttons, keys and logo are effective as they are parallel to each other and are symmetrical.

This design includes 8 buttons that the user can push to send signals to a receiver unit that will be placed in the ward office. The angle of this product is aesthetically pleasing as the 'Hospital Help' name is extruded and always visible. To house a circuit in this design, the user can place the circuit inside the case by removing the base.

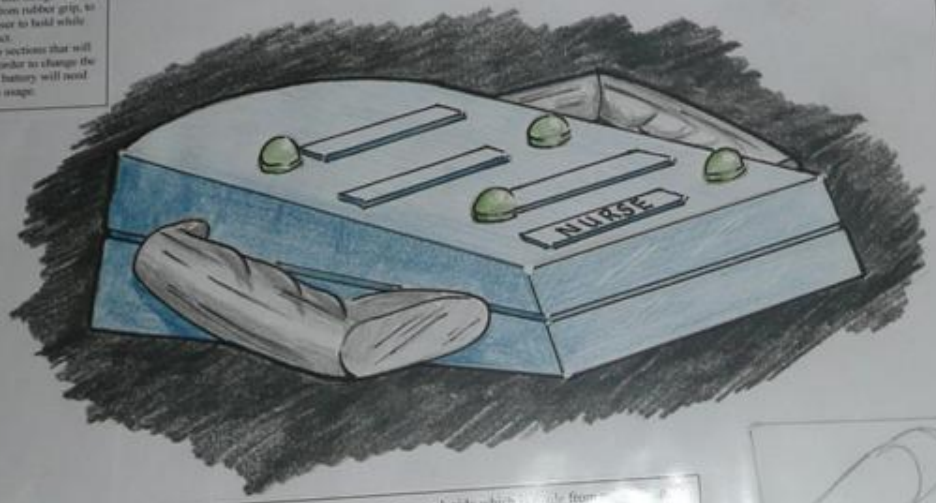
This solid works drawing is of a receiver unit. This design includes a series of 8 LED lights, that depending on which signal is set will depend on which will light up. The box is made from a bright yellow acrylic plastic, to enable the user to see it in a busy environment.

DETAIL A
SCALE 2 : 1

Initial Ideas

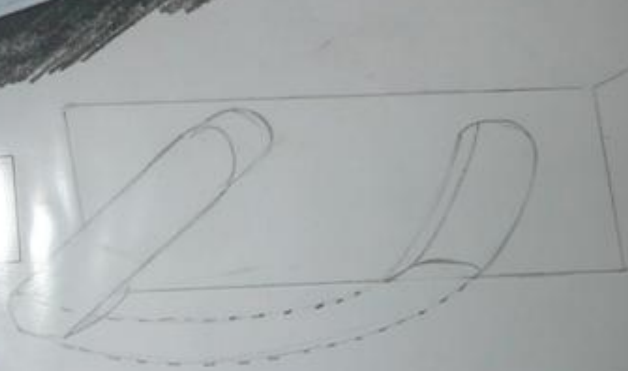
This sketch is a design of a receiver unit. The idea will allow the user to receive four different commands, which the user can then act upon. On this design there are four different LCD screens which will display different information, however which LCD lights up will depend on which signal is sent by the transmitter. When a signal is sent the LED beside each LCD screen will light up so the user can see from a distance that there is a command on the LCD. This will increase the pace in which the command can be carried out. Also on this design there is a handle on each side which is made from rubber grip, to make a comfortable handle for the user to hold while transporting the product.

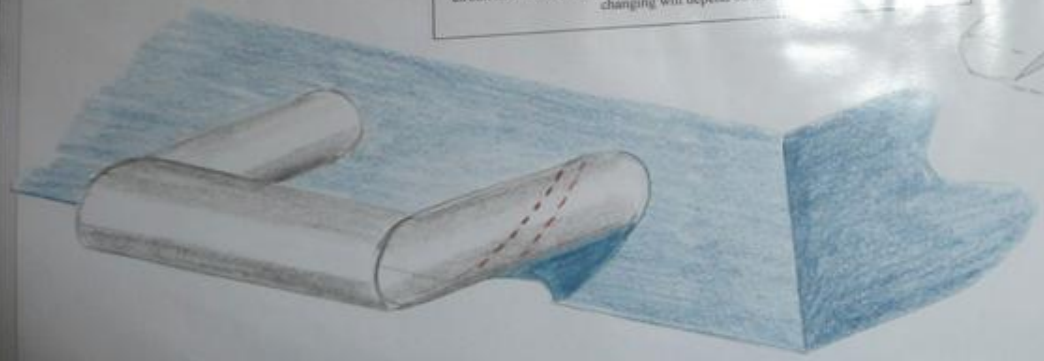
This design also will open up into two sections that will enable the user to access the circuit in order to change the battery. The amount of times that the battery will need changing will depend on its usage.



This image shows a sketch that I have created of a clip that could be attached to my product. This clip would then be attached to the user's trousers or belt. This would enable them to carry around the unit at all times. In order to carry it around the product would need to be small and compact, so it would not be of an obstruction to the user as they walk.

Also on this design there is a handle on each side which [illegible] from [illegible] make a comfortable handle for the user to hold while [illegible] This design also will open up into two sections that will [illegible] circuit in order to change the battery. The amount of [illegible] changing will depend on its [illegible]





This handle could be incorporated into a number of different designs. The aim of this handle is to use it to alter the angle of the box, so that the user can always have a clear view of the top of the box. The sketches to the right illustrate how the handle moves around to a fixed position.

Possible Control Systems

Possible Solution 1

Transmitter

Power Supply → KeyPad → Pic → Encoder → Transmitter Module

Receiver

Power Supply → Receiver Module → Decoder Module → Pic → Pic to drive LCD Screen → LCD Screen

Possible Solution 2

Power Supply → Switches → 18 Pin PIC → Transistor + Bulbs

Possible Solution 3

Power Supply → Switches → 18 Pin PIC → LED's

Possible Solution 4

Power Supply → Switches → 18 Pin PIC → Seven Segment Display

Seven Segment Display
Eight of the LEDs may be arranged in the "figure 8" pattern shown belo in Figure 5.
This is referred to as a seven-segme display. There are 7 segments in the pattern. The decimal point is ignore in the naming of the display.

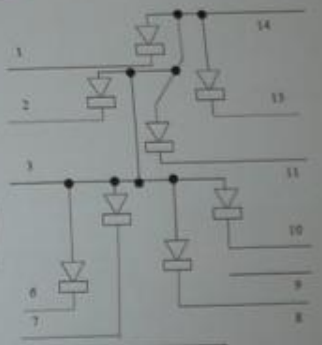
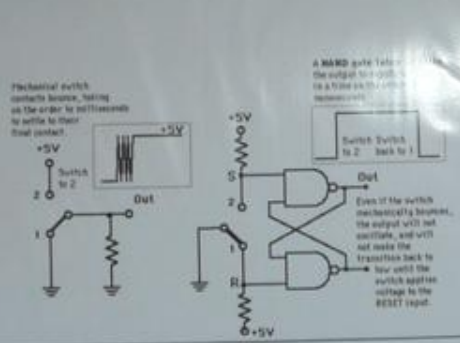
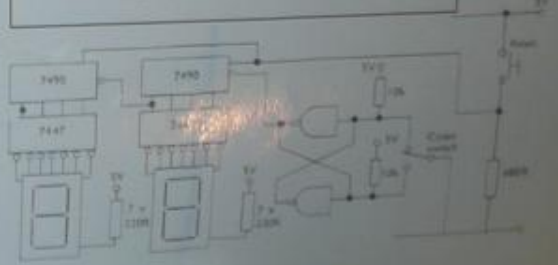


Figure 5



Counting system up to 99 with de-bounce



Counting systems can be operated by a clock system; however they can also be operated by pulsing a switch. There are problems with a mechanical switch lever moves from one counter to the other, it strikes the contact and will bounce a few times before settling on the contact. A similar situation to this is when a ball is dropped on the ground, it will not fall and sit stationary on the ground immediately, but instead it will bounce a few times before sitting stationary. This extra bounce may only take a millisecond, but as counters will work at speeds far in excess of that, it will register one count for every single bounce. This will then in turn give an incorrect count. An example when this would be a problem is if the system was counting money the system would give out less change than the person is due as it would think it had given out more change that it actually had. This is when a de-bouncing circuit is put in place. The de-bounce will eliminate the extra bounces and therefore will result in the system counting the correct number.

212 Series Decoders

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Capable of decoding 12 bits of information
- Binary address setting
- Received codes are checked 3 times
- Address/Data number combination - HT12D: 8 address bits and 4 data bits - HT12F: 12 address bits only
- Built-in oscillator needs only 5% resistor
- Valid transmission indicator
- Easy interface with an RF or an infrared transmission medium
- Minimal external components
- Pair with Holtek's 2^{12} series of encoders
- 18-pin DIP, 20-pin SOP package

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

General Description

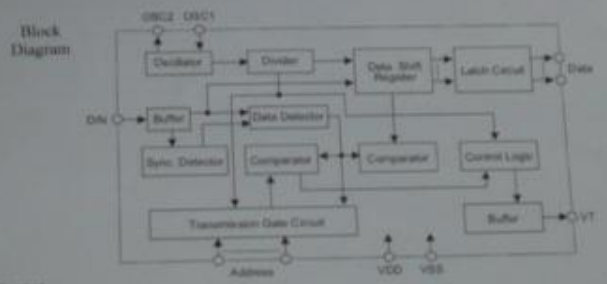
The 212 decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 212 series of encoders. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 212 series of decoders are capable of decoding information that consist of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

Functional Description

Operation

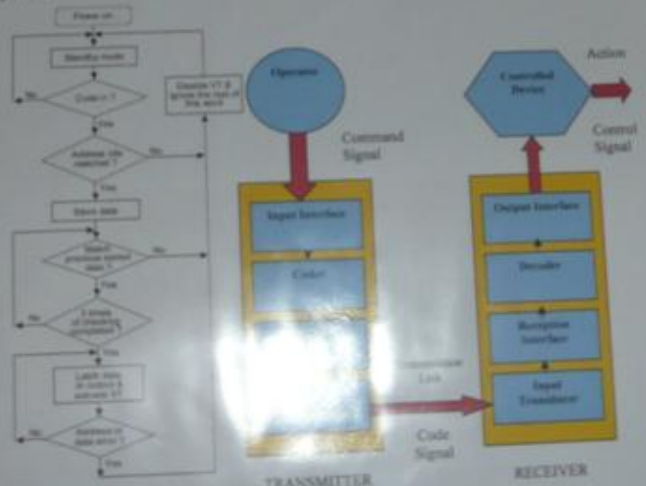
The 212 series of decoders provides various combinations of addresses and data pins in different packages so as to pair with the 212 series of encoders. The decoders receive data that are transmitted by an encoder and interpret the first N bits of code period as addresses and the last 12_N bits as data, where N is the address code number. A signal on the DIN pin activates the oscillator which in turn decodes the incoming address and data. The decoders will then check the received address three times continuously. If the received address codes all match the contents of the decoders local address, the 12_N bits of data are decoded to activate the output pins and the VT pin is set high to indicate a valid transmission. This will last unless the address code is incorrect or no signal is received. The output of the VT pin is high only when the transmission is valid. Otherwise it is always low.

Block Diagram



Flowchart

The oscillator is disabled in the standby state and activated when a logic "high" signal applies to the DIN pin. That is to say, the DIN should be kept low if there is no signal input.



Output Type

Of the 2^{12} series of decoders, the HT12F has no data output pin but its VT pin can be used as a momentary data output. The HT12D, on the other hand, provides 4 latch type data pins whose data remain unchanged until new data are received.

Part No.	Data Pins	Address Pins	Output Type	Operating Voltage
HT12D	4	8	Latch	2.4V~12V
HT12F	0	12	—	2.4V~12V

Inputs

Input is the term denoting either an entrance or changes which are inserted into a system and which activate/modify a process. There are many different inputs for circuits, below are examples of inputs;

Keypads

A keypad is a series of buttons in that can come in 4x4 or 3x4 once a button is pressed a signal is then sent to the receiver unit which will record which button has been pushed or in this case display an action on the LCD screen.

Microphone headset

The headset has a built in microphone which when the person speaks into the microphone the sound is converted and sent to the receiving unit. These type of systems are used a lot when instant assistance is needed for example Tesco use them so they can get assistance at the tills immediately.

Outputs

LCD Screen

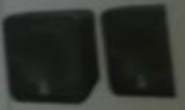
A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures. Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as video players, gaming devices.

LED

LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LED's emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness.

Load Speaker

A loudspeaker (or "speaker") is an electroacoustic transducer that converts an electrical signal into sound. The speaker moves in accordance with the variations of an electrical signal and causes sound waves to propagate through a medium such as air or water.



Intial Ideas Analysis of Existing Circutry

AM-HRRN-XXX

:eiver

- COMPACT HYBRID MODULES
- VERY HIGH FREQUENCY STABILITY (with no adjustable components)
- COMOS/TTLCOMPATIBLE OUTPUT
- LOW CURRENT CONSUMPTION
  - ➔ RR3 TYP 2.5mA
  - ➔ RR6/8 TYP 0.5Ma
- SINGLE SUPPLY VOLTAGE 3V or 5V
- COMPATIBLE WITH R.F SOLUTIONS AM TRANSMITTERS
- PATENTED LASER TRIMMED INDUCTOR
- AVAILABLE FROM 250-450 MHz
- COMPLIANT TO ETSI 300-220
- REQUIRES NO RADIO LICENCE TO OPERATE

scription

e R.F Solutions range of AM 'Super Regen' Receiver modules are compact ired RF receivers, which can be used to capture undecoded data from any A Transmitter, such as R.F. Solutions AM-TX1, or AM-RT4/ 5 range of nsmitters.

ese modules show a very high frequency stability over a wide operating eperature even when subjected to mechanical vibrations or manual idling. A unique laser trimming process which has been patented gives a y accurate on board inductor, removing the need for any adjustable nponents.

f receivers are compatible, producing a CMOS/TTL output, and require nnections to power and antenna only. The HRR6 is a version with very low wer consumption which has a typical quiescent current drain of only mA. In addition the HRR8 operates a 3Vdc supply.

AM Hybrid Transmitter

Features

- COMPLETE RF TRANSMITTER
- TRANSMIT RANGE UP TO 70m
- CMOS/TTL INPUT
- AVAILABLE IN DIL OR SIL PACKAGE
- NO ADJUSTIBLE COMPONENTS
- VERY STABLE OPERATING FREQUENCY
- LOW CURRENT CONSUMPTION (TYP 4mA)
- LOW OPERATING VOLTAGE (2-14V)
- AVAILABLE AS 315, 418 OR 433 MHz
- COMPATIBLE WITH RF SOLUTIONS RECIEVERS

Applications

- WIRELESS SECURITY SYSTEMS
- CAR ALARMS
- REMOTE GATE CONTROLS
- REMOTE SENSING
- DATA CAPTURE
- SENSOR REPORTING

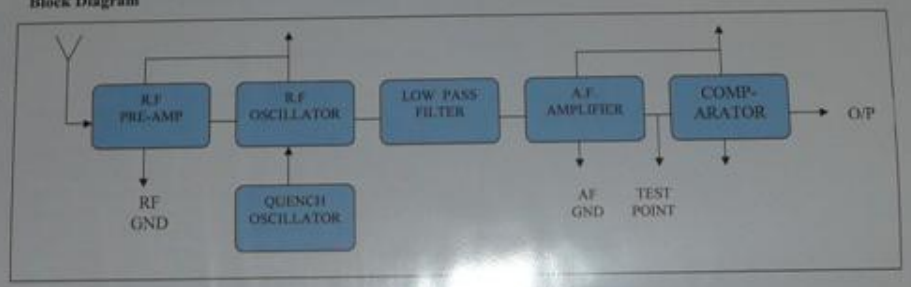
Description

The R.F Solutions Ltd. AM hybrid transmitter module provides a complete RF transmitter which can be used to transmit data at up to 4KHz from any standard CMOS/TTL source.

The module is very simple to operate and offers low current consumption (typ. 4 mA). Data can be supplied directly from a microprocessor or encoding device, thus keeping the component count down and ensuring a low hardware cost.

The module exhibits extremely stable electronic characteristics due to the use of 'Thick-Film' hybrid technology, which uses no adjustable components and ensures

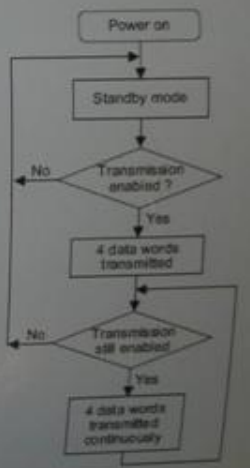
Block Diagram



Transmission enable

For the HT12E encoder, transmiss enabled by applying a low signal to th For the HT12A/B/C encoders transm enabled by applying a low signal to an the data pins d2~d11.

HT12E



212 Series Encoders

Features

- Operating voltage
- 2.4V~5V for the HT16A
- 2.4V~12V for the HT12E
- Low power and high noise immunity CMOS
- technology
- Low standby current: 0.1_A (typ.) at VDD=5V
- HT12A with a 38kHz carrier for infrared transmission
- medium
- Minimum transmission word
- Four words for the HT12E
- One word for the HT12A
- Built-in oscillator needs only 5% resistor
- Data code has positive polarity
- Minimal external components
- Pair with Holtek_s 212 series of decoders
- 18-pin DIP, 20-pin SOP package

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

General Description

The 212 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/ data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 212 series of encoders. The HT12A additionally provides a 38kHz carrier for infrared systems.

Flowchart

• HT12A

Inputs

Input is the term denoting either an entrance

Initial Ideas- Analysing Existing Products

Product 4

Intercom System

An intercom system allows the person to lift the phone and talk to who ever is listening to the speaker on the receiver. However it can also work the other way and the person at the receiver can become the sender by pushing the button on the machine and speak into the built in microphone. This system is most commonly used in homes or private areas such as nursery's or schools were the person in the office can find out who is at the door before the push the button to release the lock on the door. This is very useful for places where security is essential. However it could also be used in a hospital by having the phone on the ward and the speaker in the ward office as the machine works up to 150 meter's apart. This system provides instant communication between the two people.

There are also more advanced intercom systems that allow the person inside the building to see a live video of the person at the door. This is also useful in identifying a person before they enter the building.

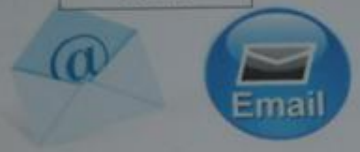
Advantages of an Intercom system

- The two people can both have immediate contact with each other,
- Depending on the model of the system they can communicate up to a distance of 150 meter's,
- The batteries do not need changed as the machines will be connected to the mains power supply of the building.

Disadvantages of an Intercom system

- **A major disadvantage of an intercom system is that the sound quality is usually poor and therefore it is difficult to understand the person on the sending unit,**
- **The receivers are subject to interference with other radio waves,**
- **These systems can be very expensive.**

Product 5



Email System

Email is the shortened term for Electronic Mail. Email is another way of sending and receiving information. Email is just like sending a letter in the post however once you send the letter within a few seconds it will have arrived at its destination. You can also attach files to an email such as audio sounds or images and even hyperlinks. To have access to email you must be logged onto a computer that also must be connected to the internet. Nowadays you can access your email from a mobile phone or Ipod. This is effective as you can connect to the web where ever you are.

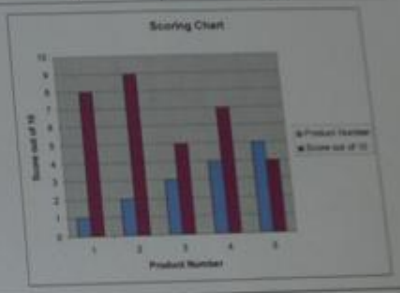
Advantages of Email

- **You Can attach images, sound clips and hyperlinks,**
- **You don't have to pay for any emails that you send,**
- **It is easy to set up an [illegible]**
- **You can send the [illegible] people without retyping [illegible]**
- **You can save all of [illegible] the same message [illegible]**

Disadvantages of Email

- **You either have to be on a computer that has an internet connection or a portable device that has internet connection to send or receive an email,**
- **The equipment that you will need to access your email, for example , computer or portable device can be very expensive,**
- **The computer won't give you any sign that you have an email unless you sign into your email account and check if you have one.**

Product Number	Score out of 10
1	8
2	9
3	5
4	7
5	4



After studying and analysing all the different types of products that are currently on the market, I used strict criteria in helping me scoring the systems. So that I would find the one that I believe is the most effective and best buy on the market and which product is the least effective for the communication within a hospital.

The product that I gave the best rating to which was 9/10 was the Two way radios which will allow instant communication within an environment which depends on quick reactions and situations that need to be reacted on as quick as possible. This system will allow both users to send and receive voice sounds to one and another. The main advantage apart from the speed of the transition of the audio sound is that once this system is bought there are no other costs involved in the communication of both handsets, other than electric to charge the handsets.

The product that I deem to be least effective in the hospital situation and with the lowest score is the mobile phone, which will also send and receive voice audio, with the added extra of also receiving text as well. My main reason for choosing this to be the lowest scoring product is because at times signal can be lost and therefore the communication would not work within the hospital. The other big disadvantage with using a mobile phone is that every time a call is made or a text message sent, the user will have to pay a fee which is around 10p per text and 25p per minute when calling another handset. This would not be ideal in a hospital situation when communication will be needed a great deal of times throughout the day.

Initial Ideas- Analysing Existing Products

Product 1

Pager Systems

A Pager is basically a small radio that listens to one radio station all the time. A radio transmitter broadcasts signals on a certain frequency which the pager will connected to the build in receiver when the pager is turned on. Each pager has a **Channel Access Protocol (CAP) code** which is a unique code to that pager. The pager will constantly wait for its CAP code, and when it recognizes its code being sent through the radio signals it will provide information such as a phone number, text or an audio sound.

There are five different types of pager's;
Beeper- this type of pager will create a sound, vibrate, light up or a combination, when a signal is broadcasted.
Voice/Tone- a voice/tone pager will play a recorded message when a signal is broadcasted to the pager.
Numeric- A Numeric pager will alert the user and display numeric data such as a telephone number on the LCD screen.
Alphanumeric- A Alphanumeric pager will send text to the receiver along with and alert tone when a signal is broadcasted to the receiver.
Two way- A two way pager will allow both machines to send and receive text and audio messages.

Advantages of a Pager System
- They are small and compact,
- They can be easily clipped onto a belt or jacket,
- They provide instant communication between two people,
- The pager is only connected to one radio frequency so therefore it is unlikely to receive interference with wither pagers.

Disadvantages of a Pager System
- **A pager is very small and compact and therefore could be lost easily,**
- **If another system tries to connect to the same radio frequency it will cause interference,**

Product 2

Two Way Radios (Walkie Talkies)

Two way radios can both transmit and receive audio such as a person's voice. Unlike a Pager which can only receive text information. Two way radios use two different radio frequencies to carry the two directions of the conversation simultaneously.
Two way radios can be hand held (Walkie Talkies) or stationary based.

This type of product is suitable for event security as they can communicate with each other instantly and as the security are all within a close distance from each other or in the same building the communication should not be interfered in anyway. These types of two way radios are made from acrylic plastic which is a durable material that will withstand wear and tear.

This product looks aesthetically effective as it is small and compact and can be easily clipped onto a belt. The product is also ergonomically effective as it easily fits in your hand and you can hold it with ease as there is hand grip incorporated into the design.
Both handsets have rechargeable batteries when they are placed back in their cradle they will recharge.

Advantages of a Two Way Radio System
- Both handsets are small and comfortable to hold in your hand,
- The walkie talkies can also be clipped onto your belt which is useful as you don't always have to carry it around in your hand.
- The batteries are rechargeable and therefore you don't need to change the batteries when they run out.

Disadvantages of a Two Way Radio System
- If other handsets try to connect to the same frequency it could weaken the radio frequency,
- If people connected to the same frequency they will be able to hear the conversation,

Product 3

Mobile Phones

Mobile telephones are another type of two-way radios. When you talk into a mobile telephone, it will pick up your voice, the mobile phone will then convert your voice into radio frequency energy which is known as radio waves. The radio waves are sent through the air until they reach a receiver at a nearby base station. The base station then sends your call through the telephone network until it reaches the person you are calling.

When you receive a call on your mobile phone, the message travels through the telephone network until it reaches a base station close to your phone. The base station then sends out radio waves that are detected by a receiver in your telephone, where the signals are changed back into voice or data.

There are a huge number of different models of mobile phones on the market. Some which take pictures, videos, and some that let the user play games.

Advantages of using a Mobile Phone
- They come in a range of models some with just the basic features such as text and phone calling.
- Mobile Phones are easily stored in your pocket and therefore easy to carry around.
- You can contact anyone else that has a mobile phone from all over the world.

Disadvantages of using a Mobile Phone
- You have to pay for each call you make.
- At times there is no reception in the area you may be in and therefore you will not be able to get through to the person you wish to.
- If the person you are trying to get through to is already on the phone to someone else you will not be able to get through to them.
- Depending on the usage the battery can run out after a number of hours.

Problem Identification And Specification

The problem that I have been made aware of takes place on a hospital ward. The problem is due to the lack of nurses on duty at one time. A nurse will have a number of different duties to carryout each day for example, help patients to the toilet, change bedding, give patients their tablets a number of times throughout the day, help patients get out of bed and sit on the seat beside their bed, providing the patients with food, along with generally helping patients recover from an illness. My Cousin is a nurse in the Royal Victoria Hospital and she has discovered a problem that proses a huge risk when she or one of the other nurses on her ward has to leave the ward to get a wheel chair for a patient on her ward, or to collect new bed linen for a patient or to find someone to help fix technical machines or even to get a patient chair lift. When a nurse leaves the ward it only leaves two nurses on the ward which could be fatal as if a patient suddenly needs emergency help the two nurses that are left will have to attend to that patient leaving all other patients at a risk in case something was to happen to them it would be difficult to get help as the only two nurses on the ward are attending to another patient.

This issue does not only apply in hospitals it is also an ongoing problem in retail shops, as I work in retail myself I have discovered that at night there are only two assistants in the shop at one time. The problem that occurs in this case is when a group of thief's come in and try and distract assistant 1 by asking them to check for a shoe size out in the back store room while the second thief tries to distract the second assistant, meanwhile the third thief steals items off the shelves. This is a serious problem as it is causes lose in money for the company.

Design Brief

I intend to design, manufacture, test and evaluate a product or system that enables nurse's [illegible] ward to communicate with the staff in the ward office.

Inputs	Outputs
1. Doctor needed	A Doctor is needed
2. Wheel Chair needed	A Wheel Chair is needed
3. Emergency Assistance needed	EMERGENCY ASSISTANCE NEEDED
4. Extra nurse needed	Extra nurse needed
5. Technical assistance needed	Technical assistance
6. New bed linen needed	New bed linen needed
7. Patient lift needed	A patient lift needed
8. Porter Needed	Porter Needed

BSI KITE MARK LOGO

Function

[illegible]

Materials

[illegible]

Safety

[illegible]

Aesthetics

[illegible]

Ergonomics

[illegible]

Reliability

[illegible]

[illegible]

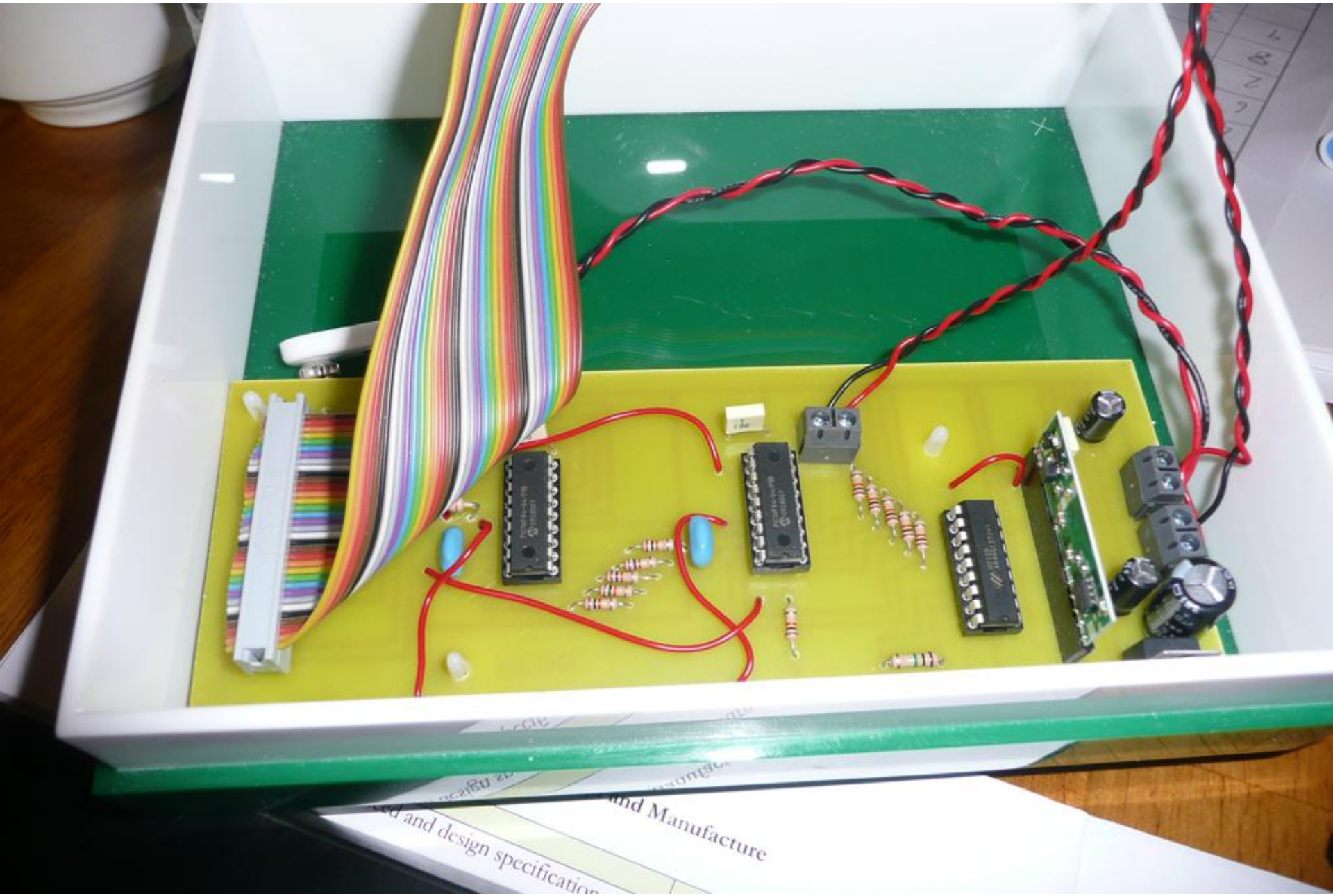
Cost

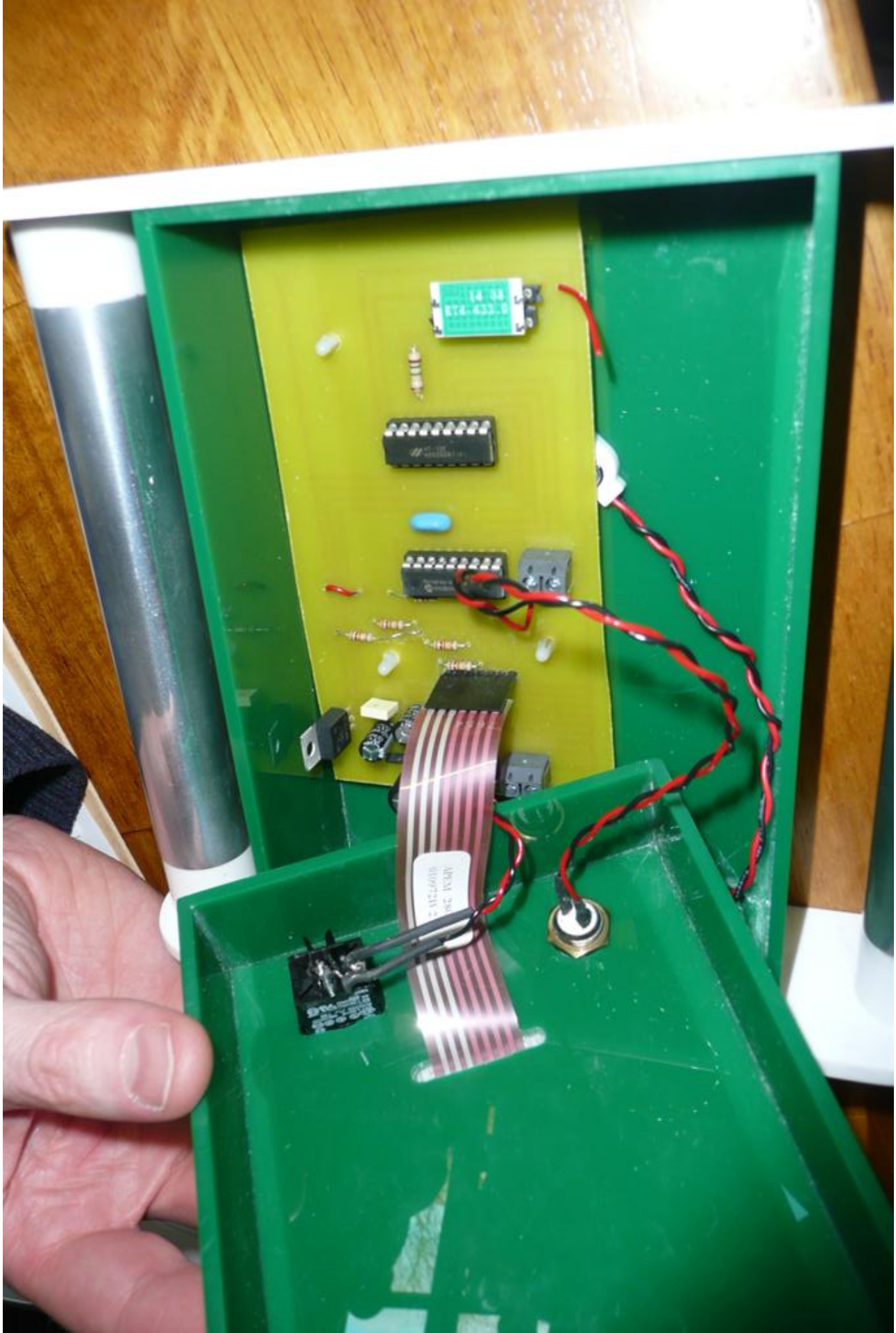
[illegible]

Anthropometrics

[illegible]


Hospital Help
1
2
3
4
5
6
7
8
9
*
0
#


nd Manufacture
ed and design specificatio

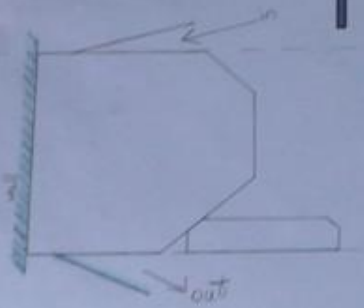


Modifications

During my testing I found that some areas of my product were weaker than others.

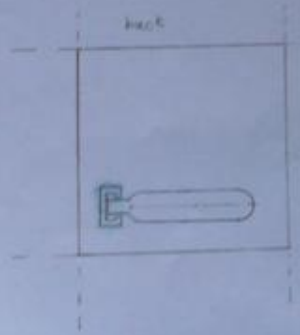
1. The main area that needs development is how the memos are taken out of the product.
2. Another area that could be modified is how the memos are put in.
3. Another feature that could be added to the product would be to add a non slip material to the bottom of the product to stop it sliding about when it is being used.
4. In terms of aesthetics I would add more over moulding to the small mould, I would place a small piece of plastic to cover the screw holes for the screen.

1



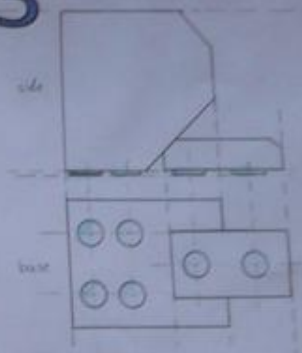
This idea to the left shows how the product could be wall mounted, wall mounting the product allows for another lid to be placed on the base. This lid would then allow for the memos to be all taken out at once, however, doing this means that the product looses the ability to count down. The reset would be incorporated into the bottom lid so when the lid is opened and all the memos are taken out, the display is reset to '000'.

As seen in the picture below, a photo-transistor could replace the LDR, the photo-transistor would pick up the pulse as the memo is pulled through the gap and breaks the beam of light.

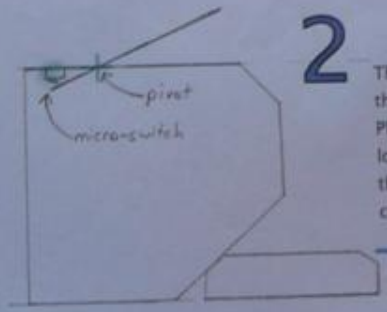


3

This modification involved adding small feet to the bottom of the product, these feet would be made from a non-slip material which would stop the product sliding about.



2



The picture to the left shows how the micro-switch could be moved. Placing it in this manner would allow the lid to be opened easier as there would be no strain needed to click the micro-switch.

Aesthetics

- The final finish of the product and the overall look that has been produced is very modern, however, it is still modest and quiet in looks, both these features allow it to fit into any office space. The 2 moulds compliment the design of each other, the way they fit together help show off the angles of the mould, giving of a modern feel to the product. I gave the product 9/10 in this area.
- The circuits are concealed in a very neat manner inside the product, the extra time spent making the PCBs as small as possible allowed them to sit in the bottom of the product, a black sheet of plastic was then carefully cut out and formed so that the circuits are covered even if the product is opened up. I feel the product deserves 10/10 in this area.

In conclusion it can be clearly seen that the product scores highly in the area of aesthetics, it has an average score of 9.5/10. The angles where the moulds join together help make the product stand out among other office equipment.




Materials

- During the manufacture of the product a range of materials were used, M.D.F was used to produce the mould from and H.I.P plastic was used to vacuum form with.
- A range of methods were used to work and produce the product throughout the whole manufacture.

Overall I am giving the product 8/10 for materials.

In conclusion the skills and methods used in manufacturing the product have varied and the range of materials has also varied, a score of 8/10 has been given.





Control System:

- When placing a piece of paper into the product, the LDRs are not effective at sensing the input. However, I know the LDRs work as seen in the development section. A reason for this defect may be because the product was tested in a different room to where it was built, so the size of the resistors in the LDR potential divider may be wrong for the amount of light in the testing room. I have given the LDRs a 5/10 as they are not very reliable when the are in the product.
- Before I put the control system in the product the UP/DOWN count was working perfectly, however, since I put it in the product it has started to affect the count. This is a bad problem as it changes the number displayed on the screen every time the lid is opened. I am again going to give the UP/DOWN switch 5/10 as it still changes the count.
- The display performs well, however since wiring it up to the new PCB the decimal points stay on, I know the connections on the board are right as the numbers are all displayed correctly. I have given the display 8/10, I did not give it 10 because of the decimal points.

In conclusion the control system has failed to work as well inside the product as it did out of the product, the reasons for these problems are unknown as I tried to source the faults of the LDRs, the switch and the decimal points. For the control system out of the product I feel it deserves 9/10. For the control system inside the product it only deserves 4/10. I am going to give the average of these 2 results as the final score, 6/10.

In conclusion to the overall evaluation of the product and control system, my product received an average score of 8/10. This score is high, I feel the product deserves this score, it falls down in some areas, whereas some areas are of very high standard and this kept the overall score high.

Testing Criteria

The main areas of the product to be accessed are:

- Ergonomics,
- Aesthetics, and
- Control system

When looking at these three areas to be evaluated, I turned back to my spec to see how my product has compared with my original idea of what I needed. I looked at my spec and made a list of questions I should ask to see if my product compares in a good or bad way to my spec.

How does the Product Compare to my Original Spec?

Function:

- What size of memos can be held?
- Is the display easy to read?

Ergonomics and Anthropometrics:

- Are memos easy to place in and take out?
- What weight is the product?

Materials:

- Were a range of materials used in the manufacture?

Aesthetics:

- Does the product look modern and stylish?
- Are the circuits concealed in a neat manner?

System

- Do the sensors work effectively?
- Does the UP/DOWN count switch work effectively?
- Does the display work well?

Evaluation of Outcome

In this section I am going to compare my product to my original spec and score the product.

Function:

- When making my product, I decided to scale the model so that it was easier and more viable to produce in a workshop environment. The size if memos the product can hold are 8cm by 10cm, the size of the paper was restricted by the hole in the top of the mould. I have given the product a score of 4/10, I have given this score because the product does not hold A4 pages as it said in the spec.
- The display on the product is very easy to read. When you are inserting a memo, the screen is very easy to read as you are looking straight down on it. I give the screen 10/10, it matches exactly what the spec states.

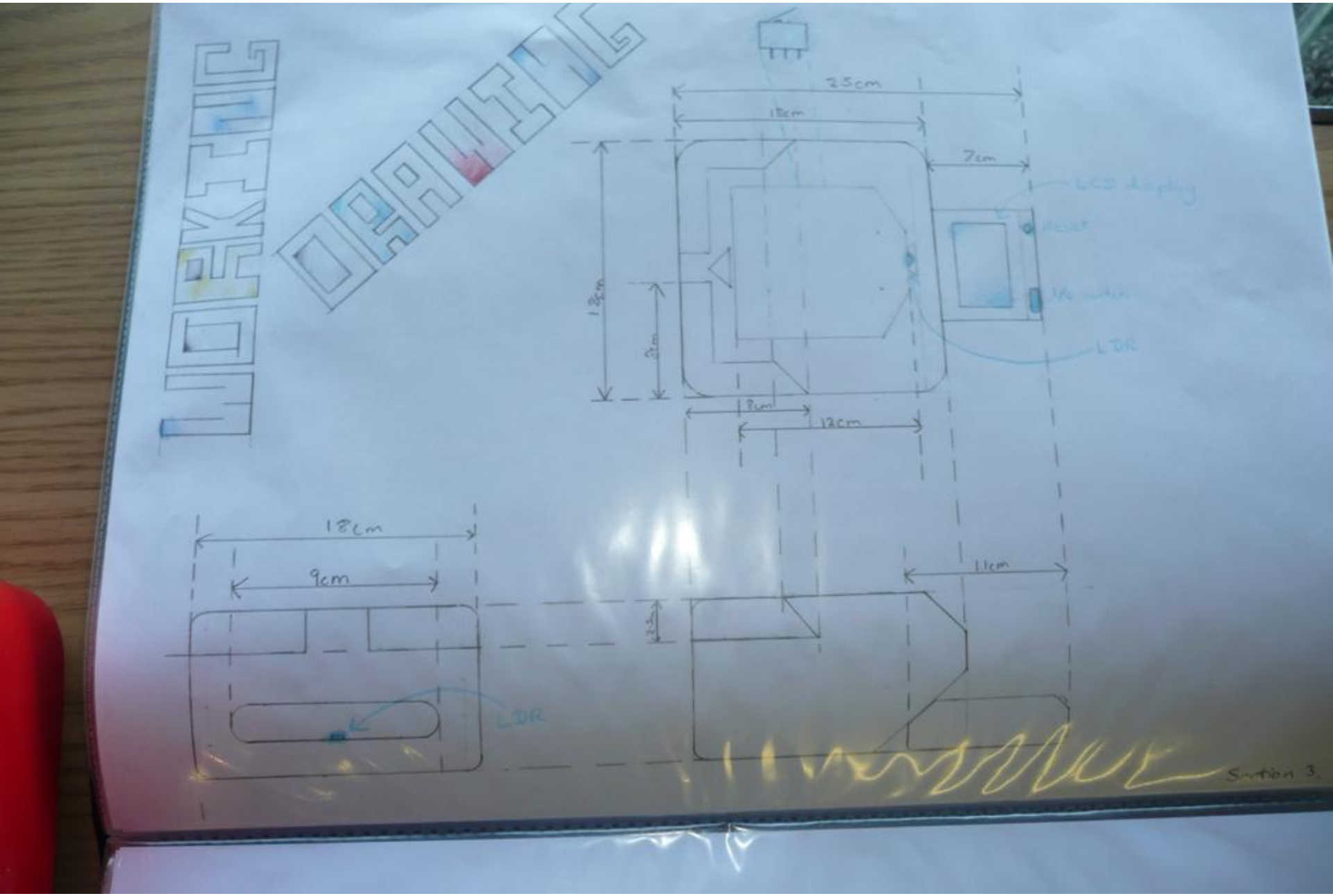
In conclusion of this area of analysis of the product the average score was 7/10, although this is still a good score it was seriously dampened by the fact the product was made to scale and does not hold A4 memos. In light of this fact I am going to give the product a score of 9/10 for Function.

Ergonomics and Anthropometrics:

- The memos are relatively easy to place in, you lift the lid with one hand and place the memo in with the other, when lifting the lid you have to apply pressure down so this pressure stops the product from moving about, this fact improves the ergonomics of the product. I give the product 7/10 for putting in memos.
- Taking memos out of the product is slightly harder in comparison to placing them in, it is hard to grip the paper with just your fingers. I am going to give it 5/10.
- The reset button and [illegible]/OFF switch are very easy to use, they are positioned on the front of the small mould, this allows them to be clearly visible and easily pushed by any user. I am giving them 10/10.
- The spec states that the product should way less than 2kg when empty, the actual product weighs 0.5kg. This fact is good as the product is lighter and easier transported, however, it may be too light as it can be pushed about easily. The stability of the product is also very good as all the weight is at the bottom. In mind of all these things I gave this section a score of 9/10.

In conclusion to the ergonomics of the product, they are mixed, in terms of placing memos in and out, the scores are slightly low. In terms of the electronic switches and stability of the product the scores are very high. Overall the product received an average score of 8/10.

Section 5.1


25cm
18cm
7cm
LCD display
Reset
IR sensor
LDR
13cm
8cm
8cm
12cm
18cm
9cm
11cm
3cm
LDR
Section 3

8 The development of the new mould to house the display and switches allows the product to increase in aesthetic potential and also greatly increases the ergonomics of the whole product, the buttons are easy to use and the screen is easy to read.



Integration of System with Product

Placing the electronic components so that the best possible Ergonomic standard is reached while maintaining the highest possible level of Aesthetics was the main goal in this area.

Both my PCB's fitted neatly into the bottom of my mould, I then made a black cover to conceal the circuits within the bottom of the mould.


On this black cover I was able to place the LDR being used to sense a memo being taken out of the box.

Below is a picture showing how the bar and the micro-switch are integrated with each other. The bar helps provide tension in the plastic to click the switch.

In the photo to the right, the LDR that is used to provide the input pulse is shown, the user can clearly be seen lifting the lid. In this instance, the micro switch would be clicked and therefore setting the count to up.

9 The final development work I did was to over mould the product. Doing this significantly added to the aesthetic value of the product and gave it a 3-D appearance.




Integration of System with User and Environment

The main links between product and the user are in the lid and the switches on the small mould. In both these areas time has been taken to carefully place the switches and the lid, this ensures that the ergonomic capability of the product is at its highest. The picture to the left shows the ease of use of the product. The picture below shows how the power is connected into the system, the terminals are placed in the underside slant to help conceal them so that high aesthetic levels are maintained.



The product was designed to be used in a modern office space, the choice of colours and the over moulding on the rear of the product help to increase the aesthetic values in relation to being placed in a modern office.

When wiring up between the small mould and the circuits in the main mould I had to use ribbon cable brought through an accurately marked and drilled hole, on either side of this hole, 2 more holes for nuts and bolts were also drilled to connect the 2 moulds.



3 The area to be routered for the lid was then marked and routered out. The wood was nailed on to the mould to make a ledge for the router to work of.

4 I vacuum formed a first draft of my mould to place circuits inside. I then marked out where I needed holes drilled, I put the formed mould back over the wooden mould and used it as a template to mark out where the circuits went.
This allowed me to then use a frostner to drill mounts for my PCB's.

5 After this I vacuum formed the final draft of my mould, I was then able to work the mould into an aesthetically and ergonomically pleasing product. I used a Stanley knife to cut out a whole in the back the mould as a place to pull the memos. I was also able to cut an area in the top half out for the lid.

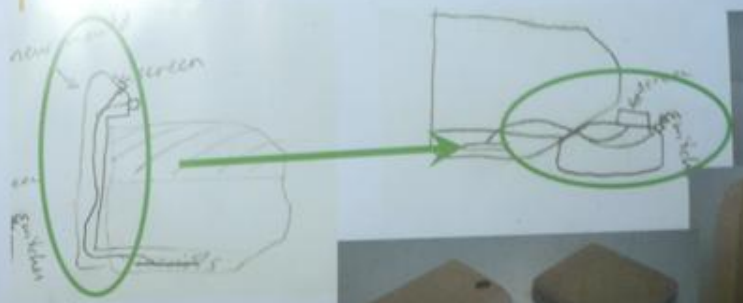
6 The next stage was to design a lid. Initially I was going to make a hinged lid, however, as I developed this idea I found that a hinged lid would not provide enough force to click my switch. By this stage I had a bar made to use as a hinge, but I then found that if I connected a piece of plastic to this hinge, but didn't let it pivot, that it would provide extra tension in the plastic and therefore help to click the switch.

