



Prtecta<sup>®</sup>

**Smarter Mailbox Protection**

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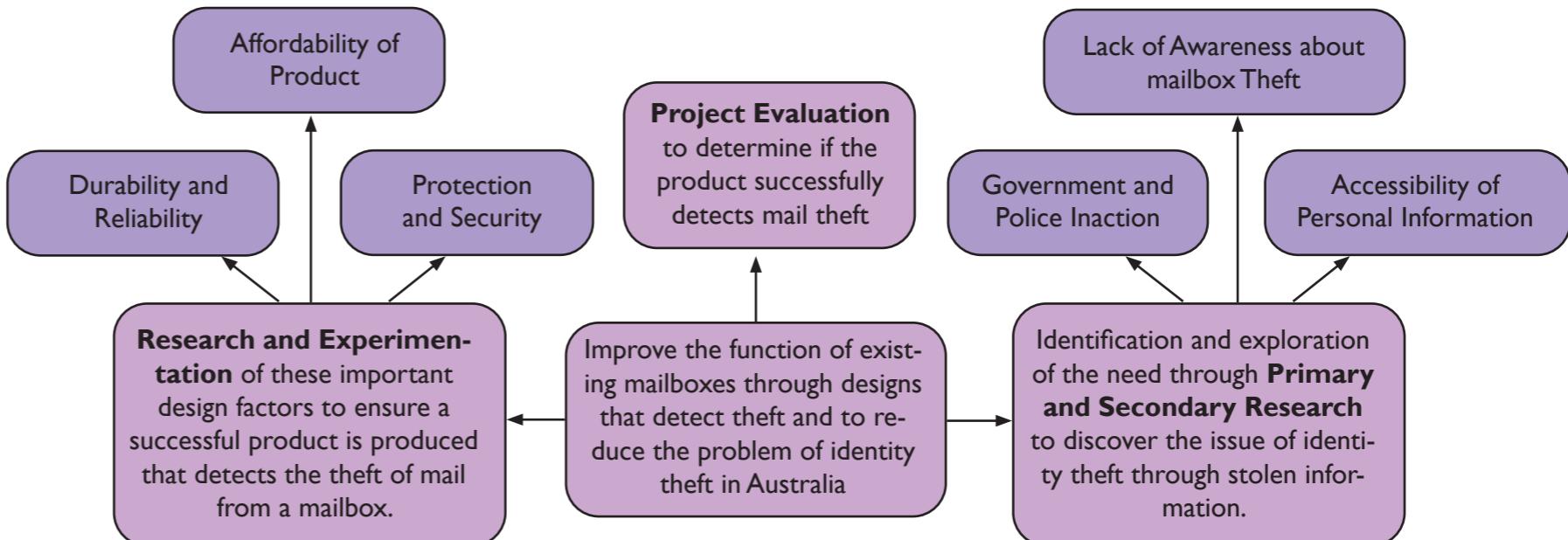
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## PROJECT OVERVIEW



## SWOT ANALYSIS

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>Research skills</li> <li>Drawing and sketching</li> <li>Autodesk and adobe skills</li> <li>Perseverance</li> <li>Planning</li> </ul>	<ul style="list-style-type: none"> <li>Time management</li> <li>Video editing</li> <li>Not considering all design possibilities</li> <li>Being hasty and rushing</li> <li>Preconceiving the end result</li> </ul>
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> <li>Acquire new practical skills</li> <li>Improve design thinking skills</li> <li>Help community members with a problem</li> <li>To develop a new creative product</li> <li>To bringing a new product to market</li> </ul>	<ul style="list-style-type: none"> <li>Loss of computer files</li> <li>Problems with technology</li> <li>Resources that are not accessible</li> <li>High cost of product development</li> <li>Unrealistic time frames</li> </ul>

## EVALUATION

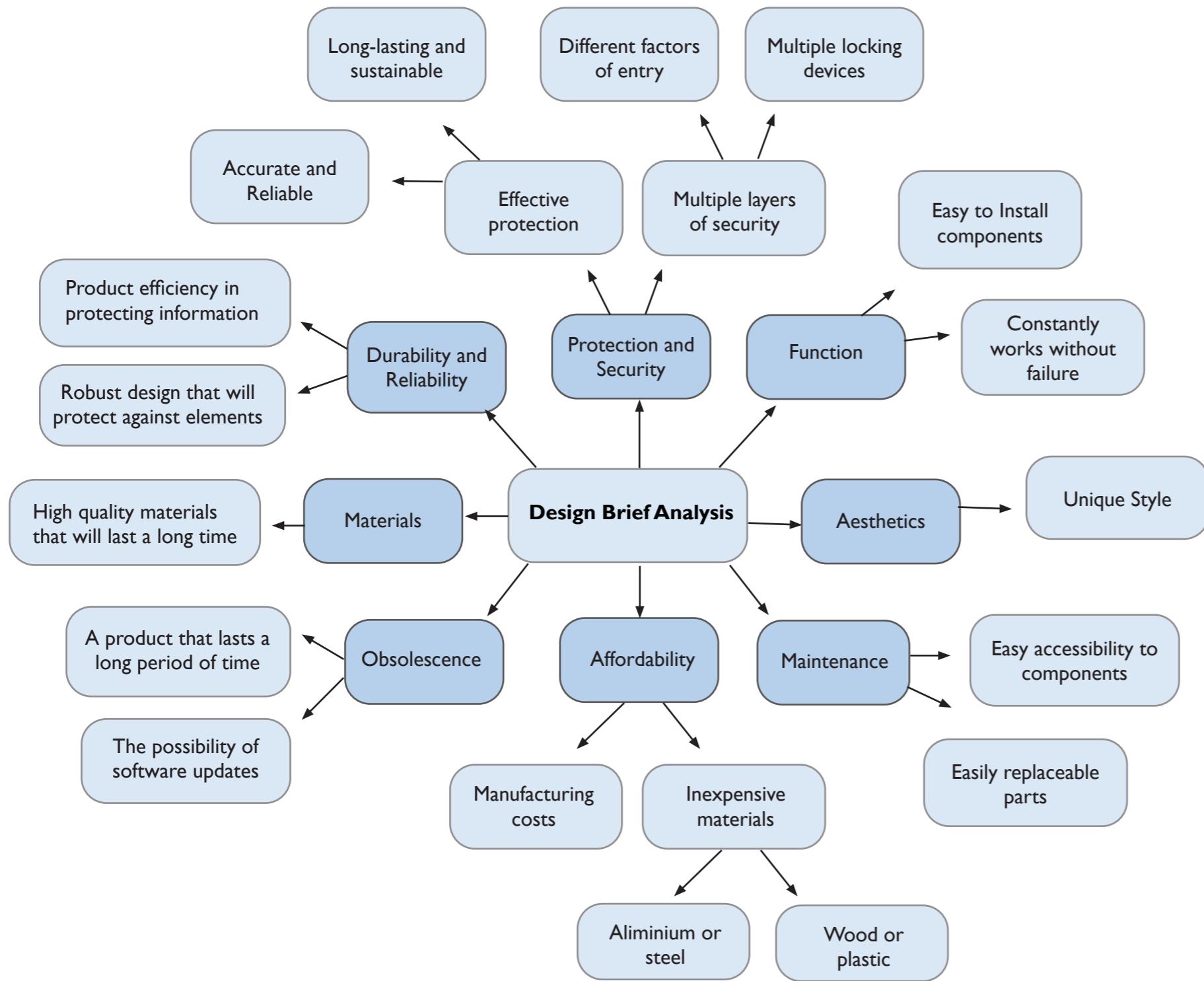
A SWOT analysis helped me to understand the range of factors that need to be considered to successfully complete the MPD. Completing the SWOT analysis made me aware of my weaknesses and identified possible threats. This in particular allowed me to address the problems early on so that they can be minimized and demonstrates my strengths and enthusiasm. By factoring in the critical information, the SWOT analysis will provide me with a high-quality project, delivered through solutions that address any outlined weakness and prevents possible threats.







## I.2 AREAS OF INVESTIGATION



## LIMITATIONS AND PARAMETERS TABLE

COSTS
The costs associated with the development of the project may be an issue as I have a limited amount to spend. This will mean that careful research will have to be carried out on components and materials. Then by selecting and comparing these components I could make sure that the product meets the overall criteria. To ensure that the costs of development are reduced I will create and follow a budget to forecast and track the amount of money that is going to be spent on the project.
EXPERIENCE
Since I have not been a victim of identity theft or experienced the issue I have to ensure that I make correct judgments and decisions throughout the project. I will have to rely on the accuracy of my primary and secondary research for the correct criteria to be addressed. As a result I will have to put more time into testing and evaluating to ensure an excellent product is produced.
SKILLS
My skills may be a potential limitation during my MPD as I only have basic knowledge in coding. I will need to develop a more advance understanding of coding languages to ensure that I produce a high-quality project. I will also focus on improving my computer modeling tools for the 3D printing aspect of my MPD to ensure that the process is smooth and time efficient. I intent to overcome these issues by watching video tutorials on lyda.com as well as testing my knowledge of relevant coding languages on grok learning.
TIME
Throughout the MPD I will have limited time to complete the project as other commitments may reduce allocated time. Another limitation could be potential procrastination and leaving sections to the last minute. This would result in sections not being completed to a high standard. As a result I will make sure that I allocate appropriate time periods for the project to be completed and will also set realistic goals to be achieved. This will reduce stress and workload and be beneficial to the end result of the project.

## AREAS OF INVESTIGATION TABLE

DESIGN FACTOR	IMPORTANCE	QUESTIONS TO BE CONSIDERED	PRIMARY	SECONDARY
<b>Protection and Security</b>	It is important that the product successfully protects mail from being stolen by thieves. To ensure this I will carry out an investigation to determine the best defences as well as the type of security layers that will be necessary. Identifying questions will ensure that effective security measures are added.	<ul style="list-style-type: none"> <li>• What are current security features?</li> <li>• Why are current security measures not effective?</li> <li>• Are mailbox security measures common?</li> <li>• How are mailboxes currently being broken into?</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews with Police Personnel and Security Specialists</li> <li>• Personal Observations</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research of existing mailbox's and their current security measures</li> <li>• Interview mailbox owners</li> </ul>
<b>Durability and Reliability</b>	Due to the product being exposed to weather elements. It is very important that all the components last a long period of time. This will be addressed through an investigation of durable materials and components that are typically the most consistent and reliable.	<ul style="list-style-type: none"> <li>• How can the life of the product be extended?</li> <li>• What materials can maximize durability?</li> <li>• Can special components be used to maximize the reliability of the product?</li> </ul>	<ul style="list-style-type: none"> <li>• Surveys into existing alternatives</li> <li>• Testing and experimentation of materials</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research on durable and reliable materials</li> <li>• Building material magazines</li> </ul>
<b>Usability</b>	My initial research showed that even when security features were available if users found they were difficult to use or maintain they would not make use of them. It is very important that the product features are simple and encourage the user to make use of them.	<ul style="list-style-type: none"> <li>• What would make the security design features more user friendly?</li> <li>• Are current products user friendly?</li> <li>• What makes a product user friendly?</li> </ul>	<ul style="list-style-type: none"> <li>• Personal experimentation</li> <li>• Survey individuals testing the product</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research into a variety of usability features</li> </ul>
<b>Aesthetics</b>	Although not a major concern, interviewing homeowners revealed that most cared about the look of their mailbox amongst the street scape. It was important to create a mailbox that looked clean and modern so homeowners would consider purchasing it over other alternatives.	<ul style="list-style-type: none"> <li>• What patterns, textures and colours make the mailbox more appealing to homeowners?</li> <li>• What style of mailbox do homeowners want?</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews with homeowners</li> <li>• Personal Observations</li> </ul>	<ul style="list-style-type: none"> <li>• Blogs and Magazines</li> <li>• Pinterest Website</li> </ul>
<b>Function</b>	The function of the product is very important as it must be able to consistently function effectively without failure, so that mail is protected at all times. Investigating the functionality of the components will be essential in determining if the product is powerful and resilient enough.	<ul style="list-style-type: none"> <li>• What steps will be needed to ensure that the product doesn't fail?</li> <li>• How long is the product typically going to last?</li> <li>• Does it do the job it is designed for?</li> </ul>	<ul style="list-style-type: none"> <li>• Personal experimentation</li> <li>• Interviews with material experts</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research into existing designs and their function</li> </ul>
<b>Universality</b>	To meet the criteria the product must be able to be retrofitted into a variety of different mailboxes. Universality is Extremely Important and needs to be investigated to find out whether it can be fitted into a variety of different shaped and sized letter boxes.	<ul style="list-style-type: none"> <li>• Is the products shape and size suitable to fit in a variety of different letterboxes?</li> <li>• Is the product easy to install in letterboxes?</li> </ul>	<ul style="list-style-type: none"> <li>• Testing of designs universality within existing mailboxes.</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research into existing designs of products universality.</li> </ul>

DESIGN FACTOR	IMPORTANCE	QUESTIONS TO BE CONSIDERED	PRIMARY	SECONDARY
<b>Materials</b>	In order for the product to be effective it Must be had out of good quality materials for it to be durable and reliable. Materials need to be investigated to make sure that the most appropriate materials are selected for the product ensuring quality.	<ul style="list-style-type: none"> <li>• Is the material easy to source and maintain?</li> <li>• How durable is the materials of the product so the life span can be increased?</li> <li>• How long does the material typically last?</li> </ul>	<ul style="list-style-type: none"> <li>• Experimentation in order to discover the best possible materials</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research to access the pros and cons of certain materials.</li> </ul>
<b>Affordability</b>	For a product to be successful it needs to be bought, people won't pay excessive amounts of money for a product. So the price aspect of the product is Very Important and needs to be considered to ensure that people can afford it and will be willing to pay the amount.	<ul style="list-style-type: none"> <li>• Can it be produced for a reasonable price?</li> <li>• What is the cost of similar existing solutions?</li> <li>• How much will the total of all materials add up?</li> <li>• What price would individuals be willing to pay?</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews with individuals in the target market to gage an appropriate price.</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research of existing products and their price.</li> </ul>
<b>Obsolescence</b>	It is common for products to become obsolete after a period of time as a new technology becomes available. Obsolescence is Important to ensure that the product lasts a long time and doesn't become redundant and useless. Identifying questions allows me to consider all aspect of obsolescence.	<ul style="list-style-type: none"> <li>• How long do similar products last?</li> <li>• What makes a product be obsolete?</li> <li>• Will mail become redundant?</li> </ul>	<ul style="list-style-type: none"> <li>• Testing and experimentation of software that reduces obsolescence.</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research regarding technology product obsolescence.</li> </ul>
<b>Manufacturing Process</b>	The manufacturing process is important, so that the product is high quality. Rushing or not correctly researching and then following the manufacturing process will impact the overall successfullness of the product.	<ul style="list-style-type: none"> <li>• What manufacturing steps are necessary for the production of the product?</li> <li>• What steps have to be completed to carefully to ensure the product is successful?</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews and surveys to find out successful manufacturing processes.</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research into the manufacturing steps necessary in the product.</li> </ul>
<b>Coding Languages Required</b>	For the product to be successful, the software needs to be built with the correct coding language. Investigating which language will be best suited to what the product is designed for is extremely important for the product to work as intended.	<ul style="list-style-type: none"> <li>• What coding languages are suited for the functions of the product?</li> <li>• Will I be required to learn a new programming languages?</li> </ul>	<ul style="list-style-type: none"> <li>• Testing and experimentation of a variety of different coding languages.</li> </ul>	<ul style="list-style-type: none"> <li>• Internet research to discover what coding languages similar products use.</li> </ul>

## EVALUATION

Areas of Investigation was critical and assisted me identify questions that need to be considered in regard to important design factors. This gave me a deeper understanding of the issue through learning about important features that would need to be considered and applied to my MPD during the development stage. As previously mentioned, outlining the design factors is important to be project. This allowed me to create questions to be explored and researched in the development stage. Doing an investigation table will ensure that the following key requirements are meet: protection and security, functionality and durability of the product.

