

Leaving Certificate
Technology

20XX / 20XX

Ordinary Level

Exam Number: _____

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The Theme

Theme: A Safe Environment

There is an increased awareness of the importance of safety in the home for both adults and children. Items such as personal alarms, child locks, burglar alarms, warning devices, temperature alarms etc. help to create a safer environment.

With reference to the above theme, design and make a device that will improve personal safety in the home. The device must incorporate a mechanical or electrical or electronic system.



Analysis, Research & Investigation

For this thematic brief the solution:

- must be a safety device
- must improve personal safety in the home
- must be suitable for use by adults and/or children
- must incorporate a mechanical or electrical or electronic system
- should be easy to use
- must be easily visible to the user

I have decided to carry out some research on the following areas:

- Personal Alarms
- Burglar Alarms
- Warning / Signalling Device

Personal Alarms:

The number of personal attacks on the elderly and young women has continued to increase in today's society. There is a need for some type of small handy device that could be easily carried and triggered by the user. The device should send out a loud sound when triggered to catch the attention of passers-by!

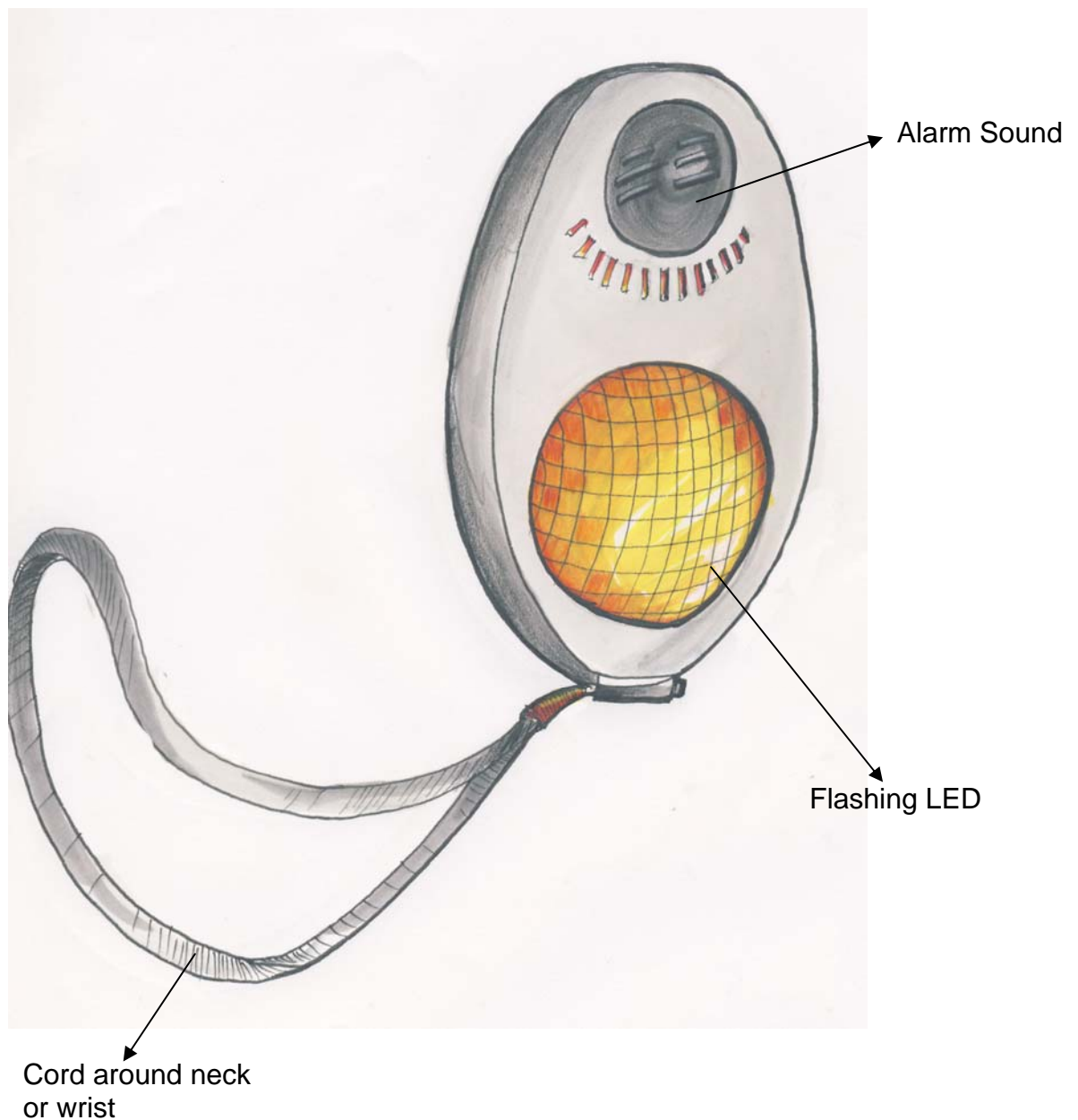
The device shown in the picture is designed to sound an alarm when the cord is pulled. As the alarm is worn around the neck the cord can be easily reached by the person wearing it in an emergency. It is cylindrical in shape to suit the round batteries it uses to power the device. It is small and light weight so would not be difficult to wear.

It might be possible to change the design to a flat shape if button cells are used instead of round batteries.



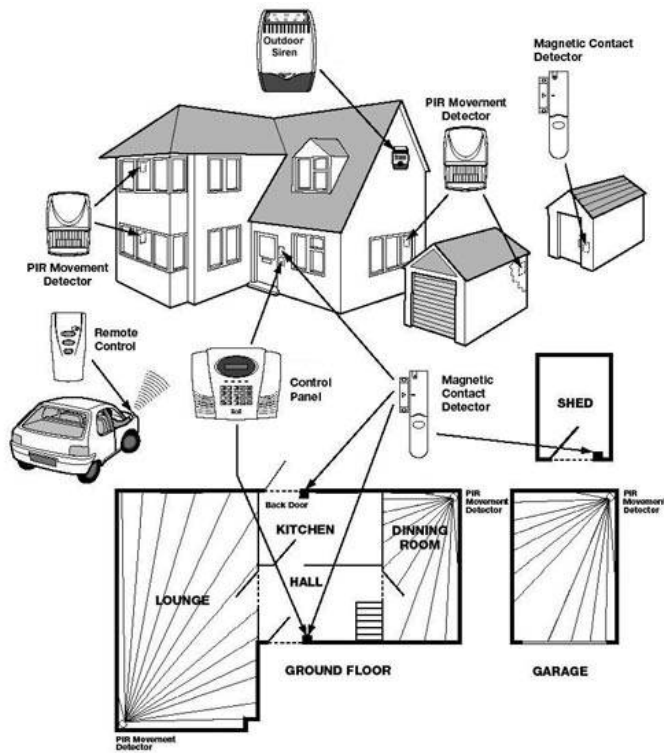
Cord

The sketch below shows an alarm that I have seen people use. This alarm is designed to be worn around the neck or strapped to a person's wrist. It is very small in size and quite strong. The casing is made from ABS, nylon etc, and it looks like it is made by a process called injection moulding. This shape could be made easily in school using the vacuum form machine and rigid polystyrene plastic. When triggered it sounds an alarm and turns on a flashing light. The flashing light is a good idea because some people are deaf and would not hear the alarm but might see the light. I have used flashing LED's in circuits before so it would be easy to make a circuit for a design like this.



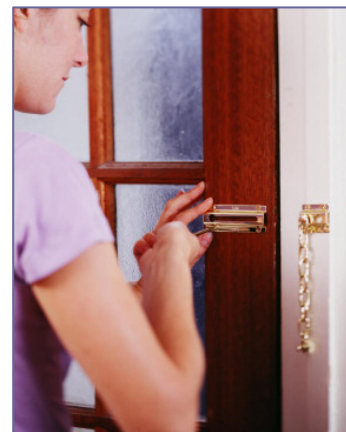
Burglar Alarms:

A Domestic Burglar Alarm:



This diagram shows the different location points in and around the home for many different alarm devices that could be fitted to help provide better security – sensors, motion detectors, monitor movement etc.

A security chain helps to make your home feel more secure. Door chains allow you to check who is calling before letting someone in. This is an obvious security device in addition to the electronic Burglar Alarm. It is generally recommended that both are installed in the home.



The Evo D413 is a wireless door bell/flashing light system. It is used to indicate that there is someone at the door of the house. The bell push is fitted to the door like any ordinary door bell, but the chime/flasher unit is wireless making it fully portable up to a range of 200 metres.

This means it can be used in any room throughout the home and can be taken out into the garden. This system is also designed with the hard of hearing in mind with a flashing light built in for use instead of the chime.



Chime sound

Flashing Light

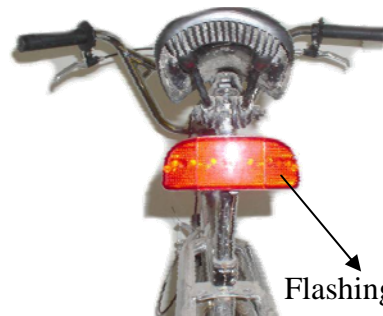
I like the range that this device provides however the electronic system is too difficult for me to make and a remote control would be necessary. Also the casing design is a bit boring and looks to be quite large.

