# Investigation



## Introduction

In order to create a product which abides by the commandments for a good design, the product should improve the lives of those who use it as well as account for the environment it is placed in. Examples of this include the aesthetics and materials used yet it is highly desirable that it is capable of solving problems within the area. Often, issues are easy to identify but are not always easy to provide solutions however it is becoming increasingly difficult every day to find these problems due to the masses of products being made which counter these issues. Therefore, I have set out to collect data within the area to identify any problems, document them and analyse them to clearly indicate to me what it is that may need to be done later down the line with this being an initial method of allocating my thoughts all in one place for ease of reference.

## Chromebooks

Like with any laptop, battery life is a concern as it can completely demolish a team in terms of productivity as the utility of the device becomes obsolete if it is in fact unable to turn on. Therefore, when they're not being used, they should be receiving charge to be ready for the next use. The current method of storing and charging these chromebooks is through the use of laptop trolleys that house many devices whilst providing a good source of power. Despite this, very often the chromebooks are left unplugged or on the top of the trolley stacked on top of each other. This can lead to damage of the screens due to the great weight from the tower of chromebooks as well as being a cause for potential accidents of them being knocked over or off the table. Instead of just one being damaged, many would face hardship. Also with the great weight of a full laptop trolley, they're particularly difficult to transport (especially up stairs, it's best to use an elevator) meaning many people often resort to carrying the chromebooks by hand.

Moreover, following the use of a chromebook, they are to be wiped down with anti-bacterial wipes to remove any harmful microorganisms from the surfaces especially within the current climate of COVID-19. Unfortunately, many users do not wipe down the chromebooks effectively, leaving parts untouched by the wipes or not wiping them down at all. This also carries over to the desktop PCs as these must be wiped down.

No doubt, these issues on their own can be irritating, yet when they all occur at the same time, they're enough to make almost any user heated.

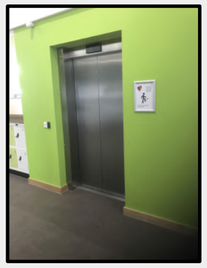
Some simple initial solutions which come to mind include charging surfaces / mouse mats to be on each work surface to provide a charge during use and they may even be left out when not being used and still receive charge. Moreover, the mobility issue may be solved by having a new system for transporting many chromebooks at once, perhaps also providing charge and secure storage which prevents potential theft or damages.

## Entry Gates / Lanyards

Upon entering the Coleg Cambria Sixth Form site, you're faced with a row of barriers which prevent access to any individual who doesn't have the appropriate method of access such as a personal lanyard issued to all students. In order to open the barriers, students have to place their lanyards onto the scanner where it will then register that they are a student and allow access to the building. Unfortunately, due to the size of the lanyards, it is particularly difficult and uncomfortable for many students to reach the scanners as they have to bend so far forwards, which could also lead to back pain. The argument could be made that the student cards can simply be removed from the lanyard to avoid this need to bed down however this takes a little while and could generate queues at the front of school. Furthermore, many pupils have many items attached to their lanyards which would further complicate things and slow down entrance for all due to it being far less fluid.

Moreover, this is yet another location where contamination could occur thanks to students queuing closely behind one another and then touching the same surface, greatly increasing the odds of any COVID spread. Perhaps the various lines of pupils could be separated by thin clear barriers as a way of creating in a way, hallways towards each gate to minimise contact with others.

As previously mentioned, people have resorted to using the elevators (see above) when transporting chromebooks which further complicates matters in terms of the route as well as the amount of energy required for a single journey. Therefore, a design that successfully counters this issue should consume less energy and time than what an elevator trip would.

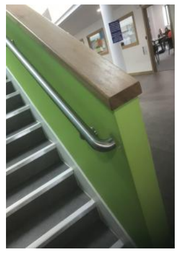


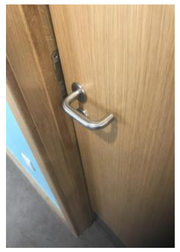
## Surfaces

Within the world of today, COVID-19 is a truly immense global issue, leading to difficulties in everyday life. This includes touching surfaces such as handrails and door handles which may have also been touched by another person, leading to contamination between individuals. There are many surfaces within college alone that face cleaning up to either once or twice a day, or none at all.

Door handles are undoubtedly the worst contenders to this issue as almost every door requires their inclusion and utility. What with so many people touching the same surface, something must be done about it as soon as possible. This may be to introduce floor door handles which require a person to place their foot down on a lever which releases the door from being closed, eliminating the touching of any surface with a hand.

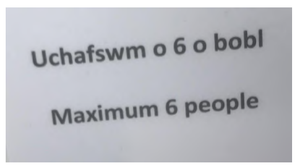
Since there are quite frankly millions of surfaces within a large building, it would be impossible to frequently clean every single one meaning instead we could aim for preventing the surfaces becoming contaminated in the first place. This may be done with gloves but surely wouldn't last a great length of time as all you need is one person to contaminate their gloves in any way, leading to even more problems.





