Codsall High

Design & Technology Option Choice

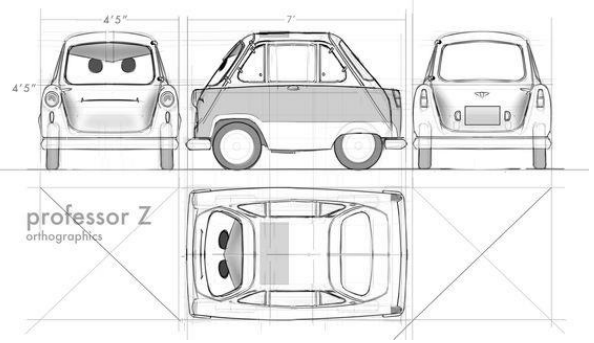
Standard GCSE Block J, L & M

- 2 x 1 Hour lessons per week
- Yr 9 – Skills Building
- Yr 10 – Developing skills and specialising in chosen areas
- Yr 11 – Coursework which is worth 50% of the GCSE – emphasis is on the practical coursework
- Plus a Final 2 Hour Examination

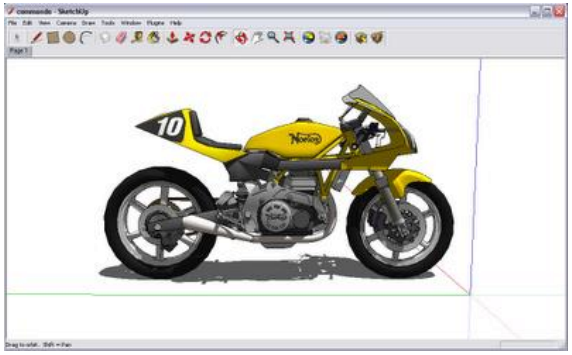
FastTrack GCSE Block K

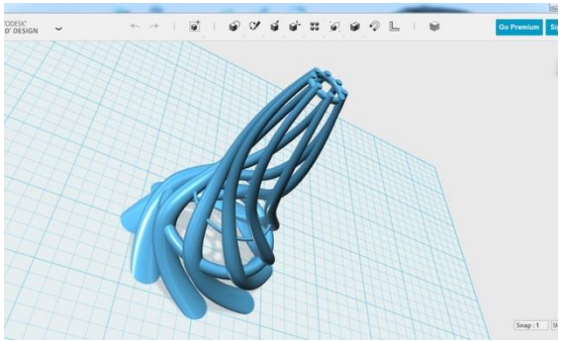
- 3 x 1 Hour lessons per week
- Yr 9 – Skills Building mini projects
- Yr 10 – Coursework which is worth 50% of the GCSE – emphasis is on the practical coursework
- Plus a Final 2 Hour Examination

Design and Communication



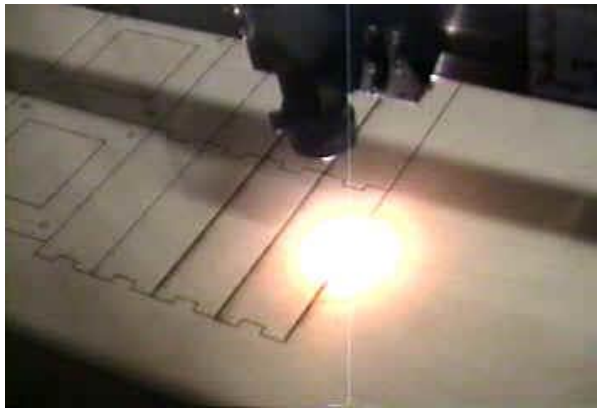
- **Impact of Design & Engineering**
- **Brief and Specifications**
- **Creating Design Ideas**
- **Orthographic Drawings**
- **CAD – Computer Aided Design**
  - **2d Design**
  - **New software***
  - **Autodesk - Free**





Materials and Processes

- **Materials and their properties**
- **Standard parts and Components**
- **Existing Products and their technological development**
- **Manufacturing and fabrication techniques**
- **Safety in the workshop**
- **Quality Control**
- **Jigs and Moulds**
- **Evaluating products**



Final Coursework – 50%

- Choice of three very open topics – last years for example:
  - Supporting or Participating in a sport
  - Educational Toys or Games
  - Eating away from home
- Topic choices are released on the 1st of June each year and they are not repeated
- Students are required to create a product and an accompanying portfolio consisting of 21 A3 pages

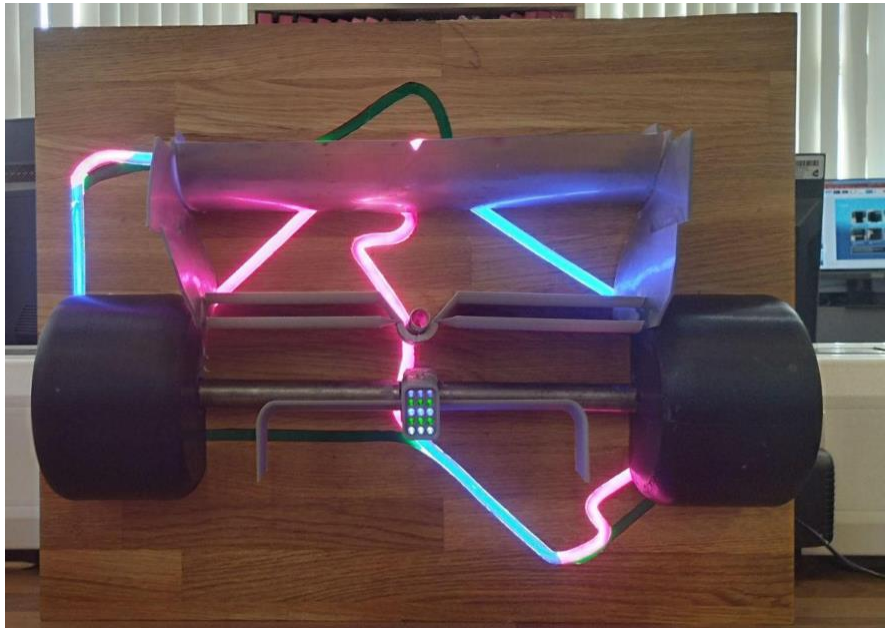
In Year 9 you will be learning how to…

- Produce working drawings
- Develop CAD and CAM skills
- Produce presentation and graphical drawings
- Learn how to work and use a metal lathe
- Learn how to work and use a laser cutter
- Learn how to work and use a 3d printer
- Casting metals
- Design and make to solve specific problems

Example Coursework

Example Coursework

Example Coursework



Example Coursework

Example Coursework

Example of Grade 9 Coursework

Design Technology NEA GCSE 50%

Title: Emergency Doorbell

Topic analysis

Idea 1: Bird play

Description: This product will be a wooden attachment that can be attach to anything outside for the birds to play on so they don't sit on anything in your garden. This will keep the birds entertained and distracted.

Idea 2: Furniture with built in entertainment

Description: This will be a product to use anywhere outdoors and includes entertainment for family and friends such as music, lights, Wi-Fi, cup holders etc. It will be able to fold down and makes being outside easier so you don't have to find a speaker for music or find a light to go out at night.

Idea 3: Pet security alarm

Description: This will be a security alarm that can detect if you pet has gone somewhere it shouldn't and outside of your garden area. This is useful for when dogs escape into or out the garden and that the owner can be alerted as soon as possible to find it again.

Topic 2:Keeping Fit And Active

Idea 1: A chair attachment to exercise while sitting down.

Description: This will be a product for anyone sitting at a desk or a computer for an excessive amount of time and can use this to exercise while they are working. This keeps them active while sat down when having to work sat down all day. It can be especially good for at home workers as they get that exercise they wouldn't get staying at home.

Idea 2:Low Cost Water dumbbell

Description- This will be a dumbbell weight for exercise training to do at home. It will be made from plastic and the weight will have a multi partition water container. You can fill it with water to have your desired weight.

Idea 3: Giant board game

Description: This will be a game for kids that can be played outside to keep fit and active and get their body moving. It will be a board game where the children are the pieces an there will be activities getting them to be active (e.g. star jumps).

Topic 3: Preparing For

Idea 1: Medication dispenser and reminder.

Description: This product will be able to notify someone for when they need to take medication for an illness. It will hold the medicine inside so when you need to take it you wont forget.

Idea 2: A light up box with house number on that flashes when emergency.

Description: This product will be a box which has your house number on it and then in an emergency would start flashing and light up for when emergency services arrive they know which house to go to when it is dark.

Idea 3: Compact safety kit for cleanliness. (for Covid etc)

Description: This will be a small kit that has essential supplied you may need and it will fit in so it isn't unnecessarily bigger.

Outdoor living

This topic means wonderful things like nature and being with family as I like to spend lots of time outdoors. You can approach outdoor living with many topics to get ideas such as animals, nature, insects etc. This topic would need to consider durability outdoors, weather ,people, wildlife etc.

Bird Play- A wooden attachment for birds living outside that they can sit on. This lets the birds outside have somewhere to go. This will solve the problem of birds sitting on stuff in your garden and destroying crops. It will keep them distracted from the things in your garden. This will be made out of either wood or plastic depending on which is the more durable and then will have a metal attachment clip, to clip onto branches or anything in your garden. This will give the birds a place to go and stand but also play. It would increase their motor skills if there a things on this for them to play with. It will have to be a medium size for any bird and also look aesthetically pleasing if it is something in your garden.

Pet Security Alarm- This will be a product that alerts the pet owner that their pet has escaped their designated area, e.g. garden. This will be a sensor that has a small attachment to your pe that can set off an alarm when they have gone out too far. This will quickly alert the owner and save time as it could be too late if they were alerted as a dog may not come back on its own. This could be connected to an app on a phone that the alarm would go off on . With this you can set an area in which the pet cannot go past and is customisable.

Furniture With Built In Entertainment- This product will be a table or a chair that can be used for outside enjoyment. It will try to bring what we enjoy inside to outside. It will include lights, cup holders, WIFI and speakers to enjoy your time outside. It will occupy everyone outside and stop anyone from getting bored. It will able to let family and friends spend quality time with each other with the music it can play. This will help with outside living as it can store food and items and also provide entertainment and fun to have a nice time outdoors. It would be made out of wood or plastic so it could waterproof to survive in different weather conditions.

Keeping fit and active

This topic means thinking about the health of everyone and helping everyone be more fit . This topic lets you explore the different ways of being healthy and also being active in a fun way. This product would need to consider exercise, ability, age, etc .

An Outdoor Board Game- This product will be a game for kids to be able to get involved and play outside. It will allow them to be active by playing the pieces on the board. This gets them doing some sort of exercise in a fun way. It will also have small challenges such as star jumps or some running to get them to keep fit but also play the game. It will be a giant sized board game one made from plastic so it can fold down and stored. It will be lightweight so anyone can get it out to play with. This will make children want to be more active if it is being done in a fun way for them to enjoy.

A chair exercise attachment- This product is an attachment that can be attached to your chair that can exercise your legs when sat for an excessive amount of time. This is ideal for any one will long time day jobs at a computer, this will get the mobility in your legs moving to keep the blood circulating. This is good for when you don't have enough time to go and exercise and keep fit. It will be something to help with strength and movement with exercise equipment for example, bicycle pedals. It will be made of metals and to be used for at home use.

Low Cost Water Weight- This will be a product which will have a multi partitions on it to be able to fill each with water to change the weight. It will be replica of a dumbbell but able to have customisable weights and use it at home for low cost. This is ideal for someone who wants to do light training at home. It will be safe to store as you can just empty the water out of it and can fill it up and carry around whenever desired. It will be made out of plastic because it is lightweight and durable. This can be used by anyone mainly adults or teens that are doing daily exercise top keep fit and healthy.