However I like the idea of including a light in addition to a buzzer as not everyone will hear the buzzer including the elderly.

Warning Device:

There is plenty of warning or signalling devices available such as hazard lights and reflective surfaces used today.

I took a picture of this flashing tail light on a bicycle using my digital camera.



Flashing tail light

When trying to decide what I would do I thought about who would use the safety device. The device should provide personal safety and in the home. This is necessary in the event of personal attack / fire risk / fall / accident etc

People who will be in the home include:

- babies/ children / teenagers
- adults
- elderly
- handicapped



Handicapped people include those that are:

- Visually impaired
- Wheelchair bound
- Hearing Disability

People with a hearing disability could have problems hearing:

- someone ring the door bell or someone knocking on the door
- the telephone ring
- a cooker alarm sound
- the smoke alarm sound
- an intruder enter the house
- a dog barking to warn of an intruder
- the television or radio which they have accidentally left on

Conclusion

After much thought and discussion with my teacher I decided to investigate the need for some type of visual indicator to signal to people with hearing difficulties someone has called at the door. I also wish to include a security alarm that indicates that an intruder has entered the property.

My Design Brief:

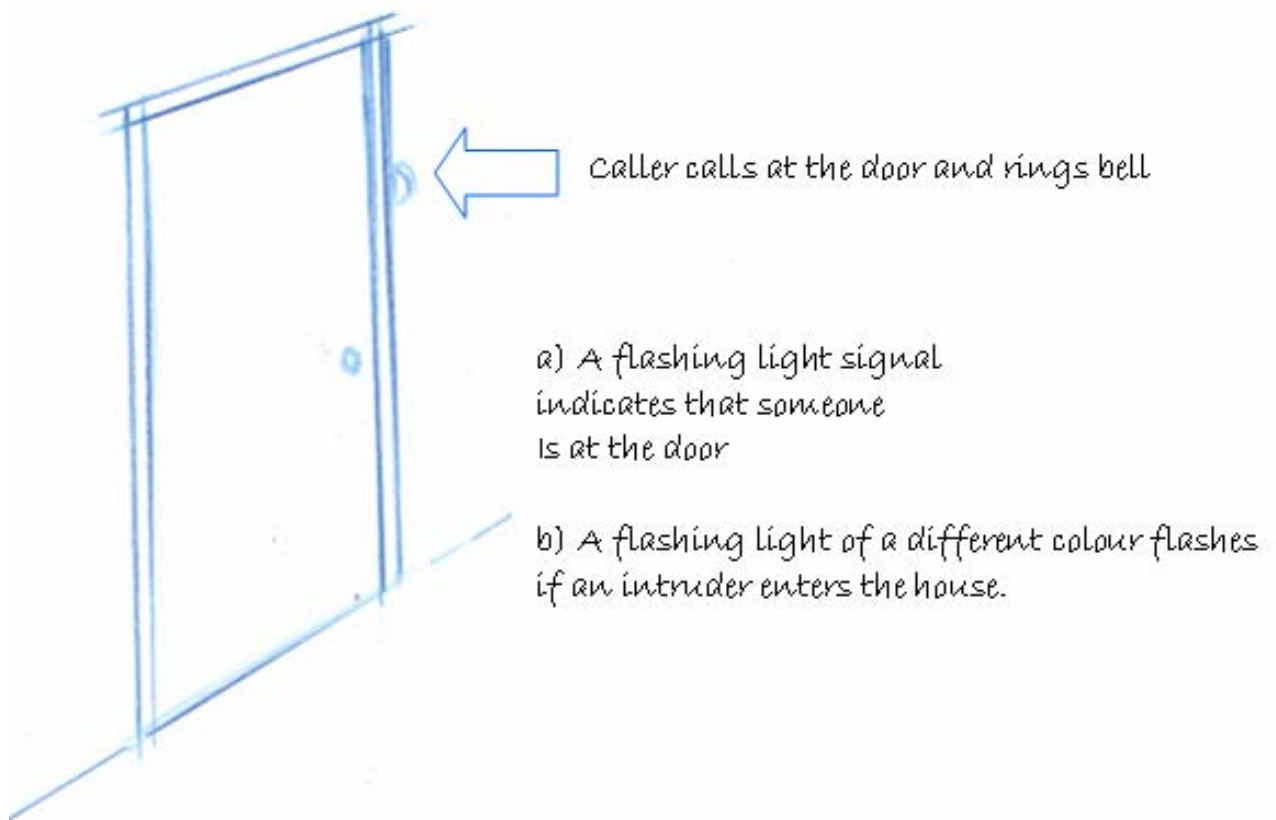
Design and manufacture a device which will signal to a hearing impaired person that someone is at the door. An output light will indicate when someone is at the door. The device will also include an alarm to indicate that an intruder has entered the house.

I have decided to design the casing or housing as a TV remote control holder or stand as this is often in a handy location and easily seen.

I thought of this idea when I found the picture below during my research showing a TV remote control that went on fire. When it fell down between cushions on a couch some buttons remained pressed causing the remote control to overheat and go on fire.

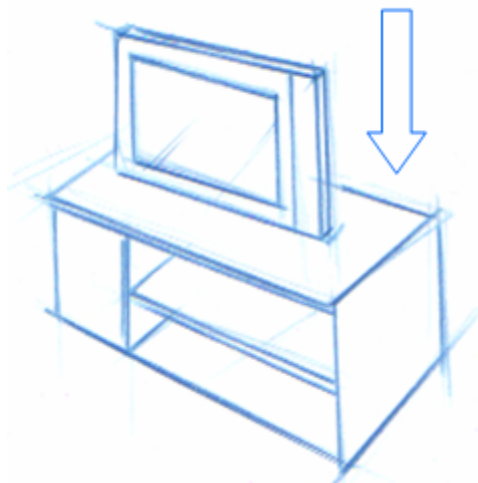


Two different coloured lights will be used to show that someone is at the door or an intruder has entered the house.



A TV remote holder/stand
could be dual purpose?

The unit is placed near the TV
in a central location.



Design Specification:

1. The device should be operated by a normal door-bell push button
2. When the button is pressed the LED will flash until the device is reset
3. It should be easy to change the battery
4. The product / device should also hold a TV remote control
5. I should be able to make the project in the Technology room
6. The electronic parts should be visible and accessible to the examiner
7. The product should be strong and withstand sudden shocks
8. The product should be environmentally friendly

Overall Management of Project

A Proposed Timeframe: -

Time: We have approximately 11 weeks to complete the project and folder. This excludes Xmas holidays, February mid-term break and the time allocated for our pre-leaving cert exams.

I have five classes per week. Two doubles and one single. It is hard to get project work done during a single class so I will use this class for putting my folder together. I will use the double classes for making the project. The Gantt chart below shows how I plan to use these classes to make the project. It is difficult to know at this stage of the exercise just how long some of the processes will take therefore the above timeframe is approximate but this will be useful as a guide to help time manage my work to ensure that I am on target and meet the deadline.

Class Periods:	5	5	5	5	5	5	5	5	5	5	5
Analysis, research & investigation											
Overall management of project											
Design ideas & selection of optimum solution											
Sketches & drawings for manufacture											
Environmental impact											
Materials and production planning											
Product realisation											
Evaluation & critical reflection											

Budget: I have estimated that approximately 10 euro should cover the total cost of making the project. However my research will help me calculate the cost of materials and components. When I decide on my final design I will know exactly what the total cost will be.

Materials: I will use plastic or wood for the project as these are the materials I have used to make other projects.

Resources: We use a woodwork room for our technology class but it also has plenty of technology tools and machines.

Skill: I have to be able to make the project myself in the technology class. I like working with plastic as it is easy to cut, file and bend into a lot of different shapes using a strip heater or vacuum forming machine. It is also very easy to cut on the CNC router. The design must not be too difficult or I may run out of time and not get it finished by the completion date.