Modifications

Ergonomics and Aesthetics Development:
I designed the lid to look aesthetically similar to the curves on the main box, I heated the end and bent it upwards so that it makes the product more user friendly, increasing the overall ergonomics of the product.

Modifications

7 Ergonomics and Aesthetics Development:
When deciding where to place my LCD screen, I found that I had to make another mould, firstly I was going to make a second mould that fitted over the back of the product, I then decided to make a smaller mould that sat in front of my product, this increased the aesthetics and ergonomics of the products as the size was smaller. I then made the second mould and shaped it to an aesthetically pleasing design and vacuum formed it to place the display and switches.



Development of Manufacture

Detailed Plan Of Manufacture For Product:

1. Produce sketches to show the main shape of the product in rough.
2. Glue MDF together to produce the main mould.
3. Mark out angles to be cut out and router edges.
4. Develop mould into an aesthetically pleasing shape.
5. Mark out border for lid on top half of mould and router out the area.
6. Vacuum form first draft of mould to place circuits.
7. When circuits have been placed, use plastic mould to mark out on wooden mould.
8. Use frostner to drill out the marked area to mount PCBs on.
9. Vacuum form the final draft of the mould.
10. Use Stanley knife to cut out area on top of the mould where memos can be put in.
11. Drill holes in bottom of mould to hold circuits in place.
12. Cut out and design a lid.
13. Cut out and glue MDF together to make second mould to house screen and switches.
14. Mark out angles to cut out so mould can be set up and connected to main mould.
15. Vacuum form first draft to place LCD screen and switches.
16. Use a frostner to drill out sockets to mount the screen.
17. Reform the mould again, using the Stanley knife cut out the hole for the screen. Also ergonomically place and cut out 2 holes for the reset and on/off switch.
18. Glue a collar around the edge of each mould to hold both halves together.
19. Join 2 moulds together.
20. Place and wire up circuits in both moulds and wire up display.

1

I started of sketching down the ideas and problems needed to be overcome on my product.

These photos show ideas of the product will look and sit, and rough ideas of where the circuits would sit.

2

I then moved on to cut out and glue a mould. Initially I was going to use the smaller section to house the circuits but I then changed this idea and decided to house the circuits in the bottom of the main mould.

Modifications

Aesthetics Development:

The mould started as a square, upon making an initial practice mould, I thought the shape was too bulky. Aesthetically the shape was poor, the final shape of the mould is shown in the photo below to the right, there were curves cut out of the top and bottom. The curves and shapes allow the product to be higher quality in terms of aesthetics as it looked sleeker and modern.

Process

- Clean pulse generated from Schmitt trigger provides count input for 4510.
- Chips count up in binary.
- 4543 DECODER chip translates binary codes to decimals.

1 The data below is the chip I am going to use for the process in my control system. I am using my INPUT circuit to provide a pulse, the SCHMITT TRIGGER will provide the clean count pulse which will allow the circuit to count, the pulse will go into PIN 15, the CLOCK INPUT on the chip.

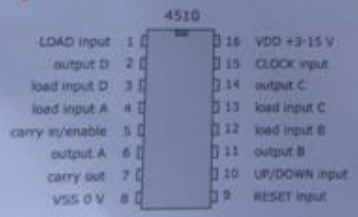
I am going to use a SPDT switch into PIN 10, this will allow me to change the count to UP or DOWN in the 4510 chip.

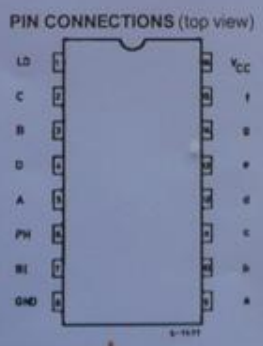
PIN 2, 6, 11 and 14 are the OUTPUT pins, these will be connected to the 4543 DECODER chip below.

PIN 7, the CARRY OUT of the first chip will be connected into the CLOCK input on the second chip, this allows the counter to count up in more than 1 digit.

PINS 1, 3, 4 and 5 are all connected to the -ve and PINS 12, 13 and 16 are all tied to the +ve.

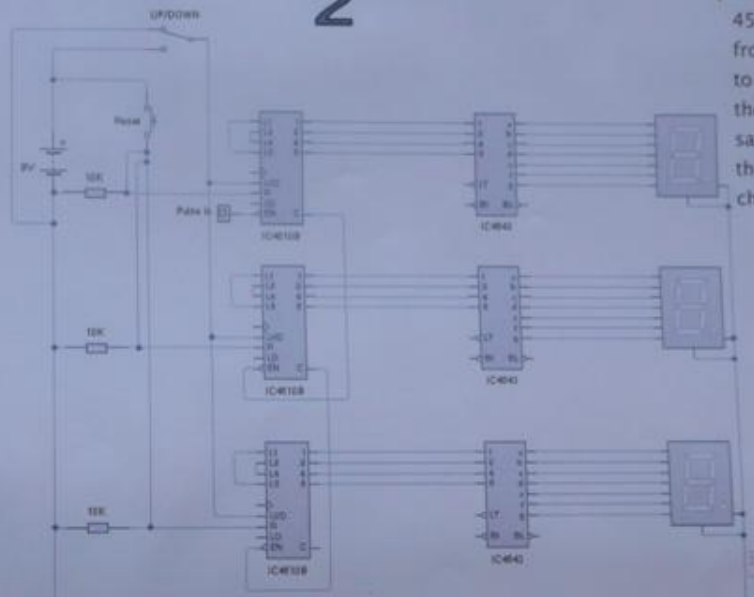
The RESET on the chip is tied high and uses a combined reset for all 3 counter chips.





This is the data for the 4543 decoder/LCD driver chip. The A, B, C and D pins are connected to the 4 output pins on the 4510. the a, b, c, d, e, f, and g are the output pins to the LCD display. Pins 1 and 16 are both tied to the +ve volts and pins 6, 7, and 8 and all tied to the -ve volts.

This is the livewire drawing of my process section of my control system. I had to use 3 separate LED displays to show the wiring as livewire did not have an LCD display diagram. The diagram shows the PULSE IN, this is where the count pulse is received from the SCHMITT **2** TRIGGER from the INPUT section. This pulse goes into the first 4510, a wire is the taken from the CARRY OUT pin to the CARRY IN pin of the second chip, the same is done between the second and third chips.

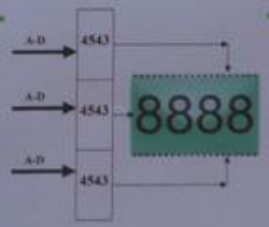


Output

- LCD DISPLAY connected up to OUTPUT pins of 4543 chip.

This is the data for the LCD display.

- Pins 1 and 40 are common and both connected to the -ve volts.
- N.C means the pins are not connected.
- The outputs from the first 4543 chip are connected into the 1A—1G pins, the second 4543 chip outputs go into pins 2A—2G and the third set of 4543 outputs go into pins 3A—3G.



PIN	COM
1	COM
2	Y
3	K
4	N.C
5	N.C
6	N.C
7	N.C
8	DP1
9	1E
10	1D
11	1C
12	DP2
13	2E
14	2D
15	2C
16	DP3
17	3E
18	3D
19	3C
20	3B

PIN	CO
21	3A
22	3F
23	3G
24	2F
25	2A
26	2B
27	2G
28	1
29	1F
30	1A
31	1B
32	1G
33	N.
34	N.
35	N.
36	N.
37	N.
38	
39	
40	C

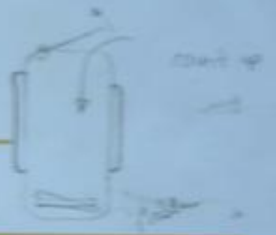
Development of Manufacture

Detailed Plan Of Manufacture For Product:

1. Produce sketches to show the main shape of the product in rough.
2. Glue MDF together to produce the main mould.
3. Mark out angles to be cut out and router edges.
4. Develop mould into an aesthetically pleasing shape.
5. Mark out border for lid on top half of mould and router out the area.
6. Vacuum form first draft of mould to place circuits.
7. When circuits have been placed, use plastic mould to mark out on wooden mould.
8. Use frostner to drill out the marked area to mount PCBs on.
9. Vacuum form the final draft of the mould.
10. Use Stanley knife to cut out area on top of the mould where memos can be put in.
11. Drill holes in bottom of mould to hold circuits in place.
12. Cut out and design a lid.
13. Cut out and glue MDF together to make second mould to house screen and switches.
14. Mark out angles to cut out so mould can be set up and connected to main mould.
15. Vacuum form first draft to place LCD screen and switches.
16. Use a frostner to drill out sockets to mount the screen.
17. Reform the mould again, using the Stanley knife cut out the hole for the screen. Also ergonomically place and cut out 2 holes for the reset and on/off switch.
18. Glue a collar around the edge of each mould to hold both halves together.
19. Join 2 moulds together.
20. Place and wire up circuits in both moulds and wire up display.

1 I started of sketching down the ideas and problems needed to be overcome on my product.

These photos show ideas of the product will look and sit, and rough ideas of where the circuits would sit.



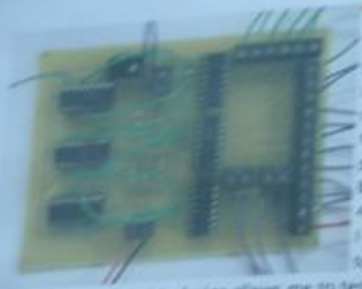
2 I then moved on to cut out and glue a mould. Initially I was going to use the smaller section to house the circuits but I then changed this idea and decided to house the circuits in the bottom of the main mould.

Aesthetics Development:

The mould started as a square, upon making an initial practice mould, I thought the shape was too bulky. Aesthetically the shape was poor, the final shape of the mould is shown in the photo below to the right, there were curves cut out of the top and bottom. The curves and shapes allow the product to be higher quality in terms of aesthetics as it looked sleeker and modern.

Modifications

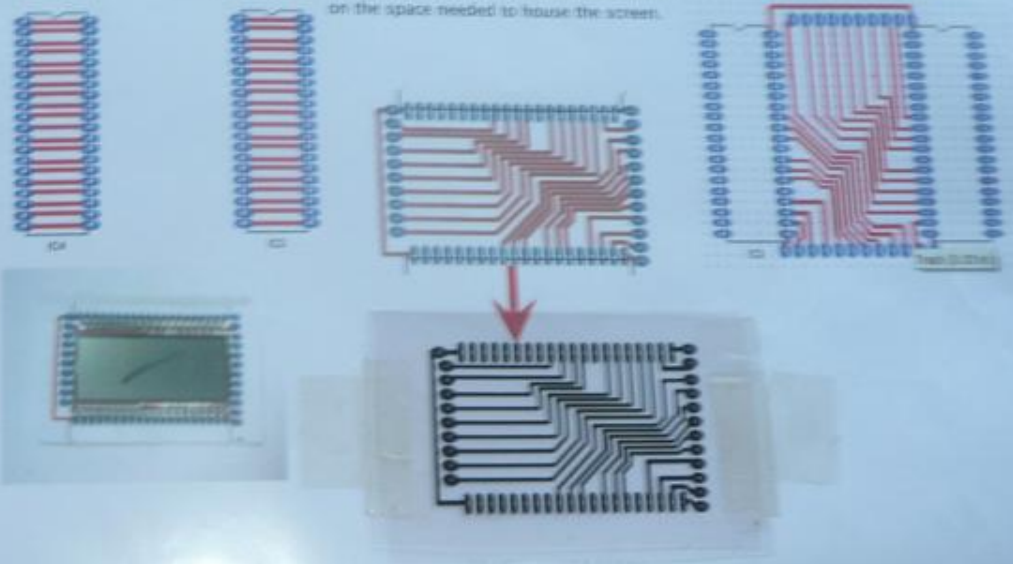
Section 3



I then soldered all the components onto the board. When I did this I did a few tests on the whole circuit and I found that there was a problem with the BCDs between the first 4510 and 4543 chips. I used a multi meter to try isolate the problem, using this device allows me to test for voltages, while doing this I noticed that there was a connection between 2 pins on the 4543 chip, I used a magnifying glass to get a closer look and I found a small bit of solder was lying between the connections and causing the problem, I used a scribe to scrape the solder out, this fixed the problem. I was then testing the UP/DOWN switch (SPDT) and realised that when I moved the switch the screen went blank, this gave me a clue that a connection was touching allowing voltage to run from the +ve to the -ve, thus taking all power from the screen. I again used the magnifying glass and seen that another bit of solder was causing the problem, I again used a scribe to scrape it off. After doing this I ran further tests and found that the circuit was counting up and down correctly.

Output

To make a PCB for my LCD screen, I had to use 2 40 pin chip holders separated at the right distance, initially I was going to use the PCB on the right but I later changed my decision and used the PCB on the right. The chosen PCB made wiring simpler and cut down on the space needed to house the screen.



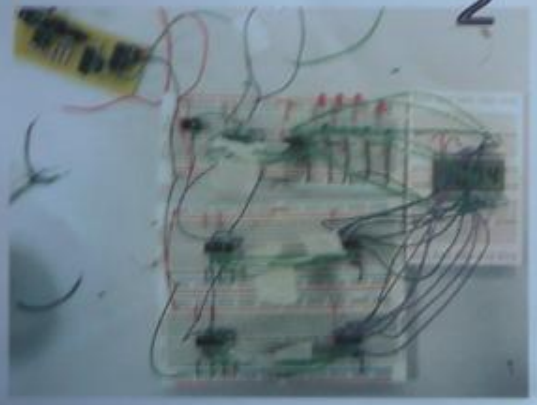
Highly developed Outcome

The picture to the right shows the number 001 being output on the display and the photo on the left shows the number 020 being output. This shows that the inputs, process and outputs are fully working in my control system.

Process

1

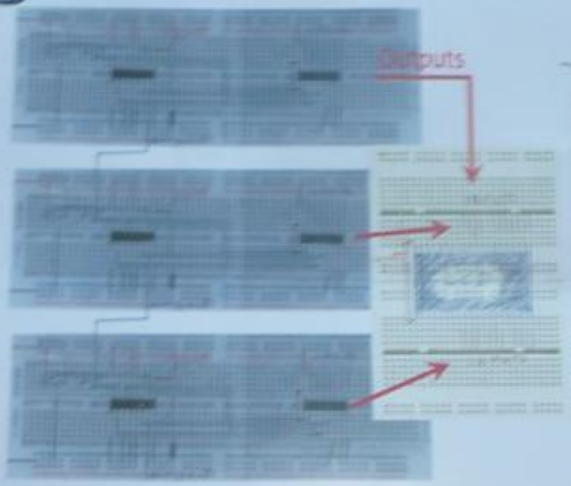
The photo above shows the input section connected to the 4510 chip, the 4 LEDs show a physical representation of the binary codes output by the 4510 chip. These LEDs were simply to let me know the 4510 was counting properly.
The photo below show my input PCB leading into 3 proto-boards together with the LCD screen wired up, each of the 3 larger proto-boards are identical apart from the carry in and carry out pins.



2

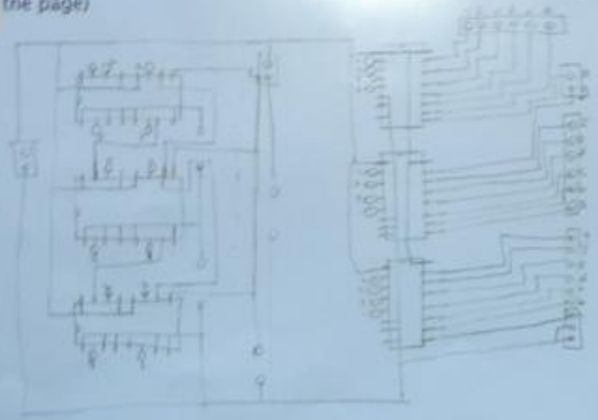
3

I then drew up a proto-board diagram.

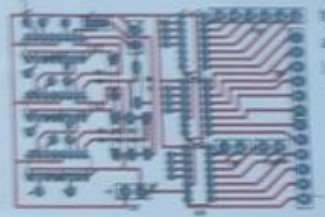


I then designed the PCB layout on [illegible] before designing it on PCB Wizard. (This image has been [illegible] down to fit the page)

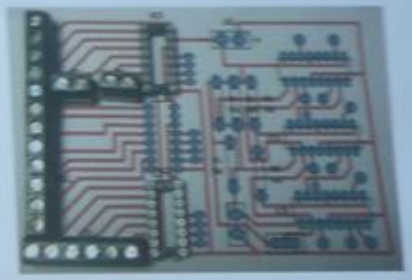
4



I then created a PCB layout on PCB Wizard, I placed some components on the paper layout to check that each one had room, It was then checked by the teacher. This is the first and final draft of my layout as no changes had to be made.

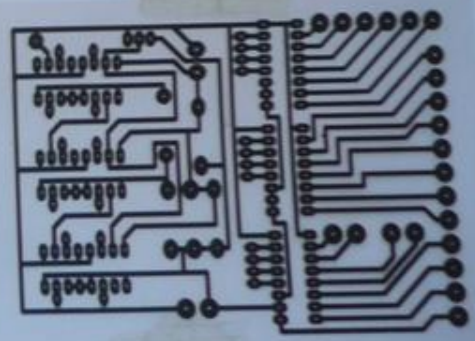


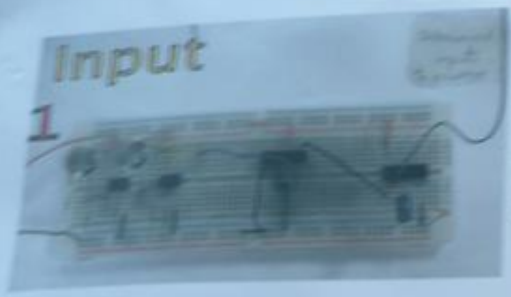
5



The final draft was the printed out on acetate ready to be made on PCB.

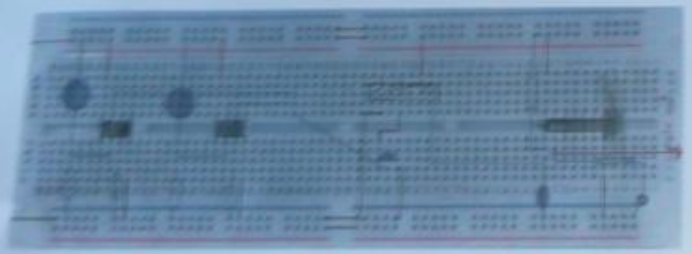
6



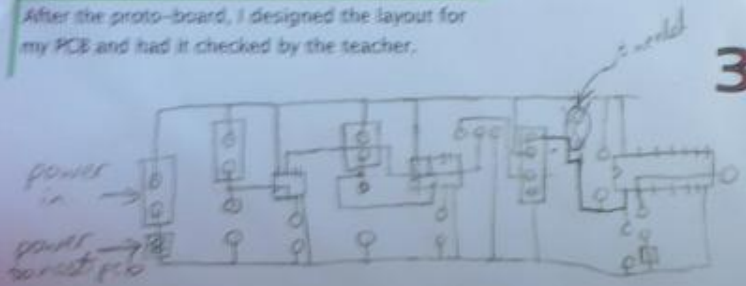


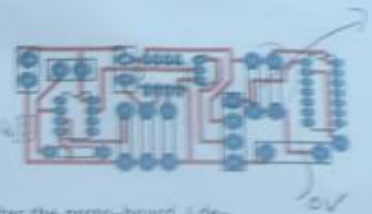
I produced my circuit on a proto-board. I added an LED to the output from the SCHMITT TRIGGER simply to let me know if an output is being sent to the 4510 chip.

I then drew up a proto-board diagram. 2

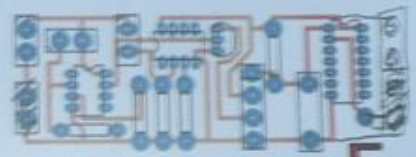


After the proto-board, I designed the layout for my PCB and had it checked by the teacher. 3

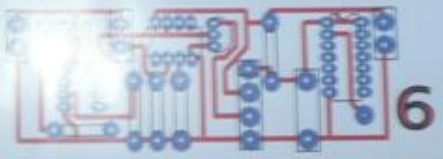




After the proto-board, I designed the layout for my PCB and had it checked by the teacher. This is the first draft of my PCB LAYOUT. 4

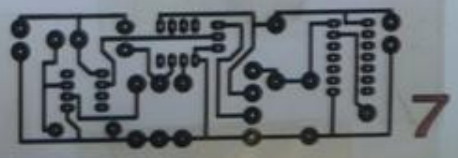


Second draft of PCB LAYOUT. 5



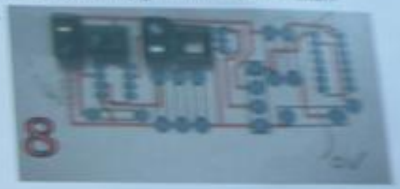
6

Final PCB LAYOUT ready to be made on PCB.



7

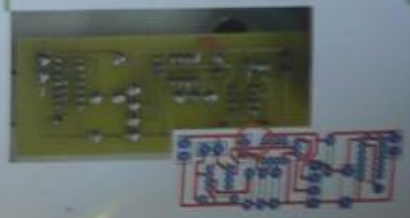
Before I had my PCB made I set a few of the components onto the final draft to check that there was enough room to solder them on.



8

9

I then had my PCB made and I soldered on all the components and tested it. During testing I found that the circuit was not producing an output, I then carried out further tests using a multi meter and I found that the second half of the board had no voltage. this led me to discover I had missed out a +ve connection, I rectified this by adding a red wire link where the connection was missed.



Section 3.3

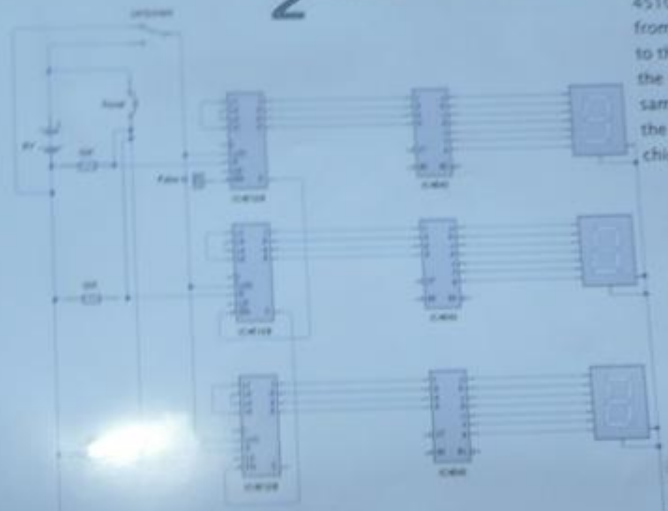
Process

- Clean pulse generated from Schmitt trigger provides count input for 4510.
- Chips count up in binary.
- 4543 DECODER chip translates binary codes to decimals.

1 The data below is the chip I am going to use for the process in my control system. I am using my INPUT circuit to provide a pulse, the SCHMITT TRIGGER will provide the clean count pulse which will allow the circuit to count, the pulse will go into PIN 15, the CLOCK INPUT on the chip.
I am going to use a SPDT switch into PIN 10, this will allow me to change the count to UP or DOWN in the 4510 chip.
PIN 2, 6, 11 and 14 are the OUTPUT pins, these will be connected to the 4543 DECODER chip below.
PIN 7, the CARRY OUT of the first chip will be connected into the CLOCK input on the second chip, this allows the counter to count up in more than 1 digit.
PINS 1, 3, 4 and 5 are all connected to the -ve and PINS 12, 13 and 16 are all tied to the +ve.
The RESET on the chip is tied high and uses a combined reset for all 3 counter chips.

This is the data for the 4543 decoder/LCD driver chip. The A, B, C and D pins are connected to the 4 output pins on the 4510. the a, b, c, d, e, f, and g are the output pins to the LCD display. Pins 1 and 16 are both tied to the +ve volts and pins 6, 7, and 8 and all tied to the -ve volts.

2 This is the livewire drawing of my process section of my control system. I had to use 3 separate LED displays to show the wiring as livewire did not have an LCD display diagram. The diagram shows the PULSE IN, this is where the count pulse is received from the SCHMITT TRIGGER from the INPUT section. This pulse goes into the first 4510, a wire is the taken from the CARRY OUT pin to the CARRY IN pin of the second chip, the same is done between the second and third chips.

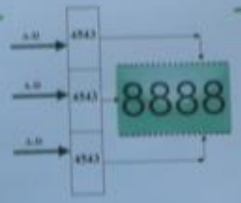


Output

- LCD DISPLAY connected up to OUTPUT pins of 4543 chip.

This is the data for the LCD display.

- Pins 1 and 40 are common and both connected to the -ve volts.
- N.C means the pins are not connected.
- The outputs from the first 4543 chip are connected into the 1A—1G pins, the second 4543 chip outputs go into pins 2A—2G and the third set of 4543 outputs go into pins 3A—3G.



PIN	COM
1	COM
2	Y
3	X
4	N.C
5	N.C
6	N.C
7	N.C
8	DP1
9	1F
10	1D
11	1C
12	DP2
13	2F
14	2D
15	2C
16	DP3
17	3F
18	3D
19	3C
20	3B

PIN	COM
21	3A
22	3E
23	3G
24	2B
25	2A
26	2E
27	2G
28	1B
29	1E
30	1A
31	1F
32	1G
33	N.C
34	N.C
35	N.C
36	N.C
37	N.C
38	Z
39	X
40	COM

Development of Control System

Input

- LDR value changes
- Comparator amplifies pulse

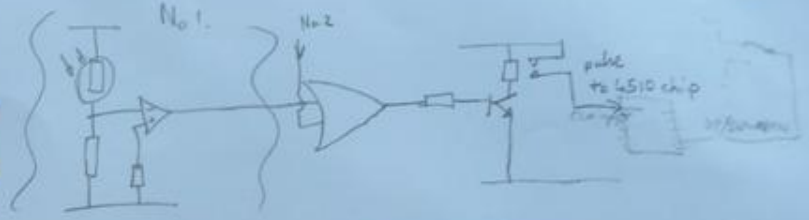
→ Pulse is de-bounced by a Schmitt trigger.

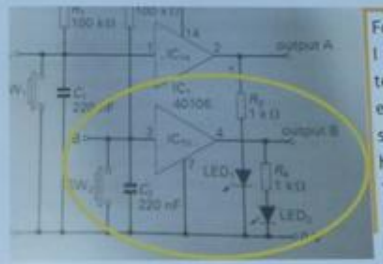
→ Pulse is output to 4510 counting circuit.

Plan Of Manufacture For Control System:

1. Produce a sketch of circuit diagrams on paper.
2. Create a livewire drawing of these sketches.
3. Work out calculations of resistor values and transistor values.
4. Develop proto-board of circuit until whole circuit is working.
5. Design circuits on PCB Wizard.
6. Print design on paper and have it checked by teacher.
7. When correct, manufacture PCBs, drill the PCBs at correct size and solder on components.
8. Find and fix any faults that may have been missed during checking.

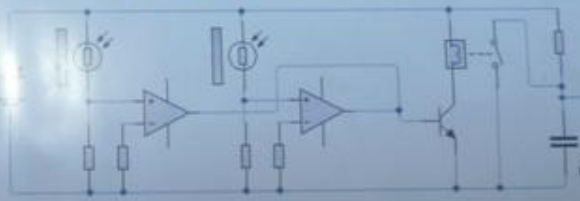
1 This is the original sketch of my circuits.





For the Schmitt trigger, I took a diagram from a textbook called basic electronics, the circuit shown has 2 inputs, however I only needed 1 input from the relay.

1

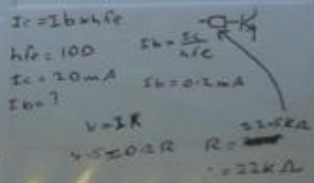


2 I then produced a diagram of my circuits on livewire.

The input to the system is by two LDRs set up in an OR arrangement. Each LDR is connected to its own OP AMP COMPARATOR which amplifies the pulse from each one so that the voltage is large enough to trigger a transistor. The transistor is set up with a SPST relay which switches when the transistor opens. The relay then sends an unclean pulse to the 40106 SCHMITT TRIGGER. This device is used to de-bounce the voltage coming from the relay and it sends a clean, single pulse to the 4510B counting circuit. The livewire circuit below shows how the circuit is put together.

Potential Divider Calculations:

Transistor Calculations:



Numerical Analysis 3

Section 3. 1

Solution for Development

The ergonomics of this product is its main asset, the doors to put in and take out memos are well designed so that they are easy to use and the reset button and screen are ergonomically placed to allow users to comfortably use the product.
The aesthetics are also very high on this concept with the translucent acrylic doors and angles cut out of the front.
The circuit in this product is also of a high standard with the LCD display and LDRs as the input.

	Concept 1	Concept 2	Concept 3
Function	4	5	3
Ergonomics	5	4	4
Aesthetics	3	4	3
Materials	4	3	4
System	5	3	4
Total out of 25	21	19	18

The aesthetics in this product are of a high standard, the acrylic and aluminium pillars help provide a contrast of materials and colours. The ergonomics of this product are good, when the lid is lifted to input a memo the micro-switch provides a pulse to count up on the LED display. When a memo is pulled out it rolls over the micro-switch at the rear and counts down.

Chosen idea:
The idea I am going to develop is **Concept Idea 1**. I feel this product is best to make as it scored the highest in the table, but also as it fits well to the environment that it will be made in.
I am going to make a change to the idea, instead of having 2 doors on idea 1, I am going to replace the rear door with the idea on idea 2, I think changing this section will make the aesthetics of idea 1 better by making it more modest as the 2 doors stuck out of the product.

The aesthetics and ergonomics on this concept are both of a good standard, however I feel this idea is the weakest of the three concepts. Notes are simply fed in through the slot on the front of the product and retrieved from the sliding drawer ate the rear.
The circuit on this product is good, the photo-transistors are connected to different inputs of the PIC, the PIC would be programmed to count up or down when it receives a pulse.

Circuit Idea 3

Input

- Two PHOTO-TRANSISTORS as INPUT.

- INPUTS go into 16627 PIC

Process

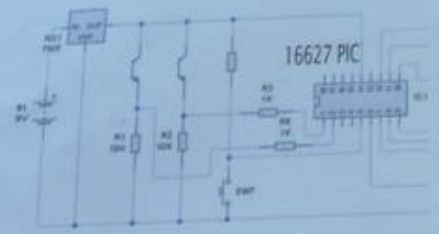
- PIC programmed to take INPUT from either PHOTO-TRANSISTOR.

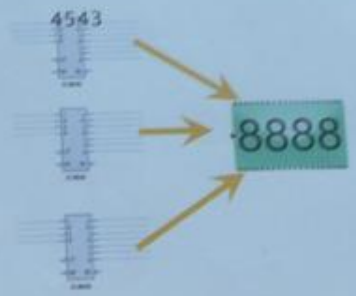
- PIC sends count pulses into 4543 DECODER/LCD DRIVER CHIP.

- Chip changes BINARY into DECIMAL.

Output

- LCD DISPLAY connected up to OUTPUT pins of 4543 chip.





Data

16F627 PIC

4543 Decoder/LCD Driver chip.

LCD Display.

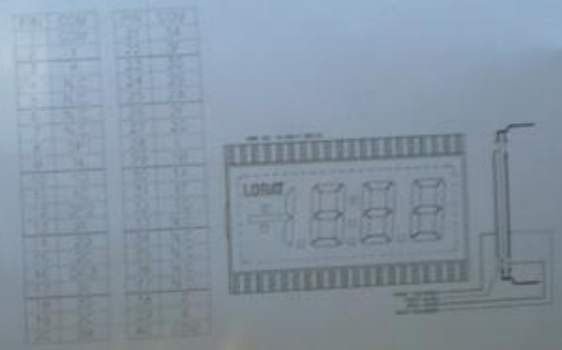
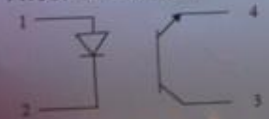


Photo-transistor



section 2.6

Initial Idea 3

Pull out tray to remove notes

- Curved front allows for high aesthetic value.
- Circuits are located at base of product.
- Tray at the rear of product allows easy access to memos.

Section 2. 5

Circuit Idea 2

Input

- Two MICRO SWITCHES as INPUT.
- Micro switches go into OR GATE.

- OR GATE sends a pulse to a RELAY.

- Pulse is output to 4510 counting circuit.

Process

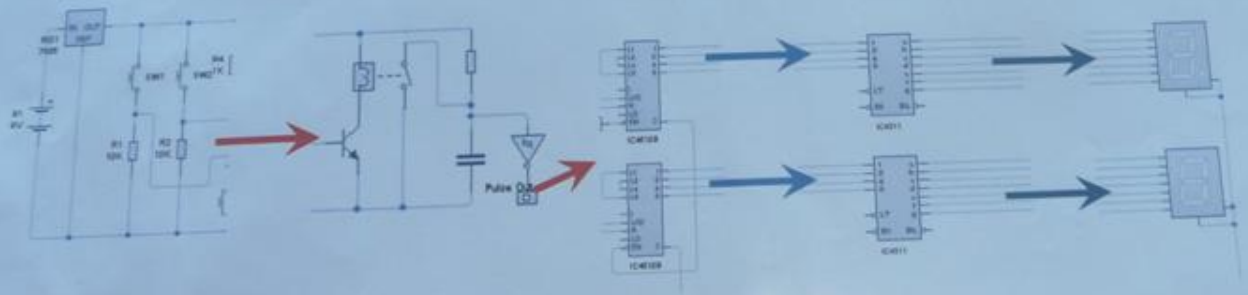
- INPUT pulse provides count input for 4510B chip.

- Chips count up in binary.

- 4511 L.E.D Driver chip de-codes and outputs

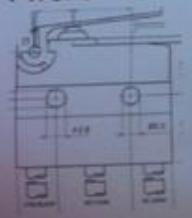
Output

- LED 7-SEGMENT DISPLAY connected up to OUTPUT pins of 4511 chip.



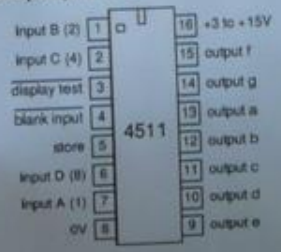
Data

Micro-Switch

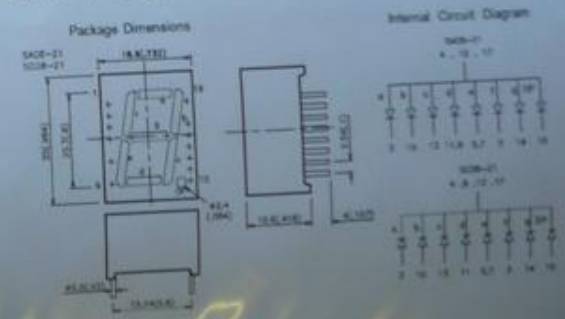


4510B Counter chip.

4511 BCD to 7-segment display driver.

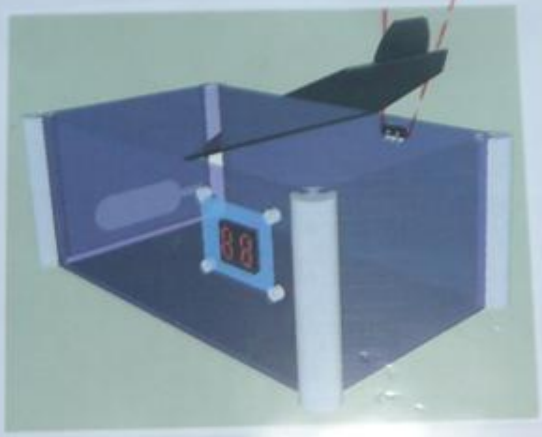


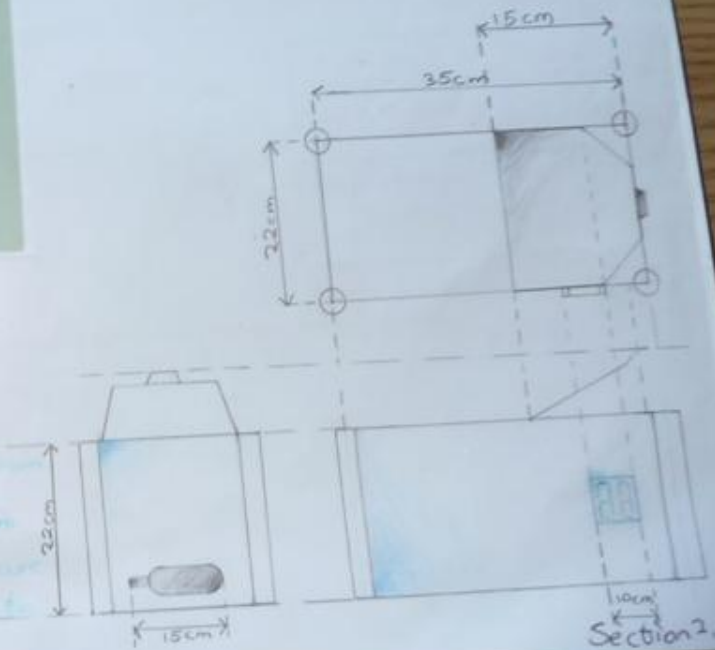
LED 7-segment display.



Section 2.

Initial Idea 2





Circuit Idea 1

Input

- LDR as INPUT
- COMPARATOR to amplify input for relay.

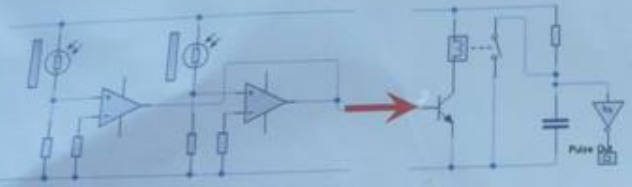
- Pulse needs to be de-bounced
- Pulse is output to 4510 counting circuit.

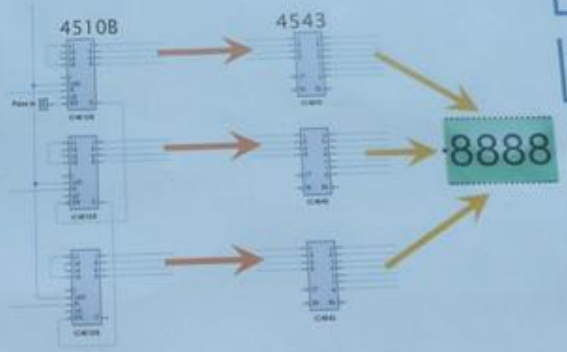
Process

- Clean pulse generated from INPUT provides count input for 4510B chip.
- 4510 sends binary to 4543 DECODER
- 4543 DECODER chip translates binary codes to decimals.

Output

- LCD DISPLAY connected up to OUTPUT pins of 4543 chip.





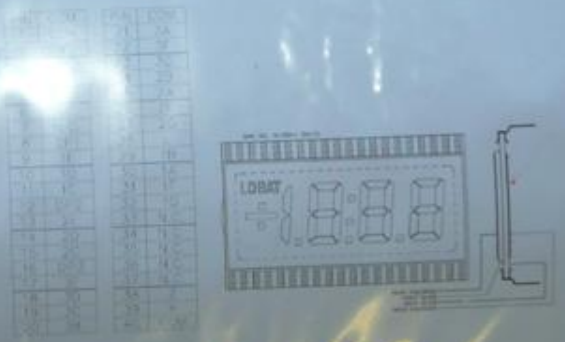
Data

Schmitt trigger to debounce input.

4510 B Counter chip.

4543 Decoder/LCD Driver chip.

LCD Display.



- Sensors into counter need to be effective
- Solution should incorporate sensors to pick up memos in and out.

Section 1, 2

Initial Idea 1

Section 2, 2

Specification

Count set to up
File In → Sensor → Count Up
Count set to down
File Out → Sensor → Count Down

Function
- Product should hold up to 50 A4 memos
- Memos are placed in and taken and counted as this occurs
- The current total should be displayed when required.

Ergonomics and anthropometrics
- Memos are placed into system by hand and retrieved by hand
- The inside of the product should be designed to match A4 MEMOS, an A4 page is 21cm by 30cm.
- The product should be about the size of a standard A4 printer which is about 28cm by 35cm.
- The product should not exceed the weight of a standard laptop when empty, about 4kg.
- Should be designed to be moved or positioned easily.
- Display should be about 2 - 3cm in height and clearly visible and easy to read.

Materials
- Prototype should be made as close to the real life as possible.
- The product should also incorporate a range of workshop materials such as wood, plastic and metal.

Aesthetics
- The materials and design of the product needs to look modern and fit into a modern office environment.
- The casing of the box needs to look appealing and also needs to look small so as not to make a desk space feel crowded.
- Circuits should be concealed in a neat manner so the product looks professional.

System
- The book counter activating an electronic visual display.
- Display will show the number of memos in the product at that time.
- Sensors and counter need to be effective so they sense memos going.
- Solution should incorporate sensors to pick up memos in and out.

Existing Solutions

During my market research I found no products that were able to count and store memos in an office environment. However I found a range of products that are used to store and sort memos.

One of the most existing solutions on the market is the original filing cabinet, this product is readily available in many shapes and sizes to cover the needs of the wide market available.
Ergonomically the product is good as it can hold many documents in an ordered fashion, most cabinets have a lock on them so it is to secure.
However, the product is aesthetically poor as it is simply a grey box.

After looking at these products, I then continued my search and looked at products that are able to store or count items other than documents.

The image below shows an idea of counting people walking past a kiosk, it is designed to count the number of people walking past using a motion/light sensor to sense the movement of the person.

I can take the idea of the sensor for use in my product.

Another solution is the product on the right, it is a rack that holds and stores documents in an ordered fashion.
Ergonomically the product is excellent as it can easily hold documents and it is easy to put documents in and take them out.
Aesthetically the product is also good, the curved design of the sides make the product able to fit into a modern office environment.

Section 2 3

Initial Idea 1

Product Identification, Need and Opportunity

In an office situation where files need to collected and sorted it can often be hard to keep track of the number of files in circulation.
For an office to function productively there needs to be a sense of organisation and in the current market there are very few products that I can find that provide a service that counts and keeps files neat and organised.

Problem: If there is no sense of organisation or method of working in an office then the productivity of that office will decrease and this can lead to a loss in efficiency and profits. It is important to keep the space organised so that the maximum potential output is maintained by the staff.

Need: From considering this problem there is a need for a product to keep track of files in an office. A simple and easy to use product would benefit most office spaces and make them more productive.

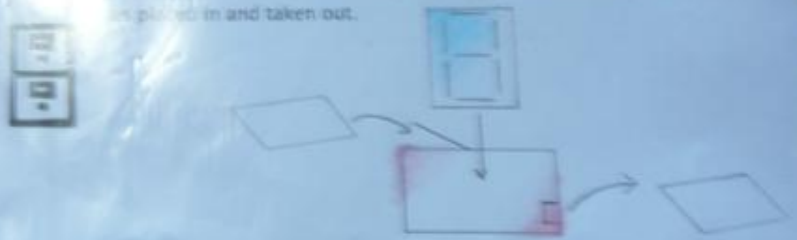
Opportunity: In this area there is an opportunity to develop a product that counts the number of files in circulation and keeps the files in one place. There is an opportunity to make such a product and distribute it to an already existing market.

Factors of consideration:

- The sensor needs to be sensitive enough to pick up the files being passed through, will the files be able to make a suitable pulse?
- How are the files going to be stored when inside the product and will they need to be kept in order of importance.
- Will the display need to show more than one digit so how many files will be in the product at any one time.
- Will the product blend in to a normal and modern office space environment? Will it be placed on an open desk or beside a computer?
- How easy the product needs to be able to be used to maximise the efficiency of the office.
- The physical size of the product needs to be kept at a minimum so that office space is not used up, and what size are the files needing to be stored.
- Who is the display for? Is more than one display needed and where should they be placed on the product.

Design Brief

To design and manufacture of a counting system to track the placement of files in and out of an office tray displaying the total number of files placed in and taken out.