## Furniture

A product should be as effective as possible for the space used if prioritised over form (Bauhaus), allowing more room to be allocated for other products. Unfortunately, the opposing route has been taken within the building as circular chairs and tables have been selected, resulting in a great deal of wasted space and complications. Round tables lead to the consumers being sat rather close to one another whilst there being empty space in the center which is quite frankly just being wasted. Moreover, with the current social distancing laws, these tables have pupils be sat way too close to one another, even when the guidelines are followed and just 6 people are seated. What with the chairs doing something very similar and also being harder to maneuver, the furniture is of poor selection for the surroundings, despite being of appropriate aesthetics.




## Hand Sanitising Stations

Although they are made out to be the solutions to a load of our problems within the current climate, hand sanitisers also introduce an entire new wave of issues which then need to be solved. For instance, a large portion of hand sanitisers require the user to push into the dispenser to release the fluid, resulting in the contact with a surface touched by many other people. Usually, this is perfectly fine as the fluid will eliminate anything harmful on the hands of the consumer yet in the event the sanitiser is empty, this process cannot be completed. Therefore, the consumer is left with contaminated hands which they may not have prior to using the cleansing station. Clearly, a product should stray away from doing the opposite of what it is aiming to accomplish.

I conducted an interview with a student called Grace Chester who stated 'The worst thing about hand sanitisers is when I use one to find it's empty and then spend the next five minutes trying to find one to clean my hands again,' showing how this is an existing issue with pupils Like myself across the site. Clearly something is to be done about this.

Henceforth, I propose that we introduce sanitisers which indicate to the individual how much sanitiser is remaining inside as a way of preventing unnecessary touches. Additional dispensers may be a positive iteration within the area for various products (such as masks in the event someone were to forget to bring theirs) which display the contents as well as utilising sensor technology to minimize contact.

# Investigation - Expanded



## COVID PPE Packs

Across the college site, various COVID-19 PPE packs can be found in what appear to be a bin bag taped to a wall. Understandably, the presentation isn't a priority yet when it comes to a long term solution within design, a lot can be done here to improve. Surprisingly enough though, I myself have never been told about these packs and their contents (presumably protective equipment) as a result of a lack of communication and information awareness. I am unaware of their locations and in what case I would be obliged to open them since I have simply never been informed on the topic.

Interestingly, it isn't just students who are oblivious to the existence of these packs as I conducted various interviews with many teachers who informed me that they had never been told about them, didn't know where they are located and in what case requires opening them or even how many there are across site! Personally, I believe there should be greater spread of information within the college, not only for COVID resources but in general as it is almost daily I discover events that had already been occurring for extended periods of time yet was never introduced to them. Clearly, the existing forms of spreading information are particularly ineffective.


Here you may see the existing method of sharing information about events or key data for students and teachers yet it is in a corner and lacks the ability to draw people in to find out / read what is displayed.

## Distancing Tape

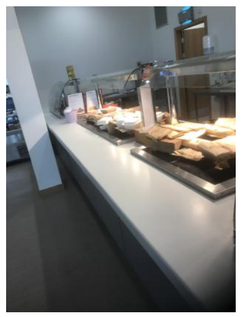
Commonly used in stores often as a one way system, tape on the floor can generate a flow and also safety when it comes to social distancing yet it creates a system for travelling, making it easier to understand and navigate through the densely packed hallways. Unfortunately, the college is quite the opposite of this. Only weeks after visiting the site daily did I notice the social distancing tape on the floor put in place to keep pupils at least 2 meters apart from one another although it instead served as nothing more than the ordinary floor and was ignored. I was not alone on this matter as following the interviews are various pupils I found that they too were oblivious to the presence of the tape. Coloured appropriately to a bright, luminous and vibrant yellow, the small size of the tape meant that it had gone unnoticed by the majority of students. Furthermore, the location of which it had been placed is truly puzzling as furniture has been moved to obstruct view of the tape and follow the guidelines of social distancing with the tape thanks to obstructions. As well as this, tape has been applied to areas which face little to no foot traffic instead of the densely populated areas such as the entrance and main stairways.

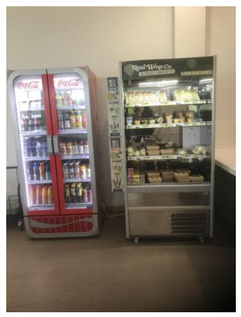
Nevertheless, even after all these issues mentioned, tape can still be extremely effective in guiding people on keeping their distance and following the correct path, as seen within countless stores. Moreover, the tape should be much larger to make it much easier to spot by people commuting and placed in areas of high foot traffic. This way, the tape  will be effective in accomplishing what has it has been set out to do.