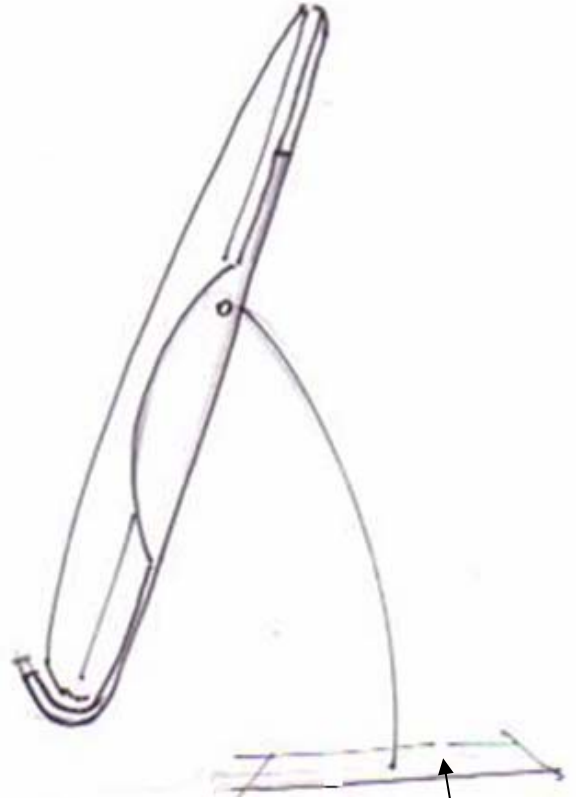
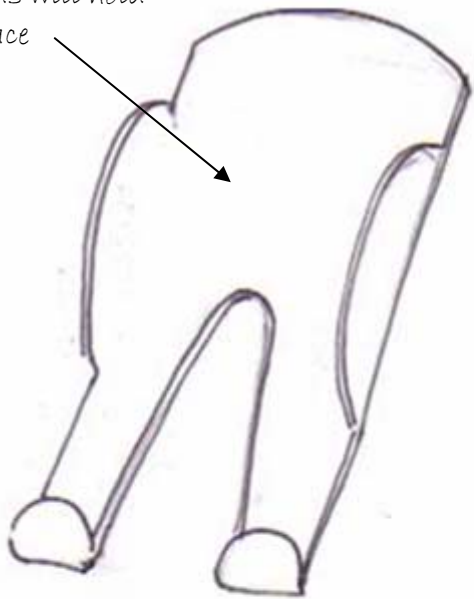
I am not very good at soldering but I can make a PCB for any circuit I choose on the CNC router. This will help me solder the circuit correctly.

Design Ideas & Selection of Optimum Solution

Ideas for the Remote Control Holder

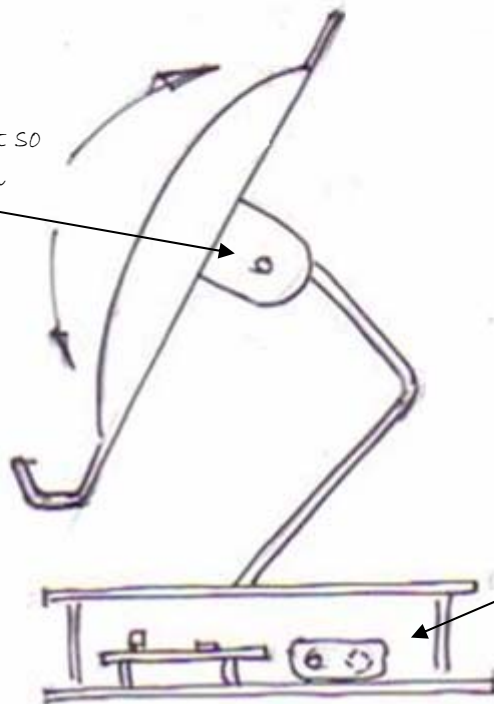
Design Idea 1

Remote control would sit in here. Bending the sides and ends will hold it in place



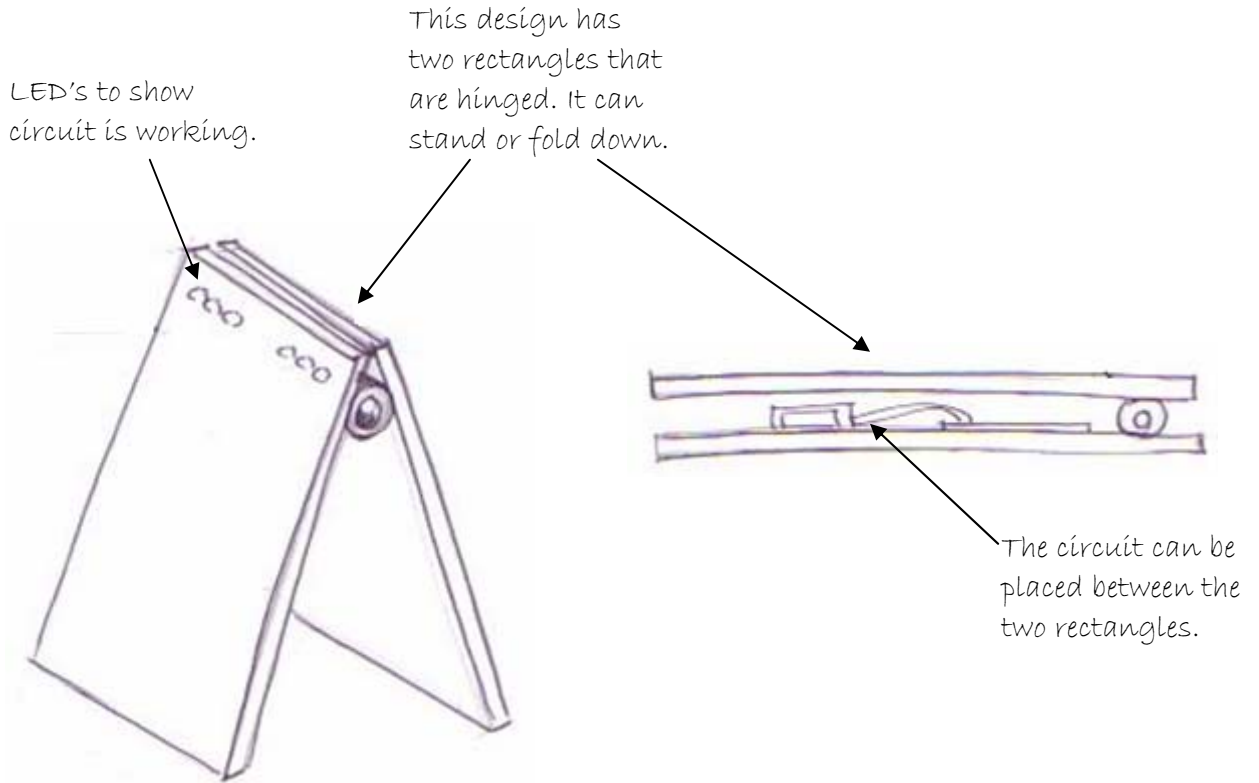
This is a simple flat base to support the remote control holder. This design has nowhere to put the circuit. It would be easy to knock it over.

There is a hinge joint so the remote holder can swivel.



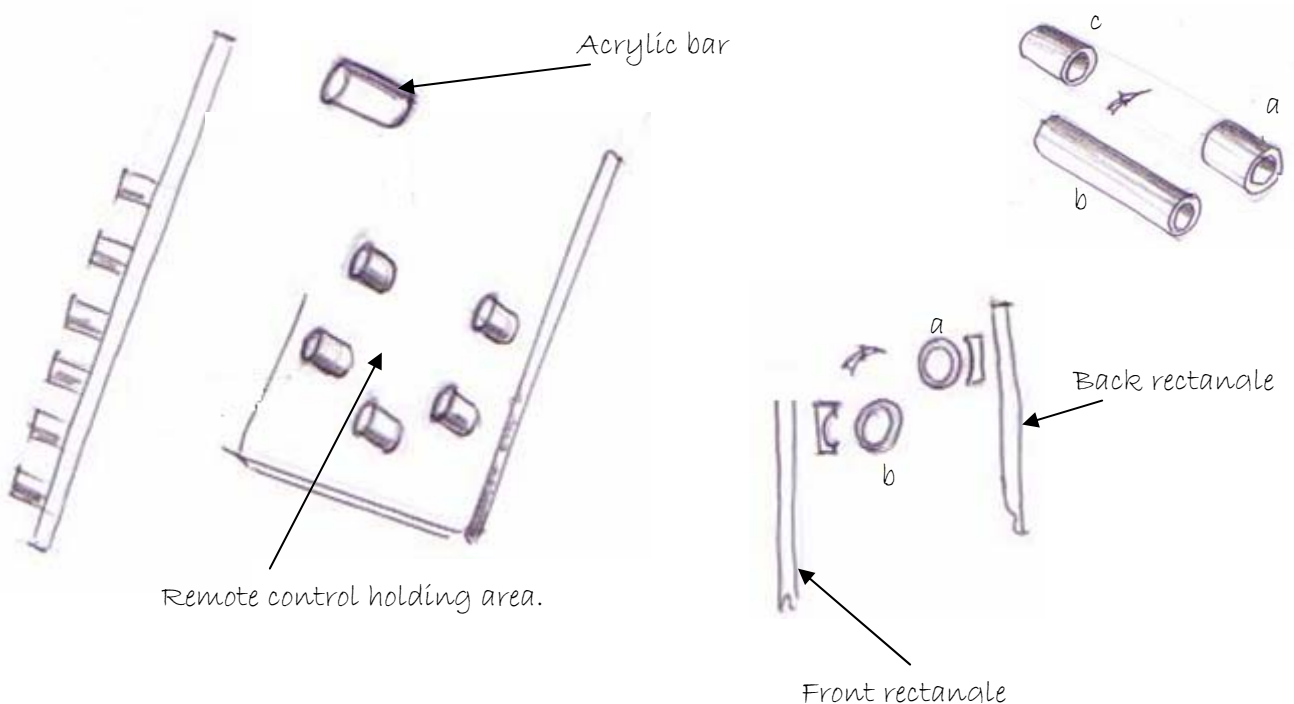
This design has a place for the circuit. Making the base bigger will make it more stable and less likely to fall over.