Section 1. 1

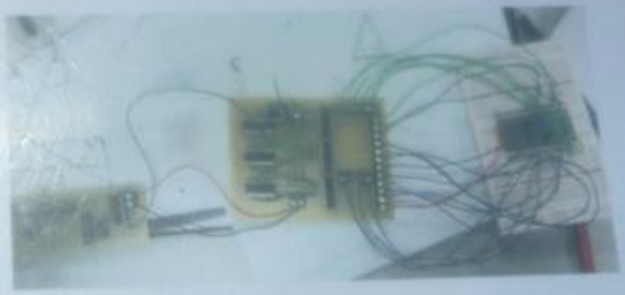
A2 Technology Coursework – Office Memo Storage Device

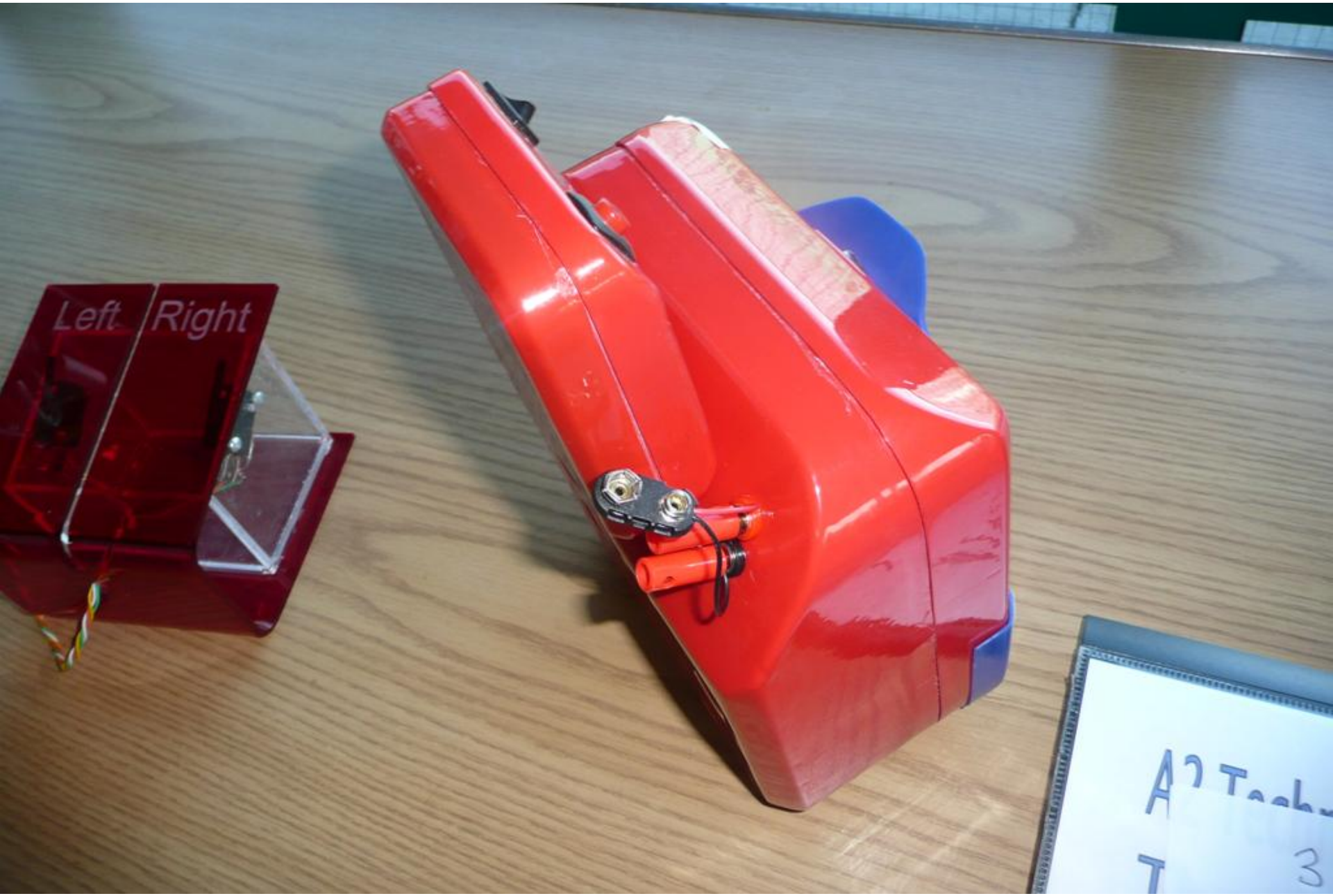
3

Thomas Annett

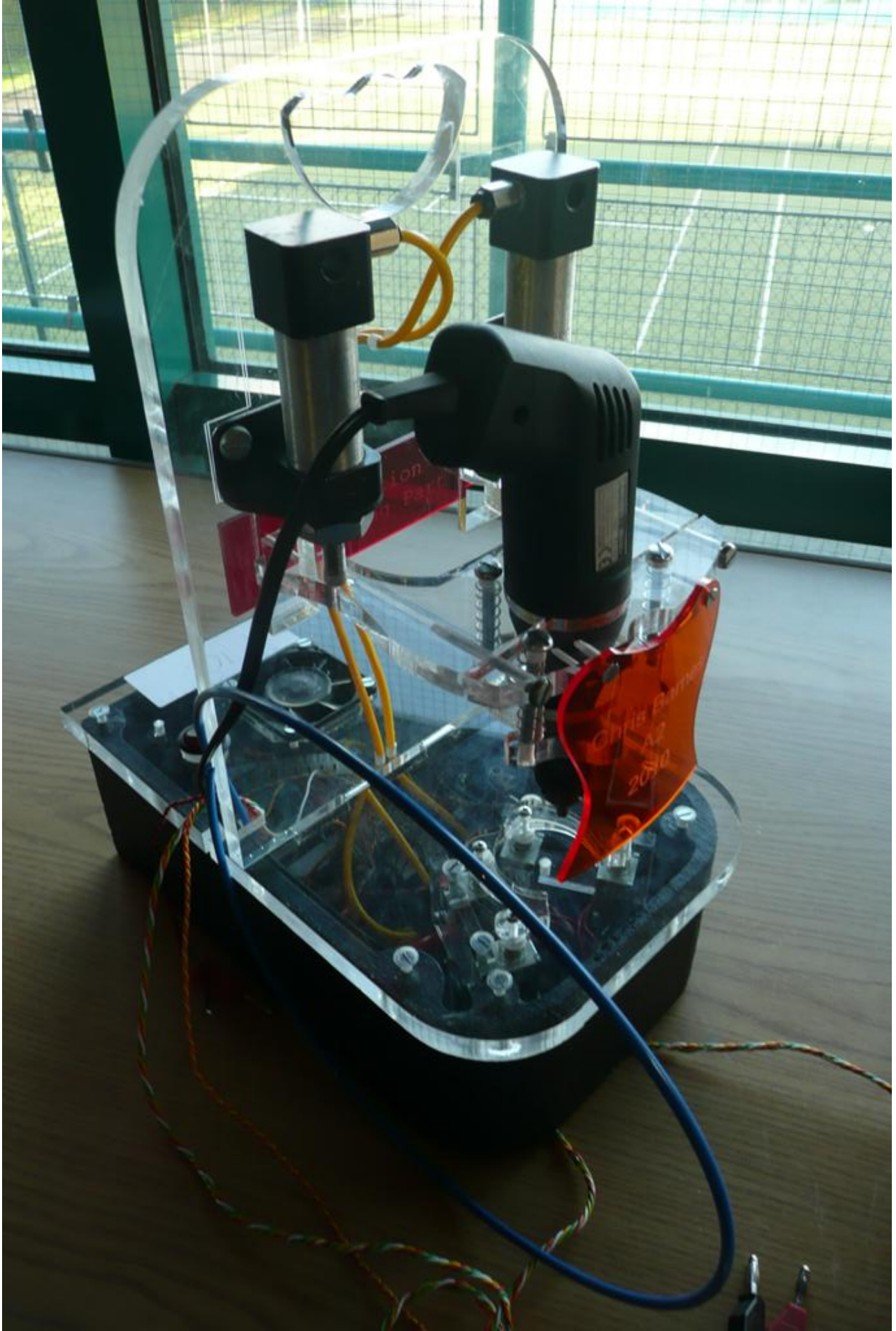
Centre : 71544

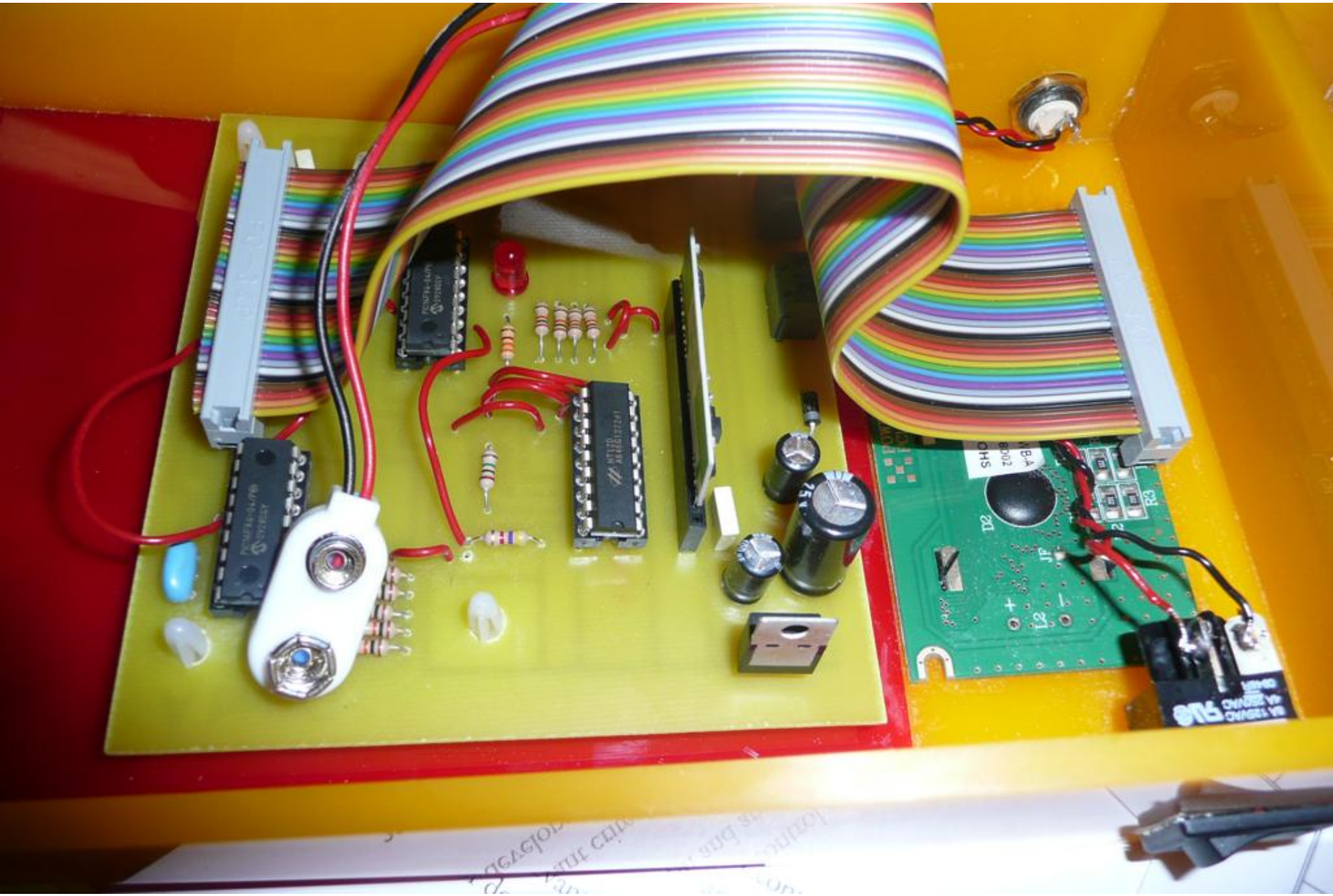
Number : 3006

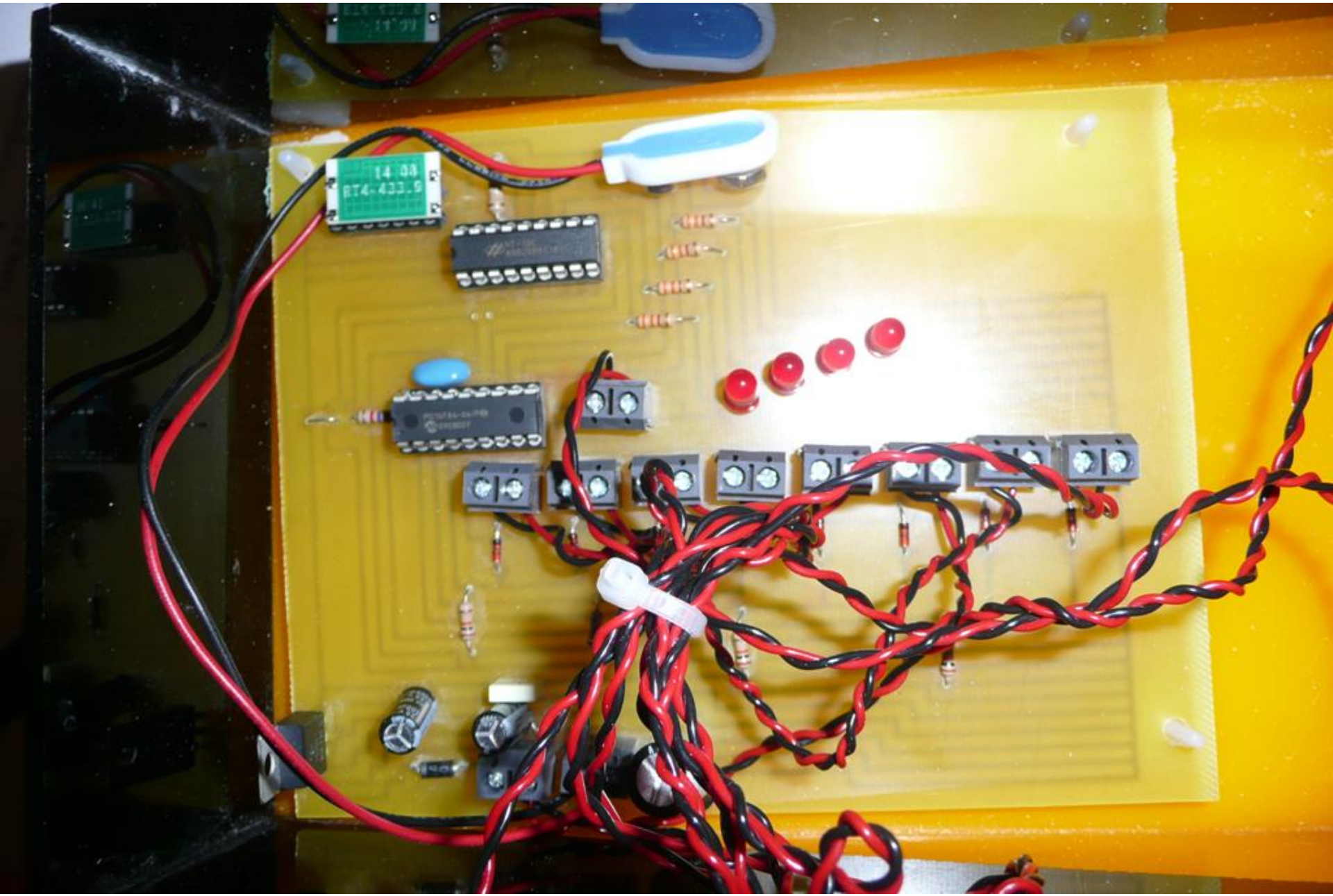



Left
Right


Left
Right
Centre : 71544
Number : 3006






14 08
RT4-433.9

Testing and Evaluation

Transmitter

There are many areas of the transmitter that I find pleasing overall, I think in a real world situation the transmitter would perform efficiently. I created a design on 'solidworks' to show exactly what the transmitter looks like. It fulfills most of the points on my specification, including, aesthetics, ergonomics, anthropometrics, etc. It also fulfills the main point on my specification and my design brief – 'I will design and create a display panel for McDonald's drive thru service, were customers can select the meal they want simply by pressing a button.'

I think that one of the best areas of my design is the face of the transmitter. It may be smaller than I would like, however given that during the manufacturing process I made a modification to the design and decided to take away the shield, it is important that the product can work effectively through all weather types without it. I think the way it is designed helps how it will cope, there is an opening and the face comes inward to the centre of the product so that it is slightly sheltered rather than being at the very front baring all weather full-on. It is a slight difference but it may prove effective. However hopefully, due to the fact acrylic is waterproof, water will not be able to seep through tiny holes and gaps by poor drilling. However this is not the case as I was very careful when drilling holes and fabricating pieces together ensuring there were no gaps.
A small problem with the product is that its heaviness and awkward shape make it difficult to place securely on a stand. It could be compressed and have a flat back to make it more appropriate to fix to a stand.

Another reason why I think that my product will be successful in its job in the real world is the layout and labelling of the buttons. The buttons are constructed in two columns with each column being equidistance from the edge of the front face. This amplifies the ergonomics of my product because the buttons are easily pressed and the two curved faces enhance this fact. The customers' index finger can easily reach the buttons as they grasp the module using the same hand. The labelling system for the button is simple and effective, as each label is written clearly as yellow letters to the right hand side of the buttons. I think that the yellow letters contrasting with the red background of the box will only boost the labels. The one problem with the labels is that they may were away over time and this would be as a result of weathering.

The colour scheme of the 'stickaplus' played a huge factor in making it aesthetically pleasing because I used the exact 'McDonalds' logo. The main colour scheme of the casing was red and yellow, the traditional McDonalds colours, which I felt went together very well.

Overall, I am very pleased with the transmitter as it fulfils its main purpose and is also aesthetically and ergonomically pleasing.

Receiver

I thought the receiver was the inferior of my two designs but in a real world situation would still be able to complete its main function with minimal trouble. The receiver also worked out very well. This design was more straightforward than the transmitter. I created the design on 'solidworks' to show exactly how it looks in real life. The receiver also fulfilled many points on my specification, including, aesthetics, ergonomics, anthropometrics, etc. It also fulfils the main point on my specification and my design brief – 'I will design and create a display panel for McDonald's drive thru service, were customers can select the meal they want simply by pressing a button.'

Although this receiver was one of the more simple designs from all my design pages I still felt it was the most suitable to fulfil its main purpose. The main shape of the receiver is just a normal box, however to give it a more interesting design and improve the aesthetics I decided to cut the top part at a slant and include another colour, red and a flat part at the top were the LCD screen would be situated. The main colour of the casing was yellow with some red and black inserts; which I felt went together very well. Also, the colour scheme of the 'Stickaplus' played a huge factor in making it aesthetically pleasing because I used the exact 'McDonalds' logo. Again, a lot of the edges and faces had to be wet and dried using sandpaper (P320-P1000) and after that I polished them to give the surface a shiny appearance.

This design was also ergonomically pleasing as it was small enough to hold and I added a handle so that it could be carried around or hung from the wall or ceiling.

An area I liked about my receiver is the simple aesthetic [illegible] the front face. Throughout my design I had the idea th[illegible] front face plain- without being boring, was the most [illegible] of making the right product. This is because it is impo[illegible] saving that the kitchen staff's attention would be drawn [illegible] screen and nothing else, so the cars can drive through quic[illegible] efficiently. I have done this by placing the screen on its own yellow surface, so that the black and yellow contrast is clearer for the user to see.

Overall, I am pleased with the receiver as it fulfils all of the main purposes; however I feel that it could have been a slightly more interesting design had I added some extra features.

Circuit Evaluation

One of the main parts to this project was the wiring and circuitry of the transmitter and receiver. The first thing I had to do when it came to the circuit was what type of circuit I was going to use and how I was going to display it. I decided to use a transmitter with push button inputs and a receiver circuit so that the remote control could display a message on a LCD screen.

When designing the circuit I used the program 'Circuit Wizard'. When designing it I went through a number of checks to make sure that all wires were properly connected and that there were no breaks or mistakes in the circuit. I also had to make sure that the circuits would fit inside my transmitter and receiver cases. When I was sure that the circuits were completely correct two exact replica PCBs were made. The next step was to sand the face of the circuit board so that the copper was fully showing. When the circuit boards were fully prepared I started to solder components onto the boards to match the circuits I designed. After making sure that all components were correctly soldered on both circuits I started to wire the buttons and bulbs into the terminal blocks. After that I programmed the circuits using 'PIC logicator'. I was then able to stick both my circuits down into the transmitter and receiver casings and fit the buttons and LCD screen into the drilled holes.

The next step was to test whether the circuit would work or not. I had to make sure that the voltage dropped from 9 volts to 6 volts as it crossed the LCD screen. To do this I used a multi-meter placing one pin on each side of the 7805 voltage regulator and made sure the potential difference across the 7805 is 3 volts. To test the output pins I used a multi-meter again and made sure there was an output voltage at each pin.
To test the PIC microcontroller I had to test different areas of the PIC. First I tested the output pins. I used a multi-meter again and made sure there was an output voltage at each pin. I then tested the 0V pin and the 6V pin using the multi-meter. The multi-meter reads 0V at the 0V line and 6V at the 6V pin.
To ensure the transmitter and receiver are on the same wavelength I had to test and make sure the two binary codes for the 8 bit address line are the same. If these address lines were not the same then the receiver would not operate at all. The testing showed that the address line was correct as the receiver module received the message clearly.
The last output area I had to test was the LCD screen. To test this was operating I used a program test. To make sure the receiver module was receiving messages from the transmitter correctly after I had tested the LCD screen I activated the transmitter and made sure the LCD in the receiver picked up the signal and displayed the relevant message.

Modifications

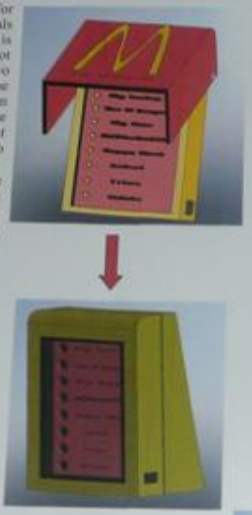
Transmitter

Earlier in my folder I focused on different design ideas for my transmitter and my receiver prototypes. I looked at each in fine detail to work out which one I should concentrate on fabricating for my actual product; looking at aspects such as function, materials used, aesthetics, ergonomics, size, storage, safety and cost. This is shown in my 'viability of designs' pages and the design I chose got four stars out of five compared to three out of five for the other two designs. I started to manufacture the product. However, during the process of manufacturing I made some modifications to the design to improve the quality of the transmitter. Some of the modifications made during manufacture were ideas I thought would make the product less expensive and less time consuming to produce; without harming the overall output of the product.

I felt that the complexity of this design was unnecessary as the shield would have to have some sort of mechanism to ensure that it did not slip and fall whilst pressing the buttons. It would then also have to be easily put down when not in use to protect from weathering and wear and tear. I thought this may be beneficial not only for the reasons stated above, but in the worst case scenario the shield could slip and seriously injure the user, the extent depending on what material it is made of and how heavy it is. This would almost certainly end up a court case that McDonalds may not have a chance in and end up paying substantial compensation sums.

However even with this in mind, the removal of the shield almost certainly decreases the durability of the transmitter and maintenance costs are sure to be higher than it would have been previously.

The next modification was related to the circuit. In the first transmitter design I only had 6 input buttons, however for my final project I included 'Fries' and 'Salad' as products to choose from therefore I needed to have 8. Consequently I had to design the circuit to have 8 inputs and also drill 8, 14mm holes in the front face of the transmitter box, securely fitting my push buttons.



If I had a chance to make this project again there are some modifications I would make to the final product. The first is to increase the size of the face of the transmitter because although the size is fine for holding and carrying I feel it would improve the design even further. I would do this so that the product names can be a bigger size so that they are clearer to those who have difficulty seeing small sized print. I would be able to also have more space between each and have larger buttons. I would also like to have a more comprehensive menu on show and a wider range of the McDonalds products. The problem with the product as it is- is that you still need verbal communication to express your desire for which drink you want or what size of meal you desire.

To increase effectiveness of the menu and help customers decide what they want, pictures can be used. Using imagery to promote new products is beneficial as it can be brushed up and made to look anyway the promoter wishes and it will not cost a lot in advertising fees as it will be on their own space.

Receiver

In the second page of my 'viability of designs' section I took a look at three of my receiver design too. I looked at each in fine detail to work out which one I should concentrate on fabricating for my actual produc again I looked at aspects such as function, materials used, aesthetics, ergonomics, size, storage, safety and cost. The design I chose got four stars out of five compared to two out of five and one out of five for the other two designs. I started to manufacture the product. However, duri the process of manufacturing I made some modifications to the design improve the quality of the receiver. Some of the modifications made during manufacture were ideas I thought would make the product bett suited for everyday use and making the product more aesthetically pleasing; without harming the overall output of the product.

I realised that my design wasn't very personal to McDonalds and lacke an edge to its aesthetic side of the design. I then decided to incorporate the famous McDonalds 'M' logo onto the red front face of the product. thought that this brought more relevance to McDonalds as one of their product, as without it, could be seen as any company's product.

Although my transmitter was easy to hold when being used I thoug that it would improve the quality of the overall product if I added in o final modification. The last idea was to add a handle so that it was ea to carry when not being used. I cut out two small pieces of yello acrylic plastic measuring 40mm by 55mm. I also cut out a 100mm le of aluminium diameter 22mm. I super glued the aluminium to the acry and then used liquid solvent cement to fabricate the acrylic to the top the receiver product, creating the handle. This allowed the pole to perfectly on to the top of the receiver and using super glue, it w permanently attached.

If I had a chance to make this project again there are some modificatio I would make to the final product. The first modification I would ma would be the complexity in design of the box. I feel that it is designed its job appropriately however it has the capacity to become an attracti and interesting looking design. However this may have been more ti consuming without actually adding to the productivity of the prod which may seem meaningless, especially if the receiver is not seen anyone outside of the McDonald's kitchen. Another modification would make is to make the handle bigger because at the moment it quite small and you can only just fit your whole hand around Although it is not a large project and it is not too heavy to lift I feel th a handle would make it easier to lift and move around. One fu modification that I would make is to find some way to attach t receiver high up on a wall hanging from the ceiling so that it can be se by all kitchen staff. One way of doing this would be to drill small hol in the back of the box so that it could hang up on screws. Another way be to place the handle on top of the receiver so that it could be used t lifting and also to hang from a nail on the wall. I would then move t positioning of the LCD screen from were it is now to the red face of t transmitter as it is a t a slant and will be more visibly clearer to see fr below if it is placed above head-height.

Evaluation against Specification

Function

- The electronic menu should be able to determine the meal selected and electronically display the choice to the McDonald's employee.
- This fundamental function is achieved with a carefully designed and fabricated circuit board.
- The menu must be able to withstand all types of weather.
- The acrylic plastic used to build my prototype designs is waterproof and will be suitable to protect the circuitry.
- It should be safely placed on a wall or stand.
- The device is small in size so that this is possible, however the materials used to produce this prototype makes it quite heavy.
- It should therefore have a fixing mechanism to secure it in place.
- I have not included this as part of the device due to time restrictions and efficient use of materials provided in school.
- The device should not cause any scratches or any other type of damage to the side of a customer's car.
- The model should not be capable of doing this as it would take a tougher material to scratch a car; however this is depending on where McDonalds situate the device.
- The product should be able to be turned on and off easily.
- The product has an on/off switch.
- The corners should be rounded with a radius of about 3mm to prevent hazards from sharp edges.
- There are no dangers of discomfort whilst using the device with regards to sharp edges.
- The buttons should be easy and comfortable to press.
- There are no dangers of discomfort whilst using the device with regards to pressing buttons as they have smooth surfaces.
- The weight of the device must not be too heavy for the stand or wall to hold up. Also to ensure that it can be moved around if necessary.
- The materials used to produce this prototype makes the product slightly heavier than it needs to be in my opinion, however it is still easily carried around.
- The product must be made out of acrylic to ensure long life.
- The product is indeed predominantly made out of this material.
- The menu must be yellow and red to keep the traditional colours of the fast food restaurant.
- The product is indeed again, predominantly made out of these colours.
- The menu's electronic wiring should be expertly done to ensure errors and faults are kept to a minimum.
- I feel that due to the fact that the circuit is complete and works effectively, I can say that with the guidance of an expert such as my teacher this need is fulfilled.
- The menu should have a power source to function.
- The circuit will be battery powered.
- This power source must not have loose wiring or leads along the ground that people could trip over to ensure the safety of customers and staff.
- All wiring is kept safely inside the device.
- The menu should be affordable for all franchisees to afford.
- McDonald's is a global franchise which turns over massive profits so they should therefore be able to afford to invest in such a device.
- The LCD screen should be clear and visible by staff from at least 2 meters.
- This should be possible however it may depend on the staff's sight and lighting in the workplace.
- The buttons should be in suitable positions so the user does not accidentally press the wrong button.
- Each button is clearly labelled by the choice of food they make.
- The buttons should also be clearly labelled so the user doesn't make a mistake when making their choice.
- Again, each button is clearly labelled by the choice of food they make.
- The product must have a reset button to return to its stable state.
- The device does indeed have this particular button.
- The transmitter and receiver must be able to withstand ranging temperatures.
- I haven't exactly tested this myself however I know that with the materials used the prototype will not melt, crack or become dysfunctional due to ranging temperatures.
- The device must have an on/off switch to save power.
- The product has an on/off switch.
- The menu must have no more than 8 inputs.
- The transmitter has the maximum of 8 inputs.
- The product must be able to withstand wear and tear from accidental bumps from cars and vandals alike.
- Hopefully if this device was invented in those who build up the stand will position it a distance that does not harm any vehicles.

Aesthetics

- The product should be manufactured with aesthetically pleasing and traditional colours such as yellow for the McDonald's 'M' and red for the background.
- The colours are indeed the colours used to produce both the transmitter and receiver.
- The product must have a rounded, polished finish.
- Each cutting out has been rounded as explained in the plan of manufacture.
- The product should be aesthetically pleasing and not an eye sore.
- This is a matter of an individual's opinion, however I don't think many would be able to call the designs eyesores as primary colours are used and the designs are pretty basic.

Ergonomics

- This product must have a smooth finish in relation to the human touch.
- This need is satisfied as there are no rough surfaces or sharp edges.
- The menu must have rounded edges and corners to make it safer for the customer to use and to not cause any discomfort whilst ordering.
- This need is satisfied as there are no rough surfaces or sharp edges.

Anthropometrics

- This product should be anthropometrically pleasing in relation to the human anatomy.
- Both transmitter and receiver are small enough to carry in one hand. The layout of the buttons are in a way that is easy to press, as the size of the buttons and the distance between each are ergonomic measurements.
- The menu should be high enough [illegible]
- This will be taken into consideration [illegible] being fitted.
- The stand on which the menu is [illegible] to the car for the customers arm to [illegible]
- This also will be taken into consideration [illegible] fitted.
- The buttons on the menu should be [illegible] diameter so that they are easy to press.
- The buttons and the space between are big enough for the human index finger to press and to distinguish between which one to press in relation to what they want.

Materials

- The product I am manufacturing will be made out of acrylic so that it is inexpensive to produce.
- This is indeed the material I have used.
- This will then ensure that the product is strong and durable for its desired use.
- Acrylic is a hard and tough material. By using it as the main material to fabricate my prototype, I will keep scratches and cracks to a minimum.
- The material used will need to be an electrical insulator.
- Acrylic is indeed, an insulator.
- It must also be a thermal insulator as in some countries the weather can reach high temperatures.
- Acrylic can melt at high temperatures however this should not be a main concern as the melting point of this plastic is higher than the temperature in the hottest temperature in any country.

Safety

- The product should have smooth edges and surfaces so that it does not cause injuries.
- This need is satisfied as there are no rough surfaces or sharp edges.
- The product must be around 4' high from the ground so that the customer ordering does not receive an injury leaning out of the window trying to reach too high or too low.
- This will be taken into consideration when the device is being fitted.
- There should be no loose wiring around the menu that may cause a health and safety hazard.
- All wiring is twisted and cable tied together to keep all of the wires tidy and in order.
- It should be electrically insulated.
- Electricity cannot pass through acrylic.
- All wires should be electrically insulated.
- They are covered by insulating material, and the parts that are exposed due to soldering to components have been covered by 'heat-shrink', that is an insulator too.
- All parts should be properly and securely attached.
- I have ensured that all parts have been connected using solder.

Maintenance

- Both products should be able to be cleaned so that there is no build up of germs from many people pressing the same buttons.
- There is no reason why the device cannot be cleaned as all circuitry is safely stored away from the surfaces.
- It should work at the same performance for its whole working life.
- There is nothing to suggest that this is not the case.
- The power source should last at least 10 hours of non-stop use.
- This may depend on the brand of battery used as the power supply.

Size and Weight

- The menu must weigh around one or two kilograms so that it is easily transported and also not too light so that it is sturdy.
- This need is satisfied as the products can easily be carried around.
- This will also ensure that the menu will not be accidentally pushed over and therefore damaged.
- The devices will also need to be fastened adequately to their stands.

Cost

- The menu should not be more expensive for the manufacturer to produce than the franchisees are prepared to pay for the product.
- Mass production will keep the cost per unit down.
- The prototype I will be manufacturing shall be acrylic to keep the production costs down.
- This need is also satisfied.

Environmental

- The menu's colours should not be an eyesore to the surrounding environment.
- The colours used are primary colours and are unlikely to be on the wrong side of many people's taste.
- The menu should not cause harm to the environment whilst being manufactured.
- The machinery used to cut out the acrylic uses electricity and does not emit CO_2 into the atmosphere.

Testing

- The menu and receiver should be well tested before they are introduced to the McDonalds drive thru service to make sure that it is safe for customers to use the menu safely and effectively.
- If the product is to be released to McDonalds it is necessary procedure to test the product before it is put to customer use. It must pass the British Health Standards.

Transmitter Working Drawing

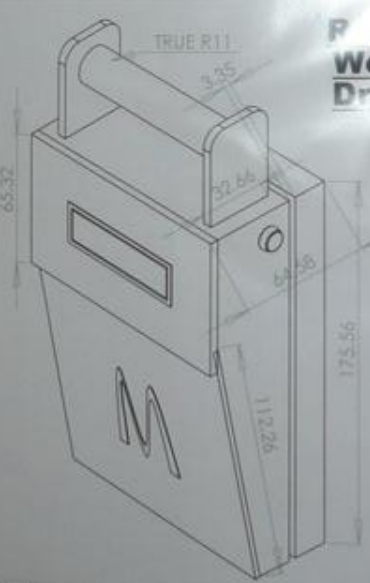
TITLE:

Assembled Reciever

SIZE DWG. NO. REV

SCALE: 1:5 WEIGHT: SHEET 1 OF 1

Reciever Working Drawing



TITLE:

Assembled Reciever

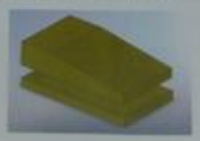
SIZE DWG. NO. REV

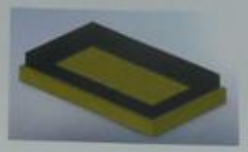
SCALE: 1:5 WEIGHT: SHEET 1 OF 1

Plan of Manufacture

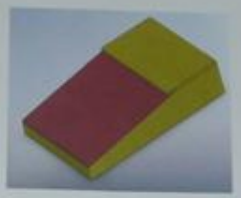
Transmitter

- Cut out: Two pieces of 85mm X 215mm, 5mm yellow acrylic.
  120mm X 90mm, 5mm yellow acrylic plastic.
  Two strips of 130mm X 15mm, 5mm yellow acrylic.
  Two strips of 200mm X 15mm, 5mm yellow acrylic.
  100mm X 25mm, 5mm yellow acrylic plastic.
  215mm X 130mm, 5mm yellow acrylic plastic.
  Two Strips of 160mm X 15mm, 5mm black acrylic.
  Two strips of 100mm X 15mm, 5mm black acrylic plastic.
  Four strips of 120mm X 50mm and 200mm X 50mm, 3mm black acrylic plastic.
  170mm X 100mm, 5mm red acrylic plastic.
- Cross-file, draw-file and wet and dry every piece of acrylic to provide a smooth and clean finish.
- Use the polishing machine to polish the acrylic using wax.
- Using liquid solvent cement, fabricate the thin black strips.
- Glue this to the single red sheet.
- To complete the front part of the transmitter, fabricate the thin yellow strips to the sides of the black acrylic.
- Fabricate the rest of the yellow acrylic parts according to the CAD.





- Using the cutting machine, cut the complete box directly down the middle.
- Cross-file, draw-file and wet and dry both halves of the box were it has been cut to provide a smooth and clean finish.
- Use the polishing machine to polish the acrylic using wax.
- Using liquid solvent cement, fabricate the thin black strips.
- Fabricate the 3mm black acrylic to create an insert.
- Glue this to back part of the original box.
- The front part can now slide open and closed. This is helpful when modifying the circuit which will be placed inside.
- Drill 8 X 14mm diameter holes down the left hand side of the red acrylic to later insert selection buttons.
- Drill another 14mm diameter hole on the side of the product for the reset button.
- Use the "Stickaplus" machine to cut out letters to form the desired words to stick beside each of the holes drilled for the selection buttons.
- Drill another hole approximately 10mm in diameter for the switch.
- Use a file to make this circular hole into a rectangle shape for the switch to fit in.



- Produce a PCB circuit for the transmitter.
- Reduce the size of this first attempt to make it compact enough to fit inside the model.
- Use solder and the soldering iron to fabricate all of the wiring and components.
- Once the switch, resent button and other buttons have been connected to the circuit, insert them into the holes that have already been prepared.

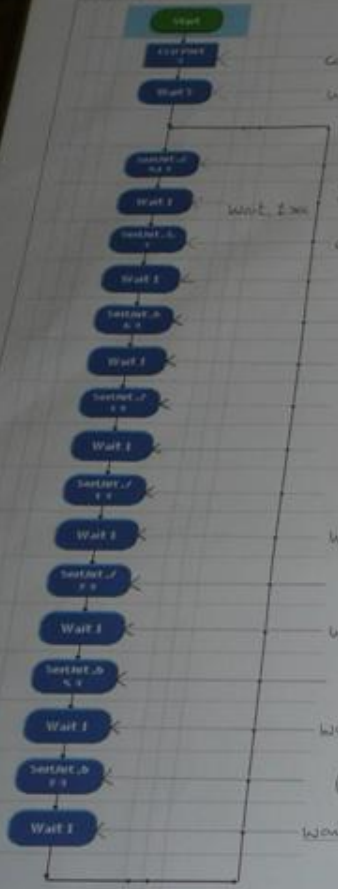
Receiver

- Cut out: 120mm X 70mm, 5mm yellow acrylic plastic.
  120mm X 40mm, 5mm yellow acrylic plastic.
  215mm X 130mm, 5mm yellow acrylic plastic.
  130mm X 80mm, 5mm yellow acrylic plastic.
  150mm X 130mm, 3mm red acrylic plastic.
  Two strips of 200mm X 40mm, 3mm black acrylic.
  Two strips of 120mm X 40mm, 3mm black acrylic.
  Two strips of 55mm X 40mm, 5mm yellow acrylic.
  Two strips of 70mm X 215mm, 5mm yellow acrylic.
  100mm long, 22mm diameter Aluminium bar.
- Cross-file, draw-file and wet and dry every piece of acrylic and aluminium to provide a smooth and clean finish.
- Use the polishing machine to polish the materials using wax.
- Using liquid solvent cement, fabricate the 3mm black strips.
- Fabricate the yellow and red acrylic parts according to the CAD.

- Using the cutting machine, cut the complete box directly down the middle.
- Cross-file, draw-file and wet and dry both halves of the box were it has been cut to provide a smooth and clean finish.
- Use the polishing machine to polish the acrylic using wax.
- Place the black acrylic inside the bottom half of the box and permanently fix it using liquid solvent cement to create an insert just as the transmitter.
- The front part can now slide open and closed. This is helpful when modifying the circuit which will be placed inside.

- Produce a PCB circuit for the receiver.
- Reduce the size of this first attempt to make it compact enough to fit inside the model.
- Use solder and the soldering iron to fabricate all of the wiring and components.
- Once the switch, resent button and LCD screen have been connected to the circuit, insert them into the holes that have already been prepared.
- Superglue the aluminium bar to the two 55mm X 40mm yellow acrylic pieces and cement these pieces to the top of the receiver to act as the handle, as shown below.

Receiver Programming



connected to port 3

Wait 5 seconds

Tells the LCD module that the next number is an instruction rather than a character.

Wait 1 sec

clear screen

Wait 1 second

B

Wait 1 second

I

Wait 1 second

G

Wait 1 second

M

Wait 1 second

A

Wait 1 second

C

Wait 1 second

All SerOut commands are sent from pin 3

Wait 1 Second

Tells the LCD module that the next number it will receive is an instruction rather than a character.

clear screen

Wait 1 second

D

R

I

N

K

S

Wait 1 Second

F

R

I

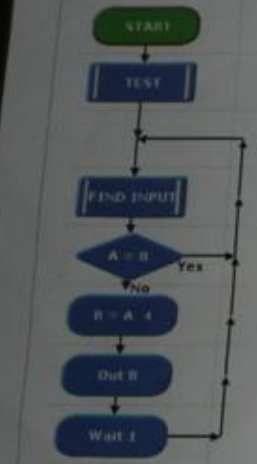
E

S

This box to the right is a key to show what each number will display on the LCD screen.

32		51	3	70	F	89	Y	108	l
33	!	52	4	71	G	90	Z	109	m
34	"	53	5	72	H	91	[	110	n
35	#	54	6	73	I	92	\	111	o
36	$	55	7	74	J	93	]	112	p
37	%	56	8	75	K	94	^	113	q
38	&	57	9	76	L	95	_	114	r
39	'	58	:	77	M	96	`	115	s
40	(	59	;	78	N	97	a	116	t
41	)	60	<	79	O	98	b	117	u
42	*	61	=	80	P	99	c	118	v
43	+	62	>	81	Q	100	d	119	w
44	,	63	?	82	R	101	e	120	x
45	-	64	@	83	S	102	f	121	y
46	.	65	A	84	T	103	g	122	z
47	/	66	B	85	U	104	h	123	{
48	0	67	C	86	V	105	i	124	:
49	1	68	D	87	W	106	j	125	}
50	2	69	E	88	X	107	k		

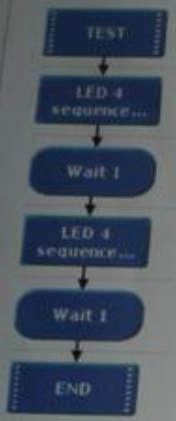
Transmitter Programming

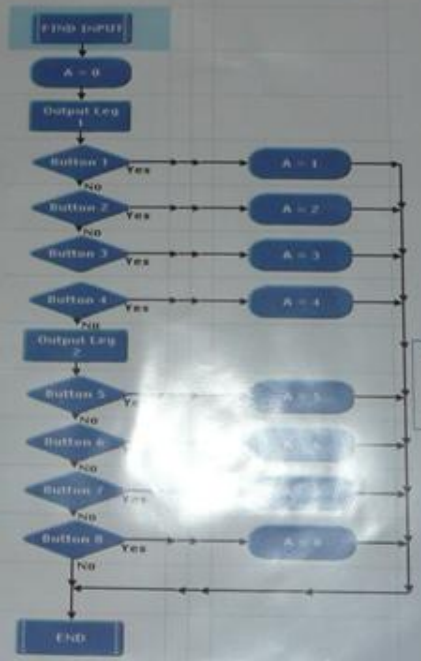


To programme my PIC-Micro controller I used the PIC-Logicator programme. This is a fast and simple way to program my chips.

Once I had my sub-routine programmed I was able to incorporate this into the programming for the main part of my PIC program for this transmitter. The START box is where the program begins, followed by a DO MACRO that runs the FIND INPUT sub-routine. The next box is a COMPARE box that will check if A is equal to 0. If A is equal to 0, no buttons have been pressed and when A equals a number between 1 and 8 it will continue down through the programme. The next stage of the programme is where it needs to OUTPUT a 4-bit binary pattern, which is done by the OUT box. But this will result in the output of the first 4 outputs on the PIC-Micro controlled, so to peevent this I placed an EXPRESSION box above the OUT box which will shift the binary so that it is on the last 4 outputs. The final box is a WAIT, which lasts for 1 second, and this allows the receiver enough time to register the output. Then the progrsemme returns back to the FIND INPUT macro to test if any buttons have been pressed and this programme will repeatedly follow this pattern.

I started my programming by making a small sub-routine circuit for my transmitter circuit. This small sub-routine will test the four outputs that are connected to the encoder. This sub-routine was designed to allow the PIC-Micro controller to detect which buttons have been pressed and also to label A with the appropriate number of the button. An expression box begins the macro so that A equals 0. This is to show that if A equals 0, then no button has been pressed and therefore no bulbs will light up. However, when a button has been pressed A will not equal 0 and the circuit can continue. I have arranged my buttons in a 2 X 4 matrix, which has been connected to 2 outputs, and 4 inputs that allows my required 8 combination. For these to work I had to programme the outputs so that they could be switched on separately using OUTPUT boxes and the inputs read from the DIGITAL boxes to see which 1 button is being pushed. Again, if no buttons have been pressed, the A will remain at 0 and the programme will reach the END box, which will end my sub-routine. However, when a button is pressed the DIGITAL box will connect to an expression box that will label A according to which button has been pressed. The expression boxes have all been programmed to give A the number which that particular switch has been wired to in my product.





Summary of **PIC-Logicator Flowsheet**

Port Decisions	Switch 1	0001
	Switch 2	0010
	Switch 3	0100
	Switch 4	1000
	Switch 5	0001
	Switch 6	0010
	Switch 7	0100
	Switch 8	1000

Port Output Functions	Outputs	00000010
	Outputs	00000100
Mactos	FIND INPUT	

Circuit Development/ Programming

Transmitter Circuit

Power Supply → Matrix of Switches → PIC → Encoder → Transmitter Module

Receiver Circuit

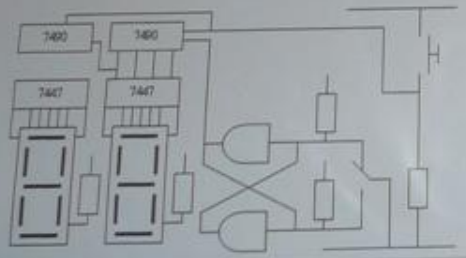
Power Supply → Receiver Module → Decoder Module → PIC → LCD Screen

Basic PIC Circuit

Power Supply → Switches → 18 Pin PIC → LED's

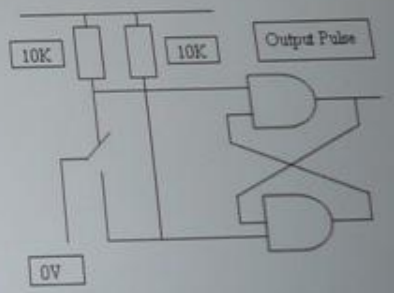
Seven Segment Display

In each case of a seven segment display there are 7 LED bars. Each segment is labelled with a letter from 'a' to 'g' and one or a number of LED bars can be switched on as desired so that a number can be displayed on the board. For each binary number from a BCD counter, certain LED's must be lit up to form the numbers e.g. number 1 requires 'b' and 'c'.



Event Counting

Counters can be pulsed by a clock or operated by pulsing a switch. Some problems with a mechanical switch connected to a digital counter are that; when the internal switch lever moves from one contact to the other, it strikes the contact and will bounce a few times before settling on the contact. This bounce only takes a millisecond, but because a counter will work at speeds far more excessive than that, it will register one count for every bounce, and will thus give an incorrect count. By counting 2 'NAND' gates in a special way, the switch can be 'de-bounced'. This arrangement is known as a 'flip flop' or a 'bistable circuit'. The output changes on the lever hitting the contact the first time. If the lever bounces without going all the way back to the other contact, no more change is made. The output will now only change when it goes all the way to the other contact.

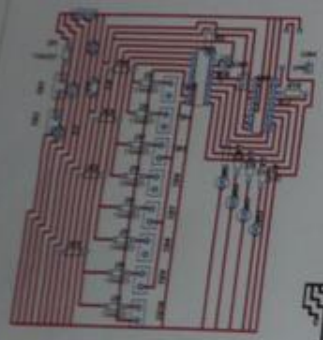


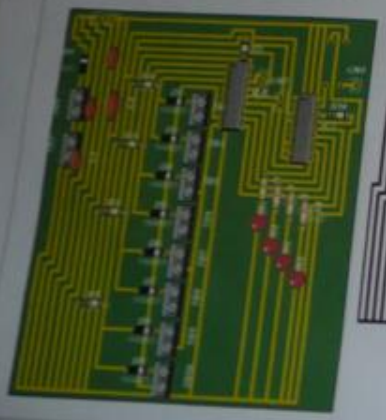
This is my final transmitter PCB design. I was able to compress the wires into the empty spaces of my original attempt, reducing the space consumed inside my product.

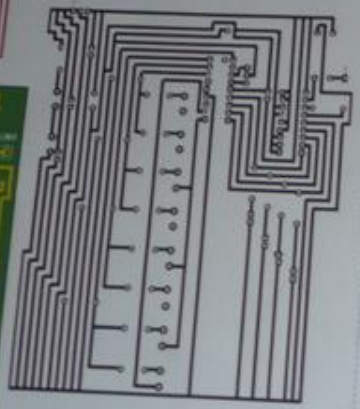
This is my final receiver PCB design. I was able to compress the wires into the empty spaces to reduce mainly only the width of my original attempt. This is because of the amount of components compressed into the PCB that the height would be difficult to modify.

Transmitter Parts List

- 2 X 18 Pin DILs
- 4 X LEDs
- 9 X 330Ω Resistors
- 1 X 4K7Ω Resistors
- 1 X Battery (Terminal Block)
- 9 X Switches (Terminal Blocks)
- 8 X Diodes
- 4 X Capacitors
- 2 X 3 Pin SILs
- 1 X Encoder

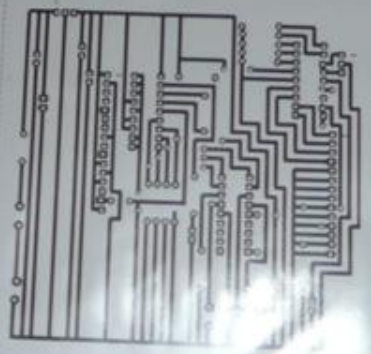


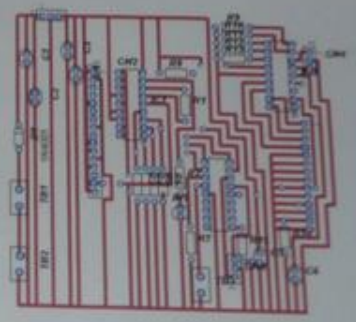




Receiver Parts List

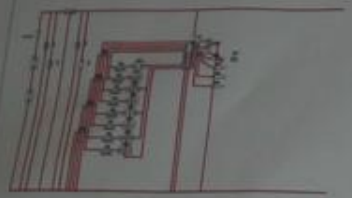
- 3 X 18 Pin DILs
- 1 X LCD
- 14 X 330Ω Resistors
- 1 X 4K7Ω Resistors
- 1 X Battery (Terminal Block)
- 3 X Switches (Terminal Blocks)
- 1 X Diode
- 6 X Capacitors
- 3 X 3 Pin SILs
- 1 X 16 Pin SIL



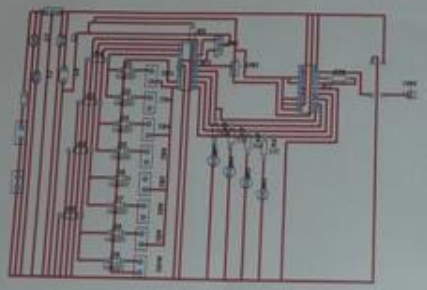


PCB Development

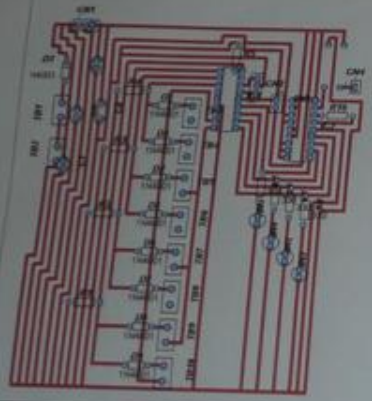
Transmitter



After much research and designing of products, I now have to design an electrical circuit for my transmitter and receiver to function, known as a Printed Circuit Board. I used 'PCB Wizard 2.7' for this. I originally found it difficult to connect the wires without cutting through another. This was because of a few simple positioning mistakes. My switch terminal blocks were also not correctly positioned, as it would be very difficult to solder wires into them while this close and facing each other. Therefore at this early stage of my PCB design I decided to start from scratch in an attempt to learn from mistakes.

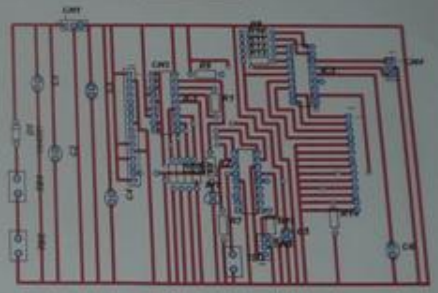


This is my first full attempt at designing my transmitter PCB. I used up a lot of space and when comparing it to my actual product, I found that it was too big to even fit inside. Therefore I had to compress this design by at least 3cm in width.