## PROJECT MENTOR

To ensure a successful project it is important that an individual that has experience and knowledgeable in the field of identity crime evaluates the project. This is essential to ensure that the correct steps are used and that the project is on track. It is important that I have a mentor or expert as I have never dealt with the issue of mailbox protection. The expert will be able to advise and assist with ways to improve the final product. These mentors might include victims who have experience of identity fraud or police offenses which have dealt with the issue. In particular Ross Andreans, a senior project manager with experience in IT will be used to assist with the coding and Arduino development for the project. Additionally, teachers and students can evaluate the overall project through mentoring on improving the analysis of research or designing the portfolio in Adobe InDesign.

## 1.3 CRITERIA FOR SUCCESS

### CRITERIA FOR SUCCESS TABLE

### EVALUATION

DESIGN FACTOR	CRITERIA	POSSIBLE TESTING METHOD	IMPORTANCE TO PROJECT
<b>Protection and Security</b>	The product must be functional and protect information using a variety of defences and layer security to ensure that the user's information isn't stolen.	Photos and videos of physical testing by simulating someone trying to break into the mailbox and seeing how the product's security defenses protect the mail and warn the owner.	This would mean that the criteria point is vitally important (9/10). As the product must effectively guard mail to stop theft.
<b>Durability and Reliability</b>	Due to the long period of time and exposure to the elements the product needs to last it must be reliable and durable without causing the product to be redundant.	Photos and videos of physical testing of product durability and reliability through exposing the materials to water, bugs and heat within mailboxes.	This is very important (8/10) to the life of the product and its effectiveness in protecting mail.
<b>Usability</b>	The users must find the product functional. Meaning it has to be easy to use in order for all functionality to occur and to fully protect the user's mail.	Allowing potential focus groups to do pilot testing of designs and evaluations of them will ensure the usability of the product is perfect and meets their needs.	This is important (7/10) as if the users requirements are not met by making the usability easy, then the product will not be successful.
<b>Aesthetics</b>	The homeowner must find the mailbox attractive to ensure that the project is successful. This is important to ensure that homeowners would purchase the mailbox.	Interviews will be conducted with a variety of homeowners to find out what style of mailbox they prefer. This will ensure that an aesthetic mailbox is produced.	This is not as important (6/10) as it is not directly related to the project need for a secure mailbox.
<b>Function</b>	The product must be able to repeatedly protect mail without failure. This is super important in order to keep thieves from breaking in and stealing mail.	Photos and videos of tests of the product simulations to ensure that the final product will constantly work accurately and effectively.	This is important (7/10) as if the product doesn't work half the time then it's useless in protecting the mail.
<b>Maintenance</b>	The product must have the ability for components to be replaced and fixed easily and effectively without damaging other components.	Test prototypes and how easy it is to do maintenance on the components of the product. Recording the accessibility through video and photo's.	This is important (6/10) as if a component breaks it doesn't mean the whole product needs to be replaced wasting money and resources.
<b>Universality</b>	Due to the limited space inside a letterbox the product must be shaped and sized appropriately otherwise it will not fit in the allocated space provided.	Videos and photos of prototype designs and physically testing the product in a variety of existing mailboxes to ensure that the product fitting will be universal.	This is vitally important (9/10) to the success of the product and for it to effectively meet its design brief.
<b>Materials</b>	Due to the product being exposed to some weather and a long period of time, materials must be chosen carefully. Materials must be waterproof, dust and bug resistant.	Researching the life span of components such as batteries etc. using sources such as articles, webpages etc. in order for appropriate materials to be selected.	This is a key point (7/10) to the success as the life span of components has to be substantial for the product to be effective.
<b>Affordability</b>	The product must not be too expensive otherwise individual will not buy the product. Price must be considered carefully without impacting the overall quality.	Researching existing products using sources such as articles, webpages etc. and comparing price alongside the overall quality to ensure that the product is affordable for identity theft victims.	This is important (6/10) as victims need to be able to afford it without it being overly expensive.
<b>Obsolescence</b>	Due to the technology in the products being potentially no longer being functional after a period of time the product must be able to be updated.	Using Photos and videos to record testing of prototypes to ensure that the product lasts a long time but can be updated.	This is slightly important (4/10) as the product needs to last a long time without becoming useless.

Understanding the criteria ensure the success of the MPD. These criterion are standards that the product must include to meet the design brief. This section allowed me to understand what methods could be used to test the design factor of the product. This allowed me to consider which criteria were the most important and why they were the most important to the overall project success.



## EVALUATION

By considering the time I have allocated for the completion of the MPD I will be able to produce a project of high quality. This will ensure that I will stay on track and work efficiently which will avoid rushing sections of the MPD. Time management is especially important for projects to be successful as quality ideas can be developed throughout so that a successful project will be produced that meets the criteria and standards of the designer. Below are my evaluations for each of the year 12 terms. I used these evaluations to assess my progress and how I managed my time in relation to due dates and challenges that I encountered.

### TERM 4 - 2019

This term consisted of identifying a project based on a real-life problem by conducting research. This was quite a challenging part of the portfolio, but was completed within the time frame allocated. Conducting primary research was difficult in the time frame as I required a lot more time to secure interviews as I had to work around the interviewees schedules.

### TERM 1 - 2020

Designing and looking into existing solutions was the main aim of this term. This took quite a bit of time and was complex because of the nature of the problem and because there were few existing ones to learn from. It was hard to manage my time in this term because of my busy schedule at school. I completed this section of the MPD just inside the intended time frame however it took longer than anticipated to reach a suitable product design.

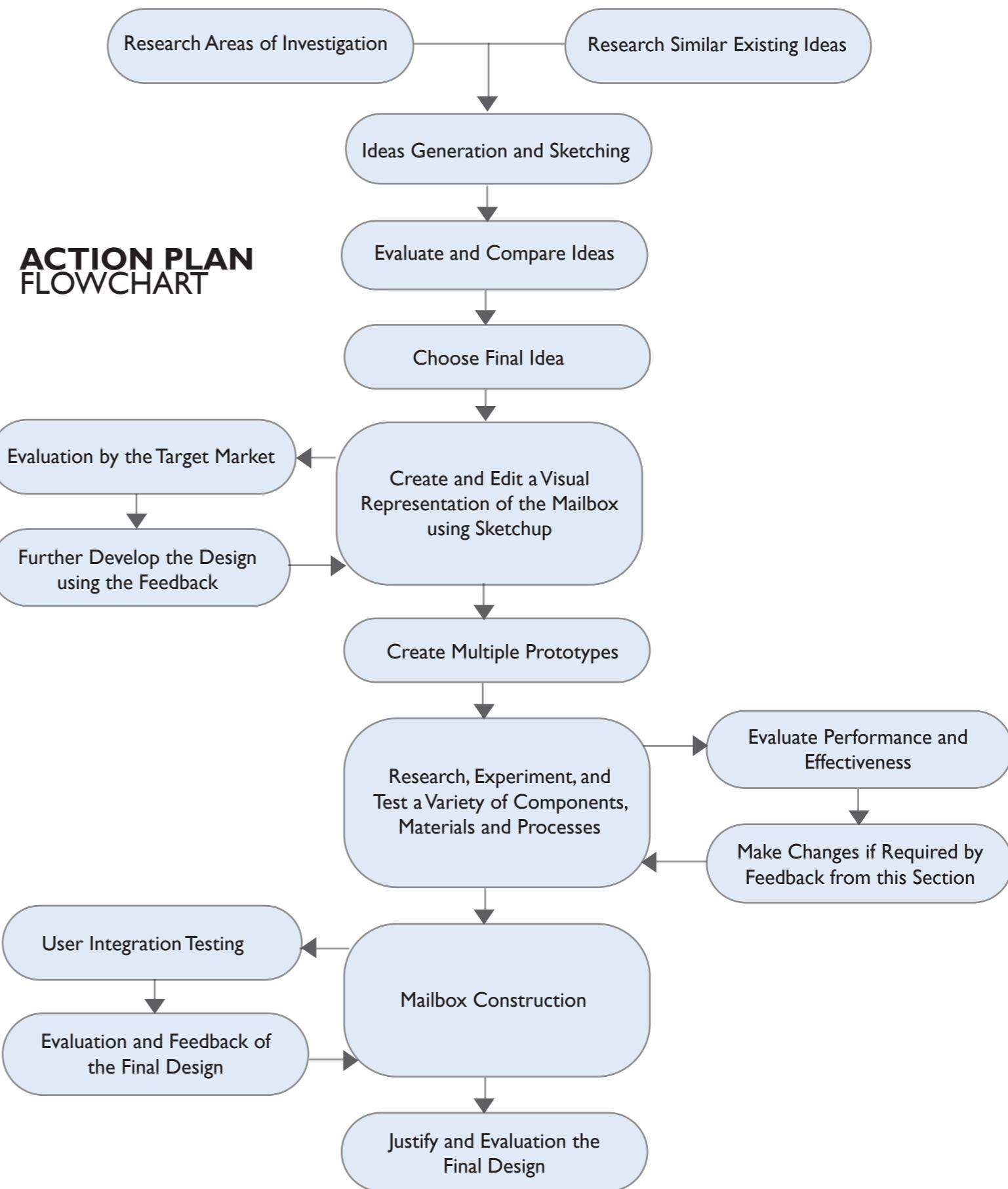
### TERM 2 - 2020

After the project planning stage it was time to build prototypes and eventually the final product. During this stage, the coronavirus lockdown started, and school was transferred to home-schooling. Although this was challenging, I was lucky enough to have a garage which I could use as a workshop at home.

### TERM 3 - 2020

The final term used to complete the project was term 3. It involved finishing the product to a high standard and evaluating the process and the product to ensure that it met the criteria. Towards the end of the project my time management got worse as my energy and enthusiasm dropped and I had to keep going despite a number of setbacks such as the complexity of the electronics.

## ACTION PLAN FLOWCHART





### 2.1 EVIDENCE OF CREATIVITY

#### EXPLORATION OF EXISTING IDEAS

##### 1ST ROUND - EXPLORATION OF EXISTING IDEAS

Looking into the advantages and disadvantage of existing products has shown me what is currently available on the market for my current target market and what features are missing for existing products. However, it is important also to note that when surveying the local area only around 10% of mailboxes had a parcel storage area and only 2% add security features. Most mailboxes looked very similar to those on the Bunnings website. This research allows me to explore the features that can be added to mailboxes to help protect them against weather (elements such as rain, dust and heat) alongside the materials and locking methods used to protect the mail. Further research concerning the best durable materials will be completed. This involved looking at multiple designs and evaluating the materials to identify the most effective resources to use in my design. These ideas will help me guide the final research and the prototyping stage of my product.

Product	Image	Positive	Negative	Influence
Packman Mailbox		<ul style="list-style-type: none"> <li>Integrated tracking technology through the ability to register your mailbox online with your local couriers so a delivery notification can be send when the barcode is scanned.</li> <li>Convenient parcel chute that accepts reasonable sized packages including boxes.</li> <li>The ergonomic handles are well positioned and easy to use allowing then to integrated well with the design</li> </ul>	<ul style="list-style-type: none"> <li>Combination lock is small and a hassle to use as it is located at the bottom of the mailbox.</li> <li>The roof of the mailbox is not sloped enough, and water will flood down into the parcel box.</li> <li>With the pull-down tray there is the potential items other than mail to be placed down into the parcel box.</li> </ul>	This mailbox is currently available on the Australian marketplace at the well-known hardware store Bunnings warehouse for \$299. Some features that will influence my project is the ability to change the code to the mailbox using an app. Additionally the use of a barcode to ensure a successful delivery is an excellent method to send the delivery notification.
Milkcan Mailbox		<ul style="list-style-type: none"> <li>A parcel tray makes it easier to drop off parcels without the hassle of a lock</li> <li>The galvanized steel means that the structure is strong and durable</li> <li>The all black aesthetic and the white labels makes the design clean and simple which could be appealing to some buyers</li> </ul>	<ul style="list-style-type: none"> <li>Smaller parcel box due to extra space that the parcel tray takes up influencing buying capacity.</li> <li>Rainwater could seep through at the bottom as the unit is not raised off the ground.</li> <li>Large letter entry slot allows for hands to slide in and take out letters easily.</li> </ul>	This mailbox is currently available on the Australian marketplace and costs \$345.00. Its influence on my project is its simple design. It features a pull-down parcel entry which removes the need for a lock and is made from steel which is strong and durable making it robust.
Reveca Mailbox		<ul style="list-style-type: none"> <li>The stainless-steel shell of the mailbox is a protective barrier against the weather keeping it waterproof and insulated reducing the temperature inside the mailbox</li> <li>The use of a RFID allows for a better security and removes the traditional lock</li> <li>The indented area at the top stops hands for stealing letters out of the letter slot</li> </ul>	<ul style="list-style-type: none"> <li>The RFID key has to be issued to the postal companies delivering to the mailbox</li> <li>The box is large taking up a large amount of space meaning customers are less likely to buy the mailbox</li> <li>No option to mount wall or have the mailbox floating</li> <li>The design stands out and could attract attention for the wrong reasons</li> </ul>	This was a mailbox idea that was conceptualised by Australia post. However is not available on the market. Some of the features that I think are good include the mailbox being raised off the ground removing water damage and the sloped shape of the roof allows for water to run off and not pool up and potentially seep into the parcel box.

### 2ND ROUND - EXPLORATION OF EXISTING IDEAS

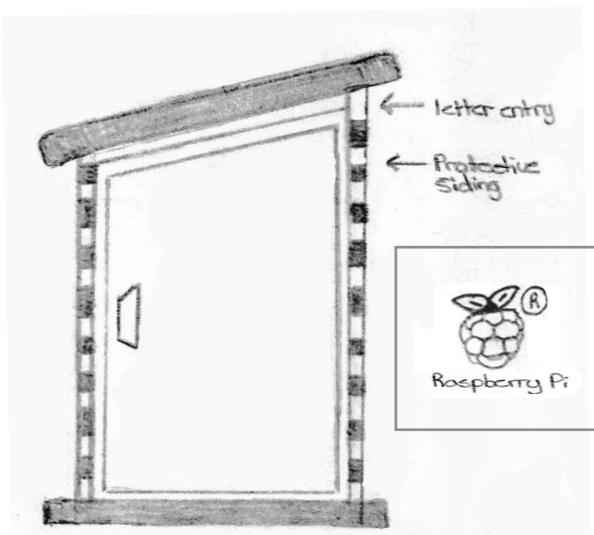
To gain a better understanding of locking mechanisms I looked at existing locks and the security method they used. I focused on accessing the security features of the lock and the suitability of these mechanism for courier and delivery services. This was crucial as locks are typically the first layer of defence when it comes to security. The main aspect of my project is to improve the security and protection of mail with a new mailbox. Additionally it is important to note that these ideas came about when researching blogs and looking into other projects which use similar technologies. Recently these devices have started to be introduced in other products for the ever growing world of home security. So, for the first round of exploration of existing ideas for the development of my project, I have looked into existing security mechanisms that are currently available in the marketplace.