Preparing for Emergencies

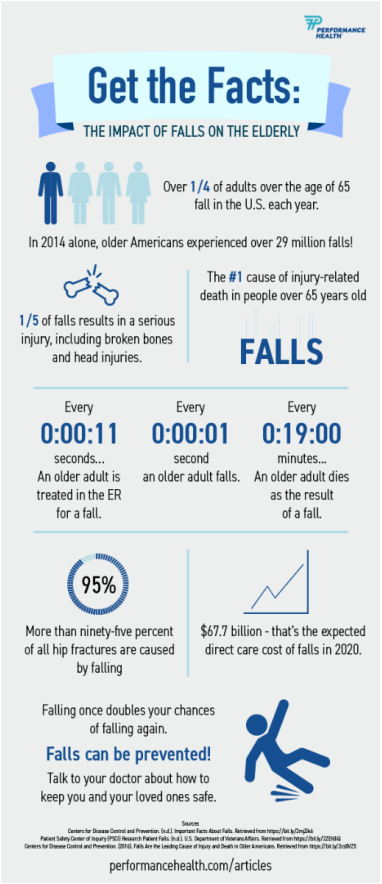
This topic can be approached in different ways like medical emergencies, personal emergencies etc. This could mean a preventative solution or something that is used after the emergency. I may be able to assist my family members with emergency situations that may occur due to them having chronic medical conditions.

A Flashing House Number Box- This is a product that will connect to the front of your house that can connect to your phone as well. It will be able to flash when there is an emergency so whenever the emergency services are supposed to come to the house that needs their help it makes it easier for them to see which house to go to especially in the dark and this will save time because they wont have to struggle looking for the house number. This will be made from plastic with LED lights inside so you can see when the lights are flashing.

A Medication Dispenser And Reminder- This is a product for people with chronic illnesses and have to take medication everyday. As they have to do it everyday sometimes they may forget so having something to remind them can be very useful. It can maybe connect to an app that has an alarm and it changes it ringtone so it doesn't get repetitive. It will hold and organise the medication so you don't forget where it is. It will be an product made from plastic or metal to be able to be customised to alert when ever time of the day.

A Safety kit For Cleanliness - This product will be a small compact box/bag that will perfectly fit products such as hand sanitiser, wipes etc to use when your are out. This will be good for when you are out and you want to clean your hands before you eat you can use what is in it. It will also include space for plasters or bandages for smaller injuries. The purpose is to have all of these items in a small compact way so it can be easy to carry around in your bag. It will be small and folds out to have two sides of emergency products. Anyone can carry one of these around but mainly adult or parents but also teenagers aswell.

The Problem



I believe that this product should be made and manufactured so that emergency services can get to the house of emergency quicker than spending time having to look for the house number they need to go to which will delay time.

In this type of situation you don't want to waste time as that could be fatal. This will help these services see what house is in need of help in the dark if no one can get outside.

This flashing light can also tell other people that there is an emergency and they can help or keep the area clear for the ambulance to arrive, this will stop delays and if

This would also help many elderly people or people with underlying health conditions who are more prone to injuries and falling. They many struggle to get to the door for the ambulance to see them so if they had this product that they can set off after calling an ambulance so there is no struggle finding their house. This flashing light could also notify neighbours so that could see that there is a problem and go help and could ring the ambulance themselves if the person cannot do it.

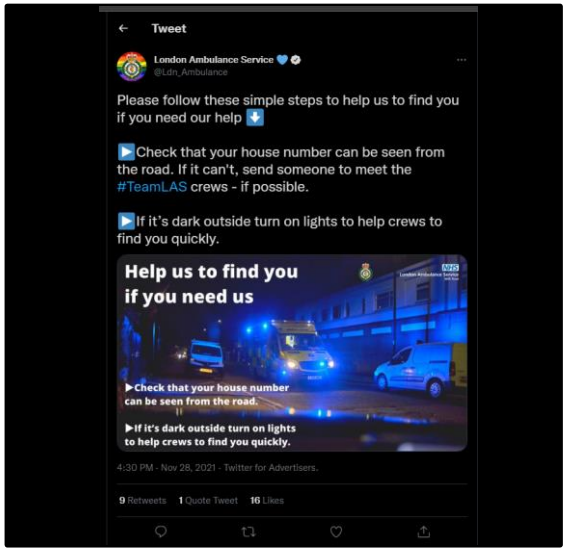
It is said by ambulance crews that your house number should be visible as it can save your life. The product I am designing will make that house number visible but also be flashing to make it 100% clear that, that is the correct house that needs the medical care.
In an article online they state that in sudden cases of cardiac arrest chances of surviving decrease by 10% every minute without defibrillation. They are encouraging people to make sure that their house numbers are clearly seen. This makes me think that in case of emergency it need to be obvious which house needs the help and so we can save crucial time from their department having to look for the correct house.

There has been issues of inconsiderate parking in which delays the ambulance to get to its intended home. This has occurred in Somerset Village as the ambulance couldn't get to the correct address as someone's parking blocked the ambulances way. This issue delays time of an ambulance could really affect the outcome of the emergency and could lead to an even worse situation. The ambulance was stuck and couldn't get to the home as quickly as they wanted, to help someone in need of medical attention, all because of someone's parking. Having this flashing light from the house of emergency could notify everyone that there is an emergency so they can move their cars to let the ambulance be able to get to their house to help them as quickly as possible. This could easily reduce the delay time so the person can get the care needed.

Other benefits:
It is not just the Ambulance Service that would benefit. Other emergency services such as Police and Fire also need to get to people as quick as possible and face the same problem in the dark.

Delivery drivers too are now more frequently delivering at night and finding the correct property is important to them and can help them deliver the parcel quicker. Reducing the time they are looking for a property can help their safety in the dark.

The following tweet was put out by London Ambulance Service that clearly shows this is an issue.



[Ambulance service urges people to make their house numbers visible - The Guide Liverpool]

The following extract is from a news article that explains this every day problem.
Lives are at risk because vital minutes are lost in life-threatening emergencies when ambulance crews cannot see your house number and property names easily.
In cases of sudden cardiac arrest, minutes can mean the difference between life and death. The likelihood of surviving decreases by 10% with every minute that passes without defibrillation. Thanks to the NHS' Act FAST campaign, it's well known that people who have experienced a stroke have a better chance of full recovery the quicker they receive treatment.

The full article can be found here:
https://theguideliverpool.com/ambulance-service-urging-people-to-make-their-house-numbers-visible/

Typical Customer

There are a range of people who fit the profile for the product.

My product is targeted towards mainly people with chronic illnesses especially those at most risk of going into cardiac arrest and time is important in an emergency situation.

It will also be very helpful for elderly people especially ones that live on their own so they can notify people in the street that they need medical assistance.

This product can also be purchased by adults to have in their home and who feels they may needs it but can be used for anyone in that household.

- I think the target audience would find it helpful that the product is easy to use as anything complicated may stop someone from using it because they couldn't figure out how to work it.
- They would also want it to be useful because if it isn't then there is no reason to buy it.
- The target market need my product to prepare for an emergency by having a signal so when you may need an ambulance they can quickly identify your home. It can help the ambulance getting to your house quickly as they don't have to go round looking for the right house number as an extra minute or two could be fatal.
- There are light up house numbers that light up when its dark that already exist. This is good as it makes the number more visible to see for emergency services but if multiple people have them then it can still be time consuming to look through them. Whereas if you had a flashing light from the house that is also coloured then it makes it very obvious that it is the correct house to go too.
- I think the target market spend the appropriate amount of money of something that could potentially save your life so I think around £25-£50. This is so it is good quality and made sustainably.

- This product could also be used act as an alarm system to deter anyone breaking in. As the light and maybe an alarm could make the intruder quickly leave.

Desired outcome
The desired outcome is going to be a house number that can flash when there is an emergency for ambulances and to everyone in the street.

It will need to be able to have a way I which it can be activated at any part of the house as if your injured you may not be able to get to it.

I believe it will be successful, especially for any incidents that happen in the night everyone knows exactly where the emergency services are needed.

The product needs to bright and clear so it can been seen and preferably from far away too.

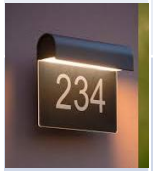
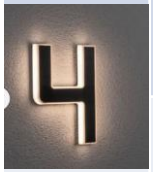
Customer Profile:
Name: Dulcie Gwendoline
Age: 76
Occupation: Is Retired pensioner.

Has pre-existing medical conditions including, arthritis and high blood pressure

Is prone to falling and relies on visitors for support. She would buy my product so that if ever they needed emergency medical care they can set of the light.

This means that after they have called the ambulance it can get to their home quickly. This also saves time by making their home obvious to the service just in case of emergency

Research – Analysis of Existing Products

	User and Target Market	Manufacture	Materials	Function	Aesthetics/Style	Cost	Environmental Concerns	Ergonomics
	This product is aimed at people who own a property such as a house. This would be mainly targeted to adults/older adults because they would most likely own a house. This would make the target audience want to buy it as it is a house number, that is a legal requirement. It also looks very traditional which may attract older people that like that look on their property.	This product has been made from using a mold to injected the plastic into it. The glass is then made into four panels and etched with the house number which then slots into the plastic base. The frame of this product would be mass produced and the glass panels would be made to order as they are going to all be different as everyone has different house numbers.	The product is made from black PVC to make the structure of the lantern and is then fitted with glass panels. The glass is used so you can see the light through it and when it has a printed design. PVC is used because it is a hard and durable material and is also strong and lightweight.	The product is fixed the side of your house and is customized with your house number. The lights inside light up the lantern making the number more visible at night. It functions correctly as the lights work and you an see the number well. It has a very traditional design and is very simplistic. The product will light up at night so you can see the house number on the building. This makes it more visible to see.	The product has been designed in a traditional lantern style but has also been modernized because of the print of the house number on the glass and the sensor and light inside. The product looks very simple and I think its look good on the side of a house and it has a multi purpose of being a house number and a light.	The prices of this product is £46. This is the selling price of the product because it is customised and has number etched on it. The number comes in many different fonts and colours. The glass is more expensive than thee plastic but will be good quality because of the personalised number.	This product is made from PVC which is a very damaging plastic and results in release of toxic chlorine-based chemicals. These chemicals are building up in water, air and food chain. This is not a recycled plastic. The glass used is also recyclable as it can be melted and used again.	I think the product is designed very well as it has the house number printed on which is quite large so it can be seen. It also turns on itself at night so the user doesn't have to come out every night to turn it on. This lighting up on its own when it gets dark makes it easy to use for the user.
	The product is designed to put on the front of your house which lights up with motion or movement it can detect. The product is designed for adults who own a house for it to be attached to. It looks very modern and unique making it look more appealing to the target audience.	This is made from pressed metal formed into the curved shape. The diffuser is made of a plastic sheet. This would be mass produced. There will be a base assembly housing the lamp. The diffuser and front panel will be secured to the base assembly with screw fixings.	The product is made from stainless steel and plastic in a dark grey colour. Stainless steel is used has it has a long-life cycle, is resistant to corrosion and is low maintenance. The plastic is used for aesthetic and give it that grey consistent colour.	The product is a light which turns on with a motion sensor that turns on the light. The main purpose of this is so when you walk past in to go into your home the light will turn on and then you can get your keys for example. The special feature is the motion sensor as it can recognize when you are near it and activates the light to turn on.	This product is rounded with the light in a rectangular shape. It looks very modern a nd sleek design which is simple and makes it look attractive. I really like the product as it lights up with motion sensor and looks very bright. The light has gaps on the top and the bottom so it can also shine the light through and creates a nice light effect. I really like this product as it has its own modernized design but is still able to look like a light and look cohesive with a modern home.	The original price of this product is £26.95. It is this price because is it made from stainless steel which is an expensive material but is also good quality as it is resistant to corrosion. It also has more components involved s it has a motion sensor which activates the light.	This product is made form stainless steel which can be 100% recycled and lasts a long time, so it doesn't have a negative impact on the environment.	The motion sensor can indicate when a person is near and turn the light on. It is made for the user so when they go past it will turn on helping them find their keys to open the door or so they can see as they go past it.
	This product is a wall lamp designed to light up the house number for your home. Anyone can purchase this but is mainly aimed towards adults who want to put this as their house number on the front of their house.	This product is formed and fabricated from cheap metal. It may be joined with welding or soldering and will be coated (galvanized) for outdoor weather protection. This prevents rusting. This product would be mass produced on a production line in another country with low labour costs.	This product is made from sturdy high-quality aluminum for the frame in the colour black. Aluminum is soft, malleable and resistant to corrosion so it can survive in weathers such as rain. This includes adhesive numbers that stick on the product so you can put your house number on it. It also has an integrated LED light source to light up the number.	This product is a house number that has a light at the top of it which lights up the number. This makes the number for the house more visible. It works well as you can clearly see the number as it is being lit up. This is useful as it the number can be seen in the dark and it isn't too hidden to see.	This product is designed in a very modern and unique way. The LED white light is facing down towards the number and lights it up perfectly so it can be seen. It looks very appealing as the stylish design makes you want to buy it as it will fit nicely on the front of your home bringing attention to it. I really like the product as it is very different and has its own design and looks like it works well.	This product is sold between £80-£90 depending on the seller. It is this price because it is made of aluminium which is an expensive metal, and It is worth paying for as it doesn't rust and is good quality.	Aluminum is 95-98% recyclable. It uses electrical power required either battery or mains, depending on electrical source could be harmful to the environment if its not renewable. It uses an LED bulb which is not renewable as they are a semi conductor material however, they use very low power compared with filament lamps.	It has been designed to connect to a wall switch this allows the user to be able to turn it on from inside their home. This means that they don't have to go outside to turn it on so they can be comfortable in their home. It makes it easy for the user to use but it could be better by being able to turn on itself when it gets dark.
	This product is designed for anyone who owns or lives in a house in which they can put their number outside it. This makes the target market adults and maybe older teenagers. It is appealing as the design is very modern with its simplistic design and classy look.	This has been made from injected molded ABS plastic to create the housing for it. They create a mold in which they inject the plastic into , this creates the correct shape and during mass production makes all of the products the exact same. It uses a two-part construction which are fix screwed together. It would be made on a production line inn a factory in a country with low labour costs.	This product is a house number made from plastic and is fitted with a solar module to charge the battery to emit light around the outside of the number so it can be seen. Plastic is used as it is less fragile but also durable so it can be used outside. It is also light and don't rust, they also have good impact resistance and also good colouring.	This product is attachable to your house so everyone can see it clearly. This number lights up when its dark a lights up the number making it clearer to see at night. It has a solar module incorporated into this product to power the batter to emit the light around the number. It uses energy from the sun to convert into electricity, making it better for the environment. This product wont always light up at night as it is using energy from the sun and it isn't always sunny.	This product is a house number that is just the number and has no other base to it making the number stand out. I think it looks very modern as it is made of basic colour such as black and white making it more simplistic. I like that it is simplistic as it makes the number very clear and doesn't look over designed. I feel as though this product is very well manufactured and the designer has though logistically about how to design it with the light around the outside of it from the back.	The selling price of this product is £58.90 for a number each, this means anyone with a 2-digit house number has to pay twice the amount for the 2 number lights. You are paying for this house number which has a solar module incorporated to light it up and as soon as it gets dark the light will turn on. I feel as though this isn't worth the price as it is only made from plastic and the reviews from people who have brought it have said it is too expensive and was not as expected but it did work.	This product is made from plastic which makes it not environmentally friendly as it cannot be recycled due to high manufacturing costs and won't be accepted for recycling. It also lasts up to 400-1000 years to naturally de-compose and some are even noon-degradable. The product uses solar powered electricity, so it doesn't use up finite resources. This allows the battery to charge in the day using the suns energy to then turn on at night and emit light	This number is very well designed as you can clearly see the number and it is in bold and is able to easily be attached to your house for it to be clearly seen. The light is designed at the back of the actual number in black itself so it can be seen from every angle. It also makes the number not too bright so when you look at it you can see the number and not just a bright white light.