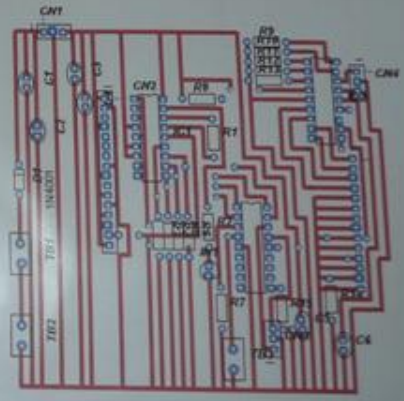


This is my final transmitter PCB design. I was able to compress the wires into the empty spaces of my original attempt, reducing the space consumed inside my product.

Receiver

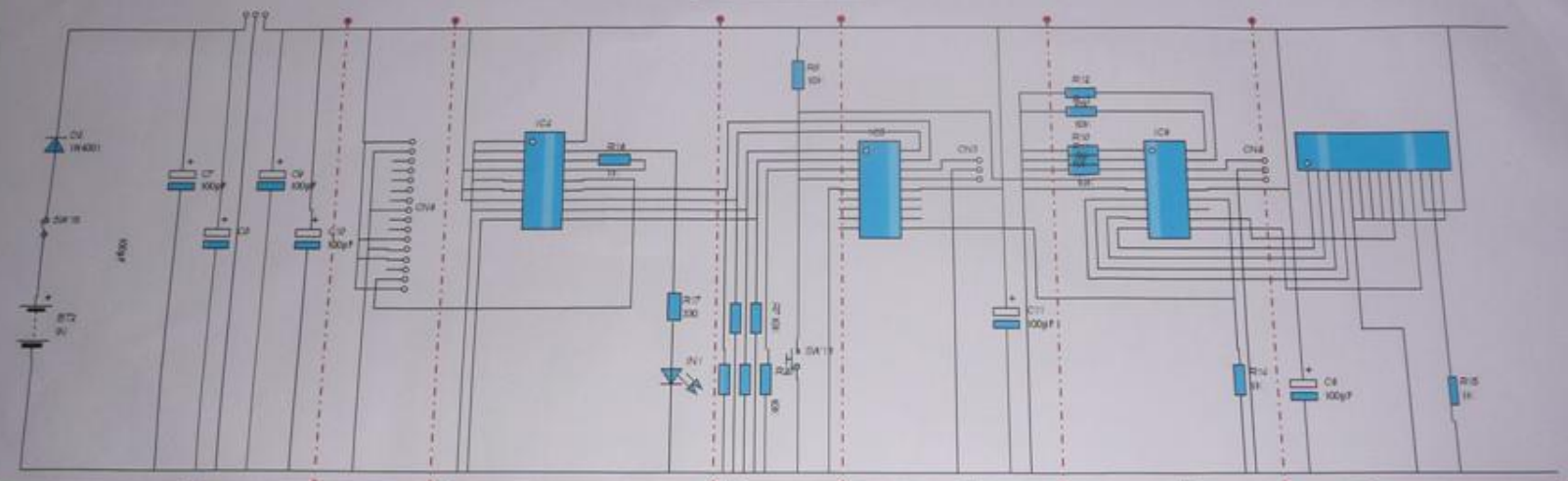


I became used to designing PCBs after completing my transmitter design so it did not take me as many attempts to produce a PCB for my receiver. This is my first attempt at designing my receiver PCB. Just as I did with my transmitter, I used up a lot of space and when comparing it to my actual product, I discovered that it was only just small enough to slot into my receiver. Therefore I decided to compress this design as I did with the transmitter for a better fit.



This is my final receiver PCB design. I was able to compress the wires into the empty spaces to reduce mainly only the width of my original attempt. This is because of the amount of components compressed into the PCB that the height would be difficult to modify.

Receiver



Power Supply

In the above circuit you can see the battery power supply, switch, diode and capacitors. We can see that the 7805 takes any voltage between 7 and 12 volts and produces 5 volt output. The diode is in place to ensure the current flows in one direction to protect the components should there be an error in the circuit. The capacitors are used to ensure a smooth DC supply so that other components can operate efficiently, stopping a fluctuation in voltage.

Receiver Module

The receiver is able to communicate with the corresponding Transmitter module from the transmitter circuit. The signal from the transmitter comes into the receiver module on the antenna that is at pin 3 on the receiver module. The receiver then outputs the original binary stream from the encoder on the transmitter circuit to the decoder on the transmitter circuit to the decoder on pin14. To power the receiver module, pins1, 10 and 12 are connected to the +5V rail whereas pins 2, 7 and 11 are connected to the 0V rail.

Decoder Module

The decoder recognises the code signal and passes the corresponding control signal to the output interface. The decoder signal can also help with the problem of noise that may occur when using this in the restaurant. It can be designed in a way to respond only to those signals which have particular characteristics. The decoder receives the binary stream from the receiver onto pin 14. It will then convert the binary stream into the original 4bit data pattern that was received by the encoder back in the transmitter circuit. The decoder is powered through pin 18. The 4-bit pattern is sent out through pins 10-13.

4 Bit Binary Pattern

Binary is an effective number system for computers because it is easy to [illegible] digital [illegible] pro[illegible] sin[illegible] dif[illegible] sen[illegible] This [illegible] binary system works by using different combinations of each output being either high or low. This indicates which input switch has been pressed and what other code [illegible] sent to [illegible] by [illegible]

18 Pin PIC

The 16F84 18-pin micro-controller requires a 6V DC supply and has 5 inputs and 8 outputs. As I need to have 16 inputs I need to programme the device in a way that it can [illegible] which size [illegible] pressed. This [illegible] achievable due to complex programming using both 4 outputs and 3 inputs to create a 3X4 switch matrix. To send the remaining inputs a four bit binary pattern is used which will enable up to 16 different outputs to be sent.

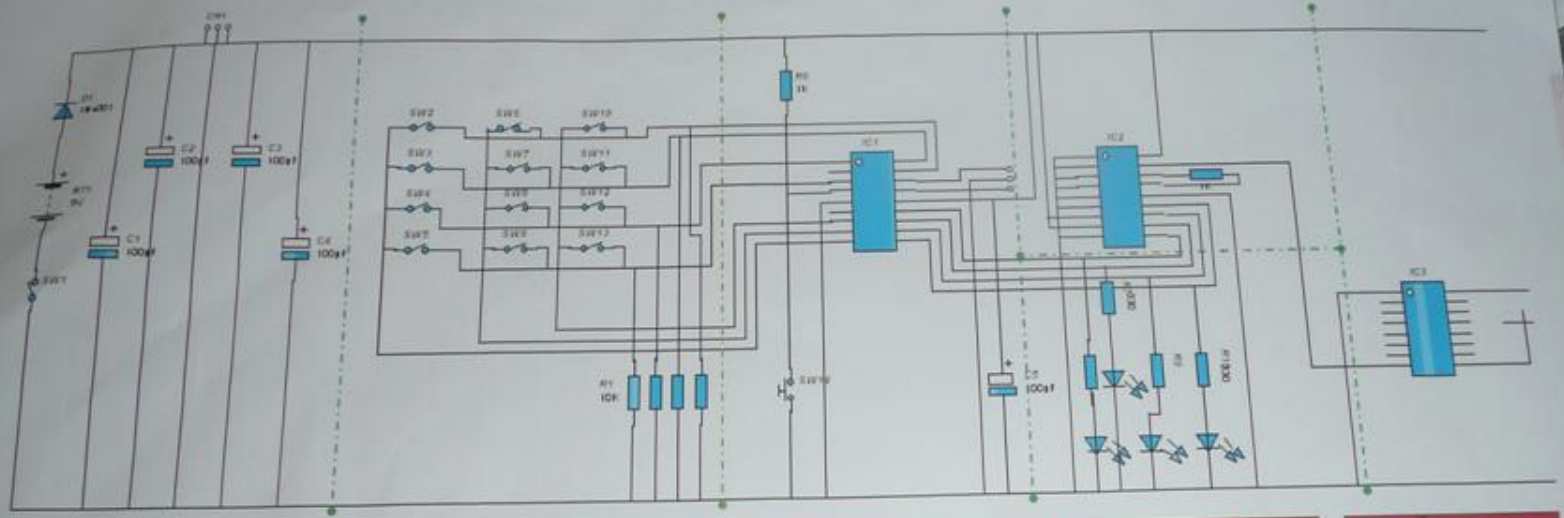
18 pin PIC for LCD Screen

All of the inputs are tied to ground via a ten kilo-ohm resistor. This PIC receives a signal from the first PIC into pin 143. a signal is then sent to the LCD screen through 4 output pins- pins 6, 7, 8 and 9. this will ensure that the LCD screen will receive information from the microcontroller.

LCD Screen

The final output of [illegible] circuit is an LCD screen. The LCD stands for liquid crystal display. It is a electro-optical amplitude modulator as a thin, flat display device made up of an number of colour or pixels arrayed in fron of a light source or reflector. The LCD screen receives information from the microcontroller into pins 11, 12, 13 and 1[illegible] the correct output message is then displayed on the screen.

Transmitter



Power Supply

In the above circuit you can see the battery power supply, switch, diode and capacitors. We can see that the 7805 takes any voltage between 7 and 12 volts and produces 5 volt output. The diode is in place to ensure the current flows in one direction to protect the components should there be an error in the circuit. The capacitors are used to ensure a smooth DC supply so that other components can operate efficiently, stopping a fluctuation in voltage.

Matrix of Switches

I have included a three by four switch matrix to allow customers to input their order with a switch for every command signal. I have connected the rows and columns together in order to connect them to the inputs and outputs. Yet two switches cannot be pressed at the same time for two reasons. Firstly, software will only detect the first one on the monitors and secondly it may result in an output driving an output. To try to prevent this I added a series diode into the circuit.

18 Pin PIC

The 16F84 18-pin micro-controller requires a 6V DC supply and has 5 inputs and 8 outputs. As I need to have 16 inputs I need to programme the device in a way that it can recognise which one has been pressed. This is achievable due to complex programming by using both 4 outputs and 3 inputs to create a 3X4 switch matrix. To send the remaining inputs a four bit binary pattern is used which will enable up to 16 different outputs to be sent.

Encoder

This incorporates my 8-bit address line, which is 5 volt line and low means it is tied to the zero volt line. Pins 1 to 8 are the address line. It is capable of sending a 4-bit data [illegible] to the transmitter data out pin. [illegible] the PIC receives and outputs a [illegible] pattern stream. A 4-bit binary stream is a 4-bit binary pattern converted into a series of pulses sent down a single output. The receiver will only work with the intended transmitter by setting an individual key.

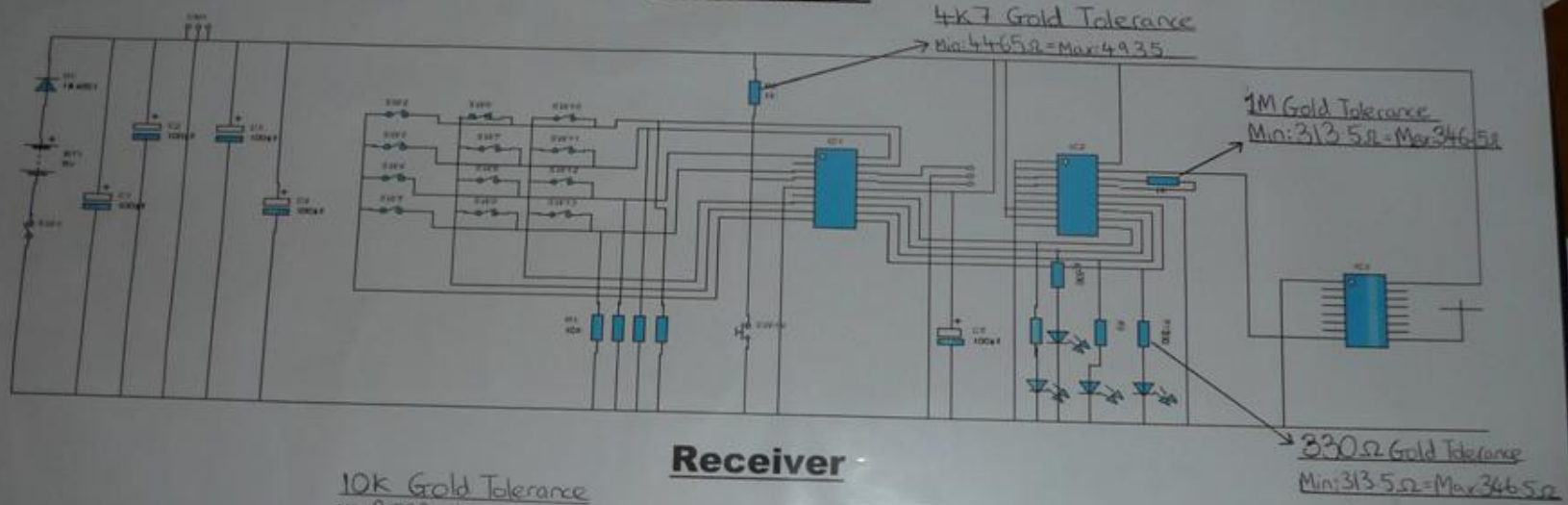
4 Bit Binary Pattern

Binary is an effective number system for computers because it is easy to implement with digital electronics, its also extremely useful for programming. The 4 bit binary allows up to sixteen different outputs to be sent by using four outputs. This works by using different combinations of each output being either high or low. It produces a pattern, for example, 0110. This indicates which input switch has been pressed.

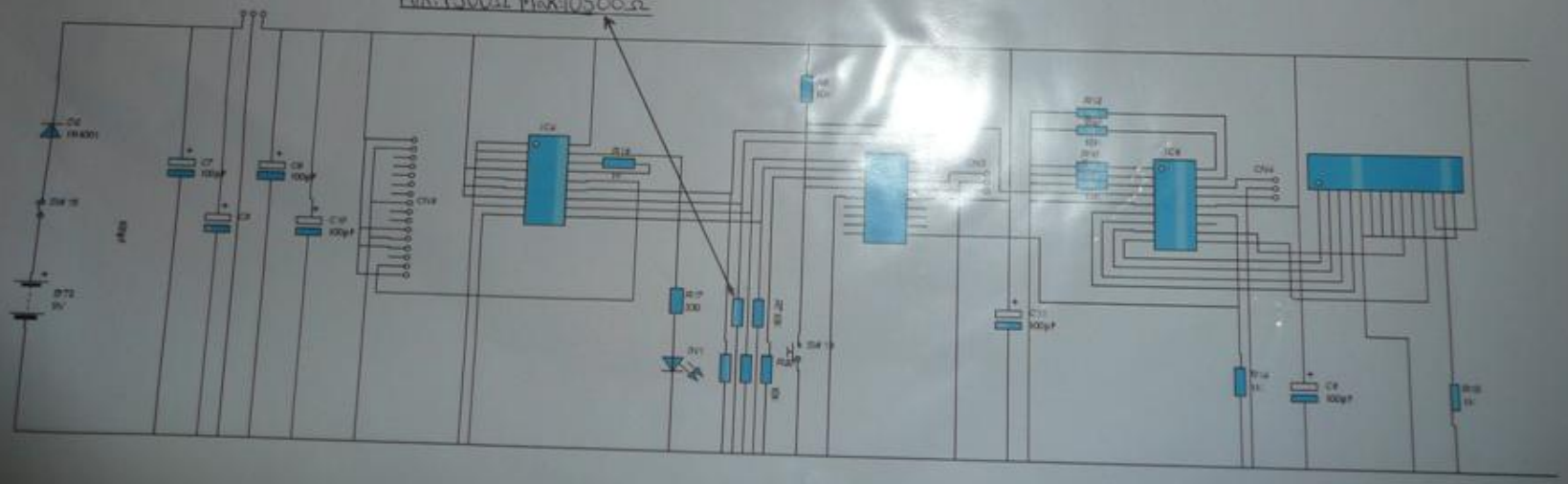
Transmitter

The AM-RT4 Transmitter sends information to the corresponding receiver through an antenna which is connected on pin 4. The transmitter receives the binary stream from the encoder. The transmitter receives its power by connecting pin 1 to the positive rail at the top of the circuit. Pin 2 is connected to the negative rail at the bottom.

Transmitter



Receiver



Receiver 1

The first receiver I designed was a simple handheld device with a container to allow the receiver part to slide in and out with ease. It has finger grooves on either side to make it simple to hold. It also has a LCD screen along with an On/Off switch on the front face to tell the staff member what has been requested by the customer. Depending on which button is pushed on the transmitter, a message corresponding with that button will be displayed on the LCD screen. It also has an antenna to receive signals.

Function

The function of this receiver is to alert the employee by displaying the message that someone has ordered a meal at the drive-thru.

Materials Used

The two materials that would be used in the manufacturing of this product will be 3mm acrylic plastic and aluminium would be used for the antenna because it is a strong and a non corrosive material. Acrylic is a durable material that will withstand wear and tear in the McDonalds kitchen.

Aesthetics

This design is made up of two parts, the container and the receiver. They are both red and yellow as McDonald's primary colours. The sides of the handheld device have curved finger grooves which have been cut out for added grip looks effective. It also has a smart LDC screen. I think this adds to its aesthetics and gives it a high-tech expensive appearance. Astrength of this product is that it is not crowded with buttons or LED's and therefore the LCD screen can be easily seen.

Ergonomics

The design is ergonomically pleasing as it has a sleek and smooth finish. The corners of this level are all filleted which means that the level is smooth and easy to carry.

Size

The size of this design is quite compact and is easily lifted because it is light in weight and is small enough to suit the users hand size. However this may cause a problem if the users struggle to see the message displayed on screen from a distance.

Storag

Storage with this design isn't an issue as the container of the device can be fabricated to a wall, or wherever in is most effective as it is not big and bulky. While the receiver is stored the message can still be seen as the LCD screen is still exposed. Having the product on the wall is also of an advantage as there will never be anything blocking the users view.

Safety

This design is safe as there are no sharp edges that could cause any damage. The only safety issue with the product is if it were to fall of the wall at any stage it could damage or hurt someone.

Cost

The cost to produce this design may be expensive due to the LCD screen and extra materials used for the container.

Overall Viability

This product looks effective and does the job required fittingly. However I feel that the time required making the extra container part would be too long.

Receiver 2

This second receiver I designed was a simple handheld device. Incorporated into this design is two handles which will enable the user to have a firm grip on the product. It also has a LCD screen along with an On/Off switch on the front face to tell the staff member what has been requested by the customer.

Function

The function of this receiver is to alert the employee by displaying the message that someone has ordered a meal at the drive-thru on the LCD screen.

Materials Used

The two materials that would be used in the manufacturing of this product will be 5mm acrylic plastic for the main body of the receiver. My second material for the product would be aluminium, which would be used for the handles at each side because it is a strong and a non corrosive material.

Aesthetics

Again, just as the previous designs, the device is red and yellow as McDonald's primary colours and the sides of the handheld device are black. The long aluminium bars which have been cut out for added grip looks effective. It also has a smart LDC screen. I think this adds to its aesthetics and give it a sophisticated appearance.

Ergonomics

The design is ergonomically pleasing as it has a sleek and smooth finish. The corners of this level are all filleted which means that the level is smooth and easy to carry.

Size

The size of this design is quite compact and is easily lifted because it is light in weight and is small enough to suit the users hand size. However this may cause a problem if the users struggle to see the message displayed on screen from a distance.

Storage

Storage with this design [illegible] easily found as it is small and light enough to put where[illegible] it [illegible] is not big and bulky. However fi[illegible] device may be an issue as it does not [illegible] be awkward to store. It may also get lost. [illegible] also quite small therefore it must be stored close enoug[illegible] the employees work so that they can see what [illegible] being displa[illegible] easily.

Safety

This design is safe as there are no sharp edges that could cause any damage. The only safety issue with the product is if it were left on the floor for someone to trip over.

Cost

The cost to produce this design may be expensive due to the LCD screen and extra materials used for the handles.

Overall Viability

This design is effective and also does the job fittingly. However the problem with this device is that I think that it will be easily lost as it is not designed to sit on a wall or stand on a desk.

Receiver 3

My third design is of a receiver that includes an LCD screen in which depending on which button is pushed on the sender a message corresponding with that button will be displayed on the LCD screen. As well as this, to improve speed, an electronic speaker will verbally tell the user what to make. If there is any uncertainty regarding the order, the user can also press and hold the yellow button and speak to the customer through the speaker as this sound will be transmitted back to the transmitter. Meaning both devices are able to act as transmitters a receivers.

Function

The function of this design is to display a message to the user to inform them what has been ordered. This can be done verbally or electronically displayed the LCD screen.

Materials Used

The material that would be used in the manufacturing of this product would b 5mm acrylic plastic. As it is a simple one piece device, I find it difficult to incorporate another material into this design. I could use a metal for the small 'M's displayed on the receivers right hand side, however this is pointless and adds to time, effort and expense.

Aesthetics

This design looks averagely aesthetically pleasing because of its simple one-piece layout. The screen is quite large in proportion to the receiver and there red 'M's down one side of the device, which perhaps to some may look attractive however I feel that there are more attractive alternative designs compared to this one.

Ergonomics

The ergonomics of this design may also be an issue that would need to be addressed if I was to go ahead with this. It is not particularly well designed to held in the users hand as there are no finger grooves and the sides of the prod are not filleted.

Size

The size of this design is quite big and may be awkward to lift and transport regular basis. The size of the receiver may also increase the weight.

Storage

The design is heavy in weight may not be easily stored. It will need its' own space to be stored on a wall or a table were it is easily seen by staff. This may a problem if there is limited or little space available.

Safety

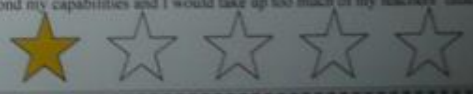
There are no safety issues with this design.

Cost

The total cost to produce this product would be quite expensive as there is a significantly larger LCD screen and the amount of acrylic needed to produce is also higher than alternate designs. However, the cost may balance out as acrylic is relatively cheap and there are no other materials needed for the desi fabrication.

Overall Viability

This design is not very suitable for my project as it will be expensive, difficul make and to build the circuitry to successfully produce this far-fetched idea beyond my capabilities and I would take up too much of my teachers' time.



Viability of Designs

Transmitter 1

This design consists of two main parts which are then joined together. The shield is attached to the main body of the transmitter by screws on both sides. The shield flap lifts up when in use so that the buttons can be pressed.

Function

The main function of this product is to send a signal to alert the McDonald's member of staff of what they must make for the customer. Customers will do this by pressing a button beside the meal of their choice.

Materials Used

The main body would be made out of 5mm acrylic plastic. I have chosen acrylic because it is strong, durable and is easily shaped. The protecting flap could be made out of aluminium because of its hardwearing properties.

Aesthetics

This design looks aesthetically satisfying, as the colour of acrylic is bright and looks attractive.

Ergonomics

The buttons beside each menu choice on this design are round and are comfortable to press. This is the only part of the product that will be touched in everyday use. The only slight concern regarding ergonomics is that corners are not rounded. However this should not be a problem as it is likely that the device will be fixed in the same position over a long period of time without being touched.

Size

The size of this design is practical to an extent, it is big enough to see easily and the buttons are of a reasonable pressing size. However it is quite chunky and will need some kind of support to hold it up to the height a driver would be able to reach from their car window.

Storage

As stated before the design will need some kind of support to hold it up to the height a driver would be able to reach from their car window. It will be stored outdoors too, so the product must be suitable for this with regards to materials and function in varying weather conditions.

Safety

The only possible safety issue with this design is in the circumstance that while the customer is in the process of ordering, the shielding flap gives way and falls down and effectively injuring the customer. It is of paramount importance that this never occurs and that measures are taken to ensure that whilst lifted up, the flap cannot fall suddenly down. This would be simple to make, as it could be designed in a way that the flap falls gradually.

Cost

The cost to produce this transmitter would be around £20. The acrylic plastic is cheap, however if I was to include aluminium as the flap, this would increase the cost significantly.

Overall Viability

This design, I feel ticks all the most important boxes, including how effective it is, how it looks and cost. This design is the one I will be producing.

Transmitter 2

This design is a transmitter that has an LCD screen with controlling buttons on either side so the user can hold it comfortably no matter if they are left or right handed. This product will send the signals the receiver once the customer has gone through each stage of the ordering process. They will choose their meal, drinks, sides and portion sizes in different windows in a high-tech mini computer. It has a long extendable neck so that customers can also do this from inside their cars, similar to the way mobile phone shops present their phones that are for sale. They have an extendable wire that retracts when the customer is finished looking at it.

Function

The function of this transmitter design is to allow the user to specifically choose what they desire with increased options. This message will then be sent to the receiver and displayed clearly on the LCD screens.

Materials Used

The base and the casing of the will be made from acrylic plastic and then is covered by rubber grip, to ensure the user has a firm hold on the product.

Aesthetics

I believe that this design looks aesthetically pleasing as it is a hand held product and therefore is small and compact and will easily fit in the user's hand. It also has an attractive glossy black finish.

Ergonomics

The texture of this design is effective and [illegible] touch as the material will have a smooth finish.

Size

As mentioned before the design is small [illegible] therefore it will comfortably fit in the user's hand and [illegible] can be easily transported.

Storage

There wouldn't be a problem with storing this product as it is small and compact.

Safety

This design has no likely safety issues, however if care is not taken while building this device and electric cables aren't wired properly or if insulating material doesn't cover all of the wiring, problems could arise if a customer touched this.

Cost

The cost to produce this product would be expensive as this product is similar to a mini computer.

Overall Viability

This design would be my favourite if there was an unlimited budget and all forms of production available. However with the resources available in the school workshop this is impossible.

Transmitter 3

Transmitter design number 3 is a sender that includes 8 buttons which illustrates to the user what each button means. It will transmit 8 different signals to the receiver unit which will then show the McDonald's staff member what is needed by lighting up the relevant LED beside the selected meal.
This design is a lot less complex then the previous design, as it is simply a box with selection buttons and a large McDonalds 'M' to promote the franchise.

Function

The function of this design is to transmit a signal to the receiver which will m the LED light up and therefore inform the employee of the meal the customer would like.

Materials Used

This design is made from 5mm yellow and red acrylic plastic. Acrylic plastic has a very clean and attractive finish to it when it is polished up. The extruded 'M' brand symbol that is fabricated over the device could be made out of acr too, joined by two aluminium rods through the centre.

Aesthetics

The shape of this design makes it aesthetically attractive because of the brigh yellow curved M and the red box shaped to complement the M that also has filleted edges. This product would be eye catching from afar and also self promotes the company.

Ergonomics

The only part of this design that needs to be touched by customers are t rounded buttons. They will pose no safety issues to press and will be comfortable to do so.

Size

The overall size of this design will be quite large. Although this may not be a problem as the device is kept outdoors. Due to its size however, it may be hea or inconvenient to move around.

Storage

There wouldn't be a problem with storing this product as it will be outdoors a the driver's side of the drive-thru. When placing a circuit inside this product, circuit will not have to be cut down as it will fit inside the product easily.

Safety

There are no safety issues with design three as the edges are curved and they don't pose as a danger of hurting the user. All of the buttons are also round as therefore comfortable when a pressing force is applied. Also, all wiring must carefully done and the device must be able to withstand wear and tear and be waterproof.

Cost

The cost to manufacture this product would be relatively cheap, as it is simple device.

Overall Viability

This design functions similarly in the way that my first design does, as buttor beside the name of each meal must be pressed so send a signal to the receiver The main difference being the 'in your face' M that is incorporated into the design that stands out. The only benefit of having this is to self promote the McDonald's food chain and I feel that a protective shield to protect the transmitter like in design 1 serves a better purpose and is a lot more effective

Transmitter Design

The logo and the box will be fabricated by an aluminium rod with screws fastened at each side. The rod will be the length of the width of the product and 3mm in diameter.

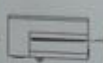
The inclusion of this large McDonalds logo is solely for aesthetically improving the device and making it more eye-catching. It does not have any input to the funtion of the transmitter.

Each choice of product is clearly laid out with a button to the right hand side of it. If this is the product the customer wants, they will press this button and a signal will be transmitted to the receiver device in the McDonalds kitchen.

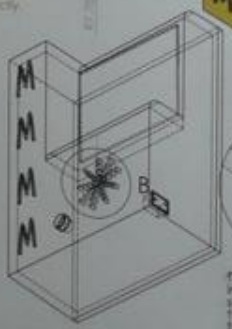
Receiver Design 4

This screen displays what the customers have decided what they want and will display to the user how much the product is to charge the customer correctly.

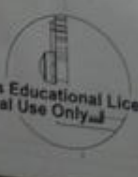
I have included the McDonald's logo as all of their packaging and products have this to promote the fast food chain. This is why the McDonald's 'M' is recognised worldwide.



The user will press and hold this button to verbally communicate the order, so that food, drinks, sides and sides can be requested quickly and efficiently.



This is were the user will talk into and also were the speaker is situated so that the employee can recieve feedback from the McDonald's customer.



DesignA

Transmitter Design 2

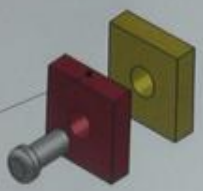
Front cover view of the menu's shield. This will help protect the device fromweather and vandalism.

A view of the menu shieldlifted up so that the menu can be used.

On/Off switch. When the cover is opened up ot slides against the switch, turning it on. When it is closed, it flicks the switch off, saving energy.

Reset button, situated on the outside cover so that it is easily located if there is a malfunction with the placed order.

The screw connecting the two components can be tightened and loosened by a screwdriver. This view shows how the shield and the device will come together.



UNLESS OTHERWISE SPECIFIED: NAME DATE

DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONAL
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±

INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING

DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:

TITLE:

SIZE DWG. NO. REV

Transmitter Design Page

SCALE: WEIGHT: SHEET 1 OF 1

Receiver Design

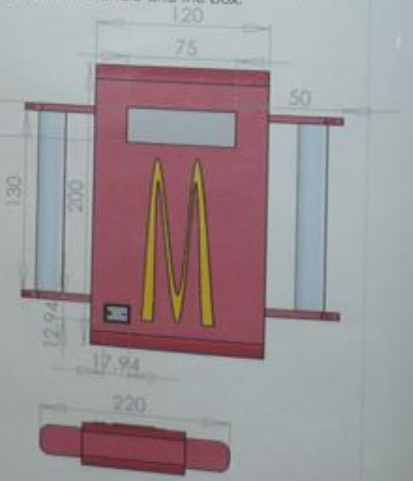
The Mcdonalds logo, to highlight the fact that it is a McDonalds product.

On/Off switch.

LCD screen will display a message to the kitchen staff in McDonalds. The message will depend on what the customer has selected from the choices available on the transmitter. This device will then pick up a signal via the antenna in the circuit.

Aluminium handle to ensure user has a firm grip on the product and does not accidentally drop it. Both handles are long enough to fit a human hand around them at 130mm with a diameter of 22mm.

The product, due to its flat back and symetrical handles on both sides, can be placed high up on a wall for more people to get faster access to the information displayed. Two hooks or nails could be inserted into the wall to fit between the space between the handle and the box.



UNLESS OTHERWISE SPECIFIED: NAME DATE

DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±

INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING

DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:

TITLE:

SIZE DWG. NO. REV

Reciever Assem1

SCALE: 1:5 WEIGHT: SHEET 1 OF 1

Transmitter Design 1

Long neck supporting the transmitter enables customers to adjust height and positioning to enable easier use. The material used for this neck is elastic rubber so that it will stretch and customers can pull the controller into thier car easily and wont have to strech out of thier window for every selection.

When the customer pulls up beside the transmitter and begins their selection, they will select from four different screens. The first will be which meal is desired. Once that is clarified the next page will ask the preferred side order and then a selection of drinks. The last screen will ask the customer their preferred method of payment.

the customer will use the arrow and select buttons to direct themselves through the on-screen menu.

Cancel/Back button.

Select button.

The controller here is a sophisticated and attractive transmitter that customers use in the Drive-Thru.

This transmitter may not be the most practical of designs as it requires two hands to operate properly. Customers must use their left hand to direct the cursor and right hand to select which meal is desired. However, the flexible neck may make this slightly easier.

A sturdy base is in place to ensure the menu is in a fixed position and cannot be easily broke-off or pushed over.

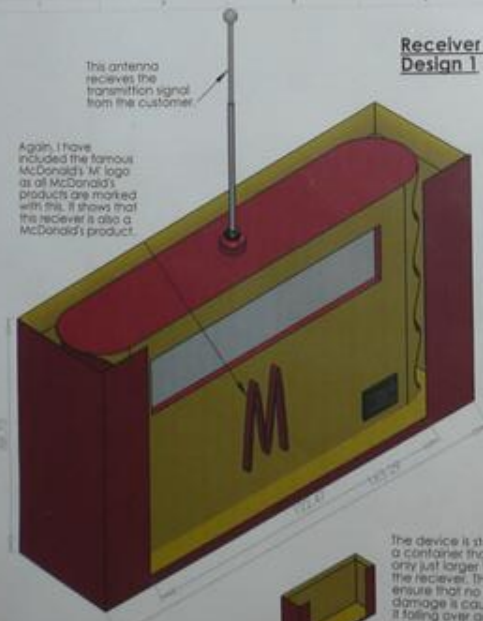
TITLE:

Transmitter Design 1

SHEET 1 OF 1

Receiver Design 1

This antenna recieves the transmition signal from the customer.



Again, I have included the famous McDonald's 'M' logo as all McDonald's products are marked with this. It shows that this reciever is also a McDonald's product.

The grooves on each side of the portable reciever are for the users' fingers so that the device fits and is comfortable in their hand, making it ergonomically enhanced. This will also reduce the chances of the user dropping the reciever, therefore making it less likely to become damaged due to wear and tear.

The device is stored in a container that is only just larger than the reciever. This is to ensure that no damage is caused by it falling over as it is securely slotted into place. The screen is still in view when the device is stored, so that staff do not need to take it out to check if an order is in place, it will automatically appear on-screen.

Reciever

A3

Control Systems

Inputs

Push Button

A button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard materials, usually plastics or metals. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state.

Switches

In electronics, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts. Each set of contacts can be in one of two states: either 'closed' meaning the contacts are touching and electricity can flow between them, or 'open', meaning the contacts are separated and nonconducting.

A switch may be directly manipulated by a human as a control signal to a system, such as a computer keyboard button, or to control power flow in a circuit, such as a light switch. Automatically-operated switches can be used to control the motions of machines, for example, to indicate that a garage door has reached its full open position or that a machine tool is in a position to accept another work piece. Switches may be operated by process variables such as pressure, temperature, flow, current, voltage, and force, acting as sensors in a process and used to automatically control a system. For example, a thermostat is an automatically-operated switch used to control a heating process. A switch that is operated by another electrical circuit is called a relay. Large switches may be remotely operated by a motor drive mechanism. Some switches are used to isolate electric power from a system, providing a visible point of isolation that can be pad-locked if necessary to prevent accidental operation of a machine during maintenance, or to prevent electric shock.

Keypads

A keypad is a set of buttons arranged in a block which usually bear digits and other symbols but not a complete set of alphabetical letters. If it mostly contains numbers then it can also be called a numeric keypad. Keypads are found on many alphanumeric keyboards and on other devices such as calculators, combination locks and telephones which require largely numeric input.

A computer keyboard usually contains a small numeric keypad with a calculator-style arrangement of buttons duplicating the numeric and arithmetic keys on the main keyboard to allow efficient entry of numerical data. This number pad is usually positioned on the right side of the keyboard because most people are right-handed.

Transmitters

A transmitter is an electronic device which, usually with the aid of an antenna, propagates an electromagnetic signal such as radio, television, or other telecommunications.

2^{12} Series Encoder

An encoder is a device, circuit, transducer, software program, algorithm or person that converts information from one format or code to another, for the purposes of standardization, speed, secrecy, security, or saving space by shrinking size.

How the Decoder Functions:

The HT640/S encoder begins a three-word transmission cycle when the transmission enable line is pulled. This cycle will repeat itself as long as the line is held high. Once TE falls, it finishes its output completes its final cycle and stops as shown in the diagram above. When a transmission enable signal is applied, the encoder scans and transmits the status of the 18 bits of address/data serially in the order A0 to A9, D0 to D7, the status of each address

2^{12} Series Decoder

A decoder is a device which does the reverse of an encoder, undoing the encoding so that the original information can be retrieved. The same method used to encode is usually just reversed in order to decode.

How the Decoder Functions:

The HT658 decoder provides ten addresses and 8 data pins in a 24 pin SOP package. It is paired with the HT640 encoder. The decoders receive data transmitted by the encoders and interpret the first 10 bits as data. A signal on the DIN pin then activates the oscillator, which in turns decodes the incoming address and data.

The decoders will check the received address twice continuously. If all the received address codes match the contents of the decoder's local address, the 8 bits of data are decoded to activate a valid transmission. That will last until the address code is incorrect or no signal has been received. The output type is momentary. The data outputs follow the encoder during a valid transmission and then reset.

Radio Control

For distances of several hundred meters ultra-sound and infrared lack t power; optical fibre is usually too expensive and wired systems are oft impractical. Radio has considerable advantages over other types of con systems. The radio transmitter and receiver are more expensive to construct, more bulky and have a greater current consumption, but thes are not insuperable problems. The construction and alignment of radio transmitter and receiver require a little more expertise, but within the scope of all except the absolute beginner. As in many other systems, noise can be a problem. In a radio system, the commonest source of noise is other radio transmissions.

Outputs

Outputs are at the end of the circuit process. There are many different types of outputs, such as;

- LED
- LCD

to detect the entire range and frequency of a human voice is equally likely to detect many background noises in the environment. Therefore it is important that the microphone is placed onto its stand at a height were it can be reached by the customer to speak into from close range. This is to ensure the order is not misheard due to background noise. Some analog microphones can reject background noise. While most speech recognition software has built in keyboard toggles to turn the

After analyzing this product and looking at the advantages and disadvantages, I was able to make a decision as to whether this was a suitable idea to use. I looked at a lot of information regarding microphones, I picked out what I think are the most important features a product has and gave the microphone and speaker a score for each. These three were the function, ergonomics and maintenance, and then lastly it's overall suitability. This graph

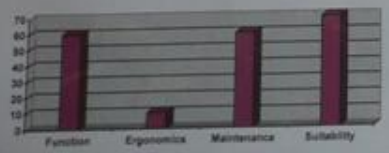
drive thru service, or can and order a delivery.
- To talk to each other through telephones requires no real effor
- Calls nowadays can be very cheap.
- Those who struggle to hear can use the loudspeaker function o their phone.

Disadvantages:

- To avoid a dead mobile phone battery, a landline would have to be used. This would cost more for customers to call from mobile phones.
- If employees misuse the phone to make personal calls or they have to make call to customers regarding their order, this will add up to an expensive phone bill.
- This idea is again useless to deaf people.
- McDonalds would need to advertise such a new move and make sure the public know what their telephone number is for when they decide to use the service.
- Prank calls may cost McDonalds dearly if they prepare a meal to send to a made up address.
- McDonald's staff would need to be trained for new practises.
- They may also need more personnel to cope with this move.
- McDonalds would need at least 2 delivery cars and employees to manage the demand, which would be very expensive.

Product Conclusion

After analyzing the possible use of telephones for McDonalds to communicate with customers by and looking at the advantages and disadvantages, I was again able to make a decision as to whether this was a suitable idea to use. I picked out what I think are the most important features a phone has and gave it a score for each. These three were again the function, ergonomics and maintenance, and then an overall suitability score. This graph shows the results and whether phones are suitable products for my idea. The function is not so high on the chart because of the added effort needed for customers to call up, and spend phone credit at the same time. Ergonomics are virtually zero because customers' phones are nothing to do with McDonald's. Although McDonald's will have a phone, it will take up space and be unattractive. Mainteonance is also not high because if there were problems with the phones in McDonald's, no orders will come through leaving customers frustrated. The reason why suitability is so high is because even though function, ergonomics and maintenance are look poor on the chart, this idea will increase sales significantly as customers will not have to leave their homes. It will put McDonald's into competition with other takeaway restaurants too.



Electronic Menu and Receiver

In a restaurant, a menu is a printed brochure or public display that shows the list of options for a diner to select. At the drive thru, the driver will pull up beside the menu and decide what he or she wants. They will the press the apropriate button beside the name of the food McDonalds has on offer that they desire. A signal will be trasmitted from the menu to the reciever inside the restaurant. The employee preparing the meals in the kitchen of the restaurant will see a red light flash beside the name of the chosen meal on a display after the signal has activated the L.E.D. and know exactly what to make – cutting out communication. The idea of cutting out verbal communication is to reduce time taken to place orders and avoid complications with orders. There are many different ways in which the menu and reciever can be powered. One of these could be by Battery Power. A battery is a type of linear power supply that offers benefits that traditional line-operated power supplies lack: mobility, portability and reliability. It consists of multiple electrochemical cells connected to provide the voltage desired. The menu could be designed in a way that it has a solar panel so that it provides its energy from sunlight. Solar Panels use light energy (photons) from the sun to generate electricity through photovoltaic effect (this is the photo[illegible]lectric effect). The majority of modules use wafer-based crystal[illegible] a thin-film cell based on cadmium telluri[illegible]

[illegible]ver

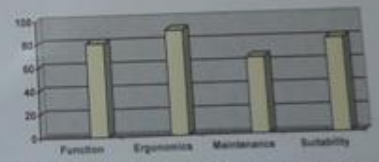
- Communication is clear a[illegible]
- This idea appeals to deaf peopl[illegible]
- Is inexpensive to both McDonald's and the custom[illegible]
- This idea is simple to create and set up[illegible]
- McDrive, the name McDonald's has gi[illegible] through, will be faster for diners to dri[illegible]
- McDonald's would not need to train staf[illegible]
- They also would not need more personnel to cope with this move.
- The waiting time for customers to receive their order will be cut.
- To press a button beside the name of the food you desire requires the least amount effort of the 3 ideas.

Disadvantages:

- The customer may be confused as to which button to press.
- Some people have reading difficulties.
- If the wrong button was pressed and there were no cancel button, the order would be wasted.
- If the product was to fail maintenance costs could be expensive.
- If this happened, it would result in closing the drive through which would reduce sales and disappoint customers.

Product Conclusion

After analyzing the advantages and disadvantages of the possible use of an electronic menu and receiver for McDonalds to communicate with customers at the drive through, I was again able to make a decision as to whether this was a suitable idea to use. I picked out what I think are the most important features the menu should have and gave it a score for each. These three were again the function, ergonomics and maintenance, and then an overall suitability score. This graph shows the results and whether the product is suitable for my idea. The function is high on the chart because the menu will do its job effectively and makes the process of ordering very simple for the customer and employee. Ergonomics are also high because the menus could be fabricated in a very attractive way with the McDonald's traditional red and yellow colour scheme. There could be pictures of the meals on it and even the cartoon mascot 'Ronald McDonald' depending on how big the menu is. Maintenance is good, but the lowest of them all because with many people using it there could be a malfunction if someone presses the wrong buttons. Also during closed hours vandals may attack the menu. And lastly, the menu may not be able to withstand extreme weather conditions, whether it be a very hot day or a day of high levels of snow. The reason why the suitability for this product is higher than the others is because I think that it appeals to a greater number of customers. It will do its job effectively and it can look good it McDonald's want it to. Even though maintenance may be a slight problem, it should be designed in a way that weather will never affect it and its performance. Also a casing could be placed over it during closed hours to protect it from vandals. This idea, I believe, will increase sales, as the lower waiting time will appeal to more customers.



Initial ideas: analysing existing products

McDonald's Corporation is the world's largest chain of hamburger fast food restaurants, serving nearly 47 million customers daily. In a bid to sell more food, with less congestion in the restaurant McDonalds introduced a drive-through, or "McDrive".

Background Information

The business began in 1940, with a restaurant opened by brothers Dick and Mac McDonald in San Bernardino, California. Their introduction of the "Speedee Service System" in 1948 established the principles of the modern fast-food restaurant. The original mascot of McDonald's was a man with a chef's hat on top of a hamburger shaped head whose name was "Speedee." Speedee was eventually replaced with Ronald McDonald in 1963. Since then McDonalds has become an international success. Worldwide there are 31,000 restaurants in 118 different countries. This fast food chain made $22.6 billion in revenue and $4.31 billion net profit with around 1.5 million employees. Like any other business- it strives to make even more – and I think my product can help McDonalds achieve this.

Microphones and Speakers

A possible device McDonalds could use to provide communication between customer and employee at the drive thru would be a microphone connected to speakers. The customer could press and hold a button whilst ordering, by talking to the microphone. A microphone is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal. This signal will be transmitted to speakers inside the restaurant were an employee will be listening to the order through these speakers. The most common microphone design today uses a thin membrane that vibrates in response to sound pressure. A microphone that is sensitive enough to detect the entire range and frequency of a human voice is usually likely to detect many background noises in the environment. Therefore it is important that the microphone is placed onto its stand at a height were it can be reached by the customer to speak into from close range. This is to ensure the order is not misheard due to background noise. Some analog

microphone off, it may be more energy efficient for McDonalds to have a microphone with an on/off switch. A speaker is an electroacoustic transducer that converts an electrical signal into sound. The speaker pulses in accordance with the variations of an electrical signal and causes sound waves to propagate through a medium such as air or water. Loudspeakers are the most variable elements in a modern audio system and are usually responsible for most distortion and audible differences when comparing sound systems.

Advantages:

- Communication is clear and if there is a complication in the order, the customer and employee can easily solve this by communicating effectively.
- There could be a volume adjuster to help the elderly or people who are hard of hearing to increase the volume.
- To talk to each other through microphones and speakers requires no real effort.
- This idea, that is the most common way for 'drive-thru's to operate, is simple to create and set up.

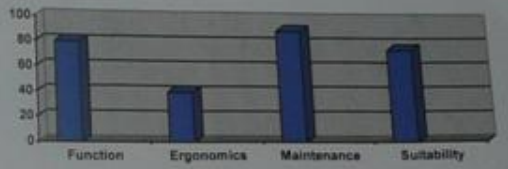
Disadvantages:

- A sensitive microphone is likely to detect many background noises in the environment.
- People may not be able to understand others who have different accents or languag
- This idea is of no
- The use of mi
- The

Product Conclusion

After analyzing this product and looking at the advantages and disadvantages, I was able to make a decision as to whether this was a suitable idea to use. I looked at a lot of information regarding microphones; I picked out what I think are the most important features a product has and gave the microphone and speaker a score for each. These three were the function, ergonomics and

shows the results and whether they are suitable products for my idea. The graph tells me that it is an appropriate idea for my product, hence why it is the most commonly used in drive throughs to place orders. However I am looking to create an alternative.



Telephones

A telephone or a mobile phone is a long-range, electronic device used for communication. Telecommunications (mobile telephony, text messaging or data transmission) over a cellular network of specialised base stations is known as cell sites.
Most current phones connect to a cellular network consisting of switching points and base stations owned by a mobile network operator (the exception is satellite phones, which are mobile but not cellular). In addition to the standard voicefunction, current mobile phones may support many additional services, and accessories, such as SMS for text messaging, email, packet switching for access to the Internet, gaming, Bluetooth, infrared, camera with video recorder and MMS for sending and receiving photos and video, MP3 player, radio and GPS. Using a phone to pre order a meal could save time spent on waiting for your order being prepared. Therefore McDonalds could introduce this as a new idea, a collection service to keep the queue for the drive-thru short and moving quickly to make as many sales as possible. Another idea would be a delivery service. A customer could call their nearest McDonalds franchise and place their order and the food could then be delivered to their address. This may be new to McDonalds but has been used for a long time and is common among takeaway restaurants.

Advantages:

- The waiting time for customers to receive their order will be cut.
- McDonalds will make more sales with a wider range of ordering food. You can go to the restaurant and sit in, use the drive thru service, or call and order a delivery.
- To talk to each other through telephones requires no real effor
- Calls nowadays can be very cheap.
- Those who struggle to hear can use the loudspeaker function c their phone.

Problem Identificaton

McDonald's Corporation is the world's largest chain of hamburger fast food restaurants, serving nearly 47 million customers daily. McDonald's predominantly sells hamburgers, various types of chicken sandwiches and products, French fries, soft drinks, breakfast items, and desserts. In most markets, McDonald's offers salads and vegetarian items, wraps and other localized fare. Portugal is the only country with McDonald's restaurants serving soup. This local deviation from the standard menu is a characteristic for which the chain is particularly known, and one which is employed either to abide by regional food taboos (such as the religious prohibition of beef consumption in India) or to make available foods with which the regional market is more familiar (such as the sale of McRice in Indonesia).