Product	Positive	Negative	Influence	
Locking Mechanisms	<b>Radio-Frequency Identification (RFID):</b> This innovative technology is a relatively new security measure that has recently been introduced. It operates by connecting and transmitting signals through electromagnetic waves.	<ul style="list-style-type: none"> <li>Track and monitor the usage of the lock using timestamps.</li> <li>Convenient due to the ease of access.</li> <li>Wireless key cards cannot be copied or cloned improving secureness.</li> </ul>	<ul style="list-style-type: none"> <li>Requires a power source to operate the deadbolt, but also may malfunction during power outages.</li> <li>Possibility of that the lock could be hacked and bypassed by professional hackers.</li> </ul>	In terms of my project a RFID lock would not be feasible as it would require a key card to be issued to postal services to be able to access the parcel box. However, it would be a good option for the owner of the mailbox as it would save them time to enter a different pin each time.
	<b>Smart Wi-Fi Devices:</b> This is also an emerging technology that is being used to automate existing products. It operates by sending frequency waves through a built-in wifi transmitter to a router.	<ul style="list-style-type: none"> <li>Boosts the connectivity of product allowing it to be conveniently monitored and controlled from anywhere.</li> <li>Allows for software and over the air updates to the mailbox via the application.</li> </ul>	<ul style="list-style-type: none"> <li>Requires a smart device to be able to control the lock.</li> <li>If there is a fault with the devices recognition you wouldn't be able to unlock.</li> </ul>	The lock would require the owner to be available to open the parcel box when being delivered. This is because they have to press a button on an app over the Internet to unlock the mailbox. however, it is possible to open the mailbox on mobile data this option is subsequently not practical option as it is a hassle and time consuming.
	<b>Touch Keypad:</b> This is a touch screen display that shows a periodic number pad. It works by entering a combination or code to unlock the latch on the door when the correct code is entered.	<ul style="list-style-type: none"> <li>Ability to change the security combination at any point in time making it harder to penetrate.</li> <li>Mechanism to prevent the lock from opening after several failed attempts at entering the code.</li> </ul>	<ul style="list-style-type: none"> <li>Requires a power source to operate the deadbolt, but also may malfunction during power outages.</li> <li>Sensitivity issues due to the size of the keypad for the lock.</li> </ul>	A touch keypad lock is easier for the postman to put mail into the parcel box. This is because a code can be issued to the delivery driver through a code left on the delivery instructions on the parcel. This is the best way to access the mailbox in a safe and user-friendly manner.
Sensors and Switches	<b>Magnetic Switch:</b> This sensor is a simple and reliable operating by using a magnetic field (magnets) to relay an open or closed message to the motherboard in order to indicate whether the magnets can be released.	<ul style="list-style-type: none"> <li>Reliable for all operating conditions such as rain, wind and a range of temperatures.</li> <li>Does not require electricity or a power source for the operation of the sensor.</li> </ul>	<ul style="list-style-type: none"> <li>Must make direct contact for the sensors to work otherwise other operations will be impacted.</li> <li>Moving mechanical parts will wear and tear after lots of usage meaning the magnets may be weaker and less effective.</li> </ul>	The lock will require a sensor that is reliable and can operate without issues all of the time. As a result I will be investigating this sensor to be including into the design of my mailbox either for the parcel door and the letter slot.
	<b>Pressure Sensor:</b> This type of sensor is used to monitor and control a product or device. It measures a signal through the weight that is registered by the sensor pad.	<ul style="list-style-type: none"> <li>Expensive depending on the size or the sensor of mat and the sensitivity.</li> <li>Quite accurate when weight is placed on the sensor and works better than other sensors.</li> </ul>	<ul style="list-style-type: none"> <li>Requires power and electricity to the sensor for the weight to be recorded and a notification sent.</li> </ul>	A pressure sensor would be useful to record if a parcel has been delivered to the parcel box. However it would not always detect letters as they are light and don't always fall to the bottom of the box.
Camera Systems	<b>Internet Protocol (IP) Camera:</b> Is a digital video camera that receives control data which is sent via the Internet through an Internet connection to home routers.	<ul style="list-style-type: none"> <li>Remote surveillance through Internet connectivity means that security video and a live feed can be viewed anywhere.</li> <li>Two-way audio communication allows the user to communicate through the camera.</li> </ul>	<ul style="list-style-type: none"> <li>When connected to your home Internet if your connection is already slow it could take up more bandwidth.</li> </ul>	This is extremely useful for my project as it allows homeowners to monitor their mailbox from any location, improving the convenience of mailbox monitoring.
	<b>Closed Circuit Television (CCTV):</b> Television system in which video signals are transmitted from one or more cameras by cable to a monitor or application.	<ul style="list-style-type: none"> <li>Easier to maintain records as CCTV systematically organizes information, this helps when records need to be looked through quickly.</li> </ul>	<ul style="list-style-type: none"> <li>CCTV is less secure as it can be hacked by professionals and disabled, or footage can be tampered with.</li> </ul>	This is more expensive and is less necessary for a project this small as CCTV is usually used for monitoring buildings and residences. I will not be looking into this idea.



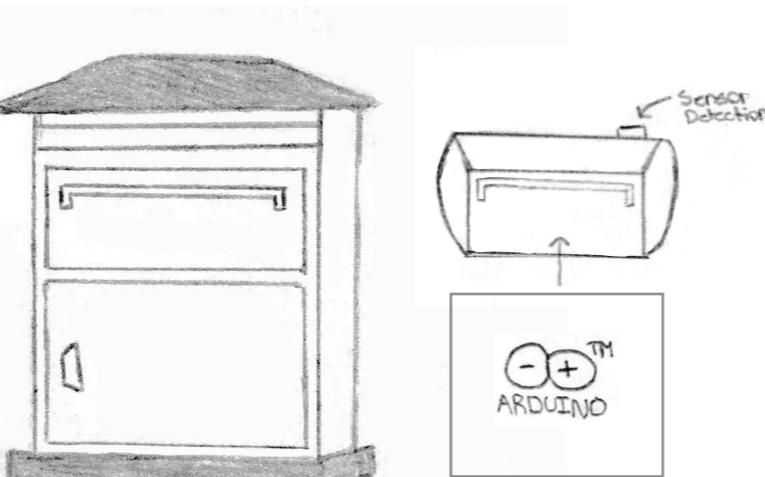
### IDEAS GENERATION

1



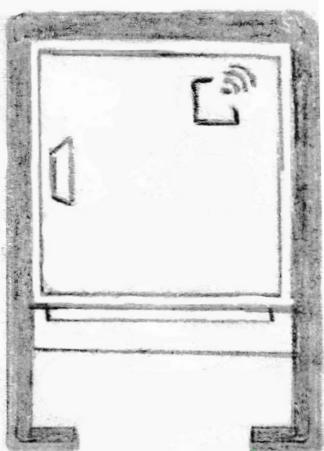
The design of this mailbox is centered around space maximization and optimal security. This is achieved through a sloped roof, designed for extra vertical space and weather protection. As well as an angled letter entry slot that also hides letters out of sight from thieves. The design also includes insulation to keep the inside cool, for the potential storage of groceries. I feel this mailbox has a lot of potential and therefore I will be developing the idea further.

3



Inspired by a previous and secure generation of mailboxes, this mailbox which consists of a pull-down tray is an easy way to save costs on technology. This includes easy access for deliverers and does not waste as much time as other locking mechanism. However, it leaves a small parcel storage area at the bottom of the mailbox. Overall, I think this is a clever design that does work well but as it has downsides I will not be evaluating this idea.

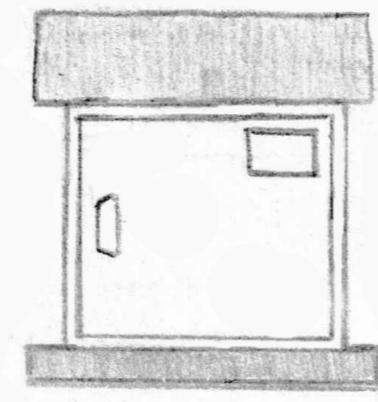
2



This mailbox has a full warped around steel shell that overhangs the front and back of the mailbox in order to protect it from the weather. Being raised considerably higher than existing mailboxes there is less chance of flooding destroying mail, but this is also more ergonomic as deliverers don't have to bend over to insert mail.

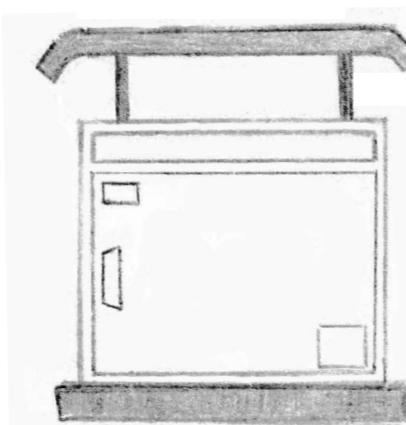
The use of a RFID locking mechanism to open the parcel box and access the letters means that mailbox is very secure. I feel this mailbox has potential due to its clean design that is protective and simple.

4



This mailbox uses an electronic keypad to insert mail making it quicker and easier for deliveries. It also comprised of a lift up cover on the top of the mailbox for mail to be inserted, making it handy as deliverers don't have to crouch. Overall this mailbox is smaller so will have less space to store parcels, however due to its size and weight, it has the possibility to be mounted to a wall.

5



The mailbox has a junk mail slot allows for junk not to be jammed in the letter slot. The mailbox also comprises a protective cover with an overhang to protect the mailbox from the rain. This mailbox is small and compact and is suitable for most homeowners needs.

### DESIGN DEVELOPMENT



#### Design Components of the Mailbox

Designing the structural components of the mailbox was an important and crucial stage of the design development stage in the MPD. As a result every aspect of the design has to be looked at to ensure that the mailbox would meet its requirements and work well in the environment it would be placed in, which in this case would be the outdoors.

**Letter Entry-** I researched many possibilities for the letter entry of the mailbox. I believe that the option I choose is most suitable and better than traditional mailboxes. This is because it has a thin letter entry which means that hands can't reach in and take letters out.

**Covers and Roofs-** Three types of covers to protect the mailbox from rain include a sloped, flat and slanted design. I feel these are the best mailbox covers to protect the rain from damaging mail within the mailbox. Although I from observation a slanted design better than flat.

I am going to use the mailbox cover that is sloped because of its simple and aesthetic design but also because the sloped design and overhangs mean that water flows right of the mailbox. In addition if a solar panel was ever needed to be added the roof would be positioned perfectly for maximum sunlight.

**Raised Feet-** It is important to raise the mailbox in the case that the ground floods. I choose to use feet for the design and use a light material as I think that it will best suit my target market due to its simplicity. Also it will be modular so if the client wants to remove it to mount the mailbox on a wall they have the possibility to do so.

**Types of Handles-** I prefer the intended handle which is sketched on the images beside because of its simple and clean design that is out of the way of the postman when the mail is being delivered. However, it can be hard to create as it does involve carving into the plywood. Due to time restraints I will be buying a metal handle for the mailbox door.

### DESIGN DEVELOPMENT



#### Protection and Security System

In designing the mailbox it is important to address all criteria outlined previously in the MPD. In particular, the protection and security system (PSS) must consider the four main factors and requirements as explored in the sketches and descriptions below.

**Locking Devices-** Traditional mailboxes use a lock and a key however my research indicated problems with this option. I will possibly explore the combination keypad and RFID sensor although I prefer the second option, which is the combination keypad because of its convenience to postal services but also because of its simplicity and usability.

**Locking Mechanisms-** I needed to consider a range of bolts for the locking mechanism. This is highly important in ensuring the lock is strong enough not to be pried by a crowbar as research as indicated.

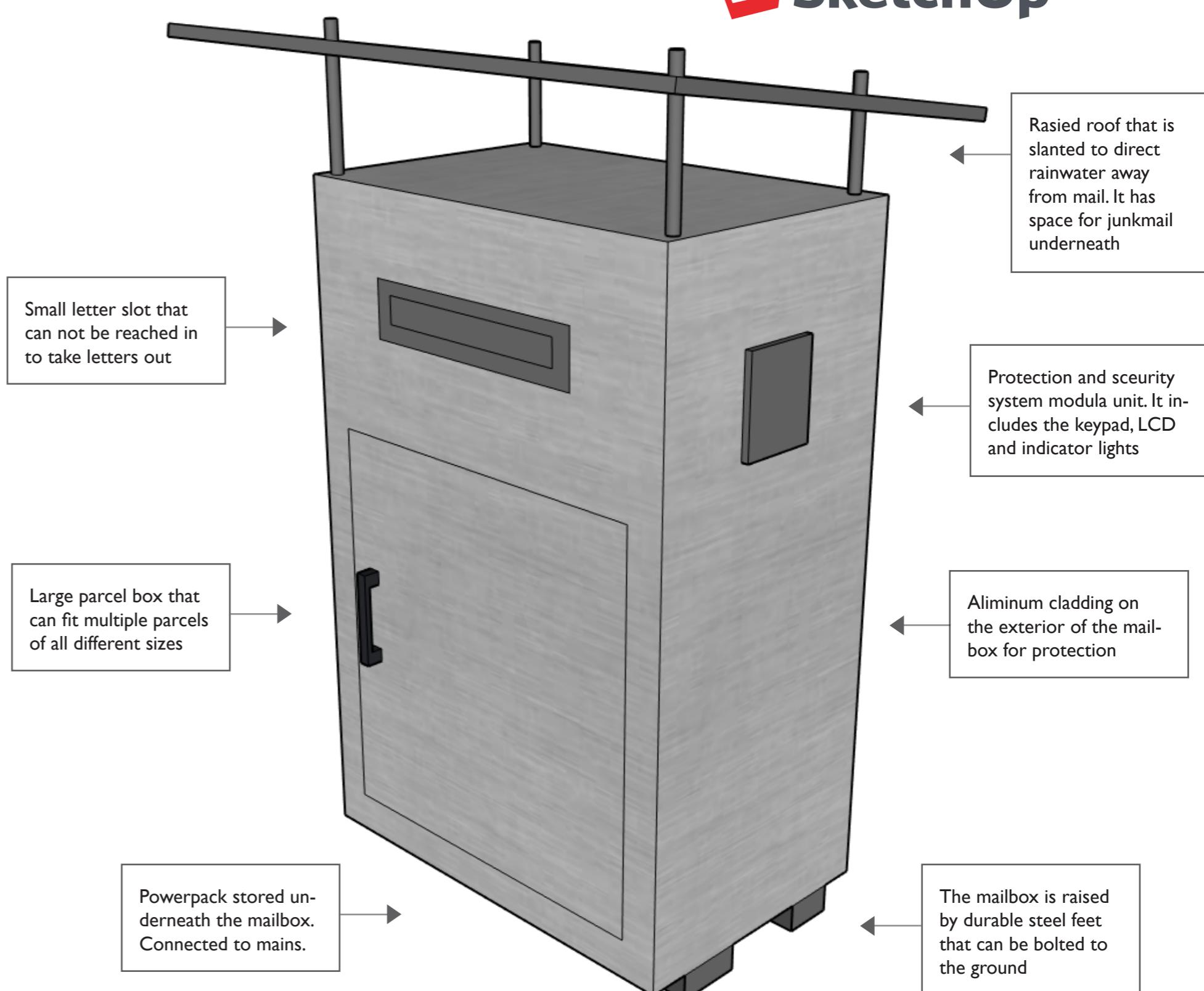
I researched possible options, both a deadbolt and a electromagnetic bolt to get an idea of what would best fit my project. I concluded that the deadbolt is stronger and best suits the requirements of my design.

**Microcontrollers-** The best microcontroller that would suit my requirements in order to see if the controller would be Arduino and Raspberry Pie as it is capable with handling the required hardware and what would work better.

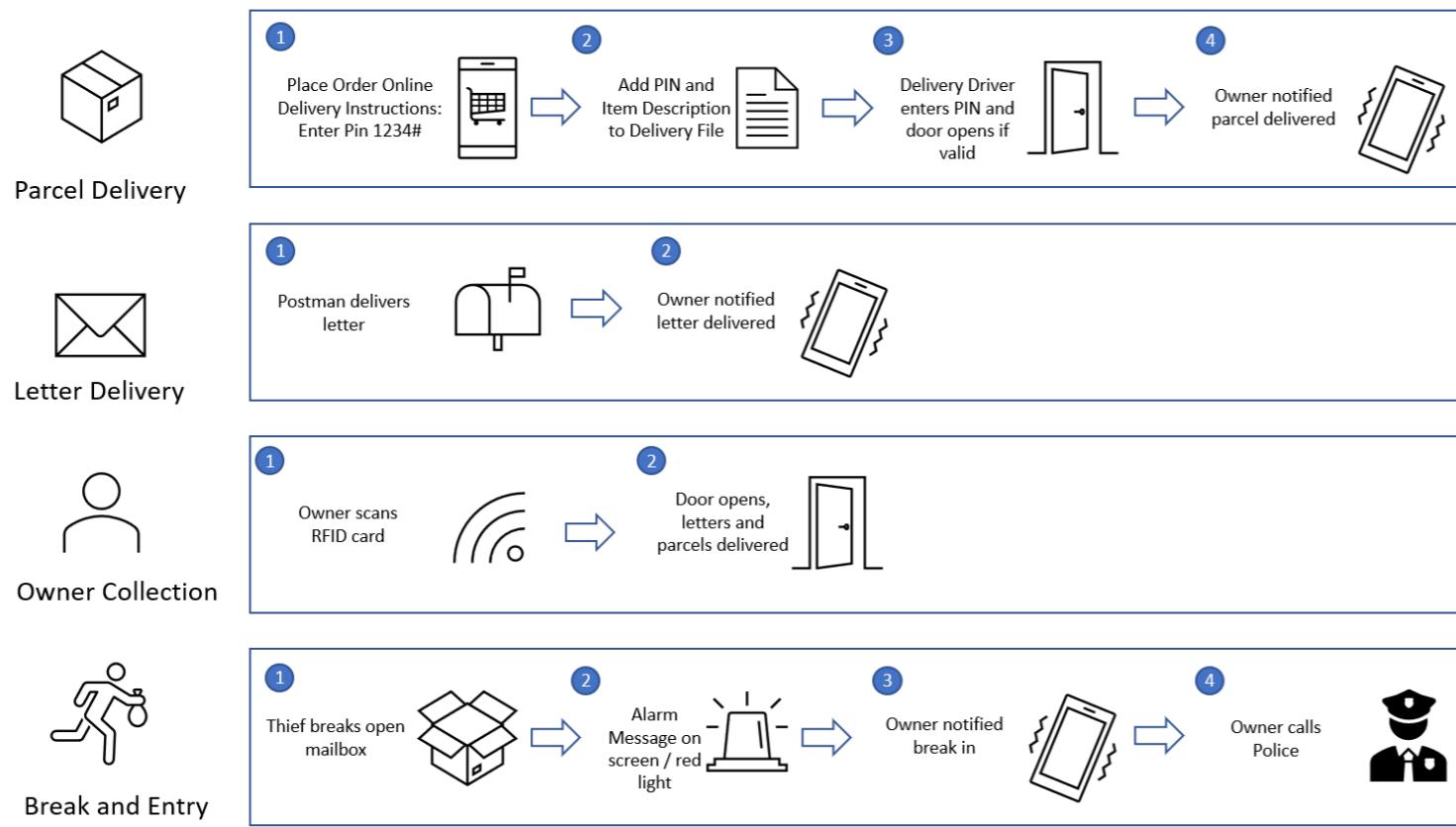
I looked at the following options paying special attention to the output and input capacity, memory and processor. This is important as the microcontroller is the control Centre of the system and is responsible for the successful operations such as a delivery notification and to control the lock.