Design Idea 2



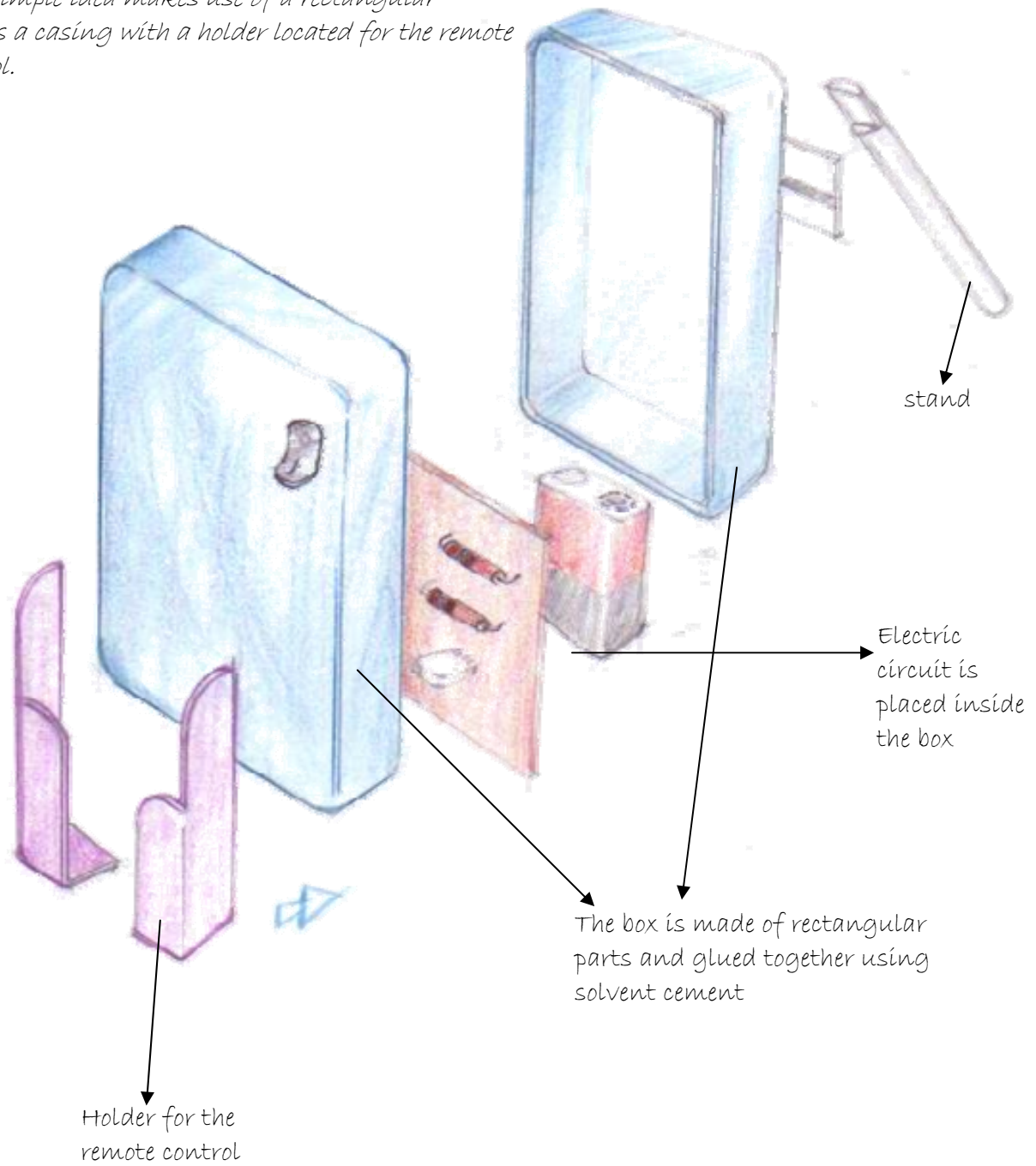
The remote control could be held in place by pieces of acrylic bar that are glued onto the surface of the front rectangle as shown in the sketches below.

Tube a and c are glued to the back rectangle and tube b is glued to the front rectangle. The tubes are placed in position and a bar is pushed through all 3 tubes making the hinge.



Design Idea 3

This simple idea makes use of a rectangular box as a casing with a holder located for the remote control.

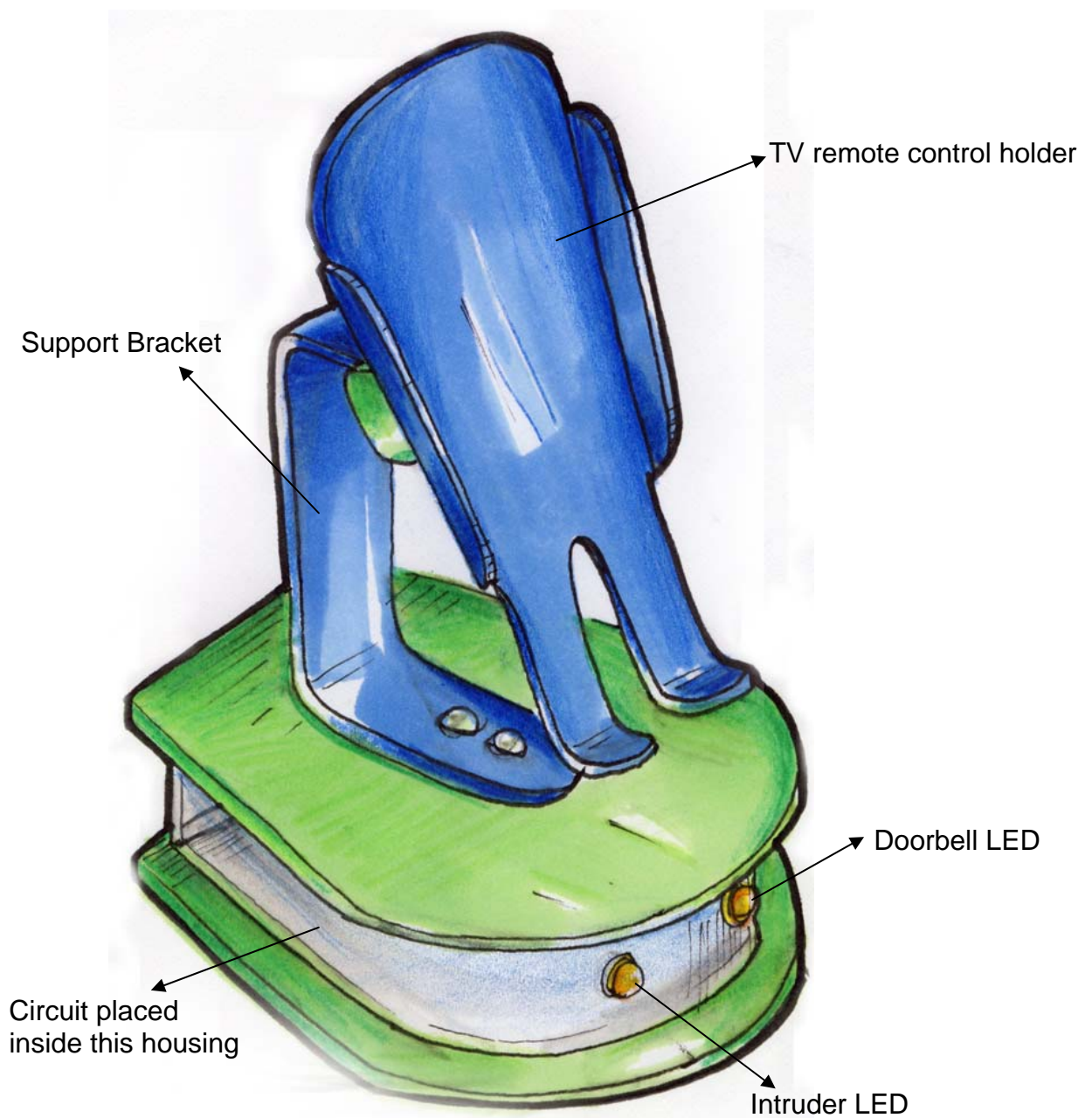


Optimum Solution

I have decided to select idea 1 as the design I will make. I will make the last version where there is a housing to contain the circuit as shown below in the sketch.