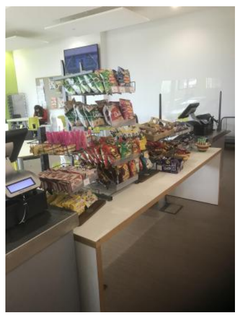
## Canteen

Clearly, much greater precautions are to be taken within the location of which food is purchased and consumed yet very little has been done in order to protect pupils from being exposed to the threat of COVID-19 in the canteen. Whilst clear plastic barriers have been implemented to reduce contact between staff and students, there is often someone to manage payments stood in the open with the pupils protected by only a mask who will later mix in with the other members of staff, making the protective measures implemented almost obsolete. When selecting food, students are free to pick up as much as they please without any regard for cleanliness or contamination to then go and eat without washing or sanitising their hands.

Quite frankly, a system must be put in place similar to in ice cream stores and bakeries where the customer chooses what they would like to purchase, whilst the store owner handles the food with kitchen appliances instead of their hands. This way, potentially hundreds of other people handling the produce are removed and instead only equipment makes contact with the food to completely minimise any risks of a health issue / hazard. However, this is only one potential solution as there are many other options to be explored. For example, contactless payment instead of cash (which has already been implemented) for the safety of everyone involved within the transaction.





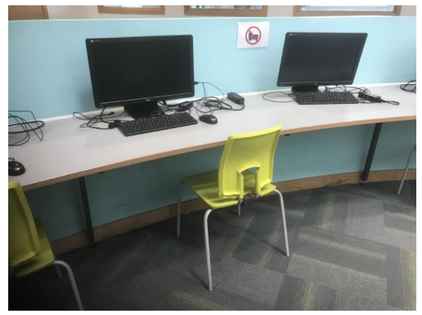


## Key Points

Some very interesting points can be taken from this piece of investigative work following the documentation and assessment of various problems which are prevalent within the college site.

I want to further elaborate on my points made surrounding the chromebooks as I feel they are of great importance within everyday college life. Upon completion of utility, the laptops are to be wiped down (this also applies to the desktop computers) by using some wipes from the packets found around the area. Unfortunately, there are many defects in the design of the wipes' packaging.

Issues include the lack of the ability to easily take just one wipe from the packet and instead pull out many, contaminating all of them instead of just the one, resulting in great amounts of waste. Furthermore, when reaching in for the wipes, the hole present to gain access to them is particularly small making it rather difficult to reach the wipes (especially if there are only a few left at the bottom) and so it is very often that you may touch the packet many times when trying to get your wipe. This happens to many people and so consequently, many people end up touching the same surface. Whilst the wipes will counter any harmful things on the hands of the user, they may only use one hand to wipe down the surfaces, allowing the other hand to remain contaminated.



As a complete fix to this, we would require a form of dispenser which eliminates any need to touch the packaging and instead have it be given to the user and ensure they wipe down their hands afterwards or use antibacterial hand sanitiser to completely cleanse themselves.

Overall, this task has opened my eyes up to the many issues within our everyday lives within not only college, but a COVID-ridden world and if there are ways in which we can have the appropriate precautions put in place, we could protect the lives of many from not only Corona, but any future diseases or illnesses.

Finally, I shall set out to prioritise countering the most severe issues in an attempt to further improve the lives of those not only within the building, but the world through the ongoing effort against disease. Perhaps real breakthroughs in protection one another can be made through this work and it will all be due to the investigation initially completed to identify those problems, making this a truly important piece of work.

# Mind-Map







## Introduction

No doubt having many ideas is a tremendous start for a product as it opens it up to so many different potential paths that it may later take during its development, yet sometimes all of these ideas may become cluttered and unorganised in a list. Luckily, this may be countered through the utility of mindmaps which present the ideas and links them showing the chronological order within the thought process in how an idea develops. Furthermore, since so many ideas are being displayed and re-read by the individual completing the mind map, it is very common for them to return to previous points and expand upon them, ultimately resulting in a great number of points and ideas for the subject. Therefore, I have used a digital form of constructing my mind map on a site known as bubbl.us to help me illustrate my points clearly, as seen below.