**Monitoring Devices-** I looked into what monitoring device would be best for the development of my project. Below are two possible options, both the IP camera and the magnetic switch i will use to ensure that the mailbox is protected at all time.

### FINAL DESIGN

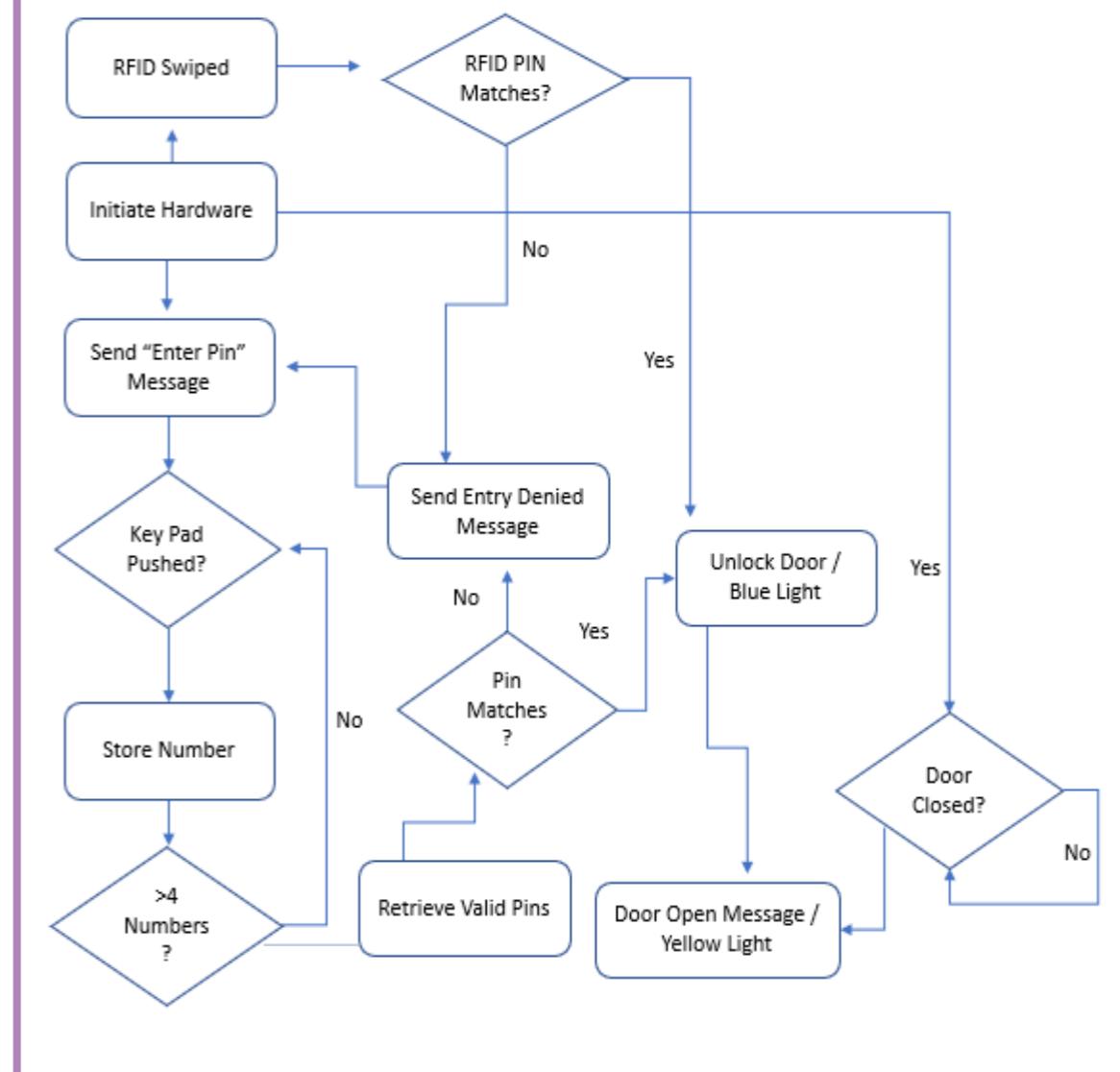


### DIAGRAM 1 - MAILBOX PARTICIPANTS



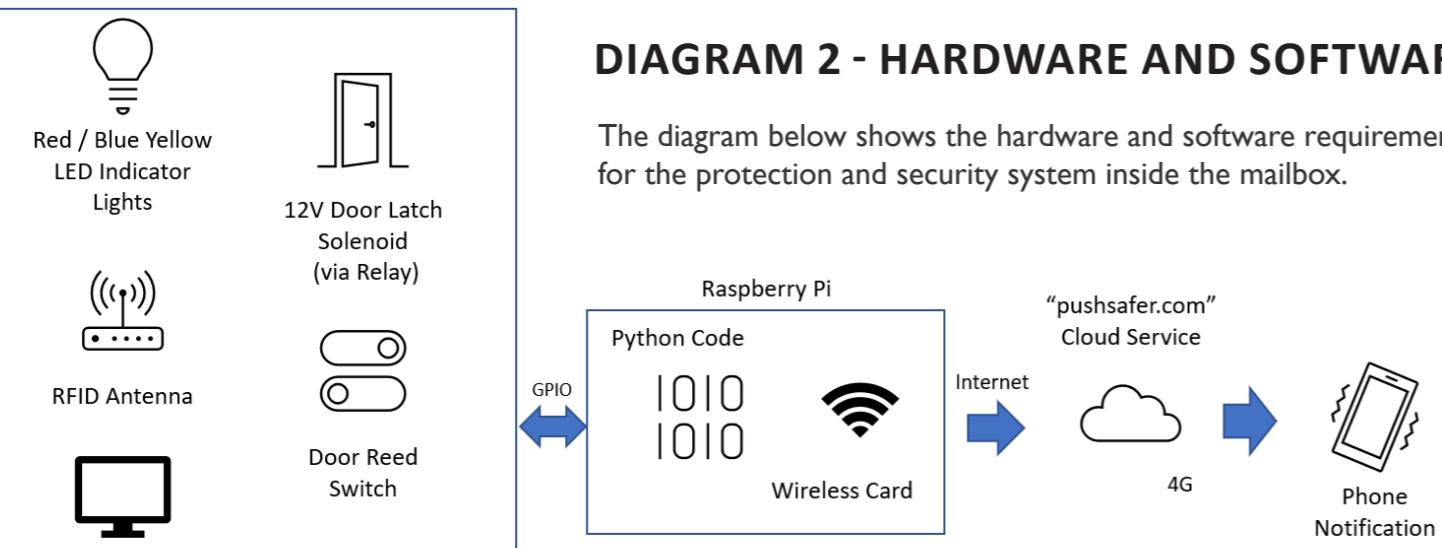
### DIAGRAM 3 - MAILBOX PROCESSES

The diagram below shows the mailbox processes in which the user will follow when interacting with the protection and security system. In addition it shows the system processes and the decisions that take place. In this case the square represents a process and the triangle represents a decision.



### DIAGRAM 2 - HARDWARE AND SOFTWARE

The diagram below shows the hardware and software requirements for the protection and security system inside the mailbox.



The hardware is inside the blue boxes and included sensors, output devices and indicator lights. The raspberry pie will be hooked up to Wi-Fi and send smart notifications using a cloud service. The cloud service app will be downloaded on the users smart phone so they can receive notifications of parcel and letter arrival.

**EVALUATION** Understanding how the protection and security system participants, hardware and software and processes will ensure that a high-quality system is created that meets all the target market requirements. This has been possible from understanding who would be using the mailbox and how the system is going to operate. Drawing these diagrams allowed me to see the entire system in context which will be really helpful for documentation and communication to the target market.



### 2.2 CONSIDERATION OF DESIGN FACTORS

Design Factor	Impact	Consideration & Application	Evaluation
<b>Protection / Security</b>	Protection and security will greatly impact the mailbox as it one of the main factors of design that existing mailbox lack. It also was one of the main requirements for the development of the new design and as a result the design has been thought out carefully to be effective, reliable and efficient in protecting thieves trying to access the mailbox.	My project has addressed this through the careful consideration of a variety of devices and components in the new protection and security system (PSS). This system has addressed the outcomes of the design as it can better handle situations with thieves due to additional security features such as sensors that trigger notifications and locking devices that are smart.	Through protection and security being addressed in the planning and designing of this mailbox it has ensured that the PSS is best equipped with the best possible components from the best manufacturers. This will reduce the number of faults and failures that existing mailbox security components have. Overall the design had been successful as it meets the needs of the user.
<b>Durability / Reliability</b>	The design will impact the target market as it will provide a product will improved protection of personal information on mail while also ensuring that the product remains durable to wear and tear due to the weather. This is through high quality of reliability throughout everyday usage.	My design effectively addresses the needs of by target market by creating a secure, protective place to store and protection mail from both thieves looking to steal property and the weather elements. I have specifically chosen to mainly use Arduino and Raspberry Pie hardware and software. It is most effective as it is reliable and durable.	The research that was conducted to discover the needs and wants of the target market helped me understand the durability and reliability needs. Throw a design that addresses these needs I am confident that my product will be durable and reliable into the future through this carefully selection of hardware and software.
<b>Function</b>	Function is extremely important and plays a huge role in the quality of the product. As a result the function of the PSS system and the mailbox design has been tested to ensure it works as designed. Furthermore, the target market now has a design that is more functional and easier to use.	The new mailbox design has considered the function through testing and developing both the PSS system and components of the mailbox design such as the door, roof and stand to ensure that the design is even more functional than existing products. This is clear within the design with the introduction of an improved roof that has been sloped.	I have effectively considered and improved the function of my mailbox through choosing to use only the best components, materials and devices throughout the design and the PSS system. This has been a result of the through large amounts of research on that has been completed in improving the functionality of existing mailbox
<b>Usability</b>	Usability impacts the target market due to the wide range of demographic which will use the product. Usability was especially important for the design of my product as older people that are used to traditional mailboxes and might not understand how to use the technology in the new mailbox.	The usability and the needs of the target market have been considered as the new design has locking and security features that will allow individuals within the target market to adapt and understand. A simple touch screen can be used to open the mailbox and send the notification, breaking the hole process done into just one step.	Usability is important as the target market is mainly the elderly typically are less able to travel to a post office. This has been achieved through a new mailbox that allows their mail to be stored and received at their address securely and they don't have to travel to the post office.
<b>Maintenance</b>	Maintenance is an important part of improve a products life cycle and is important to address. The target market is impacted as they may have to clean and adjust the components, so it is essential that the mailbox is easy to access every single part and component of the mailbox.	The new and improved design has features such as the PSS can be removed from its holder within the mailbox so components can easily be looked at. Also a big parcel door in the design means that your head can freely see all the bolts from the inside of the mailbox. While also your hand can adjusted fittings if necessary.	I have carefully considered the impact of maintenance and improved this feature form existing design that either don't address maintenance and have mailboxes that are hard to clean and hard for components to be change if they are damaged or potentially break.
<b>Universality</b>	This is less important; however it still was considered when designing the mailbox. This is because it may be aesthetic but not effective and using all the allocated space within the mailbox.	The mailbox design has no narrow or pointy edge or angles and is shaped square as that is the typically space of a parcel. In addition, design is custom to parcel sizes and is different to existing mailbox as it has a bigger parcel box than existing mailboxes.	I have addressed this through the design that uses all space effectively and is bigger in size overall meting the target markets requirements and the design requirements.
<b>Materials</b>	Quality of materials and component throughout the design is a very important factor including aluminum in my design has helped differentiate my mailbox from other currently on the market.	The new design has vicarious quality testing to ensure that my product meets the standards that my target market and clientele expect. I will look in depth at what materials and components are have a long lifespan and can handle the exposure to the elements the best.	This is very important, and I feel that my project must address in order to be successful. I will do testing and research on materials to ensure that the best materials are chosen for the design of the product.
<b>Obsolescence</b>	The impact of design towards obsolescence has been positive as the design features materials and components that are sustainable and can be recycled after their use. In addition, the product will have a long life cycle.	My design has incorporated obsolescence through using reusable components and materials that positively impact both the purchasing consumer. But also so the product is sustainable and reusable after its life cycle is complete.	Considering the obsolescence in the design of the mailbox has ensured that the product is sustainable and meets the demands of the target market for a durable and reliable mailbox. Ensuring that the mailbox is sustainable and environmentally responsible.
<b>Affordability</b>	The affordability is very important as an expensive mailbox is less likely to be brought rather than an appropriate proceed one so this has greatly impacted the design. The mailbox designed will be impacted by financial restraints.	The new design has focused on cutting costs through simple features, instead of expensive and unnecessary features. Also the selection of materials has been investigated thoroughly to cut costs. This is essential for the mailbox to be cost effective as material costs are very high.	I feel that my design is more affordable than existing mailboxes on the market as it made out of different materials and using different components that are cheaper and achieve the same effect.

## RESEARCHING, EXPERIMENTATION AND TESTING

## What sort of security features do mailboxes currently have?

The results from my research into the security features of existing mailboxes revealed that most mailboxes are not secure. This was evident through a street survey of 400 houses in my local area which revealed a lack of security features in place to protect mailboxes. The mailboxes that did have security features just had traditional locks which were usually mounted lock and sometimes locks were broken and rusty. Although rare, about 5% of mailboxes had an alternative locking feature such as a RFID or combination. Conducting online research into mailbox security features, I found that many still had a traditional lock and key for protection and security.



The traditional lever handle locks which are accessed using a key are still largely popular today even though they are weak and can easily be broken by using force which was noticeable on some mailboxes.

## Why are the current security measures not effective?

My street survey research had previously revealed that many mailboxes are not secure and have locks that are rusted and weak. Looking into this issue further, I came across one of the locking specialists, Britlock's blog. The blog stated that typical mailbox locks can be easily picked or jiggled open due to the low quality of lock used. The blog also highlighted how easy it is to make copies of keys for mailboxes that thieves could potentially use to open them and gain entry. In addition to this blog the physical inspection of the locks in my street survey revealed the poor quality of locks commonly used. I discovered that more than 60% of the mailboxes had poor locks that where rusted and falling apart. I therefore concluded that mailboxes generally don't have effective security measures to protect the mail in the mailbox.



Beside are pictures that I took when surveying my local area. It was common for locks to be rusty and not working on mailboxes especially on wood.