I chose this idea because:

- It does not have too many parts
- All the parts are quite big so they will be easy to make
- Acrylic is easy to shape and bend
- A light will flash if an intruder enters the house
- Another light will flash to show someone is at the door
- It contains an electronic system
- It will hold a remote control



Ideas for the Electric Circuit

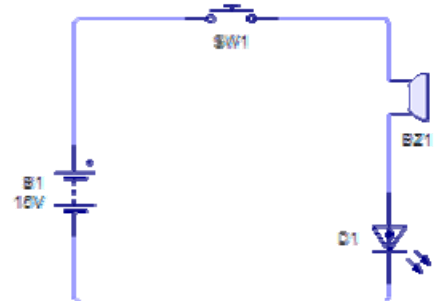
Circuit 1: Shows a very basic electronic circuit design

Pros:

- A very simple circuit that turns a buzzer on and off and has a flashing light or LED

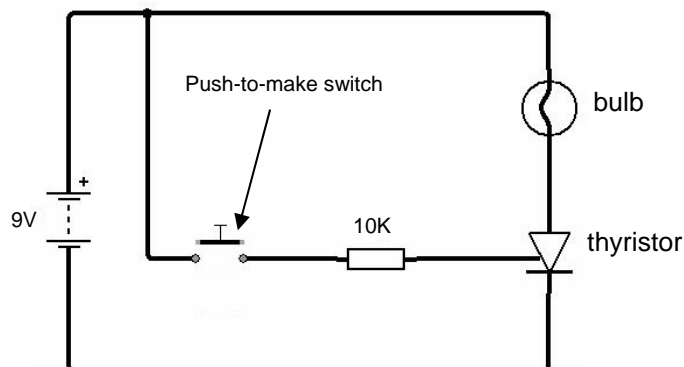
Cons:

- The circuit only works while the door button is pressed. Most people only press it for a second and take their finger away.
- The circuit needs to sound and flash for at least 10 seconds
- It does not indicate if an intruder has entered the house



To use this circuit I would have to change it so that the buzzer and LED stay on longer.

Circuit 2: Shows a simple latching circuit using a thyristor. When the door bell is pressed the light will stay on.



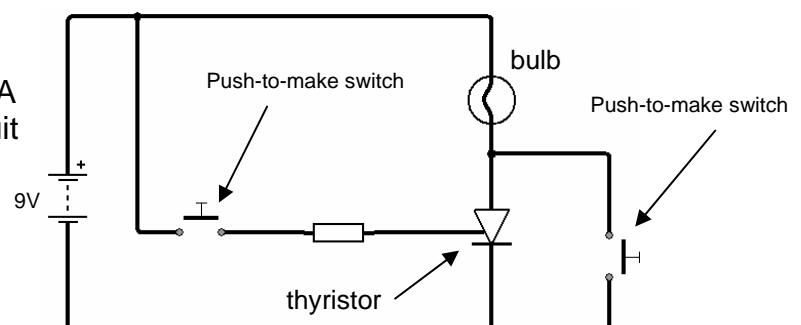
Pros:

- The light will remain on even if the door push button is released.

Cons:

- When no one is at home light will remain 'on' wasting battery power. So how can I get the light to go off?
- There is no indication of an intruder in the house.

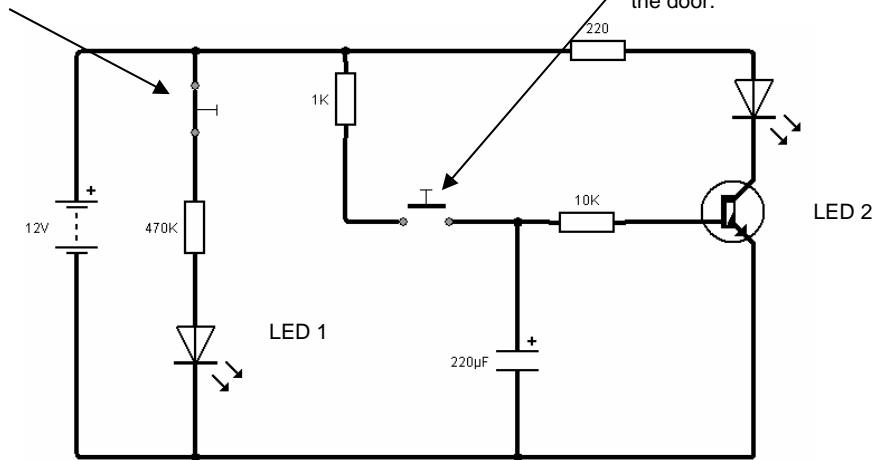
I looked up a technology book and found how to reset a latched circuit. A push-to-make switch resets the circuit by bypassing the thyristor.



Circuit 3: An electronic timer circuit design using a capacitor.

Push-to-break switch. When the door is opened LED 1 will light to indicate there is an intruder in the house,

Push-to-make switch (door bell). When this switch is pressed LED 2 will light indicating someone is at the door.



Pros:

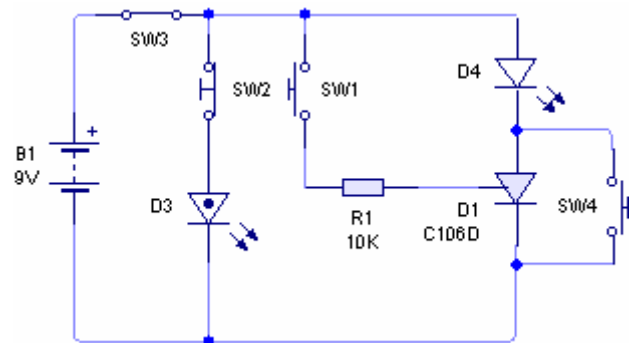
- this circuit design uses a capacitor to keep the light flashing (LED2) for approximately 10 -15 seconds
- LED1 turns on when the door is opened
- easy to manufacture

Cons:

- capacitor timing tends to be inaccurate
- there is a lot more components to solder

Optimum Solution

My circuit design will use a combination of circuit 2 and circuit 3. I will use circuit 2 to latch the light on and a push-to-make switch to reset the circuit. I will also use a push-to-break switch and flashing LED from circuit 3 to warn if there is an intruder in the house.



