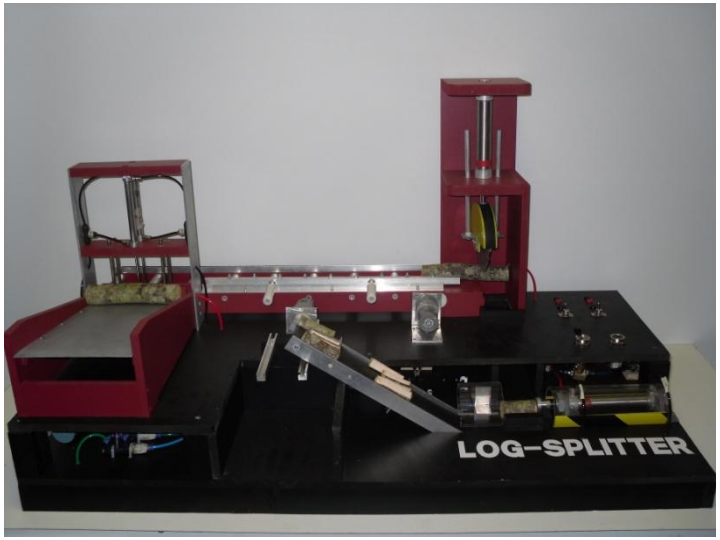
A2 Agreement Trial
Technology & Design
Thursday 25th October
Ccea



About today

- Standards
- Marking
- Moderation Procedures
- Discussion
- Support

Moderation

- PM + 2APMs Mary O'Brien & Mark Irwin
- CCEA Educational officer Judith Ryan
- Visiting moderation
- All centres visited
- Wed 23rd May to Fri 31th May
- 2 Post moderation meetings Pm-APMs

General issues

- Candidates must identify a problem or need and ensure it provides sufficient scope to meet the assessment criteria.
- Responsibility of the teacher to ensure that the topic chosen allows sufficient scope and intellectual challenge appropriate to an A2 course.
- Manufacturing should take place within candidates own school or college. Accreditation cannot be given for manufacturing completed outside the school or college unless the teacher has directly supervised such work.
- Use an appropriate range of materials in the manufacture of the product.
- 2O A3 pages in portfolio.
- Unit A2: 2 is worth 100 marks.

- Teachers to indicate on Candidate Record Sheet why high level marks have been awarded.
- Retention of work for use at RMA.
- Internal standardisation must have taken place
- Presentation of design.
- Teachers to indicate on Candidate Record Sheet where/why innovative work is being awarded with a high level work.

- A Level Technology & Design Specification
- Unit A2 2: Coursework: Product-System, Design and Manufacture.
- A portfolio should accompany the practical component with written and graphical information produced on no more than 20 A3 pages.
- It represents approximately 60 hours work and will be internally assessed and externally moderated.

Marking Criteria A2 Unit 2: Product-System Design and Manufacture

	Marking Criteria		Level	Mark
1	Identification of problem, need and design specification	6	High	5-6
			Medium	3-4
			Low	1-2
2	Initial ideas, selection of ideas for development	20	High	14-20
			Medium	7-13
			Low	1-6
3	Development	20	High	14-20
			Medium	7-13
			Low	1-6
4	Manufacture	40	High	27-40
			Medium	13-26
			Low	1-12
5	Testing and Evaluating	14	High	10-14
			Medium	5-9
			Low	1-4
			Total	100

Communication: All information presented for assessment should be presented in a coherent and concise manner using a range of ICT, illustrations, extensive photographs, annotated sketches, text and other appropriate means of communication.

Approximate pages for each section.

- 1.Identification of problem, need and design specification 2 pages.
- 2. Initial ideas, selection of ideas for development 7 pages.
- 3. Development 7 pages.
- 4. Manufacture 1page.
- 5. Testing and Evaluation 3 pages.

A2 Technology

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.

Medium (3-4)

Problem/ need identified with appropriate design brief.

A suitable design specification allowing some development of ideas

Low (1-2)

Problem/ need superficially identified, imprecise brief.

An incomplete specification, allowing limiting design development.

oblem Identification
ad Design Brief

Problem Identification

In modern day construction and manufacturing industries there is a large demand for a device that will be able to sharpen tools. In this case a chisel sharpener which requires very little effort to sharpen compared to the old manual way of using your hands and a sharpening tool. Most devices that have already been developed have been designed to help the needs of carpenters, engineers, technologists, secondary schools and universities. Sharpening strong/ tough chisels such as steel can take a lot of effort and a lot of force using a manual sharpening file. Therefore it is almost too much for a human to cope with. This is one of the main reasons I am producing a product that can carry out this task automatically, efficiently and effectively without any effort required from the user.

It has been noticed that there is a gap in the tools market for a design of a fully automatic chisel sharpener. It has been attempted before and has either failed, hasn't been fully developed or did not meet the required standard that was needed for the users. No one up to date has created a fully automatic chisel sharpener.

The problem the current manual sharpeners have is, they are not very user friendly for the task. Meaning the effort required to sharpen the tool is a lot compared to an automatic approach to it.

It was also noticed that most manual chisel sharpeners did not give the sharper edge of the chisel I perfect sharp finish. It was discovered that it left dangerous threads of metal poking out after it had been sharpened which if exposed to skin can easily cut open and infect the wound. I feel there is a strong need in industry for an automatic chisel sharpener that can give the chisel a perfect clean finish at the proper angle. The purpose of the design would be implemented by all its efficiency to give the chisel a clean finish to the sharp edge.

In conclusion it has been proved that in several industries and professions they can benefit off using an automatic chisel sharpener. Some of the benefits are it has better efficiency, force, finish, speed and quality, all these certain areas help to satisfy the user and to make his/her job easier.

The Consumers requirements

This device will be designed for a wide range of users to perform a similar purpose to the original. The age limit for this device would be 18years and above due to the dangerous tools needed to sharpen a chisel. The main user group is targeted towards carpenters or any occupation which requires the usage of a chisel sharpener.

This device is specifically around the needs of these trades. This device can also be targeted towards secondary schools and university who study technology and design.

This device would be a huge benefit to the teachers who teach technology as it is a hard job to properly sharpen a chisel safely. Some the subjects that would use this device in schools would be Technology and Design, Art and Construction. A few professions would include carpenter, joiner, contractor, civil engineering, structural engineering, mechanical engineering, Universities and secondary schools. Some other day uses would be sharpen your own and possibly neighbours tools at home.

This is a small compact device which will be comfortable for the user to hold and to move around.

The Function

This product will be used to sharpen relative size chisels as effectively and as efficiently as possible without much effort required from the user. It will be close to hand held and portable o that users can easily transfer it from table to table, so that it can be used in any environment.

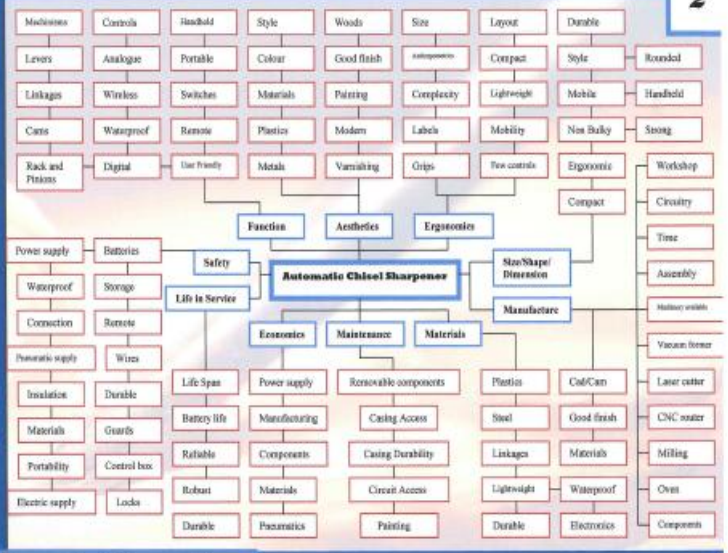
The device will be mobile so that it can store all the mechanics and pneumatics inside the actual base of the product. The device will also turn at an angle so that you can get an angled face on the chisel. The device will need to be able to sit flat on the surface so that all the mechanics can run smoothly without it coming in contact with wiring. The method of operating the tilting mechanism is a stepper motor will turn the wheels which will there for change the angle of the file.

This chisel sharpener will be small and compact so that it can be easily stored. The product should be capable of sharpening a chisel with very little user involvement, other than press a few buttons. Over all, this device will require little effort compared to sharpening a chisel by hand.

The Location

This device is mainly to be used in industry, carpenter workshops and possibly building sites that needs to sharpen their chisels. Therefore this device must be waterproof to prevent all the mechanics and electrics from getting soaked when being used outside with bad weather. Not only waterproof but it should be durable, for if anyone was to drop it would be destroyed. It would need to be able to withstand a lot of pressure and external force on its casing due to the heavy usage of the chisel sharpener it would require a lot of force as well to get the file to sharpen it. This product would also have to be smallish and compact so that it can be easily stored away and will not take up a large volume of space. It would be able to lock itself to a work bench to give extra support when the file is moving b[illegible] to sharpen the tool. This product can also be used in work place and quiet [illegible] running so that it does not annoy the user.

[illegible]ework



Aspects of the problem

This device will be designed and manufactured to be much more efficient and require less effort for users. E.g. carpenters and contractors. It is designed to sharpen their chisels to give them the best blade to cut the wood etc. The is space in the market for a fully automatic chisel sharpener which is somewhat slim line and portable as well as compact.

Most devices in the market are too bulky and large for some small situations. This device requires accuracy and precision to get the required force to sharpen the chisel up to a given standard.

There is a space in the market for an automatic chisel sharpener which is somewhat slim line and compact. The product would have to consider the thickness and length of the chisels as well. A chisel sharpener is a dangerous piece of equipment that will handle a lot of care when using it. This is extremely dangerous for the persons involved and hence the reason why there is a necessity for an automated chisel sharpener.

Frequency of use

This product can be used in a large scale in industries due to the heavy usage of the chisel, when the chisel gets blunt this would be a quick and effective way to sharpen the chisel.

This device is most likely to be used during normal working hours due to all occupations normally start around 9 and finish about 4. This device can be used any time of the day in any weather condition due to the durable and waterproof outer casing to protect the circuitry, and pneumatics inside.

All parts of the day this device can be used to help carry out work and maintenance on woodwork, metal work or stone work. The safest part of the day to use the chisel sharpener would be during day light or under artificial light so that you can't harm the user due to not being able to see. This devices file to sharpen the chisel would need to be changed after every week of heavy usage.

Design brief

I am going to design and make a freestanding, portable and compact device that will automatically clamp a range of chisels to allow them to be sharpened from a required angle.

Automatic Chisel Sharpener

Product Identification & Design Brief

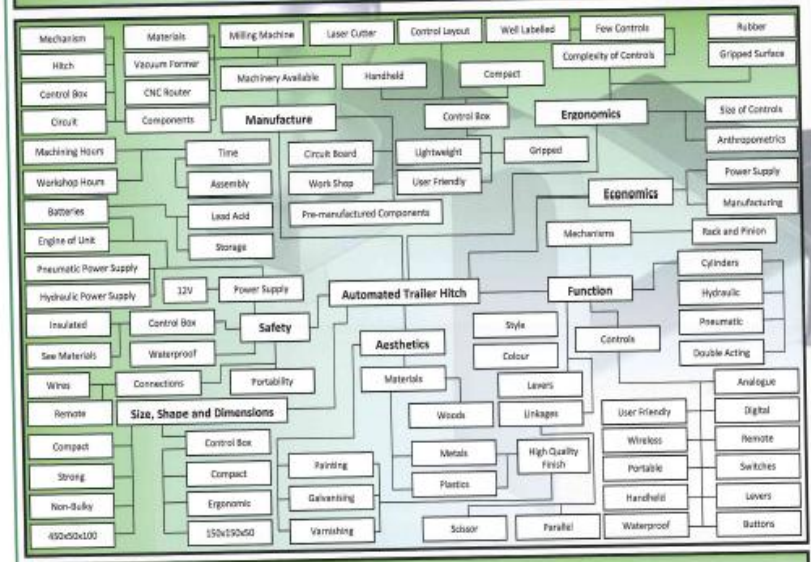
Problem Identification

A problem that has encountered many people over the past few years is due to the increasing number of people buying trailers and getting tow bars fitted to their cars. In doing so they have created another problem in that in the process of lifting the trailer, to attach it to the car, they can put a large amount of stress on their back and other parts of their body. This can therefore result in an injury or even worse a serious injury.

It is apparent that there is a gap in the market for an automated devise to attach a trailer to a vehicle. To the current day there isn't another device out there that will fulfil this position. Also in developing a product that can fulfil this position it will also save the users money, cause when attaching the trailer many people have dam aged the rear bumper on their due to hitting it with the hitch of the trailer.

By manufacturing a product that can prevent this it will ultimately save the user money in the long term as well as helping their health by saving their back and other parts of their body from injury.

Overall, it has been proven that in developing a product that currently doesn't currently exist on the market shows that there is a space for a product. This product will greatly help people's health as well as assisting them in hitching a trailer to their vehicle.



Design Brief

I am going to design and construct a automated trailer hitch to attach the hitch of a trailer to the ball socket on a car, with minimal manual involvement from the user of the product.
The product will be designed in such a way that it is user friendly; durable, weather resistant as its working environment will be outside where the weather conditions are not reliable. Also it will be impact resistant in case another car comes in contact with it as a result of a collision and may damage it.

The User

The problem will be solved by designing for use by a wide range of ages. The product will be designed to increase the ease of use for the user. This product should only be used by people of age 18 and over, as there are extremely dangerous moving parts and the pneumatic cylinders have the potentials to cause serious injury to the user. The main user of this type of product would be people that are in constant contact with hitching and unhitching trailers. The sorts of people could be the likes of joiners and carpenters, all of which use trailers on a regular basis. I can also be used by the elderly, so that they won't have to physically make contact with the trailer therefore there are no health risks to the in using this product. This product can basically be used by anyone, no matter their health state, over the age of 18. This then gives the product as very wide product range, giving it a wide market to sell in. thus it has a highly likelihood of selling in large numbers.

The Function

This product will be used to attach any type of trailer to any type vehicle providing the vehicle has a conventional tow bar and the trailer a conventional hitch. The device will be able to fulfil its task providing the trailer in under a hitch gross weight of 600kg. This device will be large enough so it can cope with the weight of the trailer and also light and small enough so it can be transferred between different trailers. The product size will be as small and as transportable as the components that make it up will allows. Also that product will have to have some bulk to it in order to make it strong and durable.
The product will be easily capable of connecting a trailer a vehicle. It will have to hook over the tow bar of the trailer, then clamp onto it. The product will then lift the trailers hitch up and onto the tow bar of the vehicle that is being used to tow the trailer that the devise is attached to.

The Location

The product will be used in the day-to-day life of many people. Mainly those in the labour industry such as joiners, carpenters and plumbers. The sorts of people that are in contact with trailers on a daily basis. As the product will be outside all the time at the rear of a vehicle it will need to be waterproof and durable, as it will more than likely be hit with debris from the road that has been thrown up by the vehicle towing the trailer.
The product will need to be extremely strong as the forces that will be passing through it when it is in motion during the lifting process. There will be immense forcing passing through the linkages on the product due to the weight of the trailer possibly being up to 600kg.
This product is capable of hitching a trailer to a vehicle in any weather accept whenever the hitch gross weight exceeds 600kg.

Frequency of Use

This product will be used during any hours that a labourer such as a joiner, carpenter or plumber decides to work. An example of those times could be between 8:30am – 5:00pm; this is a generalisation of the times that a labourer such as the ones previously stated would work.
This product could also be used normal household users at anytime whenever they are needed to hitch a trailer onto their vehicle. This device will allow them to safely attach a trailer at anytime of the day. This device could also be used with the same amount of safety at night. This product has a high value of safety, as each part of it has been designed around that factor. As it can be used at anytime of the day this will widen the margins among which is can be sold, which in turn will increase the profit margins of the seller of the product.
This product could also be used by people in the manufacturing industry on a daily basis.

Aspect of Problem

This product will be designed so that it is able to hitch a trailer as efficiently and effortlessly as possible. This allows the types of people that will be using this product such as joiners, carpenters, ad plumbers the ability carry on with other work with the product is attaching their trailer to their vehicle. This means that they can be more efficient with their time and get more work done. This is a plus point for both the customer as well as the labourer.
As no other product exists on the market today to fulfil these tasks this creates a big gap in the market for this product.
The only way in the current day to hitch a trailer is to do it manually which, if not done properly, puts a lot of strain on certain parts of the body.
The design of this product will have to consider different aspects of the tow bar and hitch. That fact that not every tow bar is the same will need to be considered and that the trailers hitches will all be different.

A2 Technology

- 2. Initial Ideas- selection of idea(s) for development.

  High(14-20)

- Analyse in detail existing solutions.
- Produce viable new solutions incorporating a broad range of control systems or product design features.
- Produce viable new product outcomes integrating either system and application of function or product design features, displaying innovation.
- Detail evaluation of each idea based on relevant criteria.
- An appropriate selection of a solution for development.

2 Initial Ideas- selection of ideas(s) for development.

Medium (7-13)

- Analyse with some detail existing solutions.
- Produce some generally viable and new solutions incorporating a moderate range of control systems or product design features.
- Produce some generally viable and new product outcomes either with reasonable integration of system and development in application of function or reasonable product design features, displaying innovation.
- Some evaluation of ideas based on generally appropriate criteria.
- A potentially viable selection of solution for development.

2 Initial Ideas- selection of idea(s) for development.

Low (1-6)

- Limited analysis of existing products.
- Produce some limited solutions incorporating control systems or product design functions.
- Produce some product outcomes with limited integration of system and application of function or limited product design features, displaying innovation.
- Superficial evaluation of ideas based on limited criteria.
- An inappropriate selection of solution for development.
- Zero should be awarded for a response which is not worthy of any credit.

Existing Solutions

AL-KO — AK 300 Coupling Head

Aesthetics
The aesthetics of this product aren't really as good as other products that are on the current market place to fulfil the same job. The fact that this product is manufactured from stainless steel greatly increases its aesthetic appeal to the user. This main purpose of this product though is to attach a trailer to a vehicle safely, not top be the most aesthetically pleasing product on the market. The product being made form stainless steel does add to the aesthetics but not to the same extent as other products.

Ergonomics
This product isn't that ergonomic, as the product isn't supposed to be in much contact with the user. The designers have designed the handle with the user in mind by incorporating finger grips and they would have designed the handle around the average size of an adult male's hand. But apart from these small design features this product doesn't have many ergonomic features.

Life in Service
As this product has been manufactured from a single piece of stainless steel it means that it will never rust or corrode. This ensures that, providing the owner looks after the product, it will have an extremely long life in service.

Environment and Maintenance
The environment that this product has to work in is extremely harsh, it will get attacked with all the dirt and debris that is thrown up from the road by the tow vehicle. In terms of maintenance there is very little to do with this product, apart from the grease nipple on this hitch would need to be greased every few months to stop the mechanism seizing.

Safety
The safety features on this product are pretty limited, as the only features that have been included in its design are the safety indicator at the front of the product and the spring handle. The safety indicator tells the user when the product has been safely attached to the hitch, the red indictor will pop out whenever this process has been completed. The handle on the product has been sprung so that it is always pulling the handle of the product down.

Manufacture and Economics
The manufacture processes for this product are simple and very cost effective. They allow the producer to manufacture in large numbers for an extremely low cost. This low cost method of manufacture allows the seller of this product to sell it on for a greater profit.

Anthropometrics and Size, Shape and Dimensions
This product has been designed with the user in mind. The dimensions of this product allow the user to grip and hold it comfortable without too much discomfort. The designers have created the size and dimensions around the anthropometrics.

Components	Materials	Industrial Production Method	Reasons for this Method of Manufacture
Main Section	Stainless Steel	Die Cast	Die casting is a low cost and relatively quick process of manufacture. This means that the manufacturer can product larges amounts of this product on demand and it wont cost the a lot to make it.
Handle	Stainless Steel	Die Cast	Dies Casting is another example of a manufacturing method that is quick as well as rather low cost. This keeps the costs for the manufacturer down which means the have more profit.
Nuts and Bolts	Carbon Steel	Extrusion	Extrusion is another low cost production method. By doing this the manufacturer can create the product on demand for a low cost to the consumer.
Safety Indicator	ABS	Projection Moulded	Projection moulding is a method of manufacture that allows the producer to create a high detailed product, in large numbers for a low cost. This then means that they can increase their profit margins.

Vipex — Vipex Trailer Coupling

Aesthetics
The aesthetics of this product aren't of great quality. This product has been designed sorely for the purpose of coupling a trailer so in the design the aesthetics have been compromised. The product has manufactured out of carbon steel which has been coated in a chemical which has greatly added to the aesthetics of the product. This small detail has improved the aesthetics of the product but overall it still isn't an aesthetically pleasing as others that are on the market.

Ergonomics
This products ergonomics in general are fine, but it has been found that when it comes to unhitching the trailer that it can be difficult to deactivate the locking latch and then pull up the handle to unhitch the trailer. The act of unhitching that latch is what makes it difficult as the spring in some products is quite stiff. The method of coupling the trailer is made rather easy by this product.

Life in Service
This product has been designed out of a corrosion and rust resistant material. This means that it is very capable of having an extremely long life span in its line of work. The product is manufactured from an extremely durable and impact resistant material which greatly adds to the length of time that the product can be in service.

Environment and Maintenance
This product has rust and corrosion resistant coating such as carbonata steel that has been coated in a chemical. All the parts to the product have been manufactured in the same way this greatly reduces the likely hood of the product rusting. There are very little maintenance jobs to be done on this product but the bolts at the top of the product would need to be lubricated and if the lock was being used on a daily basis it too would need to be coated in a corrosion preventing liquid.

Safety
This product has a safety latch that hooks onto the release handle when the trailer has been attached. This ensures that when the trailer has been attached that it will definitely not be able to uncouple itself. The handle is also spring activated this means that the handle is always under tension to pull it down and hitch the trailer. Apart from that there are no other safety devices on this product.

Manufacture and Economics
This product manufacturing process is relatively low cost and allows the manufacturer to produce a high quality finish. By having a low cost manufacture process it allows the seller of the product to maximise their profit margins and subsequently the designers.

Anthropometrics and Size, Shape and Dimensions
The designers of the above product have considered the safety and comfort of the user while using the product. They have seriously researched the anthropometrics for their product and designed it around them to ensure a comfortable hold.