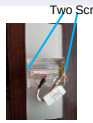
Product Disassembly

I took apart an LED wall light to see how it was constructed inside. This product has an LED strip for the light source which is similar to what my design uses.
This strip lights up at the edge of opaque Perspex and causes a white panel of light.

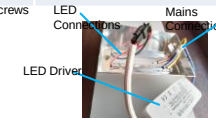
1. Remove screw fixings on the side mounting bracket.
2. Pull out the loose wires.
3. Inside you could see the LED strip, LED Driver, Connections and diffuser.

What I found with this light is that there was quite a bulky LED driver circuit unit. This is required because it connects to the mains electricity supply. It is also high power as the LED's were 12W. I intend to operate my light from batteries and so won't need such a large bulky driver unit.

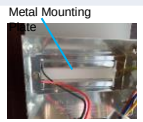
LED Wall Light



Rear of light with mounting bracket removed



Inside there is an LED driver, two connections to led strip and mains connection to LED driver. There is no switch



The LED strips is secured with a single metal Mounting bracket which holds them against the edge of the Perspex sheet

Two screws hold the metal mounting plate in position.

Customer Questionnaire

QUESTIONAIRRE DESIGN

To assist with my research my target market, the functions and direction of design I have created a Consumer Research Questionnaire. This consisted of a variety of questions that would allow the specification to be formed based on need. Different question types would gain both direct responses or detailed comment allowing a useful mix of responses. I wanted to provide the Questionnaire in a paper form and also as an online survey to allow instant return of the results but I ended up just using a paper form and put the information in my spreadsheet.

QUESTIONNAIRE RESULTS

The results I received have been put into an Excel Spreadsheet table for analysis. I have collated data and looked for the most common trends. The final results are shown below. I will include graphic charts to show visually the outcomes.

Customer Questionnaire Results

No. Respondents = 5

	Response No.	1	2	3	4	5		RESULTS ANALYSYS and OBSERVATIONS
1	What is your age range?	50-60	70+	60-70	50-60	70+		All respondents were over 50, most were identified as elderly.
2	Do you have any underlying health conditions?	No	Yes	No	Yes	Yes	60%	of people had an underlying medical condition.
3	If Yes, does your house number illuminate at night?	No	No	No	No	No	100%	of people don't have an illuminated house number.
4	Does your home currently have a visible house number on your property?	No	Yes	No	Yes	Yes	60%	have a number on the property.
5	Do you have a mobile phone nearby most of the time?	Yes	No	Yes	Yes	No	60%	had a mobile phone nearby most of the time.
6	Do you feel that this product would be beneficial?	Yes	Yes	Yes	No	Yes	80%	said it would be beneficial.
7	Around what price do you feel as though you would spend on this product?	30-40	50-70	50-70	70-100	70-100		The preferred priced range was between equal between £50-70 and £70-100.
8	Would you want the product to be more modern or traditional style?	Modern	Traditional	Modern	Traditional	Traditional	60%	preferred traditional house numbering.
9	What illuminated colour would you consider to be best to signify an emergency situation?	Red	Red	Red	Red	Red	100%	of people identified red as warning colour.
10	Do you have any thoughts on useful features or ideas for this product?	Outdoor Fitting	Free Batteries	Visible Day and Night	Easy Fit	Easily Seen		There were a range of different comments.
11	Please select what best describes your home near to the front door at night?	Some light	Dark	Dark	Dark	Pitch Black	80%	Said their front door area was dark or pitch black at night.
12	Please add any other comments that you consider would be useful in this design?	Reliable	Easy Operation	Good Quality	Simple to use	Reliable		Most people said they wanted simple to use, good quality and reliable.
13	How many numbers or letters identifies your property? i.e. House No. 1, 27, 132, 17A	1	2	2	3	2	2	The average numbers and letters is 2.

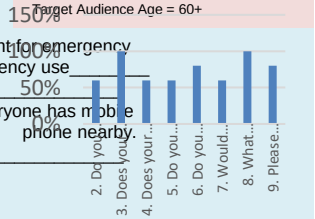
QUESTIONNAIRE SUMMARY

I have used the results to create a summary of the key data that will be use to influence the design.
This will ensure that the product is being aimed at the most applicable target audience.

This will have several benefits. Apart from ensuring those who want to buy the product have a product that appeals to the it will also mean the most people benefit from the safety features.

QUESTIONNAIRE OVERVIEW

Respondents = 5
Design Features Identified = 10
Final Selling Price Target = £50-£100
Design Style = Traditional Numbers
Number of Characters = 2
Target Audience Age = 60+



KEY DESIGN CONSIDERATIONS - EVALUATION

1. Suitable for elderly (simple to use) — Implemented [✓] Not Implemented [ ] Reason Important for emergency
2. Reliable — Implemented [✓] Not Implemented [ ] Reason _Emergency use_____
3. Up to 3 letters o numerals — Implemented [✓] Not Implemented [ ] Reason _____
4. Mobile phone enabled — Implemented [ ] Not Implemented [✓] Reason Not everyone has mobile phone nearby.
5. Price between £50-£100 — Implemented [✓] Not Implemented [ ] Reason _____

Customer Questionnaire – Illuminated Emergency House Number Light

1) What is your age range?
20-30 [ ] 30-40 [ ] 40-50 [ ] 50-60 [ ] 60-70 [ ] 70+ [ ]
2) Do you have any underlying health conditions?
Yes [ ] No [ ]
3) Does your house number illuminate at night?
Yes [ ] No [ ]
4) Does your home currently have a visible house number on your property?
Yes [ ] No [ ]
5) Do you have a mobile phone nearby most of the time?
Yes [ ] No [ ]
6) Do you feel that this product would be beneficial?
Yes [ ] No [ ]
7) Around what price do you feel as though you would spend on this product?
£20-£30 [ ] £30-40 [ ] £40-£50 [ ] £50-£70 [ ] £70-£100 [ ]
8) Would you want the product to be more modern or traditional style?
Modern [ ] Traditional [ ]
Other (Please Specify) _____
9) What illuminated colour would you consider to be best to signify an emergency situation?
Red [ ] Blue [ ] White [ ]
10) Do you have any thoughts on useful features or ideas for this product?
Comments _____
11) Please select what best describes your home near to the front door at night?
Pitch Black [ ] Dark [ ] Some Light [ ] Well lit [ ]
12) Please add any other comments that you consider would be useful in this design?
_____
13) How many numbers or letters identifies your property? i.e. House No. 1, 27, 132, 17A
Answer _____

Design Brief and Specification

Summary:
These are some points of what needs to be considered when designing my product and how it will function to help the user, aesthetics and how it may be made.

Specification point	Justification
High Visibility	The number and warning indication needs to be easily seen from a distance in both daylight and night time conditions. This can be tested by viewing the house number sizes and alert indicator at different distances. I will record the distance, ability to view and choose the best size for the product. **From my questionnaire I found that the doorway to most properties was dark or pitch black at night which justifies the main purpose of the design.**
Weather proof	The product will be installed on the outside of a domestic property and subject to external weather and temperature conditions. This can include water and extremes of temperature. Since it is an emergency device it will need to operate under all conditions. I can test the waterproof level by creating the enclosure with seals and putting absorbent material inside to then spray water on the enclosure. The material can be inspected to see if water got inside. I could also test temperature within the box by putting a thermometer and then using a hair dryer to simulate heat from the sun and record internal temperatures. I will need to check operating temperatures of components to ensure they operate in the required temperature range. **Some of the client questionnaire results said it would need to be outdoors so would need to be protected.**
Adjustable number	The number on the product will be different for every property and needs a means of being set. This may be by using adhesive vinyl numbers, laser engraving or electronically adjustable numbers. I can test this by selecting any required number and see if the product successfully displays the number.
Aesthetically pleasing	This will be a permanent fixture on the front of the property and must be of smart appearance to add to the looks of the property and not be un-sightly. I can test this by producing visually illustrations, 3d models, or prototypes and do a questionnaire to see what is the most preferred design. **From my questionnaire, I found that most people prefer traditional style numbering and I shall consider this in my font style.**
Alert illumination	This will be a high brightness light source that is used for the emergency warning element of the product. This can be tested to see how bright it is in the lowest light conditions and brightest light conditions. Observations can tell effectiveness but a light meter cold also be used to record intensity. **From my questionnaire, it was identified that the alert warning colour should be red as this is the most identifiable.**
Remote activated	This is some electronic control that activates the warning feature, possibly remotely using a smart phone app. This can be operation tested for functionality to see if the product performs as intended and multiple people could also try the controls. From my questionnaire, I found that only 60% of people had a mobile phone nearby. Therefore this feature would not be a high priority and maybe something for the next version. I can see the smartphone feature may be more useful to younger family members and I could build in the technology for future use. **The client questionnaire revealed they want simple operation and I intend to have a simple remote control fob to turn the emergency light on or off.**
Always on	The device operation is constant and permanent and will require power for the electronic elements of the design. This could be permanent, sustainable i.e. solar power or switched on/off automatically i.e. dusk sensor or a low power circuit that only requires batteries changing occasionally.. This can be tested by operating the device over a controlled period of time and record effectiveness. **This meets the brief as being prepared for emergency means it always need to be ready.**
Sustainable materials	The product design must consider sustainability in the materials used for manufacture. This should also included consider end of life and recycle-ability. This can be tested by recording all materials used and cross referencing with material sustainability data. This can be designed in and considered further if went to production.
Durable long lasting design	The product should be hard wearing due to being outside. The internal components should be protected from damage and the weather. This can be testing by different methods such as impact testing, wear and tear testing, normal operation and weather testing. Results should be recorded as observations and allowable limits of damage defined. **From my questionnaire, most people wanted good quality, this is important for a successful product.**
High reliability	This is an emergency device and therefore should be extremely reliable and not fail when used for emergencies. This means high quality design, components and manufacture. This can be tested using a controlled time period and operating at different times and conditions. Observations should be recorded for functionality, particularly for the emergency light system. **From my questionnaire I found that people expected a highly reliably product and were prepared to pay more money for it.**

Design Brief

I am going to create a house number device that will visibly show the number of the property during both day and night hours with an emergency alert function. This can be activated to aid emergency services locating the property when required for visit (E.g. ambulance or doctor on call). The night mode and the alert mode will feature electronic illumination for high visibility. If possible I would like to include smart functions such as remote activation and maybe a customisable number.