In a bid to sell more food, with less congestion in the restaurant McDonalds introduced a drive-through, or "McDrive". This allows customers to purchase McDonalds meals without leaving their cars. The format was first pioneered in the United States in the 1930s but has since spread to other countries. Orders are generally placed using a microphone and picked up from a person at the window. In a drive-through the cars create a line and move in one direction in drive-throughs, and do not park. The food is generally brought to the window by a server, and the customer can remain in the parked car to eat. Drive-throughs have become very popular, and are now found in the vast majority of modern fast-food chains. The problem I have identified with the drive through is that it too can get very congested at peak times. Therefore, to try to speed the process of the "McDrive" service, I will design a device that will be on display to drivers on the 'drive-thru' lane. On it will be eight buttons with the order beside each so that instead of verbally communicating with the employee at the window the customer only has to press a button. I think this will make it clear to employees at McDonalds exactly what the customer wants and will reduce the waiting time of other people in line. In the long run, this could make economic sense as the display I will make will not be expensive and the speedy service is sure to improve customer loyalty- generating greater sales.

- Beef Burger Meal
- Chicken Burger Meal
- Little Tasters
- Happy Meal
- Deserts

Design Brief

I will design and create a display panel for McDonald's drive thru service, were

Specification

Function

- The electronic menu should be able to determine the meal selected and electronically display the choice to the McDonald's employee.
- The menu must be able to withstand all types of weather.
- It should be safely placed on a wall or stand.
- It should therefore have a fixing mechanism to secure it in place.
- The devise should not cause any scratches or any other type of damage to the side of a customer's car.
- The product should be able to be turned on and off easily.
- The corners should be rounded with a radius of about 10mm to prevent hazards from sharp edges.
- The buttons should be easy and comfortable to press.
- The weight of the device must not be too heavy for the stand or wall to hold up. Also to ensure that it can be moved around if necessary.
- The product must be made out of acrylic to ensure long life.
- The menu must be yellow and red to keep the traditional colours of the fast food restaurant.
- The menu's electronic wiring should be expertly done to ensure errors and faults are kept to a minimum.
- The menu should have a power source to function.
- This power source must not have loose wiring or leads along the ground that people could trip over to ensure the safety of customers and staff.
- The menu must be able to transmit a signal of at least 10 meters.
- The menu should be affordable for all franchisees to afford.
- The LCD screen should be clear and visible by staff from at least 2 meters.
- The buttons should be in suitable positions so the user does not accidentally press the wrong button.
- The buttons should also be clearly labelled so the user doesn't make a mistake when making their choice.
- The product must have a reset button to return to its stable state.
- The transmitter and receiver must be able to withstand ranging temperatures.
- The device must have an on/off switch to save power.
- The menu must have no more than 8 inputs.
- The product must be able to withstand wear and tear from accidental bumps from cars and vandals alike.
- The product should be easy to use for customers of any age over 17.

Aesthetics

- The product should be manufactured with aesthetically pleasing and traditional colours such as yellow for the McDonald's 'M' used for the background.
- The product must have a rounded, polished finish.
- The product should be aesthetically pleasing and not an eye sore.

Ergonomics

- This product must have a smooth finish in relation to the human touch.
- The menu must have rounded edges and corners to make it safer for the customer to use and to not cause any discomfort whilst ordering.

Anthropometrics

- This product should be anthropometrically pleasing in relation to the human anatomy.
- The menu should be high enough to reach from a car window.
- The stand on which the menu is fastened to should be close enough to the car for the customers arm to reach out of the window.
- The buttons on the menu should be no smaller than 25mm in diameter so that they are easy to press.

Materials

- This will then ensure that the product is strong and durable for its desired use.
- The material used will need to be an electrical insulator.
- It must also be a thermal insulator as in some countries the weather can reach high temperatures.

Safety

- The product should have smooth edges and surfaces so that it does not cause injuries.
- The product must be around 4ft high from the ground so that the customer ordering does not receive an injury leaning out of the window trying to reach too high or too low.
- The product must pass British Safety Standards.
- There should be no loose wiring around the menu that may cause a health and safety hazard.
- It should be a thermal insulator.
- It should be electrically insulated.
- It should fasten well enough to the stand so there is no change of it falling.
- All wires should be electrically insulated.
- All parts should be properly and securely attached.

Maintenance

- The product should be long lasting as it will be used very frequently.
- It should be able to be cleaned so that there is no build up of germs from many people pressing the same buttons.
- It should last up to 5 years.
- It should work at the same performance for its whole working life.
- The power source should last at least 10 hours of non-stop use.

Size and Weight

- The menu must weigh around one or two kilograms so that it is easily transported and also not too light so that it is sturdy.
- This will also ensure that the menu will not be accidentally pushed over and therefore damaged.
- The menu should not be any larger than 1ft by 1ft.
- The menu should be in proportion to its' stand.
- The receiver that the employees use to take orders should not be larger than the menu so that it does not take up too much space.

Cost

- The menu should not be more expensive for the manufacturer to produce than the franchisees are prepared to pay for the product.
- The table should be of satisfactory value for money for the franchisees, it should make economic sense in the long term to have this menu available.
- The prototype I will be manufacturing shall be acrylic to keep the production costs down.

Storage

- The receiver should be designed in a way that it is easy to store.
- The receiver should not take up too much storage space.

Environmental

- The menu must be as environmentally friendly as possible.
- The menu's colours should not be an eyesore to the surrounding environment.
- The menu should not cause harm to the environment whilst being manufactured.
- The materials used to produce the product should be environmentally friendly.

Testing

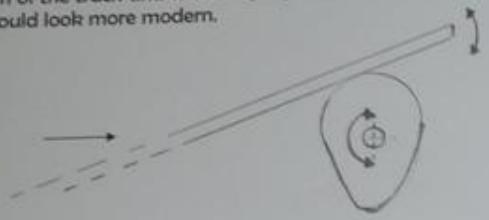
- The menu and receiver should be well tested before they are introduced to the McDonalds drive thru service to make sure that it is safe for customers to use the menu safely and effectively.


Big Tasty
The M Burger
Big Mac
McChicken Sandwich
Happy Meal
Salad
Fries
Drinks


HIGHLAND
SPRING
i'm lovin' it

Changes made as a result of testing

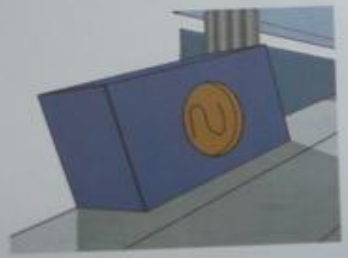
Change 1:
The first change I would make to my prototype is changing the way of raising and lowering the track. I would substitute my method of using aluminium rods to hold the track in different positions, with an eccentric cam which will change the elevation of the track as the shaft it is on turns. The cam-shaft could be turned by a well made and modern handle. This change would make it a lot easier and quicker to change the elevation of the track and would slightly improve the aesthetics of the prototype as it would look more modern.



Change 2:
The second change I would make to my original idea would be to have less circuitry. In my original prototype I had 4 different PCB boards which takes up a lot of space and is extremely hard to fit into circuit housing and wire up. I would solve this problem by maybe using a different circuit with a PIC or an LCD display to reduce the amount and size of the PCBs. Because there would be less circuitry I think the whole product would have a more solid feel and be easier to move around.

→ Solve problem by using circuit idea 2 or 3

Change 3:
On my original prototype had quite tall sensor units which would fall over backwards quite easily because of the weight of the wires coming from them, they would also twist around on the track and face the wrong way. This problem could be solved by using less tall sensor units and stronger magnets. It could also be solved by using a different way of moving the sensors up and down the track.



Change 4:
The last change I would make to my prototype is making the sensors a lot more sensitive and making the timing more accurate. My prototype cannot really be used for physics experiments as the time is counting slightly too fast which will make results inaccurate. Also the sensors sometimes do not pick up the trolley as it goes past so again it effects the results of the experiment. I would solve these small problems by firstly doing more detailed calculations to make sure the count was exactly 1 second and when choosing the resistors to go along with the LDRs in a potential divider arrangement so that the sensors work when there is a very small change of light intensity.

Section 4 . 3

Testing

Is the display clearly visible and easy to read?

⇒ the display is in clear view, should be big enough and stand out enough to be read easily by the user.

⇒ The face section around the display makes it clearly stand out.

Is the product easily storable?

⇒ This product is not easily storable it does separate into two parts but mainly the length of the track makes it hard to fit into most cupboards.

Does the system time accurately to 1 decimal place?

⇒ The system does time to one decimal place as shown.

⇒ The timing is not as accurate as anticipated, despite doing calculations the count is slightly faster than it should be.

Can the elevation of the track be changed?

⇒ The elevation of the track can be changed by sliding the track on top of track holders.

⇒ This method of changing the elevation is a little time consuming and awkward as you have to constantly slide the track in and out.

Does the time start at one sensor and stop at the other one?

⇒ The system will start and stop time when you cover the sensors with your hands.

⇒ When a trolley is sent down the track the LDR's struggle to sense the trolley going past and sometimes will not start or stop the time.

Can more than one of them be used in classroom?

⇒ The product is small enough so that a number of them will fit into a classroom situation. product is pictured to the right sitting on a typical classroom desk.

⇒ The product is easy enough to use so that a pupil can use it without help from their teacher.

Is the distance between the sensors changeable?

⇒ The distance between the sensors can be easily changed using the magnets situated on the track

⇒ The magnets are not very strong so they can rotate or the sensors can [illegible] off backwards this is not ergonomically good.

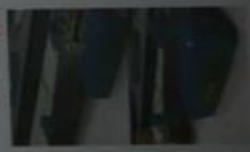
Can the unit withstand wear and small impacts?

⇒ When just holding the unit it feels fragile and likely to break if it was dropped.

⇒ The aluminium track is very easily scraped and will look worn after not much use.

Does the system eliminate human reaction error and is it automatic?

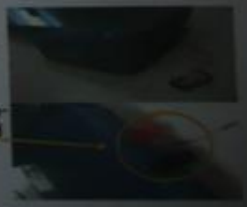
⇒ The system is completely automated and there is no area where human reaction time can be a problem as the sensors are accurate and will activate instantly.



Can the system run of one 9v battery?

⇒ The circuit will run without any problems on a new 9v battery. But if the voltage drops in the battery the circuits begins to not function properly

⇒ Because this product is designed for a physics classroom I included connections on the back of the product where a power pack can be used to keep the voltage at 9v.



Section 4.2

Critical and objective evaluation

Ergonomics

- ⇒ Product isn't easy to move around as circuit housing can come apart easily because there is a lot of circuitry inside and it is quite a tight fit to get it all in.
- ⇒ The sensors are very easy to move up and down the track and do stay in place. However the weight of the wire coming out of them make the sensors twist around on the track and the wire has to be manipulated into a position where the sensors stay in place.
- ⇒ The elevation of the track can be changed to three different heights from which the trolley will travel at different speeds.
- ⇒ Changing the height of the track isn't very difficult but it isn't very practical and could be made a lot easier.
- ⇒ The circuit works properly when you cover the sensors with your hands however the sensors struggle to pick up the trolley as it goes past.
- ⇒ The timing of the circuit is slightly off. It counts faster than 1 second which will make any results taken from an experiment using the product would be inaccurate.

Aesthetics

- ⇒ This product will fit in really well in a modern classroom situation.
- ⇒ The shape of the main circuit housing and smaller moulds is really modern and contemporary.
- ⇒ The aesthetics are also improved by the product being very symmetrical and completely in line.
- ⇒ The small magnets have been integrated into the track and sit down below the surface of the aluminium. Again this makes the product look well made and really improves the aesthetics.
- ⇒ The sensors sit quite high up on the track. I think the sensor units look a bit bulky and square in comparison to the rest of the product. This is a slight drawback to the aesthetics.
- ⇒ The translucent face plate looks very stylish and highlights the LED displays effectively the face plate really improves the aesthetics and makes the product look well made and modern.

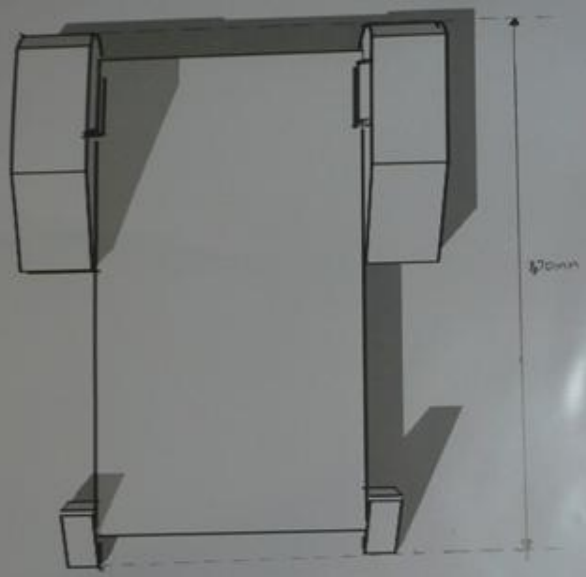
materials used

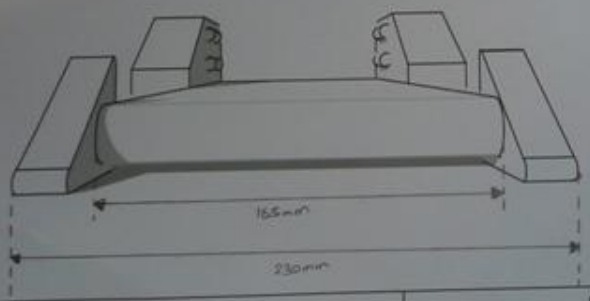
- ⇒ Vacuum formed plastic is strong and looks modern.
- ⇒ Plastic will scrape easily and show signs of wear after prolonged use.
- ⇒ Aluminium track makes the product look high quality and well made.
- ⇒ The track has a polished finish which can be scraped easily so after use it may start to look old and in bad condition.
- ⇒ The aluminium rods used to hold up the track are one of the best features of the product, they wont show many signs of wear and again give the product a high quality appearance.
- ⇒ The translucent acrylic face plate highlights the displays cleverly and incorporates the reset switch really well.
- ⇒ The face plate was cut out using a CNC micro router so all the cuts are extremely accurate and everything fits in place perfectly. This makes the product look well made.

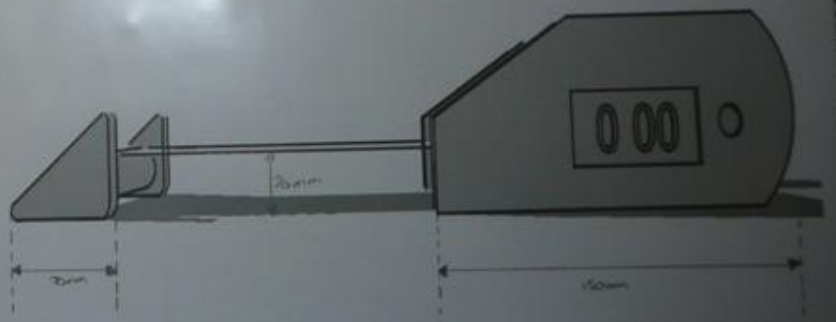
Other considerations

- ⇒ This product should be safe for pupils to use while in school, there are no sharp edges and no high voltages that would be a danger for pupils.
- ⇒ Because most of the product is made using vacuum forming it could be made in a range of different colours, which is good for a classroom situation.
- ⇒ I am very pleased with my finished product I think it looks really modern and would fit in well in any classroom environment. I would have liked the circuit to be able to sense the trolley better and definitely would have liked it to count accurately. The product is easy to use and set up but I would like the method of elevating the track to be a bit more technical and modern. All in all I think my product looks great and works well and I am extremely happy with the finished prototype.

Working drawing







Jordan Graham	Physics timer	Working drawing

Section 3.1.8

Track

Rectangle track cut out of aluminium and 13mm holes drilled for magnets. Marking holes for aluminium strip to hold magnets in place on track.

Track held in place by rivets evenly spaced between magnets to improve aesthetics. When I had put the strip on I realise it would make the track wobble on the holders so I modified the track by joining another aluminium strip onto the track so that it would balanced and steady when being held in an inclined position.

I made a pivot for the track by drilling holes in either end of an aluminium bar and slotting smaller aluminium bars in at either end allowing the bigger bar to rotate.

Photos showing strips all joined on and magnets glued in place.

Small moulds made for holding small aluminium rods at the ground so bigger aluminium rod is allowed to pivot fr

Joining track to large aluminium rod so whole track is allowed to pivot up and down. This means the speed of the trolley moving down the track can be varied.

Sensors

When making the sensors I made small MDF moulds with a hole just big enough to hold an LDR. I also put a small design on to improve aesthetics.

Once I had vacuum formed the moulds I made small PCB's and soldered wires and the LDR's onto them. Originally I was going to rivet a piece of steel along the bottom of the sensors but I realised this would mean only a small part of the sensor would be touching the track so I modified it and bent a strip of steel at a right angle and joined it to the back of the sensor.

Finishing

When I had finished building all my moulds I drilled holes in them where needed to pass wires through for connecting up circuitry. I put grommets in where the holes were drilled to improve aesthics.

Riveting on track holders and making sure they are strong enough. Also addition of terminals at the back of the product so that a power pack can be easily connected.

When everyting was completed I attached my displays and face plate. I also put the completed product together and photographed the finished prototype.

Section 3.7

Product Development

Plan of manufacture

Main unit

- Cut out and glue measured pieces of MDF together to make moulds.
- Mark out appropriate radius' and lines to be cut out on the moulds.
- Cut out and tidy edges to make general shape of model.
- Router the edges to improve aesthetics and split moulds.
- Vacuum form one side of the mould where the circuit will be housed and drill holes to hold circuit in place. And plot holes on the moulds.
- Plot any other necessary features and vacuum form.
- Make small track holders to put on side of mould.
- Put edges on all of the moulds, cut out space for displays, drill holes for circuit and rivet on track holders.

Track

- Mark out on aluminium rectangle 600mmX165mm and cut it out.
- Tidy up and file edges to make sure it is perfectly square.
- Mark out 100mm intervals and drill holes to fit magnets into.
- Cut out small pieces of aluminium to glue magnets onto.
- Make small moulds and plot holes on them to hold aluminium rods.
- Cut out a larger aluminium rod and drill holes into each side of it using the lathe so it can slot over smaller rods and pivot.
- Vacuum form moulds and rivet on smaller rods.
- Drill holes in track and larger rod and rivet them together to make a pivoting track.

Sensors

- Make 2 small moulds and plot holes big enough for LDRS in them.
- Vacuum form moulds and make a small PCB solder in LDRS and appropriately long wires.
- Drill a small on the sensors to pass wires through.
- Make small strips of steel to put on sensors so they stick to magnets on the track.
- Glue sensors together.

Main unit

Gluing MDF together in vice. When I took it out I marked out the shape I wanted and cut it out. I curved the edges by marking a radius on them and sanding around it with a band-facer.

Photos showing shaping of mould, routered edges and positioning of track holders.

Bottom mould modified shape so that circuits would fit in much easier.

n forming split moulds for positioning cir-
d plotting holes for track holders.

Holes drilled and circuits screwed in place.

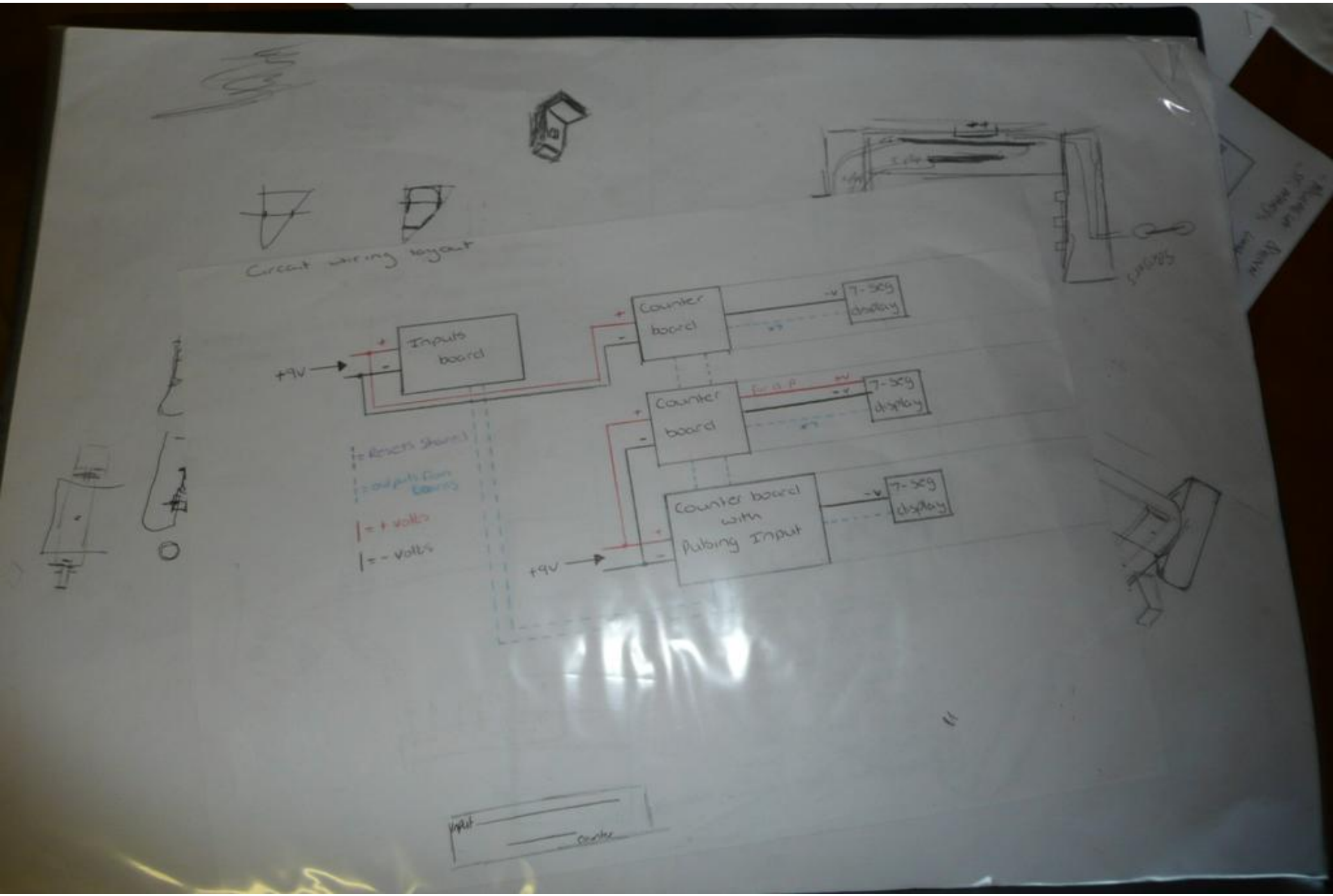
Area cut out of formed mould for display. Also acrylic face section being cut out on cnc micro-router.

Putting edges on circuit housing and showing circuits in position.

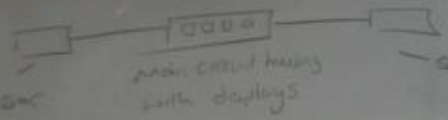
Modifications are highlighted in red

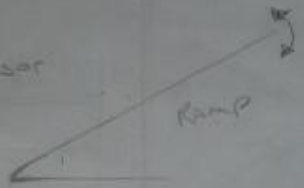
Face plate modified by plotting holes on back so that when displays are screwed on to the formed mould the face section will sit flush with the side of the mould.

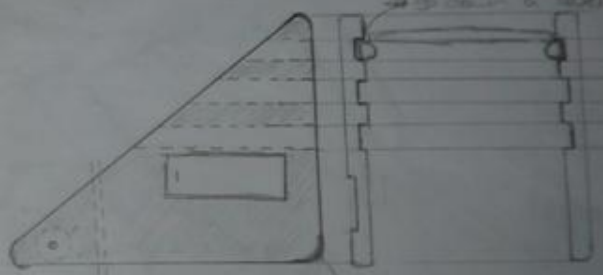
Track holders modified from strips of aluminium to small aluminium rods. I made this modification because it would be very hard to plot positions on the mould for the strips and it would be difficult to position them at the correct angle.


Circuit wiring layout
Inputs board
Counter board
7-seg display
Counter board
7-seg display
Counter board with Pulsing Input
7-seg display
+9V
+9V
= + volts
= - volts

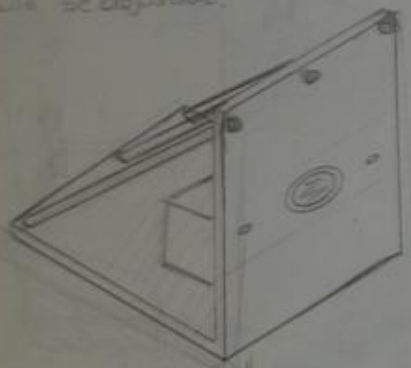
3 units

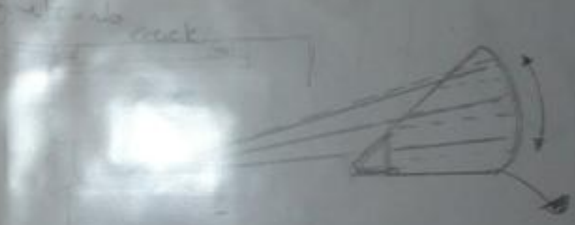


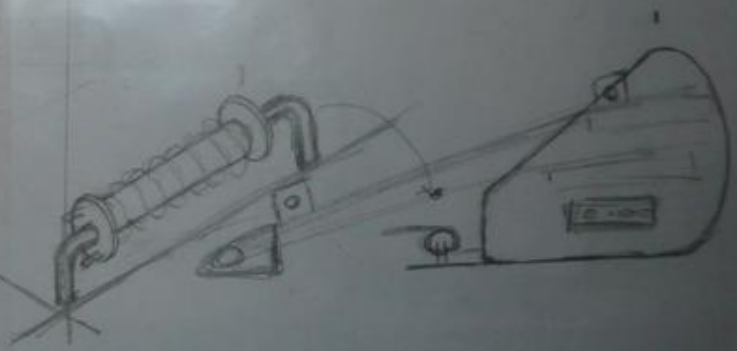




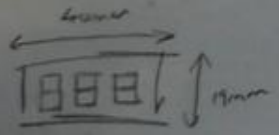
- Could have main circuit housing as part of the Ramp
- Something to stress distance between sensors
  - magnetic on the bottom.
- Ramp could be adjustable:







PCB dimensions => 80 x 80 x 40



Section 3.5

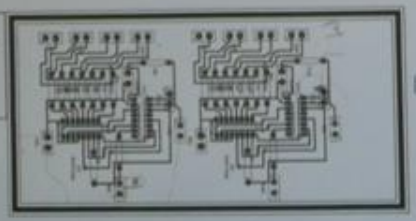
Process continued

Once I had my first PCB working and counting 0.1 of a second, I built an identical proto-board only without the 4093 part as the pulse will come from the carry out of the first PCB.

I then tested the proto-board with the working PCB. This is pictured on the left.

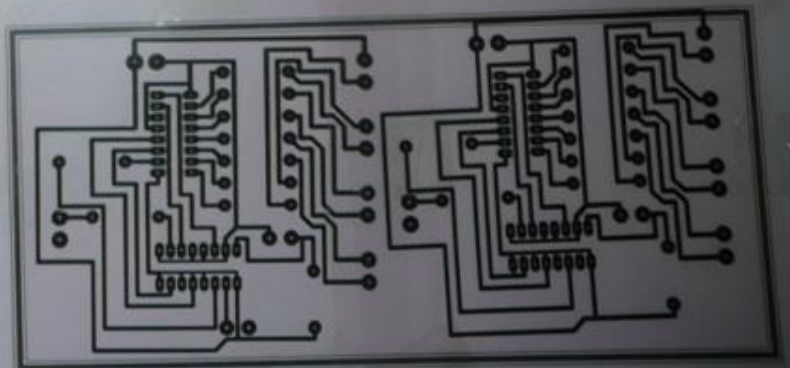
I then built the final proto-board and tested it too. However I found that it was not very ergonomic to have a reset switch for each display so I made a modification and joined the relays into one switch for all three displays. (circled in yellow)

I then made PCB layouts for the two proto-boards, because they were the same as the last PCB a new design was not needed. However terminal blocks for sharing + and - volts were needed.



Photographs of finished PCB timing with sensors.

Modification on display PCB ribbon cable not long enough so more cable soldered on and heat shrink wire used to tidy and secure joint.



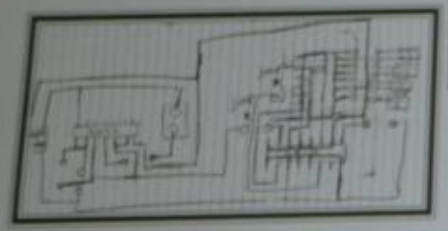
Acetate print outs of counters.

» PCB.pdf

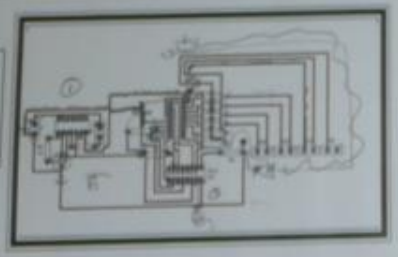
Section 3.4

Process Continued

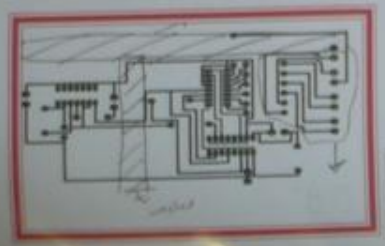
Shown here are pictures of working proto-board. The green LED shows the pulsing output from the 4093 part of the circuit (circled in yellow). The pictures show the time is counting up as I have taken photographs in two count positions.



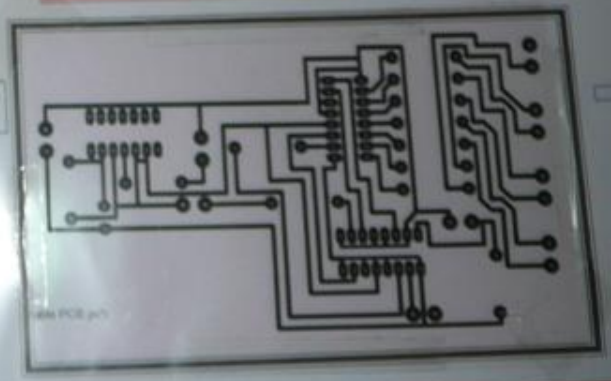
Original PCB layout design. I could not find a way of designing the PCB without using two wire jumps so when making the actual PCB I will use 0 ohm resistors as the jump.



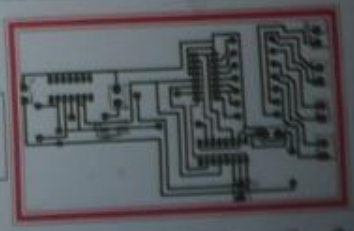
First checked PCB layout. This shows where a lot of modifications need to me made. In this I have left out a terminal block for the reset and for the carry out pin. I have also wasted a lot of space in the way I have positioned the outputs.



Shows modified layout. However there is still some wasted space which will need to be changed as the PCB should be as compact as possible so it can fit into the product easily.



PCB layout printed on acetate ready to be made into a PCB



Shows further modified layout with very little wasted space. This layout is ready to be printed on acetate and made into a PCB.

When I was happy with all the connections on the PCB I tested it with a 7 segment display and it is photographed working properly to the left.

When I had fixed the first problem it still didn't work. I then realised I had connected a copper track on the PCB to the wrong pin so I used a small drill to break the track and soldered a wire from the broken track to the correct pin. (circled in yellow)

When I had soldered on all the components my PCB did not work. I then realised that I had made no terminal for the negative pin on the 7- segment display so I had to join a wire from the negative to a spare pin in a terminal block (circled in yellow)

Inputs Continued

Picture shows two modifications

1. I had connected the output to pin 5 of the 7400 chip when it should have been connected to pin 6 (circled in yellow).
2. I was originally going to have another battery connected to the inputs. This would have been the power supply for a relay. However I decided it would be more user friendly to have the power shared (circled in blue).

Pictures showing testing of PCB on a working part of the circuit.

Process

Plan of manufacture for process and output parts of circuit

- ⇒ Draw the circuit on livewire.
- ⇒ Look up data for relevant chips and displays and build the circuit on proto– board.
- ⇒ Test the proto-board and draw out a PCB layout on paper.
- ⇒ Draw the PCB on PCB wizard and check for any mistakes.
- ⇒ Eradicate any mistakes and print the layout onto a circuit board.
- ⇒ Drill holes for components.
- ⇒ Solder in components
- ⇒ Test the PCBS
- ⇒ Make a small PCB on PCB wizard to hold 3 7-segment displays.
- ⇒ Print the layout onto a board and drill holes
- ⇒ Solder in ribbon cable to make the circuit look more tidy.
- ⇒ Test the whole circuit.

Relevant system calculations

When I was choosing the resistor and capacitor values which would determine the time constant for the 4093 output I needed to do a calculation.

T=RC

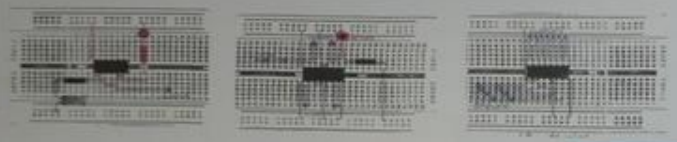
0.1=(1x10^-6)XR

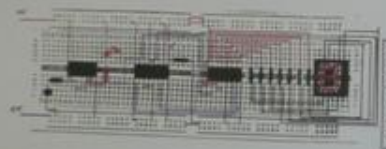
0.1/R=1x10^-6

...n to work out resistor and capacitor values

...e period will be 0.1s

R=1x10^5=100K





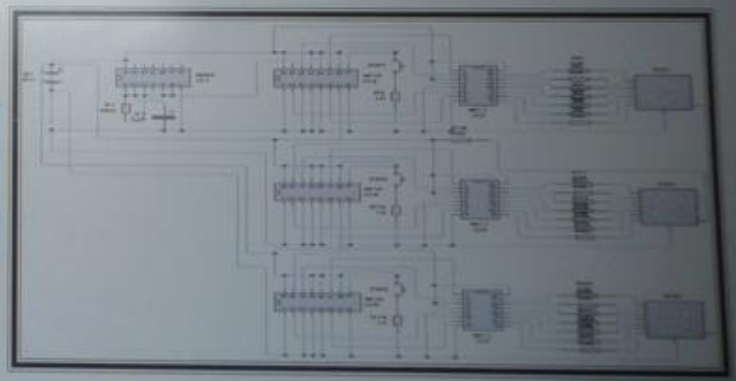
Proto-board layout designs for the 3 parts of the circuit. And all 3 parts together which is what the actual proto-board will look like.

Power calculation for circuit

$P = VI$

$P = 9 \times (2 \times 10^{-3})$

$P = 0.018$ watts



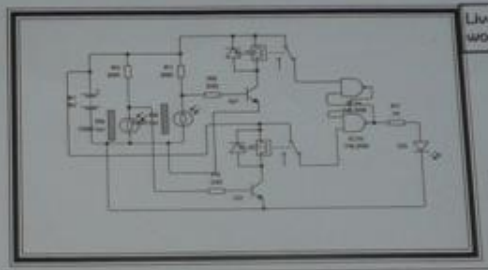
Section 3.2

Circuit Development

Inputs

Plan of Manufacture for inputs circuit.

- ⇨ Draw circuit on live wire and make sure it will work.
- ⇨ Make the circuit on proto-board and test it.
- ⇨ Draw out on paper a plan for a PCB layout.
- ⇨ Make the PCB on PCB wizard and check for mistakes.
- ⇨ Once all mistakes have been solved print the layout onto a circuit board.
- ⇨ Drill holes for components.
- ⇨ Solder in components.
- ⇨ Test the finished PCB.



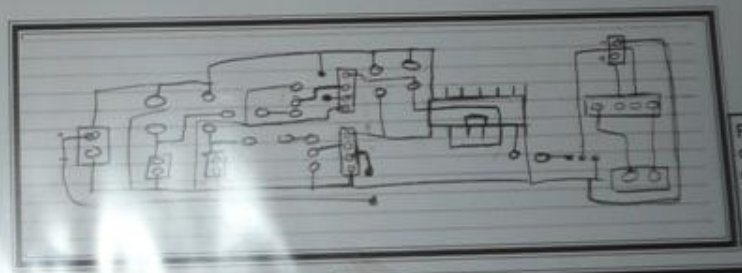
Live wire drawing of inputs setup showing working output as an LED.

Testing the relays.

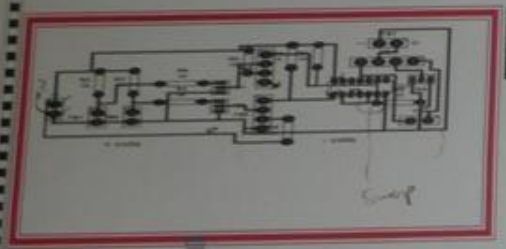
Working flip-flop shown in on and off positions.

Testing the proto-board with a working part of the circuit.

Photographs showing testing of proto-board at various different stages of its production.

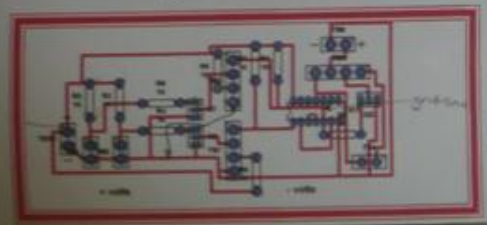


First drawing of PCB layout to make sure the circuit can be drawn on PCB wizard without any wires overlapping.

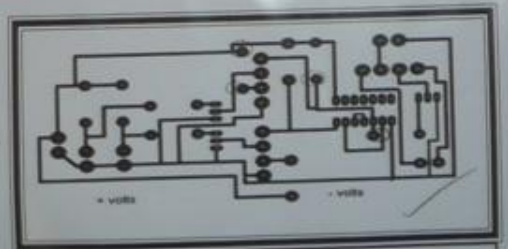


Original PCB drawing. Shows mistake made and highlighted so modification needed to be made to correct it.

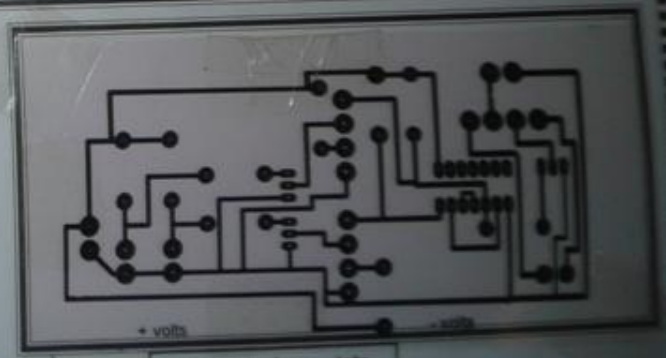
Note: Red boxes are modifications



Modified layout from above and all connections correct however some pads and lines are too close together and may touch so they need to be moved slightly more apa...



Final check before printing on acetate showing all correct connections and no touches.



Layout printed on acetate.

Section 3

Selection and Rejection

Idea	Design	Circuit
1 	My first deign idea is aesthetically quite pleasing. The general shape of the main unit is modern and stylish. The display has been integrated nicely and will sit flush with the side of the unit. Ergonomically this idea is ample. The track incline can be adjusted however it may be a little time consuming as the track will have to be pulled out, lowered and slid back in. On the other hand the sensors can be moved up and down the track quickly without having to loosen or tighten anything as the are magnetic. This design should also be quite sturdy and be able to take a decent amount of weight on the track. However there may not be a lot of room for circuitry. All in all this is a very suitable design proposal.	My first circuit idea includes a very simple input method, for an LDR to give an input it has to be subjected to a change of light , and depending on the value of the resistor it is connected to in a potential divider arrangement this change of light can be very small making the LDR highly sensitive which is ergonomically excellent for measuring time. The main process of the circuit is very simple and can be used to count on a number of different displays using the carry out pins of the 4510 chips. However when using more than one display the circuit can become quite bulky and take up a lot of space. The 7-segment displays would improve the aesthetics of the product as they look modern and are simple to integrate into the design.
2 	My second idea is not as good aesthetically as my first design idea, however the face plate around the display does improve the aesthetics dramatically. Also the shape of the product is not as modern as the other two ideas. Ergonomically this design idea is quite good its shape would allow it to be moved around easily and would make it easy for the track to be inclined. There is plenty of room for a circuit in this design idea however because of this it may look a bit big and bulky in real life as it would need to be long enough so that a trolley would spend a decent [illegible] moving down the track. The over all shape and size of this product [illegible] not as viable as the first idea.	The second circuit proposal includes toggle switches as the inputs, these are the most accurate way of inputting to a circuit as there is no real chance of them "missing" the trolley as it goes past, this is an extremely good ergonomic quality. On the other hand toggle switches can be hard to integrate into a product as something has po physically push them down. The process of the circuit shouldn't be too big and bulky and wouldn't be time consuming to set up. However to make the PIC count it needs to be programmed using computer software this is an aspect where I am not as comfortable so this part of the circuit doesn't appeal to me as much. Again this circuit includes 7-segment displays which will look good on a product.
3 	I think my last design idea looks the most modern and contempo[illegible] big bulky parts of the product and the circuit housing is integrated [illegible] acrylic edges and face plate to house the display also are aesthet[illegible] However the ergonomics of this design proposal are not as good. [illegible] inconvenient place and for it to be long enough it would be a bit of a [illegible] there would be a lot of wires hanging loose because the circuit housing is not [illegible] edges of the product so wires for the display and reset switch would have to be loose. This would also effect the aesthetics of the unit. This product looks excellent however it is not viable as it would be very hard to make and there are ergonomic drawbacks to the design.	My last circuit proposal again includes LDR's as inputs to the circuit. And as I have stated above if these are highly sensitive they are accurate devices. This circuit idea uses a thyristor as a latch instead of an R.S flip flop. But this may require slightly more circuitry as a flip-flop arrangement can be obtained as a single chip. This circuit uses a 555 timer to send a pulse to 4510 counter chips, again this may require more circuitry than my previous 4093 arrangement. I have chosen a LCD display as the output of this circuit. This is a very attractive display and woul improve the aesthetics of a product, However there is a lot of wiring involved in setting up a LCD display, moreover it is not as bright and in my opinion not as good looking as 7-segment displays.

Chosen idea

LDRS

↓

4093 pulse and 4510 counter

↓

4511 Decoder and 7-segment displays

I have chosen this design idea because it is aesthetically very good it is a modern design and would fit in to any classroom situation. It is also quit good ergonomically it will support a decent weight and is very sturdy on a desk. The track can also be made to be long enough to make it useful as a timer without the whole unit looking overly bulky.

I have decided to build my first circuit proposal. This is because it is a very simple way of making a timer circuit and more than one digit can be easily integrated into the circuit improving its ergonomics. The displays used in this circuit are modern and attractive and will look good in any environment.

Section 2.7

Circuit Idea 3

Input

LDR's provide and input to an arrangement including a thyristor which will latch when one LDR is covered and not stop until another one is covered. LDR's can be integrated easily into a product as they are quite small and to activate them they only need to be subjected to a change of light intensity.

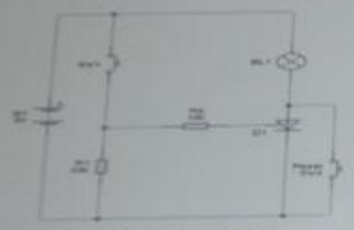
Process

The thyristor arrangement will provide an input to a 555 timer which will pulse every 0.1 seconds this can be varied by changing the vales of the capacitor and resistors. This will drive a 4510 counter chip connected up via its clock input so it will count time. The counter chip has BCD outputs which will be connected to a LCD driver chip.

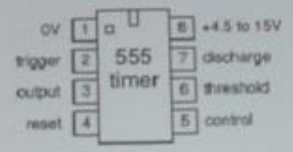
Output

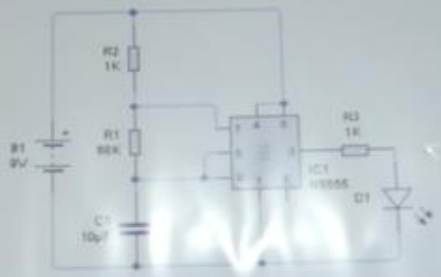
Driver chip will run into LCD display. 3 drivers will be needed for 3 digits to be shown on screen. The display will time to 99.9 seconds.

Thyristor Data



Example of a latching thyristor circuit. In my circuit switches would be replaced by a potential divider running into a transistor and a relay to give the pulse.





LED pulsing every second. This is made to happen by the values of resistors and capacitor.

f=1.44/(r1+2r2)C

f=1.44/(0.001+0.136)10

f=1.44/1.36 = approx 1Hz f=1/t so t=1 second

LCD display data

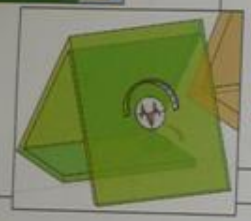
IC1

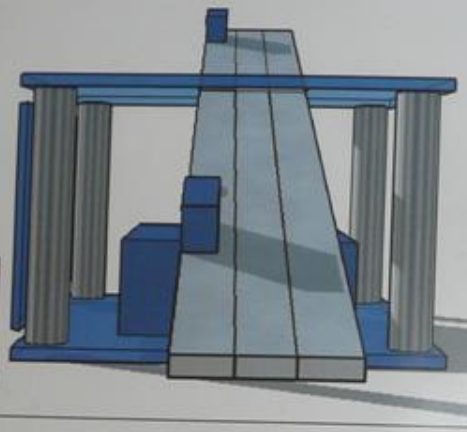
LCD driver data

Graph shows how resistance of LDR changes with light intensity.

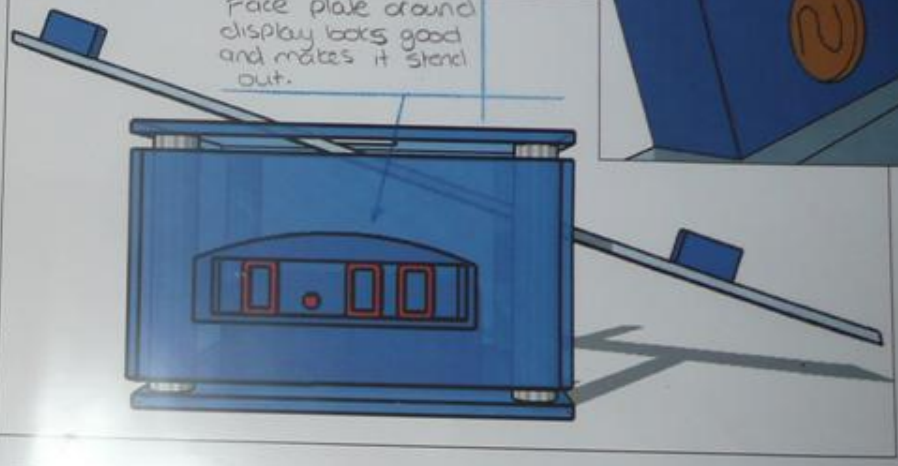
Section 2.6

Design Idea 3

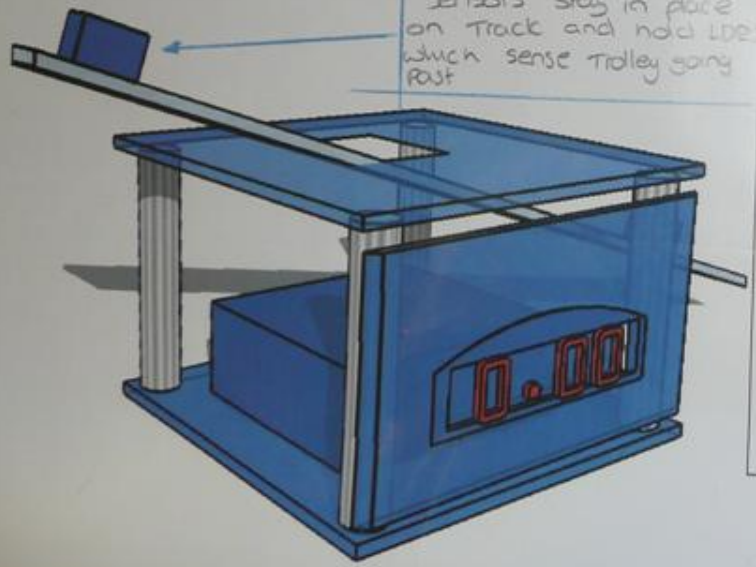


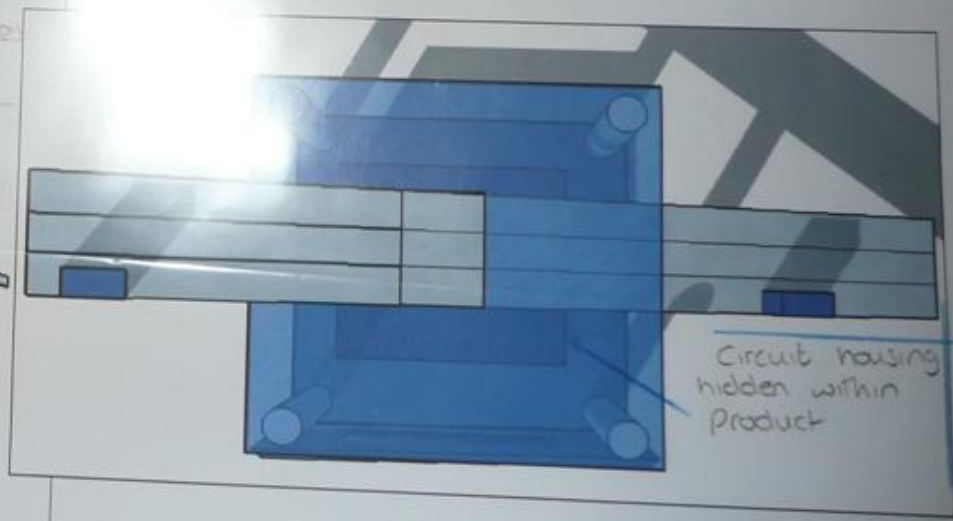


Face plate around display looks good and makes it stand out.