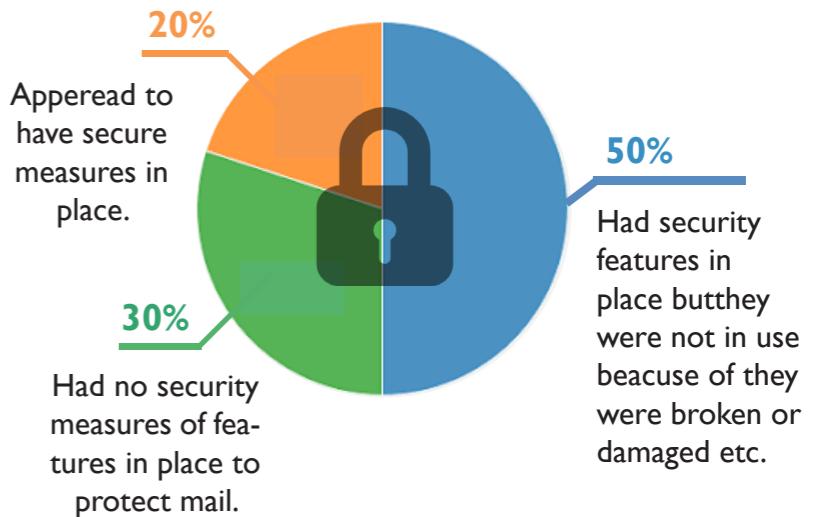
Shown beside is surveillance video of individuals breaking into a mailbox. The camera clearly shows that it is nighttime indicating that attacks commonly happen when its quite and under the cover of darkness.

## How are mailboxes currently being broken into?

Mailboxes are currently being broken into use simple equipment. Through watching security camera footage posted on news reports such as 'A Current Affair' and through the digital 'Sydney Morning Herald', it is clear that the most common methods for breaking into a mailbox include either a crowbar or a hammer. Crowbars are a very useful tool for breaking into mailboxes as the end of the bar can be put into the letter entry slot and used to pry open off the front of the mailbox. As many mailboxes currently on the market have a weak aluminum shell it is relatively easily to pull off the front of the mailbox. The benefit of a crowbar include that they are strong and powerful meaning that any opportunistic thief can use one. Hammers are also very common for breaking into a mailbox as they make destroying and breaking apart the mailbox easier. Hammers are typically easier to get your hands on and are available at pretty much any hardware store. Watching this footage revealed that mailboxes that are too hard to open or have a security camera will be avoided by thieves. However there is a need for a mailbox that is stronger and more rigid that will allow the mailbox to stay secure until the homeowner can be notified and scare away the thief or until they make it outside. Therefore looking into the tools that are currently used to break into mailboxes has revealed the wide use of weak materials and structures.

## Is it common for mailboxes to have security measures?

The local survey of my neighborhood found that it was unusual for mailboxes to have security measures in place. This result was shocking and worrying. This visual observation specifically revealed that there is a high degree of mail accessibility to thieves, due to the lack of security measures in place. Of the approximately 400 houses surveyed, 30% of mailboxes had mail that was easily accessible to anyone as there were no security measures in place. This was often evident through mail that was either outside of the mailbox due to a lack of available space or the mailbox was poorly designed and didn't have any security measures. Roughly, 50% of mailboxes had security features such as locks and narrow openings, however many that I witnessed were not using these features as the mailbox was either unlocked, left open or simply broken. The remaining mailboxes, approximately 20% of the houses surveyed appeared to be secure and reliable enough to protect their mail from thieves. In addition to this survey I did a phone survey to gain the perspective of homeowners around the Sydney.



## What tools are being used to break mailboxes?

From watching a variety of security camera footage I discovered that the tools and techniques used to break into mailboxes are quite simple. Thieves usually target the mailboxes just after mail has been dropped off by the postman and target the boxes when no one is around. It is often the case that these mailboxes are targeted in the early hours of the morning or at night.

**CONCLUSION** I have discovered that the accuracy and effectiveness of the system depends on the role of the device or components role within the mailbox prototype. This has enabled me to make an informed choice about which components and devices to include in the PSS system. Overall this experiment allowed me to narrow down the components that would be used for the final PSS system within the mailbox.







### APPLICATIONS OF CONCLUSIONS

1

The experiment into the effectiveness and efficiency of locking devices (see page 20) revealed that a RFID reader and a keypad could act as two smart and secure factors enabling access to the mailbox while also eliminating problems associated with the existing method of entry (lock and key). The easy to use keypad will ensure that when activated using a randomly generated secure code that the postman is issued, it will perform with pin-point and allow convenient access to the mailbox upon drop off. Ensuring that the parcel drop off is easy and safe for the postman while maintaining security. Furthermore, the homeowner will be able to access the mailbox quickly and simply through swiping their smart RFID card across the reader just under the display improving mailbox security and the user experience.

2

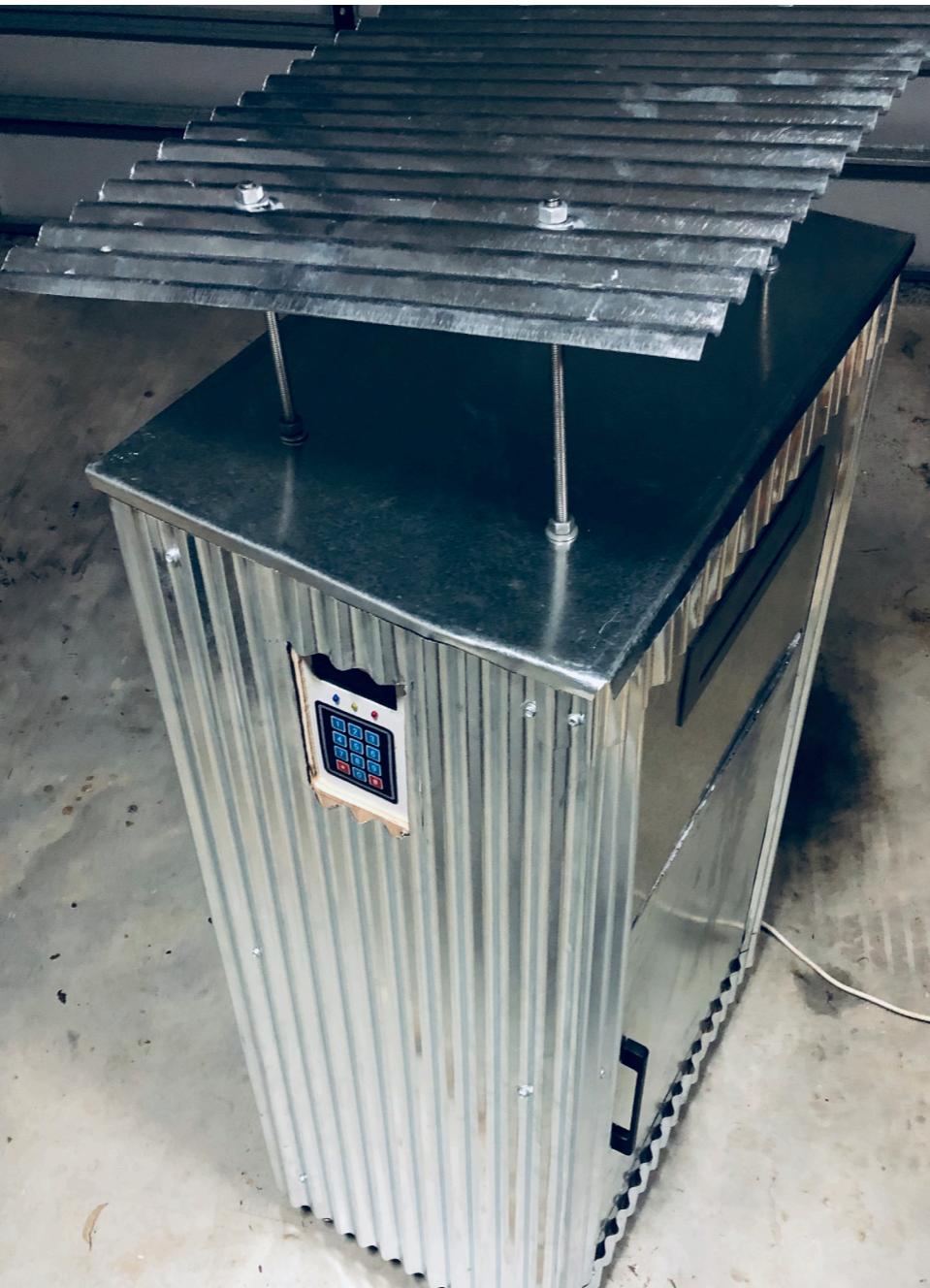
The project research (see page 3-4) identified that smart phone notifications and integration would enable the mailbox owner to be notified as soon as the mail is delivered. This will ensure that mail can be collected as soon as possible to prevent mail sitting in the box. Moreover, smartphone notifications will indicate suspicious activity such as a thief breaking in. With smart phone integration the mail inside the mailbox is more secure and can be easily tracked. This is an important improvement on existing mailboxes that are currently available on the marketplace and will provided added protection to compliment physical features such as the materials used and the devices that are incorporated.

3

Previous research into the target market (see page 21) revealed that usability is an important factor that must be addressed in the design of the mailbox. Research shows that a large number of homeowners are over the age of 65, so its important that the mailbox is useable for this demographic. A user-friendly interface that uses an LCD to display information to the user has therefore been included. This allows the user to clearly see the password they enter when the door is opened, closed, and locked. The display will be high-quality and a market leader in mailbox technology.

4

In the project design phase (see page 14-15) it was decided to keep the mailbox consistently up to date by using over the air Wi-Fi updates. Updates of the mailbox software will fix bug issues that may arise and add new security features overtime which will help ensure constant protection. Alongside this newer versions of the Raspberry Pie computer hardware would be easily upgradable so the mailbox could run new features and position the mailbox at different price points depending on the performance that the user desires. Being able to continually protect the homeowners mail for a long period of time will ensure long term sustainability and extend the life cycle of the product.



5

Using a hammer and a traditional mailbox during the research and testing stage (see page 14-15) I found that existing mailboxes are weak and with a little bit of force a person can break open it. Testing this with an existing mailbox that was commonly used by homeowners re-affirmed this. Therefore it was found that using a sturdy structure allows the mailbox to be stronger than most other mailboxes on the marketplace. With plywood reinforced with aluminium the mailbox is extremely strong and does not feel thin like current mailboxes, improving the structural integrity of previous mailboxes by a mile. Strength is key to protecting the mailbox from thieves trying to break in and this factor was taken extremely seriously in product design.

6

A visual observation during a number of street surveys alongside online research into mailbox designs (see page 20) showed that often Mailbox do not have roofs for protection. As a result I tested multiple roof designs to see which would best protected the inside of the mailbox from water and concluded that a curved roof that overhangs the mailbox allowed full protection from damage or ruined mail while also giving the mailbox a simplistic aesthetic. In comparison to other concepts I saw a huge difference in how it handled rainfall. A curved roof that overhangs means that water can flow over the mailbox and not drip down the sides causing water to leak into caps and cracks on the mailbox itself.

7

The product was inspired by a personal problem that I encountered which was the lack of a suitable mailbox to store parcels. My research (see page 12-13) also identified that this issue was a problem both in my locally community and more widely across Sydney. The introduction of a larger parcel box means that the owner can store additional parcels and increase their mail delivery without having to empty the box as often. A parcel door at the front of the mailbox and positioned at an appropriate height makes placing parcels into the box easier with lots of adjustment room for the postman.

8

Research from physical examinations of mailboxes in my local neighborhood (see Page 20) showed that existing materials (such as wood and thin metals) were weak and flimsy, so it was decided to develop a more durable structural shell by cladding the mailbox with reinforced aluminum. This will ensure that the mailbox is able to withstand thieves trying to break into it. In addition the aluminum allows the mailbox to be weather resistant which will ensure better protection for parcels and letters. This provides a substantial improvement from existing mailboxes which are often not fully weather resistant and often open to the elements.

### EVALUATION

Justifying and communicating modifications made throughout the development of the MPD highlights how the new mailbox meets the new standards set by the target market. Modifications had to be made to ensure that the final product was produced to a high standard, while still addressing the need. The improvements of my design allow ideas to be explored to determine if the idea were practical and would improve the mailbox. This allowed me to see faults in parts of the design and the electronics parts in the PSS system so ultimately the best possible mailbox can be developed.

### 2.5 IDENTIFICATION AND JUSTIFICATION OF RESOURCES

#### MATERIALS

Resource	Description	Justification	Resource	Description	Justification
<b>Aluminium</b>	Aluminium is a silvery-white, lightweight metal. It is widely used in the construction industry because of its particular properties. It has low density, is non-toxic, has excellent corrosion resistance and can be easily cast, machined, and formed which is excellent for mailboxes.	This material makes up the outside of my mailbox, providing protection from potential thieves and extreme weather which are required from this product. Because of this, Aluminium is an ideal choice, as it performs well in comparison with other metals and fabrics while being more affordable for the homeowners.	<b>Electronic Modules</b>	Electronic modules are simple and easy-to-use hardware devices that perform simple functions. Arduino modules are used for projects which involve programming and robotics. The modules allow you to build, design and develop your projects into working products. Modules usually include instruments such as sensors, LCDs, and LEDs.	AElectronic modules were chosen for the hardware of the PSS system as the modules were cheap and available but would also do their job accurately. Another benefit is that the modules are all the same brand which makes compatibility easier than buying high-branded devices and modules.
<b>Plywood</b>	Plywood is a manufactured board that consists of layers of solid timber veneer. It is extraordinarily strong and light while resisting cracking, bending, and warping which makes it suitable for the structure of the mailbox. I found that plywood was also quite affordable for building which was a huge benefit of using the material.	Plywood was used for the structure of the mailbox and was chosen carefully to ensure that the mailbox would be able to withstand opportunistic thieves and the weight of the packages which would potentially be put inside. Plywood meets the requirement of my product due to its well-known strength and durability over long period of time while being affordable to purchasing for creators.	<b>Dupont Wires</b>	Dupont wires are also called jumper wires and are low cost. They are used to connect hardware components together such as modules to breadboards and circuit boards. The connectors are available in a variety of different sizes and in male and female combinations to suit any project.	I choose to use Dupont wires as it eliminated the need to do a lot of soldering. It made the connection between the Arduino models, the circuit board, and the computer easy. The wires are also ensure a good connection between the devices and the circuit board. Within the PSS system the wires performed excellently at ensuring a strong and secure connection.
<b>PVA Glue</b>	PVA glue is an excellent adhesive that drives an extraordinarily strong bond between surfaces. It is low cost, mainly water-based, nontoxic and dries completely clear within a short period of time. PVA glue does not give off harmful fumes which are nasty and sometimes toxic which is a huge benefit.	PVA glue is perfect for ensuring a strong bond between wood. This made it perfect for the structure and gluing pieces of the plywood together in combination with screws. I choose PVA over other glues as it was stronger than wood working glue. However, I have to mention that in some cases the bond had to be considered carefully.	<b>Raspberry Pi</b>	The Raspberry Pi is a small, low-cost computer that has huge processing power in a compact board. Additional benefits of this little computer are its ability to connect many interfaces such as HDMI, Ethernet, on board WiFi, GPIO's and can also be USB powered. It also supports common coding languages Linux and Python and many more making coding easier as no application needs to be downloaded onto the computer and of which could not work effectively.	The Raspberry Pi is the brains of the PSS system within the mailbox. It was carefully selected after research indicated that an Arduino alone would not be able to achieve the requirements of the PSS. Primarily the computer was chosen as it could perform more than one function or operation at once. In addition the computer supported GPIO's which was used for connecting up PSS hardware and coding language such as python and Linux which makes customisation easier when it comes to coding the PSS hardware.
<b>Hex Screws</b>	Hex screws and bolts are known to be extraordinarily strong and rigid. They are comprised of a six-sided head that is shaped like a hexagon and can accommodate a variety of materials. In addition they are economic and easier to produce than other screws and bolts making them affordable.	Using Hex screws and bolts for my product ensured that the structure was strong and that the screws could be reliable. I wanted my mailbox to last a long time and be durable so ensuring that research was conducted into high quality screws as allowed my mailbox to be tough and rigid.			