Ergonomics

Ergonomically it has to be durable to withstand weather and outdoor conditions and seasons. It should be hard wearing to protect the electronic system from the elements and be safe to be in contact with people (i.e. not fragile or easily broken). It needs to be aesthetically pleasing as it will be a permanent fixture on the front of the property. Any lights that will be able to be controlled by the circuits, they should be connected to some sort of remote operation so it make it easier for the client to control.

Anthropometrics

Consideration of visibility at a height and be easily seen by people approaching the property. The house numbers will need to be big enough to be easily identified at a distance. The illuminated colour will have the most visibility at night. The colour of the warning alert needs to be easily identifiable as an emergency colour (e.g. red or blue). The sizing of the product would have to be considered because if it is too big it would be hard to mount or look good but if it is too small it wont be seen.

All Designs

Controls
The controls will be easily accessible so when there is an emergency the alert indicator is activated. This light has to be very bright so it can be clearly seen by emergency services when visiting the property so that the endangered person can get the help that they need and quick.
There will be button controls for quick operation of alert mode, day or night display mode for the house number and with further research I may include a remote activation of the alert. Which means someone e.g. a family member who is not there could activate the alert from somewhere else. It may be possible to include a sensor that detects if it is day or night to automatically turn the display on.

Electronics Module
This device has switch controls and powered displays so there will need to be some simple electronics. This will be located in the main body. Copper wires will join the circuits and connect to the power source. If remote activation feature is included this will require more advanced controls.

Power Source
This device needs to be powered as it has electronic lighting, control circuit and switches so will need a source of power. This could be a battery that is inside the main body. This would either need to be replaceable or rechargeable. Or the power could be from a power pack that plugs in the wall. The connection to the device would need to be waterproof and I will investigate how outdoor Christmas lights get power as these will be already designed to be weather proof.

Weatherproof Seal
The main body, controls and display need to be weather proof as this will go outside. Anywhere there is some water could get in needs to be sealed. The seal may be a rubber type material for places where covers need to be removed for access or a permanent seal could used for example around the alert indication edges.

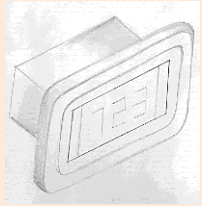
Design

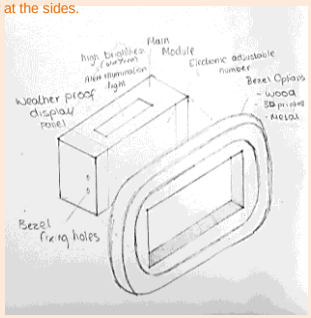
#1

Body Housing – Design #1
This is the base of the whole assembly and contains the electronic control module, controls, power source or connection to power source, alert illumination and the aesthetic bezel. It will be made from a material that can withstand the weather conditions but isn't as visible as the bezel so can be made for functionality rather than appearance. It needs to be strong and protect the other components. It will have fixings to secure to the wall and to hold the bezel in place.

Display Bezel – Design #1
The bezel attaches to the front of the product body and may be made out of wood, metal or even 3D printed. The materials will be weather proof as it needs to survive in any outdoor environment and not get damaged. It also matters that its appearance is aesthetically pleasing as it will be visible on the front of peoples homes. People will also want to buy it if it looks attractive and high quality.
The shape can be rounded form, squared off and can be either modern or traditional depending on the customers preference.
The main body will fit nicely in to the middle of the bezel and is attached securely at the sides.

Display – Design #1
The display in this design is a digitally controlled type display. It needs to use high brightness LED's and be large enough to be seen clearly from a distance. The main benefit of this type of display is that the number can be easily changed meaning it doesn't need to be personalised before the customer receives it. Any three digit number can be programmed and provision will also be considered for a letter for flat type properties like 27A. It needs to hardwearing and not be easily damaged. It also needs to be weatherproof. The display will be integrated with the main body.





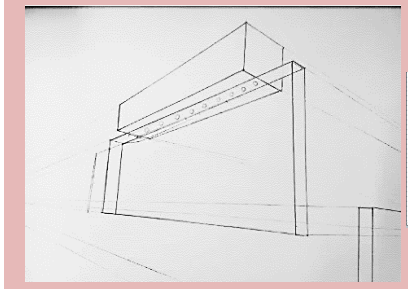
Alert Indicator – Design #1
The main body will have the alert indicator. This is the main emergency light that will flash to attract attention of the emergency services. It will possibly be made of high brightness LED's as these are low power. A cluster of these will be mounted inside the top face of the body housing and not be visible from the front of the device. When the alert is active it will light up the wall behind the bezel and flash to attract attention.

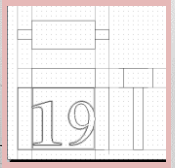
What I have learnt from this design is that it provides the option to change the number digitally. This means everyone can purchase the same product and customise it themselves. This is useful but comes at a cost. The electronics involved in this will be more complicated and cost more money.
The safety functionality meets the need of the client brief by providing an emergency light function.

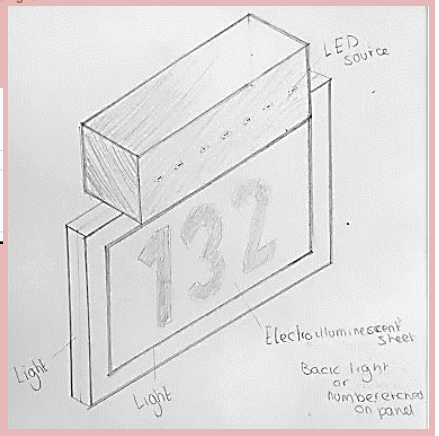
Client Feedback:
Whilst the client liked the idea of a digital display to set the house number they felt the operation would be too complicated for something that isn't used very often, meaning once it is set it won't hardly be touched. I found that the target age group wanted simplicity. The digital sign was also anticipated to be expensive by the client.

Design #2

Body Housing – Design #2
This is the base of the whole assembly and contains the electronic control module, controls, power source or connection, alert illumination and the aesthetic bezel.
It needs to be aesthetically pleasing as this will be seen. My initial design is a square shape appearance which means it will look modern. It needs to be strong and protect the other components. It will have fixings to secure to the wall and to hold the bezel in place. It will also hold the LED strip light.







Display – Design #2
The display works by having an LED strip at the top edge of the panel and this causes the light to transmit through the plastic and illuminate where the number is, border and edges of the panel. It will hopefully appear to glow like neon. It is attached to the main body housing and hangs down below.

Display Bezel – Design #2
The bezel that shows the number on this design is a made up of two clear panels made of plastic material. They make a 'sandwich' where the number is etched on the inside of one of the panels. A border is also etched around the inside edge. When the two panels are sealed together they will be waterproof.

Alert Indicator – Design #2
The LED strip will flash different colours like blue and red that indicate that there is an emergency. These will be high brightness so they can be seen visibly. This will illuminate the clear plastic panel around the edges so that it is clearly visible. It need to be an obvious signal so that can be easily spotted. The number also flashes and lights up so the number is seen clearly especially in the dark. This may require an electro-luminescent sheet as a back light. I will need to do some testing and experiment to see what is best.

What I have learnt from this design is that it is simple to use and operate. The client brief is something to prepare for an emergency. Any emergency usually means time is important and sometimes critical so there is no time for complex operation or controls.

This design does mean it has to be personalised for the client but that can also be a benefit as the client will feel secure knowing something is made specifically for them and also they don't mind paying more money for personalisation.

Client Feedback:
The feedback on this design was positive. The simplicity of the design and easy to understand concept was main points. They recognised the sign principle and could visualise it at their property.

Design #3

Body Housing – Design #3

This is the main body of the product containing the electronic control module, power source, alert illumination and the aesthetic front cover.
It needs to be aesthetically pleasing as this will be seen. This is a rectangular shape and will also house a clear illuminated number. Below the number will be a plain panel that hinges down to reveal the alert indicator underneath. The hinge panel will be secured by a key and when released will automatically start the alert indicator flash sequence. This is so it is only used for emergency reasons. The alert will trigger automatically when the flap is opened. This would only require a simple electronic circuit to make happen.

Display – Design #31

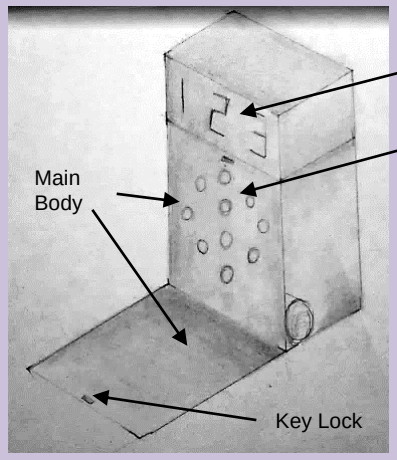
The display works by having an opaque panel, that will possibly be made of plastic. The panel will illuminate with a backlight for night time visibility. This may be a low voltage bulb or a series of high brightness LEDs. The backlight can be switched on automatically with a sensor.

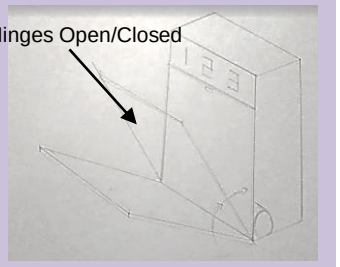
Display Bezel – Design #3

The bezel that shows the number on this design is integrated within the main body housing. The simple clean geometric design will make it look modern. It will also be large and attractive. It's main purpose will be to ensure the weather proofing stops water getting into the sign and also so that the number is big and clear..

Alert Indicator – Design #3

The alert indicator will be a series of high brightness LEDs that are arranged in a specific arrangement. There will be a mix of blue and red LED's that will flash alternatively. For example Red, Blue, Red. It may be possible to create different patterns to vary the sequence and the start could rotate in order to create a rotating effect or the centre LED could flash first followed by the others around it to create a target type effect. The alert indicator will flash straight away as soon as the flap is unlocked and opened. It will stop as soon as the flap is locked. The key for the flap could be stored in a security access box near to the sign. The type of box that requires a pin number to open. The flap uses a lock to stop someone activating it when they should, like kids playing around.





What I have learnt from this design is that it is more discreet than the other designs. Since the brief requires something related to an emergency, the client may not want this visible all the time. In this case the led emergency lights are hidden behind a flap.
Someone may not want to publicly advertise that they are vulnerable and so the cover solves this problem in relation to the brief.