## PPE DISPENSERS

- Function
  - Primary
    - To ensure maximum protection for all users of the product from the diseases and illnesses within today's age through providing the appropriate resources
  - Secondary
    - If the product is as successful in dispensing the appropriate safety equipment to the consumers, then ideally the product line should be spread across as much of the target area as possible to maximise cleanliness and safety
    - Function is one of the highest ranked priorities when it comes to product development as if a product fails to function as intended, it has failed as a product in many ways
    - Therefore, if the product is able to be moved around easily as well as its primary function, the reach of it would be much greater allowing it to function to the best of its ability, making this the obvious choice for the secondary function.
  - COVID
    - Clearly, this is the largest global issue of the millennium as of now as this disease has taken the world by storm, disabling countries and crippling economies. We must do everything in our power to prevent the spread of not only this disease but any others in the future, no matter their severity.
    - That is why I am thinking of producing an effective way of dispersing the appropriate protective gear to members of the public as a way of saving lives, not only in the original institution but the whole world if possible.
    - We have existing precautions in place as well as PPE, yet this has been very poorly dispersed throughout the majority of institutions and distancing rules are often not enforced. Clearly, something needs to be done about these issues due to the great severity of them. Moreover, if the implicated countermeasures are installed correctly, they may be able to stay for the long term, protecting us from any future potential illnesses.
  - Demographic
    - With the product most likely being placed in education institutions initially and then later being implemented across all public buildings depending on success, the demographic is quite possibly as wide as it could be due to my product catering to people of all ages and backgrounds.
- User / Client
  - Wants
    - Simply the desires of the consumer where the product can be altered in certain ways to maximise the consumer's experience
  - Needs
    - Achieved through the primary function of the product as the needs come first above all else
    - Prioritised over the wants of the consumer as they're ESSENTIAL
- Safety
  - No finger traps
  - No sharp edges
  - No exposed wires
  - Depends on age / demographics
    - Younger / older at much higher risk of injury than teens and adults
  - No moving parts exposed which may catch hair
    - Achieved through a hidden mechanism
  - Weight
    - Large weight could cause strain / injury if moved or falling
- Ergonomics
  - The design must be catered to the anthropometrics to ensure the sizing is appropriate for the product to best function
  - Different products may be produced for consumers of different sizes
    - Eg: smaller chairs and lower sinks for children
  - Catering to
    - Age group
      - Different levels of intelligence across the ages mean the product should cater to all of these by having the clearest and easiest to understand design
    - Height
      - Lower for shorter people to easily access and higher to prevent taller individuals from bending over to cause back pain - optimum height must be found
    - Hand size
      - No finger traps or requirement for smaller fingers such as button presses that are too small
- Links to location
  - Perhaps different house styles / colour schemes of the product could be produced for it to be suitable within multiple areas
  - The aesthetics of the product should be versatile, allowing it to be in a variety of locations
- Aesthetics
  - Graphics
    - Eliminates jerky and inconsistent design flaws
    - Logo of the brand which produced the product
    - The logo of the institution in which the product is housed could be displayed such as the college logo
    - The product name / logo could be displayed
    - Correct placement in order to ensure that the user sees the graphics and they do not go unnoticed as this makes their presence obsolete
  - Links to materials used
    - A colour-coding system may be implemented to indicate to the consumer which components of the product to interact with
      - Vibrant colours for removable / moving parts of the product which allow it to function
    - Certain materials may be replicated both visually and physically as a cheaper alternative to using the real material
  - Shape and form
    - Straying away from harsh corners with a mechanical sense to them, as well as improving safety for the users
    - Due to the medical nature, an elegant form with smooth curves appears most fitting
  - The functional aspects of the product may also be incorporated and adapted to the design as a way of maintaining consistency in the design throughout
  - Especially useful for important products which should have attention drawn to them
  - Eye catching colours may be used to draw attention to the product, for instance, bright orange in an otherwise neutrally coloured room to draw in consumers
- Anthropometrics - Recording data of the consumer
  - Height
  - Hand Size
  - The science of the information behind the product
  - Ease of access
    - Cater for disabilities?
  - Age Group
    - Links in to aesthetics - instead of providing only instructions, colour code moving / interactive parts to signify what parts of the product to use
- Standards
  - Not only overall quality, but the safety of a product must be considered and assessed
    - Examples include electricity consumption from electrical appliances, tipping angles for chairs and using materials that aren't easily flammable
    - Ways to keep standards high throughout a product are to utilise only the highest quality of materials as otherwise, cheaper and weaker materials may be more prone to breaking easier in comparison to those of a higher price. Moreover, the manufacturing methods within the process should also be done very carefully to cater for the design and result in a product made from high quality machinery, materials and design. This way the product is bound to be long lasting or at least greatly improved upon one that may not comprise of these listed elements
    - In any good product, high standards throughout are necessary for the best of quality and longest lifespan for the item. Therefore, I would no doubt want my product to reflect the same consistent high level of quality to ensure the best for it
  - British Standards Institute
    - The institute that assesses the standards / safety of a product
    - Each area will be assigned its own BS number to identify it
  - Ultimately, my product would require high quality throughout as it is dealing with a particularly sensitive and important subject which may result in death. Therefore, it is of up-most importance to me and my products' effectiveness that it is constructed appropriately and able to provide the necessary protection and resources.