Components	Materials	Industrial Production Method	Reasons for this Method of Manufacture
Main Middle Section	Carbon Steel	Die Cast	This method of manufacture is of low cost and can easily achieve high product numbers, due to the relatively simple process.
Handle	Structural Steel Alloy	Die Cast	The die casting method of manufacture has low costs as well as being flexible in the amount that can be manufactured in a certain time.
Locking Latch	Aluminium Alloy	Sheet metal then punched and folded	This component being punch means that extremely high numbers can be made in a very short time. This process also creates very little waste material.
Lock Cover	Aluminium Alloy	Sheet metal then punched	Punching sheet metal in to a component for this product creates very little waste material as well as being very flexible for maximum output.
Nuts and Bolts	Carbon Steel	Die Cast	Die casting allows multiple units to be manufactured at once, lowing manufacture costs as well as achieving a high quality finish.

AL-KO — Al-ko 3004 Stabilliser

Aesthetics
The aesthetics of this are actually rather good. This product is very aesthetically pleasing. This is because the designers not only manufactured the product from materials such as machined aluminium but they have created a quite modern design by including curved profiles. The design of the product seems to flow from front to back, as well as including very important safety features and making sure that the user can

Ergonomics
The ergonomics for this product are really good. The designer have definitely kept the minds of the user in mind when there were designing and manufacturing this product. They have manufactured this product in such a way that the safety functions can be acting with little effort but they produce a large force. For example, the large handle that comes over the top of the product is there to be used as a safety brake, it when it is pushed down clamps down hard onto the side of

Life in Service
This product has been designed and manufactured out of corrosion and rust resistant materials. This means that the length of time that the product can be used for is rather long as the materials that it has been manufactured from are capable of coping with the harsh and difficult environment.

Environment and Maintenance
The environment that this product has to be used in is very harsh, it has to deal with a lot of debris and water thrown up by the vehicle. It also has to be able to cope with the weight of a 1.5 tonne caravan. Also there is very little maintenance to be done on this particular product, there only maintenance related act that would need to be followed is whenever the product is actually been attached to the caravan there are 2 grease nipple that would need to be greased regularly to ensure that the braking system on the hitch is able to compress easily whenever the

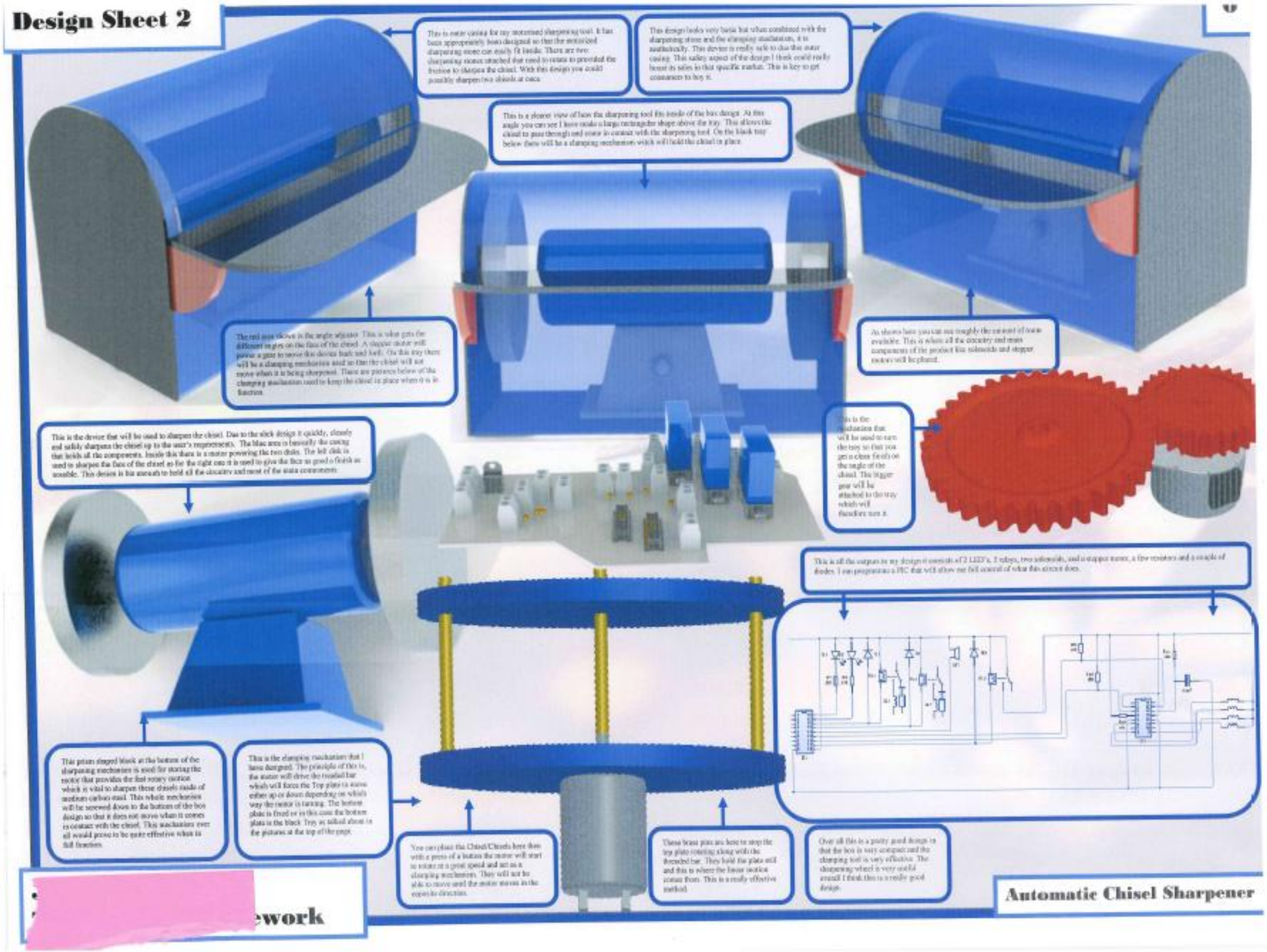
Safety
The safety features on this particular product are extremely good. This product ensures that the user cannot couple the caravan to the vehicle incorrectly. First of all whenever the ball of the tow is inserted properly into the product an indicator will come out from the product telling the user that it has been hitched correctly. Then the user is made put down the stabiliser brake that clamps

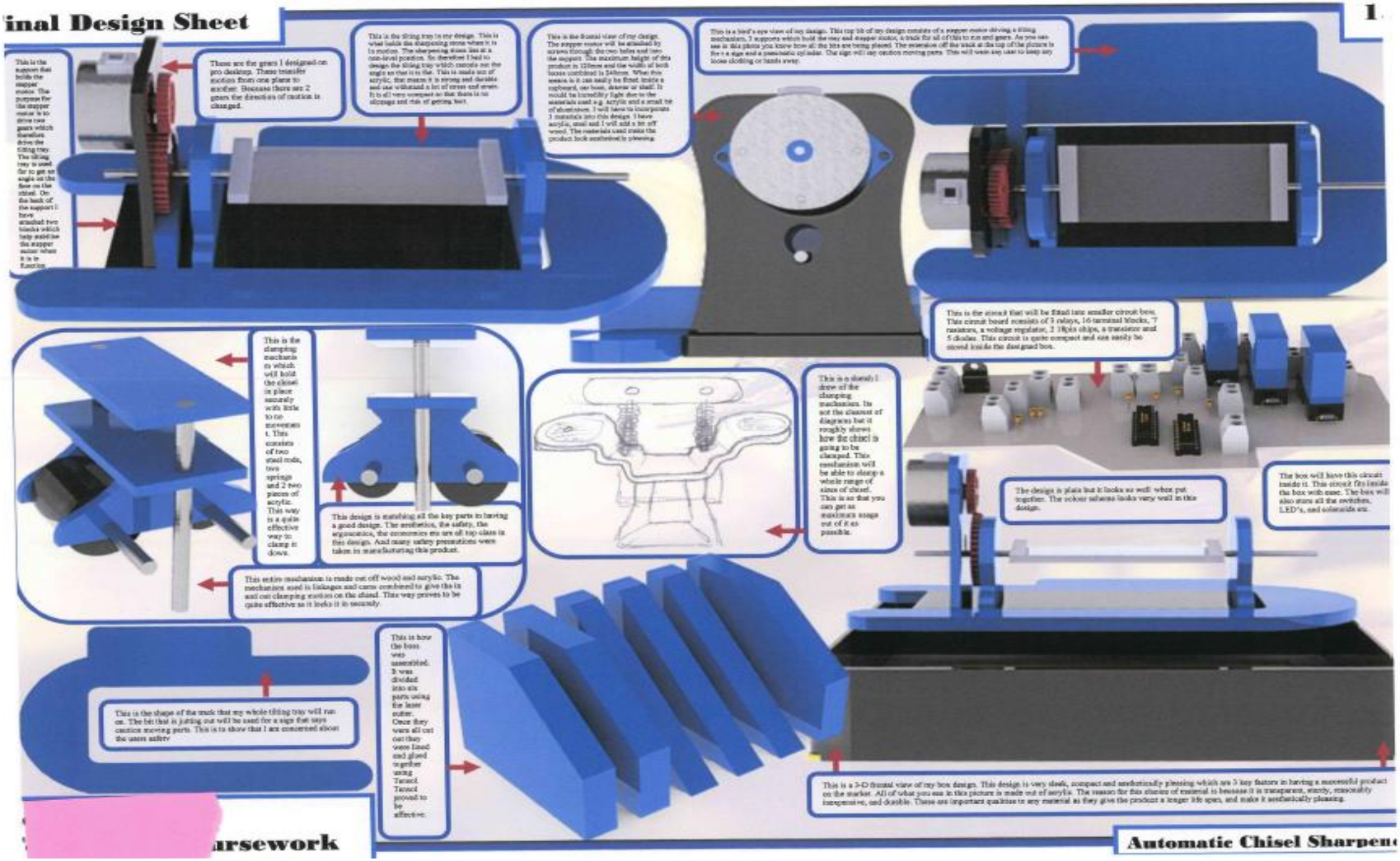
Manufacture and Economics
This product is quite expensive as it is priced at £100. But the price is no object with this product as people will pay large sums of money for it as it is quite aesthetically pleasing while being extremely robust.

Anthropometrics and Size, Shape and Dimensions
The designers have been very focus on the product to make it's as easy as possible for the user to use. The places where the user will have contact the product ware extremely ergonomic.

Components	Materials	Industrial Production Method	Reasons for this Method of Manufacture
Main Centre Section	Aluminium Alloy	Die Cast and then Machined	Die casting is a low cost method of manufacture which creates a high level of detail as well. This part has then been machined with a CNC router to complete the manufacture process.
Safety Handle Arm	Aluminium Alloy	Die Cast and then Machined	Die casting this product allows the company to manufacture large numbers along side creating high quality products. This product has then been machined with a CNC router to finish the process.
Safety Operation Handle	ABS	Projection Moulded	Projection moulding allows the manufacture to create large numbers of the product in large batches. This keep cost low. This method of manufacture also creates a good finish.
Hitching Handle	Carbon Steel	Die Cast	The manufacturing method of die casting allows the company to create a high quality product in large batches without very little waste for a relatively low cost.

Rewarding Learning

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1
Automatic Chisel Sharpen
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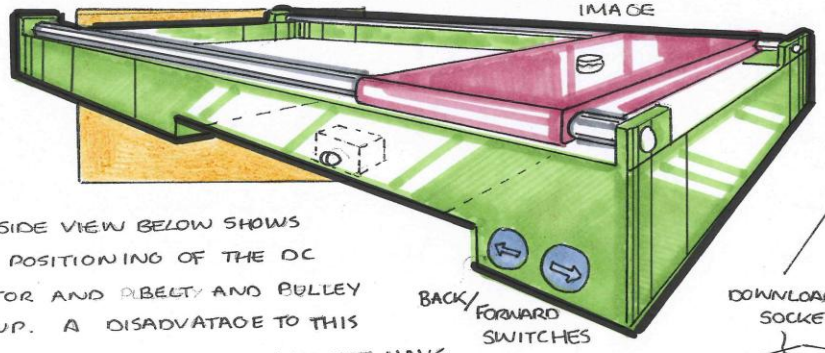
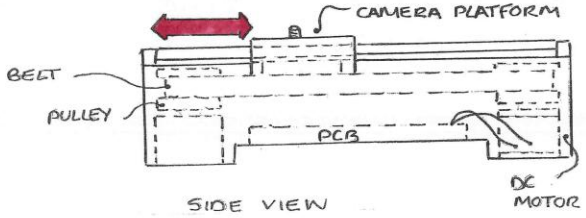
INITIAL IDEA 5

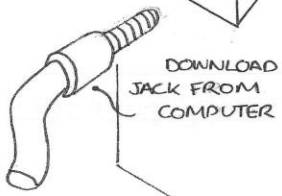
ONE DISADVANTAGE TO USING THE BELT AND PULLEY SYSTEM IS BEING ABLE TO ACHIEVE A SMOOTH MOVEMENT OF THE CAMERA PLATFORM. THE BEARINGS THAT THE CAMERA PLATFORM MOVE ON NEED TO ENABLE TO MOVE THE PLATFORM SMOOTHLY TO PRODUCE A GOOD QUALITY IMAGE

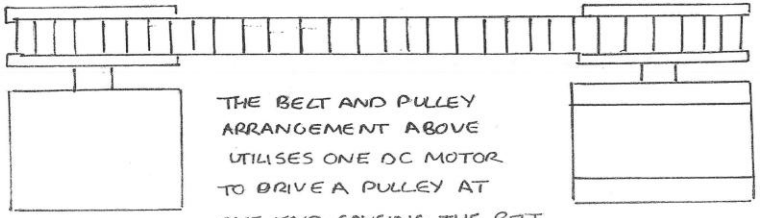


THE SIDE VIEW BELOW SHOWS THE POSITIONING OF THE DC MOTOR AND BELT AND PULLEY SETUP. A DISADVATAGE TO THIS SETUP IS ONE DC MOTOR MAY NOT HAVE ENOUGH TORQUE TO MOVE THE CAMERA PLATFORM

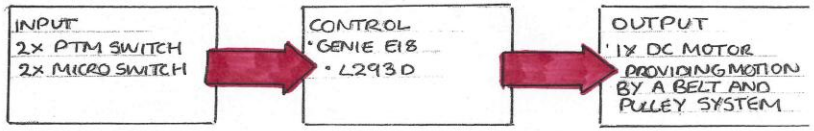


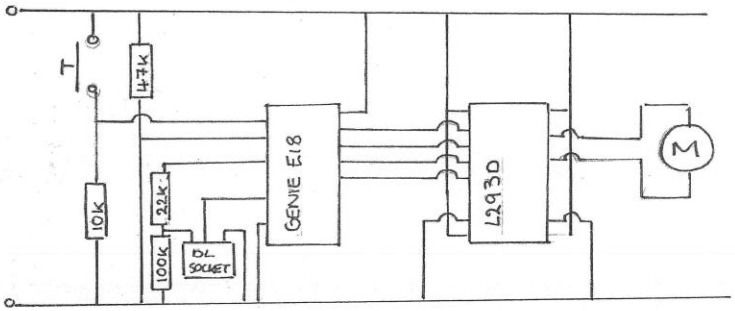
SIDE VIEW



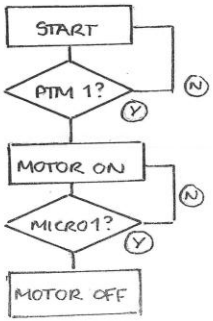


THE BELT AND PULLEY ARRANGEMENT ABOVE UTILISES ONE DC MOTOR TO DRIVE A PULLEY AT ONE END CAUSING THE BELT TO ROTATE





IN THIS CIRCUIT A L293D IS BEING USED TO DRIVE A DC MOTOR IN THE BELT AND PULLEY SETUP. A DOWNLOAD SOCKET HAS ALSO BEEN INCLUDED TO SHOW HOW THE FLOWCHART PROGRAM CAN BE DOWNLOADED TO THE GENIE E18 CHIP



THIS FLOWCHART SHOWS THE CIRCUIT WILL WAIT UNTIL CERTAIN SWITCHES ARE PRESSED BEFORE THE MOTOR CAN BE TURNED ON AND OFF

Selection of Ideas…

The process of selecting one of my 5 designs to manufacture will involve evaluating the positive and negative points of the designs. I will use the areas explored in my specification to evaluate my initial ideas.

Materials Due to the fact that I am manufacturing my product in the school workshop, the variety of materials available will be limited. Ideally for my product I would like to use materials like Aluminium and ABS, as a high quality finish can be achieved with these materials. However for the chosen prototype that I will manufacture I will use materials like Acrylic, MDF and Polystyrene

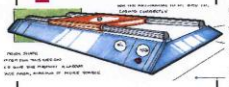
Aesthetics I believe that all my products have aesthetic appeal. However **Designs 4** and **5** are quite basic featuring a simple cuboidal shape making them rather dull and boring to look at. **Designs 2** and **3** feature more interesting designs avoiding the simple box shape. In my opinion **Design 2** is the most aesthetically pleasing out the five designs as it has smooth flowing lines giving it a more modern feel than the other designs.

Ergonomics My designs are not handheld, meaning anthropometrics was not the main focus when designing the concepts. In my opinion all the initial ideas have been designed keeping ergonomics in mind. This can be seen in the positioning of the operating switches, their location on the front of most of the designs, apart from **Design 2** were the buttons are positioned on the side of the casing. Also enough space have been left between each switch to ensure that the wrong switch is not pressed.

Safety The main area of safety included with this products would be whether the system would be protected from the elements and any components are properly insulated from the user. **Design 2** features a casing that encloses the mechanical system meaning that the elements cannot effect the workings of the mechanism. However the rest of the designs feature open tops which mean that the mechanical system will be exposed to the elements, for example moisture from rain.

Manufacturing Processes As my product will be manufactured in the school workshop, the manufacturing processes available to me will be limited to the tools and machinery in the workshop. If I were to be manufacturing my product using industrial techniques I could use processes like blow and injection moulding create the casing

1



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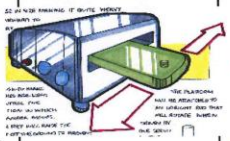

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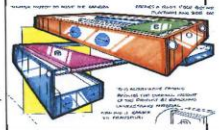

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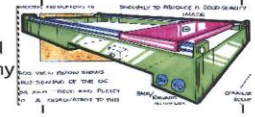


When manufacturing my product I want to be as cost and time efficient . The designs that would be most time and cost efficien to manufacture would be **Designs 2** and **4** as they feature simple casings which would involve few manufacturing processes to produce. **Design 3** would take the most time and money to make due to the number of parts involved and also the intricacy of the mechanical system.

Systems

All my concepts are designed to move a camera in a linear motion to achieve smooth and high quality footage. This is achieved by incorporating a variety of mechanical processes.

Design 1 uses a bevel gear setup to rotate a threaded bar that in turn moves the platform the camera is attached to. One disadvantage of using this system would be the large amount of space taken up by the bevel gears due to their orientation.
Design 2 uses a servo motor with an upright rod attached to move the camera platform. Instead of moving the camera platform linearly, this system moves the platform in an oscillating motion. This is another way to move the camera however it is not desirable for my finished product. Again this mechanism is bulky meaning the casing size would increase
Design 3 uses either a worm and wheel or rack and pinion setup. The worm and wheel can be difficult to line up and get the gears to mesh together as is the rack and pinion. However the rack and pinion can provide a smooth motion for the camera so high quality footage can be achieved.
Design 4 features a threaded bar driven by a stepper motor. This is the most likely system I could use for my final product as it doesn't take up too much space in the casing, and produces enough torque to move the camera.
Design 5 uses a belt and pulley system driven by a DC motor. This is my least favourite system out of the five as it is hard to achieve a smooth movement of the camera and the belt is liable to slip off the pulley.

Conclusion: Having considered both the positive and negative aspects of all 5 designs I have decided to further develop Designs 3 and 4. Design 3 features the rack and pinion setup which in my opinion could be adapted successfully into my final product. It is also aesthetically and ergonomically pleasing. Design 4 features the threaded bar setup which is another mechanism I could consider using for my final product . The casing is also quite simple meaning this design could be

A2 Technology

3 Development

High (14-20)

- The control system is highly developed to outcome.
- Clear evidence of numerical analysis in development.
- The product is highly developed to integrate system with the user and environment.
- Clear evidence of ergonomic and aesthetic development.
- Present a detailed plan of manufacture.
- Produce at a high level working drawings for manufacture.

A2 Technology

3 Development

Medium (7-13)

- The control system is reasonably developed to outcome.
- Some evidence of numerical analysis in development.
- The product is developed with some integration of system with the user and environment.
- Some evidence of ergonomic and aesthetic development.
- Present with suitable detail a plan for manufacture.
- Produce suitable working drawings for manufacture.