Client Feedback:
The feedback was neutral on this design. It was considered unusual in design and not attractive enough to put on their property. They understood the concept of disguising the warning light. They didn't see themselves buying it.

Design #4

Concept Notes – Design #4

All of the devices so far have an electronic control. This device is a much simpler concept where there is no electronic components or power required. This is a simple no-tech design but with high-tech features.

Body Housing – Design #4

This is the main part of the product and it includes the number mount, outer bezel and the rotating 'motion' device (option). It will be made from a material that can withstand the weather conditions and will also need to be attractive in appearance. It will have fixings to secure to the wall and be a single housing assembly.

Alert Indicator – Design #4

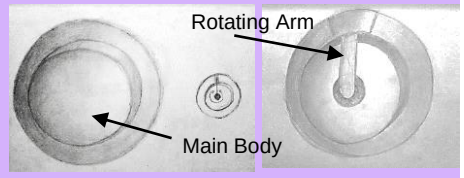
The main body will have the alert indicator. This is the main emergency light that will attract attention of the emergency services. Since this is a low-tech device the alert indicator will be a circular ring around the number of reflective material and fluorescent material also. This means that under natural light the fluorescent material will glow and artificial light such as torches or vehicle headlamps will cause it to reflect.
An additional option may be to add some movement to the circular alert ring. This could be done by having a motorised arm with a radial block out section at the end. The block out section is in front of the alert ring and when the arm rotates it will create what looks like a rotating ring.

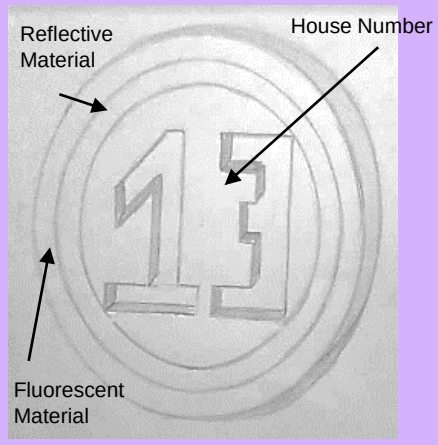
Display – Design #4

The display in this design uses self adhesive numbers stuck to the bezel panel. The panel will have a reflective material as a background to the number. This means at night when light shines on it, it will reflect back and be easily visible. It needs to hardwearing and not be easily damaged. It also needs to be weatherproof. The display will be integrated with the main body.

Display Bezel – Design #4

The bezel at the front centre of the product body and may be made out of wood, metal or even 3D printed. The materials will be weather proof as it needs to survive in any outdoor environment and not get damaged. It also matters that its appearance is aesthetically pleasing as it will be visible on the front of peoples homes. The shape will have a rounded and clean looking design.





What I have learnt from this design is that it would be possible to have a mechanical solution. Since the brief relates to emergency situation then failsafe operation is important during the emergency and if there is no electronic dependency or power required this could be a good solution.

It is simple in operation but may require more complex mechanisms to create the movement. This could increase costs.

This design is less conventional as a house number sign and when something is different to the normal this may put the client off purchasing. If it is not obvious how something works, it becomes a mystery and that may cause doubt in the clients mind.

Client Feedback:
The feedback for this design was not so positive. It was considered too eccentric for everyday use. They thought it had a novelty value but not as a serious emergency device.

Initial Design Ideas - Manufacturing Methods

Box Designs

- Consider Jointing Options
- Consider Access Inside
- Consider Materials
- Consider Exterior Weathering
- Consider Construction Types
- Consider Design of Cover

Many tools can be used to do the same thing but some work better than others and depends on what you are trying to and what you want it to look like when it is finished.

Material: Timber or Pine with Polished Finish

Very Resistant Woo

- Cedar
- European Oak
- Black walnut.

#LINKS

Choosing the Right Wood for Outdoor Projects | Blog | George Hill Timber & Building Supplies (georgehill-timber.co.uk)
https://georgehill-timber.co.uk/blog/choosing-right-wood-outdoor-projects/

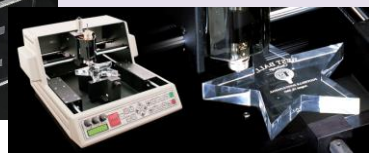
Which is the Best Timber to Use Outdoors and Why? – Elite Carpentry
https://elitecarpentry.com.au/which-is-the-best-timber-to-use-outdoors-and-why/

Manufacturing techniques that are going to be used during the process

-To use a hacksaw to cut metal I would need an extra block of wood to cut the brass u shaped channel and have that piece of wood clamped in a vice. Then cut through the wood to then saw through the metal.
-Sanding is a good way to clean up any uneven edges, (sand paper and sander machines)
-Soldering, by using a blow torch flux and solder and soldering by using a soldering iron and metal. Soldering is used to join to pieces of metal together(e.g., wires, metal bars etc)
-Gluing, joining to materials together.
-Screwing, drilling in screws that go through two metals and metal screw stays in these materials holding them in place

Sign Engraving - Laser

- Laser Processing on Acrylic.
- Laser cutting uses a high-power laser which is directed through optics and computer numerical control to direct the beam or material. The process uses a motion control system to follow a pattern that is to be cut onto the material



Cutting Metal Tools and Techniques

Saws for cutting metal

Coping Saw

- Has a very narrow blade stretched across a D-shaped frame
- Il's a handsaw used for intricate work such as cutting out shapes mostly through wood.
- It can be used to cut metal and tile.
- Typically only has teeth on one side of the blade

Hacksaw

Advantages

- Used with many materials
- The blade can successfully cut metal, plastic and wood
- **Disadvantages**
- It requires strength to operate, can only perform small jobs, and is much slower than electric alternatives.

Circular Saw

Advantages

- Used for metal cutting
- Used for larger pieces of metal
- Large tool

Disadvantages

-cannot cut curves
-common motor malfunctions or overheating
-blade gets dull and damaged easily.

Box Construction

Finger Joints

A box joint is where two edges of wood are cut so they can interlock each other to create a corner.

Advantages

- Makes a straighter joint
- Less wood waste
- Durable
- Can be made stronger with adhesives

Disadvantages

- Can turn out crooked
- Don't always get a flat smooth edge

Butt Joints

A butt joint is where two ends of wood simply get out together to create a corner with cutting it at all. It is then properly held together with glue, screws or nails could all be used.

Advantages

-Easy to do
-Inexpensive
-Simple

Disadvantages

-Isn't super secure
-weak

I have learned choosing the right material is important as it affects the quality of the final product.

Soldering

Soldering is the process of joining two metal pieces with the help of suitable filler material and at a temperature below 450°C. This will be useful to electronics component and wire joining,

Brazing

Brazing is the process of joining two metal pieces with the help of non-ferrous filler metal at a comparatively higher temperature of about more than 450°C. This could be useful for brass trims and frames for the sign.

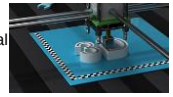
3D Printing

3D printing is the process of making a 3 dimensional solid object from a digital file. It does this by turning a whole object into thousands of tiny slices and then it gets made from the bottom upwards. The tiny layers stick together to form a solid final object. Each layer can be very complex meaning these printers can create moving parts such as wheels etc as a part off the same object. A 3D printer will mostly use ABS filament, this is a thermoplastic and has a base of elastomer making it more flexible and resistant to shocks.

It is good for prototyping and development but not practical for mass produced parts unless very small and simple designs.

Disadvantages

-limited materials
-restricted build size
-reduce manufacturing jobs



Using Concrete in a Mould

To do this you would pour concrete into a box and then put a smaller box is so when the concrete hardens the middle is hollow. It just wouldn't have a lid.

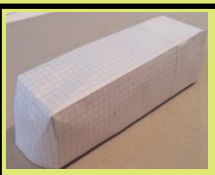
-I don't think this would have been good for my product as it would probably be hard to work with, harder than wood. They are mostly used as plant pots so they are durable outside but I don't think concrete is the right material for my product.

Vacuum Forming

A plastic is heated up so it is flexible and malleable, a vacuum then sucks the sheet if plastic into a mould causing it to take new shape when it cools.

-For my product if I was to use this I would have been for the main box but id onto think the plastic would be strong enough for what I want and outdoor use and it also isn't the look I like with some framing.

Model Making



Model scale: before I started making modes I tried to figure out the measurements I want my product to be. I used some squared paper to map out what measurements I want and to get a rough idea of what it will look like and both of the two main parts of the body proportionate to each other.

I also then glued both of the pieces together and with looking at it I think that the box could be bigger to fit more electric materials inside and also that the box of the sheet should be bigger so it is more easier to see from a distance. I also think that the proportions could better as the box on the top lo0oks too big compared to the bottom part so that means I need to make the bottom pai bigger.

Measurements

The box: 17.5cm,5cm,5cm

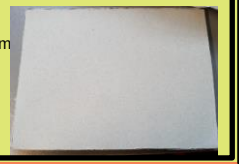
The sheet:19.5cm,14.5cm,1cm

The first model I made was out of just cardboard. I created a net with tabs as it was a simple shape, I used a knife to cut it out and I scored the edges and folded them. I then used a hot glue gun to glue it together to fit it all together. I created the main box on the top and then a replica of the acrylic or electro illuminated sheet that I will use for the final design.

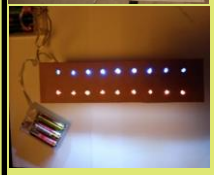
Following on from that design I re-modelled the bottom part and made the measurements bigger. I used the same technique to make it as I used card in which I cut out the net of the size, folded it and glued it together. This helped me with my development as I got to see a final measurement which I can put forward for the final design.

Measurements

24cm, 17.5cm, 1cm



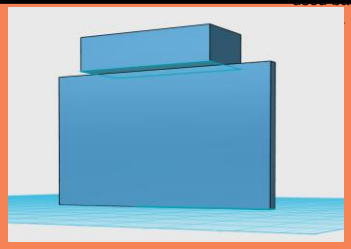
Next in my model I decided to try and create a working model that works closely and looks closely to what I want to make. I still used cardboard but added working lights and plastic to replicate a final design. First I made to top box by cutting out a net with a knife from card. I also cut out a small slot in the box so the sheet can fit inside it. I then measure and cut out holes in the bottoms of the cardboard for where to place the lights that will light up the inside of the sheet. For these lights I



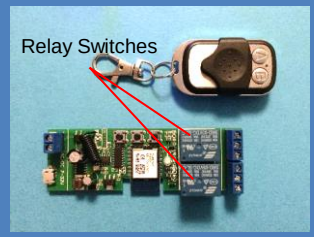
Next I measured and cut out where I wanted the lights to go on the front of the design which were going to be red and blue and for the final design may even flash to be an alert signal. I did two rows of lights the top row blue and the bottom row red.

I then assembled the box together with hot glue and put sides to it and had the battery wires coming out of the box to switch the lights on and off. I then moved onto making the bottom part ft he design. I cut it out the same way you would the box but using that as a border for the plastic , I created the two sides of the border and then stuck clear thin plastic onto the inside of it which I then stick altogether leaving the top open. I then cut out a middle part o the top that will then assemble underneath the main box and the lights will light up all of the inside and hopefully the house number completely.

To finish off I then stuck the house numbers to the back of it and this is the model in the dark which is close to what I'm visioning for the final design to be and will it will be like fully functioning.



This is the model that I designed using 123D design. This uses different dimensions close to the ones I have concluded with. This was done before I had decided that I didn't want to 3D print it. I also 3D design a completely different model which I decided not to go through with.



The +Volt jumper wires to the LED go to the relay terminal on the remote switch module. Then a return jumper from the terminal goes back to the LED. This switches the +Volts on and off from the remote module. Pressing the button A or B on the Key Fob causes the Yellow or Blue LED to light up, as it is activated.

To Remote lighting circ Remote Co has two rel that can co Remote Ke buttons act (switch) ou Each relay terminals. connection circuit. The normally o or normall contacts. over when

Both lights can be on at the time.

This simulates the Lighting S and the Alert lighting indicato being switched on remotely the key fob.