## 2. PROJECT DEVELOPMENT AND REALISATION

### TOOLS

Resource	Description	Justification	Resource	Description	Justification
<b>Adobe Indesign 2020</b>	Adobe Indesign is a professional publishing software application that is used to create posters, flyers, broachers, and magazines. It includes features such as multiple page document creation, master pages, paragraph styles and type-setting packages. For my project InDesign was used to layout and for my portfolio in a professional manner.	Indesign is considered an industry leading publishing software in the design industry. In comparison to other software such as Microsoft Word and Google Docs, Indesign is more compatible of formatting images and text due its increased number of tools and features. It also allows the portfolio to have an aesthetic design. Due to learning the complex nature of the software it has resulted in a high-quality portfolio to be produced.	<b>Visual Studio Code</b>	Visual Studio Code is a free source-code editor redefined and optimized for building and debugging modern web and cloud applications. Visual Studio Code can be used to develop code with a variety of programming languages including python, JavaScript, html etc. In relation to my project this software was used to develop code for the raspberry pi.	Visual Studio Code is an easy to use platform that has a variety of integrated features to make editing easier and quicker. In particular the software can spot syntax and logic errors quickly by highlight the code in a different colour. Using Visual Studio Code made editing code for my PSS system quick and effective allowing me to push up code from my laptop to the raspberry pi computer through the internet.
<b>Adobe Illustrator 2020</b>	Adobe Illustrator is a professional vector graphics editor that is used to create a variety of digital and printed images, including charts, diagrams, logos, and illustrations. In regard to my project Illustrator was extremely helpful when designing my project logo as well as statistics and infographics to represent research.	Similar to most Adobe products, Illustrator is considered the best graphics editor in the industry. I choose to use Illustrator due to its large selection of drawing tools and the ability to rapid sketch and change designs without losing previous sketches. Illustrator helped me develop a high-quality logo through this stream-line and easy to use platform that has a variety of high-quality tools.	<b>GitHub</b>	GitHub is a repository hosting service that provides a web-based graphical interface. It is used to store code for projects however it also has many other features such as collaboration features. I used GitHub to store all my code that I had developed for the PSS system inside of the mailbox.	GitHub was extremely useful as it allowed me to put a web link into my portfolio due to the large amount of code that was created for my project. In GitHub I would explained my code through comments and use different colours to represent different expressions. In addition, I choose GitHub over other repositories as I had previous experience working with the platform.
<b>Adobe Premier Pro 2020</b>	Adobe Premiere Pro is an industry leading time-based video editing application that can be used for producing high definition video by importing video, audio and graphics. Premier Pro was really useful when creating my 6-minute video due to its ease of use and by having a variety of functions.	I choose to use Premier Pro as I had previously used it for video editing in other school subjects. In addition, Premier Pro has a large variety of options and effects that improves videos. I also found that Premier Pro cut down the amount time that was needed to do editing due to its great user-friendly platform that allows professional videos to be produced.	<b>Autodesk Maya</b>	Autodesk Maya is a 3D computer graphics application that is used for modelling, animation, simulation, rendering and composting. Maya allowed me to create a digital 3D representation of what my mailbox was going to look like.	I choose to use Autodesk Maya as it is a high-quality software that can be used for 3D modelling. I found that it was not that hard to learn and had excellent features that made the process of making the model easier than other software applications on the marketplace.
<b>Microsoft Word</b>	Microsoft word is a high-quality word processing and document creation software. Microsoft word can be used for creating documents such as letters, brochures. For my project I used word to develop the content for my portfolio as word encompasses a variety of editing options which improved the writing process.	I choose to use Microsoft Word as it has a variety of editing options and the ability to review writing throughout the MPD. Word also has the ability to access documents online through the internet which makes editing the documents both at school and at home easy. As word processor go I feel that Microsoft Word was easy to use, navigate and interact with and improved the overall quality of my portfolio content.	<b>Fritzing</b>	Fritzing is an open-source CAD software that is used for the design of electronic hardware, to support designer and artists with planning and building a more permanent circuit. The software allows you wiring diagrams to look very professional and aligns with the industry standard. I used Fritzing to document my wiring on the circuit board.	I choose to use fritzing as it is an easy to use and open-source program that has allowed me to import modules and extra packages when needed. Fritzing was an appropriate way of presenting my electronics and that way it was chosen to represent the final wiring for the PSS system. Fritzing utilising a variety of colours and textures to make the wires look organised.

## 2. PROJECT DEVELOPMENT AND REALISATION

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### Workshop Equipment and Machinery

Resource	Description	Justification
<b>Soldering Iron</b>	A soldering iron is a hand tool that works by supplying heat in order to melt metal that can be applied to wires on the circuit board so a permanent secure connection between the electrical components can be formed. I used a soldering iron to attach the wires to the circuit board so that the wires could be secure, neat, and organised.	I opted to solder all the wires and components onto the circuit board so everything could be controlled in a central place and easily attached to the raspberry pi computer. I also found that soldering caused less power to be required, a low process temperature on the circuit board and as it is an easily automated process that does not take long once you have the hang of it.
<b>Circular Saw</b>	A circular saw is a power-saw that uses an abrasive disc or blade to cut different materials. I used a circular saw as it was a quick, easy, and efficient way of shaping the plywood to the appropriate size or dimensions.	Due to time restraints this was a great tool that sped up the construction of the mailbox frame. The saw had a guide and ruler attached making measurements easy and precise as well as a safety guard for protection. Overall the circular saw is a tool that allowed my mailbox to be of high quality.
<b>Screw driver</b>	A screwdriver is a tool that is used to install or remove screws. It has a handle, shaft, and a tip where the user puts their screw head into. I used a powered and cordless screw driver which allowed me to quickly fasten bolts and screws through the mailbox construction.	I used a screwdriver that was powerful and cordless so ensure that every screw installed would not fail. This was important as screws and bolts would hold the mailbox together and have a strong structural integrity. In comparison to a hand driver or a ranch the powered screw drivers made work quick and easy.
<b>Jigsaw</b>	A jigsaw power tool is made up of an electric motor and a reciprocating saw blade. It is used to effectively cut carvers and straight lines and as the option to cut both wood and metal using different blades. In relation to my project I used the jigsaw to cut the aluminium panels to size.	I choose to use a jigsaw as it portable and light and can effectively cut most materials accurately and in a short amount of time. I found that it was safe and comfortable to use by having an ergonomic handle and indicator lights to warn me off a problem.

### EVALUATION

The justification of ideas and resources section has provided me with the opportunity to describe the tools that have assisted me in completing my project to a high standard. These tools have boosted the quality of my project by providing me with a clear method to represent my project. I have also indicated the people who have been really beneficial throughout the project via their constant and constructive feedback. Finally, providing a justification for resources has allowed me to display and communicate the processes that took place in the creation of my final product to ensure that it was of high quality.

### Digital and Paper-based Resources

Resource	Description	Justification
<b>YouTube</b>	YouTube is an American online video-sharing platform that anyone can upload content on and can be shared across the globe via the internet. It is used to share information on a range of different things and has lots of information. I used YouTube for tutorials to learn how to connect hardware components and even to learn how to integrate software throughout the project development.	I choose YouTube as the main platform to watch tutorials and gather information throughout the construction of the project. The platform has a range of high-quality videos available which helped me solve most of the problems I encountered. In particular when attaching the wires and modules to the breadboard and when developing code for the raspberry pi computer YouTube was an especially useful tool.
<b>Publications / Articles</b>	Publications and articles are content that is available to the general public through reports on specific topics. It is used to share information about a particular topic and inform the reader on findings through text, images, and graphics. I used these for MPD in research when I did not understand something.	I found that articles were especially useful as they provided important information on whether aspects of my project were feasible as well as allowing me to do further research. I found reports that were conducted by people which were doing a similar process as I am allowing me to gauge how their experiments went.

### Human and Physical Resources

Resource	Description	Justification
<b>Father</b>	My father is a project manager that specialises in IT and has previous experience in coding and has been able to teach me aspects that I did not previously understand. He also helped me in other sections of the MPD by critiquing and editing and providing me with suggestions on how I could improve my design.	Without the assistance of my father the production of my PSS system would have been extremely difficult. He has provided continuous support showing me how to improve my project through giving me suggestions, but also teaching me how to code through using his knowledge and passing it on to me to improve the quality and consistency of my work.
<b>Design &amp; Technology Teacher</b>	Mrs Akmens provided constant assistance throughout the MPD by providing me with tips on how I could improve my portfolio. In doing so, she has facilitated the further progression of my project through directing me with suggestions on how I could improve my work in a variety of ways to ensure that it meets the high bands in the marking criteria.	Ms Akmens has provided a consistent support throughout the year both through her suggestions and goal setting advice. She is a trustworthy person who I can discuss ideas and resolve issues with allowing me to further develop my project and boost my marks as well as helping to develop me as a design student by improving my skills and refining my designs.

### 2.6 COMMUNICATION AND PRESENTATION TECHNIQUES

Technique	Page Number	Justification
<b>Fonts</b>	All Pages	A variety of fonts were used throughout the portfolio to categorize information in order to make it easier for the reader to differentiate sections. I have used Gill Sans for headings, subheadings, and body text as it is unique and stand out. Gill Sans is also extremely easy to read which ensures that the reader is at ease.
<b>Photos</b>	3,5,11,13,19,20,21	Photos have been used throughout the portfolio to offer a visual representation of ideas and to show the progression of my design. The use of photos has allowed the portfolio to be more engaging and compliment the written text. This has allowed the reader to better understand a variety of concepts by digesting information in a different way.
<b>Bolded Text</b>	3,4,5,14,15,19,20,21	Throughout the portfolio important sentences, statics and quotes have been bolded to ensure that the reader will still get the basic understanding without having to read the whole page. Bolding is a simple and effective way of showing important information due to its harsh shading that makes each letter larger and so that the reader is informed.
<b>Tables</b>	7,8,11,12,13,17,24,25	Tables are an effective way of organising text into categories so that the reader can easily understand the links between concepts and ideas. Tables were used in the portfolio where large amounts of text was needed but also where a variety of concepts were addressed to the reader.
<b>Mind Maps</b>	2,6,7,8	Mind maps were especially useful as they allowed me to organise and group my thoughts to make it easier for the reader to understand. I used mind mapping as a way to brainstorm ideas which allowed me to discover issues along the way. Mind maps allow the reader to understand an idea that cannot be explained by the use of text in a simple way.
<b>Graphs</b>	3,4,5	Graphs were used to show differences in statics over a time period. It was an effective way of representing differences in information in a clear and engaging way for the reader. Graphs ensured that key information would be displayed so that the reader could understand the problem without having to read the large slab of text.

Technique	Page Number	Justification
<b>Colours</b>	All Pages	Colours were used to organise and categorize information and to split up sections of the portfolio. The use of colour allows the reader to be engaged and creates a flow throughout the portfolio. Finally the colours make the portfolio more attractive and nicer to read in comparison to black and white.
<b>Prototypes</b>	19,20,21	Prototypes have been created to show what aspects of the product are going to look like as well as features of my design. Producing prototypes allowed me to see improvements through testing of the products functionality. Prototypes were also used to prove that the design and ideas were possible before final construction.
<b>Infographics</b>	4,5,15,16,19	Infographics were used to break up large slabs of text by displaying the critical information of that page in an engaging colourful graphic. I used lots of infographics to make each aspect of my portfolio easier for the reader to understand.
<b>Video</b>	3,4,5,19,20,21	Creating a video to represent the project allowed me to communicate sections of my portfolio that was impossible such as demonstrations. But also the construction process of my project and the methods and techniques that were used to construct the design and produce the product.
<b>Circuit Diagrams</b>	10,12,13	Circuit diagrams have been used to illustrate the placement of wires on the circuit board and their connection to the GPIO. I drew a variety of circuit diagrams to represent the placement of wires so if a fault occurred I would be able to narrow down the location of the fault. As well as represent the placement of wires to the reader so they could understand.

### EVALUATION

Communication and presentation techniques used throughout the portfolio have been effectively explained and addressed. Using a range of elements, I have ensured that I have appropriately conveyed every aspect of my project to the reader. While also illuminating how a variety of techniques can be used to visualise and represent information to further engage the reader in interesting and intriguing ways.

### PRODUCT MARKETING

#### Modifications to Original Design:

- In the beginning, the mailbox was designed for strata committees and all homeowners, however this was not possible to achieve without changing the design as not all users have the same rate of parcel delivery and the same need for a highly secure mailbox that acts like a safe. The final product has been altered to suit small home business or homeowners with lots of parcel deliveries who value security and may have expensive deliveries.
- The original concept used solar power however due to time and budget constraints (the mailbox with a solar panel attached would have added \$150 to the budget). The final mailbox is therefore mains powered; however a new version could include solar power to run the electrical components. If the mailbox were ever to go into commercial production the mailbox would be solar powered.
- The mailbox was also originally going to have its own mobile application that would have had a variety of features including: An open and close button, controlled from the mobile app, Integrated notifications within the app and Live surveillance feed to the mailbox app. However the time restriction meant that it was not possible, but again this feature could be added in the future.

Product marketing is essential as it is the way in which you communicate to your target market and attract them to purchase the product. As a result, the way in which the target market perceives my product is critical and must be carefully throughout as it could affect the overall success of the product. Marketing involved thinking about how I was going to advertise and differentiate my product effectively and accurately to entice the market.

#### Product Name

Developing a product name was essential to capturing the target markets attention when introducing a new product to the marketplace. It is important that the name will stick with the public, while also standing out amongst the crowd. Below is a brainstorm that I undertook get my thoughts out and narrow down the choices for a potential name.

In the end, I choose the name 'Protecta' as it was short, but also I thought that it was clear and concise and would accurately represent the product. The name sounds futuristic, innovative, and intriguing and was inspired by existing products ending in 'a' and I thought that it stuck with me. I also came up with the phrase "Smart Mailbox Protection" as a selling phrase. This suggests that the mailbox is high-quality and utilising innovative technology to ensure that mail is secure.

#### Product Logo

In designing the product logo initial sketching as shown below was particularly important as it ensured the best logo could be chosen and used for branding. Some of the ideas were not suitable as they did not have the right shapes, size, or colours. Others I thought were not relevant to the purpose of the overarching theme of smart mailbox protection so were subsequently not chosen. The logos were created using adobe illustrator as was deigned to be simple and convey the mailbox accuracy.



**Smarter Mailbox Protection**

The final logo I choose as shown besides, illustrates simple clean lines and curves as well as a soft blue colour to make the logo stand out and be bold. In order to attract the customers attention the colour scheme was important that is by I used blue to highlight the logo and made it stand out against the black writing.

# Protecta

This logo was deisgned to bold the pro to show the importance of that creteria to the target market.This is beacsue in comparison to other mailboxes, portecta will be more expensive.



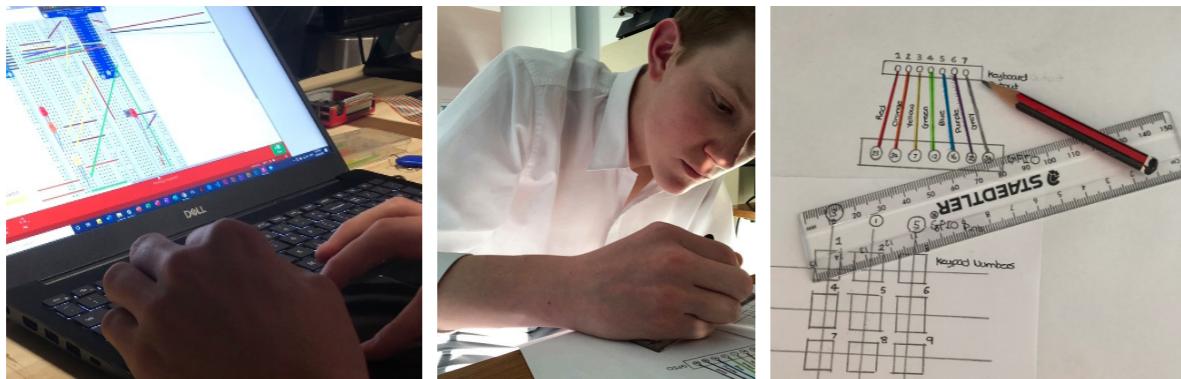
The box logo was my orignal design which i liked because it was eye catching and striking. I didnt end up choosing it beacuse it was not the style i was going for and i created a better logo.