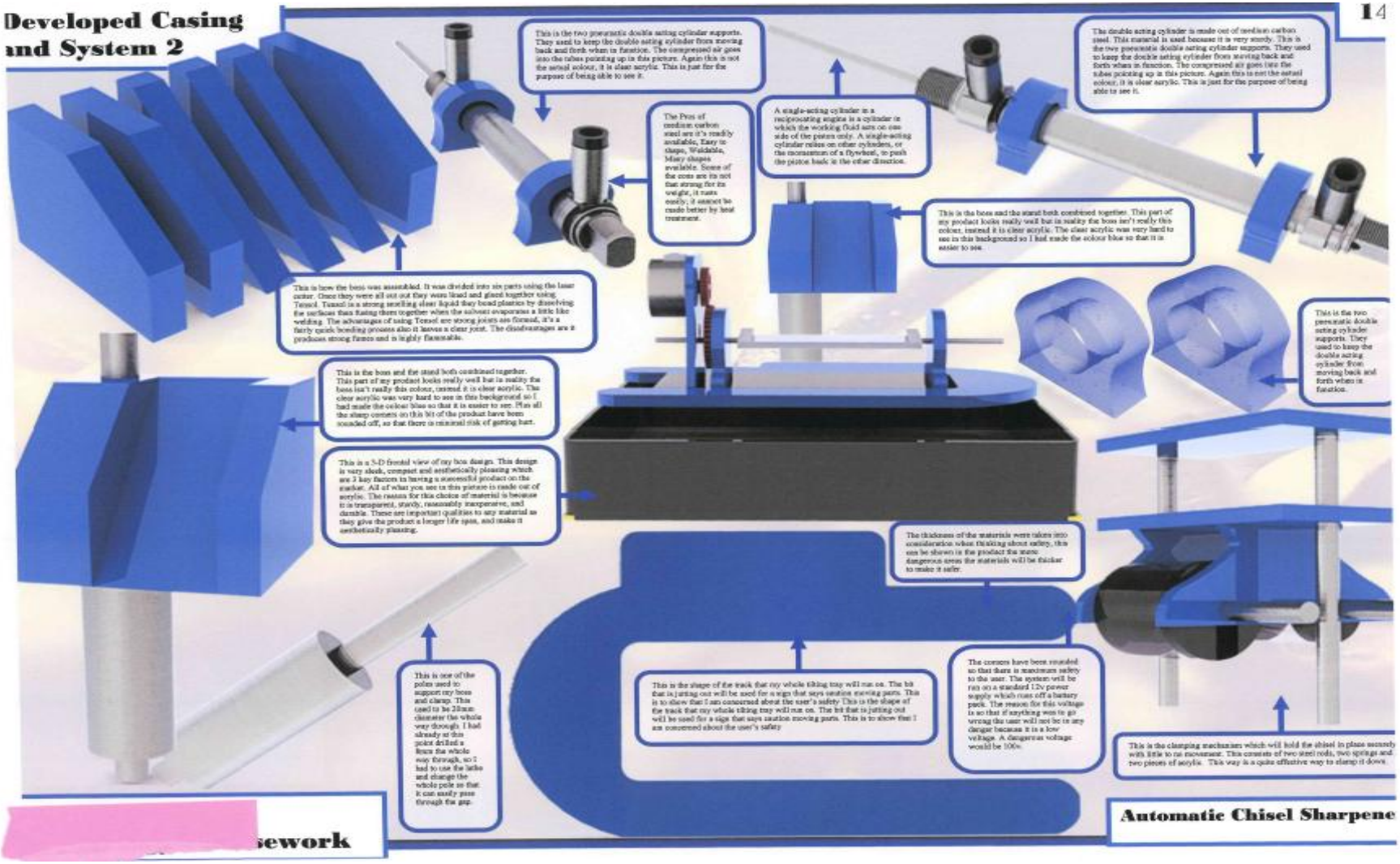
A2 Technology

3 Development

Low (1-6)

- The control system is superficially developed to outcome.
- Limited evidence of analysis in development.
- The product is developed with limited integration of system with the user and environment.
- Limited evidence of ergonomic and aesthetic development.
- Present with limited detail a plan for manufacture.
- Produce with limited detail working drawings for manufacture.
- Zero should be awarded for a response which is not worthy of any credit.

Developed Casing and System 2



sework

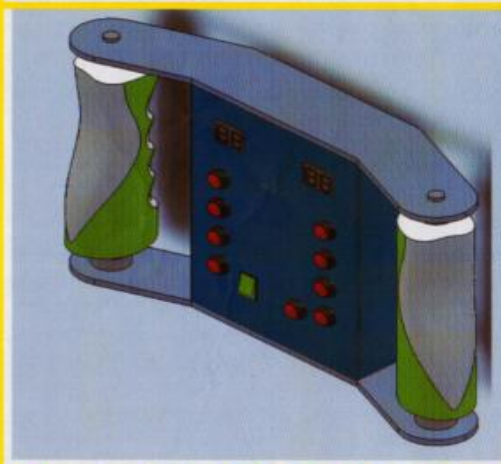
Automatic Chisel Sharpene

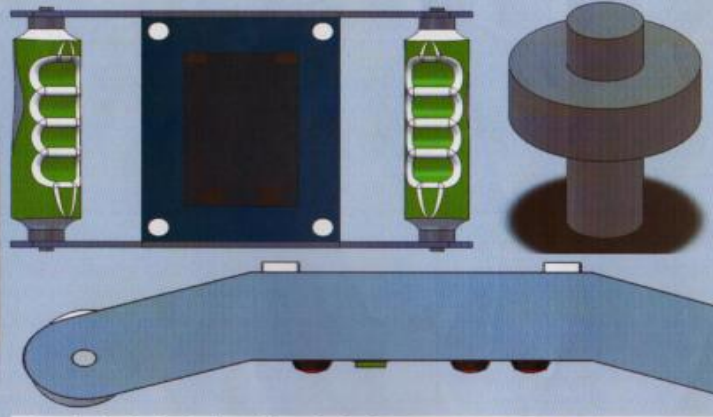
20.jpg - Windows Picture and Fax Viewer

Final Design

Design

Having evaluated all my designs as I went a long I found that all of my idea where not as aesthetically pleasing or as functional as I would like. With that in mind and all the best ideas from previous designs I came up with this my final design. I feel that it is more functional and aesthetically pleasing than the rest.





Ergonomics and Anthropometrics

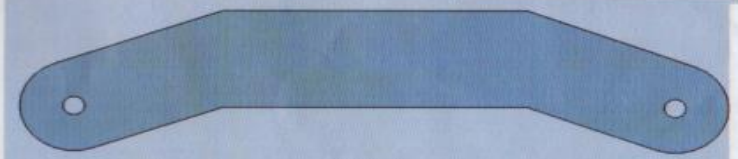
On the most important things in this design besides that it functions are the ergonomics of the product. In designing the product I was determined to ensure it was as ergonomic as possible. The main ergonomic feature is the two handles. These handles have been designed using anthropometric principles, this means that it will fit into the hand very comfortably. The back of the handle has been contoured to fit nicely into the palm of the hand. The front of the handle has finger groves which are spaced out so has when holding the handle it is comfortable and will not cause undue strain on the hand. The groves themselves are such that they are large enough to fit a wide range of hand sizes but not too large that they would become uncomfortable. The handles themselves swivel for maximum comfort; this will also allow the user to reach the buttons from the handle, a very important feature. The buttons have been spaced out so that they are easy to press form the handle but not so 2 or 3 could be pressed at once. The displays are bright and can be read easily at a glance. All of these features make a very good product that will be easy and comfortable to use.

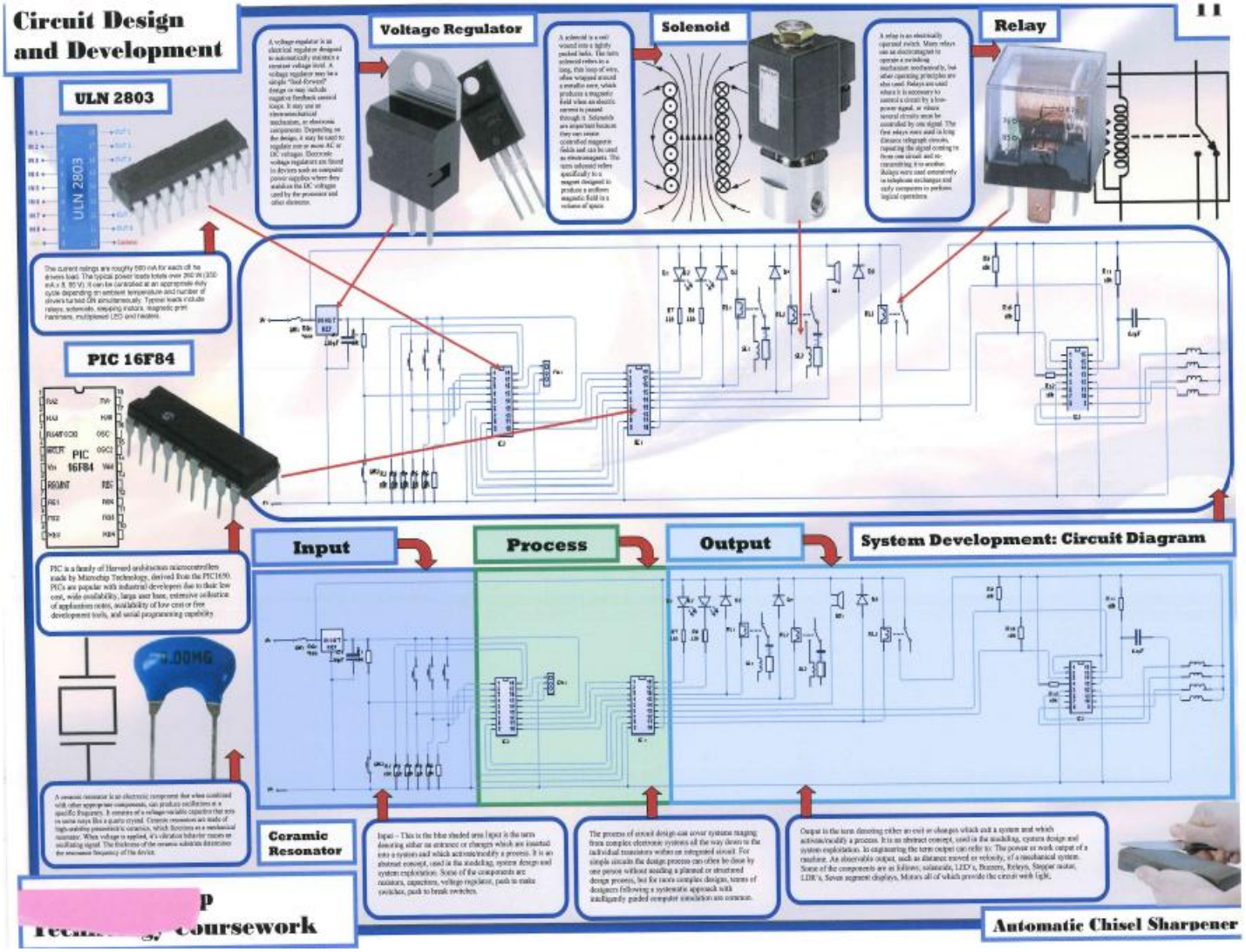
Aesthetics

Aesthetics are also and important part of any product and mine is no exception. I wanted the product to look modern and clean. I feel I have achieved this with this design. The central box which houses all the electronics is a clean rectangle, it is blue and has white bolts and the top braces are also white this gives an appealing look. I have been keeping to the colours of the international Rugby Board Green, Blue and White. The handles are Green, not only odes this match my colour scheme it is also the colour for "safe condition" this will encourage the user to hold the product by the handles. There is white also in the handle to try and brake up the green. The whole product will have a polished finish; it will be smooth and finished to a high standard. The aluminium bosses on the handles will have a machined finish; these are to strengthen the handles.

Features

The main feature of this product is the swivelling handlings, these are important for the ergonomics, anthropometrics and aesthetics. The displays are large and bright to be easily seen. The back panel is translucent so that you can see red or yellow illumined from it.



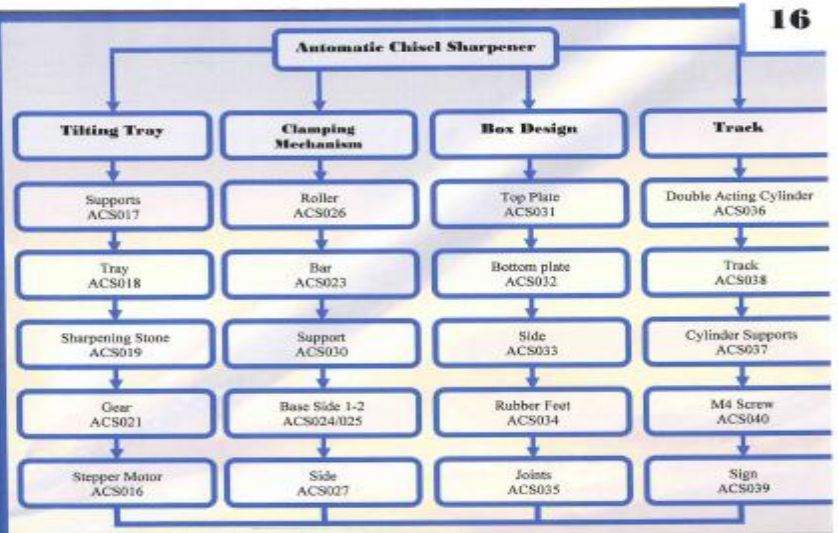

Circuit Design and Development
ULN 2803
Voltage Regulator
Solenoid
Relay
PIC 16F84
Input
Process
Output
System Development: Circuit Diagram
Ceramic Resonator
Automatic Chisel Sharpener

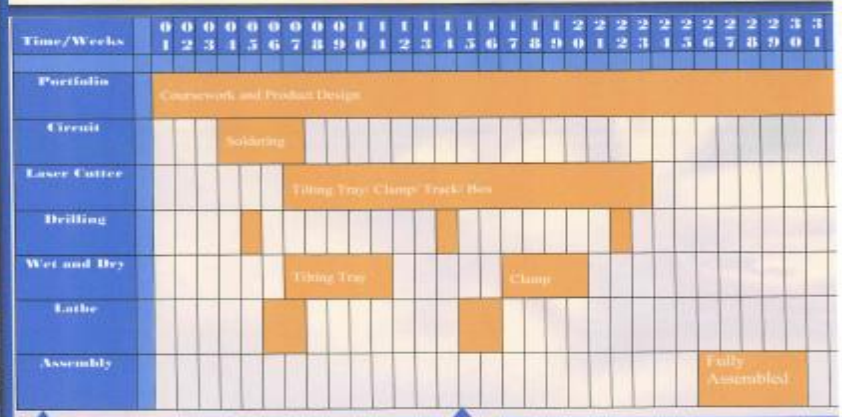
Plan of Manufacture

Component	Component No.	Quantity	Material	Material No.	Method of Manufacture	Finish
Circuit						
Voltage Regulator	ACS001	1	----	ACSM001	----	----
Capacitor	ACS002	1	----	ACSM002	----	----
Terminal Block	ACS003	16	----	ACSM003	----	----
10K Resistor	ACS004	4	----	ACSM004	----	----
18 Pin PIC	ACS005	1	----	ACSM005	----	----
16 Pin UUN	ACS006	1	----	ACSM006	----	----
Ceramic Resonator	ACS007	1	----	ACSM007	----	----
Diode	ACS008	5	----	ACSM008	----	----
Relay	ACS009	3	----	ACSM009	----	----
Solenoid (SPV)	ACS010	1	----	ACSM010	----	----
Toggle switch	ACS011	1	----	ACSM011	----	----
10 Mil Switch	ACS012	6	----	ACSM012	----	----
Buzzer	ACS013	1	----	ACSM013	----	----
LED	ACS014	1	----	ACSM014	----	----
330Ω Resistor	ACS015	4	----	ACSM015	----	----
Tilting Tray						
Stepper Motor	ACS016	1	Carbon Steel	ACSM016	----	----
Supports	ACS017	3	8mm Acrylic	ACSM017	Laser Cutter	Polished
Tray	ACS018	1	5mm Acrylic	ACSM018	Laser Cutter	Polished
Sharpening Stone	ACS019	1	India Oil Stone	ACSM019	----	----
Bar	ACS020	2	Carbon Steel	ACSM020	Extruded	Sanded
Gear	ACS021	2	Thermosetting Plastic	ACSM021	----	Polished
M4 Screw	ACS022	6	Zinc	ACSM022	----	----
Clamping Mechanism						
Bar	ACS023	2	Carbon Steel	ACSM023	Extruded	Sanded
Base Side 1	ACS024	3	10mm Acrylic	ACSM024	Laser Cutter	Polished
Base Side 2	ACS025	3	10mm Acrylic	ACSM025	Laser Cutter	Polished
Roller	ACS026	2	Acrylic	ACSM026	----	Polished
Side	ACS027	2	3mm Acrylic	ACSM027	Laser Cutter	Polished
Joint	ACS028	1	3mm Acrylic	ACSM028	Laser Cutter	Polished
Top	ACS029	1	3mm Acrylic	ACSM029	Laser Cutter	Polished
Support	ACS030	2	Aluminium	ACSM030	Extruded	Polished
Box Design						
Top plate	ACS031	1	3mm Acrylic	ACSM031	Laser Cutter	Polished
Bottom plate	ACS032	1	3mm Acrylic	ACSM032	Laser Cutter	Polished
Side	ACS033	2	3mm Acrylic	ACSM033	Laser Cutter	Polished
Rubber Feet	ACS034	4	Rubber	ACSM034	Injection Moulded	
Joints	ACS035	4	10mm Acrylic	ACSM035	Laser Cutter	Polished
DAC and Track						
Double Acting Cylinder	ACS036	1	Carbon Steel	ACSM036	----	Sanded
Cylinder Supports	ACS037	2	10mm Acrylic	ACSM037	Laser Cutter	Polished
Track	ACS038	1	8mm Acrylic	ACSM038	Laser Cutter	Polished
Sign	ACS039	1	3mm Acrylic	ACSM039	Laser Cutter	Polished
M4 Screw	ACS040	4	Zinc	ACSM040	----	----

This table shows all the materials used in my finial design. It also shows how that material was manufactured and how the material was finished. There are 5 different parts to my project.

[redacted]work



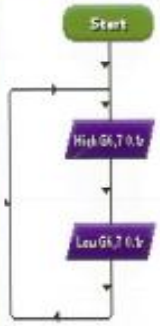


This is the production plan of my project. This shows some of the different stages of manufacturing and how long it took me to do it all. There were some delays in this process due to bank holidays, Halloween, Christmas, Easter and half term.

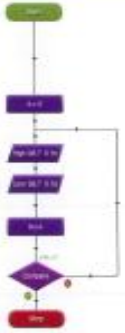
Production Plan

Automatic Chisel Sharpener

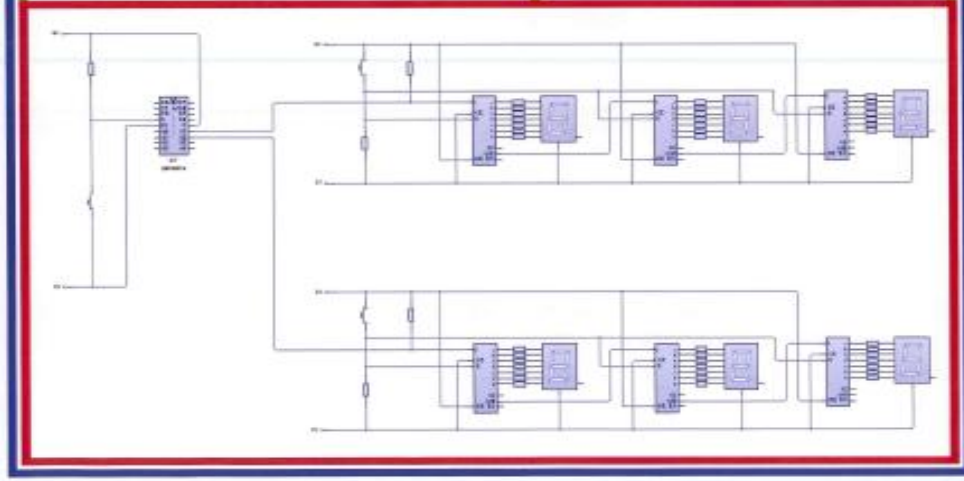
Development of Programming



This is the first program that I designed. This program is very basic, and just sent out an active high signal followed by a active low signal. This had the effect of continuously adding on one point to the score without stopping, until the scores reached 999, at which they would just reset and start counting from 0 again.
I ran this program on this circuit, so both the 4026 triple displays were counting simultaneously. However I didn't want my circuit to just keep counting continuously, so I had to redevelop my program.