The next part of my modellin be to use LED Strip Lighting controlled from the remote s module.

My final design will not use t

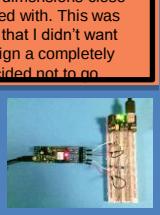
Conclusions from Model making:

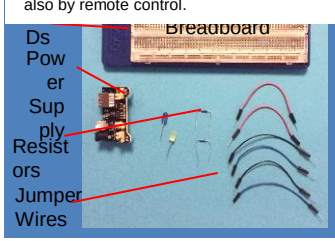
After experimenting with these many models I think I'm going to stick to the design and sizing of it but also experiment more with the shape of the box on the top. I want to experiment with materials moving forward and now I have the design I need a way I'm going to actually make it.

ELECTRONICS MODEL - My design uses electronic lighting for the sign and the alert indicator. To understand how this works I built a model so show I can switch lights on and off and also by remote control.

The Power Supply board pushes into the sockets on the bread board. This provides accessible power down the edges. This power supply output is set to 3.3Volts. The LED and Resistor are pushed into the Breadboard and connected in series. The LED has two pins and one is longer than the other. The longest pin connects to the +Volts. Jumper wires connect the +Volts and –Volts to the circuit.

This completes the circuit. When the power supply is connected the LED lights up. This replicates the idea of



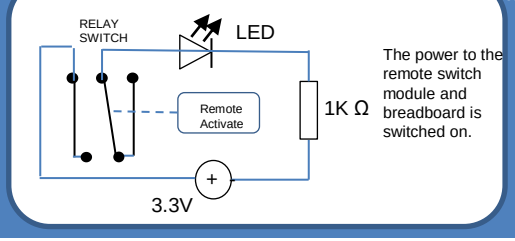


readboard kit to create a model of the electronic circuit. I wanted to simulated the actual circuit using LEDs. In the final product I expect these to be LED Strip Lighting for the alert signal. The Breadboard acts as a circuit board to connect the components. The power supply lines down the edge are all connected and the horizontal rows on the main board are all connected. Jumper wires and components push into the

I used two LEDs, the yellow one represents my sign light and the blue one represents the alert light. Each LED needs a

blue into the same circuit . Now both LEDs were switched on.

The Blue LED simulates the Alert light. This is a model on how the lights will be made up, but I wish to use a strip light and make the lights behave in different ways in my final design, to get the full impact and alert of the light, which will make it a useful feature in the

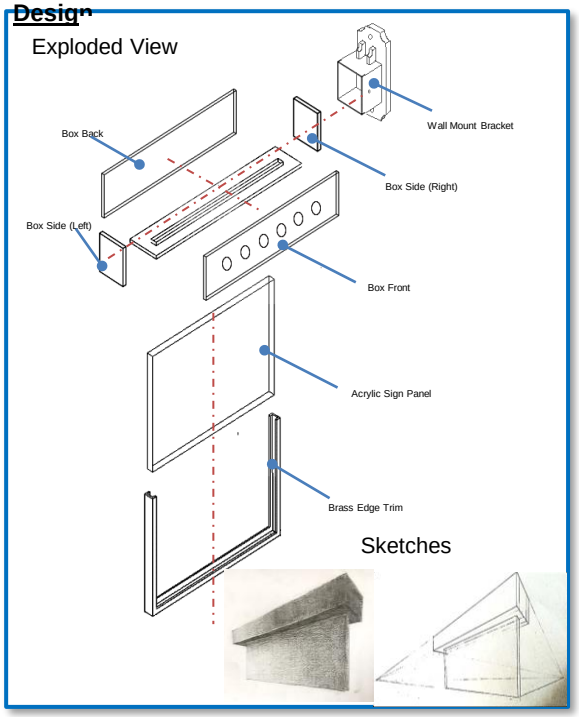


The power to the remote switch module and breadboard is switched on.

Final Designs & CAD

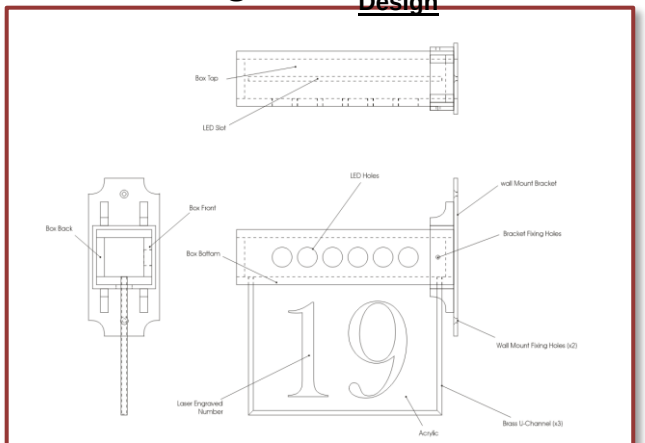
3D Design: Isometric Drawing of Final Design

Exploded View

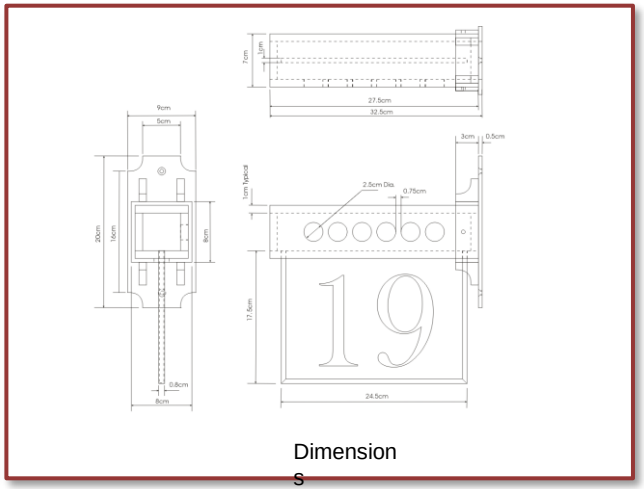


Sketches

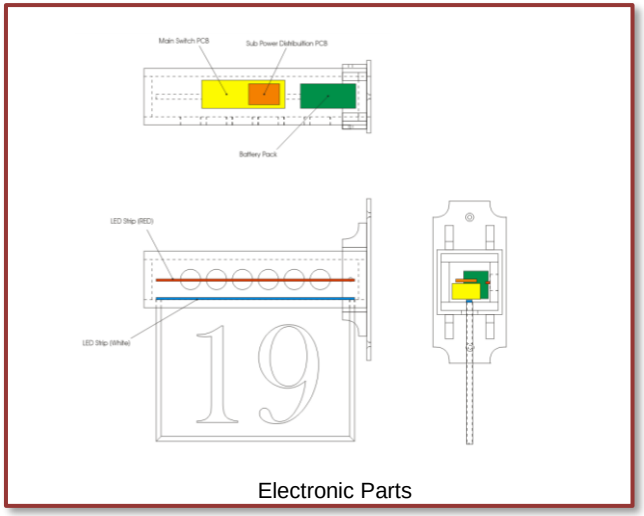
3D Designs Orthographic Drawings of Final Design



Main Components

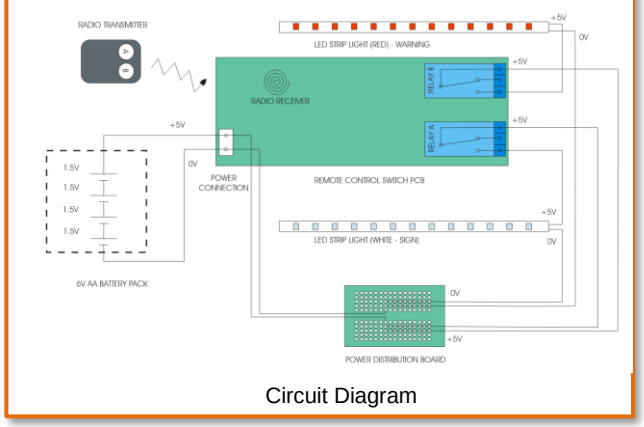


Dimensions



Electronic Parts

Electronics



Circuit Diagram

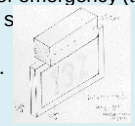
Client Feedback

The client thought my design was well thought out.
They commented that the wall mounting bracket should be interchangeable for mounting on left or right side wall.
They also commented that the traditional number style was what they had in mind initially.
They commented that the brass trim would make it look traditional also and were happy with the overall size.

Chosen Design

Design

My refined idea is to make a house number that will attach to the front of your house, this will have the functions of displaying your house number, being able to be lit up when switch on and also be able to be activated by switch just in case of emergency (these will be colours easy to recognise like red and blue so it is very clear that they need s



It will based upon my Design #2.

The product will have a box at the top to be able to be attachable and also stores all electronics used for the lights to turn on the LEDs. The underneath the box there Is going to be a cut piece of acrylic that will be engraved with your house number, this when lit up will display the number nicely and so it is very visible to everyone. The acrylic will also have a frame for aesthetics to look good with the wood and to help hold it in place. Also the box will be longer than the Perspex length so the light can light up the entire number.

Comments from end user and possible customers

After discussion with a possible customer it was considered that my idea would be useful to them. It was important from their point of view that the operation should be simple.

They are elderly and cannot cope with complicated technology.

They understood and felt the concept quickly and said it would be useful to them especially the remote control feature. One of the things they fear most is having a fall and therefore anything that could be operated remotely they could see would be helpful.

An important thing they said was that because it is a safety device they expect it to be good quality and reliable.

They also understood this would mean more expensive cost but are willing to pay for safety.

They liked the plain and clear appearance as it would blend in with their property.

Another possible customer explained that they have wondered for a long time why there were not many illuminated house number signs around. They have Amazon deliveries anytime up to 10pm now so it would be helpful for all deliveries not just the Postman that delivers in daylight.

I have learned that when considering a design it can't be perfect for everyone. Some may like it others not. You need to try and make it the most suitable then people will want to buy and use it. It seems people like simple things rather than complicated or unusual things. I will consider this in my design.

Changes that have to made the design following on from making the model

Changes that have to made the design following on from making the model
From making the model I was able to determine what were good dimensions to use. I had a provisional size but the model confirmed that a more compact size would be better.
I also determined my preferred font type as I was able to view what the house number would look like.

I had to consider the dimensions differently also as I was going to use wood for the enclosure box and this had a thickness that needed to be taken into consideration else the internal dimensions of the box was too small for the electronics.

I had to change the battery pack module to a more compact size to make it fit.

The model allowed me to consider the functionality of the electronics and for my main design I decided it was best to keep the operation simple.

I originally had the acrylic overhanging the box either side but the model made me consider the width differently. By having a slot in the box and using a rectangular shape it would make manufacture easier and use less acrylic material. Both these things reduced cost of the final product.

After making the model I decided to enlarge the holes on the front of the box. This would make them easier to see and more noticeable.

Costing and sources of the materials to be used

Item	Description	Application	Qty	Price	Supplier	Notes
1	Wood (Walnut)	Box	125cm x 8cm	£ 12.00	Wood Experts	
2	Acrylic	Sign	25cm x 18cm x 0.6cm	£ 4.57	Plastic Sheets.com	
3	Brass U-Channel	Sign	60cm	£ 8.89	Hardware Warehouse	
4	Remote switch PCB - Radio	Electronics	1	£ 27.99	Amazon	Remote Fob + Wi-Fi Smartphone App Control
5	Power Distribution PCB	Electronics	1	£ 1.50	Amazon	
6	Wires	Electronics	50cm	£ 0.50	Amazon	
7	Battery Holder 4 x AA	Electronics	1	£ 1.50	Amazon	
8	Led Strip 5v	Electronics	50cm	£ 1.63	Amazon	£6.49/2M
9	Waterproof Seal Tape	Led Strip Fixing/Seal	50cm	£ 0.67	Amazon	£8.59/6.4M
10	Semi-opaque Plastic Sheet	Warning Alert Diffuse	25cm x 8cm	£ 0.25	Amazon	
11	3D Print Filament 0.4mm Generic PLA	End Cap	45m (134g)	£ 2.14	Amazon	£16.00/Kg
			Total	**£ 61.65**		

My costings don't include things like glue or Velcro. The total cost is **£61.65**

Material Considerations & Selection

One of the most important elements of making and designing a product is the materials. For my product I need to find what material would be best for the main box and outer framing. I will have to consider durability, availability, sustainability, maintenance, cost, aesthetic, performance, weather etc.