### 2.7 EVIDENCE AND APPLICATION OF PRACTICAL SKILLS

#### Developing and Building the Protection and Security System

#### Stage 1: Planning the Circuit Board

Planning the wire placement on the circuit board involved working out the positioning and arrangement of modules and wires. In order to ensure that each wire was routed to the correct port or outlet it was therefore essential to draw both a circuit diagram and maps. The drawings involved drawing straight lines to represent the wire and circles to represent ports, alongside colours and labels to differentiate the wires. Fritzing was used to combine the previous diagrams that had been sketched and create a final wire map for the portfolio. I had to learn how to use the software application using a few YouTube tutorials and through hands on experience, but I managed to pick it up very quickly. A control panel on the side of the software allowed components to be adapted to suit the users requirements such as the length, colour and type of wire required.



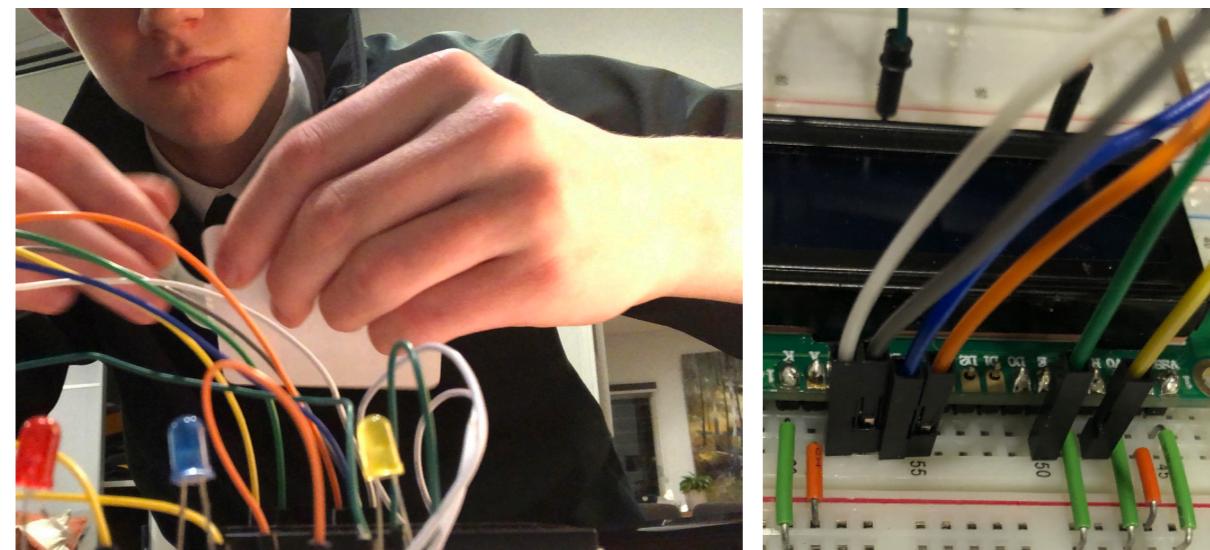
#### Stage 2: Soldering the Wires to the Circuit Board

Soldering was required to fix all the components to the circuit board. As a consequence, I had to learn a variety of new soldering skills and techniques to undertake the soldering aspect of my project development. I had to learn how much solder was needed, what temperature the soldering iron needed to be at before commencing the soldering and what angle the iron need to be placed during the process of soldering. I found that soldering was quite difficult but after practicing and destroying a few circuit boards my skills improved and I could completed each wire in a timelier manner.



#### Stage 3: Assembling the Circuit Board Components

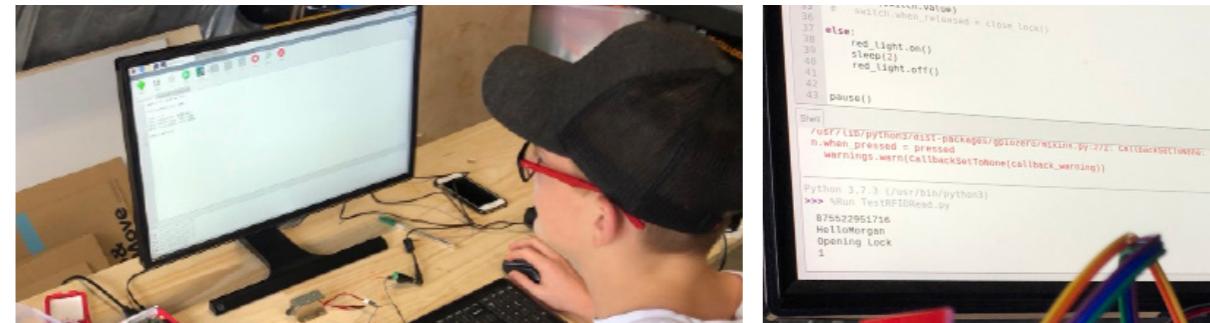
Assembling the circuit board and modules into the plastic housing box involved working with cable and plugging in wires and modules. This involve carefully arranging and organising all components to fit into the plastic box housing which would be placed in the mailbox. Once the components were in the box the next step was to attach the raspberry pi computer which would control the components within the protection and security system.



#### Stage 4: Developing the Code

In developing the code for the protection and security system I needed to improve my coding skills and learn how to use a new application. Visual studio code was a way of improving my coding skills and a platform that greatly helped me out during the development of my mailbox. Visual studio code was not so hard to use as I had previous experience from extracurricular studies. In creating the code, the Internet had a plethora of sources describing people doing similar tasks. This was a great help and allowed me to code the system quickly and efficiently.

**Code Repository = <https://github.com/Morga2/protecta-secure-mailbox>**



## 2. PROJECT DEVELOPMENT AND REALISATION

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**Figure 1**

Figure 1 shows the GitHub page for the development of the protection and security system. I used GitHub to develop and store my code because it was cloud based service and could be accessed on both my personal laptop and the school computers.

### Components

- controller.py - Main file which reads keypad entry and checks the codes entered and controls responses
- initiate.py - Gets the electronic components ready
- actions.py - Performs actions according to code entered either accepting code (which unlocks door), (sends message to display or raises alarm (send alarm message)
- lock.py - open and shuts lock when called code is accepted
- validations.py - compares PIN Code or RFID Tag id entered against the stored known codes
- message.py - triggers Push Safer event, which sends notification to phone app
- data.json (no in repo) - PIN codes for parcel delivery, RFID Id's and Push Safer Private Key

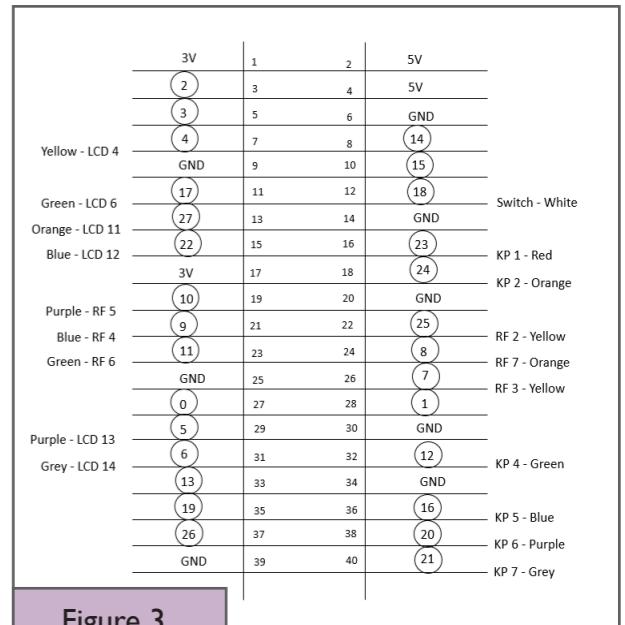
### References

- <https://learn.adafruit.com/circuitpython-on-raspberry-pi-linux/overview>
- LCD Controller - [https://github.com/adafruit/Adafruit\\_CircuitPython\\_CharLCD](https://github.com/adafruit/Adafruit_CircuitPython_CharLCD)
- Matrix Keypad - [https://github.com/adafruit/Adafruit\\_CircuitPython\\_MatrixKeypad](https://github.com/adafruit/Adafruit_CircuitPython_MatrixKeypad)
- RFID - <https://pimylifeup.com/raspberry-pi-rfid-rc522/>

Push Safer Service - [www.pushsafer.com](http://www.pushsafer.com)

**Figure 2**

Figure 2 shows the different files that were used when developing the software for the protection and security system. It outlines what each file was used for and breaks down the software into sections.



The GPIO wire map in figure 3 shows the port for each wire. This will ensure that the correct wires will be placed in their allocated slot. This was an important part of the development of the protection and security system to ensure that components could be connected together.

### RFID Reader

Duinotech XC4506 RFID RC522  
[https://www.jaycar.com.au/medias/sys\\_master/images/images/9403738816-dataSheetMain.pdf](https://www.jaycar.com.au/medias/sys_master/images/images/9403738816-dataSheetMain.pdf)

Pin Config			
Position (left to Right)	Wire Colour	GPIO Pin	Details
1	Brown	3.3V	VCC
2	Yellow	GPIO25	RST
3	Black	GND	GND
4	Blue	SPIMSO	MOS
5	Purple	SPIMOSI	MOSI
6	Green	SPICLX	SCK
7	Orange	SPICEO	NCS
8	Null	Null	Null

### KeyPad

Membrane 3x4 matrix keypad - <https://www.adafruit.com/product/419>

Pin Config:

Position (left to Right)	Wire Colour	GPIO Pin	Details
1	RED	GPIO23	Row 1
2	ORANGE	GPIO24	Row 2
3	YELLOW	GPIO07	Row 3
4	GREEN	GPIO12	Row 4
5	BLUE	GPIO16	Col 1
6	PURPLE	GPIO20	Col 2
7	GREY	GPIO21	Col 3

### LCD Matrix

Adafruit Standard HD44780 LCD - <https://www.adafruit.com/product/181>

Pin Config:

Position (left to Right)	Wire Colour	GPIO Pin	Details
1	Black	GND	VSS
2	Red	5V	VDD
3	Black	GND	V0
4	Yellow	LCD_RS = GPIO4	RS
5	Black	GND	RW
6	Green	LCD_E = GPIO17 : Green	E
7		Null	D0
8		Null	D1
9		Null	D2
10		Null	D3
11	Orange	LCD_D4 = GPIO27	D4
12	Blue	LCD_D5 = GPIO22	D5
13	Grey	LCD_D6 = GPIO5	D6
14	White	LCD_D7 = GPIO6	D7
15	Red	5V	A
16	Black	GND	K

Above are the wiring maps and diagrams for the main modules within the protection and security system. Each table outlines the important information about the details of each wire and its placement within the circuit board. Completing these tables was done through online research of existing projects. Luckily when it came to the project although I had to write sections of the code myself I was able to use parts of open source code that was available on similar projects.

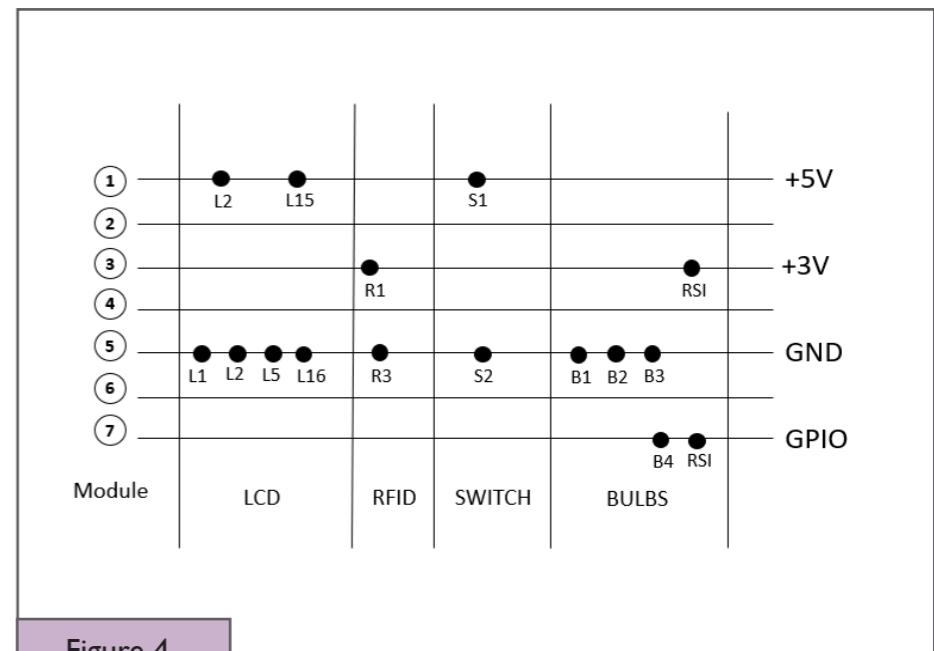
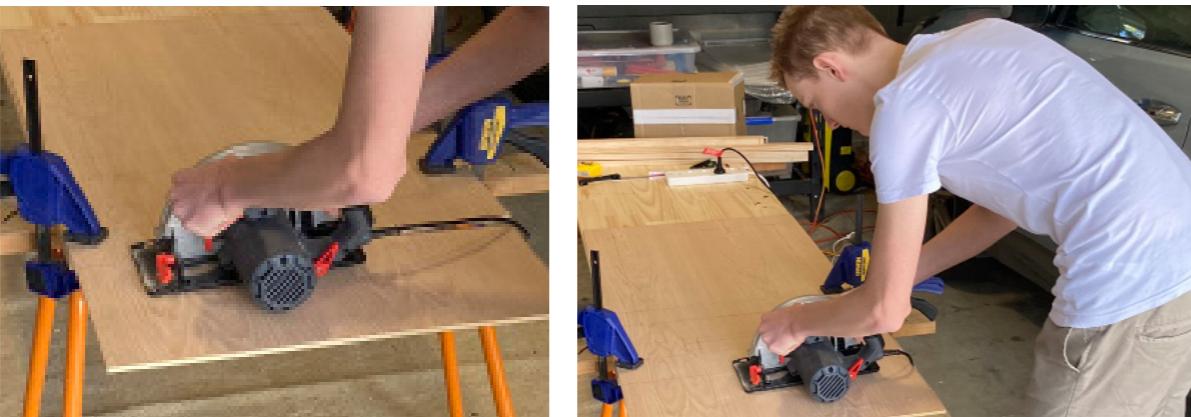


Figure 4 shows the relationship between components within the PSS system. Each module is shown followed by what pins it connects to in relation to voltage, GND and GPIO. This made connecting each wire simple as I already knew where each wire connected.

### Stage 1: Measuring and Cutting Plywood using a Circular Saw

The first stage of the mailbox construction was to measure the plywood using a ruler and pencil using predetermined dimensions. This not too difficult for me and only took a short amount of time and prepare the wood. Once the plywood was ready to cut I used a circular saw to cut each piece that was outlined. I had previous experience using the circular saw and watched a few YouTube tutorials to refresh my memory before beginning.



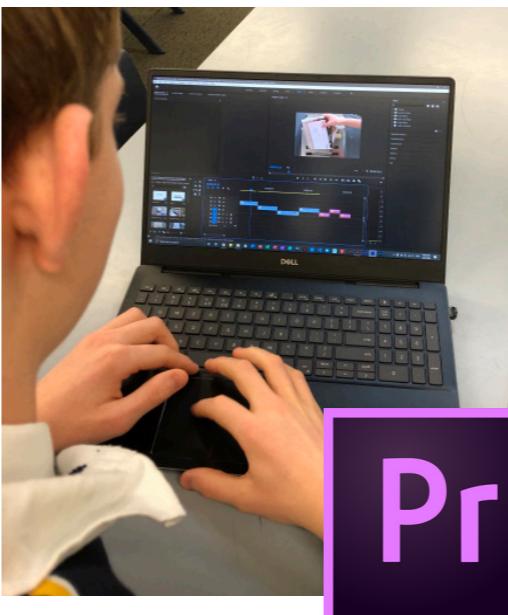
### Stage 2: Screwing the Plywood Together using a Powered Drill

Screwing the plywood together was a simple process using a power drill that I had done before in wood work in junior school. This involved using the appropriate screw for the job by researching what screw was best for the material and planning where the appropriate screw was going to be placed. Working the drill was easy and did not require much training, this experience came in handy as the process was able to be speed up and did not require as much time.