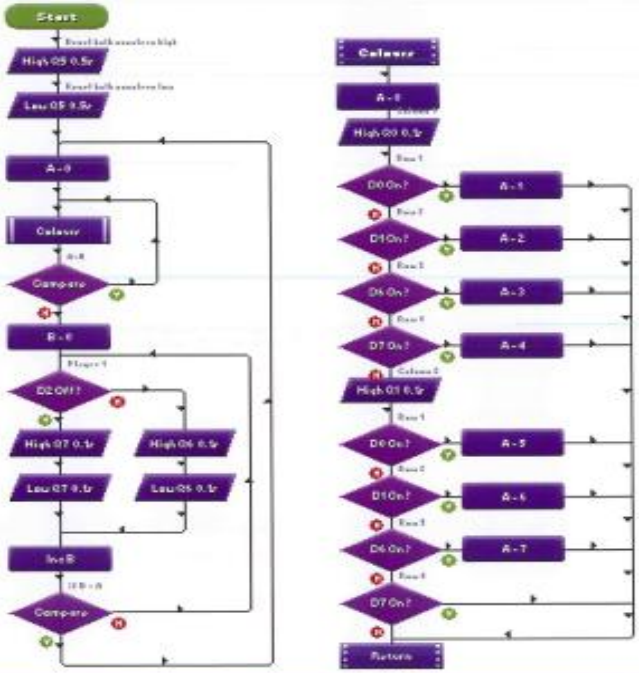


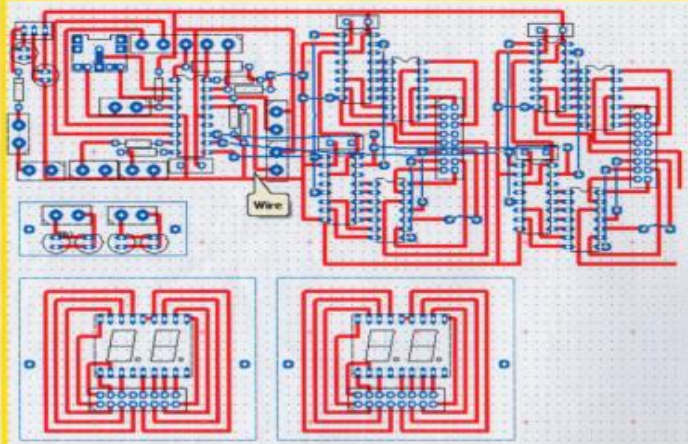
This is the second program that I designed. What it does is send a high signal to Q6 & Q7, then a low signal to them both immediately after. The program is told to repeat this process until the score is 7, and then stop sending out signals. I used this program on the exact same circuit that I used with my last program, and it worked out as planned. I knew at this stage that I was ready to add in my keypad and start to develop my final program



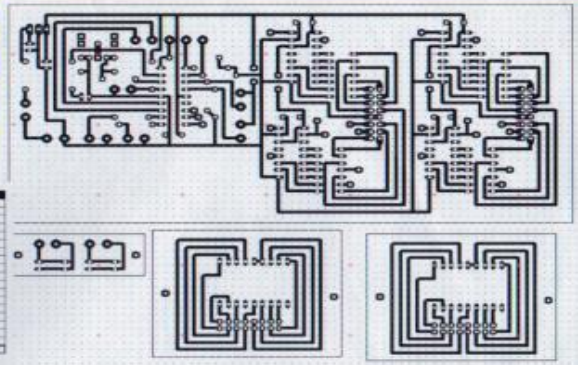
FINAL PROGRAM

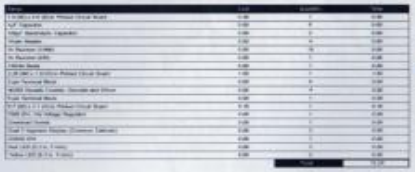
This is the actual program that I will be using in my circuit. This program shows allows me to have 7 different buttons that are in a matrix of switches, and program them so that when each one is pressed, it will add on a different value to the score that is displayed on the & segment displays. This program also allows me to toggle between 2 displays, and this means that I can show the scores of 2 players who are playing against each other at one time

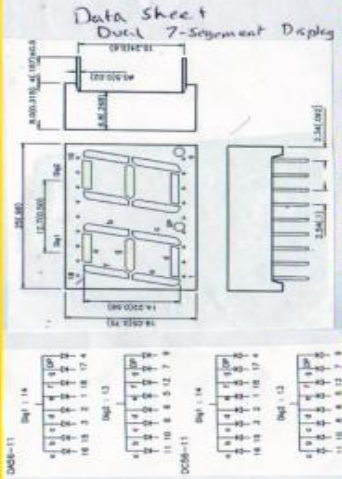




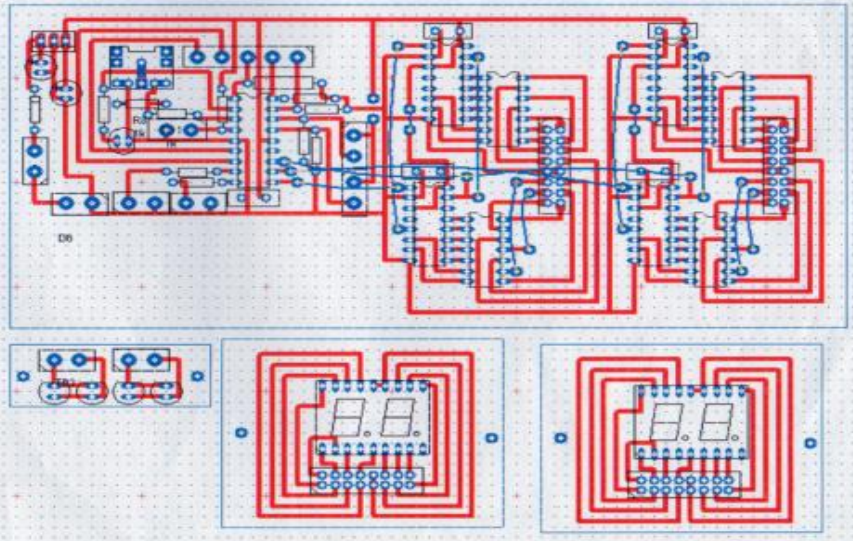
To the left is my 3rd draft of the PCB again I have rearranged things slightly and mad all the connections. At this point it is mainly a case of double checking everything and seeing if there is any way to make it smaller.







To the right is my fourth and final draft. From the last I have tidied the whole PCB up and I put in the final components and connections. A few things have been moved around and changed in order to make the board more compact. I have also enlarged some of the contacts to ensure a good connection can be made. The final board will be printed on acetate (seen above) and then developed using the chemical tanks. Once made I will have the board with all the copper tracks and contacts and I will have to solder in all the components being careful to ensure that the resistors are the right value and all components are soldered correctly. Then I will program the PIC via the download socket fitted to the board. As some of the inputs and outputs have changed my program will have to be altered slightly to take account for this. Then it will be ready to be mounted in my product.



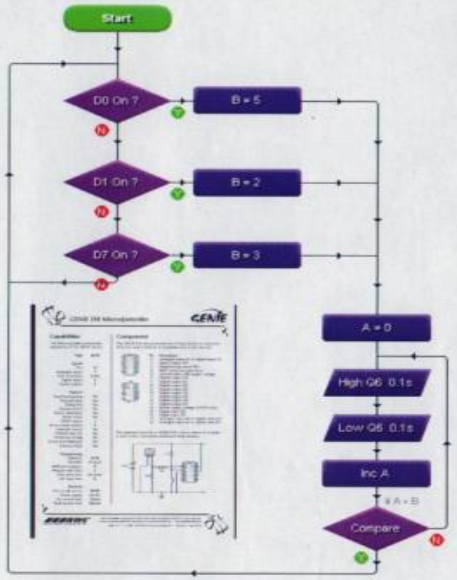
Circuit Ideas

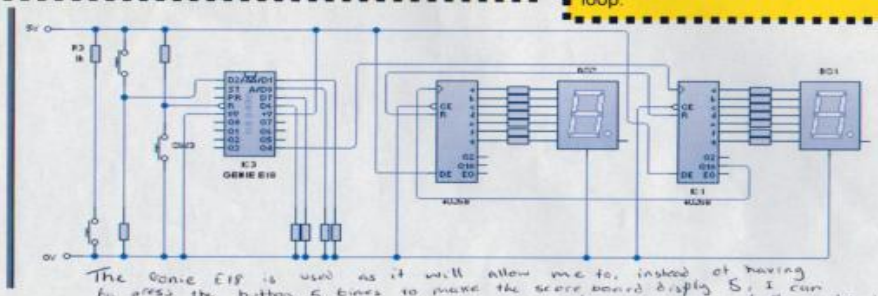
Circuit

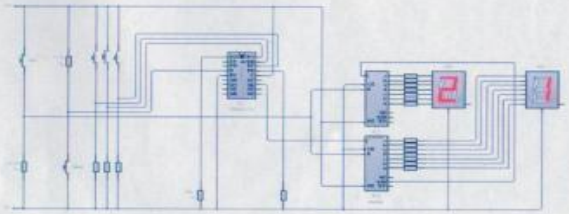
Below is a circuit similar to the one the previous page only witn the notable addition of a Genie E18 PIC. The PIC is a microcontroller with 18 pins. Its has 5 inouts and eight outpt pins. It also has a reset pin, progamming input, status output pins along with a power and ground pins. What makes this PIC usefull is that it is programable via a dowload socket fitted to the circuit board. This PIC allows me to program the cricuit for my own specific application. It runs of a 5 volt powersupply and the download socket requires two resistors one of 22k and one of 100k, this can bee see in that data sheet. The circuit below shows the how the E18 could be used to drive two 4026 up counters which inturn drive 7 segement displays. The input D2 could be programed so that when a high signal is detected it will cause the output Q4 to pluse high 3 times. The output Q4 is connected to the 4026 up counter that will be increcented by 3 ans the display will show 3, this would make the counter count up in 3s. this is just on example of and endless stream of possibilities I have from the programmable chip. The reset id detected by an active low signal and will reset the PIC thus restarting the program from "start".

Program

To the right we can see an example program I have used in this circuit. The circuit has 3 inputs. It starts off and checks if each of the inputs is on (D0, D1 and D7). If it does not detect that an input is on it will loop back round and start the check sequence again. If it does detect an input is on for example D0 the next part of the program is the expression B=5 for input D0. The expression tells the PIC how much to add on each time it needs to be incremented. The next part of the sequence starts with A=0, this set the variable A to 0. It will then set the output Q6, which is connected to the 4026 counter, high and the low again. The will increment the timer by one. The next command is to increment a. What this will do is add one to A making A=1. The final command is a compare. It is set to compare A=B. seeing as we are using input D0 as an example B=5, so once the PIC has incremented A 5 times A will equal B this will the send the sequence back to the start. The whole program is one big loop.

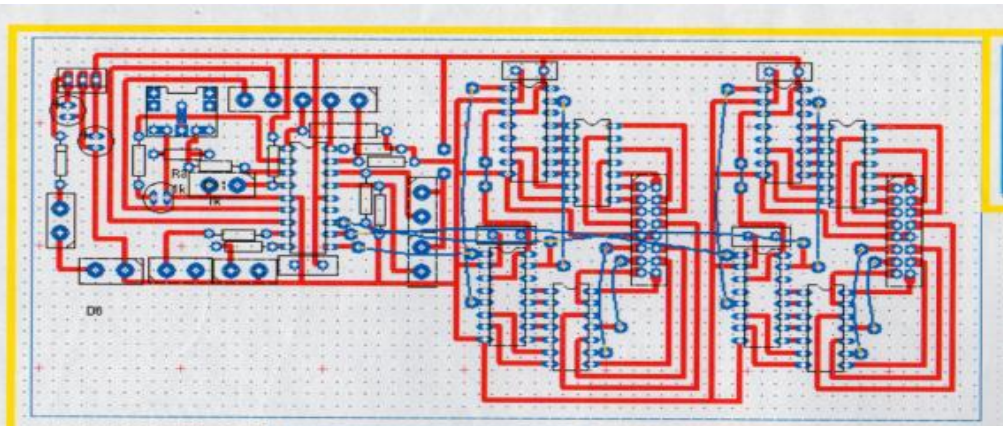


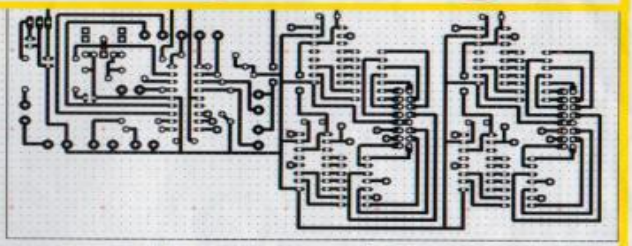


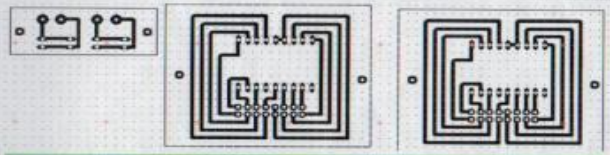


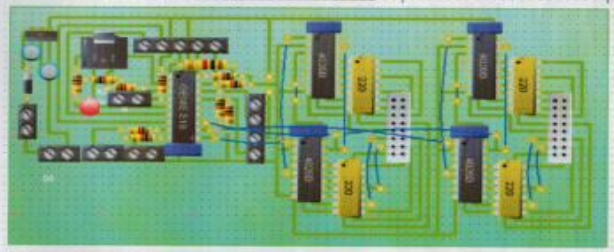
The Genie E18 is used as it will allow me to, instead of having to press the button 5 times to make the score board display 5, I can programme the PIC so that when a button is pressed it will increment the counter by 5, 3 or 2 depending on the score.

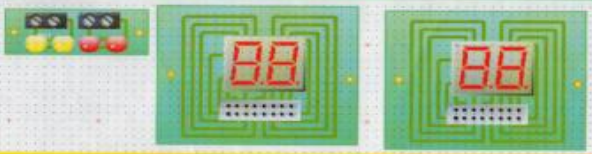
Final PCB





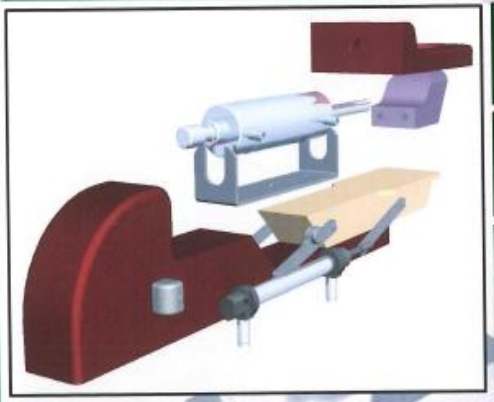






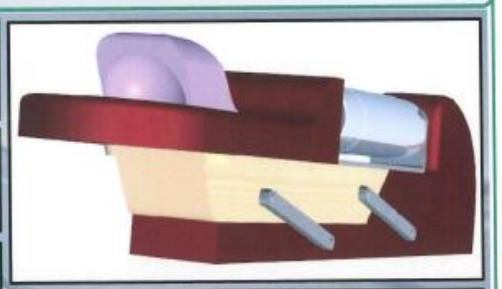
Name	Cost	Quantity	Total
1.6 (W) x 0.6 (H) in Printed Circuit Board	0.40	1	0.40
1µF Capacitor	0.00	5	0.00
100µF Electrolytic Capacitor	0.00	2	0.00
16-pin Header	0.00	4	0.00
1k Resistor (1/4W)	0.00	10	0.00
1k Resistor (2W)	0.00	1	0.00
1N34A Diode	0.00	1	0.00
2.25 (W) x 1.8 (H) in Printed Circuit Board	1.80	1	1.80
2-pin Terminal Block	0.00	9	0.00
4026B Decade Counter, Decoder and Driver	0.00	4	0.00
5-pin Terminal Block	0.00	1	0.00
6.7 (W) x 3.1 (H) in Printed Circuit Board	8.16	1	8.16
7805 (5V, 1A) Voltage Regulator	0.00	1	0.00
Download Socket	0.00	1	0.00
Dual 7-Segment Display (Common Cathode)	0.00	2	0.00
GENIE E18	0.00	1	0.00
Red LED (0.2 in., 5 mm)	0.00	3	0.00
Yellow LED (0.2 in., 5 mm)	0.00	2	0.00
		Total	12.24

Final Design



This is the design page of my final design. This is what I would like my product to look like when I have finished the manufacture of it. There will probably be a few changes as due to the machines and capabilities of the school workshop I won't be able to make the design identical to this one on this sheet. This design includes the major and best qualities of my other design and incorporates them into one design page, to make a good product.

The screen shot on the left shows the product in the album view all split up into its component parts. It shows just how many parts there are in the design to make up the final design of my product, which adds to the complications whenever it comes to manufacture in the school workshops. As it sometimes occurs that the machines in the workshop such as the laser cutter and the CAM router may not be able to manufacture some of the design s that I come up with.



The component drawing shows that the mid section has been manufactured from wood which has then been coated in a heavy duty clear varnish to protect it from weathering and harsh conditions as well as adding to the aesthetics appeal.

The screenshot on the left is the concept for the parallel linkage. The advantage with using as linkage like this is that as long as the holes for the pins are fixed in position the rest of the linkage can be made to any shape as long as the overall dimensions are the same as the original drawing.

The above screen shot is of the front view of the product, it makes it easy to see parallel linkage and the from bat socket as well as the front clamp that does all the main work in the product, making it the mot important component.

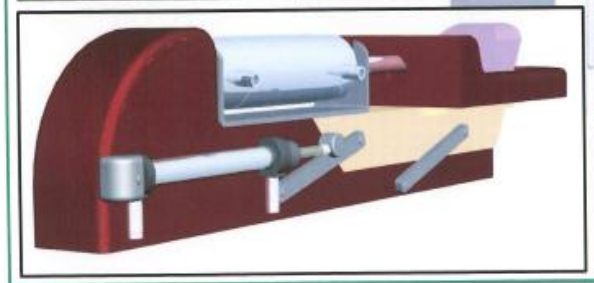
Also in the component drawing above it makes it easy to see what each component has been coated with when the manufacturing has finished. The main section that holds all of the other components has been manufactured from a hard wood that has been painted in a heavy duty paint to protect it from weather as well as drastically improving the aesthetics of the product. The same thing has been done to the front clamp on this product. The parallel linkages and the brackets that hold the two cylinders have been manufactured from machined aluminium. This is a strong material as well as being lightweight and corrosion resistant making it the perfect material to be manufacturing these components from.

The below screen shot is of the rear view of the product. It shows the sleek design of the product that helps to catch people's eye when they went to purchase the product when it is on the shelves in the shops. The front bracket on the product has been manufactured out of a special material specifically design for the CNC Router.

This material is lightweight has when it is routared it creates a very smooth surface. This material is good for prototyping as it is easy to work with and responds well to sanding. But when the product would be manufactured for real it would me manufactured from cast iron as it is a heavy duty and strong material, which will take well to being powder coated.

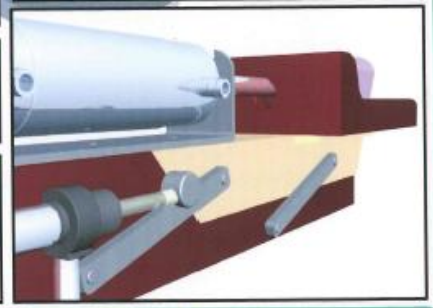
As long as the original size of the new drawing is the same then the linkage will still be able to work as well as a plain straight linkage. This advantage means that the designer can greatly improve the aesthetics of the product without changing any of its practical capabilities.

The above screen shows the design drawing of the product when it in is the CAD software ProDesktop. It shows all the components of the product before they have been rendered.



The screen shot on the right shows the close up of the bracket that holds the end of the cylinder onto the parallel linkage. This means that the product will be able to move smoothly and freely. The will ensure that the product will be able to attach itself safely and easily to the hitch of the vehicle. The cylinder has been hinged at the front and at the back of the product to ensure that the cylinder is able to move smoothly when it is activated.

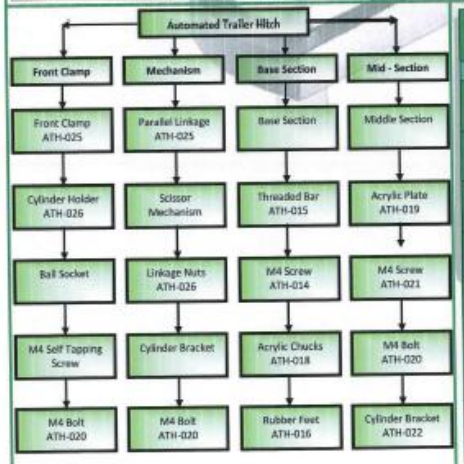
In the screenshot on the right it is easy to see the bracket that holds the top cylinder into place, it has been manufacture from aluminium. Aluminium an ideal material to make the bracket from as it is lightweight as well as being aesthetically pleasing. As aluminium is a soft metal it means that it is easily bent into the desired shape.
The screen shot on the right shows the rear view of the product. It is easy to see the hole in the back of the front clamp that is used to attach the front of the cylinder to rear of the front clamp. The two will be attached with a nut inside the clamp and the cylinder will be screwed into the nut.

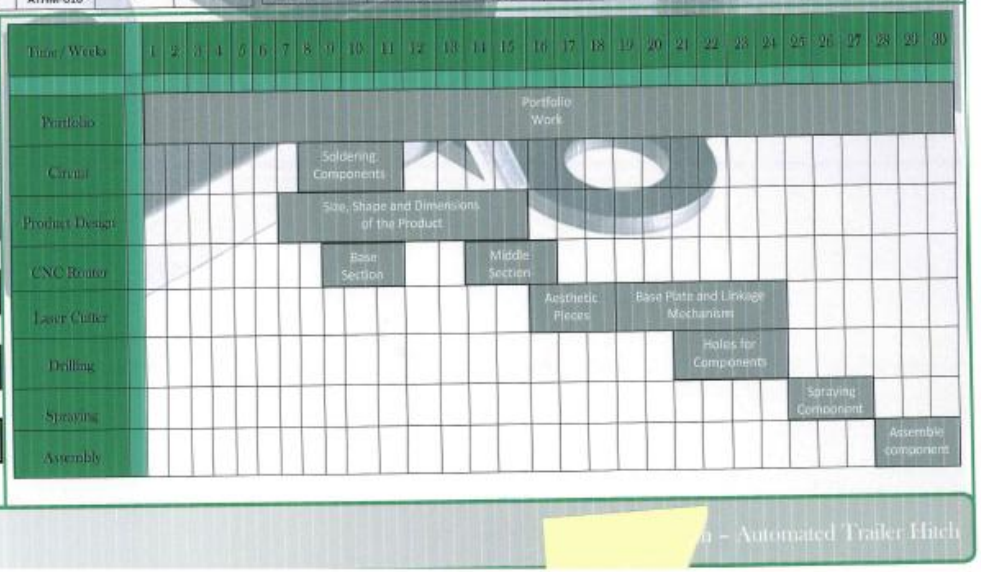


Plan of Manufacture

Component	Component Number	Component Description	Quantity	Material	Material Number	Method of Manufacture	Finish
Circuit							
10K Resistor	ATH-001	10K Resistor	9	-	ATHM-001	-	-
Diode	ATH-002	1N4001 Diode	4	-	ATHM-002	-	-
Toggle Switch	ATH-003	Toggle Switch	1	-	ATHM-003	-	-
Push Switch	ATH-004	Push-To-Make	4	-	ATHM-004	-	-
Voltage Regulator	ATH-005	7805	1	-	ATHM-005	-	-
Solenoid 3 Port Valve	ATH-006	5 Port Valve	1	-	ATHM-006	-	-
Terminal Block	ATH-007	Terminal Block	11	-	ATHM-007	-	-
Relay	ATH-008	9V Relay	4	-	ATHM-008	-	-
Capacitor	ATH-009	Capacitor	1	-	ATHM-009	-	-
28-Pin PIC	ATH-010	PIC 16F873	1	-	ATHM-010	-	-
18-Pin ULN	ATH-011	ULN 2803	1	-	ATHM-011	-	-
330Ω Resistor	ATH-012	330Ω	1	-	ATHM-012	-	-
Ceramic Resonator	ATH-013	4.00 MG	1	-	ATHM-013	-	-
Main Section							
M4 Screw	ATH-014	Self Tapping	4	Zinc	ATHM-014	-	-
Threaded Bar	ATH-015	Threaded 5mm	4	Steel	ATHM-015	-	-
Rubber Feet	ATH-016	5mm radius	4	Rubber	ATHM-016	-	-