For my product I needed to consider the frame for the clear acrylic and I think metal will be the best material for it. There are advantages and disadvantages for each one.

Brass

Advantages
- soft metal that is strong and incredibly durable and stays in good condition for years.
- very malleable which making it ideal for shaping into intricate designs.
- holds up well in all environments even high temperatures
- is made from a combination of copper and zinc which makes it more resistant to corrosion, so the material will last out.
- It has a rich aesthetic and is often wanted for luxury hotels, banks, historical buildings and restorations as it is a high end material but with a quality finish, this makes it more expensive.
- Brass fixtures are more expensive that some of the other metals used, but is the best quality and most durable metal that will last the longest.
- can be polished
- easily machined
- last many years

Disadvantages
- requires maintenance
- All substances, especially metals, oxidize when exposed to the air
- It may corrode, and it will tarnish if it is not protected with lacquer or other clear

I think using brass for the frame of the product firstly for aesthetic will be good because it has a shiny polished look to it and adding a some colour to the wood and acrylic. Brass u shaped channel will be used so the acrylic can slide into it and it can be held in place. I will melt the brass or cut it so it can fit around the rectangle acrylic front.

Aluminium

Advantages

- is a silvery-white colour
- is a lightweight metal.
- It is soft and malleable
- low-maintenance
- durable
- long life span
- ductile
- It can act as a good thermal and electrical conductor
- corrosion resistant
- almost 100% recyclable without any loss of its natural qualities nontoxic.

Disadvantages
- Aluminium isn't as strong and can be expensive compared to steel of the same strength.

Wood

Plywood

Plywood is commonly used for furnishing homes and offices. It is versatile and highly workable building material. It is a wooden panel made by stacking and gluing thin layers of wood together.

Advantages
- good strength and durability
- easily polished or painted
- resistive to shrinking, twisting or cracking.

Disadvantages
- More expensive than MDF
- Difficult to cut
- Isn't fully water resistant.

Walnut

Advantages
-easy to work with
-aesthetically pleasing surface
-resistant

Disadvantages
-high price
-not weather resistant

Box Enclosure Material

For the main box I have decided to use walnut wood because it will be able to survive in many weather conditions and will look more aesthetically pleasing. I will have to assemble; pieces it all together to create a box. I can then put the electrical components inside and I will also have to cut out a thick line underneath so I can put the led lights in. I will also polish the wood so it won't get damaged or destroyed so it can last a long time. It will also look nice with the brass frame and acrylic.

Plastics

Thermoplastics

Thermoplastics are materials that soften to a liquid in high heat and then harden when cooled, they can be molded into many different shapes and structures.

Advantages
- Impact resistance
- Strong plasticity
- Reversibility
- Little to no waste
- Can be moulded and reshaped

Disadvantages
- limited temperature spectrum compared to metals
- Thin

Acrylic Perspex plastic

A thin and durable plastic used for it being transparent and strong

Advantages
- strong and can take a lot of pressure
- shaped and styled in anywa
- heat resistant
- light weight
- can be cut

Disadvantages
- cost
- Flammable

Glass

Glass forms an inorganic, transparent or translucent material which can be molded into any shape.

Advantages
- Shiny
- Transparency
- Waterproof
- Recyclable
- Weather resistant
- Sustainable

Disadvantages
- Fragile and brittle
- High cost
- Less impact resistance
- heat absorbance

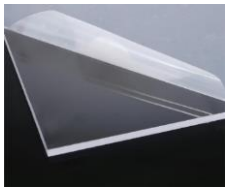
For my product I will be using the acrylic Perspex instead of the glass as I want it to be durable outside and not be too fragile to use and display.

Making Diary

Materials
To make my product I will be using these materials:

- Brass u shaped channel – This is for the framing of the product
- Clear Acrylic Perspex- This is being used so I can laser cut my design into it and is much stronger than glass and will have the design of a house number printed into it.
- Walnut Wood- This is for the main box in which the electronic circuit is going to go into and also to hold the rest of the product such as the house number making this the main body.
- Electronics- I will be using a circuit board with many components along with led light strips to make the light be able to be controlled using a remote control fob .

Extra materials: Velcro- to attach components but also so it can be taken apart again, Plastic sheet for a light diffuser, Sealant tape- water resistant and stop water going inside of product damaging electronics, Battery holder.


I started off by marking out my measurements, I want the framing to be on the long brass u shaped channel that is going to be used to go around a piece of clear Perspex. I measured using a rule from the very edge and the then instead of marking off a straight line on the side piece I had to measure out a 45 degree angled line to cut across, this is so it can fit with other pieces accurately in the corners. While doing this I had to make sure I kept the opening of the channel on the shorter side of the 45 degree angle as that is where the plastic Perspex is to slot into.
The two side measurements were both 17.5cm on the outside length. The bottom piece is the longest as it convers the width, this piece is 24.5 cm long and also had to be cut with edges angling at a 45 degree angle. I clamped a piece of wood into a vice and then held my piece of brass on it, to then use a hacksaw to start sawing into the wood that then cuts into the brass creating a smoother cut. This is how I cut all my sides. I then pieced them together, to see if they fit. They were not perfect so I used some sanding paper and placed it on a flat stable surface to then sand my edges so they could fit together more comfortably. I found that using an actual sander was easier and just had to be careful when using the machine but it did in the end line up all my corners so that they could now be fixed together. I had to consider safety and wear safety goggles.
To join the corners together I soldered them by placing the two corners together and then putting some flux on the top and bottom and then some solder. I then used a blow torch and distributed the heat across most of the brass causing it to change colour and then finally melt the solder to conjoin the two corners together. I used gloves as hot



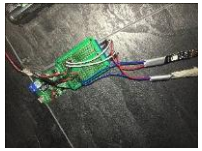
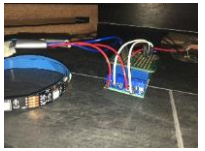



2. Perspex Acrylic
On the Perspex acrylic plastic I want to have a number laser cut in it so it can show someone's house number. Firstly I drew out a design I wanted, which included the font, size, spacing etc. I then moved to designing on a 2d design software. On this I experimented with different fonts as I had more of a variety and also deciding which parts of the number I want to be engraved. Also designing on a software can make sure its more accurate and also be ready to be laser cut. Once I had chosen a design I laser cut the outline on to some card board to test the design, sizing, font etc and see what it looks like to see if I need to make any alterations. Once this was cut I put it inside the brass framing and it fit perfectly so the sizing is correct. I just need to change and alter the font slightly so the laser cutter can engrave the numbers into the plastic. The idea of this is to slot inside the plastic which will then slot into the main box of the design to get lit up and be able to work





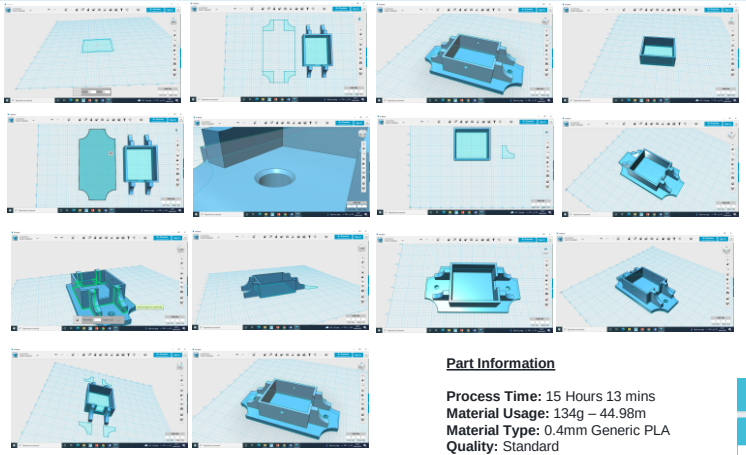

3.Box
First I got the measurements for the box that is going to be the main body of the product. I am using walnut wood to make the box out of as it is a hard wood and is durable and is easy to work with. The whole box will consist of 6 pieces of wood that will be put together. I measured and cut all these pieces and then got them planned so they are all the same size. Then the bottom piece of wood in the middle I cut out and small strip 1cm thick to fit the led strip light. I then used glue to stick each piece of wood together apart from a side piece and a front piece so we can get the electronics inside. I then decided my design needed to drill out circles in the main front piece to display red led lights which are going to symbolise and alert for the emergency. When drilling out these holes I measure out the centre line and then guide marks for where the leds are going to sit so I can I drilled a hole for each one. I started off with a medium size holes and when drilling the holes lined up a bit unevenly so instead I drilled larger holes which I think turned out to look much better. When doing so I had to be careful not to make the circles accidentally over lap each other but they turned out evenly spaced. I wore goggles for safety.
Next I cut out part of a sheet of white thin plastic to go on the inside of the box to cover the holes we just drilled so the lights on the leds can still shine through.
I used some water resistant and waterproof tape to seal the edges


4. Electronics
I have started by Soldering the short power wires (+5V and 0V) to the main switch pcb. This is for the main supply from the battery pack.
The solder power wires from the main switch pcb goes to the sub pcb (power distribution). This is to allow more terminations to the power connections.
The solder power wires from the sub pcb (+5V and 0V) for connection to the screw terminals on the main switch pcb. The screw terminals are the relay switches and these connection provide the power to switch on to the led light strip.
I soldered wires to both the led strips (+5v and 0V) and connect them to the screw terminals on the main switch board. This connects the led strip to the relay switch that in turns will connect the power to make the circuit to operate.
Then I've attached the sub pcb to the top of the relays using Velcro pads.
I soldered the power wires from the battery pack to the two power wires connected to the main switch pcb .
Then I put the batteries in the batter holder. This connects power and the power led on the main switch board will light up to show it is switched on.
The led strip operates off 5V and requires two connections to make them light up, 5V and 0V. The wires are soldered to the led strip power circuit connections to enable it to connect to the relay switches.
I used Velcro to attach the circuit board and the battery pack inside the box so it can be taken off to be replaces or replace batteries.

CAM - 3D Printed Wall Mounting Bracket Design

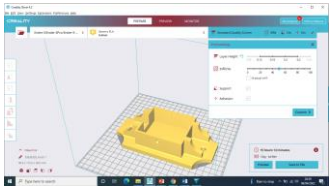
These are the stages used to make the design for the 3D Printed Wall Mounting Bracket.
The different parts of the bracket are designed individually then assembly together to create the finished part. It is important to dimension correctly for symmetry and align each part correctly with each other. The grid and snap tools help with this.



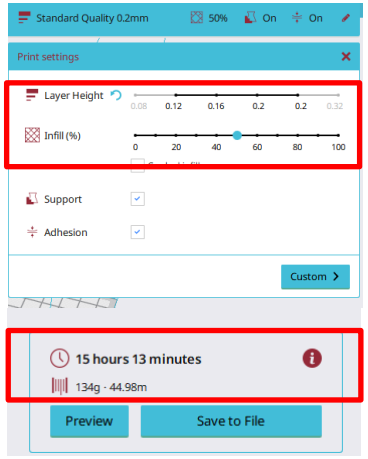
Part Information

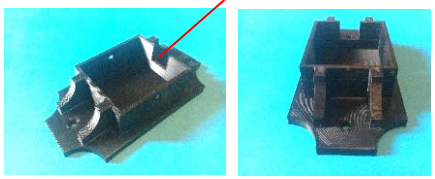
Process Time: 15 Hours 13 mins
Material Usage: 134g – 44.98m
Material Type: 0.4mm Generic PLA
Quality: Standard

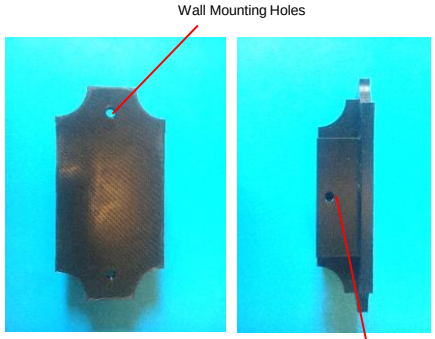
3D Slicing Program



The last stage of the process is to use a program called Slicing. This is the way that the computer communicates with the 3D printer to tell it what to build and where. There are many settings that can affect the output including the print weight. It also shows the amount of time it will take to process.