Sensors stay in place on Track and hold LDRs which sense Trolley going Past





Circuit housing hidden within Product

Circuit Idea 2

Input

toggle switches provide a digital input to PIC. The input would be set up in the standard input arrangement for a PIC and would be connected to a digital input pin. This could be integrated into timer product by running a trolley over the switch to push it down. i.e having the switches sitting just below the track with the arm just above it.

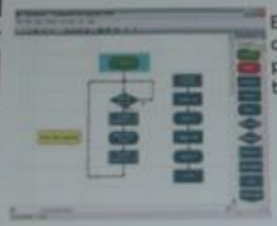
Process

Using a normal PIC a programme can be written on a programme such as PIC logicator so that it will count. It can also be set up to latch when one input is activated and only turn off if another input is pressed. This could be integrated into a product by situating the PIC on the outside of the product so that the programme can be changed if something is wrong.

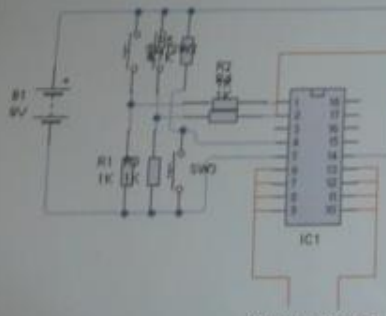
Output

PIC outputs to 7-Segment display which will need to be protected by 330 ohm resistors. These displays would be easy to integrate into a product as there are not many wires connecting them to other parts of the circuit so they don't take up too much room.

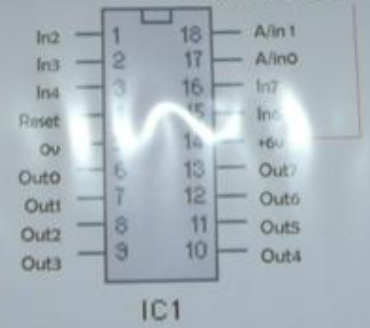
Toggle switch drawn on CAD 26th March 2010.

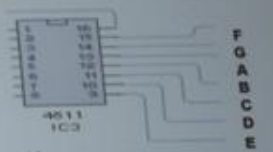


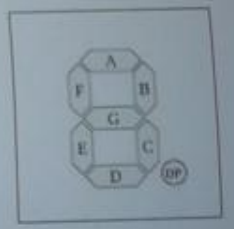
Example of a PIC logicator circuit note: this is not a counting programme its an example of the software used to write it.



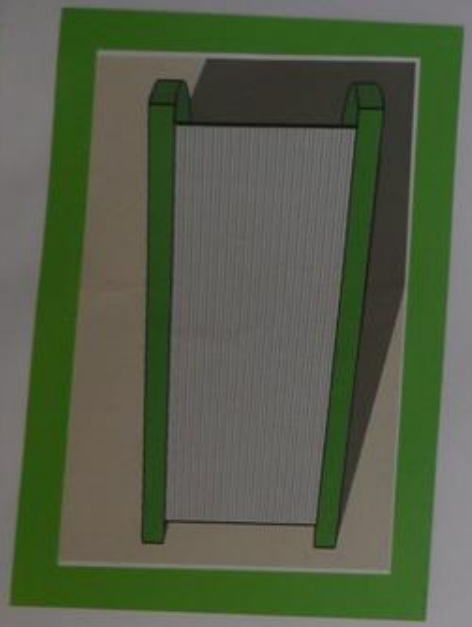
Because PIC works at +6v a voltage regulator will be needed if I was to use a regular +9v battery.



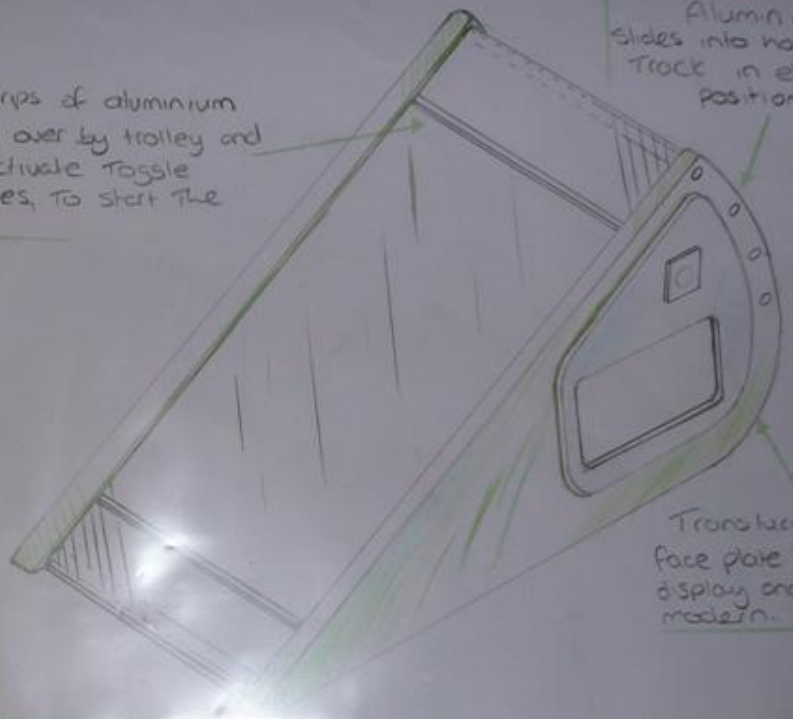




Section 2.4



Strips of aluminium are ran over by trolley and will activate Toggle switches, To start The count



Aluminium pin slides into holes To hold Track in elevated position.

Translucent acrylic face plate highlights display and looks modern.

IDEA 5

Section 2, 3

Circuit Idea 1

Input

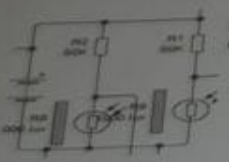
LDRs provide an input to a latching RS-flip flop set-up. Which uses a 7400 chip. LDR's use an increase or decrease in light to make a change which allows a transistor to be activated and an input to a larger component to be made. In this case the LDR's would activate a relay which would pulse into the 700 flip-flop arrangement.

Process

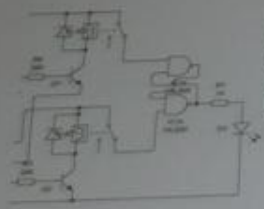
4093 chip arranged to provide a pulsing output leads to a 4510 counter chip. The frequency of this pulse depends on the values of the capacitor and resistor in the arrangement. The pulsing output will be connected to the clock pin of the 4510 counter chip so that it will act as a timer. From the counter chip there will be 4 BCD outputs going to a 4511 decoder chip.

Output

The 4511 decoder chip changes the binary information sent from the counter chip into digits which will be shown on the 7-segment displays. Each segment contains an LED so they will have to be protected by 330 ohm resistors.

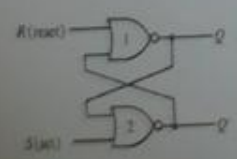


LDR's set up as a potential divider.

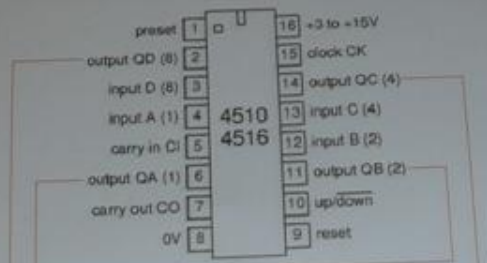


Relays providing an input for R.S Flip-flop when one relay activates the LED stays on until the other one is activated.

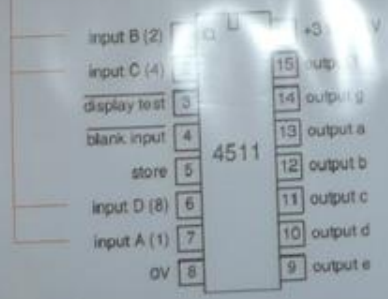
Data for R.S flip-flop and truth table.

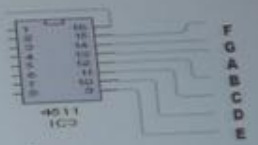


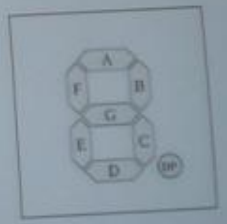
S	R	Q	Q'
1	0	1	0
0	0	1	0
0	1	0	1
0	0	0	1
1	1	0	0



BCD outputs







Section 2.2

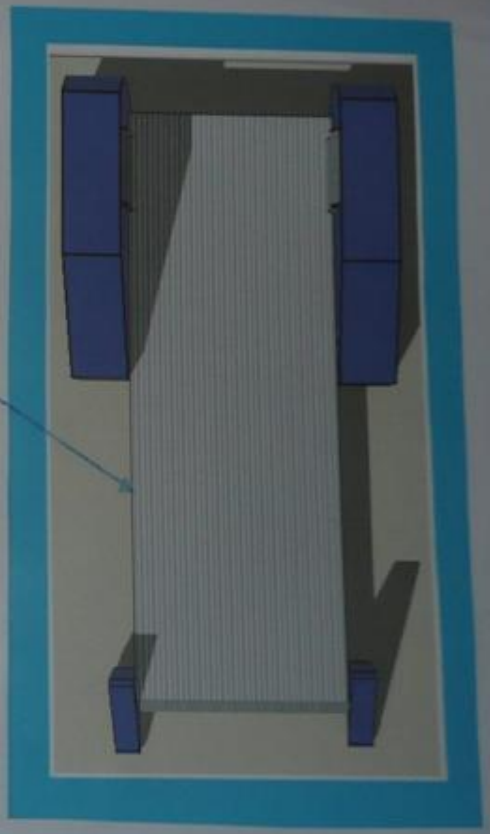
Section 1, 2

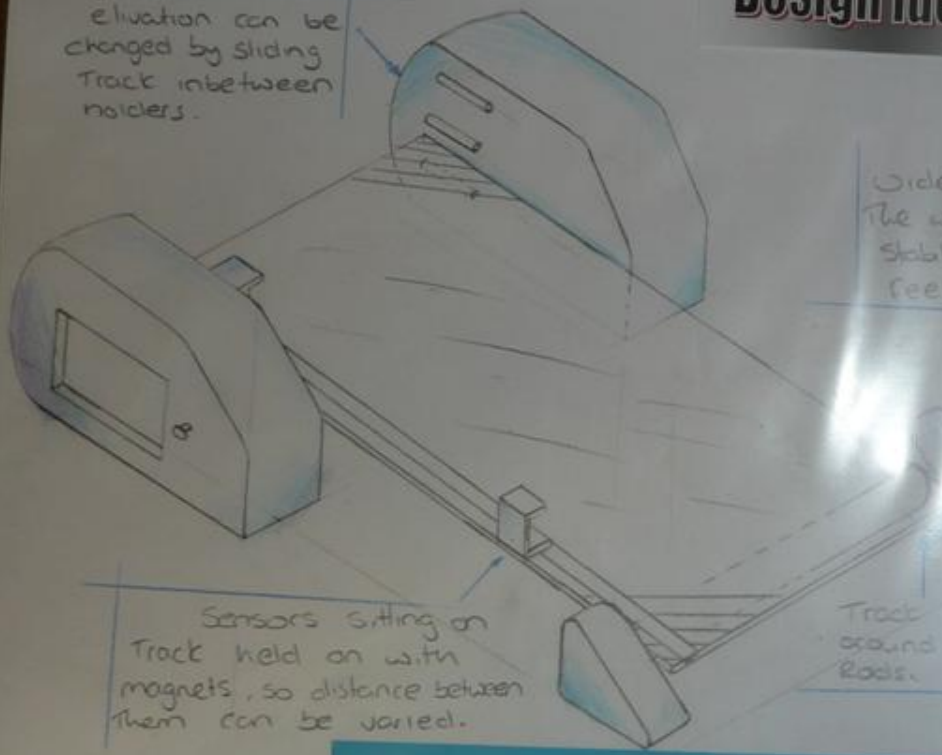
Section 2, 1

Design Idea 1

elivation can be changed by sliding Track inbetween holders.

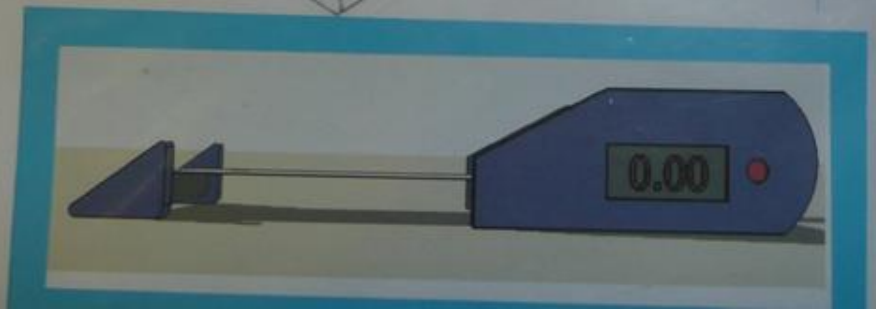
Wide track gives the whole unit good stability and a solid feel





Sensors sitting on Track held on with magnets, so distance between them can be varied.

Track can rotate around aluminium Rods.



Specification

Ergonomics:

⇒ The display must be clearly visible and easy to read.

⇒ The entire product must be small enough so that a number of them could be used at once in a classroom.

⇒ Once the system is switched on the user should not have to connect any parts of it together. This will save the teacher and pupils time so the experiment will not have to be rushed.

⇒ The product should be simple enough to use so that anyone can use it without any specific training or instructions.

⇒ The product should be easily storable. If a number of them are going to be in use they need to be easily storable so that they do not take up a huge amount of space.

⇒ The distance between the sensors must be changeable. This is so that a range of different values can be taken making the experimental results more reliable.

⇒ The system must time accurately to 1 or 2 decimal places. This will effect the accuracy of the results although timing to 1 decimal place should be ample for a simple experiment.

⇒ It should incorporate materials which will resist wear and small impacts as it may be dropped or pushed over.

⇒ An average desk in a school lab is approximately 1.5m so the product and distance between sensors should not exceed 1.5m

Aesthetics:

⇒ The design should be aesthetically pleasing to pupils and teachers and should contain a range of materials.

⇒ It should fit well a modern classroom surrounding.

⇒ The design should be symmetrical and all parts should be proportional to each other.

Function:

⇒ The system must time an objects movement between two points using sensors. Sensors will eliminate the problem of human reaction time.

⇒ Timing must be automatic once product is switched on.

⇒ Time must start when object passes one sensor and stop when it passes the next one.

⇒ There must be a way of resetting time.

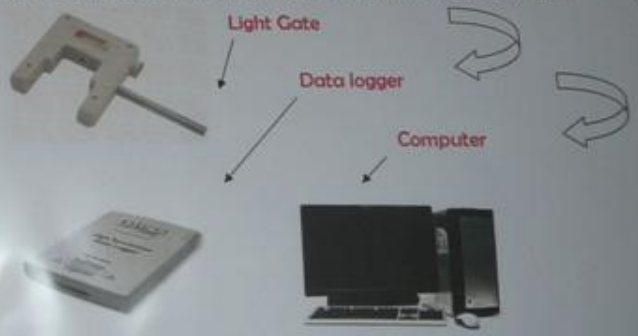
⇒ System should be able to run on no more than two 9v batteries.

⇒ System must be able to count from 0-9.9 seconds or 0-9.99 seconds. The time only needs to go [illegible] 9.9 seconds because the spacing between the sensors will not exceed 1.5m so there is no need for the [illegible] higher than 10 seconds.

Existing solutions

Existing solution 1: A speed= distance/time experiment are most commonly done using apparatus called light gates. Light gates are usually shaped like a "C" so that a light source on one side can shine onto a phototransistor. The signal from a light gate is sent when this beam of light from the source to the phototransistor is broken. This is a very accurate device.

There is a drawback with light gates, They have to be connected to a computer via a data logger. Setting up this equipment alone takes quite a bit of time and after this it all has to be synchronised using a computer programme. All in all I think the whole process is far too lengthy and complicated than what it should be for such a simple experiment.



Existing solution 2: Another way of measuring time in a speed=distance/time experiment is by using simple stop watches and starting and stopping them at specified intervals. This is a very simple and easy way to do this experiment.

However stopping and starting a stopwatch by eye is not very accurate so this would effect the results. This accuracy can be improved by taking a number of measurements and taking an average, Although again it will not be as accurate as when it is electronically timed and like the light gates it can be very time consuming to take a lot of different results and then doing extra calculations to work out the average.

All times added together
Amount of times recorded

Section 1, 2

Problem identification and design analysis

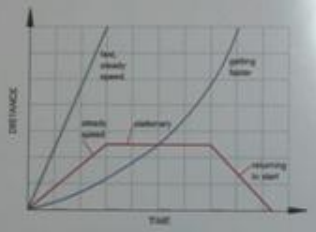
Problem

Being a physics student for over 6 years I have noticed that setting up a simple distance time experiment is extremely time consuming. Speed=distance/time is one of the most basic physics principles and there should be a quick and easy way of demonstrating it. The quickest method currently is just simply using stopwatches to measure the time it takes for a trolley to travel a certain distance. There are a number of problems with this method.

- Timing will be inaccurate due to human reaction time of approx 0.2-0.25 seconds.
- With a short distance it may only take the buggy around 3 seconds to pass both points so reaction times could lead to a %error of 8.3% for every result obtained.

Another method used in timing experiments is using two light gates which start and stop a timer on a pc. But again this method has drawbacks.

- The apparatus used in this experiment takes a long time to set up and wastes a lot of teachers time trying to get the light gates to measure time properly with the pc and data logger.
- Also the apparatus takes up a lot of space so usually pupils in the class will not get to carry out the experiment themselves as only one will be set up and the teacher will demonstrate using it.



A simple distance/ time graph.

Design Brief

I propose to design and build a product which will time the travel of an object over a specified distance. The product will have to measure the time using sensor inputs and a timing circuit. The time taken will be displayed clearly and will be easy to read. The system will be automatic after being switched on and the time should be able to be reset by means of a switch. It will be compact enough so that a number of them could be used at one time in a classroom environment. When in use it should be quick and easy to set up without any training.

Need

There is a need in a physics classroom situation for a product which makes carrying out a speed=distance/time experiment quick and easy for any individual pupil or teacher. The device needs to be accurate to reduce percentage error and eliminate anomalous results.

Light gates.

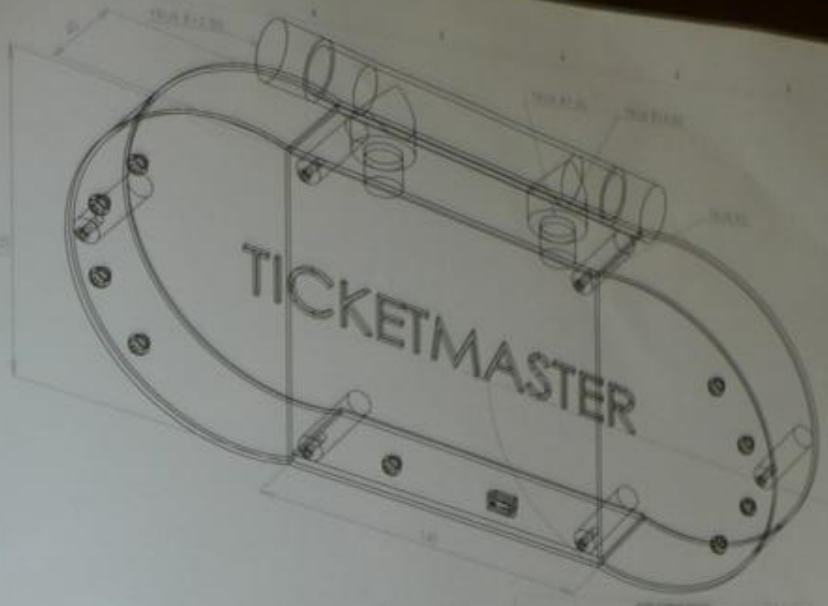
Experiment has to be connected to a computer.

Simple distance/time calculation: Distance=30cm
Time =3 seconds

Find the speed of the object:

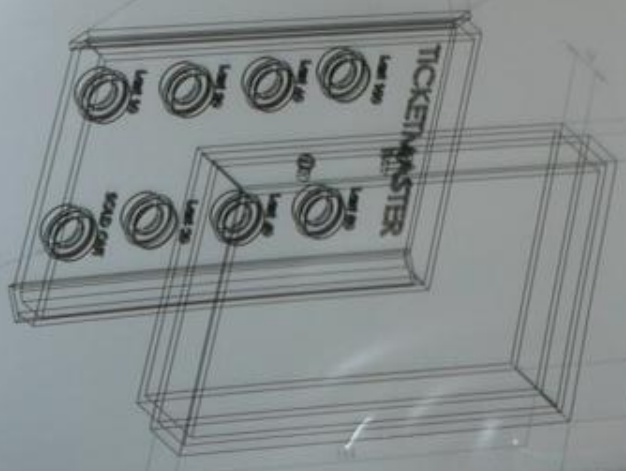
Speed = 0.3m/3seconds

Speed= 0.1 meters per second
Or= 0.36 kilometres per hour

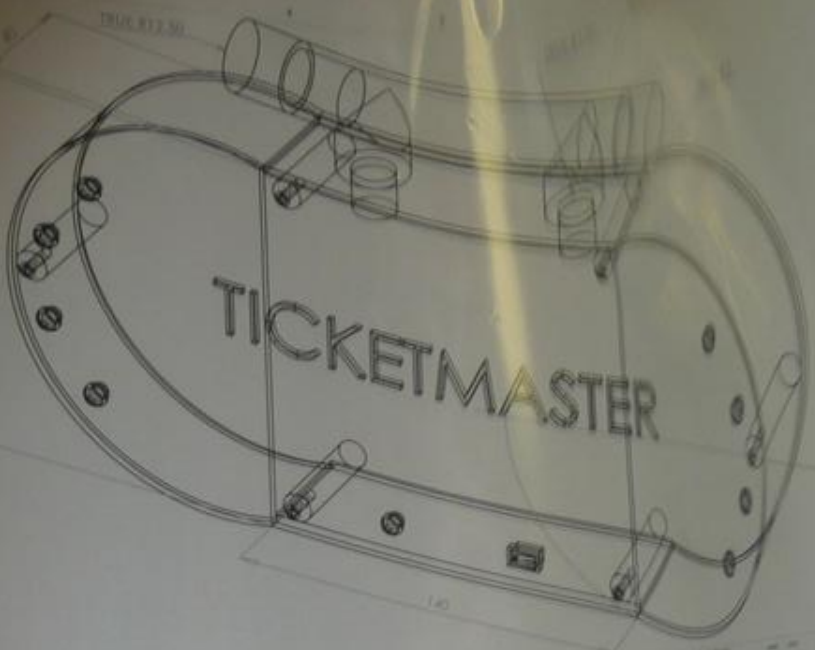


SolidWorks Educational License
Instructional Use Only

Transmitter WD

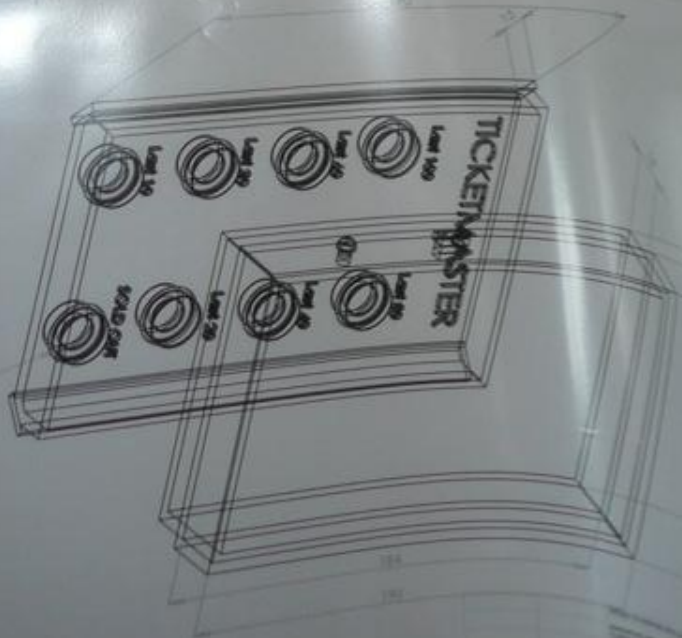


SolidWorks Educational License
Instructional Use Only



Transmitter WD

SHEET 1 OF 1



Testing and Evaluation

Transmitter

Overall, I believe that my remote control (transmitter) worked out extremely well. I created a design on 'solidworks' to show exactly what the transmitter looks like. It fulfills most of the points on my specification, including, aesthetics, ergonomics, anthropometrics, etc. It also fulfills the main point on my specification (function) and my design brief – 'I am going to design, make and test an electronic product which can give costumers an idea of how many tickets are left.'

Firstly, I feel that the design I chose from the number of design pages was the best as it incorporated many aspects of the proposed ideas and used them best. Although the manufacturing of the transmitter casing was quite unusual and difficult to do I feel that it was definitely worth the extra effort in as the design turned out very aesthetically and ergonomically. The shape of the casing was a main factor in making the product aesthetically pleasing because it was made in the image of a remote control, only much larger. Also, the colour scheme of the 'stickaplus' played a huge factor in making it aesthetically pleasing because I used the exact 'TICKEMASTER' logo. The main colour scheme of the casing was red and blue, which I felt went together very well; however the blue used in the transmitter was lighter than the receiver and therefore they did not completely match. A lot of the edges and faces of the transmitter required much wet and drying which took a lot of effort but after polishing the whole casing it turned out to be worth the effort because of the satisfying shiny surface.

This design was very ergonomically pleasing as it was perfectly designed to be held while being used. The shape of the casing makes it very easy to hold. Also, the buttons are aligned in a way so that the user can push them with ease while holding the box. I feel that the handle on top of the transmitter added to the pleasing ergonomics however it could have been better if there was a larger gap for your hand. There is some room to hold the transmitter by the handle although it is slightly too small which makes the user unable to fit their whole hand around the handle.

Overall, I am very pleased with the transmitter as it fulfills its main purpose and is also aesthetically and ergonomically pleasing.

Receiver

The ticket display (receiver) also worked out very well. This design was more straightforward than the transmitter. I created the design on 'solidworks' to show exactly how it looks in real life. The receiver also fulfilled many points on my specification, including, aesthetics, ergonomics, anthropometrics, etc. It also fulfills the main point on my specification (function) and my design brief – 'I am going to design, make and test an electronic product which can give costumers an idea of how many tickets are left.'

Although this receiver was one of the more simple designs from all my design pages I still felt it was the most suitable to fulfil its main purpose. The main shape of the receiver is just a normal box, however to give it a more interesting design and improve the aesthetics I decided to cut the 2 front corners off and attach a strip of acrylic plastic on each. The receiver was designed to have bulbs at the front of the casing so that it could display to people how many tickets were left. To try and improve the aesthetics of the receiver I decided to put bulb covers over each of the bulbs. The main colour of the casing was blue with some red, which I felt went together very well; however the blue used in the receiver was darker than the transmitter and therefore they did not completely match. Also, the colour scheme of the 'stickaplus' played a huge factor in making it aesthetically pleasing because I used the exact 'TICKEMA[illegible] logo. Again, a lot of the edges and faces had to be [illegible] using sandpaper (P320-P1000) and after that I p[illegible] to give the surface a shiny appearance.

This design was also ergonomically pleasing as it was small enough to hold yet the bulbs and bulb covers made it very noticeable which is a key factor in the specification. The design could have been more ergonomically pleasing if I had of added a handle or a hook of some sort so that it could be hung from the wall or ceiling.

Overall, I am pleased with the receiver as it fulfills all of the main purposes; however I feel that it could have been a slightly more interesting design had I added some extra features.

PCB

One of the main parts to this project was the wiring and circuitry of the transmitter and receiver. The first thing I had to do when it came to the circuit was what type of circuit I was going to use and how I was going to display it. I decided to use a transmitter and receiver circuit so that the remote control could display a message on the ticket display via bulbs.

When designing the circuit I used the program 'Circuit Wizard'. When designing it I went through a number of checks to make sure that all wires were properly connected and that there were no breaks or mistakes in the circuit. I also had to make sure that the circuits would fit inside my transmitter and receiver cases. When I was sure that the circuits were completely correct two exact replica PCBs were made. The next step was to sand the face of the circuit board so that the copper was fully showing. When the circuit boards were fully prepared I started to solder components onto the boards to match the circuits I designed. After making sure that all components were correctly soldered on both circuits I started to wire the buttons and bulbs into the terminal blocks. After that I programmed the circuits using 'PIC logicator'. I was then able to stick both my circuits down into the transmitter and receiver casings and fit the buttons and bulbs into the drilled holes.

The next step was to test whether the circuit would work or not. I tested the main sections of the circuit to see whether they were getting the full power supply. I did this using a volt meter and connection leads. I found that there were a few connection problems that I had missed before although they were easily fixed by re-soldering. I encountered no major problems with the circuits and therefore it was easy to get working.

Overall, I was very pleased with both of my circuit as I only had a few small problems with them at first. Once these small connection problems were fixed my circuit was working perfectly. It helped to fulfill the main purpose of my project because the remote control (transmitter) was able to send signals to the ticket display (receiver) via buttons. Each button was labeled to a corresponding bulb so that you know which message you are going to display. When you push a button, one of the bulbs will light up and the message will let the customer know roughly how many tickets are left.

Modifications

Transmitter Manufacturing Modifications

After I decided which transmitter design I was going to use from my 'viability of each design' I started to manufacture the product. However, during the process of manufacturing I made some modifications to the design to improve the quality of the transmitter. Some of the modifications made during manufacture were ideas I thought would make the product suit my specification better. The other modifications made during manufacture were due to flaws in the design of my product and therefore necessary.

The very first modification I made to the transmitter was the overall base of the design. When I first thought about manufacturing this design I wanted to have the circuit in the centre box and the wires running through the poles and handle to connect to the buttons. It would have been very simple to make the centre box, but unfortunately the only way I could make the handle in this design was using the 'CNC Router' and therefore would not have been hollow. This would make it impossible to run the wires through it to connect to the buttons. I then decided that I could keep the main shape of the design, but I would make the whole transmitter a hollow box.

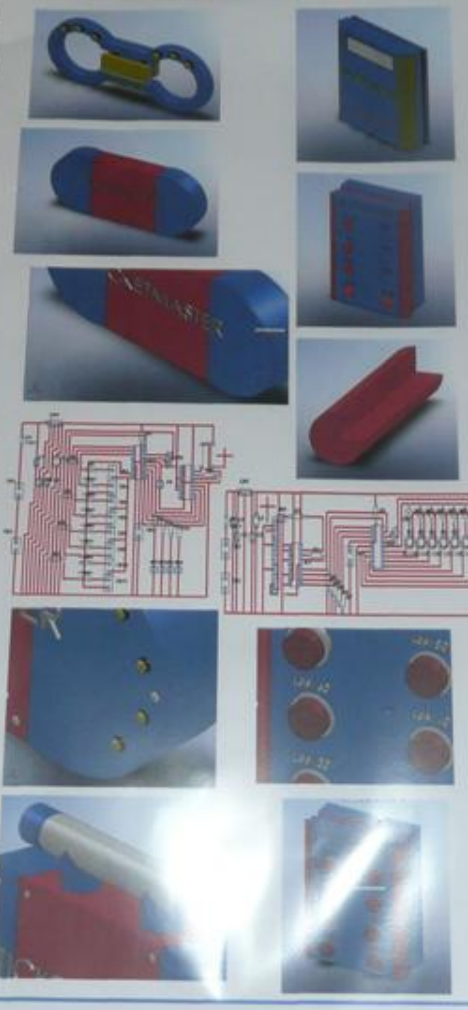
The next modification was related to the circuit. In the first transmitter design I only had 6 input buttons, however for my final project I needed to have 8. Therefore I had to design the circuit to have 8 inputs and also drill 8 holes in the front face of the transmitter box.

Due to these first few modifications it became necessary to make some more so that the transmitter would work to the suitability of my specification. Because I was now using a hollow box rather than a thin handle with an inner box, I had to think of a way to connect the front face semi-permanently. My initial idea was to make an insert piece; however, due to the shape of the transmitter this would be too difficult. I then decided to cut out 6 small cylinders and use the lathe to drill a hole through the centre of each. I then created a screw thread in each hole and permanently attached each cylinder to the inside of the box. Following that I had to drill 6 more holes in the front face so that it could be easily attached and unattached by screws.

Although my transmitter was easy to hold when being used I thought that it would improve the quality of the overall product if I added in one final modification. The last idea was to add a handle so that it was easy to carry when not being used. I drilled 2 holes into the top face of the transmitter. I then used a metal tube for the handle but also permanently attached 2 acrylic poles to either end of the tube (to work as end-caps). Then I cut out 2 more acrylic poles and using the lathe I took down one end on each so that they could slide into the top face of the transmitter. On the other end of these poles I used the pedestal drill to create a groove in the plastic and sandpaper to smooth out the groove. This allowed the pole to fit perfectly on to the top of the transmitter and using super glue, it was permanently attached.

Transmitter Future Modifications

If I had a chance to make this project again there are some modifications I would make to the final product. The first is to decrease the overall size of the transmitter because although the size is fine for holding and carrying I feel it would improve the design even further. The other modification I would make is to make the handle large because at the moment it is quite small and you cannot fit your whole hand around it.



Receiver Manufacturing Modifications

After I decided which receiver design I was going to use from my 'viability of each design' I started to manufacture the product. However, during the process of manufacturing I made some modifications to the design to improve the quality of the transmitter. Some of the modifications made during manufacture were ideas I thought would make the product suit my specification better. The other modifications made during manufacture were due to flaws in the design of my product and therefore necessary.

The first modification I made to the receiver was the colour of the product. In my design the main colour of the box was blue with yellow inserts and outer attachments. When cutting out the plastic I decided to make the secondary colour red instead of yellow. This is not a drastic change to the design although I felt it would improve the overall aesthetics in the end.

The next modification was in relation to the poles at the back of the box. My first idea was to cut out 2 poles and using the milling machine, cut out a quarter of the whole area so that there would be a right angle in the centre of the pole. This was to improve the stability of the receiver, however I found that once the main parts to the box were made, it stood on its own and were therefore not necessary. Due to this I decided to take this part of the design out altogether.

The next modification was related to the circuit. In my design I used an LCD and also a few LED's as well because I was still unsure of which I was going to use in my final product. When it came time to making the circuit I thought it would be better to go for a completely different idea. I decided I would use 8 bulbs instead of an LCD or LED's. This meant that in my circuit I would have to use transistors and also that I would have to drill 8 holes in the front face of the box. However, because I was using bulbs instead of an LCD or LED's, the project would be more prone to breaking and so I therefore attached each of the bulbs to bulb covers.

One last modification I made was the layout of the receiver. In the first design I just had an LCD, 3 LED's and the 'TICKETMASTER' logo. Therefore since I took out the LED's and LCD there was a lot of empty space on the front of the box. I decided that as well as keeping the 'TICKETMASTER' logo that I would also label each of the bulbs so that you know what each means when it lights up. Using 'stickaplus' I labeled each bulb by sticking down headings such as; Last 100, Last 80, Last 60, etc.

Receiver Future Modifications

If I had a chance to make this project again there are some modifications I would make to the final product. The first modification I would make would be the colour of the box. Although I wanted the box to be blue, it was a different blue from transmitter and therefore they did not match. The next modification I would have made would be to put a handle of some sort on the box. Although it is not a large project and it is not too heavy to lift I feel that a handle would make it easier to lift and move around. One final modification that I would make is to find some way to attach the receiver to the wall or ceiling so that it can be seen by all customers. One way of doing this would be to drill small holes in the back of the box so that it could hang up on screws. Another would be to place the handle on top of the receiver so that it could be used for lifting and also to hang from a nail on the wall.

Evaluation of Specification

Function

- The receiver displays how many tickets are remaining.
- The device can easily be placed at least 3 metres off the ground.
- It can easily be placed 1 metre apart from other objects.
- The transmitter has 8 input functions to control the receiver.
- It has 8 different input buttons to display a different message on the receiver.
- The receiver could easily be placed on any shelf.
- The outputs on the receiver are bulbs, not an LCD, although it can still be seen from at least 5 metres away.
- The receiver can be easily placed in any direction.
- Neither the transmitter or receiver can attach to the wall or roof.
- The products can only stand themselves but not attach to anything.
- All corners are rounded sufficiently to avoid hazard.
- The receiver has 8 bulbs instead of LED's.
- The bulbs will light up in relation to how many tickets are left.
- One of the bulbs will show when the tickets are sold-out.
- The device has a receiver circuit, controlled by a transmitter.
- Both transmitter and receiver are of sufficient size to be seen by customers.
- Both devices are made out of acrylic plastic, but the transmitter also has a metal pole for a handle.
- Both devices have an ON/OFF switch and a reset button.
- Both devices will be battery powered.
- Both devices are much lighter then 1kg.
- The transmitter sends signals to the receiver through an encoder and decoder.
- The transmitter sends signals to the receiver and the receiver then shows how many tickets are left.
- The transmitter sends signals to the receiver through an encoder and decoder.

Performance

- Both transmitter and receiver are of sufficient size to be seen by customers and do not take up a lot of space.
- The outputs on the receiver are bulbs, not LED's, although it can still be seen from at least 5 metres away.
- Each bulb (when lit up) will represent how many tickets are left.
- There are 8 input buttons to control the receiver.

Size/ Weight

- The transmitter is very light and can be easily held while operating.
- The receiver is less than 1kg although it cannot attach to a wall or roof.
- Both transmitter and receiver are of sufficient size to be seen by customers and do not take up a lot of space.

Anthropometrics

- Both transmitter and receiver are of sufficient size to be seen by customers and do not take up a lot of space.
- The receiver is large enough to be seen by customers.
- The transmitter is of sufficient size to hold with ease.
- The receiver is the correct size to be seen by customers and also not too big that it becomes an eye-sore.

Ergonomics

- The transmitter is a sufficient size to be easily held and operated.
- The receiver is large enough to be seen by customers.
- The receiver is large enough to be seen by customers but small enough that it does not take up a lot of space.
- It can easily be placed to sit on a high or low shelf.

Safety

- All corners are rounded sufficiently to avoid hazard.
- The main material in both the transmitter and receiver is acrylic plastic.
- All wires will be neatly covered inside the boxes.
- The transmitter sends signals to the receiver through an encoder and decoder so now wires are needed.
- All circuitry is properly connected using solder.

Aesthetics

- The transmitter can be easily placed in any direction.
- The transmitter uses bulbs to display how many tickets are left.
- The transmitter is designed attractively to catch the customers' eye.

Maintenance

- The transmitter can be easily cleaned with a damp cloth.
- The receiver can be easily cleaned with a damp cloth.
- There is easy access to both circuits so you can easily change the battery.

Material Choice

- Both transmitter and receiver are made from acrylic plastic.
- Acrylic plastic is an excellent waterproof material.
- Acrylic plastic is an excellent electrical and heat insulator.

Storage

- Both devices are within these limits and therefore do not take up a lot of space.
- The receiver cannot attach to anything.
- Both transmitter and receiver can be easily unattached.
- All wiring will be encased inside the devices.

Plan of Manufacture

Transmitter

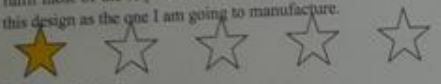
- Cut 3mm acrylic plastic (360x160).
- Using band facer, face off edges to make both ends rounded and curve into a straight edge in the centre.
- Cut 3mm acrylic plastic (140x 135).
- Cut 2 X 3mm acrylic plastic (160x110) and face off edges to match the back face.
- Cut 2 X 3mm tubes (150ø)
- Cut 2 X 3mm acrylic plastic (140x30)
- Cut off part of the 2 tubes to fit the angle of the back face (360x160).
- Fabricate the front face with liquid solvent cement, using the 2 X 160x110 pieces of plastic and the 140x135 piece of acrylic.
- Fabricate the back face to the side faces (2 cut tubes and 2 X 140x30) using liquid solvent cement.
- Cut out 6 X 30mm cylinder pieces of acrylic and face off both edges on each using the lathe.
- Also using the lathe drill 3mm holes through the centre of each and make a screw thread in each hole.
- Attach these cylinders the inside of the back face with the drilled holes facing upwards.
- Drill 6 X 3mm holes in the front face to concentrically mate with the 6 holes in the cylinders.
- Using 6 screws attach the front face to the rest of the parts to finish the main box.
- Drill 10 X 14mm holes in the front face.
- File one of the holes into a rectangular shaped to fit the ON/OFF switch into.
- Drill 2 X 15mm holes in the top flat face.
- Cut out a steel tube (135mm X 25mm ø)
- Cut out 4 solid acrylic poles (40mm X 25mm ø)
- Turn down half of 2 acrylic poles on the lathe so that they can insert into both sides of the steel tube.
- Use super glue to permanently attach these insert pieces to the tube.
- Turn down half of the other 2 acrylic poles so that they can insert into the 2 X 15mm hoes on the top face.
- Using the pedestal drill create a groove on the other end of these acrylic poles so that the metal pole can fit exactly on top.
- Using liquid solvent cement permanently attach these 2 poles into the 15mm holes in the top face.
- Using super, permanently attach the steel pole onto the 2 acrylic poles so that it sits neatly in the groove.
- Clean the whole box and handle with a damp cloth and use the polishing machine to improve aesthetics.
- Using 'stickaplus' add the 'ticketmaster' logo to the front face followed by the action of what each button will perform.
- Produce the transmitter PCB circuit and attach all components by soldering.
- Neatly place and secure the circuit inside the transmitter box.
- Place all buttons and switches into the holes drilled into the front face.

Receiver

- Cut 2 X 3mm acrylic plastic (190x120)
- Cut 2 X 3mm acrylic plastic (190x40)
- Cut 2 X 3mm acrylic plastic (115x40)
- Fabricate these pieces of plastic to make a box using liquid solvent cement.
- The box was then cut in half through the centre of the side faces.
- Cut 2 X 3mm acrylic plastic (184x45)
- Cut 2 X 3mm acrylic plastic (103x45)
- Fabricate these pieces of plastic using liquid solvent and then attach this insert piece to the inside of the back half of the box.
- Slide the front half of the box over the insert piece and cut the 2 front corners off at a 45e angle.
- Cut 2 X 3mm strips of acrylic plastic (190x15)
- Using liquid solvent cement permanently attach these strips of plastic onto the 2 cut corners at the front of the box.
- Using the pedestal drill, drill 8 X 20mm holes into the front face of the receiver.
- Again, suing the pedestal drill, drill 2 X 14mm holes onto the side face of the back part.
- Using a square file, file one of these holes into a rectangular shape to fit the ON/OFF switch.
- Clean the whole box with a damp cloth to get rid of any dirt or dust.
- Using the polisher machine, polish the box to improve aesthetics.
- Using 'stickaplus' add the 'ticketmaster' logo to the front face followed by the key of what each output will mean.
- Produce the receiver PCB circuit and attach all components by soldering.
- Neatly place and secure the circuit inside the receiver box.
- Place all buttons, switches and bulbs into the holes drilled into the front and side face.

Overall Rating

The overall rating of this design was not very good as it failed to fulfil most of the requirements. Therefore, I will not be considering this design as the one I am going to manufacture.



Transmitter 6

The sixth transmitter I designed was a simple circular shaped box. It has a front and back cap with an insert piece permanently attached to the inside of the back cap. This allows the front cap (with 6 buttons and the logo 'ticketmaster' on the front face) to slide on and off to reveal the circuit.

Function

This design fulfilled some of the function requirements, but it only has 6 input buttons, and my final project will have 8.

Aesthetics

This design is not aesthetically pleasing as it is too small and it is also a very simple design.

Anthropometrics

It does however fulfil most of the anthropometric requirements because it is so small. This makes it easy to hold in one hand and due to the curved shape it would be comfortable to hold.

Overall Rating

This design was anthropometrically pleasing but failed to meet many of the other requirements, therefore this will not be a candidate for my final idea.

Receiver 6

The sixth receiver I designed was quite a complex idea. It was a hexagon shaped box with a solid block of plastic permanently fixed to the bottom face so that it could lift in and out of the base attachment. It also had a slide door with a handle on the back face so that you can get easy access to the circuit. There are 5 LED's on the front face of the box and a 'ticketmaster' logo on the front face of the box and the front face of the base attachment.

Function

This design fulfils most of the function requirements as not only does the LCD show you how many tickets are left, but there are also 5 LED's to get the customers attention.

Aesthetics

This design fulfilled some of the aesthetic requirements but not all. The shape of the box is not very suitable for the project theme and does not sit very well with the base.

Anthropometrics

This design is not anthropometrically pleasing as it would be too large to move around, especially because there are no handles to lift with.

Overall Rating

This project did fulfil a fair amount of the needed requirements although not enough for me to pursue this idea any further. Although this design idea looks quite simple, there some very complex parts to it and therefore it would be not worthwhile making it my final project, especially if it does not fulfil most of the requirements.

Transmitter 7

The last transmitter design was a slightly different type of box. It is made up of a normal shelled box with no top face. This is so that the inside drawer can slide in and out of the box so that you can get easy access to the circuit. The drawer is easy to pull in and out because of its small handle. The outer box has 8 holes drilled in the front face for the input buttons.

Function

This design fulfils the function very well as it has 8 buttons and the design I am going to manufacture must have 8 inputs.

Aesthetics

I think this design is aesthetically pleas[illegible] an unusual design to it and also has the two main colo[illegible] my final product to have (blue and red).

Anthropometrics

This design fulfils some of the anthropometric requirements e.g. the filleted edges make it safe to hold, although there are no handles on the outer box to be able to hold it with complete ease. There is a handle on the inner drawer however, which makes it very easy to slide it in and out.

Overall Rating

Overall, this design was very successful as it fulfilled most of the requirements needed and was also a slightly different style of design from the rest of my transmitters. A disadvantage to this design may be that it is very simple, although I will still consider it to be my manufacturing product.

Receiver 7

The final receiver I designed was another of my favourite. Although it is quite a simple design there are slight adjustments to the normal box to make it different from the rest of my receiver boxes. It is made up of a front, back and insert piece with the insert piece permanently attached to the inside of the back piece. There are also 2 acrylic poles attached to the back part of the box to stop the front part sliding the whole way over the insert piece. I also added in 2 strips of rectangular acrylic plastic to the 2 front corners of the front part of the box.

Function

This design fulfils the function very well as not only does it have an LCD to display how many tickets are left, but it also has some LED's to attract the attention of the customer.

Aesthetics

This design fulfils most of the aesthetic requirements also and although it is just a normal box, it has a few adjustments to give it a more creative design.

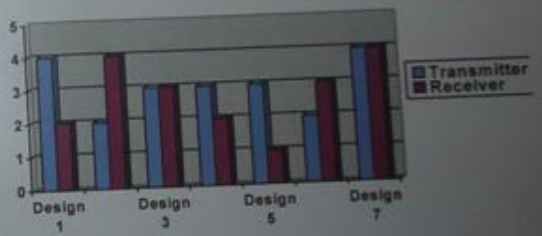
Anthropomstrics

This receiver is also anthropometrically pleasing but if I were to pursue this design I would have to make a few modifications to make it better.

Overall Rating

This design was overall very successful in fulfilling most of the requirements. It is a simple yet effective design which is why it will definitely be one to consider as my manufacturing project.