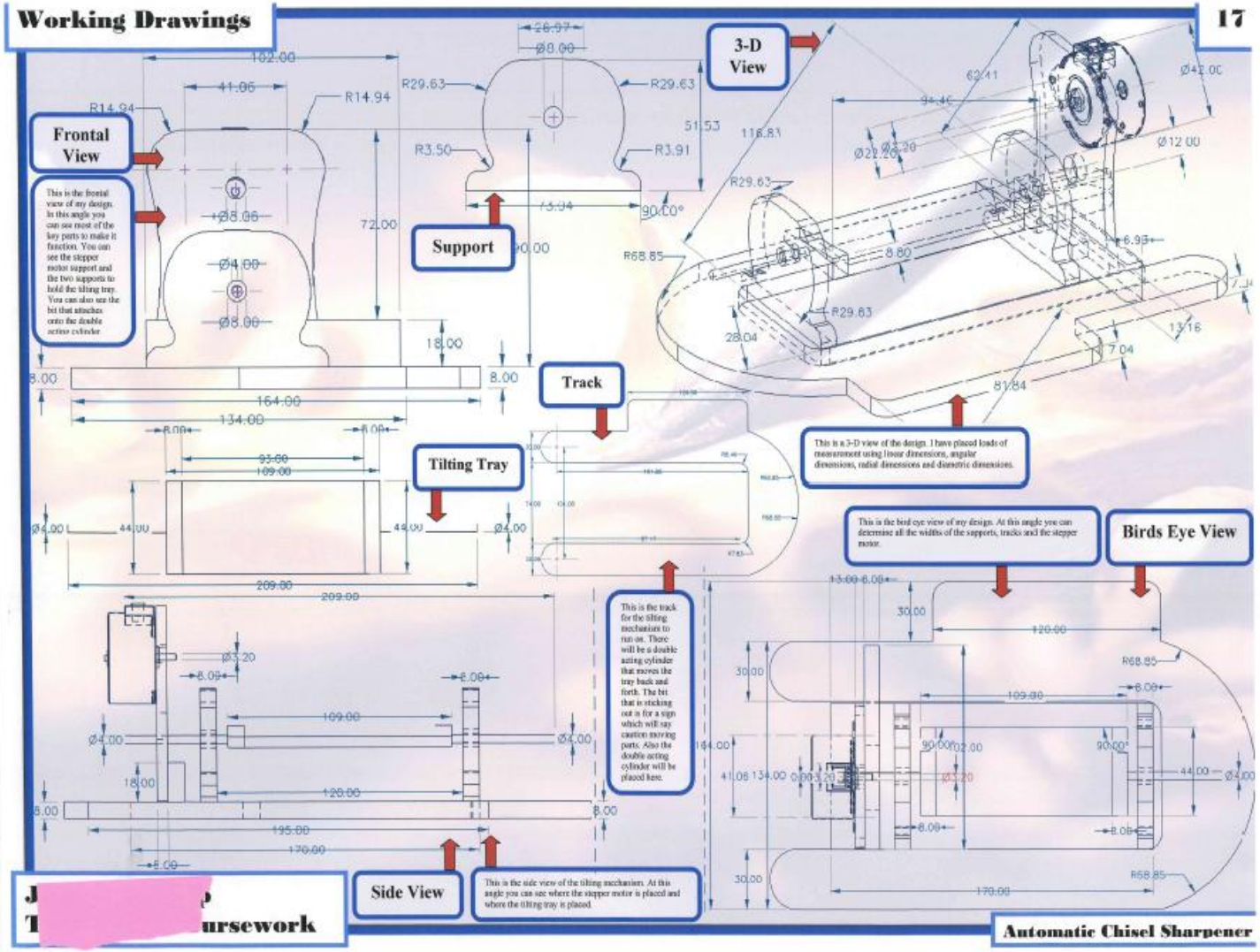
Component	Component Number	Component Description	Quantity	Material	Material Number	Method of Manufacture	Finish
Base Plate							
Rubber Feet	ATH-017	5mm Radius	6	Rubber	ATHM-017	-	-
Acrylic Chucks	ATH-018	5mm Acrylic	4	5mm Acrylic	ATHM-018	Laser Cut	Polished
Middle Section							
Acrylic Top Plate	ATH-019	5mm Acrylic	1	5mm Acrylic	ATHM-019	Laser Cut	Polished
M4 Bolt	ATH-020	M4 Bolt	2	Zinc	ATHM-020	-	-
M4 Screw	ATH-021	Self Tapping	8	Bolt	ATHM-021	-	-
Cylinder Bracket	ATH-022	Folded Part	1	Aluminium	ATHM-022	Folded	None
Front Clamp							
Front Clamp	ATH-023	CNC Routered	1	Wood	ATHM-023	CNC Router	Sprayed
Cylinder Holder	ATH-024	Acrylic Square	1	3mm Acrylic	ATHM-024	Laser Cut	Polished
Linkage							
Linkage	ATH-025	Acrylic	4	8mm Acrylic	ATHM-025	Laser Cut	Polished
Linkage Nuts	ATH-026	Acrylic	10	8mm Acrylic	ATHM-026	Laser Cut	Polished
Circuit Box							
Casing	ATH-027	Acrylic	1	3mm Acrylic	ATHM-027	Laser Cut	Polished
Acrylic Chucks	ATH-028	Acrylic	4	5mm Acrylic	ATHM-028	Laser Cut	Polished
M4 Bolts	ATH-029	M4 Bolt	4	Zinc	ATHM-029	-	-





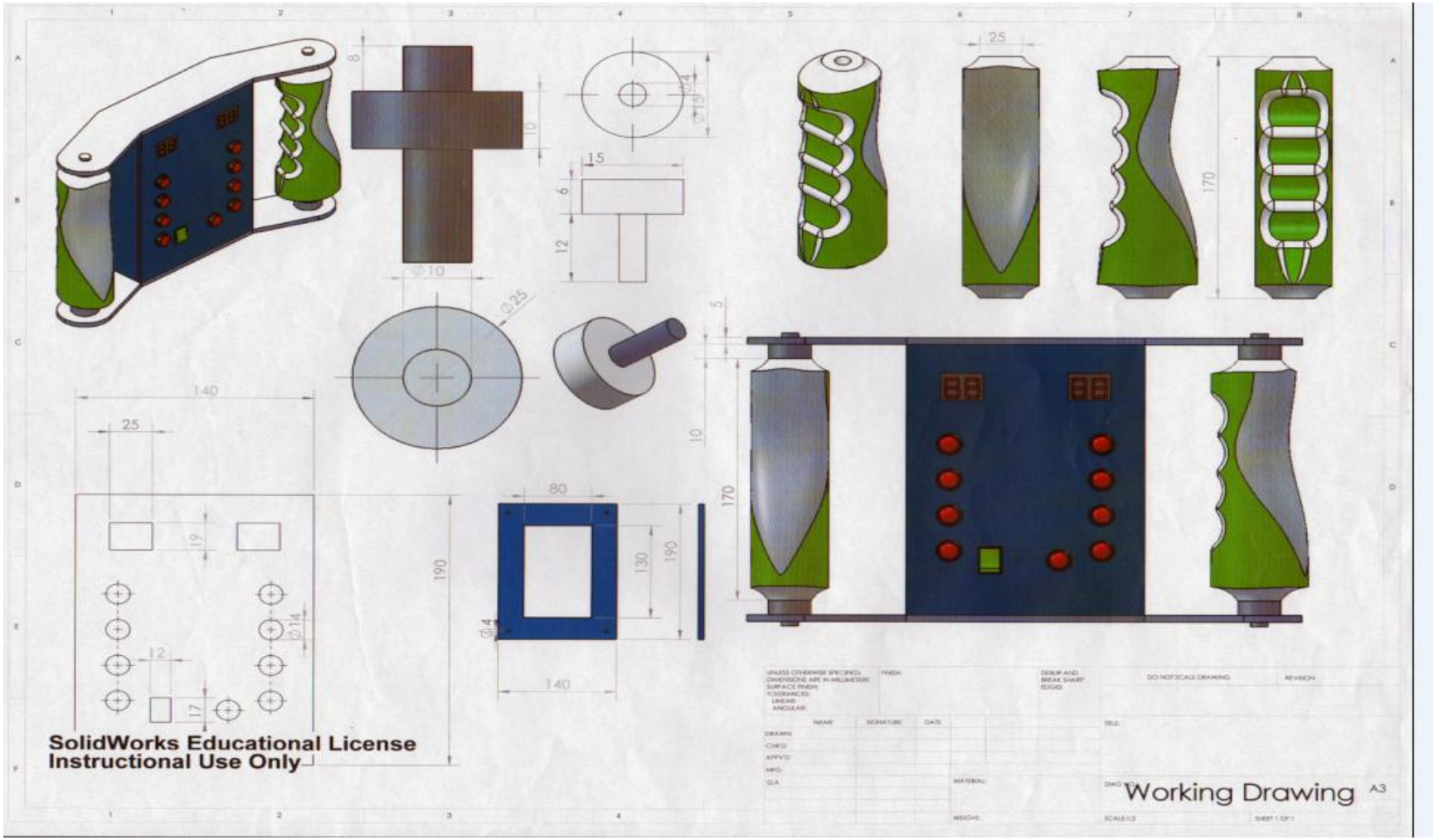
– Automated Trailer Hitch

Working Drawings



[redacted] coursework

Automatic Chisel Sharpener


SolidWorks Educational License
Instructional Use Only
Working Drawing
A3

4 Manufacture

High (27-40)

- Produce a high quality outcome in a wide range of components and materials.
- Demonstrate clear competence in a range of production skills and processes.
- Produce a highly functional product with system.
- Record in detail modifications made during manufacture.

4 Manufacture

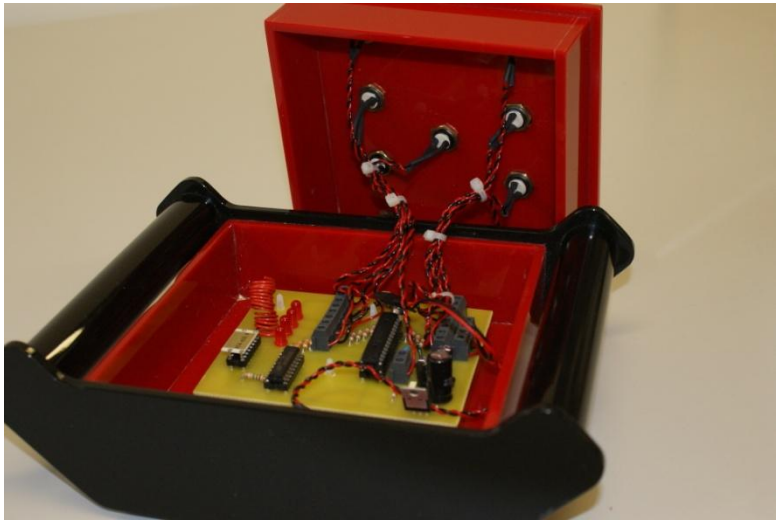
Medium (13-26)

- Produce a good quality outcome in an appropriate range of materials and components.
- Demonstrate reasonable competence in a range of production skills and processes.
- Produce a functional product with system.
- Record some detail of modifications made during manufacture.

Manufacture

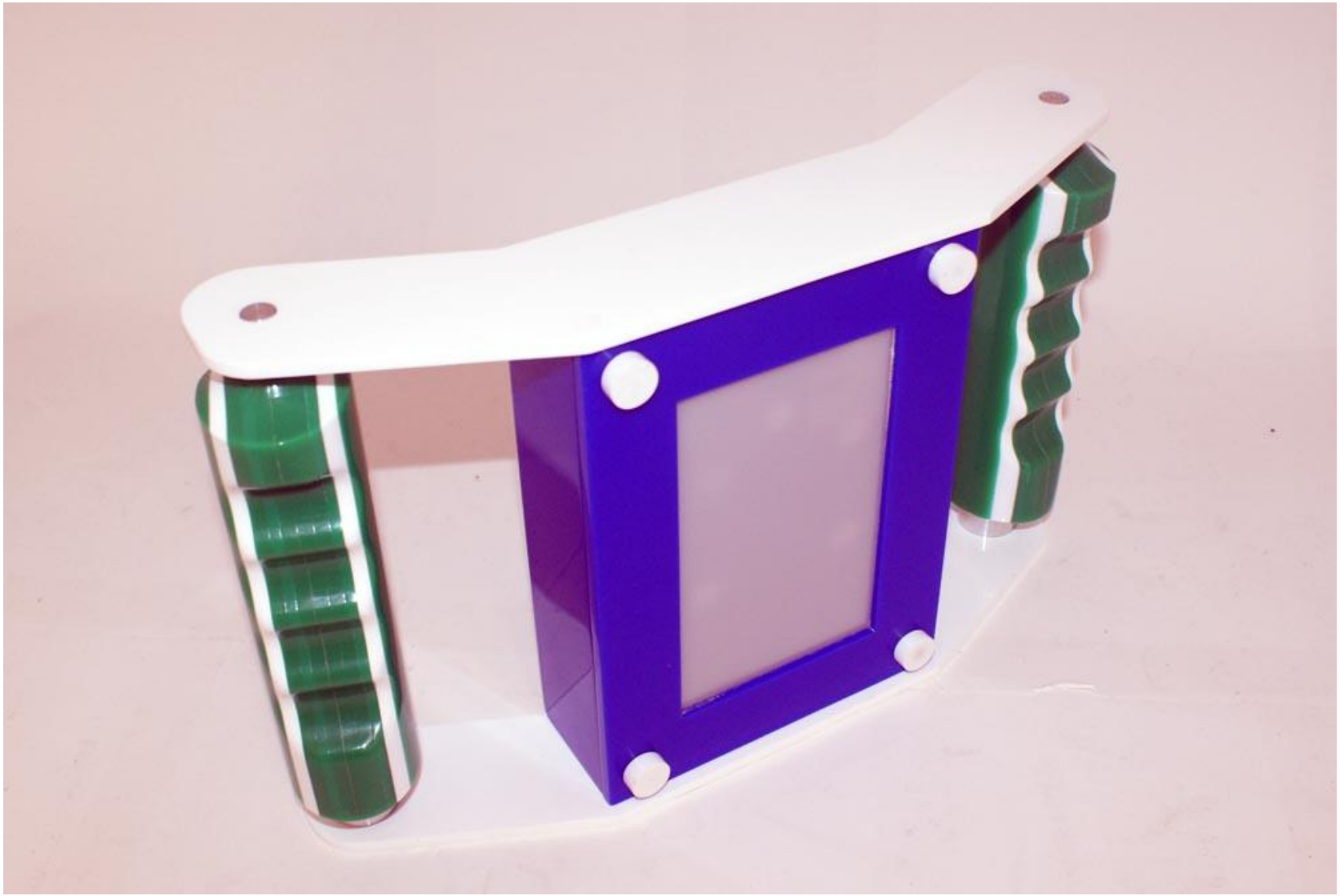
Low (1- 12)

- Produce a low standard outcome in a limited range of materials and components.
- Demonstrate a limited competence in a range of production skills and processes.
- Partly functional product with system.
- Limited and superficial record of modifications made during manufacture.
- Zero should be awarded for a response which is not worthy of any credit.