# Mind-Map



# PPE DISPENSERS

## The R's

- Reduce
  - Reduce power usage and emissions to ensure maximum efficiency in both time and environmental aspects. This could include reducing the amount of time a machine is on and reducing the amount of processes within a single products manufacturing like having as many parts on a single line in a laser cutter
  - Time taken to reach a final product as well as the time it takes to utilise the product and its function upon completion
  - Material usage to prevent waste and later reuse them for future products if possible
- Repair
  - In order to incorporate this availability within my product, it should be easily accessible to reach the internals and replace / repair and parts required as well as using standardised sized parts such as 10mm bolts making them easy to purchase since they're widely available and common to the average person as well as potentially sell replacement parts or provide a repair service to the consumer
  - It goes without saying that repairing a product instead of purchasing an entirely new one is far better for the environment due to great reduction in waste
- Rot
  - These wooden products have been thought out and designed to rot over time as a way of naturally decomposing to be left with absolutely no waste at all. If we use natural resources, they often are able to take care of our issues themselves
  - This is a prime example of when what was once an issue with countless products or anything constructed from most woods, has been re-purposed to eliminate environmental problems
- Rethink
  - To prevent this in newer products, it is imperative that we future-proof them with the environment in mind at the top of our list of priorities
  - Therefore, we should rethink the way we construct products and be creative with how we can fix current issues and prevent any future ones making this segment of the R's truly important
  - Many of the current environment issues have been caused by short-term solutions to old problems which were only meant to be temporary yet we simply didn't advance upon these areas and allowed them to cause us many issues
- Refuse
  - This means taking a strong stance and saying no to anything harmful for the globe. This way, a lot of the negative processes / emissions will never begin in the future
  - Instead of embracing the negatives that come with many design choices, ignoring the small issues and moving on we need to stop ourselves as designers from allowing these issues to continue and refuse products with negative impacts on the envoriment and the world that we live in
- Rent
  - Furthermore, newer products could be rented over the older options which may also consumer less power making them more energy efficient and better for the environment
  - A simple concept, renting instead of buying, has been in our world for centuries now yet it is becoming more and more desired since it is cheaper, takes up less room (to house all products permanently) and brings down production costs and emissions thanks to less products being within the world
- Recycle
  - This process has been widely spread across the world and education systems as our answer to the plastic crisis yet whilst it is a helping hand in the ongoing battle, it isn't enough.
    - As a counter to even needing the process of recycling, we need to utilise materials which don't require recycling. If we remove the need initially, all products which follow this process will be so much better for the environment due to no energy being used through recycling.
      - Remove the need for recycling the second the product is made.
  - Use recycled and recyclable materials within my product so that the option is there in future to take this route in disposing of it as environmentally friendly as possible
    - Use a limited range of materials in order to make it as easy to recycle as possible
      - Take the Pringles can as an example of exactly what to stay away from - plastic, card, aluminium, etc all in one single use product!
  - In the event when recycling is used, it must be done efficiently and to the best of our abilities to minimise waste
    - Dismantle the product as far as possible and recycle individually from there
- Reuse
  - Materials - countless plastics and plywood are only some of the many materials which can be reused thanks to their long-lasting properties, enabling their use over extended periods of time in multiple products
  - Reusing as a process has an edge over recycling as it takes up less energy and often much less time making it ultimately the preferred route to take when taking the environment into consideration
  - Left over components from the previous batch of products and entirely different projects. This includes excess material which would otherwise be wasted as well as parts from completely separate items which could be repurposed.
  - Many products and parts are left to go to waste in bulk, allowing them to be easily accessed by not only manufacturers but the general public, meaning almost anyone can utilise this method of production - it's as simple as going to the nearest skip

## Environment

- Clearly, the global environmental issues are critical to our future as a species and the planet, meaning the environmental aspects of the product should be a priority along with function as a way of ensuring we can reduce or even prevent any future damage being done

## Location

- Product must be appropriate to the setting
  - Colour scheme
    - Linking to aesthetics, the product may take on various approaches to the colours scheme such as matching the surroundings or on the contrary, being of vibrant colours to stand out amongst the surroundings for maximum visibility for the consumer
  - Size
    - The product should be appropriately sized to prevent overshadowing other features within the area whilst still being prevalent to enable the product to be easily located
- This way the reach of the products resources are greatly increased
- Appropriately located in areas of high foot traffic enabling many people to use the product

## Materials

- Certain materials should be chosen for allocated roles such as flexibility
- Weight is a large factor to be considered
  - If too heavy, may cause injury or damage to surface or consumer such as falling from a wall mount
- Properties
  - Consider potential incidents which may occur to the product
    - Eg: product being dropped would require great toughness to avoid sudden damages
  - Prioritise what is best for a certain product
- Easy to clean / maintain
  - Materials which don't stain or become damaged easily should be selected
  - Product may be touched by many people and so it becomes a hazard for being unhygienic
- Links to environment - extremely important with current global issues
- Combinations
  - Better overall weight : strength ratio
  - Can result in nicer aesthetics
    - Eg silver outline on wooden base for a high end product
- As little waste as possible
  - Consider what processes can be used for which products
    - Many plastics and woods may be used for the laser cutter yet many woods cannot be moulded
  - Excess material may be reused for future manufacture of products

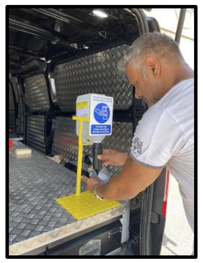
## Maintenance

- Keep away from moisture - high off the ground and under solid overhead cover from the rain
- Wood may rot
- Materials may wear
- Metal may rust
- May use stainless steel to prevent this however costs are high
- As little amount of jams as possible - achieved through constant maintenance and well thought out, logical design mechanism
- Removable components which grant greater access to the internals of the product
  - Ease of cleaning
  - Ease of maintenance
- Moving parts may need adjusting if over time they have shifted
- Components may require grease / oil to move smoothly
- Produce a sustainable product
- Achieved through perhaps material choice and overall build quality