Summary



I summarized my whole further evaluation into a graph so that I could quickly see which few were the best. I rounded my decision down to transmitter 1 and 7, and receiver 2 and 7 as these four all got four stars out of five. I then decided that receiver 7 was the one I was going to pursue as my project of manufacture as I felt it suited the requirements slightly better than receiver 2. I then chose transmitter 1 because I did not want both my transmitter and receiver to be similar designs (as transmitter 7 and receiver 7 were). Now that I have my transmitter and receiver designs I will be able to start manufacturing, although I may have to make a few modifications along the way to improve them further.

Anthropometrics

This design fits nearly all of the anthropometric requirements as it is small enough to hold in one hand, and it has 'finger grip' on the edges so that you can hold the product with complete ease.

Overall Rating

This product is definitely a candidate for my final product as it fits a lot of the requirements that I need. If I were to choose this design I would have to make some, but not many modifications.

Receiver 3

The third receiver is a regular box with back front and insert piece. The front part has 2 hinge doors to show and cover the LED's and LCD. The front part of the box can slide on and off the insert piece to get access and cover the circuit.

Function

This design fits most of the requirements and does the main function very well (show how many tickets are left).

Aesthetics

The product is not very aesthetically pleasing as may be too big. The product needs to be large enough for people to notice it but if it is too large like this design it could become an 'eyesore'.

Anthropometrics

This design does not fit many of the anthropometrical requirements as it is too big. Also, it does not have an attractive finish as it has many sharp edges.

Overall Rating

This design was not one of the best but still fulfilled some of the necessary requirements. Because this idea is rather complex and does not fulfil a lot of the requirements needed, I will not be considering this as my final product.

Transmitter 4

The fourth transmitter design is similar to a basic steering wheel with 6 buttons on the front face to control the receiver. If I where to consider making this my final transmitter idea I would have to make it using the CNC Router which is not a suitable method for manufacture. Therefore, I feel that already I will not consider this design to be my final product.

Function

The design fulfils the function very well although it only has 6 buttons whereas my final product will have 8.

Aesthetics

This design has an attractive finish to it because of the rounded edges and also the blue and black combination in colour, although the style of design is not very appropriate for my idea because it is shaped like a steering wheel.

Anthropometrics

This idea does however fit most of the anthropometric requirements as it is perfectly designed to be held and the buttons can be easily pressed with your thumbs while holding.

Overall Rating

This design is very useful in some aspects as it fits a lot of the criteria needed e.g. anthropometrics, ergonomics, and function, etc. However, there are many aspects which it has failed to meet the criteria e.g. aesthetics. Due to this variation in criteria, and because it will be made using the CNC Router, I feel that it would be better not to consider this idea.

Receiver 4

The fourth receiver I designed is made from a simple box, fabricated through using a front, back and insert part. It also has 2 swinging hinges on both sides of the box and a stand/hook attached to the other end so that the box can sit on a desk when the stand is sitting underneath it or hang from a wall when the stand is hooked onto a nail or screw.

Function

This design fulfils nearly all of the requirements needed and can clearly get the attention of a customer and tell them how many tickets are left.

Aesthetics

This design has quite an aesthe[tic] appearance but here are some [issues] the box part which make it less [appealing].

Anthropometrics

This design idea does not however [fit] of the anthropometric requirements [as] it is [too] big and bulk. Although the product needs to be large enough to be noticed by customers, it may be too big and therefore take up a lot of space.

Overall Rating

The overall rating to this design was not very good because, although it did fulfil some of the requirements needed; it was not enough to consider this design. Also, there were some parts of this design which could be quite complex to make.

Transmitter 5

This fifth transmitter design was quite a simple one and was designed to look like a remote control. It was made of a few rounded pieces of acrylic plastic and an insert piece to let the back slide on and off to get access to the circuit.

Function

This design fulfils the function perfectly, although if I were to use this as my final idea, I would have to add in more buttons and make it slightly bigger as the circuit will not fit inside of it.

Aesthetics

I think this design looks quite attractive as it is rather small and has all of its edges rounded to give it an attractive finish. It is however a very simple design and does not look like its needs a lot of effort to make.

Anthropometrics

This design also fits all of the anthropometric requirements as it is the perfect size and shape to fit in the palm of your hand which means you have your other hand free to press the buttons.

Overall Rating

Overall, I was quite pleased with this design as it fulfils the function and anthropometric requirements perfectly, although a problem I do see with this idea is that it may be too small and not be able to fit the circuit inside it. Also, it is quite a simple design and will be very easy to make and therefore does not make it aesthetically pleasing. Due to these negative points will not pursue this idea any further.

Receiver 5

This receiver design was not one of my favourite as the shape and fabrication of it is not suitable for my theme. It is made from a tall pyramid shaped base with a metal pole insert straight down through the base and has the acrylic box part sitting on top of it. It has a small slide door at the back of it so that you can get access to the circuit.

Function

Although this design does not seem suitable for the theme of my project it does however fulfil most of the function requirements. Another problem with this design is that it has more outputs than I can use in my final project.

Aesthetics

This design does not fulfil many of the aesthetic requirements and also does not have a suitable design for the theme of my project.

Anthropometrics

It is not anthropometrically pleasing either as it is too large and therefore hard to move around.

Further Evaluation of Designs

Transmitter 1

The first transmitter I designed was made of an acrylic casing with steel bars in the centre to hold the circuit box in place. It was shaped like a kind of steering wheel so that it would be easy to hold. It has 6 buttons placed along the top of the front f ace so that when you are holding the product you can push the buttons with ease. The circuit box was designed so that the back part was permanently fixed and the front part could easily slide on and off of the insert piece inside the box. It also had the word 'TICKETMASTER' along the bottom of the front face made of acrylic plastic (via the CNC Router) or simply just 'stickaplus'.

Function

This product fulfils the function as it can control the signals being sent to the receiver box, although this design only has 6 input buttons whereas my final product will have 8.

Aesthetics

The main colour of the transmitter is blue with some yellow. I decided that the secondary colour should be red so this design does not completely fit the aesthetic needs. It does however have rounded edges which give the product a smoother finish.

Anthropometrics

This design is anthropometrically pleasing as it is the perfect shape and size to fit in the users' hands. Also, the lid to the circuit box can be removed easily because of its small size, although because of the poles going through the inside of the box, there is very little room for the circuit.

Overall Rating

This design was overall very good as it fits most of the criteria of the specification. This design is definitely a candidate for my final product although if chosen, it would need a few modifications.

Receiver 1

The first receiver I designed was a simple acrylic box with a front, back and insert piece to allow the front part to slide on and off with ease. It has 2 metal handles on either side to make it simple to hold. It also has 5 LED's on the front face with 'stickaplus' writing on it show what each LED means when lit up.

Function

The design does fulfil the main function but not very accurately. This design has 5 LED's with writing beside each to show how many tickets are left. To know how many tickets are left you must look at the LED which is lit and read the writing beside it. This only gives you a rough idea of how many tickets are left so it is not very useful.

Aesthetics

This design also has blue as its main colour with yellow as its secondary colour. If I was to pursue this design I would change the yellow to red as I think it would be more attractive to the look at. The edges however are not rounded at all so therefore does not meet many of the aesthetics requirements.

Anthropometrics

This design is quite large which fits the requirements for anthropometrics because it should be noticeable to the customers in a shop. It may be too big though and therefore harder to lift, although it has 2 metal handles on each side which makes it much easier.

Overall Rating

This design fits some of the criteria from my specification but not enough for me to use this as my final design. It is also too simple of a design; therefore I will not pursue this idea.

Transmitter 2

The second transmitter idea was quite a complex one and would be very hard to make. It was a prism shaped box with a hinged door on the top to reveal the input buttons and a slide open drawer to allow access to the circuit.

Function

This design does fulfil the function by sending signals the receiver box although it only has 6 input buttons which is not enough as I wanted 8.

Aesthetics

The design has an attractive look to it because of the shape and colour although there are very sharp edges on the box so the finish is not aesthetically or ergonomically pleasing.

Anthropometrics

It is not anthropometrically pleasing because the design is too big and heavy, and therefore it is not the correct ratio of product to hand.

Overall Rating

This product does not fit many of the requirements and is quite a complex design; therefore I would not consider this design a candidate for my product.

Receiver 2

The second receiver is quite a simple design. It has a main body which is made up of a small box with a front back and insert piece, but also has a hollow casing to fit around it when not being used. The bottom part of the casing is permanently fixed because there are LED's fitted through the box and casing and the top part can slide on and off to show and cover the LCD display.

Function

This design fulfils the function requirements very well as it has an LCD to show how many tickets are left. The only problem with it is that it is quite small and therefore may be hard for customers to see.

Aesthetics

The design has a nice finish to it and looks well with and without the top casing part, although, again, if I were to pursue this design I would change the yellow colour to red.

Anthropometrics

The design fits these requirements quite well because it would be a small product and therefore very easy to fit in the palm of your hand. The only problem with this is that it would make it harder for customers to notice.

Overall Rating

The overall rating to this design is very good as it fulfils most of the requirements. I will be considering this design to be my final receiver although it stills needs some modifications to make it better.

Transmitter 3

This design is simple but effective. It is similar to receiver 2 as it has an inside box with casing around the outside. The inside box holds the circuit and the top casing can slide on and off to get easy access to the circuit. The 5 buttons come right through the casing and there is also 'finger grip' on the edges to make it simple to hold.

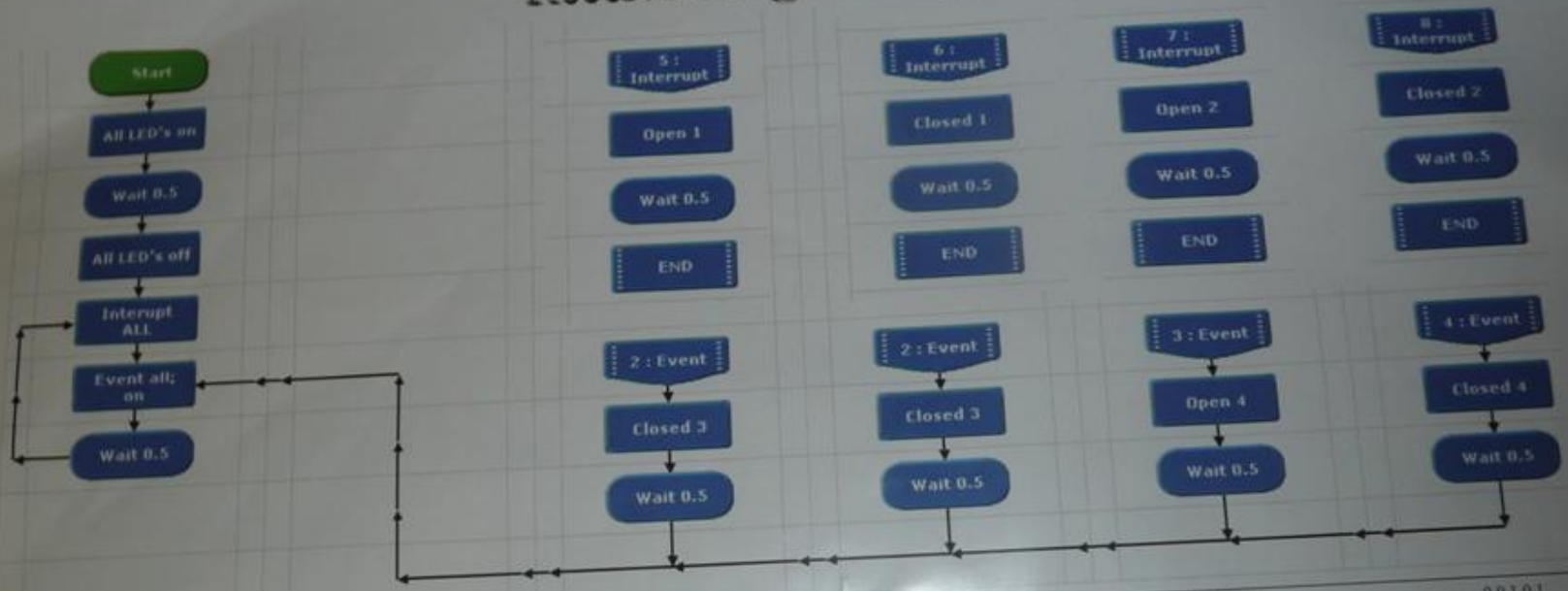
Function

It fulfils nearly all of the requirements needed from the transmitter although it only has 5 buttons which is not enough for my product.

Aesthetics

This design also fits most of the aesthetic and ergonomic requirements as all of the edges are rounded and when the top casing is sitting on it has a pleasing appearance. Again however, I would change the yellow colour to red.

Receiver Programming

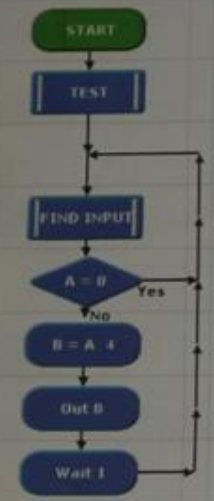


The main part of the programme begins with an OUTPUT box that will turn on all the bulbs followed by a WAIT box so that the user can check all of the bulbs. After that there is another OUTPUT box to turn the bulbs off again. This is to test the bulbs and make sure that they all work properly. These three boxes could be simplified into a DO MACRO but I thought that this way would be a more simple method and it would mean I am less likely to make any errors in my programming. To read the input from the decoder, the receiver PIC needs to be programmed with INTERRUPTS and EVENTS. These two boxes work in the same way, however the EVENTS need to be connected back to the main part of the programme while INTERRUPTS are like a macro and do not need to be linked. I programmed my EVENTS and INTERRUPTS so that they turn on whenever they receive the appropriate binary pattern. The two boxes in the main programme called INTERRUPT ALL and EVENT ALL, switch the bulbs on.

To the right is the summary of the receiver programme. It shows which inputs and outputs I have used in my programme. The first eight items are my events and interrupts which all run through the binary code sent from the transmitter program. Below those are the 10 outputs that are all different, showing what each output box in the program is doing.

Events	1: Event	...00101
	2: Event	...00110
	3: Event	...00111
	4: Event	...01000
Interrupts	5: Interrupt	...00001
	6: Interrupt	...00010
	7: Interrupt	...00011
	8: Interrupt	...00100
Port Output Functions	All LED's on	11111111
	All LED's off	00000000
	Open 1	00000001
	Closed 1	00000010
	Open 2	00000100
	Closed 2	00001000
	Open 3	00010000
	Closed 3	00100000
	Open 4	01000000
	Closed 4	10000000

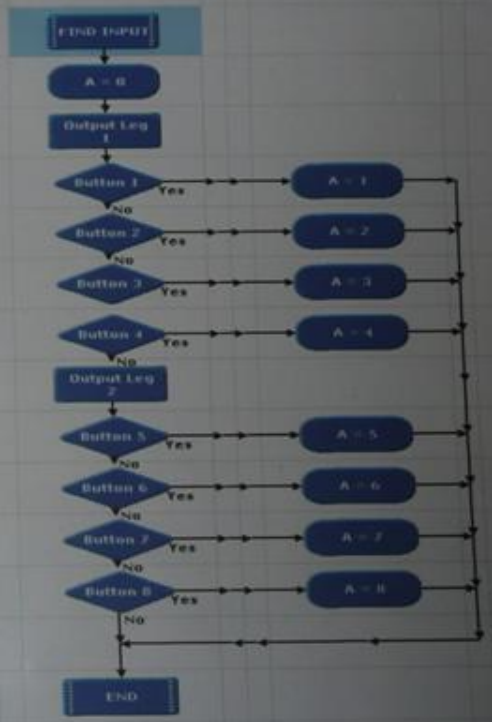
Transmitter Programming



To programme my PIC-Micro controller I used the PIC-Logicator programme. This is a fast and simple way to program my chips.

I started my programming by making a small sub-routine circuit for my transmitter circuit. This small sub-routine will test the four outputs that are connected to the encoder. This sub-routine was designed to allow the PIC-Micro controller to detect which buttons have been pressed and also to label A with the appropriate number of the button. An expression box begins the macro so that A equals 0. This is to show that if A equals 0, then no button has been pressed and therefore no bulbs will light up. However, when a button has been pressed A will not equal 0 and the circuit can continue. I have arranged my buttons in a 2 X 4 matrix, which has been connected to 2 outputs, and 4 inputs that allows my required 8 combination. For these to work I had to programme the outputs so that they could be switched on separately using OUTPUT boxes and the inputs read from the DIGITAL boxes to see which 1 button is being pushed. Again, if no buttons have been pressed, the A will remain at 0 and the programme will reach the END box, which will end my sub-routine. However, when a button is pressed the DIGITAL box will connect to an expression box that will label A according to which button has been pressed. The expression boxes have all been programmed to give A the number which that particular switch has been wired to in my product.

Once I had my sub-routine programmed I was able to incorporate this into the programming for the main part of my PIC program for this transmitter. The START box is where the program begins, followed by a DO MACRO that runs the FIND INPUT sub-routine. The next box is a COMPARE box that will check if A is equal to 0. If A is equal to 0, no buttons have been pressed and when A equals a number between 1 and 8 it will continue down through the programme. The next stage of the programme is where it needs to OUTPUT a 4-bit binary pattern, which is done by the OUT box. But this will result in the output of the first 4 outputs on the PIC-Micro controlled, so to prevent this I placed an EXPRESSION box above the OUT box which will shift the binary so that it is on the last 4 outputs. The final box is a WAIT, which lasts for 1 second, and this allows the receiver enough time to register the output. Then the [illegible] returns back to the FIND INP[illegible] any buttons have been [illegible] programme will repeatedly [illegible]

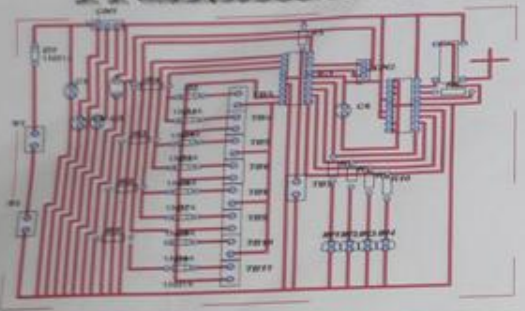


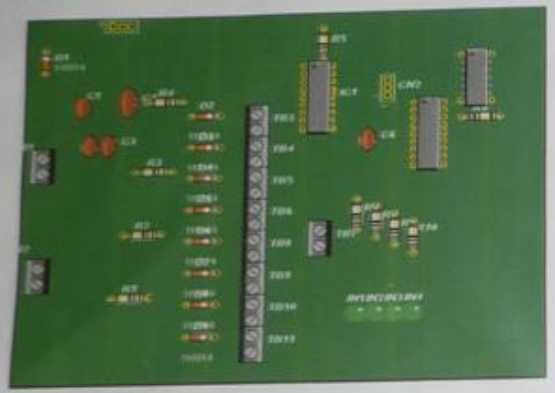
Summary of PIC-Logicator Flowsheet
File Name:
Author:

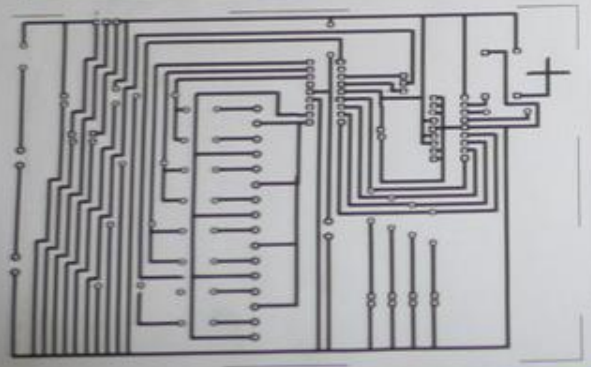
Port Decisions	Switch 1	0001
	Switch 2	0010
	Switch 3	0100
	Switch 4	1000
	Switch 5	0001
	Switch 6	0010
	Switch 7	0100
	Switch 8	1000

Port Output Functions	Outputs	00000010
	Outputs	00000100
Macros	FIND INPUT	

Transmitter Parts List

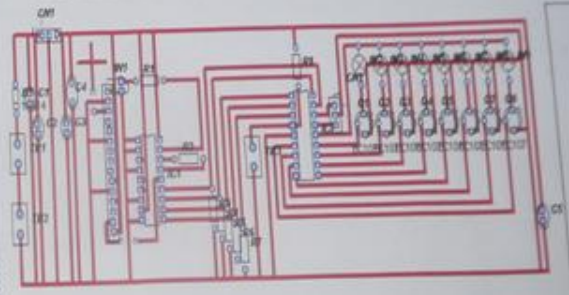


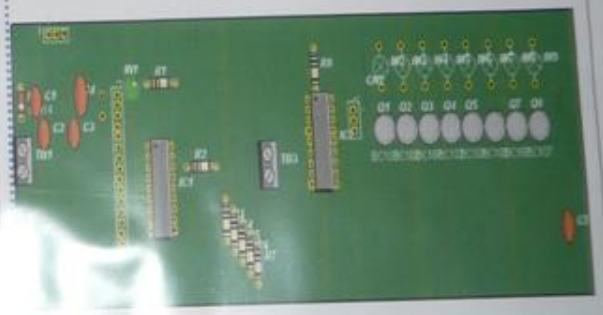


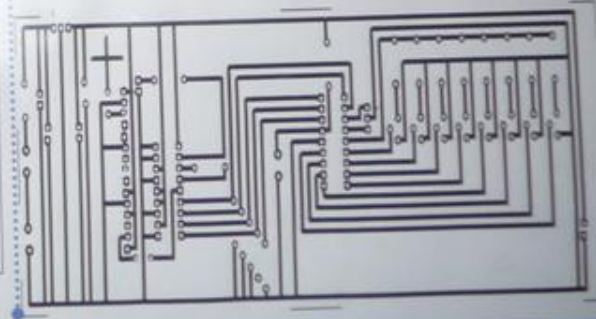


- 1 X 9V Battery
- 1 X ON/OFF Toggle Switch
- 9 X Diodes
- 1 X 7805 Voltage Regulator
- 4 X 100µF Capacitors
- 1 X 1000µF Capacitor
- 4 X 10K Resistors
- 9 X Push-to-make Switch
- 2 X 18 Pin Pic Microcontroller
- 1 X 4K7 Resistor
- 1 X 3 Pin Resonator
- 4 X 330Ω Resistors
- 4 X 3mm LED's
- 1 X 1MΩ Resistor
- 1 X Encoder
- 11 X Terminal Blocks

Receiver Parts List



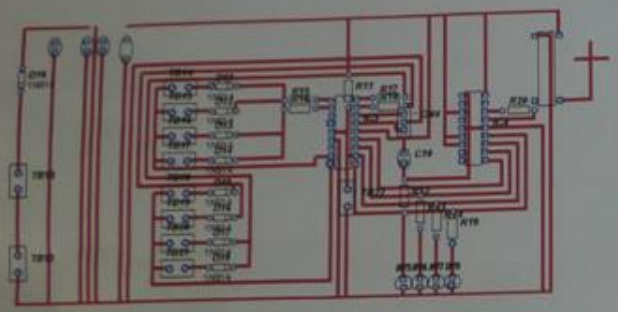




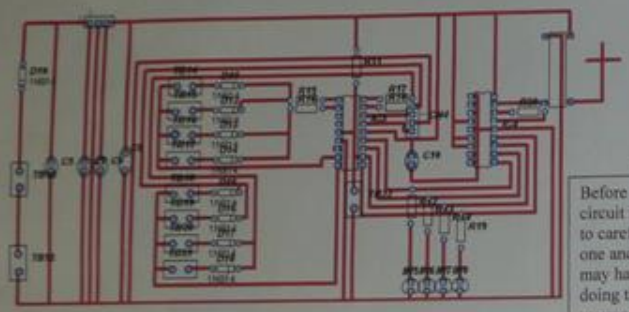
- 1 X 9V Battery
- 1 X ON/OFF Toggle Switch
- 1 X Diode
- 1 X 7805 Voltage Regulator
- 4 X 100µF Capacitors
- 1 X 1000µF Capacitor
- 1 X 15 Pin Decoder
- 2 X 18 Pin Pic Microcontrollers
- 1 X 330Ω Resistor
- 1 X 1MΩ Resistor
- 5 X 10K Resistors
- 1 X 4K7 Resistor
- 1 X Push-to-make Switch
- 1 X 3 Pin Resonator
- 8 X Transistors
- 8 X Bulbs

PCB Development

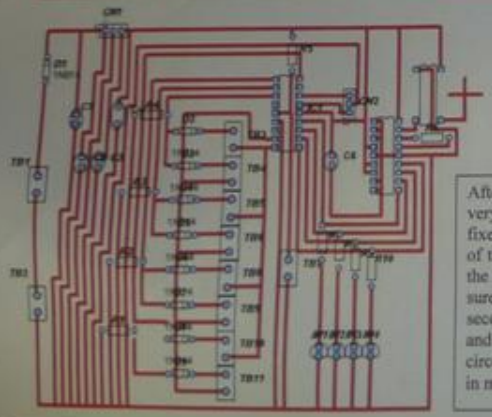
Transmitter



Before making my PCB Circuit I first designed it on 'PCB Wizard' to get a rough idea of what it should look like when manufactured. In my first attempt a drew the circuit quite large to allow a clear understanding of what is happening in the circuit and so that I could see any mistakes I may have made along the way. This is absolutely necessary in the first stage because I do not want to modify an incorrect circuit.

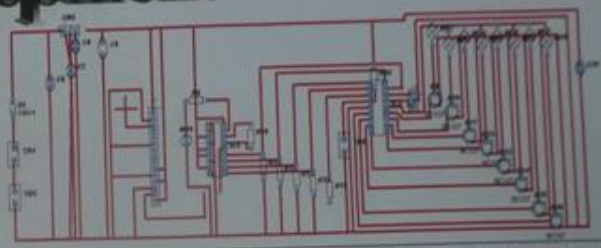


Before modifying my first circuit into stage two, I had to carefully analyse stage one and fix any mistakes I may have made. While doing this I slightly rearranged my parts so that I could reduce the size in the circuit. These are some examples of my mistakes in stage one; missing flow regulator, unconnected wires, parts overlapping, etc.

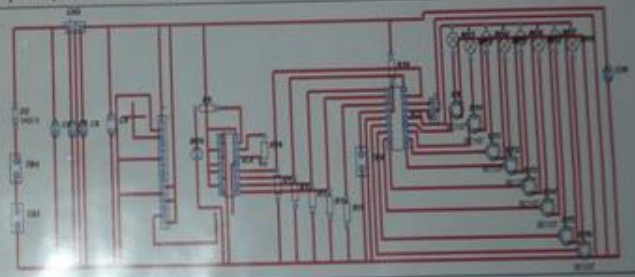


After the second stage I analysed the circuit very carefully (like after the first stage) and fixed any final mistakes. I then rearranged all of the parts to allow a smaller circuit and give the circuit a better presentation. When I was sure that there was no more mistakes on the second circuit I then started to move the parts and wires closer together to try and make the circuit as small as possible so that it could fit in my box when manufactured.

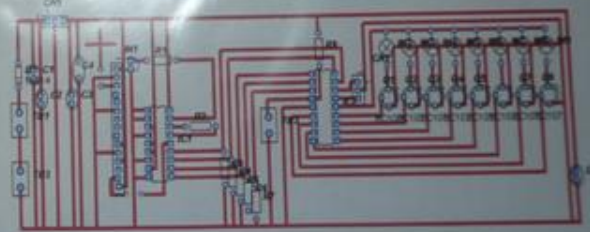
Receiver



Like the transmitter PCB circuit I first designed my receiver circuit on 'PCB Wizard' so that I could get a rough idea of what the circuit will look like when manufactured. Again, I drew it out quite large so that I could easily understand everything that was happening in the circuit and spot any mistakes that my need altered.

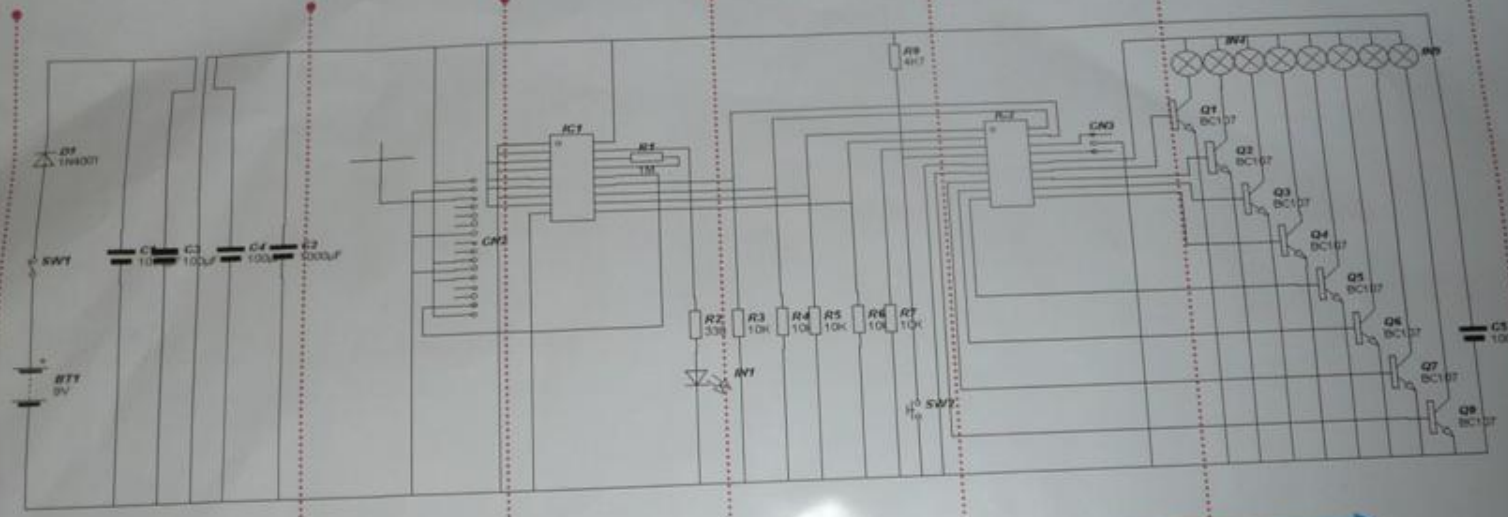


[illegible] first circuit into the stage two circuit I carefully analysed it and fixed all [illegible] were visible to me. I then moved some parts to slightly reduce the size of the circuit [illegible] analysing it even closer to try and find any further mistakes. These are some examples of the mistakes I made; slanted lines crossing, parts overlapping, etc.



After closely analysing the circuit for a second time I managed to fix all of the final mistakes. I then rearranged a lot of the parts and wires to allow the circuit to reduce in size and give it a better presentation. When I was positive that there were no more mistakes on the second circuit I then started to move all of the parts and wires closer together to reduce the size further so that when manufactured it would be able to fit in my box.

Receiver Circuit



Power Supply

The power supply in this receiver circuit is the same as the power supply in the transmitter circuit. The 7805 voltage regulator converts the 9V from the battery into 6V. This is because the PIC microcontroller needs 6V to properly operate. The switch is there to open and close the circuit and the diode is necessary to ensure that the current will not flow the wrong way. The use of the capacitors is to smooth the current as it flows through the regulator.

Receiver Module

The receiver module in this circuit is able to communicate with the corresponding transmitter circuit. The signal from the transmitter is received by the antenna on pin 3 and then outputs the original binary to pin 14 on the decoder.

Decoder Module

The decoder is necessary in this circuit to recognize the code for each signal and pass it on to the 4 bit binary pattern and the 18 pin PIC to allow the outputs to operate correctly. The decoder has the same address line so that the signal can be sent from transmitter to receiver.

[illegible] is necessary [illegible] the receiver [illegible] is the same as the 4 bit binary pattern on the transmitter circuit. Each input button has its own individual pattern e.g. 0101 which will indicate which button has been pressed. It is able to do this by using different combinations for each output.

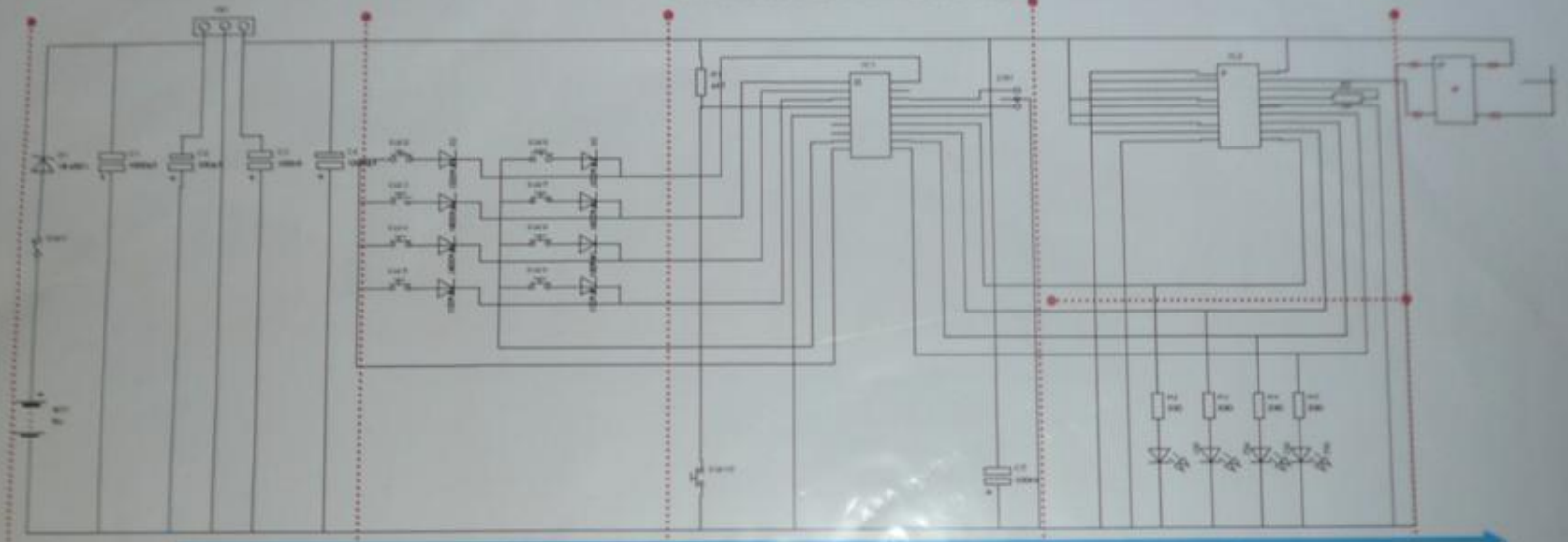
18 Pin PIC

The 18 pin PIC in this circuit is the same as the one used in the transmitter circuit. It has the 4 bit binary pattern connected to 4 of the input pins and the other input pin connected to ground. All 8 of the outputs pins are connected to the 8 bulbs. Pin 14 connects to all of the bulbs and pins 15 and 16 are connected to a resonator.

Bulbs

The outputs on my circuit are bulbs and are all connected to a pin on the 18 pin PIC. All of the bulbs are connected to ground using transistors. The signal is sent from the decoder through to the PIC's input pins and through the output pins to the bulbs.

Transmitter Circuit



Power Supply

The 7805 voltage regulator converts the 9V from the battery into 6V. This is because the PIC microcontroller needs 6V to properly operate. The switch is there to open and close the circuit and the diode is necessary to ensure that the current will not flow the wrong way. The use of the capacitors is to smooth the current as it flows through the regulator.

Matrix of Switches

The matrix of switches has been laid out in a way that it enables me to have 8 switches in only 4 outputs. I have designed the circuit so that each input pin will have 2 switches and 2 diodes connected to it. The diodes again are placed after each switch to prevent the current flowing the wrong way.

[illegible]

[illegible] also has a pin connected to ground and a pin connected to supply. 2 of the pins are connected to a resonator which keeps the pulse of the PIC at the correct speed. There are 2 output pins connected to the 8 input switches to allow the matrix to work. The other 4 outputs are connected to the 4 bit binary pattern and into the encoder.

Encoder (Top)

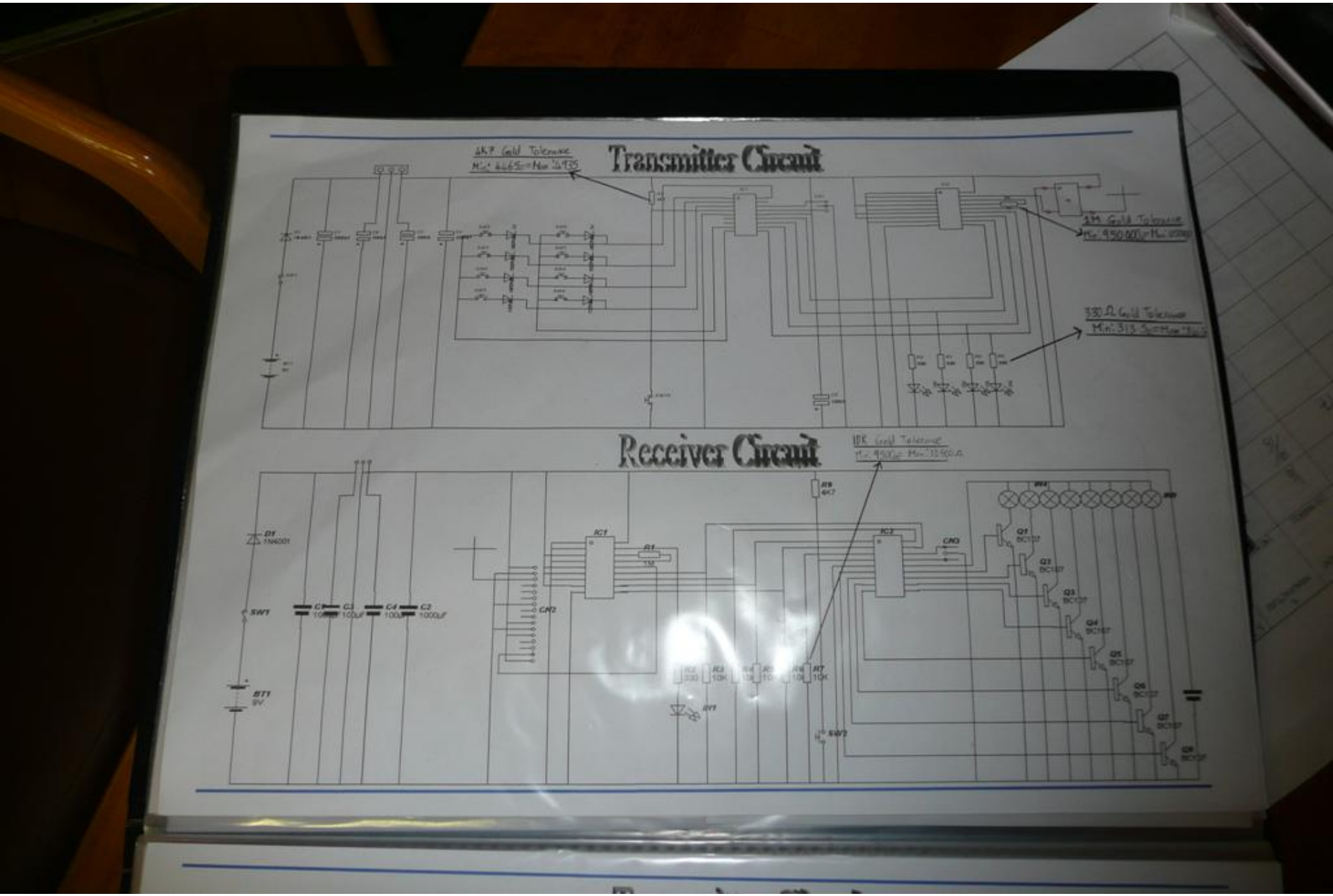
The encoder above has an 8 bit address line (the address line on this circuit is 00010110). This address line is needed to communicate with the receiver and must have the same address line, otherwise it will not operate correctly.

4 Bit Binary Pattern (Bottom)

In the bottom half of the circuit above I have used a 4 bit binary pattern. Each input button has its own individual pattern e.g. 0101 which will indicate which button has been pressed.

Transmitter

The transmitter shown above receives data from one of the encoder pins and sends the signal to the corresponding receiver module which is activated.


Transmitter Circuit
Receiver Circuit
D1 1N4001
SW1
BT1 9V
C1 100uF
C3 100uF
C4 100uF
C2 1000uF
IC1
IC2
R1 1M
R2 330
R3 10K
R4 10K
R5 10K
R6 10K
R7 10K
R8 4K7
LED1
Q1 BC107
Q2 BC107
Q3 BC107
Q4 BC107
Q5 BC107
Q6 BC107
Q7 BC107
Q8 BC107
GND
VCC

Circuit Development/Programming

Transmitter Circuit

Power Supply → Matrix of Switches → PIC → Encoder → Transmitter Module

Receiver Circuit

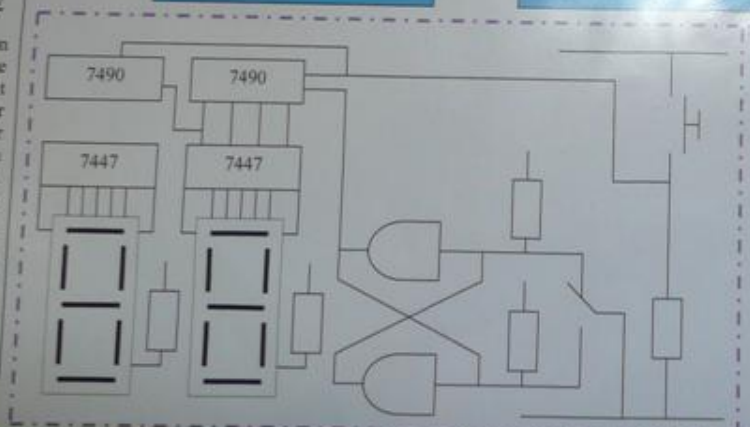
Power Supply → Receiver Module → Decoder Module → PIC → Transistor and Bulb

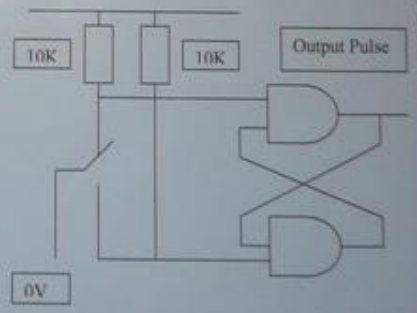
Basic PIC Circuit

Power Supply → Switches → 18 → LED's

Seven Segment Display

In each case of a seven segment display there are 7 LED bars. Each segment is labelled with a letter from 'a' to 'g' and one or a number of LED bars can be switched on as desired so that a number can be displayed on the board. For each binary number from a BCD counter, certain LED's must be lit up to form the numbers e.g. number 1 requires 'b' and 'c'.

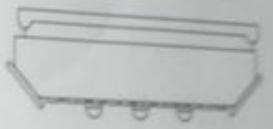




Event Counting

Counters can be pulsed by a clock or operated by pulsing a switch. Some problems with a mechanical switch connected to a digital counter are that; when the internal switch lever moves from one contact to the other, it strikes the contact and will bounce a few times before settling on the contact. This bounce only takes a millisecond, but because a counter will work at speeds far more excessive than that, it will register one count for every bounce, and will thus give an incorrect count. By counting 2 'NAND' gates in a special way, the switch can be 'de-bounced'. This arrangement is known as a 'flip flop' or a 'bistable circuit'. The output changes on the lever hitting the contact for the first time. If the lever bounces without going all the way back to the other contact, no more change is made. The output will now only change when it goes all the way to the other contact.

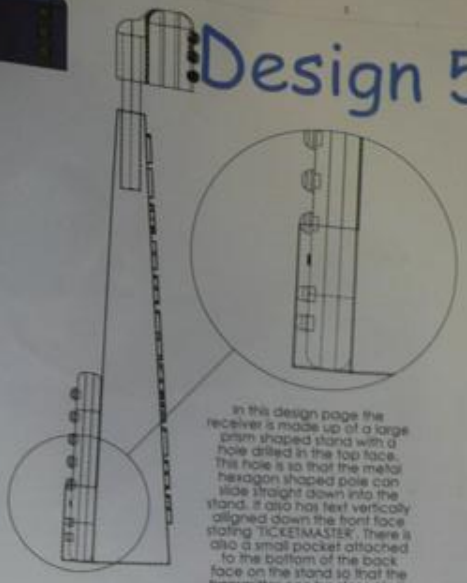
The transmitter in this design is made up of a normal hollow box with no top face. It is made by fabricating a front, back, bottom and two side faces using liquid solvent cement. It has no top face so that the inside drawer can slide in and out of the box to get easy access to the circuit. The drawer is easy to pull in and out because of its small handle. All of the edges and corners are rounded to reduce hazard and give the box a pleasant finish. The outer box has 8 holes drilled in the front face for the input buttons. It also has some extrusions into the front face and the 'TICKETMASTER' logo to give the design a more impressive appearance.



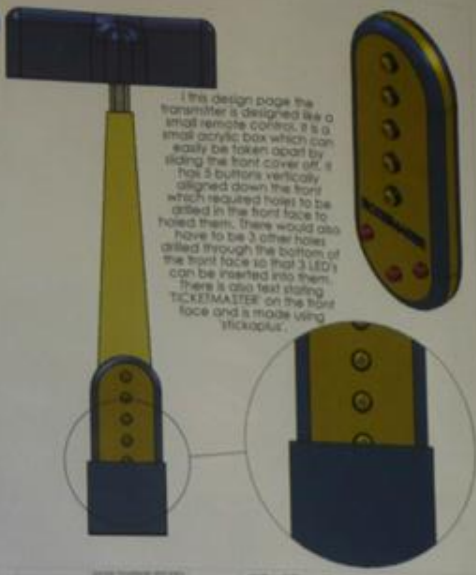
The receiver in this design is made up of a front, back and insert piece with the insert piece permanently attached to the inside of the back piece. There are also 2 acrylic poles attached to the back part of the box to stop the front part sliding the whole way over the insert piece. It also has its 2 front corners cut off and 2 strips of rectangular acrylic plastic attached to these 2 front corners. On the front face there are 3 LED's to get the customers attention and an LCD to show customers of how many tickets are left. It also has the normal TICKETMASTER logo to improve the aesthetic presentation further.

(7) Drawing 1

Design 5



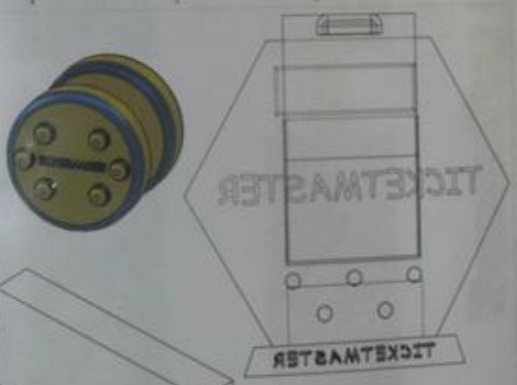
In this design page the receiver is made up of a large prism shaped stand with a hole drilled in the top face. This hole is so that the metal hexagon shaped pole can slide straight down into the stand. It also has text vertically aligned down the front face stating 'TICKETMASTER'. There is also a small pocket attached to the bottom of the back face on the stand so that the transmitter can be stored in it. There is a box on attached to the top of the pole with the circuit inside of it. It has an LCD and LED's on the front of it to create the display and the front face can slide on and off to allow access to the circuit.

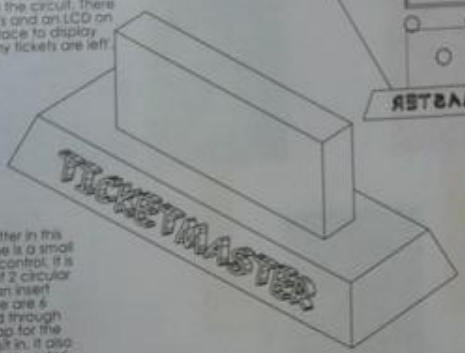


In this design page the transmitter is designed like a small remote control. It is a small acrylic box which can easily be taken apart by sliding the front cover off. It has 5 buttons vertically aligned down the front which required holes to be drilled in the front face to hold them. There would also have to be 3 other holes drilled through the bottom of the front face so that 3 LED's can be inserted into them. There is also text stating 'TICKETMASTER' on the front face and is made using 'stickaplus'.