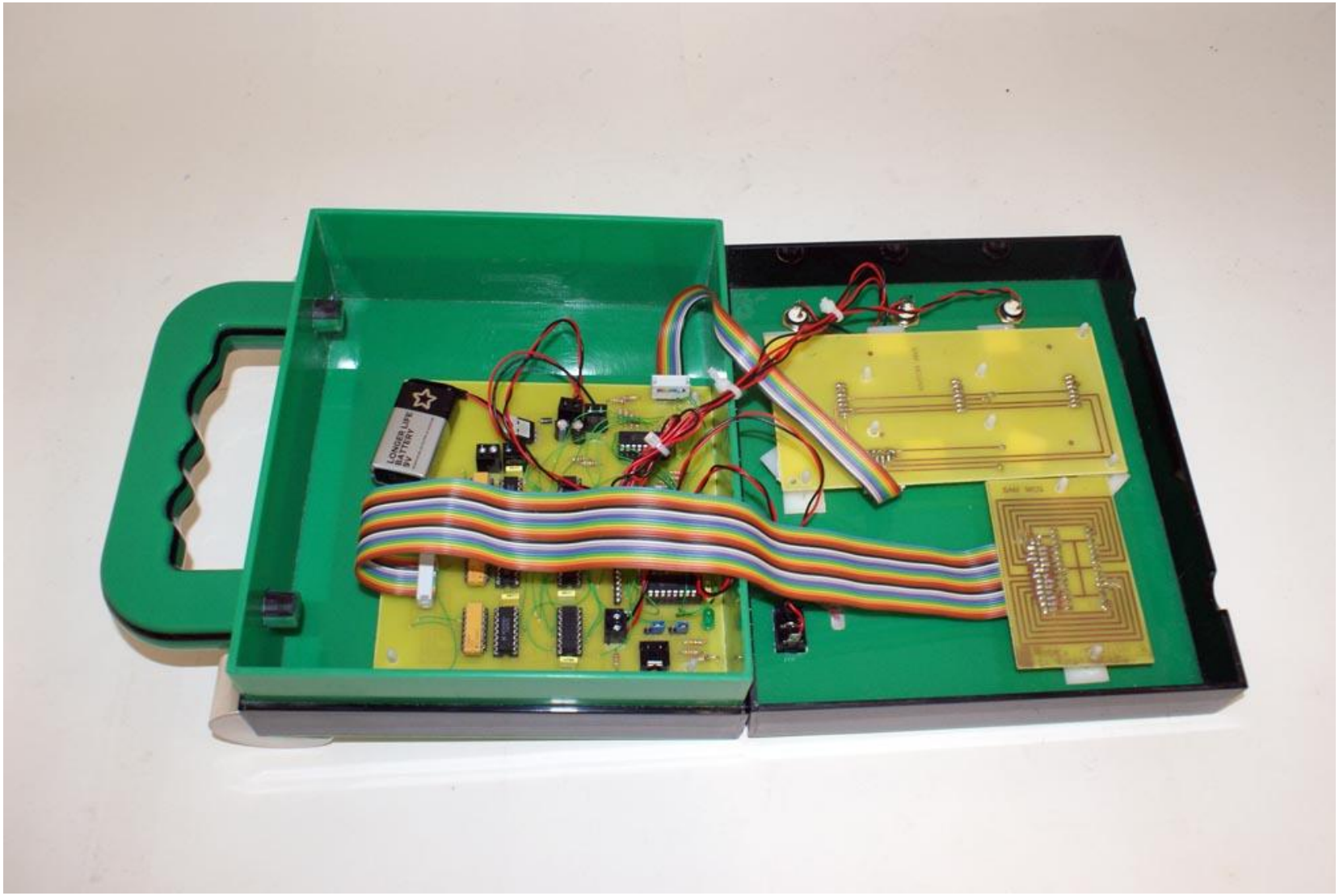


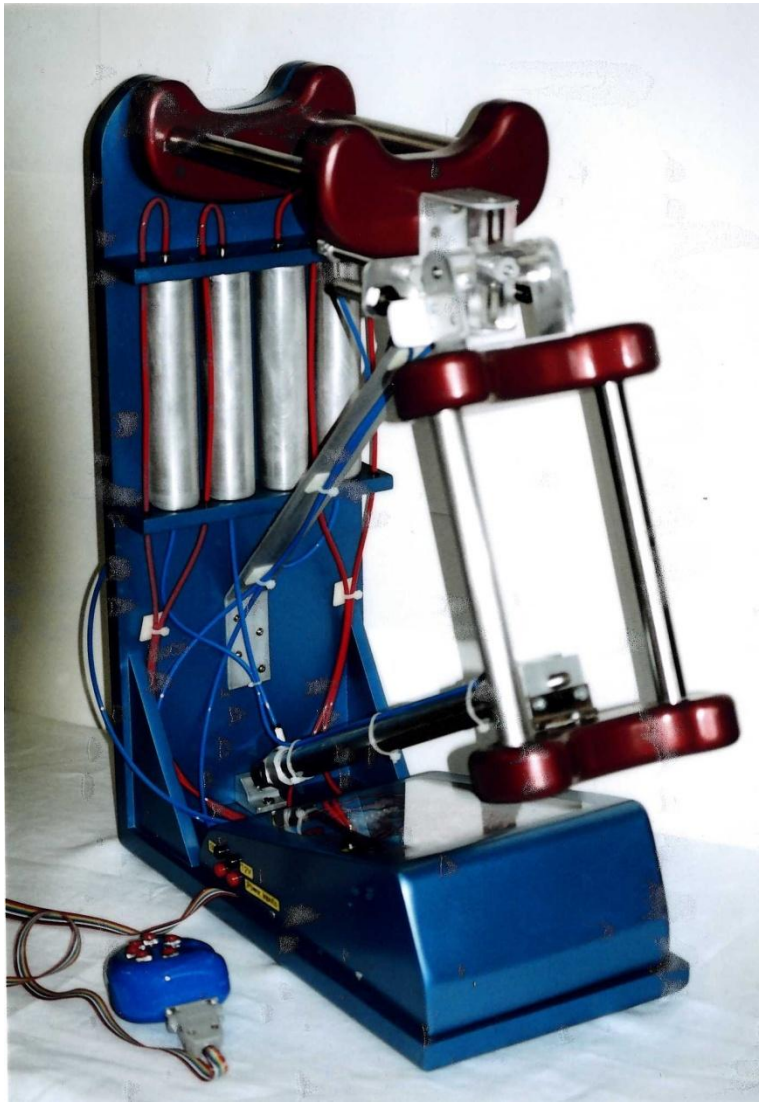

Flash
Reset

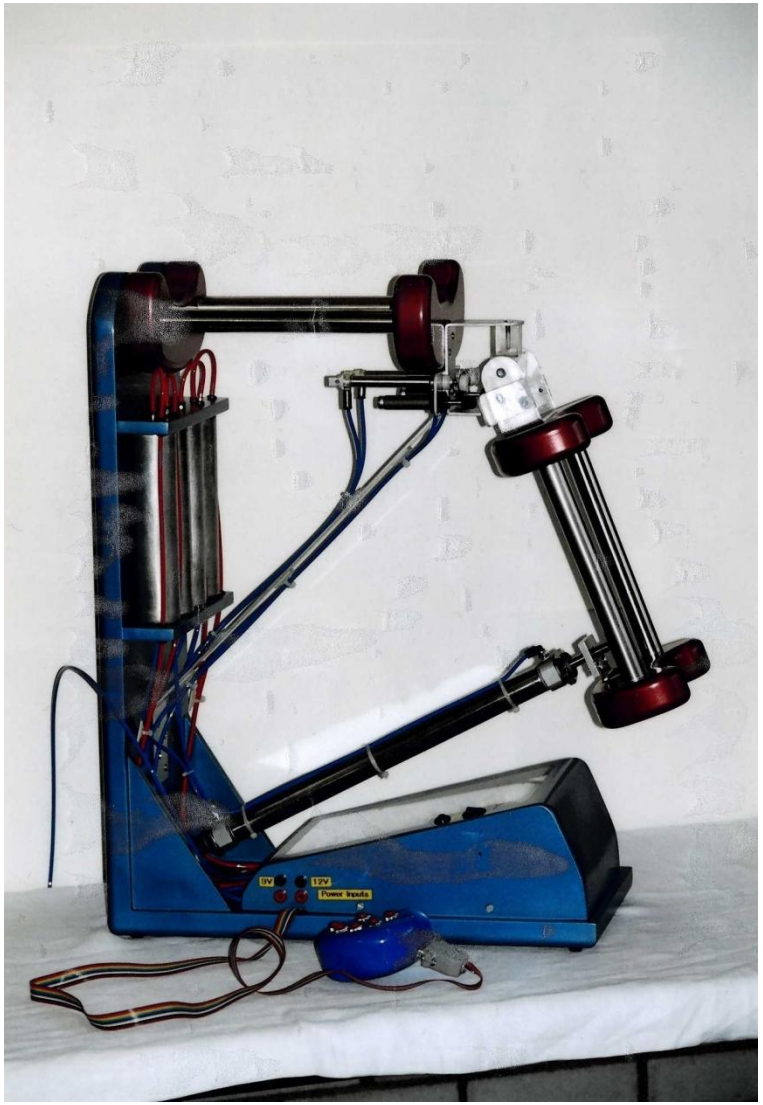

HOME
AWAY
TRY
CONVERSION
PE
TY/DG
YELLOW
RED

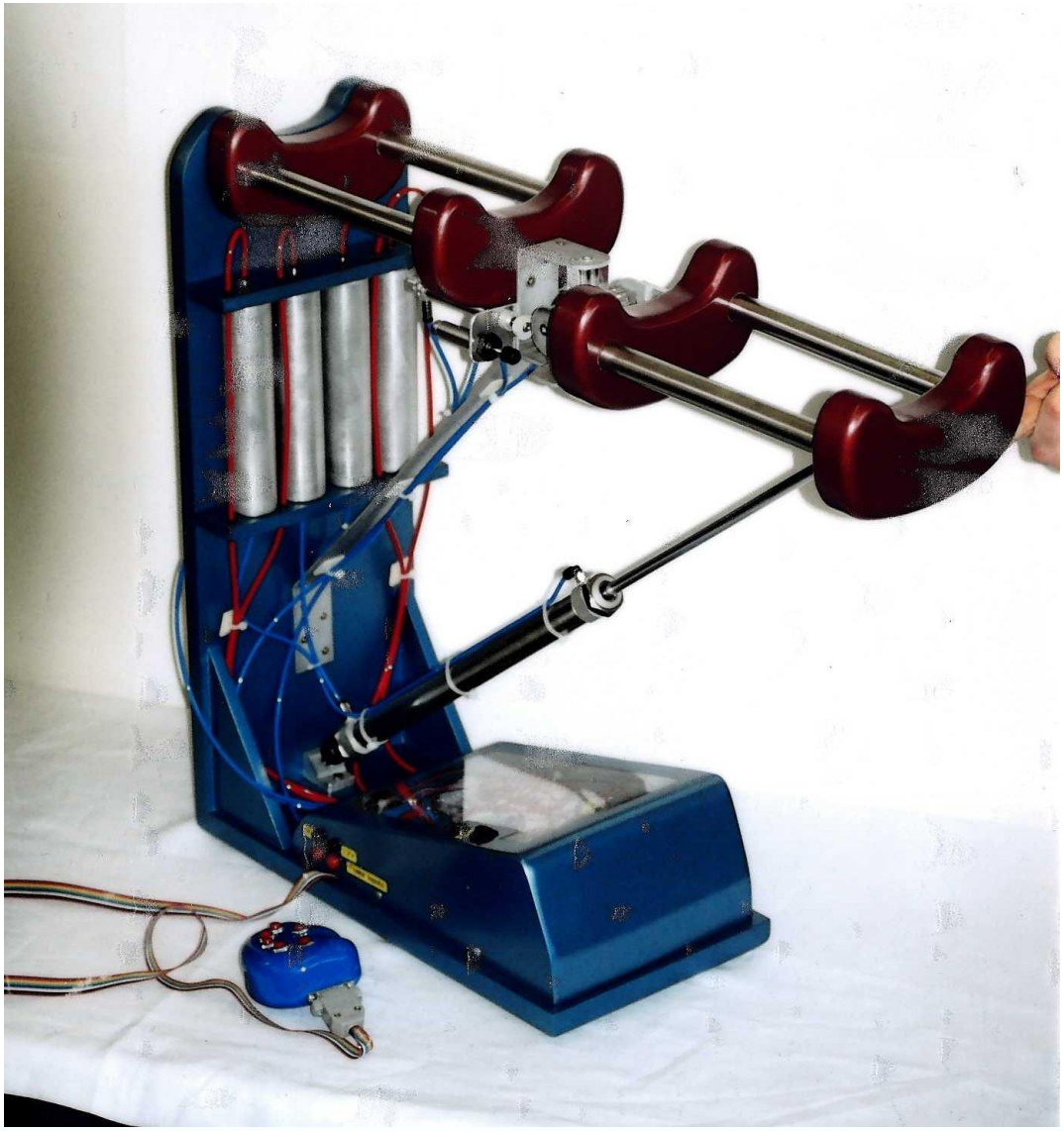



TOTAL
50-150 yrds
150-200 yrds
200 yrds +


LONGER LIFE
BATTERY
9V

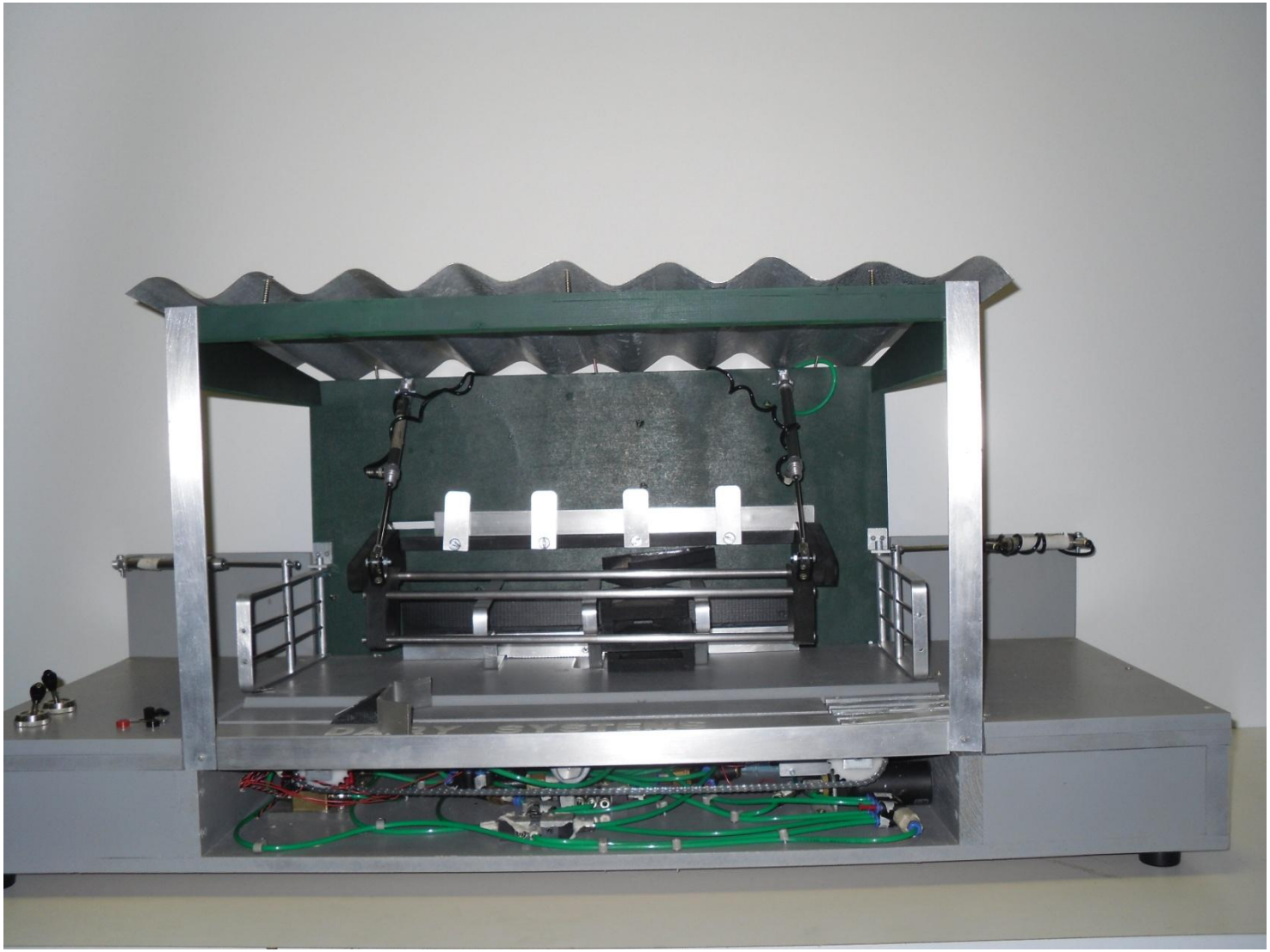


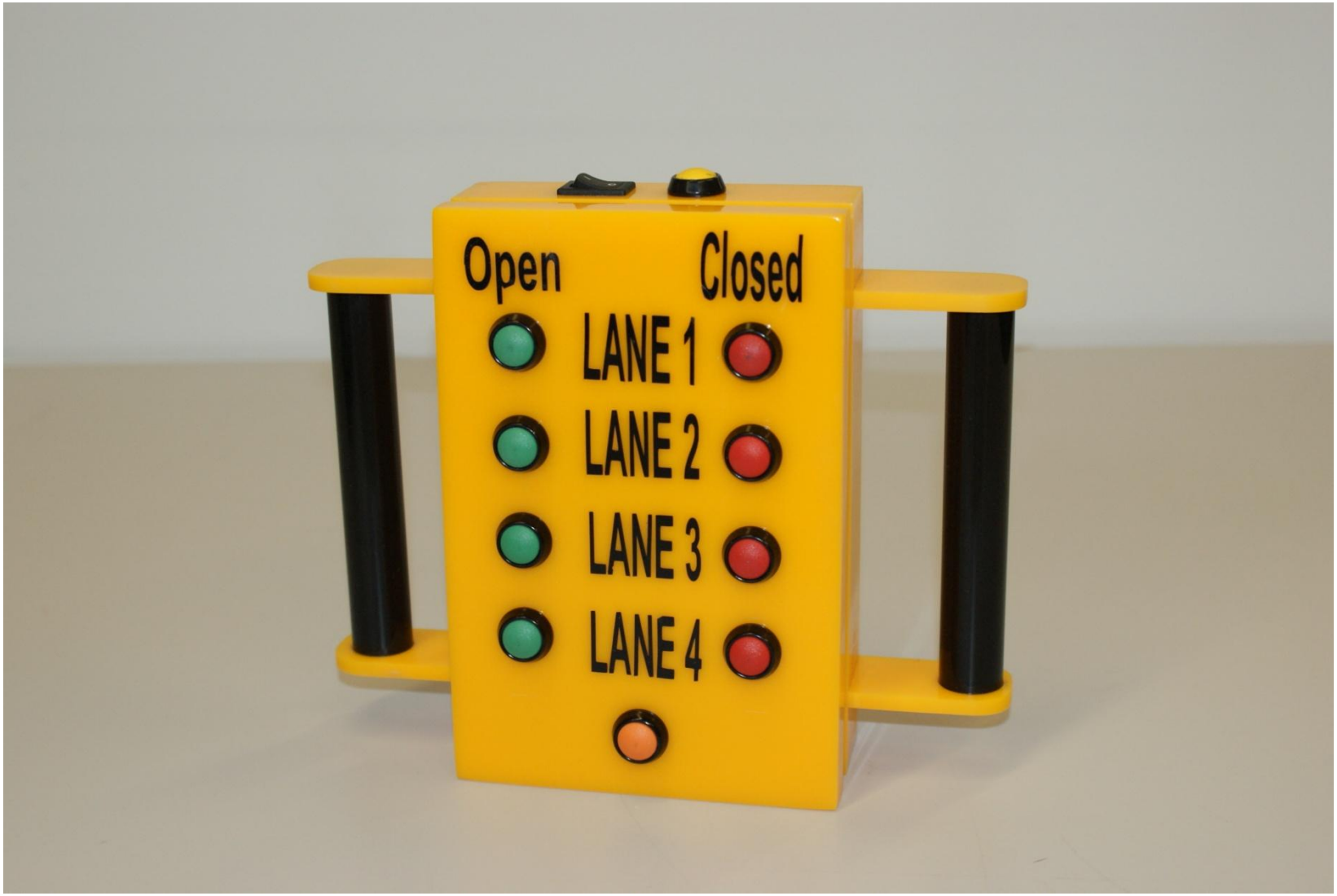

9V
12V
Power Inputs

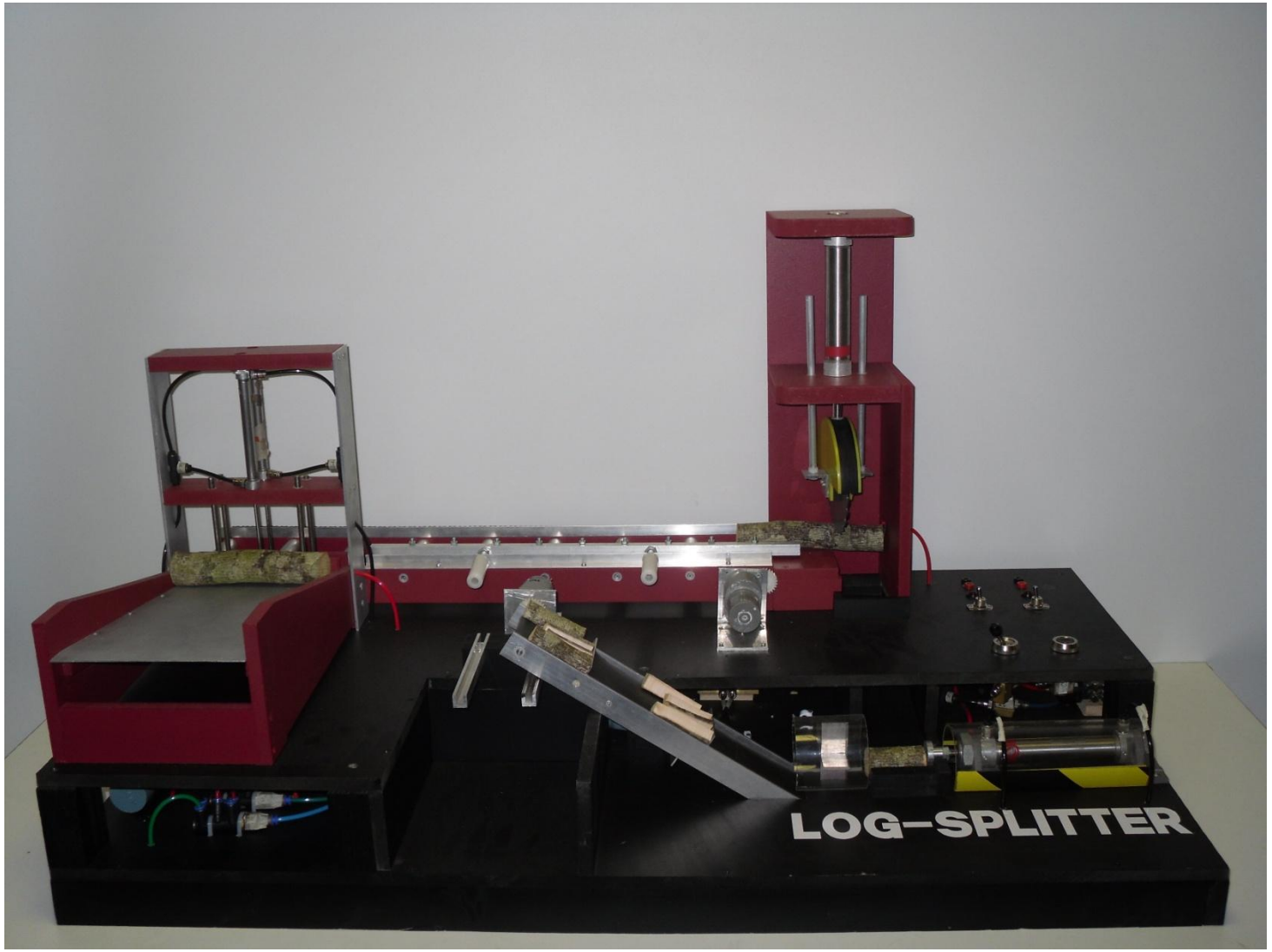


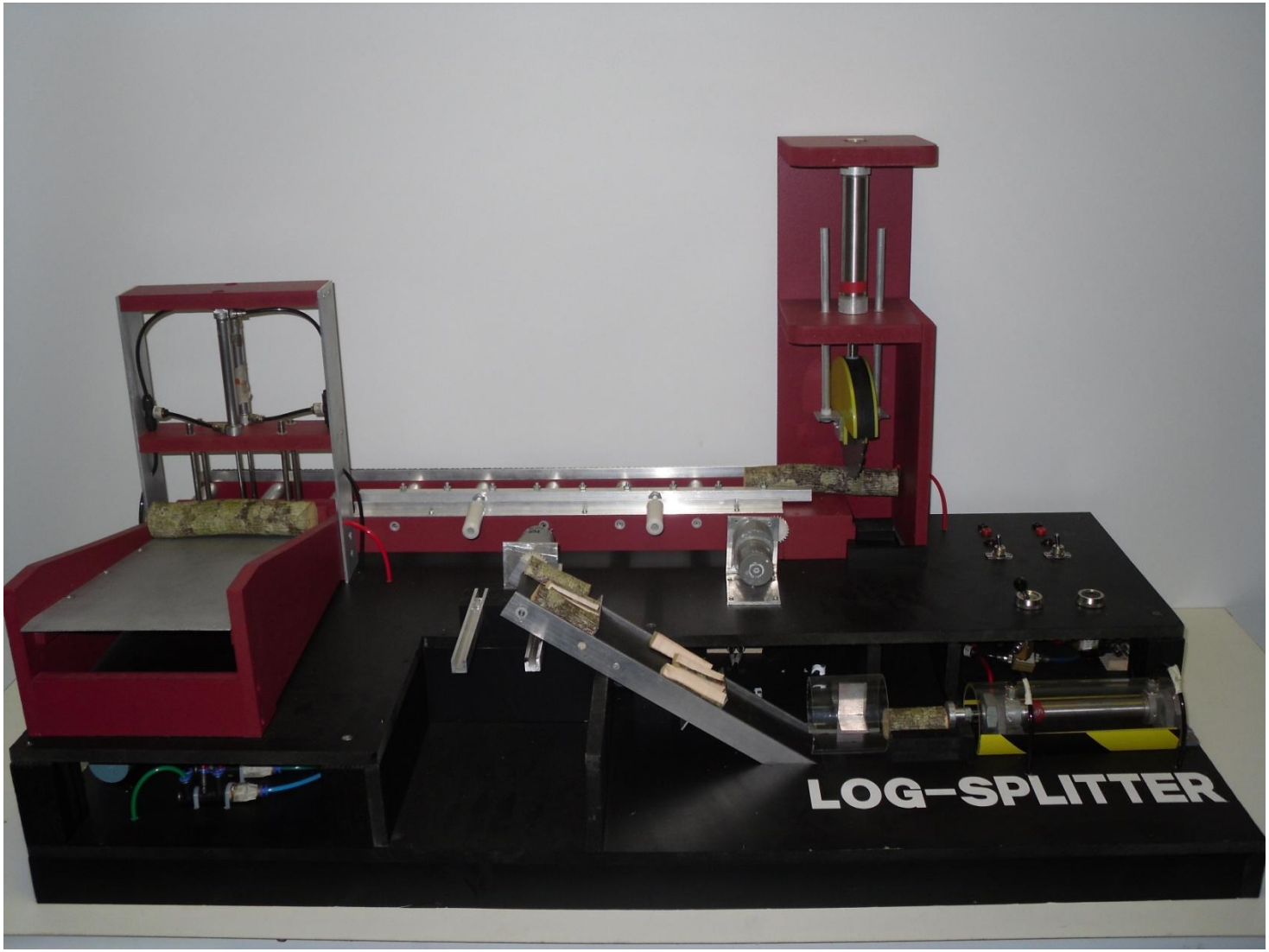

Player 1
Player 2
RESET

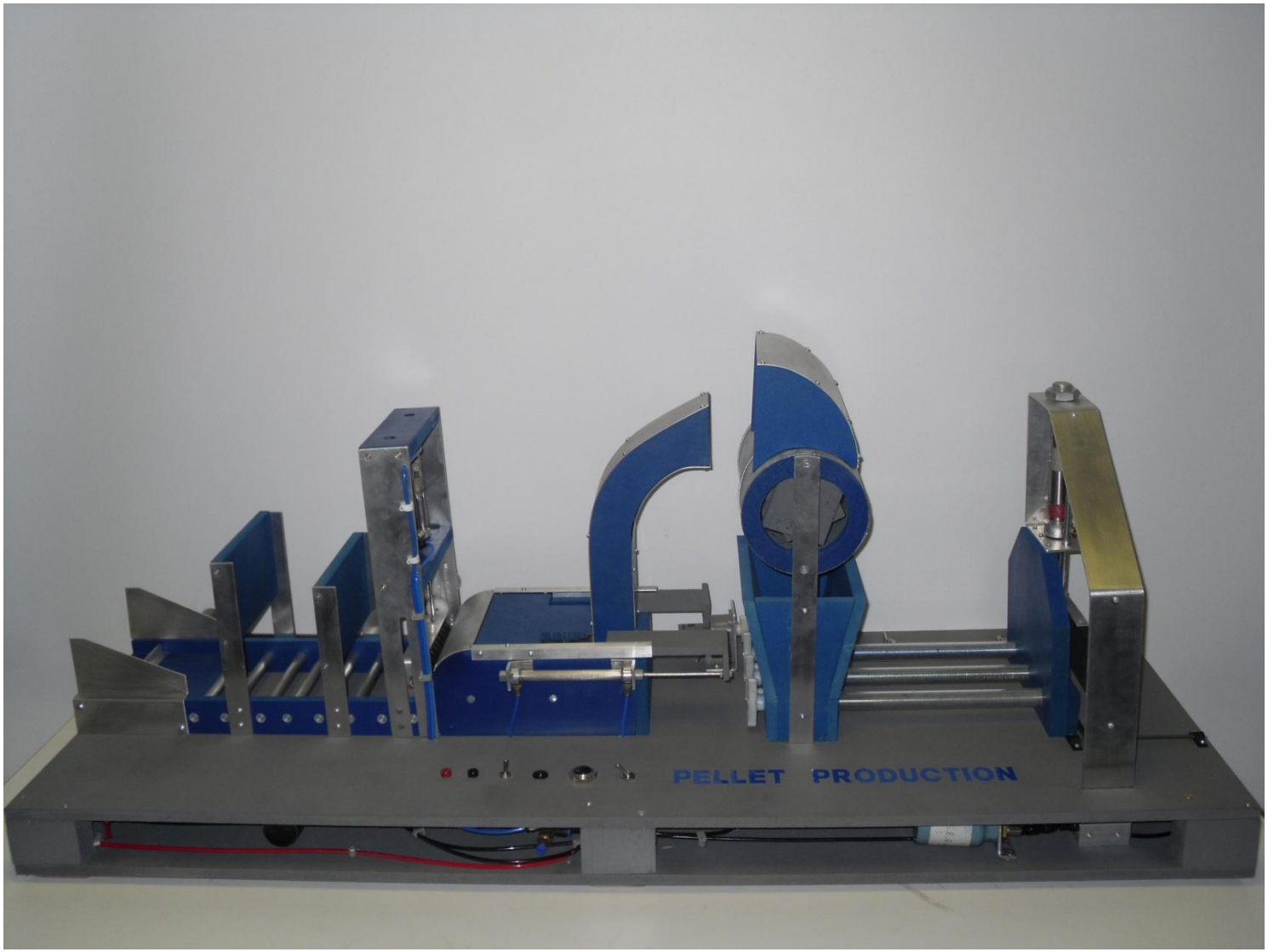

Bridgestone
www.F1.com
Vodafone




Open
Closed
LANE 1
LANE 2
LANE 3
LANE 4

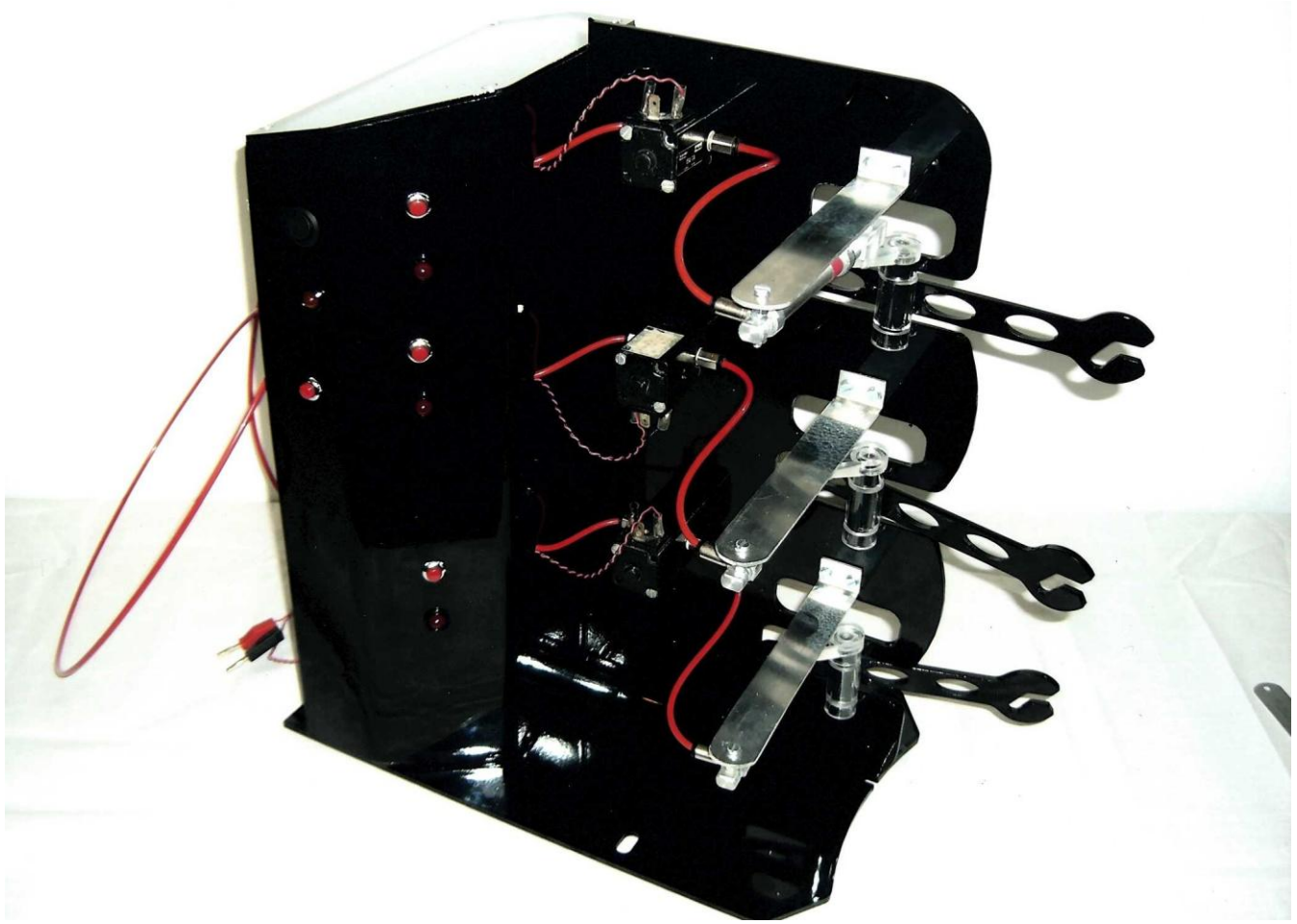

LOG-SPLITTER

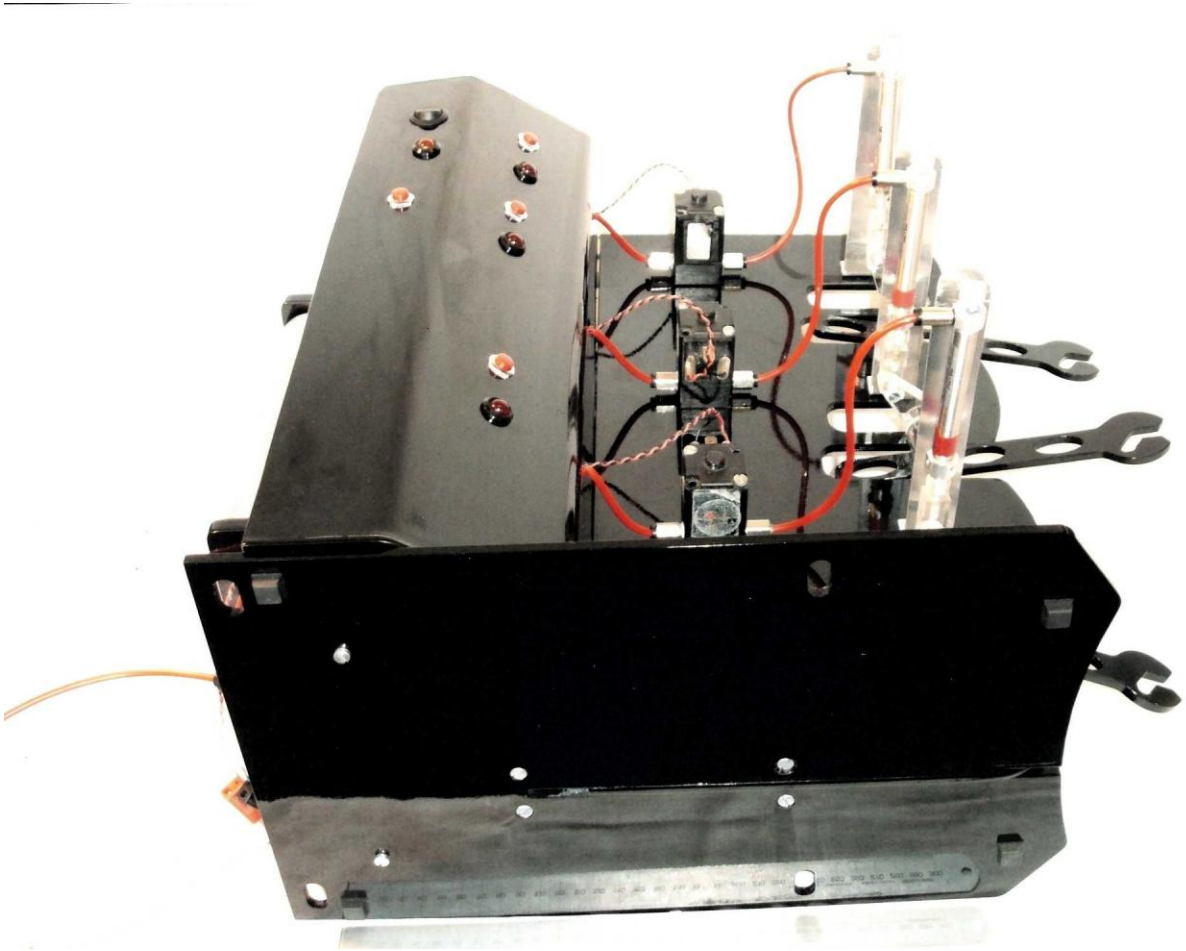

LOG-SPLITTER

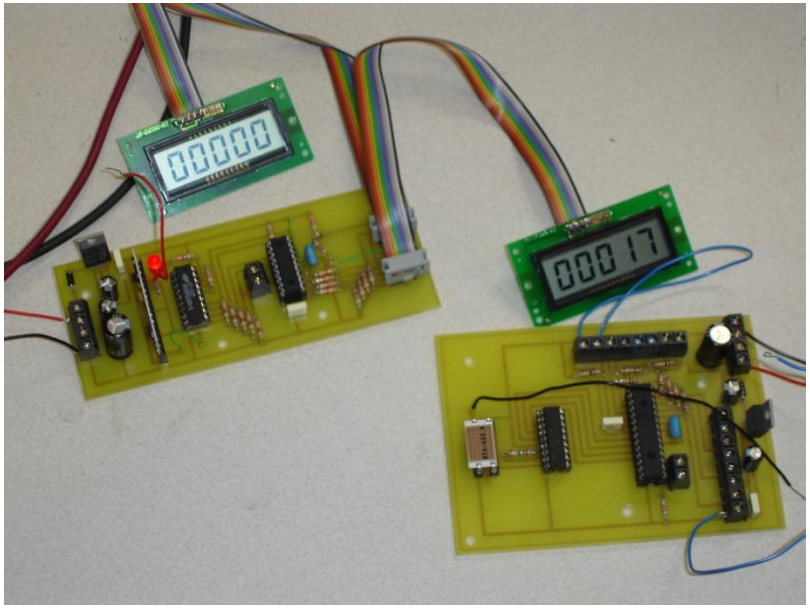

PELLET PRODUCTION


46
Sportsboard
Sports Panel
1
2
3
4
5
6
7
8
9
*
0
#


Sportsboard



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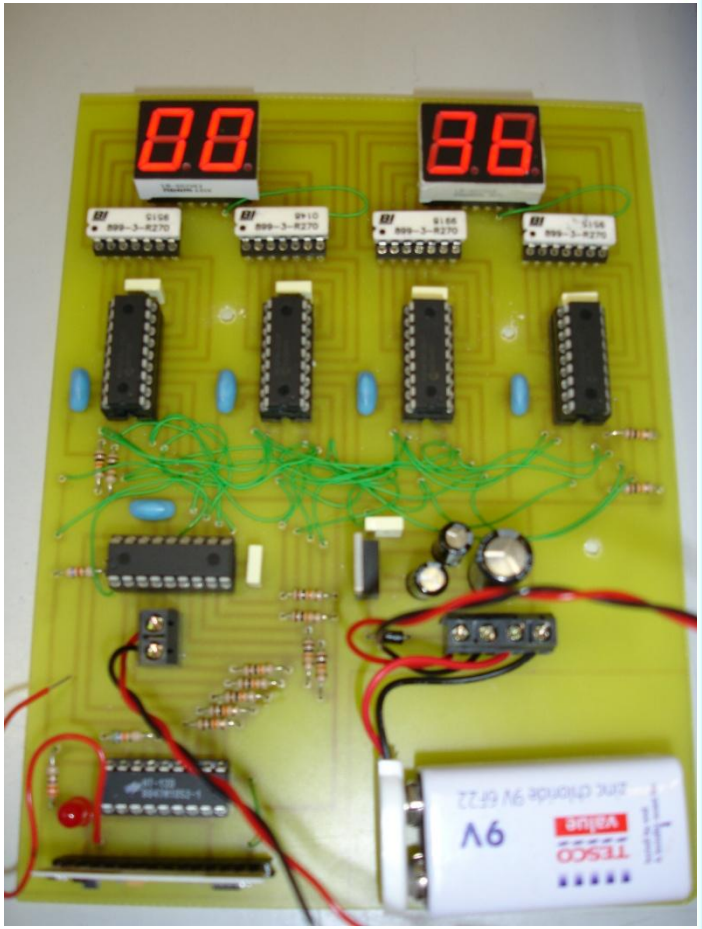
00017


88
88
9V
TESCO
Value

5 Testing and Evaluation

High (10-14)

- Produce a high level critical and objective evaluation of the outcome.
- Carry out and present an extensive range of detailed testing, showing meaningful conclusions.
- Make high level proposals for further development as an outcome of testing.

5 Testing and Evaluation

Medium (5-9)

- Produce a satisfactory evaluation of the outcome which is mainly objective.
- Carry out and present some outcomes of tests, which show mostly meaningful conclusion.
- Make appropriate proposals for further development.

5 Testing and Evaluation

Low (1-4)

- Produce a limited evaluation of the outcome.
- Show limited evidence of meaningful testing with only simplistic conclusions.
- Demonstrate limited awareness of possibilities for further development.
- Zero should be awarded for a response which is not worthy of any credit.

Evaluation against Specification

Aesthetics

- The products colour scheme consists of clear, yellow, red and black acrylic. As there are only 3 main colours the product is not an "eyesore."
- Instead of having it just the one colour scheme the project was manufactured in clear acrylic, Yellow and black for the box and a bit of red for the warning signs.
- The user interface it in the form of a clearly labelled user friendly lid on the control unit which meets the specifications of the device.
- This device is made from several layers of Laser cut Acrylic. The reason for this was because Acrylic doesn't rust or rot or expand in heat, and the look aesthetically pleasing.
- The input controls consist of 5 large red Push to make switches which can easily be operated in all conditions these look well amongst the product parts.
- The product is strong and sturdy but still looks good, Acrylic was used in the first examples to help show the devices working parts and acrylic is a lot easier to work with, also it is less expensive to purchase.
- There was a fair amount of manufacturing to be done, but the CNC router and laser cutter produced the high quality finishes that have been used in my final design. To finalise the quality I had to wet and dry the edges to get rid of all rough edges.
- The product has an industrial theme that is brought out through practical design and choice of materials such as acrylic, and therefore fits into its environment very well.
- All the circuitry, systems and control components are concealed within the black and yellow control box. This is to make the product more aesthetically appealing

Manufacture

- The main body of the product will be designed on CAD systems and manufactured CAM processing which involves routering the main body using the school workshop machinery.
- The design will be symmetrical and accurately fitted together thanks to an accurate Router technology as well as the extremely accurate laser cutter.
- The product was manufactured in under 30 hours, the guideline set by the CCEA exam board, and the amount of time available in the workshop due to theory work.
- All materials used in the manufacturing process were available in the school workshop and all machining was also done in the school workshop.
- All the rules of the workshop must were adhered to during the manufacture of the product as well as national laws such as the Health and Safety act of 1974.
- All designing was fully complete with a full CAD simulation of the product before entering the production stage, to ensure there was no time wasted and no material wasted due to unknown measurements or features.
- After all these stages the product should be ready to be assembled carefully by hand and shouldn't take up too much effort.

Materials

- The product is mostly created using plastic sheet acrylic which than can be formed or cut into pieces to fit the product. The reason acrylic has been chosen is because it is very strong and is weather resistant. It has more flexibility that the likes of metal or glass. Acrylic is easily cleaned and can be solvent bonded.
- The PCB in this product will be made of 1.5mm thick Fibreglass. This is an appropriate material due to its ease of addition of the copper plates. Not only that but it is lightweight and compact and has flexible properties.
- All materials chosen for use in the product must were available in the workshop and were recyclable where possible to decrease the environmental impact the product has.
- None of the materials used in the parts of the product that will be exposed to the environment are ferrous. Acrylic was used instead.
- One single sided PCB was be used for the electronics in the product.
- All materials used are durable, practical and marketable as they would be in an industrial market. They need to have a high strength to weight ratio if they are to cope with the pressures involved during its use.
- All plastics used should are either clear or pre coloured to avoid unnecessary finishing and costs.
- The bulk of the product was made using 5mm and 10mm Acrylic and 3mm red Acrylic.

Maintenance

- This device has very little maintenance increasing its user friendliness and its life span.
- All moving parts which will require maintenance are easily accessible to ensure they are easy to spot and not forgotten.
- There are no parts requiring maintenance inside the casing that holds the circuitry, as any interference with electronics is dangerous.
- All maintenance must be carried out only the product is turned off. A 10mm LED indicates when the products power is on/off.
- There are no ferrous metals used in the product, as they would require painting and extra maintenance on an annual basis.
- There is wood exposed to the atmosphere on the control unit although it is designed to be kept indoors when not in use.
- The design will be made of materials that have splash proof properties, to prevent the need of replacing any components due to it getting soaked, in case there was an internal water leakage.