Bracket shown on final design

I have learned that 3D printing is good for prototype work. It allows you to test the design before a product is mass produced. Also to consider safety.

Manufacturing Safety

Machines (Drilling Machine, Sander, Cutting, Engraving)
- Wear goggles to protect eyes from sawdust.
- Wear an apron to protect clothing from dust.
- Make sure the guard for the drill on.

Sawing
- Make sure metal or wood is clamped or help firmly so you don't slip with the saw and hurt yourself.

Sanding
When using a sanding machine:
- Tie hair back so it cannot get caught in machine.
- Keep you hands away from the moving parts.
- Wear an apron to protect clothing form excess sawdust.
- Wear goggles to protect your eyes from sawdust.

Soldering
When soldering together electrical components with a soldering iron:
- Don't touch the end of the iron as it is very hot and you will burn yourself
- When soldering using a blow torch:
- Keep hands away from flame so you don't burn yourself
- Once finished don't touch the metal as it will be very hot, use tongs to run it under some cold water to cool it down for use.

Design Safety

When designing something you should consider things about safety. It could be how it is made or it could be from the operator view.

For example if you need a big hole in wood, you may do it in steps else the wood may try to spin or snatch. In the design notes you could say you need a smaller hole first then open it up bigger.

In CAM design settings you can consider speed of tools and clearances to ensure safe operation.
Also someone doing something by hand must not be given a job too dangerous that could hurt them.

Mass Production

If my product was to be mass produced it would be made in much larger numbers than one at a time.

This could be 10,000 or 100,000 units and it would need different ways of producing the individual parts.

The wooden box could be fully machined and not by hand.

I could simplify the electronic with my own design rather than buying the pcb. With the power distribution, connections and battery pack all on one pcb.

The metalwork frame could use jigs and automatic soldering.

The sign engraving could be automated maybe using a feeder for acrylic to keep engraving all the time.

The 3D printed bracket could be injection moulded.

The final assembly could be design to click together to save people costs.

Material and components could be bought in bulk.

Need to consider quality of materials and production to ensure still good.

The cost of my product would be much cheaper than £61.65. If it could be made for around half the cost, allowing for cost for people's time, it could be sold at my target price of £75 to £100 and make profit.

Product Manufacture & Test

This is the flow process for the manufacture of my product. It shows each manufacturing stage and testing.

I have put them in order and different categories. Decisions points are shown by diamond.

KEY

DECISION
Is it correct to specification?
Y = Continue
N = Put right

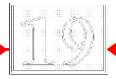
START

SIGN MANUFACTURE (METALWORK & ACRYLIC)

Measure and cut raw metal brass u-channel to length (3 pieces). Do this by sawing the corners that are supposed to connect at a 45 degree angle and clamp a piece of wood in a vice and then place the metal on top to then saw through it. Sand edges so they fit in place perfectly.

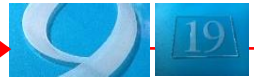
Next join the corners together by soldering, making made sure the corners were aligned correctly before.

Inspect, clean and file each corner to smooth finish.



Use a 2d design software to design the acrylic and create a template. Consider: size, font, placement, number etc. (optional) Laser cut this onto some carboard to double check your sizing is correct to go inside your frame and the design is perfect.

Once design is finalised, laser cut it and engrave onto acrylic Perspex. Once it has finished it will be cut and you would have e to clean excess debris from the process.



Mark clearance around edge to go in brass frame. Mask and sand chamfer (angled edge) on edges to fit u-channel.

Insert acrylic panel into brass frame. Ensure good push fit.

BOX MANUFACTURE (WOODWORK)

Measure and then cut raw timber to correct wall thickness for the box

Cut box base, end walls, front panel, rear panel and top to size. Then use a planning machine to cut all pieces of wood to the same thickness

Check quantity and dimensions of each panel.

Assemble Box. Fix together with glue base, front panel, rear panel and one end. Leave one end and top loose. Use a sanding machine to sand any edges so all the sides are smooth. Check smooth.

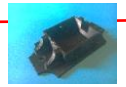
Mill slot in long front face of box to the correct size. Check size.

Measure out along a centre line the space between each led and drill holes in front panel that is sized for one LED each. Check spacing

Clean up holes and slot, sand to smooth finish. Check smooth.

Check front face and end wall fit.

3D PRINTING



3D Print end mounting cap. Check it fits box. Inspect quality.

ELECTRONICS

Cut LED strip to length (10 LEDs), solder wires to +5v and GND terminals and cover with insulation tape.

Solder power connections to power lines on remote switch PCB. Cover with heat shrink insulation. Check secure.

Solder power lines and power feeds onto power distribution sub PCB.

Connect 5v supply and LED 5v line to the screw terminals on the remote switch PCB.

Solder GND of LED strip to 0v on power distribution PCB. Check good connections

Use self adhesive Velcro to attach sub power distribution PCB to remote switch PCB

Solder battery pack to power cables. Use insulation tape on joints.

Insert Batteries

Wait for led to initialise and test.

White LED strip test. Tested: Working

Red LED strip test. Tested: Working

Both LED strip test. Tested: Working

ELECTRONICS FINAL

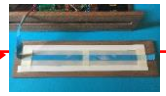
Using self adhesive velcro attach remote switch board and battery holder to the box and position LED strip in designated slot.

Position White LED strip onto waterproof self adhesive tape.

Position waterproof self adhesive tape and LED strip behind acrylic sign slot.

Check LEDs are aligned in slot

Put white semi-opaque plastic sheet behind holes on front panel. Secure with water resistant sealant tape, this will stop water from getting inside the box and damaging electronics. Check secure.



Put Red LED strip on white semi-opaque plastic sheet on inside of front panel. Double check that there is an LED positioned behind each hole, secure this with tape.

Cover LED strip with waterproof self adhesive tape.

Electronics Assembly is complete. Check all tape and seals are secure.

White LED strip test. Tested: Working

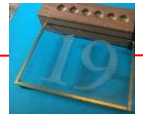
Red LED strip test. Tested Working

Both LED strip test. Tested: Working

SIGN FINAL ASSEMBLY

Place in the loose side piece in place, this I an entrance so batteries can be changed

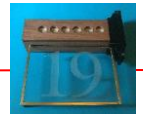
Using adhesive attach front panel to main box.



Insert acrylic panel and brass frame into the slot and align. Check fits properly

Using hot melt glue gun apply glue at the brass contact points only. Check it is secure

Push the bracket onto end of box at loose battery access end. Secure with screws. This allows is to be mounted onto a wall but also gives you easy access to the components inside the box. Check fits properly

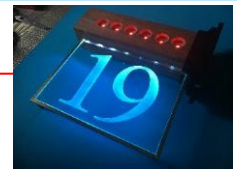


Assembled product ready to test.

Use fob to test.
A = White LED (Sign)
B = Red LED (Alert)

White LED final product Test Check Operation Tested: Working

Red LED final Product Test Tested: Working Check Operation

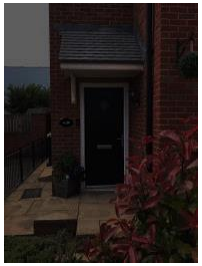


FINISHED

I have learned that there are many steps in the process of making something and I have lots of decisions to make during them. Also, the photos show the white leds looking like blue but they are white in real life.

Product in Use

This section shows the product operation and how it would work in practice. The property below is shown at night and with no number at all it is hard to identify. My product helps to improved the visibility of the house sign.



No House Number

Without the product. A typical property at night does not have a house number visible.

Emergency services have to rely on GPS and local knowledge but sometimes the property street can be total darkness and this can costs lives.

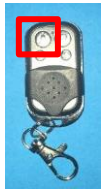
This simple but effective product solves this problem and provides reassurance to the client.

House Number Lit Up

Normal operation. The sign can be illuminated at night using the key fob.

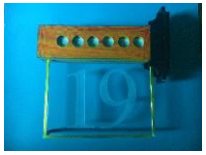
Alert Activated

Alert Operation. The sign illuminates a row of red leds for added visibility.



House Sign On

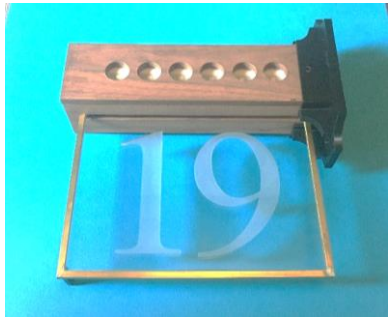
Warning Light On



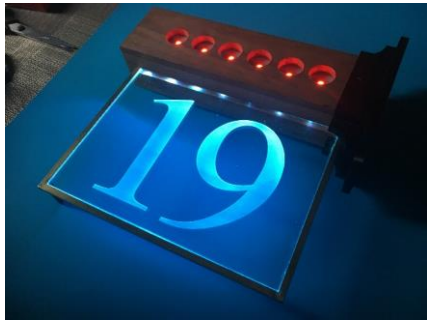
The sign is visually attractive In daylight. It has a walnut wooden Enclosure, brass frame, modern acrylic sign and traditional number style. At night time the ultra-bright leds turn the number into a high visibility sign with added emergency alert feature.

An example scenario

An elderly person has fell and an ambulance has been called. The house number and alert led is activated to enable high visibility at night and the emergency services to identify the property as soon as possible.



Day Time Operation – No Lights



Night Time Operation - Lights

Current Features:

- Large house number sign.
- Modern acrylic style with traditional number font.
- High quality wood, acrylic and brass finish.
- High brightness illumination at night.
- Warning Alert Illumination.
- Remote control operation.
- Battery powered, no mains or adaptors needed.

Future Features or Adaptations

- Multi-purpose wall fitting adaptor.
- Advanced sealing for weatherproof.
- Flashing red leds.
- Rechargeable battery pack.
- Wi-Fi Smartphone Operation to enable long distance operation.
- Design for mass production.

Client Feedback

The client feedback was positive. They like the fact it was attractive in both day and night. They felt the simplicity of operation was just right for the kind of product it is. They suggest it would be useful for the mounting bracket to be able to fit on the left or the right and an option to mount if from the rear flat on the wall. This is something I can consider as a future change.

They thought the level of illumination was really good in the dark and it could be seen from quite a distance away. I explained the final selling price was aimed at between £75 and £100 and they felt that this would be acceptable.

They also thought the overall finish quality was a high standard and they were interested in how long the batteries would last. This would require some extra testing and something that could be improved on with bigger battery cells.

Summary

I have learned that following a series of stages you can take a brief and through design and research if leads to a final product. There are lots of things to be considered at each step with the most important thing to design to the brief. The client is the end user and needs a product that meets their needs, there is no point making something that they can't use. You would not be able to sell many if not.

I think this was a good project to work on as it covered lots of areas including woodwork, metalwork, 3D printing and electronics manufacture. Each part was made in each section and assembled together for the final assembly. I had to consider changes along the way based on materials available and functions I could achieve.

I am pleased with my finished product as it fully works and meets the original brief.

The Examination – 50%

- The paper is 2 hours duration
  - There are three sections
  - **Section A: Core technical principles** (20 marks)
  - consists of multiple choice and short answer questions examining the core technical principles
  - **Section B: Specialist technical principles** (30 marks)
  - consists of longer response questions that assess the specialist technical principles
  - **Section C: Designing and making principles** (50 marks)
  - consists of questions that assess the designing and making principles.

Equipment

- Refitted T1 classroom with 24 high end PCs for running 3d software
- New A1 sized Laser Cutter
- Access to 12 3d Printers that can print with a range of materials.

Why choose this option?

- It gives learners the opportunity to demonstrate creativity and innovation
- The course is designed to be flexible in approach, offering learners the opportunity to focus on specific materials or adopt a broader approach using a range of different materials.
- Provides sound progression from KS3
- Focuses on the production of a prototype
- Any questions?????