Drawing Design 5

Design 6





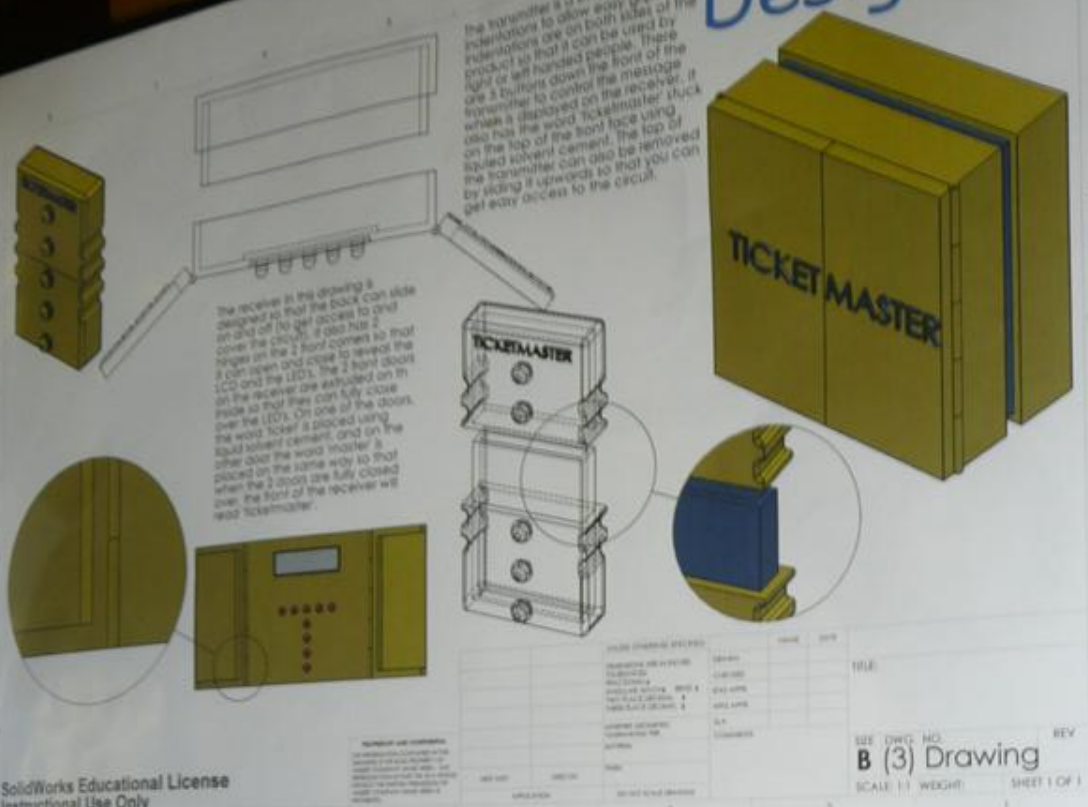
The transmitter in this design page is a small hand held control. It is made up of 2 circular caps with an insert piece. There are 6 holes drilled through the front cap for the buttons to sit in. It also has the 'ticketmaster' logo on the front of it which could be stuck on by 'stickaplus' or made with the CNC Router and stuck on with liquid solvent cement.

B (6) Drawing

Design 3

The transmitter is a small design with indentations to allow easy grip. The indentations are on both sides of the product so that it can be used by right or left handed people. There are 3 buttons down the front of the transmitter to control the message which is displayed on the receiver. It also has the word 'ticketmaster' stuck on the top of the front face using liquid solvent cement. The top of the transmitter can also be removed by sliding it upwards so that you can get easy access to the circuit.

The receiver in this drawing is designed so that the back can slide on and off (to get access to and cover the circuit). It also has 2 hinges on the 2 front corners so that it can open and close to reveal the LCD and the LED's. The 2 front doors on the receiver are extruded on in side so that they can fully close over the LED's. On one of the doors, the word 'ticket' is placed using liquid solvent cement, and on the other door the word 'master' is placed on the same way so that when the 2 doors are fully closed over, the front of the receiver will read 'ticketmaster'.



TITLE:

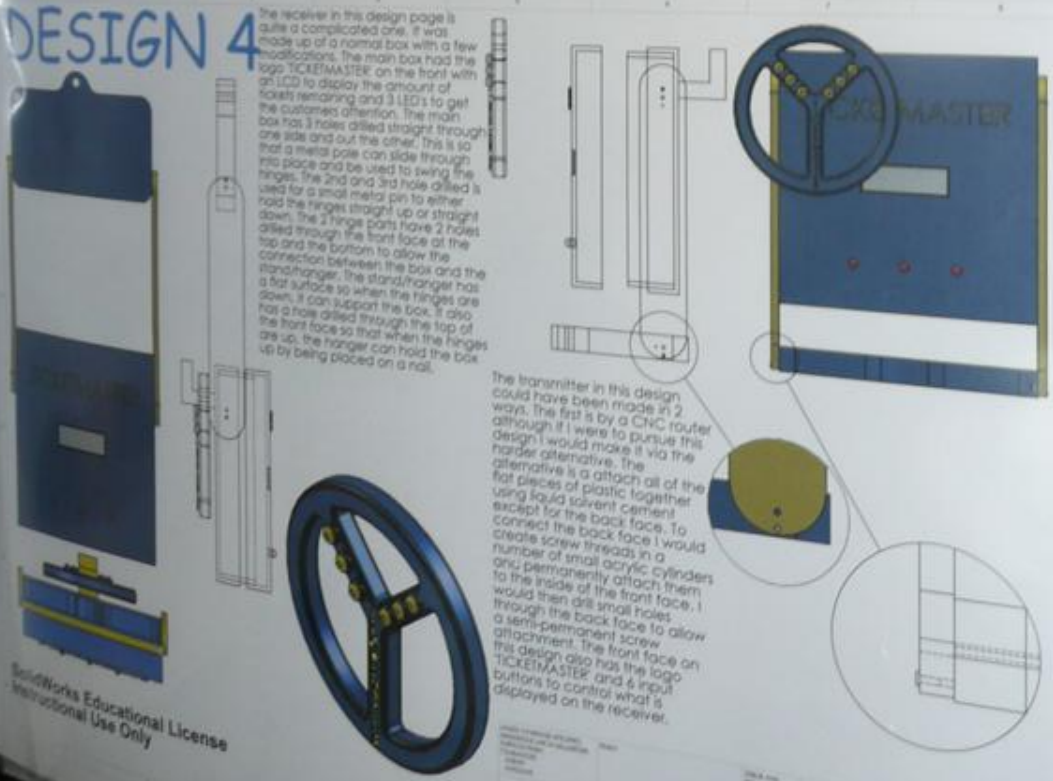
SIZE: B DWG. NO. (3) Drawing REV

SCALE: 1:1 WEIGHT: SHEET 1 OF 1

SolidWorks Educational License
Instructional Use Only

DESIGN 4

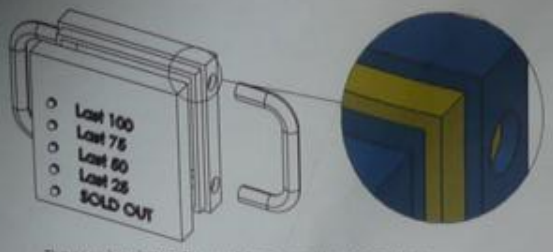
The receiver in this design page is quite a complicated one. It was made up of a normal box with a few modifications. The main box had the logo TICKETMASTER on the front with an LCD to display the amount of tickets remaining and 3 LED's to get the customers attention. The main box has 3 holes drilled straight through one side and out the other. This is so that a metal pole can slide through into place and be used to swing the hinges. The 2nd and 3rd hole drilled is used for a small metal pin to either hold the hinges straight up or straight down. The 2 hinge parts have 2 holes drilled through the front face at the top and the bottom to allow the connection between the box and the stand/hanger. The stand/hanger has a flat surface so when the hinges are down, it can support the box. It also has a hole drilled through the top of the front face so that when the hinges are up, the hanger can hold the box up by being placed on a nail.

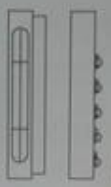


The transmitter in this design could have been made in 2 ways. The first is by a CNC router although if I were to pursue this design I would make it via the harder alternative. The alternative is a attach all of the flat pieces of plastic together using liquid solvent cement except for the back face. To connect the back face I would create screw threads in a number of small acrylic cylinders and permanently attach them to the inside of the front face. I would then drill small holes through the back face to allow a semi-permanent screw attachment. The front face on this design also has the logo 'TICKETMASTER' and 4 input buttons to control what is displayed on the receiver.

SolidWorks Educational License
Instructional Use Only

Design 1



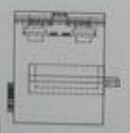


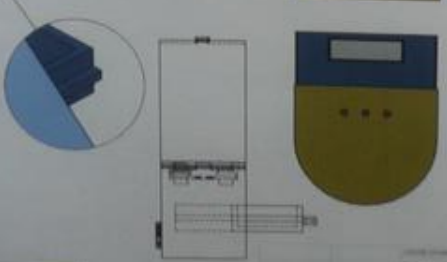
The receiver is made up of 5 main parts. It is made by permanently joining an insert piece of plastic into the inside of the back part using liquid solvent cement. Then an identical part to the back part can slide on and off of the insert peice. I would then drill 5 holes in the front of the box so that the LED's can fit in it. There are also 2 holes drilled into both sides of the back part so that the 2 handles can be permanently connected using liquid solvent cement.

The transmitter design is made up 6 main parts. The main frame of the transmitter could be made by a CNC router. I would drill 3 holes in each of the 2 top curves so that the buttons can fit into it. There are also 4 holes drilled into the top and bottom straight edge on the inside of the frmae so that 2 poles can be permenantly joined. Thes poles are used to support a similar, but smaller box to the receiver. It is made in the same way as the receiver box so that it can hold the circuitry

SolidWorks Educational License
Instructional Use Only

Design 2



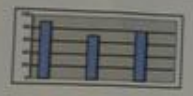


SolidWorks Educational License
Instructional Use Only

- It will be a suitable product for most customers but not all because those who are blind or have bad eyesight will not be able to read the LCD board.
- The material it will be made out of is quite strong but it may not be able to withstand a strong blow or impact.
- The power source will be a battery so you would have to change it every time it runs out.
- The product will be made as 'one-off production' so it will therefore be more expensive and time consuming than a product being made in batch or mass production.

Product Conclusion

Because the third product I analysed was my own idea there was no information that I could find on it. I therefore thought up my own design and from there I was able to create advantages and disadvantages for it. Using these advantages and disadvantages, and my own designs I was able to draw up a graph for this idea also using the same points.



Final Conclusion

Through all of my research of initial ideas I was able to draw up a graph on each. I could then use these graphs to compare each of the ideas with each other so that I could decide which product would be the best to fulfil my aim. I realised that it was my own idea which would be the best to alert customers of how many tickets were remaining to be sold.

Control System Analysis

Inputs

The inputs are used to start the circuit process. There are many different types of inputs which could be used in my product, such as;

- Push Button
- Switch
- Keypad

Transmitters

General Description

The R.F. Solutions AM Super heterodyne Receivers are compact modules, which can be used to capture undecoded data from any equivalent, AM Transmitter, such as R.F. Solutions AM-RT4 range of transmitters. The Receiver modules are manufactured on a ceramic substrate incorporates either a SAW Filter and pre amplifier front end or PLL Synthesizer for maximum sensitivity and reduced EMC emissions. These AM modules show very high frequency stability over a wide operating temperature even when subjected to mechanical vibrations or manual handling offering a very cost effective solution.

Features

- Low cost AM radio transmitter module
- Transmit range up to 100m
- CMOS/TTL input
- Available in DIL or SIL package
- No adjustable components
- Very stable operating frequency
- Low current consumption
- Low spurious emissions (-35dBc)
- Wide operating voltage (2-14v)
- Available as 315 or 433 MHz
- Complies to ETSI 300-220

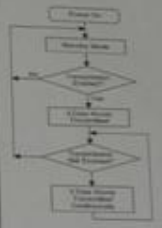
Receivers

General Description

The R.F. Solutions AM receiver modules are compact hybrid RF receivers that can be used to capture undecoded data from any AM transmitter, such as R.F. Solutions RT4 & RT5 transmitters. These modules show very high frequency stability over a wide operating temperature even when subjected to mechanical vibrations or manual handling. A unique laser trimming process (now patented) gives the receivers a highly accurate circuit inductor, removing the need for any adjustable components as found on most other AM regenerative receivers. All of the radio receivers are pin compatible providing a CMOS/TTL output. They require connections to power and antenna only. These modules conform to EMC directive ETSI300-220.

Features

- Compact hybrid AM Receiver module
- Very high frequency stability (with no adjustable components)
- Receiving range up to 50 metres
- CMOS/TTL compatible output
- Single supply voltage 3V or 5V
- Low current consumption
- HRR3 - 2.5mA
- HRR18 - 70Na
- Patented laser trimmed inductor
- Standard frequencies available
- Complies with ETSI300-220



Encoders

An encoder is a device, circuit, transducer, software program, algorithm or person that converts information from one format, or code to another, for the purposes of standardization, speed, secrecy, security, or saving space by shrinking size.

General Description

The HT640/S encoder is a CMOS LSI for remote control system applications. It is paired with the HT658/S decoder. The HT640 encoder is capable of encoding 18 bits of information, which consists of 10 address bits and 8 data bits. The programmable address / data is transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal on the TE line.

Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Capable of decoding 18 bits of information
- Pairs with HOLTEK's HT640 encoder
- 10 address pins
- 8 data pins
- Two times of receiving check
- Built-in oscillator needs only a 5% resistor
- Valid transmission indictor
- Easily interface with an RF or an infrared transmission medium
- Minimal external components

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

Decoders

A decoder is a device which does the reverse of an encoder, undoing the encoding so that the original information can be retrieved. It has similar features and applications to encoders.

General Description

The HT658 decoder provides ten address and 8 data pins in a 24 pin SOP package. It is paired with the HT640 encoder.

The decoders receive data transmitted by the encoders and interpret the first 10 bits of the code period as address and the last 8 bits as data. A signal on the DIN pin then activates the oscillator, which in turns decodes the incoming address and data. The decoders will check the received address twice continuously. If all the received address codes match the contents of the decoder's local address, the 8 bits of data are decoded to activate the output pins, and the VT pin is set high to indicate a valid transmission. That will last until the address code is incorrect or no signal has been received. The output of the VT pin is high only when the transmission is valid. Otherwise it is low always. The output type is momentary. The data outputs follow the encoder during a valid transmission and then reset. Note: The oscillator is disabled in the standby state and activated as long as a logic "high" signal is applied to the DIN pin, i.e., the DIN should be kept "low" if there is no signal input.

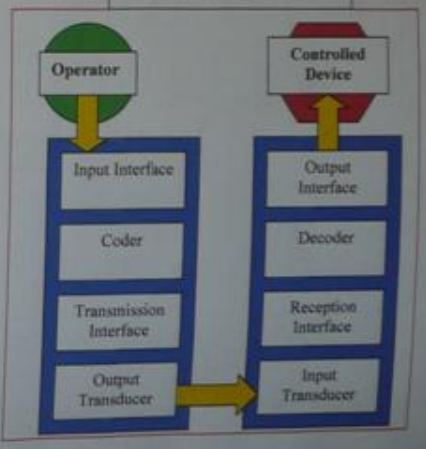
Radio Control

For distances of several hundred metres ultra-sound and infrared lack the power, optical fibre is usually too expensive and wired systems are often impracticable. Radio has considerable advantages over other types of control systems. The radio transmitter and receiver are more expensive to construct, more bulky and have a greater current consumption, but these are not insuperable problems. The construction and alignment of a radio transmitter and receiver require a little more expertise, but are within the scope of all except the absolute beginner. As in many other systems, noise can be a problem. In a radio system, the commonest source of noise is other radio transmissions.

Outputs

Outputs are at the end of the circuit process. There are many different types of outputs, such as;

- LED
- LCD
- Buzzer



Design 1

The receiver is made up of 5 main parts. It is made by permanently joining an insert piece of plastic into the inside of the back part using liquid solvent cement. Then an identical part to the back part can slide on and off of the insert piece. I would then drill 5 holes in the front of the box so that the LED's can fit in it. There are also 2 holes drilled into both sides of the back part so that the 2 handles can be permanently connected using liquid solvent cement.

The transmitter design is made up 4 main parts. The main frame of the transmitter could be made by a CNC router. I would drill 3 holes in each of the 3 top curves so that the buttons can fit into it. There are also 4 holes drilled into the top and bottom straight edge on the inside of the circle so that 3 poles can be permanently joined. The poles are used to support a circular but smaller box to the receiver. It is made in the same way as the receiver box so that it can hold the circuitry.

SolidWorks Educational License
Instructional Use Only

Drawing 1

Design 2

SolidWorks Educational License
Instructional Use Only

Drawing 2

Disadvantages:

- It will be a suitable product for most customers but not all because those who are blind or have bad eyesight will not be able to read the LCD board.
- The material it will be made out of is quite strong but it may not be able to withstand a strong blow or impact.
- The power source will be a battery so you would have to change it every time it runs out.
- The product will be made as 'one-off production' so it will therefore be more expensive and time consuming than a product being made in batch or mass production.

Product Conclusion

Because the third product I analysed was my own idea there was no information that I could find on it. I therefore thought up my own design and from there I was able to create advantages and disadvantages for it. Using these advantages and disadvantages, and my own design I was able to draw up a graph for this idea also using the same points.

Final Conclusion

Through all of my research of initial ideas I was able to draw up a graph on each. I could then use these graphs to compare each of the ideas with each other so that I could decide which product would be the best to fulfil my aim. I realised that it was my own idea which would be the best to alert customers of how many tickets were remaining to be sold.

Control System Analysis

Inputs

The inputs are used to start the circuit process. There are many different types of inputs which could be used in my product, such as:

- Push Button
- Switch
- Keypad

Transmitters

General Description

The R.F. Solutions AM Super heterodyne Receivers are compact modules, which can be used to capture undecoded data from any equivalent, AM Transmitter, such as R.F. Solutions AM-RT4 range of transmitters. The Receiver modules are manufactured on a ceramic substrate incorporates either a SAW Filter and pre amplifier front end or PLL Synthesizer for maximum sensitivity and reduced EMC emissions. These AM modules show very high frequency stability over a wide operating temperature even when subjected to mechanical vibrations or manual handling offering a very cost effective solution.

Features

- Low cost AM radio transmitter module
- Transmit range up to 100m
- CMOS/TTL input
- Available in DIL or SIL package
- No adjustable components
- Very stable operating frequency
- Low current consumption
- Low spurious emissions (-35dBc)
- Wide operating voltage (2-14v)
- Available as 315 or 433 MHz
- Complies to ETSI 300-220

Receivers

General Description

The R.F. Solutions AM receiver modules are compact hybrid RF receivers that can be used to capture undecoded data from any AM transmitter, such as R.F. Solutions RT4 & R13 transmitters. These modules show very high frequency stability over a wide operating temperature even when subjected to mechanical vibrations or manual handling. A unique laser trimming process (now patented) gives the receivers a highly accurate circuit inductor, removing the need for any adjustable components as found on most other AM regenerative receivers. All of the radio receivers are pin compatible providing a CMOS/TTL output. They require connections to power and antenna only. These modules conform to EMC directive ETSI300-220.

Features

- Compact hybrid AM Receiver module
- Very high frequency stability (with no adjustable components)
- Receiving range up to 50 metres
- CMOS/TTL compatible output
- Single supply voltage 3V or 5V
- Low current consumption
- HRR3 - 2.5mA
- HRR18 - 70Na
- Patented laser trimmed inductor
- Standard frequencies available
- Complies with ETSI300-220

Encoders

An encoder is a device, circuit, transducer, software program, algorithm or person that converts information from one format, or code to another, for the purposes of standardization, speed, secrecy, security, or saving space by shrinking size.

General Description

The HT640/5 encoder is a CMOS LSI for remote control system applications. It is paired with the HT658/5 decoder. The HT640 encoder is capable of encoding 18 bits of information, which consists of 10 address bits and 8 data bits. The programmable address / data is transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal on the TE line.

Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Capable of decoding 18 bits of information
- Pairs with HOLTEK's HT640 encoder
- 10 address pins
- 8 data pins
- Two times of receiving check
- Built-in oscillator needs only a 5% resistor
- Valid transmission indictor
- Easily interface with an RF or an infrared transmission medium
- Minimal external components

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

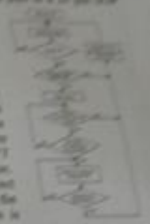
Decoders

A decoder is a device which does the reverse of an encoder, undoing the encoding so that the original information can be retrieved. It has similar features and applications to encoders.

General Description

The HT644 decoder provides an address and 8 data pins in a 24 pin SOP package. It is paired with the HT640 encoder.

The decoders receive data transmitted by the encoders and interpret the first 10 bits of the code period as address and the last 8 bits as data. A signal on the DIN pin then activates the oscillator which in turns decodes the incoming address and data. The decoders will check the received address twice continuously. If all the received address codes match the contents of the decoder's local address, the 8 bits of data are decoded to activate the output pins, and the VT pin is set high to indicate a valid transmission. That will last until the address code is incorrect or no signal has been received. The output of the VT pin is high only when the transmission is valid. Otherwise it is low always. The output type is momentary. The data outputs follow the encoder during a valid transmission and then reset. Note: The oscillator is disabled in the standby state and activated as long as a logic "high" signal is applied to the DIN pin. I.e., the DIN should be kept "low" if there is no signal input.



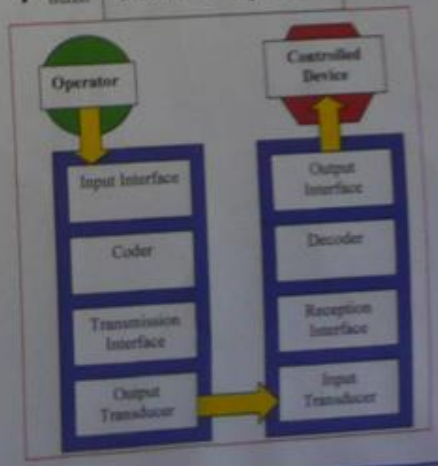
Radio Control

For distances of several hundred metres ultra-sound and infrared lack the power, optical fibre is usually too expensive and wired systems are often impracticable. Radio has considerable advantages over other types of control systems. The radio transmitter and receiver are more expensive to construct, more bulky and have a greater current consumption, but these are not insuperable problems. The construction and alignment of a radio transmitter and receiver require a little more expertise, but are within the scope of all except the absolute beginner. As in many other systems, noise can be a problem. In a radio system, the commonest source of noise is other radio transmissions.

Outputs

Outputs are at the end of the circuit process. There are many different types of outputs, such as:

- LED
- LCD
- Buzzer



Initial Ideas: Analysing Existing Products

Introduction

Music is a wonderful thing and if you get enjoyment out of it, there is nothing better than attending a concert or music festival of some sort. Whether you prefer to stand or sit at a concert it is most likely that you will purchase your tickets from 'Ticketmaster'.

Background Information

Ticketmaster Entertainment, Inc. is a ticket sales and distribution company based in West Hollywood, California, USA, with operations in many countries around the world. The problem with the ticket outlets is that for many popular concerts and events there are huge lines and only a limited amount of tickets. This means that there is always a chance that you could queue up for hours and by the time it is your turn to be served the tickets could be sold-out. This is a huge annoyance to some people as if they knew before hand that the tickets would sell-out before they reached the front of the queue they could have saved themselves a lot of time and also resorted to a different method of purchase e.g. internet. There are not many electrical devices that show customers how many tickets are remaining, but there are some other ideas. There are many ideas which are non-electrical, but are still as effective in doing the job. As I have already mentioned in my 'problem identification' I am going to design, make and test an electronic product which can give costumers an idea of how many tickets are left in that particular store. The reason I wish to create such a device is because not only will it please customers, but it will improve efficiency in selling the tickets and therefore attract more customers. This will help stores such as 'Ticketmaster' sell-out more often and make the concert and festival more full. This helps to give a better atmosphere by having more of a crowd (which can make more noise) and make it enjoyable for everyone. Also, the venue will be making more money because more of their tickets have been sold and there will be a larger crowd to buy drinks and souvenirs, etc. Therefore it is not just 'Ticketmaster' that will benefit from this device, but also the customers and the venue (clients). However, before I did this I had to analyse a range of similar products so that I could improve the quality of my device.

Product 1 – Microphone and Speaker

I found that one way in which some businesses let there customers know how much stock is left is by using a microphone connected to a speaker. They have speakers placed around the shop and then the person working at the ticket selling area can let the customers know the amount of remaining tickets every so often. A microphone, colloquially called a mic is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal. Microphones are used in many applications such as telephones, tape recorders, hearing aids, motion picture production, live and recorded audio engineering, in radio and television broadcasting and in computers for recording voice, and for non-acoustic purposes such as ultrasonic checking. The most common design today uses a thin membrane which vibrates in response to sound pressure. This movement is subsequently translated into an electrical signal. A loudspeaker, a transducer that turns an electrical signal into sound waves, is the functional opposite of a microphone. Since a conventional speaker is constructed much like a dynamic microphone speakers can actually work (in reverse) as microphones. The result, though, is a microphone with poor quality, limited frequency response (particularly at the high end), and poor sensitivity. In practical use, speakers are sometimes used as microphones in such applications as intercoms or walkie-talkies, where high quality and sensitivity are not needed.

Advantages:

- The number of tickets left could be clearly stated into the microphone so that everyone around the shop would be able to hear it through the speakers.
- The volume could be adjusted so that it is loud enough to hear, but it is not so loud that it will displease some customers.
- The idea is very simple to operate.
- It would be very useful to blind people who would not be able to read something that states the amount of tickets left.
- It does not cause the employee operating it a lot of effort.

Disadvantages:

- A microphone that is sensitive enough to detect the entire range and frequency of a human voice is equally likely to detect many background noises in the environment; therefore people may not clearly hear what is being said.
- If you are using a desktop microphone, it may pick up sounds from the keyboard.
- LCD monitors tend to have too small of a body to effectively mount the microphone and there may be no space for the microphone to sit anywhere.
- If the room is noisy you may not be able to hear what is being said.
- If the volume is then turned up due to this, the message could become blurred and make it hard for people to understand what is being said.
- If you wanted to use this idea you would need a large amount of speakers so that they can be placed all around the shop and this could be quite ex[illegible]
- This idea [illegible] for deaf people as it would be impos[illegible] at is being said.

Product Conclusion

After analysing [illegible] the advantages [illegible] able to make a [illegible] was a suitable idea to use. I looked at a lot of information regarding a microphone and speakers and by looking at its good and bad qualities I designed a simple graph to show whether it would be a suitable product for my idea. The 3 points I looked at were function, ergonomics and maintenance as I feel these would be the most important.

Product 2 – Number Board

The second idea I choose to analyse was number boards as they can be used in a various range of ways. There are different types of number boards, as some could be used to keep score in a football match or even the price of something. Many businesses use them for advertising and to show the public many different kinds of information. This is one of the reasons why I am choosing to analyse this product. Number boards are made up of an input, control and output circuit (output being the LED's lighting up). The LED is the main part to this product as it shows the number or information. A light-emitting diode (LED) is an electronic light source. The LED was introduced as a practical electronic component in 1962. All early devices emitted low-intensity red light, but modern LED's are available across the visible, ultraviolet and infra red wavelengths, with very high brightness. LED's are based on the semiconductor diode. When the diode is switched on, electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the color of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm^2) with integrated optical components to shape its radiation pattern and assist in reflection. LED's present many advantages over traditional light sources including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching. However, they are relatively expensive and require more precise current and heat management than traditional light sources. They are used as low-energy indicators but also for replacements for traditional light sources in general lighting and automotive lighting. The compact size of LED's has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in communications technology.

Advantages:

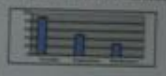
- A very low energy consumption level. – Cheaper energy bill.
- Lasts much longer than traditional lighting (it has been known to last up to 50,000 hours).
- Can easily resist thermal shocks and vibrations (normal light bulbs are useless when you drop or bump them).
- There is no infrared lighting from LED lights, and there is no UV radiation, which is better for you and the environment.
- Contains no mercury making it safer.
- Cool to the touch so we need to worry about burning or turning off the lights for 30 minutes before you change them.
- They make great colored lights from anywhere on the light spectrum.
- Can easily state the amount of tickets remaining to be sold.
- It would be easily seen by all customers as it would stand out from its environment.

Disadvantages:

- A very limited variety and selection.
- Hard to find in smaller towns where consumers may have a smaller interest in this lighting alternative.
- Significantly more expensive than regular lighting and not budget conscious.
- Although they are available in many colors, the quality of the colors is not quite as good as with regular lighting.
- Blind people would be at a disadvantage as they would have no way of knowing how many tickets are left.
- It would be an annoyance for the employee as they would have to change the number which appears on the board every time they sell a ticket.

Product Conclusion

Again, after analysing this idea and looking at a range of information I was able to make up a list of advantages and disadvantages. From there I was once again able to make a graph showing whether the product would be suitable for my aim.



Product 3 – 'Ticket Counter'

For my third initial idea I decided to think of my own product which would be able to state the number of tickets that are remaining. Because there is no such product ever invented I have to take all of my specification points into consideration. It would also have to be a realistic idea if I want to fulfil my aim by designing, making and testing a product which can alert customers of the amount of tickets remaining to be sold. To fulfil the aim it must have an input, control and output circuit. The input will be a number of switches and buttons to turn the product on and off, and also to change the LCD. The outputs could be an LCD and possibly some LED's and/or a buzzer. The product must have a control box (transmitter) which sends signals to the message board (receiver). This means that the inputs and outputs will be on separate products. Both the transmitter and receiver should be made out of acrylic plastic as it is a cheap, strong material. The transmitter must be the correct size so that it is not too big or heavy to hold in your hand and the receiver should be big enough for customers to see, but not too big that it is an 'eyesore'.

Advantages:

- It will clearly state the number of tickets left without confusion.
- The receiver will not be heavy to hold or take up a lot of space when not being used.
- It will be powered by a battery so it will not be dear to keep running.
- It will be made of a material which is waterproof and an electrical insulator so it is a safe product.
- It will have an LCD on the receiver so all customers around the shop will be able to see it.

Problem Identification

Music is a very important part of our society in today's world and it brings enjoyment to so many people. Nowadays it is very simple to go to various concerts/ music festivals through purchasing tickets. One place where you can buy tickets for these various concerts and festivals is 'Ticketmaster'. Ticketmaster Entertainment, Inc. is a ticket sales and distribution company based in West Hollywood, California, USA, with operations in many countries around the world. All US ticket sales for US venues are fulfilled at the Ticketmaster sale fulfillment center located in Charleston, West Virginia. Typically, Ticketmaster's clients (arenas, stadiums, and theaters) control their events, and Ticketmaster simply acts as an agent, selling the tickets that the clients make available to them. Ticketmaster sells many of its tickets online, some via phone, and some through its many ticket outlets. Ticketmaster Group, Inc. is the largest ticket distribution company in the United States, completely dominating its market niche. The company distributes tickets for more than 4,000 clients whose events range from professional wrestling matches and rock concerts to Broadway shows and operas. Tickets are sold at more than 3,400 outlets nationwide, over the telephone, and through the Ticketmaster Online-Citysearch web site, which is run by a publicly traded affiliate of the company. Ticketmaster also has been branching out into international markets, making moves into Australia, Europe, and Latin America. Barry Diller's USA Networks, Inc. owns 100 percent of the company. Although it does have many different methods for obtaining tickets e.g. internet, the ticket outlets are the main provider. This is because not everyone has access to internet and mobile phones. The problem with the ticket outlets is that for many popular concerts and events there are huge lines and only a limited amount of tickets. This means that there is always a chance that you could queue up for hours and by the time it is your turn to be served the tickets could be sold-out. This is a huge annoyance to some people as if they knew before hand that the tickets would sell-out before they reached the front of the queue they could have saved themselves a lot of time and also resorted to a different method of purchase e.g. internet.

Ticketmaster was started by two Arizona State University students who were looking for a solution to a problem they encountered when buying concert tickets. At the time, the buyer of a ticket was forced to select from the seats that had been allotted to the particular vendor from whom he or she was purchasing the ticket. If the vendor was nearly sold out, the buyer might be forced to buy bad seats even though better seats were available through other ticket sellers. Melees occasionally erupted when ticket buyers, after standing in line for hours at one place, found that the vendor was sold out or that better seats were available elsewhere. The system also was inefficient for promoters and owners of venues, who often had difficulty selling all of their tickets, despite unmet demand.

For this reason I have decided to design a device which can inform and alert people in the queue whether they will be able to purchase a ticket or not. I will aim to design two boxes (control box and message box) which can do the task mentioned. The 'control box' will have 5 buttons on it to change the message which reads on the 'message box'. I will use 'stickaplus' to show which message each button will show. On the 'message box' there will be an LCD with 5 LED's below it. The speed in which the LED's flash is linked to the amount of tickets which are left. The less tickets there are, the quicker the LED's will flash and when they are sold out, the LED's will stay on. The 5 messages in which the LCD board will read are;

- *Last 100*
- *Last 75*
- *Last 50*
- *Last 25*
- *SOLD OUT*

Design Brief

I am going to design, make and test an electronic product which can give costumers an idea of how many tickets are left.

Specification

Function

- The device must give customers a rough idea of how many tickets are left e.g. last 75.
- The device must be placed in at least 2 metres off the ground so that it is visible to customers.
- It must be placed at least 1 metre apart from any other object or sign so that there is no distraction from the device.
- The device must have an input function to control what message will read on the device.
- It must have at least 5 input buttons so that 5 different messages can be shown.
- It must be placed in an area which is close to the back of queue as they are the customers who will have most use for it.
- The LCD board must be visible for up to 5 metres away so that it can be seen by most customers in the queue.
- The front of the device should be placed so that it is perfectly perpendicular to the direction of the line.
- It must be designed so that it can easily attach and unattach to the roof or a wall.
- It must be designed so that it can be attached to a number of different areas in the shop.
- The corners must be rounded with a radius of about 10mm to prevent hazards from sharp edges.
- The device must have 5, high intensity LED's so that it is more noticeable to customers.
- The LED's must flash in relation to the amount of tickets left (the less tickets there are, the faster the LED's must flash).
- When the tickets are sold-out the LED's must stay on to alert this.
- The device should compromise of a receiver circuit.
- The device must be between 100-300mm in height, 100-300mm in width and 50-150mm in depth (large enough to be seen by customers but not too big that it takes up a lot of space).
- It must be made out of acrylic as it is a strong, hard material.
- The device should be easily controlled (have 1 switch to turn it on and off, and 5 buttons to control the different outputs).
- The device should be operated by a battery because it is a cheap electrical power source.
- It must not weigh more than 1kg so that it is easily lifted and carried.
- The switch and input buttons must transmit signals to the LCD board and LED's.
- The control box (transmitter) must send signals to the message board (receiver) to do the desired function.
- There must be no wires attaching the transmitter and receiver boxes and so it must therefore send wireless signals.

Performance

- The device must be between 100-300mm in height, 100-300mm in width and 50-150mm in depth (large enough to be seen by customers but not too big that it takes up a lot of space).
- The LED's should light up bright enough to catch people's attention from 5 metres away.
- The LED's should work at multiple formations and be linked to the number of tickets left.
- The formations must be controlled by pushing the input buttons.

Size/ Weight

- The control box must be less than 1kg so that it is not too heavy to carry.
- The message board must not be more than 5kg's as it may cause difficulty when trying to attach it to the wall or roof.
- Both the control box and message board must be between 100-300mm in height, 100-300mm in width and 50-150mm in depth (large enough to be seen by customers but not too big that it takes up a lot of space).

Anthropometrics

- The device must not be [illegible] big that it becomes an 'eye-sore' or takes up a lot of space.
- The message board [illegible] not be t[illegible]t that it cannot be seen by any of the customers.
- The control box should be between 100-300mm in height, 100-300mm in width and 50-150mm in depth so that it can be held without strain.
- The message board should also be between 100-300mm in height, 100-300mm in width and 50-150mm in depth so that it can be clearly seen by all customers without strain.

Ergonomics

- The size of the control box must be considered so it must be a comfortable size for the user to hold and easily change the message on the receiver.
- The message board must be large enough so that it can be easily and clearly seen by all customers without strain.
- The message board must not be too large as it would be placed in quite an enclosed environment.
- The message board must not be too small that it would blend into the environment.
- The message board must not be high enough off the ground so that it is visible to all customers, but not so high that it is a strain to read the message.

Safety

- The corners on both the message board and control box must be rounded with a radius of about 10mm to prevent hazards from sharp edges.
- The device must be made out of acrylic as it is an electrical and heat insulator.
- The device must be made out of acrylic and all wires covered to ensure that it is completely waterproof.
- The signals should be sent wirelessly so that there are no loose wires hanging out of the box.
- All circuitry should be properly connected so that it cannot harm the user.

Aesthetics

- The message board should be placed so that the front of it is perfectly perpendicular to the direction of the queue so that it is visible to all customers.
- The message board must clearly state the range of how many tickets are left.
- The message board should be aesthetically pleasing so that it is not an 'eye-sore' to look at.

Maintenance

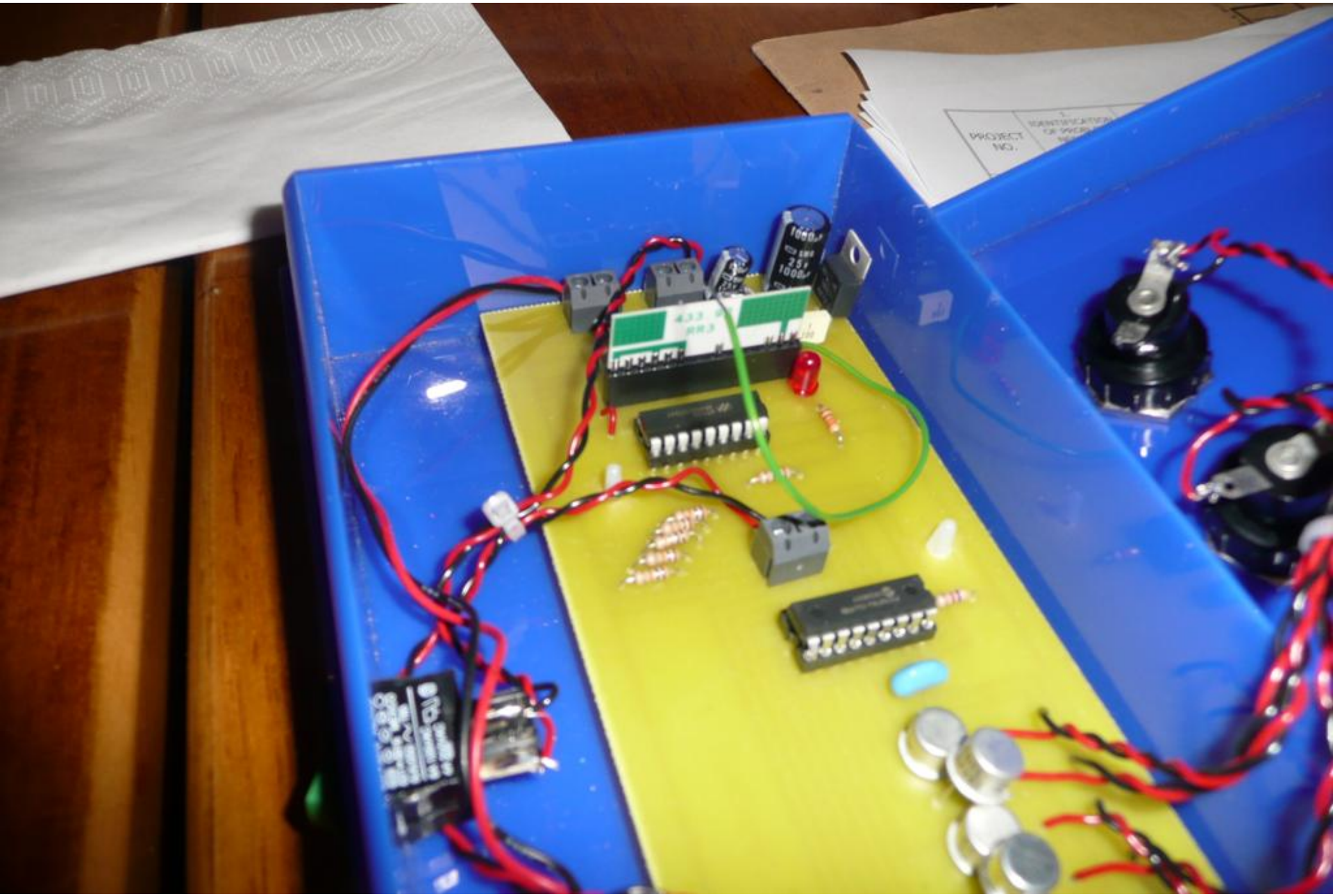
- The control box should be regularly dusted and cleaned with a damp cloth so that the input buttons can be easily seen.
- The message board should be regularly dusted and cleaned with a damp cloth so that it remains visible to all customers.
- The battery in the control box and message board should be replaced with a new one every time the old one runs out so that it can always be in use.

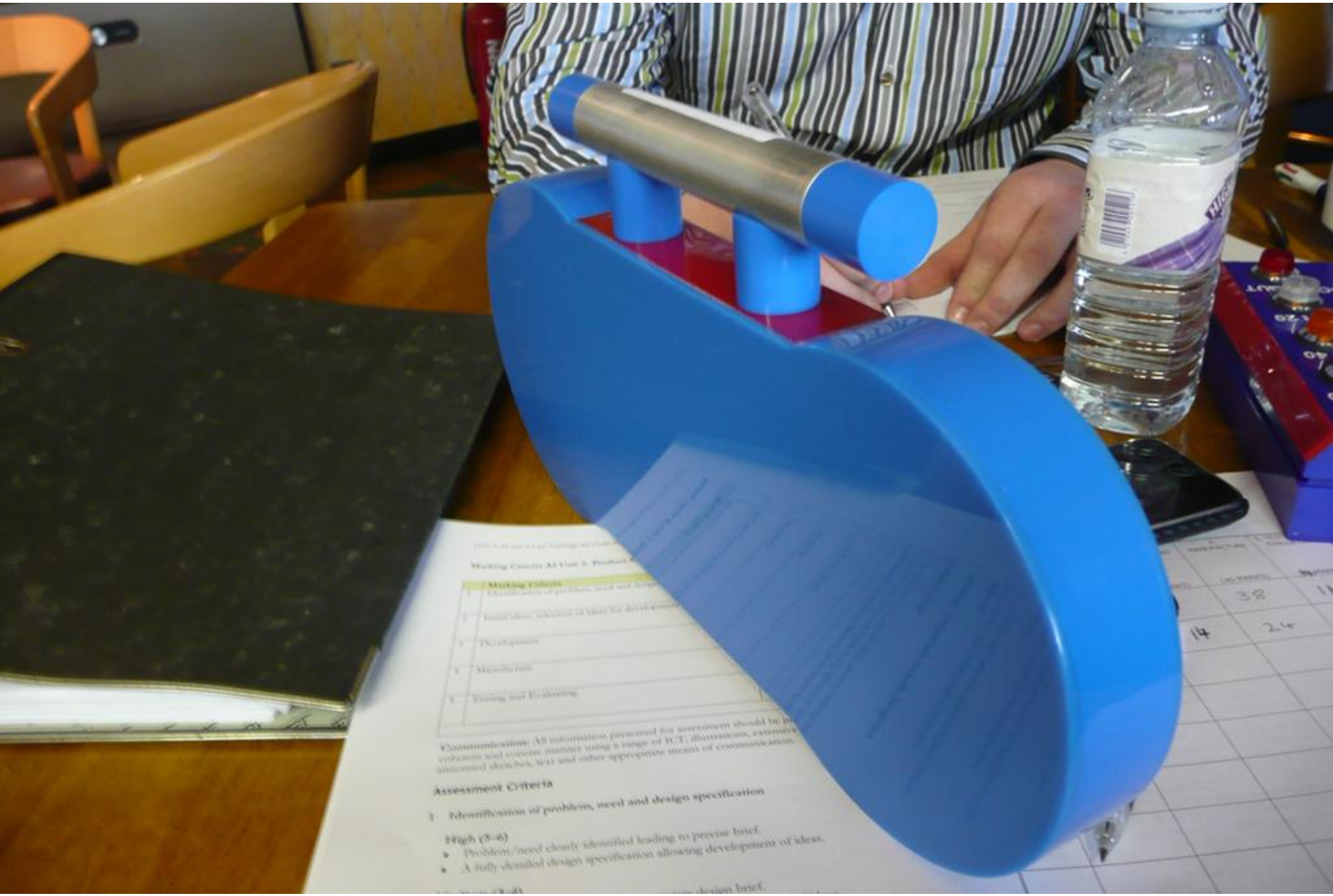
Material Choice

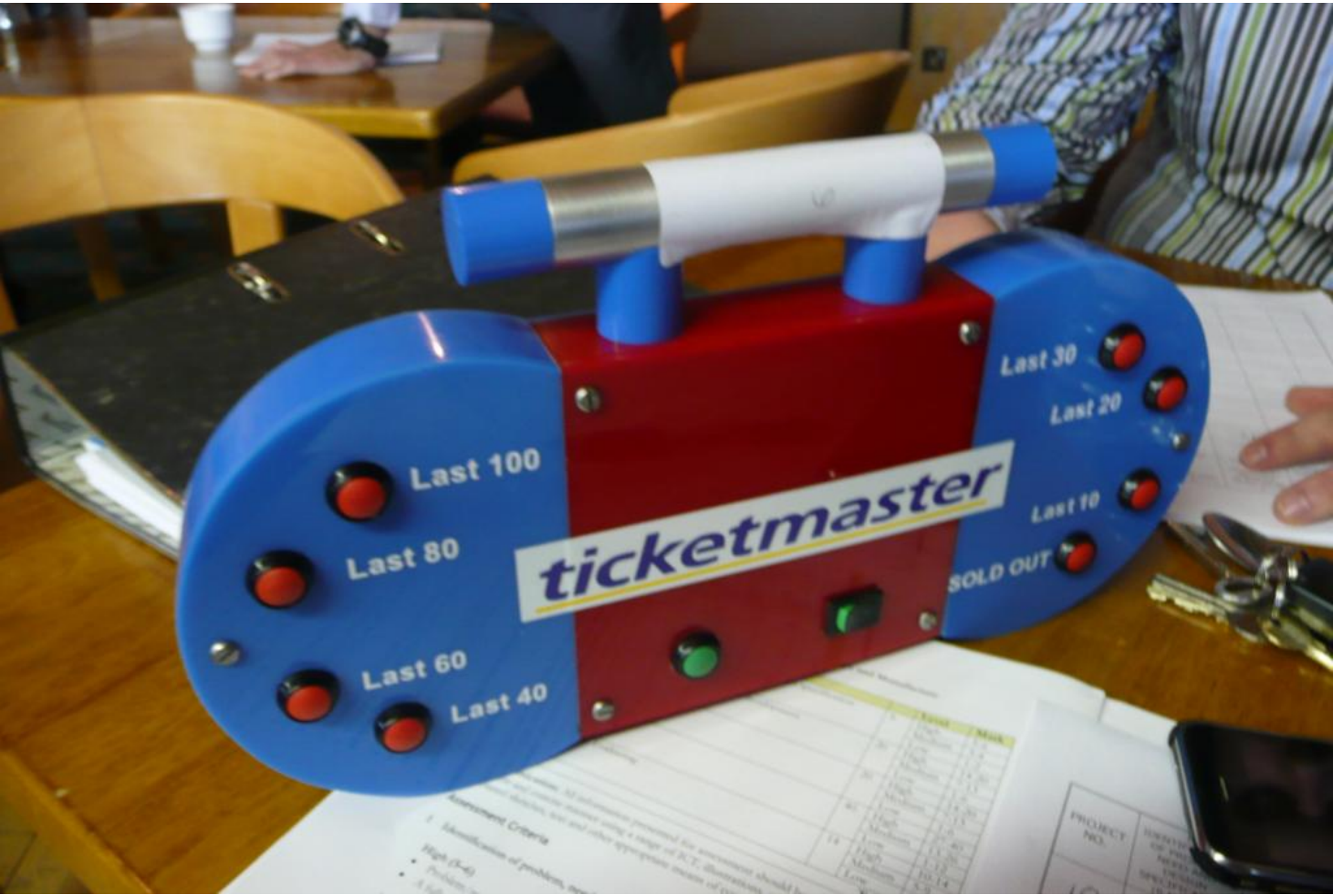
- Both the control box and the message board must be made out of a strong, hard material.
- The device must be made of a material which is waterproof incase of accidental spillage.
- It should be made out of a material which is an electrical and heat insulator.
- The material I will choose to use for my project is acrylic.

Storage

- Both the message board and the control box must be small enough that they do not take up a lot of space in storage (100-300mm in height, 100-300mm in width and 50-150mm in depth).
- The message board must be detachable from wherever it is placed so that it can be put into storage when it is not being used.
- Both the control box and the message board must be able to be taken apart so that the power source (battery) can be removed when it needs to be put into storage.
- There must be no loose wires on either the control box or message board so that it does not cause a hazard when in storage.




Assessment Criteria
1 Identification of problem, need and design specification
High (5–6)
Problem/need clearly identified leading to precise brief.
A fully detailed design specification allowing development of ideas.


Last 100
Last 80
Last 60
Last 40
ticketmaster
Last 30
Last 20
Last 10
SOLD OUT


ticketmaster
Last 80
Last 100
Last 40
Last 60
6.
HIGHLAND SPRING
STILL