- The system will be run on a standard 12v or 9v power supply with sure off a battery pack, therefore means there is now need to change the batteries.

Ergonomics

- Taking all ergonomics into consideration the device comfortably sat on the desk/ table. This gave the device maximum stability for the product to fully function and to work effectively. Not only that but it allowed the user to work with it at a comfortable height, to allow no strains to be put on the user when he/she leaned on it
- The box design easily fits in to the users hand to make the product comfortable to use. (Base width 200mm)
- The users' controls did outside of 6 input controls, and does not appear congested, but has a high simplicity factor, and its overall ease of use is very high.
- All controls have a clear label each to add to the products user friendliness and its appeal. As well as simplify things for the operator.
- The control box weighs more than 1800g due to manufacturing and component restrictions, but is still ergonomic
- The product produces signals in the form of 2 10mm bright LED's to show when it is on/off or ready one LED for each
- The control boxes shape is basically a square but it is ergonomic, and very comfortable to hold. Anthropometries were consulted to design as well as material choice.
- The product was designed with varying weather conditions in mind to ensure ease of use in all weather conditions. Temperature range -4°to 23° approximately.
- I made sure that the product is small and compact enough so that it can be easily carried from table to table and small enough so that it can be easily stored without taking too much room.

Size/ Shape/Dimensions/Weight

- If the product is too big it will become useless as it can't be transported and would have to sit stationary and would have to be used at the same position every time, this is very impractical and not very economical.
- The requirements for this product show that this device must be kept as small as possible so that it can be easily transported from place to place and can be easily stored without taking up too much space.
- A viable solution would be to allow the product to be no bigger than 21cm by 30cm by 21 cm.
- Over all the products size will be a bit bigger than the size of an A4 page. This will be the right size as it can be easily stored, and it will roughly be less than 1 kg to let it be easily carried.
- The automatic chisel sharpener should be kept in a compact box to protect the circuitry to prevent it from getting wet. It must also look aesthetically pleasing (the outer casing).
- The outer casing must be big enough though to allow all the pneumatic cylinders to go positive/negative and to allow circuitry inside so as it does not get damaged.
- I must make sure it is compact enough so that it can be transferred from destinations.
- The device must also be able to store the metal shavings that come off the chisel when it is sharpening so that it can be easily disposed of when finished.

Economics

- To reduce the costs a bit I reused some of the pneumatic cylinders and I also used some of the components. This had saved about £20 of resources. The solenoids alone for one costs around £40. Not only money but it will save time/effort and sometimes patience. By Recycling and reusing you can be saving up to £30 -£40 in components which can be used for something more useful.
- The final selling price can be roughly calculated using Direct costs + Indirect costs + profit = finial price.
- This component was constructed for well under the market average (Approximately £200) the product can be built and sold for a much more affordable price of £150. (spec-£180)
- The product had been built using inexpensive but high quality materials, in some places reused acrylic and woods had been used to keep the price down a little bit more.
- This Product costs less than £100 to manufacture, and was made in less than 40 hours to keep within the specified time to complete these tasks.
- Acrylic was used as it does not require a lot of effort to get an aesthetically pleasing finish
- All the manufacturing was done using the CNC router or laser cutter these both proved to be very efficient in the manufacturing stages of my design.
- The budget I estimated for the development and manufacture of this product was estimated between £40 -£55. This was a moderate assumption for the total amount the product should cost.

Anthropometrics

- The whole box design can be comfortably held in the average user's hand. Only small modifications were made to the dimensions of this design, this was so that we could fit in all circuitry and key components.
- All input components consist of 6 16mm diameter, push to make switches.
- The box design was made to be maneuverable so that the user, can access it easier and quicker, and so that it can be much more efficient to the user. The box design incorporates a solenoid, a stepper motor circuit and the main circuit.
- The box design was designed without handles to increase its user friendliness and its overall appeal as simple trustworthy product.
- Due to restrictions on lightweight component availability the product, as a whole weighs roughly between 1-1.5 kg so that it is easily carried.
- All anthropometrical measurements used in the design of the product were taken from an adult male

Performance

- My redesign is a top performer and operates as it says by doing a reliable and a dependable job whenever it is required and how often it would be needed.
- It runs smoothly and cost effectively so as it can offer the best solution for the buyer.
- The product does perform up to a required standard so that it can last a long time.

Function and Features

- This product is a freestanding, portable and compact device that automatically clamps a range of chisels to allow them to be sharpened from a required angle.
- This system is run on a standard 12v power supply which runs off a battery pack, therefore means there is no need to change the batteries.
- The automatic chisel sharpener has 3 main functions. The first is the clamping of the chisel, to give the chisel maximum stability when sharpening. The second is the positive/negative movement of the double acting cylinder which in what provides the force to sharpen the chisel. The last main function is the angle of the sharpening tool. The angle will be made using a stepper motor to turn a wheel which is attached to a sharpening stone.
- Some of the outputs used are double acting cylinder, solenoid's, LED's, relays and buzzer.
- The product performs rush operation in less than 5 seconds, as speed is essential to ensure there is maximum effort pressing the chisel to give it the cleanest sharpest edge.