### Stage 3: Cutting Aluminium using a Jigsaw

Cutting the aluminium was something that I had never done before and I had to learn how to use a jigsaw to cut it. Watching metal workers on YouTube and practice in my workshop and home, I taught myself the process. Cutting aluminium with the jigsaw involved clamping the aluminium securely to the bench and using a metal blade that was rotating at a high speed. This process took a long time and was done carefully due my lack of experience, but by the end was I learned a new practical skill and built my knowledge about cutting metal.



Alongside the portfolio premiere pro was used to create my promotional video from scratch. I used the platform by importing raw footage that was pre-recorded to compose the video. Using the software I added transitions between the shots and sliced the film together. A voice over was recorded to go alongside the music to make the video clearer and more concise. To ensure that the video was intriguing I used animated infographics to represent information. I had no experience of premier pro and had never edited before so I had to learn from scratch. I taught myself through lots of trial and error, YouTube tutorials and the knowledge of friends and fellow classmates. The process has taught me a lot such as how to edit video, important different file types, insert and edit audio and animate images and graphics.

In the design and development of a logo for my project I digital sketched a variety of options, in order to reach my final design. After creating the design I create different versions of the design by playing around with proportions and colours. Illustrator is great for graphic design as it is a vector-based program and as a variety of tools to finetune designs to make them look aesthetic and professional. At the beginning of my project I had minimal experience with the software but through creating a logo I have been able to improve my skills and be more confident using the features and have leaned a variety of graphic design skills. The process I undertook when designing and developing my logo include:

1. Creating a variety of symbols and icons
2. Choose an appropriate font and size for the text
3. Place the icons and symbol created within the text
4. Copy and paste the logo and adjust proportions
5. Choose the logo that best represents project style

## EVALUATION

Practical skills have been demonstrated through the development and construction of the MPD and have been vital in the success of the project. Demonstrating these practical skills has illustrated the process has allowed me to see that appropriate steps have been undertaken to meet the design brief and ensure that product is off high quality. Learning new skills has therefore allowed me to improve my project design, development, and construction in a multitude of fantastic ways and boosted the success of the project.

## 3.1 FUNCTIONAL AND ASTHETIC ASPECT OF THE DESIGN

### FUNCTION

#### PERFORMANCE

The quality design has been developed to ensure the protection and security system components such as the electronic modules accurately perform their function. The main functions of the mailbox include making it simple for a user to operate the interface by having buttons that are easy to press and are positioned in a usable layout. In addition, each component must have a fast response time to be able to meet the performance objectives as well as improving the operations of the interface for both the user and for the accuracy of the system.

The versatile nature of the mailbox components can be seen in the research, testing, and experimentation section of the portfolio, where each component was carefully chosen and tested to ensure it met the functional and quality requirements of the design brief. This section was crucial as it allowed me to detect faults in performance and change to other devices from a different manufacturer if required. This method of quality control ensured that the final system would be the best it could be within budget and time constraints.



In relation to the project need, performance was a significant requirement as the mailbox had to be secure and accurately protect mail from theft of personal information. The performance of the mailbox PSS system was successful because of the careful considerations outlined above. This meant that each component was carefully selected, significantly improving the quality of the mailbox by ensuring the final product met the design requirements and was made from the most suitable materials, while considering the target market and project need.

#### USABILITY

The product provides an easy to use and above satisfactory level of usability. This was achieved by making the user interface simple. The requirements of both postmen and homeowners in the research, experimentation, and testing section of the portfolio were met and this is demonstrated in their comments. The keypad entry was found to be simple for the delivery personnel as they did not require a key to open the mailbox, which would not have been feasible. The keypad requires a pin, which is available to the postman in the delivery instructions on the mail. The RFID card was designed to speed up the process of opening the mailbox for the homeowner. This is important as they would be using the mailbox on a regular basis. Another important aspect of usability is safety, so the mailbox PSS system wiring, and electronics is designed to be safely housed in a plastic insulated box stowed at the back of the mailbox. This means that the user will avoid electrocuted which is a concern when working with electricity. The overall mailbox design includes a parcel door that has high-quality hinges and large door handles to ensure that the user can easily open and close the door. The letter slot is large enough to fit letters in with ease. These major design aspects will ensure that unlike exiting mailboxes the user can easily access their mailbox while also ensuring the highest protection of their goods. The final mailbox is simple and has an intuitive user manual for the homeowner to ensure that during their first use of the mailbox they are guided through the mailbox operation. Included in the user manual are guidelines and safety instructions on possible dangers to ensure that the user safely access their mailbox.

#### DURABILITY

Throughout the MPD a key consideration has been the quality and durability of the materials. This has resulted in careful consideration of what materials should be used in the mailbox. The mailbox is made from plywood and aluminium which are strong and reliable materials. The structure of the mailbox is made of plywood to ensure the necessary strength is achieved. The strength of mailbox is important as research indicated that desperate thieves use a variety of tools to break into the mailbox. Aluminium cladding was used as it allows the mailbox to be corrosion resistant, waterproof and insect resistant. Research found that there was a huge problem with existing mailboxes as water frequently leaked into mailboxes damaging the mail inside. The mailbox has been designed with aluminium panels with grooves that direct the water away from the mailbox reducing the risk of damaged mail.

### AESTHETICS

#### STYLE

The style that I achieved was 'industrial' with a balance between curves and lines to add contrast. While aesthetics was less important than other design factors, there was a focus on developing a mailbox within a unique style. The goal was to have a mailbox which stood out in the streetscape and looked modern and contemporary. This was important because while interviewing homeowners, I found that most cared about how their mailbox looked in relation to their home.

#### COLOUR SCHEME

The colour scheme which contributes to the appeal of the product consists of mostly dark greys with blue accents to highlight the boldness of the mailbox with blending in with the streetscape. These colours also make the mailbox look futuristic and modern, unlike anything else that is currently available in the marketplace. However it is accepted that the colour scheme may not suit all tastes and environments.

#### MEDIA AND PRESENTATION

The development of a product name and logo helps to provide the product with a character which acts as a judgment for public viewing the product. In this way I feel that my logo is superior to other marketplace products as it has eye-catching icons intertwined with its name. The contrast between the bright vibrant blue bolded symbols and the medium grey text was chosen for its look of simplicity and the cleanliness it portrays to the viewer. The slogan "Smarter Mailbox Protection" was chosen to compliment the logo and to further emphasise the advanced and innovative nature of the product to position it as futuristic.

#### 3.2 INDIVIDUAL, SOCIETY AND THE ENVIRONMENT

##### INDIVIDUAL

Through evaluating research conducted on the target demographic, I was able to better understand how the improved design impacted their experience with stolen or missing mail and if it reduced financial implications, stress, and anxiety. The mailbox was designed in response to the issues of security, function, and quality of existing mailboxes within Australia as a result of the rising issue of stolen mail including letters with personal information leading to identity fraud. Although, that was the main concern, the process involved solving other issues with existing mailboxes along the way.

The new mailbox greatly reduced homeowners fear of stolen mail and personal information with the new features and design. The strength and durability of the design alongside the digital components of the protection and security system reassured homeowners that they could improve their currently mailbox. Through developing an understanding of my target demographic I got to understand the stress and anxiety that many faces when their mail is stolen especially if it may contain sensitive information. Homeowners involved in directing this project believed that the new mailbox could improve their quality of life. By developing this new mailbox for homeowners, an important step has been made in tackling this anxiety. The target market requirements have contributed towards an innovative product that addresses as many of the needs as possible.



##### SOCIETY

The mailbox plays a valuable role in Australian society as it helps reduce a problem that effects a variety of people within society and is a growing problem that most of the population are starting to experience due to the increase in delivery of mail as a result of online shopping and ordering. While the product cannot totally eliminate these issues, it will reduce the number of cases of stolen or lost mail which leads to personal information being stolen. This product also helps brings awareness of issues of identity fraud to the general public and provides a better alternative for the market.



##### ENVIRONMENT

Although the environmental impact of the product was not the key element of the project, it was still important to choose materials that had as few negative impacts on the environment as possible. I decided to choose materials that could be recycled at the end of their useful life, as well as being the most durable and long-lasting to increase the life-span of the product, therefore increasing the time between initial construction and final disposal and recycling.

#### ENVIRONMENT LIFECYCLE ANALYSIS - PLYWOOD



Forests are cleared as mature trees are cut down by trained harvester. This involves deforestation which has negative impacts on the environment as land-clearing can lead to habitat loss and erosion. Logs are transported from the forest to the mill to be processed. Transportation also has environmental consequences as land has to be cleared for roads.

On arrival at the mills, logs are stored in a log yard where various sprinkler systems help the logs retain moisture. The bark on the logs are removed by industrial machines and put on a production line. The logs are sized and cut depending on production at the time of cutting. Finished panel size and grain direction play a role in this process. The environmental impact is that the manufacturing process does use non-renewable energy.

Logs are peeled using a rotary lathe until smooth sheets are formed. Then the sheets are placed on a conveyor belt and sent down the production line. While travelling along the production line, the sheets are cut to size and go through an initial grading process so defects in veneers are found. This process can result in offcuts that can cause waste, but are usually recycled.

The veneers are dried out, so all the moisture is released. This is important for protecting the wood from fungal decay and increasing the mechanical properties of the finished board. Defects are also fixed and repaired at this stage. Veneers are run through a gluing machine which essentially rolls the glue onto the face and back of the veneer. They are then placed on top of an unglued veneer so that the stack alternates; Glued, Unglued, Glued, Unglued and so on.



#### EVALUATION

Although logs are cut down in order to manufacture plywood, it is 100% recyclable and can be reused for future products. The manufacturing process uses a variety of machinery to cut, shape and size the sheets. The process is sustainable as offcuts are also recycled.

Waste wood and timber are usually divided at recycling plants for processing. Recycling plants make use of a shredder and a mill to turn wood waste into compost or mulches, to be used for soil improvement, landscaping, erosion control, and animal bedding. Another use for recycled wood waste is to create biomass and biofuel, both of which provide clean and renewable energy for large national and international companies. As an energy source, it is renewable and reduces carbon emission.

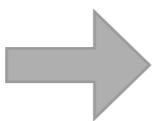
The board is left to stabilise and cool down before further processing. Then it is a case of trimming down any excess veneer, so the board has square edges, then the boards are most commonly sanded using a large, industrial sander. Finished products are then stacked up and banded together. Any relevant CE marks are printed on the packaging. Then placed on a delivery truck for the destination such as hardware stores.

Cold Pressing occurs after glue has been applied in order to prepare the veneers for Hot Pressing. This works to flatten out the veneers and ensure the glue is distributed across the veneers evenly. The Daylight (Hot) Press then compresses and maintains heated pressure on the boards for a long period of time. This creates and maintains required contact between the glue and veneers. It also decreases tension in the glue line and the thickness of glue layer.

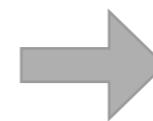
#### ENVIRONMENT LIFECYCLE ANALYSIS - ALUMINUM



The pure form of aluminum does not naturally occur in nature, so remained largely unknown until as recently as 200 years ago. Creating aluminum using electricity was first developed in 1886 and is still used to this day.



**Bauxite Mining** The aluminum production process starts with the mining of bauxites, an aluminum rich mineral in the form of aluminum hydroxide. About 90% of global bauxite supply is found in tropical areas. This is a non-renewable practice and additionally is harmful to the environment through the burning of fossil fuels during mining.



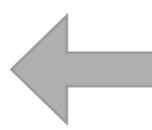
Bauxite is crushed, dried and ground in special mills where it is mixed with small amount of water. This process produces a thick paste that is collected in special containers and heated with steam to remove most of the silicon in bauxites.



The ore is loaded into autoclaves and treated with lime-caustic soda. Aluminum oxide appeared in the resulting slurry while all the admixtures settle at the bottom as red mud. The sodium aluminum solution is stirred in precipitates for several days, eventually pure alumina settles at the bottom.



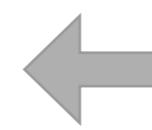
**EVALUATION** Aluminum is sourced from mining which is not sustainable. Although aluminum is still 100% recyclable and can be reused. The manufacturing process uses a variety of machinery and furnace to make liquid aluminum and mold it to a desired shape.



**Recycling**, Aluminum is corrosion resistant so it can be remelted and reused an infinite number of times. The added benefit is that recycling requires only 5% of the energy need to make the same amount of primary aluminum.



**Foundry alloys** is the process where aluminum is shaped to its required form. This process is used for making a vast majority of aluminum products. The malleability of aluminum means that it can be rolled into thin sheets.



**Reduction process** at an aluminum smelter, alumina is poured into a special reduction cells with molten crystallite at 950 degrees. Electrical currents are then induced in the mixture at 400 KA or above, this breaks the bond between the aluminum and oxygen atoms resulting in liquid aluminum at the bottom of the reduction cell. Primary aluminum is formed.

### 3.3 RELATIONSHIP TO PROJECT PROPOSAL

Criteria	Explanation	Relationship to Project	Score
<b>Protection and Security</b>	The mailbox provides an improvement in the level of security such that mail is better protected from opportunistic thieves. Homeowners will feel more confident and not have to deal with the problem of stolen mail and stolen personal information.	The design is able to address the issue of mail protection and security through the incorporation of an electronic and digital user interface. This interface allows the use of a password which can be changed at any time to improved security and the homeowner can be notified when mailbox activity occurs. The key to the success of the mailbox is in the improved experience for the homeowner and the reduced stress of potential identity theft.	9/10
<b>Durability and Reliability</b>	The mailbox improves durability and reliability as thieves will not be able to use tools to break in. In addition the mailbox will be tough and strong enough to withstand harsh weather conditions which it may be exposed to while outside a house or apartment.	The design of the mailbox addresses the issue of mailbox protection through the integration of a strong structure and durable aluminium cladding on the exterior of the mailbox. The mailbox is well suited to the range of environment conditions such as rain, hail or sun that can cause mail to be damaged and destroyed.	8/10
<b>Function</b>	The mailbox is functional as every aspect of the design has been tested and assessed so that it is usable for the target market and can accurately protect the mail inside.	The design addresses the issue of functionality as it involved testing of components within the PSS system and aspects of the mailbox design. The mailbox is functional due to the careful selection of materials, tools, and techniques and through the careful staged development of the MPD to ensure that only the highest quality mailbox would be produced as an end result.	8/10
<b>Usability</b>	Usability is important due to the wide range of target mailbox users. The mailbox is usable as it incorporates a variety of high-quality features such as the keypad and the RFID reader.	The mailbox design addresses usability through improved entry devices such as a keypad, and an easy to use handle. Understanding the target demographic as well as user testing ensured that any feedback could be incorporated and implemented as the project progressed. This resulted in a high-quality user interface and a high-quality mailbox.	9/10
<b>Maintenance</b>	The mailbox is easy to maintain because of its large parcel entry, large size, and components which can be easily changed and replaced to meet maintenance requirements.	The mailbox design incorporates a PSS box lid that can be screwed off if the user wishes to replace or upgrade parts. But for cleaning the mailbox parcel opening is large and wide enough for a person to fit in, this ensures that all areas are cleaned.	7/10
<b>Universality</b>	Universality has been met through the implementation of multiple aspects of the design to ensure that mail remains safe inside the mailbox.	Universality has been achieved through testing at all stages of production. This was important to ensure that all components would work together so that the system could accurately protect mail inside.	7/10
<b>Materials</b>	The exterior should be durable for extended periods of time and should ensure that the mailbox cannot be broken into.	The mailbox has met the materials requirement as it incorporates a reinforced structure that consist of plywood and aluminium. Both materials are strong and durable which ensures that it provides a resistance from tools such as hammers and crow bars that thieves may use.	9/10
<b>Obsolescence</b>	The mailbox has been designed so that all components are off high quality and also can be recycled. This ensures that the mailbox has a satisfactory lifecycle and does not become obsolete within a short period of time.	The mailbox has met this design factor through the use of materials like plywood and aluminium which are sturdy, durable and long-wearing. The mailbox materials can be recycled and reused for future needs due their simple composition. Fulfilling this criterion will make the mailbox more attractive to consumers.	9/10
<b>Affordability</b>	The mailbox meets the design factor of affordability as the design has tried to minimise costs as much as possible, although obviously the mailbox is expensive.	The mailbox design incorporates materials that are cheap but still of a high quality. Aluminium is cheaper than stainless steel or even galvanised aluminium making it ideal for the mailbox cladding.	6/10