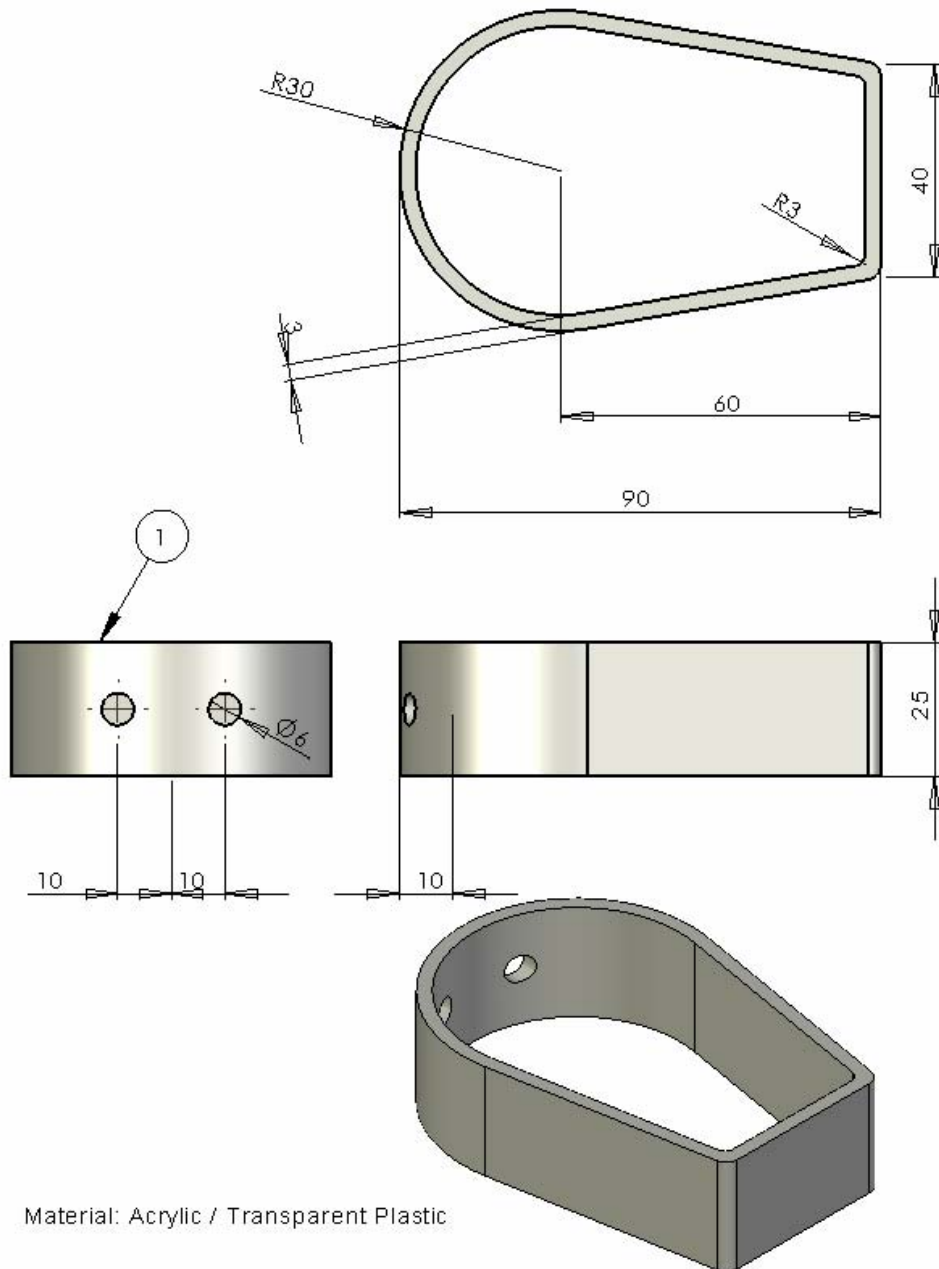
Final Circuit Design

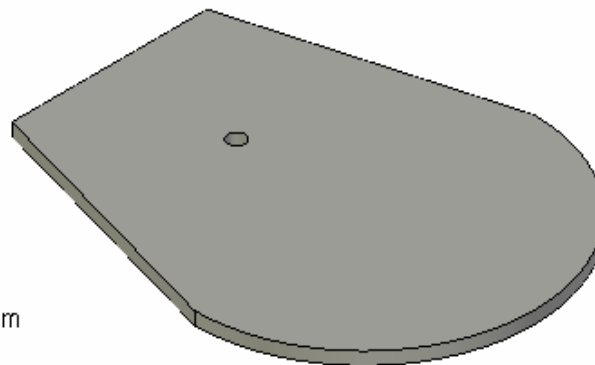
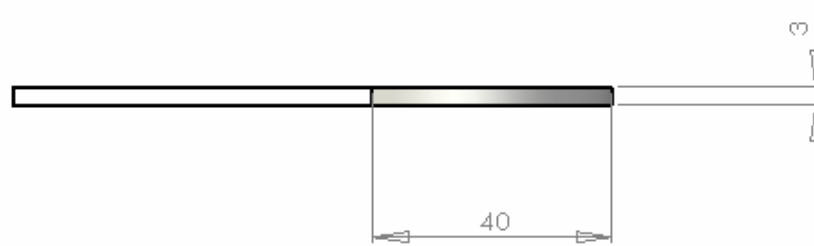
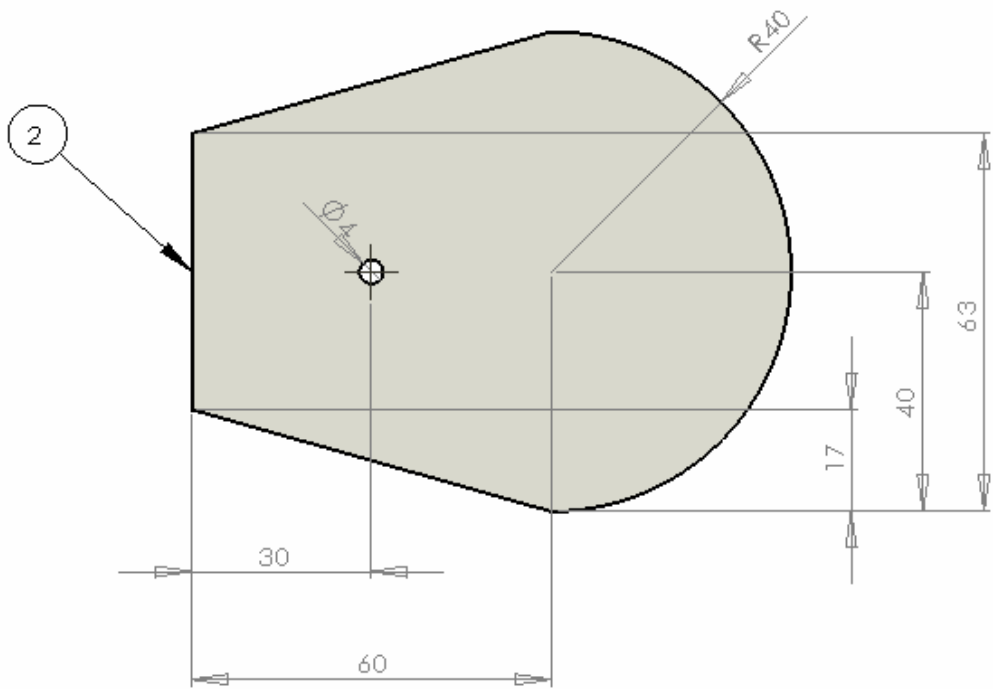
I chose this circuit because:

- It will show when someone is at the door and when the door is open.
- All the components are in the technology room.
- I can use the CNC router to make the PCB board so soldering this circuit will be easier than using strip-board.
- I have used push to make and push to break switches before so I am familiar with how they operate.