Safety

- The products controls are 1m from the grain chute to avoid injury risk.
- The product was built using inexpensive but high quality materials, like plastics and woods to avoid high risks of product failure.
- All controls on the product are clearly labelled by labels with a font height of at least 15mm to ensure that the user interface is clear and concise, otherwise there would be a high injury risk.
- All moving parts are clearly labelled and coloured bright red to avoid injury as risk due to poor safety warnings.
- All circuitry must is concealed in a watertight housing to prevent any risk of electrocution or injury due to system failure.
- There is no more than 12V used in the circuits to eliminate electrocution risk if the user tampers with the electronic systems in the products electronics housing.
- The products control box weighs 2.5kg, although this makes the product heavy and cumbersome and a hazard.
- Once turned on, a 10mm green LED is activated to alert the user that the power is on and the product is working.
- There must is a safety button on the system that must be pressed before any functions can be performed so that no functions can be performed by accident and cause injury.
- The product must is capable of stopping any grain flow within 5 seconds of being given the command for emergency situations.
- The chute locks shut to ensure no spillage of grain/trader contents during transit on roads, in it would be a potential hazard for any vehicles travelling behind the unit.
- All parts and components have a safety factor of at least 2 to reduce catastrophic failure probability.
- All controls are large, red and ergonomic so as they can be activated in all conditions including those that involve poor visibility e.g. fog or mist. They are also made out of a suitable high visible material.

Legal Factors

- All aspects of the design do not infringe upon any existing UK or other global patents. All patents were checked and viewed at the patents office
- Health and safety laws were be adhered to in the products construction. Such laws include the 1974 health and safety at work act as well as CE, SI and ISO standards.
- Products that must must requirements set out in the European Union (EU) directives must carry a CE marking if they are sold in the UK and the rest of the EU.
- Putting the CE marking on the product acts as a declaration that the item meets relevant legal requirements.
- In order for this product to be sold on any market it first must be inspected or tested by an authorised independent body, they will certify it to be sold to any buyer then the product can receive a CE marking.
- Once the product meets all these standards it then can be manufactured and distributed to shops to be sold anywhere in the EU.

Environment

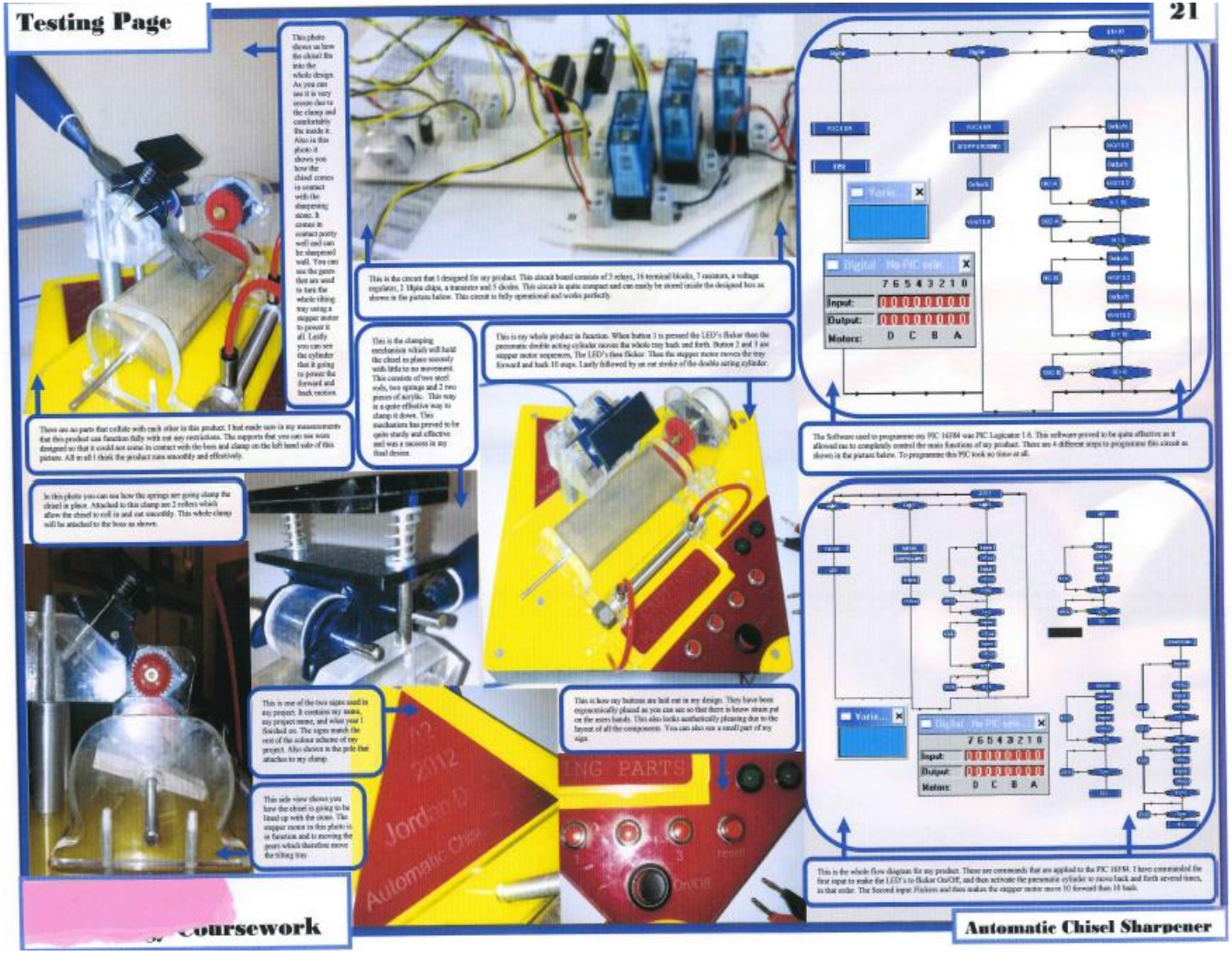
- This device was to be made to create no known, harmful emissions as it simply runs on a 12V battery pack and compressed air. The final outcome of the product followed this promise so it did not produce any harmful substances.
- The products 12V power supply will come from the user's power source so as to prevent the use of batteries. Batteries can harm the environment when not disposed of properly due to their acidity and relatively weak casing.
- The product was made from recyclable material wherever possible, such as acrylic and oboco and is over be 80% recyclable overall making it very environmentally friendly.
- The product has zero emissions making it environmentally friendly is an industry where environmental issues are an ever increasing concern.
- This product is to be used in a workshop or garage of a work enthusiast such as a carpenter. This product should be designed to allow it to work comfortably in normal room temperature 25°C and will be able to work in a cold environment such as -4°C

Life in service

- The product can be used periodically throughout the year and be used a lot during the months of late summer and early autumn.
- In the environment it is being used, product life spans vary, but the product should last at least 10 years/seasons to be economically viable for the user.
- It should cope with constant use for up to 5 hours at a time and also long periods of no use at all.
- Any components used that were bought e.g. pneumatic cylinders were from a reputable supplier with a product warranty of at least 3 years.
- The product life span varies, but our rough estimate is it will last around 10 years this will be economically viable for the user.
- It will be designed to withstand constant use up to around 4 hours then it will need to cool down before it over heats and breaks down.

Automatic Chisel Sharpener

Testing Page

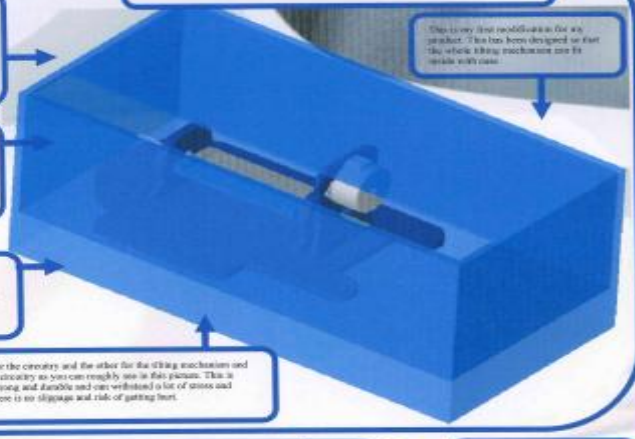


Coursework

Automatic Chisel Sharpener

Future Modifications

Future Modification 1



The design is pretty plain but this is because I have based this design on the safety aspect. This is so that there is minimal risk of the users harming themselves. The corners will also be rounded so that the user can not harm themselves in any way. I had also kept in mind how far the product will be pushing out so I had to make sure there was enough room.

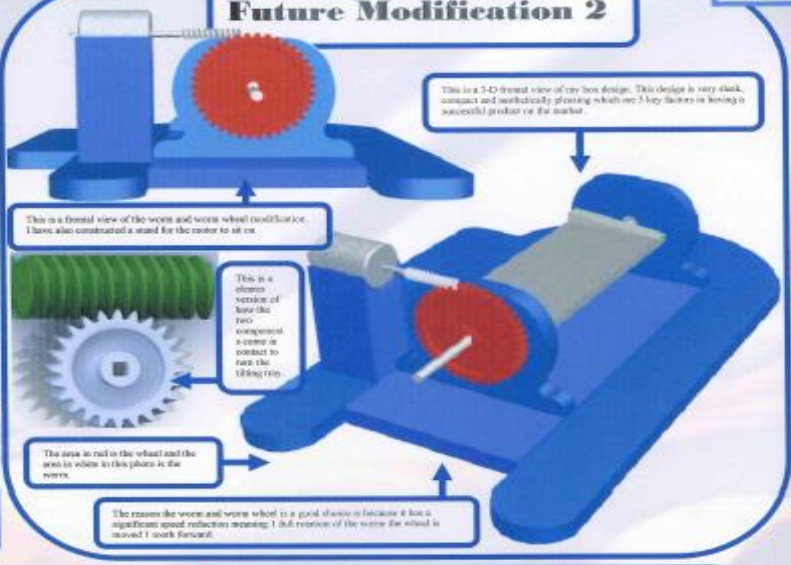
There is a gap at the top of this box. The reason for this is so that the chisel can be placed in and out of the box and clamp. The bottom, LED's etc will be placed at the sides of the box instead of making a side box. This minimises wastage so that its better for the environment.

This is the tilting tray in my design. This is what holds the sharpening stone when it is in motion. The sharpening stone lies at a non-level position. So therefore I had to design the tilting tray which cancels out the angle so that it is flat.

The box has two compartments one for the circuitry and the other for the tilting mechanism and track. There is plenty of space for the circuitry so you can roughly see in this picture. This is made out of acrylic, that means it is strong and durable and can withstand a lot of stress and strain. It is all very compact so that there is no slippage and risk of getting hurt.

This is my first modification for my product. This has been designed so that the whole tilting mechanism can fit inside with ease.

Future Modification 2



This is a 3-D frontal view of my box design. This design is very sleek, compact and aesthetically pleasing which are 3 key factors in having a successful product on the market.

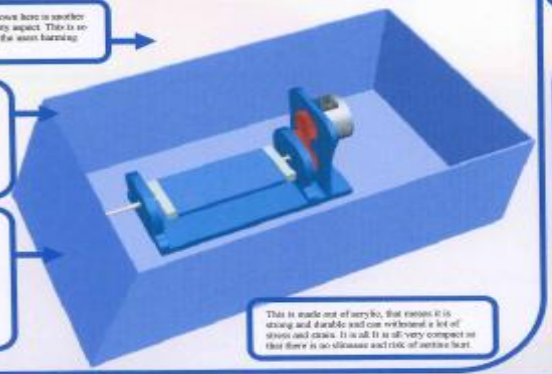
This is a frontal view of the worm and worm wheel modification. I have also constructed a stand for the motor to sit on.

This is a clearer version of how the two components come in contact to turn the tilting tray.

The area in red is the wheel and the area in white in this photo is the worm.

The reason the worm and worm wheel is a good choice is because it has a significant speed reduction meaning 1 full rotation of the worm the wheel is moved 1 tooth forward.

Future Modification 3



The third modification as shown here is another box design based on the safety aspect. This is so that there is minimal risk of the users harming themselves as seen stated.

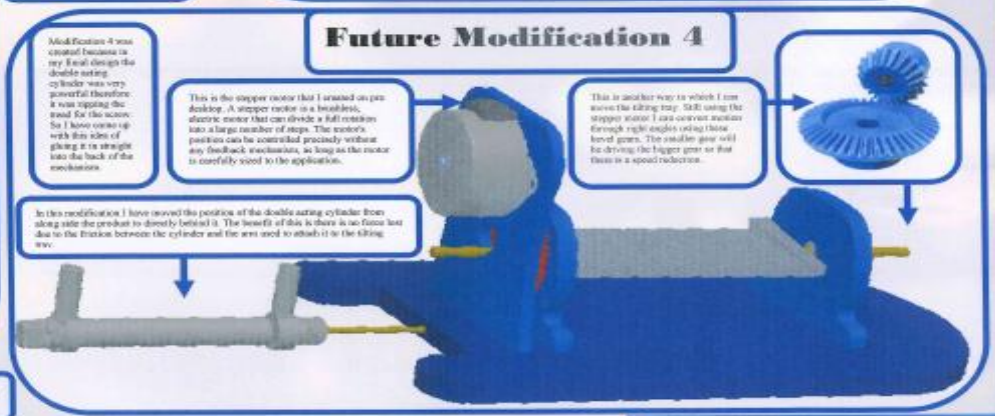
This was designed so that you could also store supplies as it as well so I had to make it pretty big in size. The closest slanted side here is where all the components will be placed.

This design is very basic but looks pretty well with the rest of the product. There is plenty of space for the circuitry as you can roughly see in this picture.

This is made out of acrylic, that means it is strong and durable and can withstand a lot of stress and strain. It is all fit in all very compact so that there is no slippage and risk of serious hurt.

In the future modifications page I have made 3 have 4 main modifications on this page as shown and they all could benefit in my final completed design.

Future Modification 4



Modification 4 was created because in my final design the double acting cylinder was very powerful therefore it was ripping the head for the screw. So I have come up with this idea of gluing it in straight into the back of the mechanism.

This is the stepper motor that I wanted on pre desktop. A stepper motor is a brushless, electric motor that can divide a full rotation into a large number of steps. The motor's position can be controlled precisely without any feedback mechanism, as long as the motor is carefully sized to the application.

This is another way in which I can move the tilting tray. Still using the stepper motor I can convert motion through right angles using these bevel gears. The smaller gear will be driving the bigger gear so that there is a speed reduction.

In this modification I have moved the position of the double acting cylinder from along side the product to directly behind it. The benefit of this is there is no force lost due to the friction between the cylinder and the arm used to attach it to the tilting tray.

All of the above modifications could significantly change the product by safety and aesthetics aspects.

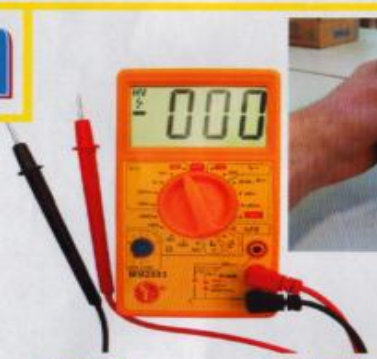
rsework

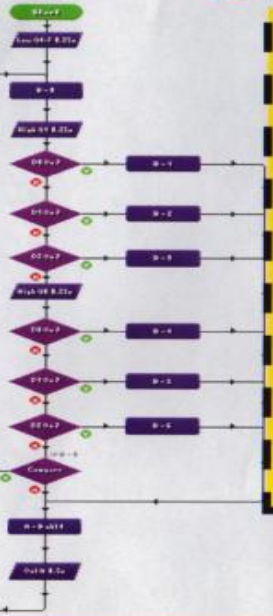
Automatic Chisel Sharpener

Testing and Evaluation

Circuit Testing

To ensure my circuit worked properly I need to test it out before I can program it fully and install it in my product. Firstly once I have soldered all of the components of the circuit on to the board I visually checked all of the connections and components against the diagram to check everything was in the right place. Once I was sure of this I the n used multi meter to check all the connections were connected properly. What the multi meter does is let me know if for example the power and ground are connected. It does this by the use of two probes which can be placed on any part of the circuit, is there is a connection the multi meter will beep to alert me to this. This is important as id I was to put power through the circuit and some of the connections were wrong it could damage the circuit.. I did this test and found a few errors in my circuit which were fixed and checked. Once I was sure the circuit was correct I powered it up using a powers supply. I did this with out any PICs install. Again using the multi meter I checked the voltage across components and sockets making sure signals that are meant to be high were high and vice versa. At this stage I had no problems and decided to move on and test the 7 segment displays and the 4026 up counters. I installed the counters, resistors and connected the 7 segment displays using ribbon cable. I manually incremented the counters by using a wire from the supply of the socket and pressing it on the clock pin of the counter. This caused it to increment and showing on the display. At this point I had some trouble with the one of the displays. It turned out one of the pins was soldered wrong so I re soldered it had that fixed the problem. It was at this point I had to wire my matrix in the box and could connect all the buttons and LEDs confident that my circuit worked. Having done this and installed the genie E18 into its socket I plugged in the circuit via the download socket to the computer for the first time. The Circuit wizard program picked up the circuit almost instantly which was a good sign. I first installed a simple test program for the matrix to check all of the buttons were recognised in the right place. This was all fine so I made another program to test if the genie and 4026 counters would work together it display the rugby scores which it did without issue. I finally tested the LEDs which worked perfectly with out issue. All I had too was install the whole program which worked fine after a little tweaking of timings. With the circuit working fully I installed it in the product and began testing it.





Ergonomics

In testing the ergonomics of the product I tested the handle by holding it in various positions making sure it was comfortable. The one problem I came across was that the handles are slightly too far away from the buttons, I could reach tem but it was not ideal. From this test I have cam to the conclusion that the handles should be moved closer to the box by approximately 20-25mm. the swivelling handles work very well and rotate freely. This allows the product to be held in a variety of positions comfortably the displays were tested and were bright and easy to read even from a distance of 2 meters which was excellent. The only slight problem was that under bright sunlight the displays were difficult to see. Having shown the product to a referee at Bangor rugby club I got some feed back which was over all positive. The ergonomic handles went down very well.

Evaluating the Circuit

Over all I am pleased with the outcome of my circuit and program. The circuit works well and forfills the function of my product. However there are a few areas where in my opinion it could be improved. Firstly upon power up you have to wait about 45 seconds before the circuit is product is ready to use. I think it would be better if this was quicker the same can be said for the reset function. Secondly when a button is pressed for a score the counter counts up a little slow inn my opinion and I would have liked that to be a little faster also. The Red and Yellow card system turned out a bit disappointing. The LEDs were not bright enough to illuminate the whole back panel. It can be seen very faintly which shows that the principle works. I would use brighter LEDs in the future. Over all though I am quite pleased with how it turned out.

Evaluation of Product

Pros

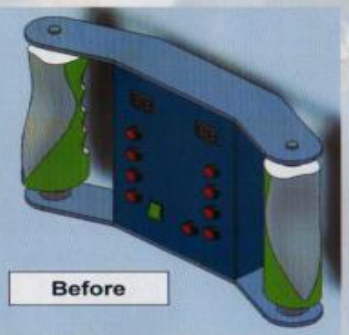
The product turned out well the finish is very good and it functions as it should. The ergonomics are excellent, the handles are comfortable to hold even for a long time and they fit a range of hand sizes. The displays are bright and can be easily read from a distance. The product is suitable for its task and is well made and durable

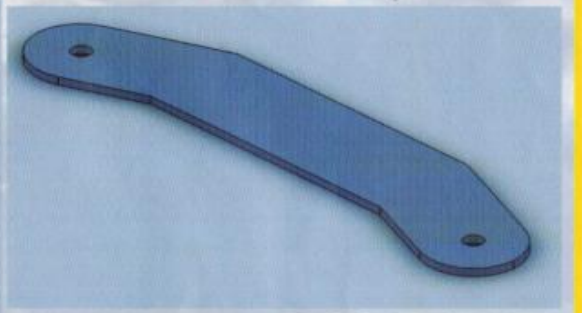
Cons

While I am pleased with the outcome like any product it its not perfect and there are some areas I feel could have been done better. The handles are too far away from the buttons meaning that you either have to stretch your thumb to reach them or hold the product in one hand whit operating it with the other and this could be an inconvenience to the user. The Red and Yellow card system does not work as well as I hoped, as a mentioned before.

Further Development

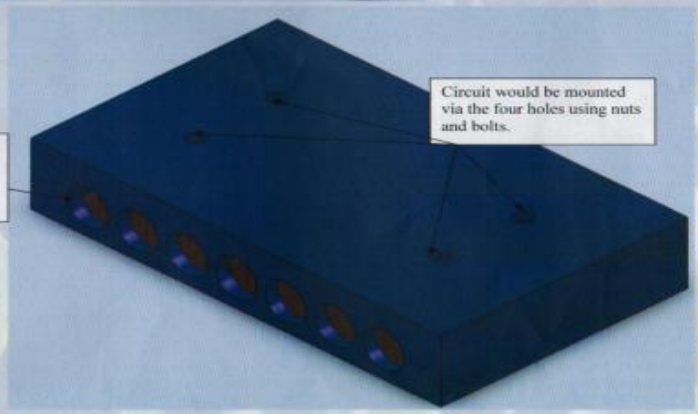
As this product is a prototype the next step would be to develop the product further in order to create a refined product. In light of this I have come up with some further developments that I believe would improve my product. Firstly I would move the Handles closer to the box by modifying the supports to not come out as far. (See drawing.) This would greatly increase the ergonomics of the product as the user would be able to reach the buttons form the handles a lot easier.





The final piece of development I would do would be to refine my program. I would make it run faster so as the reset and start up do not take as long. I feel this would help make my product more user friendly and a better overall product.

LEDs mounted here. A total of 14 will be used, & red and 7 yellow



Another development I would make would be to the LED system. I have re deigned my mount to house more LEDs and the circuit board. By increasing the number of LEDs the display would be brighter and be far more effective than at present. Also as this mount will have the circuit and LEDs on it it could be removed as one unit for maintenance etc… I would also have the LEDs running off a separate Genie due to the number of them.

DVD of student's work.