## Manufacture

- Not only do we as the designers want manufacturing to be fast, cost effective and high quality, it also links in a great deal with the environmental aspects as this is the time of which the item is produced by many processes which have negative impacts on the environment.
  - Therefore, the way the product is constructed is extremely important in the way that we ensure to use as little material as possible with a system that will allow mass production that is as energy efficient as possible.
    - Quick changes may be made
    - Furthermore, 'green' production if you will is a clear choice in route as this will certainly reduce any emissions since only the best machinery and healthiest (for the environment) will be used
- CAD
  - Allows you to see the product before construction - both plan views and extremely realistic renders
  - Allows you to easily manipulate the shape / design easily to experiment much more than what was previously possible in a drawing
- Traditional
  - Slow - very time consuming
  - Inaccurate - human error
  - Examples include tools such as saws, milling machine, sander and drills
  - Rather high skill level required
    - Means training will most likely be needed and so overall cost and time is increased in the manufacturing process
  - Hand-drawn plans are much more restricted than CAD
  - Better for hand-made projects with less parts - specialised
- CAM
  - Saves time due to automation
  - Repeatability
    - Enables the option of mass production for a product
  - Very precise - better than humans as there is no human error within CAM
  - Expensive initial startup costs
  - Good for models thanks to being able to make small changes to various drawings to draw comparisons to those prior



## Key Points

Following the completion of the mind-map seen here, I have greatly expanded my knowledge in certain areas of solving issues and have presented them accordingly. Despite the mindmap being incredibly beneficial in establishing a range of ideas which have been expanded through research such as the BSI system I have looked into here, the mindmap can become very cluttered and the original and less significant ideas can consume a lot of space when unnecessary.

# Mind-Map - Expansion



## Introduction

As mentioned on the previous page, the mindmap can become incredibly cluttered and those crucial points may be missed or simply ignored due to the lack of easily identifying them or expanding upon them easily with the space provided, I shall look into them on this page instead. Taking into consideration everything from the page prior, I will expand upon those main points which will ultimately point my product in the right direction towards success, which is imperative.

## Environment

With the global condition of the environment worsening every second at an immensely increasing rate, it is clear that there is much to be done to help prevent any further damage to the planet. Thankfully, this can be achieved through the products we create through a variety of methods such as the well known system of 'R's' (as seen on the mindmap).

Reduce - Material consumption, power usage and emissions from the manufacturing process to ensure the resources are being used in the most efficient way possible whilst having minimal or entirely no negative effects on the environment. Due to less materials being used within the production of a product, there are more spare components available to the manufacturer to build more products, either the same or entirely different ones.

Reuse - The materials and products, no matter their condition, that would otherwise go to waste may be dismantled and used for parts within another product as a way of reducing waste and costs on brand new or recycled materials since reusing existing products is far cheaper and better for the environment than the recycling process. People across the world are disposing of old products every day making it extremely accessible to anyone to take advantage of these resources for a more sustainable product.

Recycle - As praised and widely educated as this process may be, recycling isn't the answer to all of our environmental issues yet when it is available as an option, a product may desire to take the path of recycling if reusing isn't appropriate. Recycling is a very demanding process for power and also releases emissions during the process, making it have a rather negative impact on the environment when compared to reusing yet whenever recycling is possible and other processes are not, it shall most certainly be chosen as this is a way of making use of what is already available to us and can also clean up the littered environment.

Repair - If a product is easy to be repaired then it is most likely that it will be done so over the option of purchasing an entirely new product as a replacement, making it much more environmentally friendly. Perhaps a single component runs into issues, restricting the product from operating. This may be easily accessed by the user and replaced / repaired with a functioning part to return the product to its working state. Therefore, a product should be easy to repair if necessary for many benefits, including environmental.

Rethink - Clearly, the approach designers have taken for the past few centuries has left us and our climate in a very critical state which needs addressing through the way we design things. We must think outside the box and interpret the design process in new ways to counter any potential future damage to the ecosystems which inhabit our world including ourselves (take the Chinese smog for example). This may be done through using the points mentioned throughout my mind-map task as well as expanding upon them further such as using new, smart and modern technologies and materials as a way to introduce revolution into the design industry as a whole.

Refuse - As tempting as it may be to opt for less sustainable options within the design process to perhaps cut costs or production times, this approach must be greatly avoided as cutting corners such as these results in a product of lower quality and standards, whilst being harmful towards the environment perhaps through the process or material usage. We, as designers, must refuse taking these paths and instead utilise those options which are more beneficial for the product and its effectiveness in aiding in the environmental battle.

Rot - Wood rot has been an issue for thousands of years within many designs due to the gradual breakdown of natural woods within products and homes yet this can be re-purposed in new products which incorporate the natural breakdown process as a way of disposing of the product in a healthy way as opposed to landfills and the great amounts of harmful emissions from the recycling process. Woods may be left without varnishes and finishes since these may play a part in preventing the breakdown process and also further reduce the resources required in designing and creating a product.