Sketches and Drawings for Manufacture

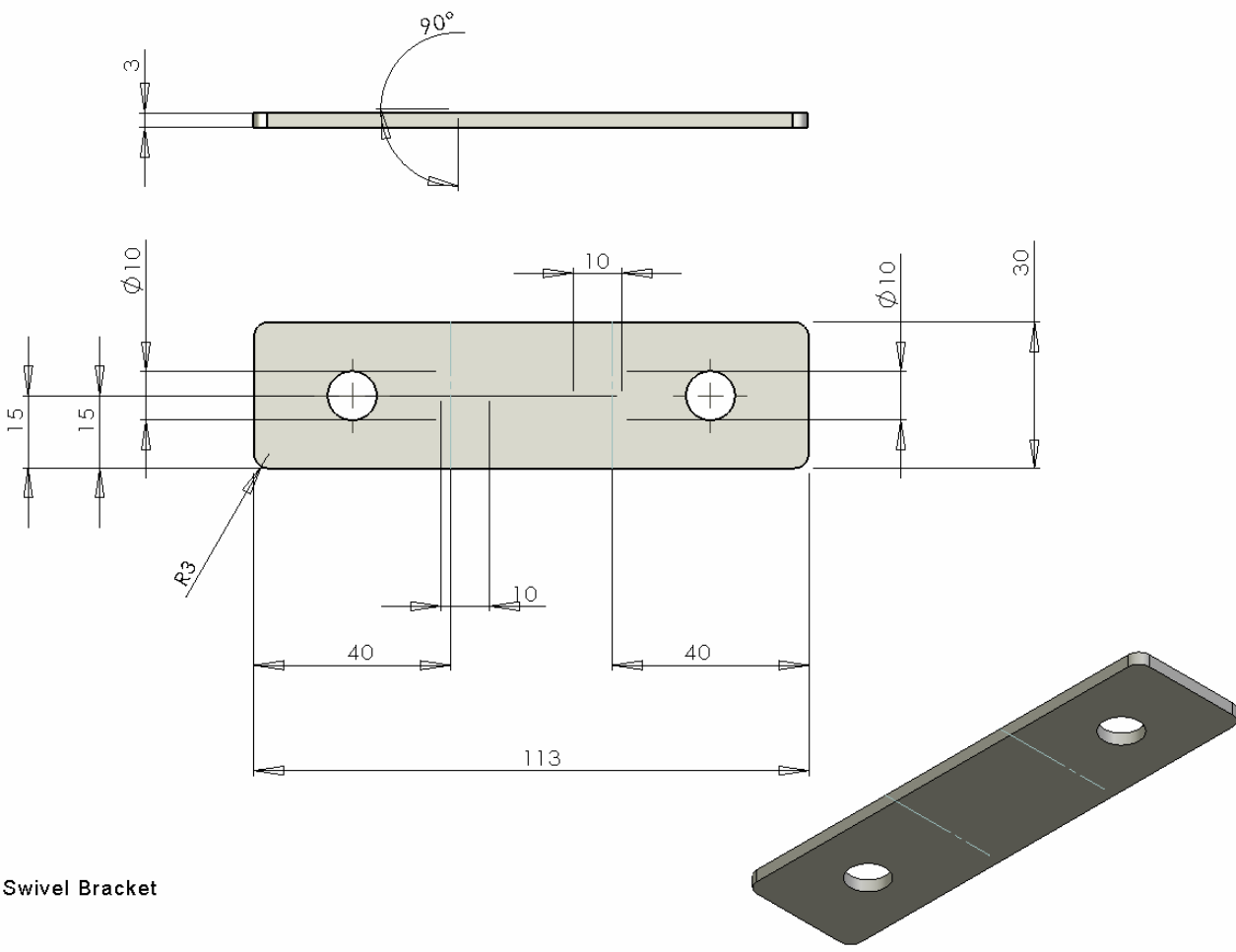
Housing: Part 1



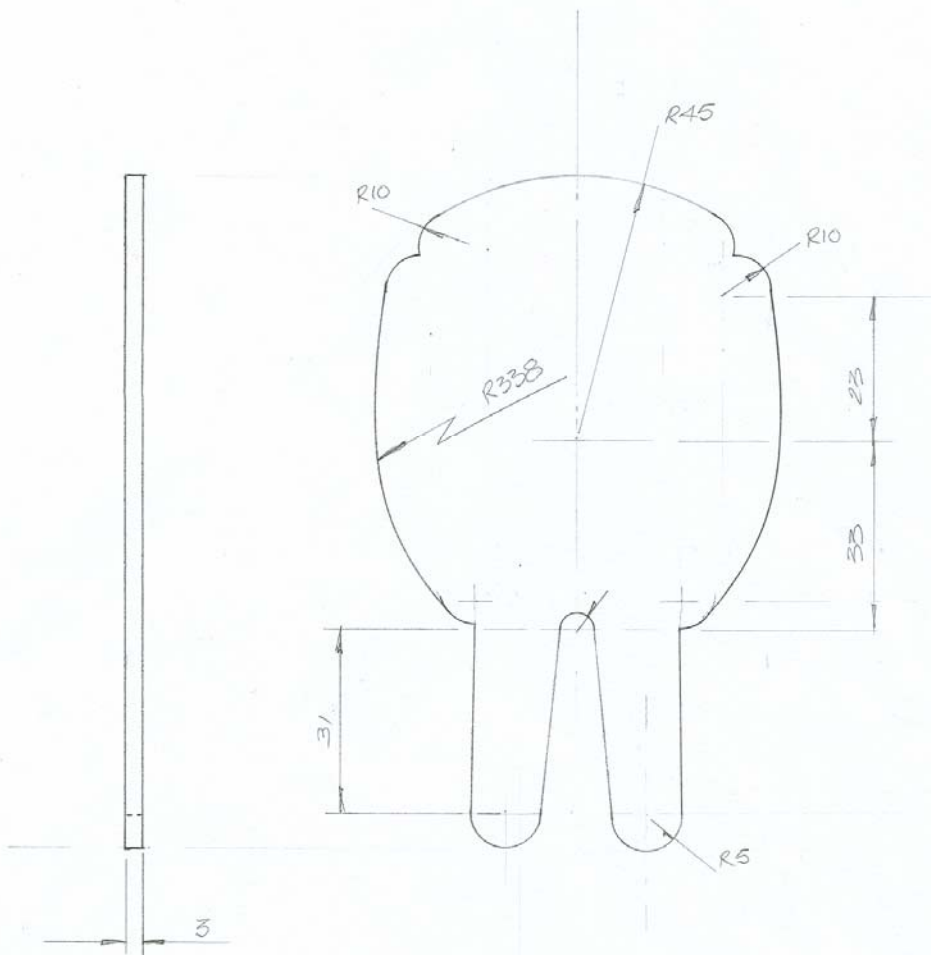


Base: Part 2

Material: Acrylic Plastic 3mm

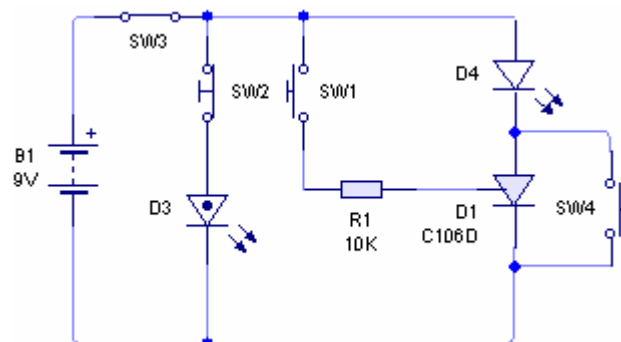


Swivel Bracket



TV REMOTE CONTROL HOLDER.
SCALE 1:1 MATERIAL ACRYLIC

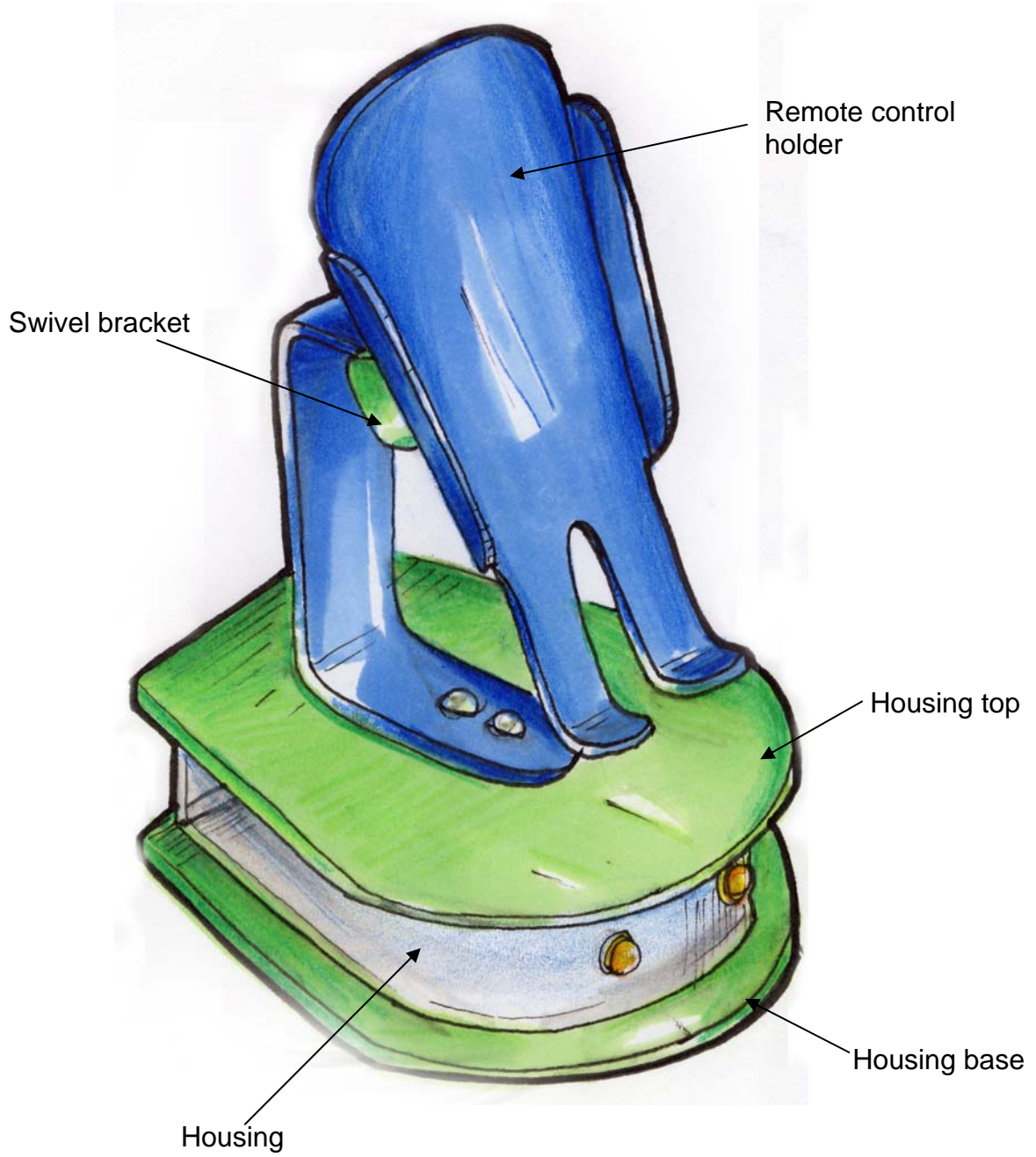
Circuit Diagram



Environmental Impact

The material that I intend using for my casing design is acrylic plastic. Plastics are made from oil which is a fossil fuel and unfortunately as the price of oil increases then so will the cost of plastics. Another disadvantage of this type of plastics is that acrylic is not biodegradable and will take many years to disintegrate. However many types of plastics can be recycled and have alternative uses. Sign makers use acrylic because it is easy to machine, is lightweight and does not corrode. Off-cuts can be used for school projects. Another material I could have used is wood. There are many different types and some give an excellent finish. Wood is a renewable material. Wood can also be recycled, reused for heating and is biodegradable. I chose acrylic because I thought it would be easier to make the project and it is available in many colours. I would have to paint the wood to get the same effect.