Rent - This brings great convenience to both consumers and businesses through the commercialisation of 'borrowing' products through a renting system. This saves the consumer money as it eliminates the need to purchase an entirely new product for a single task making it particularly expensive and an annoyance to them in finding appropriate storage. Furthermore, the consumer may rent out newer products instead of using outdated equipment over extended periods of time since the business will have the funds to purchase many new products and profit off renting them out to customers. This links into the environment in the way that it reduces the amount of products being manufactured whilst still having the same consumer reach, meaning less resources are consumed and less emissions are released.

If a product were to utilise most of these points within its construction, it'd be entirely beneficial to the environment and ultimately 'keep on giving' for future products since it may be repurposed in a vast variety of ways. Negative material choices and manufacturing processes' must be turned away, reused / recycled materials shall be welcomed and we must rethink the way we are creating products for the world of tomorrow. This is one of our many steps to a greener future and action can be taken now for the greater good of not only the environment, but mankind.

## Materials

The physical properties of a product depend greatly on its construction through both the structural integrity and the materials chosen meaning that the materials and their properties must be greatly considered in the design process of a product to ensure it is capable of accomplishing its desired purpose in the best possible way. For example, a lightweight, strong and durable material which is relatively new to the market is carbon fibre, often used in aircraft and formula one cars due to its wildly impressive weight:strength ratio, henceforth, the materials chosen for my product may be selected due to these regards. Furthermore, the application of a product should also be considered when designing it because in the event it suffers from sudden impact like being dropped or falling from a wall mount as a dispenser may, the materials should be able to withstand these applied forces with the worst case scenario in mind to prepare for any possible events.

Furthermore, different materials have different appearances meaning that there may be some that work together particularly well for certain environments since their individual styles compliment one another. Of course, these combinations are further reflected within their properties (like previously mentioned) and so there is a lot to consider when choosing which materials should be included within the construction of a single product. As well as this, the materials may be easy to clean and maintain and be environmentally friendly in the ways that they are produced (what processes are the least harmful for the environment yet still effective) how the product is used and finally how it is disposed of, meaning there are a great deal of areas to account for.

## Aesthetics

This point in particular plays a vital part in a product's success and utility as it is the way in which it presents itself to the consumer through a variety of ways such as the overall form and shape of the product and its adopted colour scheme. If a product is effective in the way that it presents itself, it should be easy to understand to the widest range of consumers as well as taking a certain approach to how it may do so. It may choose to take on a more minimalist approach and blend into the surrounding environment or be easily located with a vibrant colour scheme which conflicts with the location. This way, consumers would find the product much easier as well as operate it effectively if it is clear on how to use it, perhaps through colour-coding moving and functional parts.

Incorporating the best of both worlds, a product may be versatile, allowing it to be placed in a variety of different locations however to accomplish this, it must also accommodate for the shape / form of the product. With the theme of COVID PPE dispensers being medical and sanitary, an elegant design may be implemented as this is in line with the theme.

Perhaps graphics may be included on the product such as instructions or logos. Firstly, instructions and information may be given in a variety of ways such as through infographic imagery or written instructions, yet a combination of the two can prove to be particularly beneficial to the consumer in their understanding of the products system / flow. Moreover, logos such as the company which produced the product or the institution it is being housed in may be presented on the surface of the product as a way of identifying who the product belongs to as well as maintaining a house style in both the colour scheme and the logo / slogan of a location in all products.

## Standards

A good product must have high standards throughout its construction in order to present itself as high quality since if a single piece of the item was constructed at low standards it can impact the quality of the product as a whole, hence why standards are so crucial to a product's success. Take a safe, for instance. If you were to construct the main body from extremely high quality steel yet have a low quality weak hinge, the safe instantly drops in overall standards since its main function has become easily impaired thanks to the cheap hinge installed. Therefore, a product must maintain high quality throughout if it wishes to be of high standards.

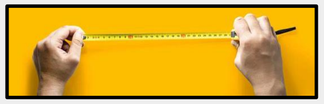
Furthermore, there are ways of assessing the standards of a product and they are often done on the majority of products before they hit the market since more often than not, a products standards may have an impact on the health and safety of the user, making it crucial that they are catered for. In Britain, these quality assurance tests are completed by the British Standards Institute which assign BS numbers (coding system) to certain parts of the product which are to undergo testing such as stress tests. If the product succeeds in the testing process, it will be granted access for sale to consumers.

## Maintenance

There are many parts of a product which may need maintenance ranging from a few moving components which may need oiling to ensure smoother movement, a metallic surface which may need a finish applied to prevent rusting or any other form of degrading and wear to the product as a whole. Either way, many products break down over time yet we can keep on top of them by constantly providing maintenance to ensure the correct function of a product.

The maintenance process may become tedious and time consuming due to certain parts of the product being particularly hard to reach for cleaning or maintenance and so if these are adapted to better suit the consumers methods, it will make the process a whole lot easier and quicker. Therefore, parts which restrict access should be easily maneuverable by perhaps moving to the side out of the way or completely removing them for the time of cleaning. Furthermore, in the event of a jam or mishap with the internal mechanism such as what may occur in a dispenser, the possibility for ease of access and cleaning would greatly improve the performance and upkeep as a whole.