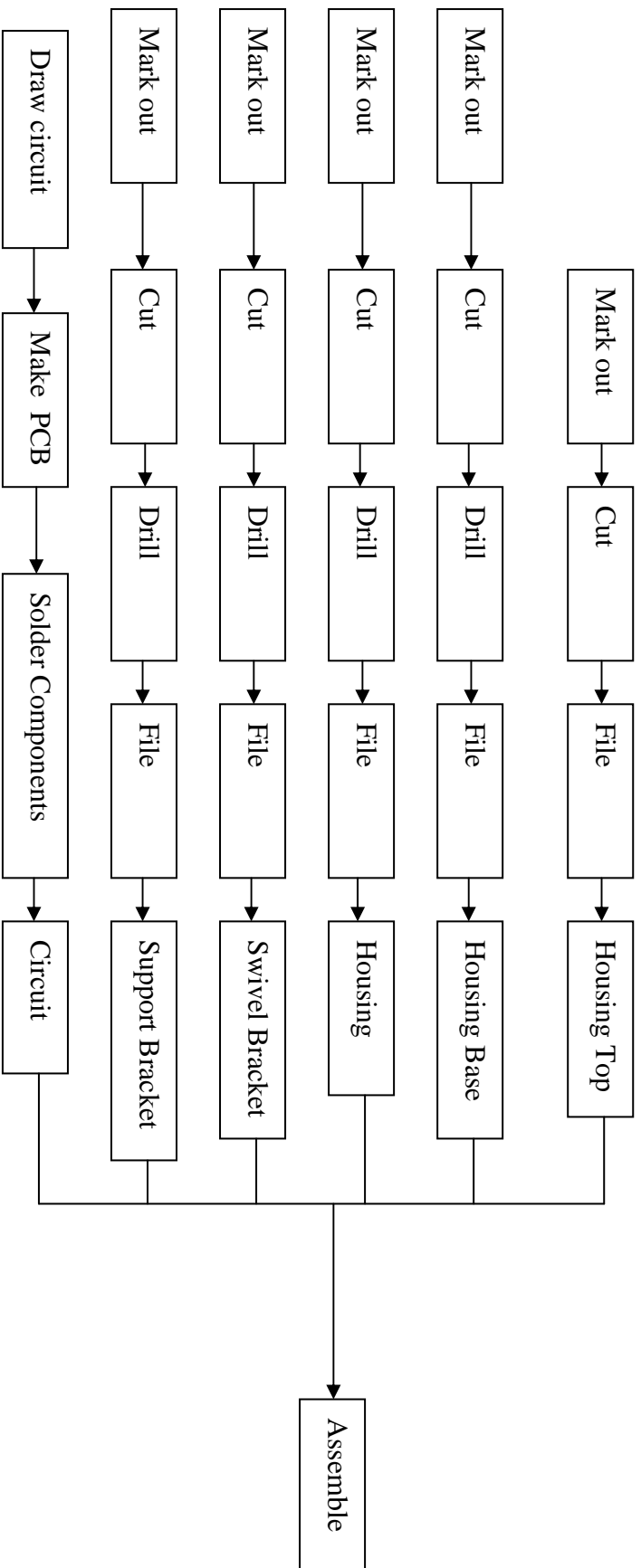
Materials & Production Planning



Part	Material	Measurements	Classes
Housing base	Acrylic	110 x 80 x 3	5
Housing top	Acrylic	110 x 80 x 3	5
Housing	Clear acrylic	270 x 25 x 3	5
Swivel bracket	Acrylic	1130 x 13 x 3	3
PCB board	Copper clad board		4
Soldering circuit			5

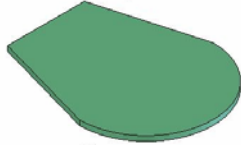
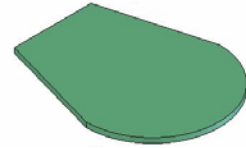
Components	Quantity
LEDs	2
10k resistor	1
Push to make switch	2
Push to break switch	1
Battery	1
Thyristor	1
On/Off switch	1

Work Breakdown Structure Diagram.



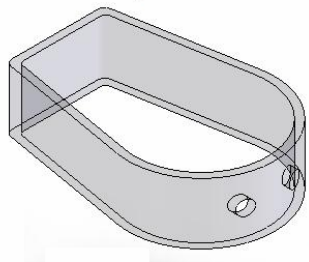
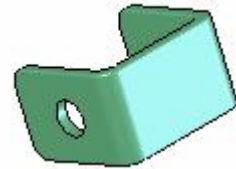
Production Realisation

1. Mark and cut out the housing base using a fret saw. File and polish the edges.



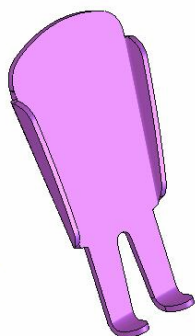
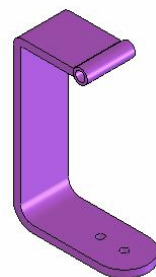
2. Mark and cut out the housing top using a fret saw. File and polish the edges.

3. Mark out and cut the swivel bracket. Drill holes for hinge. Bend each end at 90° using the strip heater.



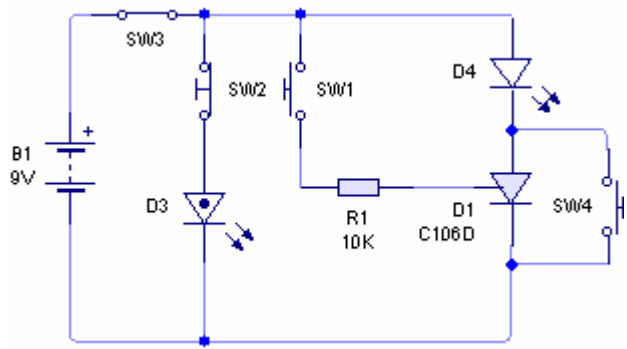
4. The casing unit was made from cutting a plastic pipe in half for the semi-circle portion. Strips of plastic were marked out and cut for the sides and back. These were then glued to the pipe to form the casing unit using solvent cement.

5. Mark and cut out the support bracket. Drill the two holes. Bend each end using the strip heater. Glue plastic tube to top end.

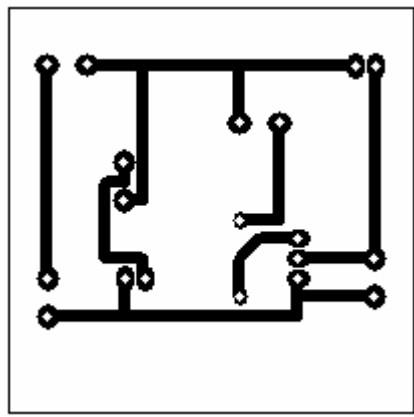


6. Mark and cut out the remote control holder. Bend into shape using the strip heater.

7. Draw the circuit using circuit wizard and produce a PCB layout. Make the PCB on the CNC router.

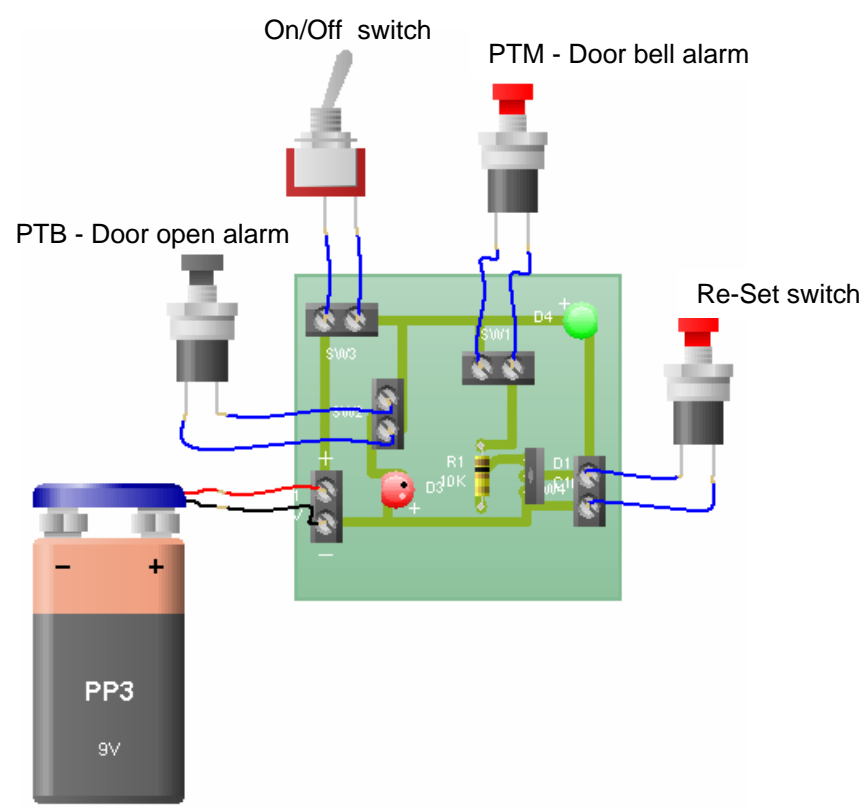


Circuit Diagram



P.C.B. Layout

8. Solder the components onto the PCB and test the circuit.



9. Assemble the project.

Evaluation & Critical Reflection

I was pleased with the appearance of the finished model and I enjoyed making the product. However I feel I am now just ready to start all over again and do a better job! My research materials helped me and the reference materials I collected inspired the final design. Google images are great for looking at other ideas / existing products particularly of TV remote control holders. I also researched mobile phone holders to get ideas. The acrylic plastic was quite easy to cut, file, glue and polish and overall I had no problems using this material. Fortunately no finishing was required on this material just polishing the edges on the 'buff'. The liquid solvent cement was clean and easy to use in the assembly of the stand.

My teacher showed me how to use the burette opposite which applies the liquid solvent cement precisely.



Bending the acrylic was also quite easy I used the hot wire bending machine for sharp bends and the strip heater for the larger radii. I would have liked to have more time to experiment using certain types of hardwoods with acrylic plastic. For example black acrylic and sycamore?

I struggled with my time management despite having a plan at the start. However I did not realise and underestimated the time it would take to complete certain tasks particularly when manufacturing.

If I was involved in a major project like this again I would plan my time better!! I would also make two changes:

- When the door opens LED1 turns on but when the door closes again it goes off. I would use a thyristor in the circuit to keep the alarm on until it was reset by the owner.
- The support bracket is weak and bends slightly under the weight of the remote control. I would make it wider to give it some extra strength.

Overall the project satisfies the brief:

- It improves personal safety in the home
- It can be used by the majority of people
- It does contain an electronic system
- The device is fairly sturdy and strong

In the future the TV may be developed to include some type of house security indicator integrated providing a signal / warning to the home owner that an intruder has enter the property?