On the topic of cleaning the product as a way of maintaining it, laminated surfaces may be used as these can provide a barrier and form of protection between the item and any outside effects like weather as well as strengthening it and preventing any ripping or tears. This way, instructions may be kept clean and in good condition whereas if it were simply a piece of paper it could suffer the environmental impacts.



# Mind-Map - Expansion



## Anthropometrics

The data used to alter a product to further optimise it for a certain range of consumers is known as the anthropometrics. Often kept in large data books consisting of hundreds - if not thousands - of pages, with data records on people from all over the world, consisting of every ethnicity, age, gender, height, etc... The list goes on. This way, every time a designer decides to begin to alter their product / base their product around their certain target consumer, they will have the appropriate measurements for them in order to ensure that the product caters towards their physical needs.

Without anthropometric data, products would be unsafe and particularly uncomfortable as they hadn't been able to be molded around that ideal consumer, no matter what extent they went to unless there had been immense amounts of testing completed across hundreds of prototypes and models. Therefore, we have these records which account for almost every single consumer range to allow products to be specifically tailored towards them to maximise the consumer's experience in utilising the product.

## Ergonomics

The act of using the anthropometric data to cater towards the target demographic is known as ergonomics as this is the process of optimising a product to maximise the experience for the consumer both through ease of use and enjoyability when doing so. Henceforth, the ergonomics of a product are key in being effective in accomplishing their desired task to ultimately satisfy the consumer as much as possible, meaning that they will grow to greatly appreciate the product making it a great success along with its intended purpose.

Different products may be catered towards different target consumers in a way to best suit certain groups as it is almost impossible to create one product which is perfectly comfortable for everyone. This includes certain aspects such as the weight of the consumer which would be appropriate for some products yet not others. Take a young child's chair for example, it would be much smaller since they are of a lower height than most consumers and it wouldn't have to support as much weight as a regular chair because these are often used by average sized middle-aged people. Therefore, an overweight tall man wouldn't be supported or comfortable in a child's chair since it hasn't been designed ergonomically for them.

For my dispenser product, I would most likely need to gather data on the hand sizes of the average consumer within the college campus if that is where I desire for it to be located. Moreover, the height from the ground that the dispenser is held must be accounted for as this enables the amount of people which may utilise the product entirely and comfortably. Furthermore, the design must be easy to understand so it may be used by the wide range of age groups which use it such as through using basic images and instructions along with colour-coding moving parts to conclusively have an all around ergonomic design which performs highly.

## Safety

It is an absolute priority that all consumers and distributors are safe during the usage and installation of my product as otherwise there could be legal action as well as the potential of someone becoming injured from my work and so it is an absolute must that the product is designed to be as safe as it may possibly be.

This can be achieved through removing fingertraps, sharp edges and corners, poor surfaces which may cause cuts or splinters, and hidden wires and mechanisms to prevent electrical injuries and anyone being caught in the moving parts. If a product is too heavy then it could fall from its wall mount and become damaged or even inflict harm on anyone in the vicinity, as well as the possibility that a consumer is unable to carry it easily and strains a muscle or the product resulting in any other issue. These areas should be smoothed out, well thought out to prevent ever occurring and being hidden away until access is desired such as to the wires and mechanism also as a way of protecting not only the people involved, but the product itself.

Moreover, it is to be understood that people of many ages and demographics may be using my product and for this reason it should be catered to every possible user for maximum safety and utility. Therefore instructions should be given in a clear and concise manner for all to understand to prevent potential harm for any users.

## Location

The location of the product/s must be chosen very carefully for maximum efficiency and utility such as having a hand sanitising station being in an area of high foot traffic to enable a large number of people who may even just be passing by to make use of the products intended function.

Furthermore, when linking into the aesthetics of the product, it shall be appropriate to the setting through both the size, form / shape and colour scheme to potentially match the house style of the surrounding area or establishment. It may also be intended that the product is a certain size to not overshadow other aspects of the area and so it must be taken into considerations which dimensions are best for the majority of areas and situations, therefore market / product research must be done to get a general idea of what is currently being done to cater for this particular need.

## User / Client

When it comes to the client we must consider three points being their needs, wants and demographics because this way we can see who may use our product and what they look to get from it. In the event we know the needs and wants of the consumer, we can alter the design to cater for them and provide as much as possible to provide the best overall experience.

Needs - The needs of the consumer are ESSENTIAL for the product as without them, the product has failed to provide them with what they need from it meaning it has ultimately failed to function.

Wants - The wants of the consumer are DESIRABLE meaning that it would improve the overall experience for them yet are not needed for the product to function properly, although are very nice to have and will result in customer satisfaction.

If all areas are taken into account when designing the product, the product will serve the consumers in the best way possible which is of course the aim form us as designers.


## Manufacture

Whilst a large part of the product development process is dedicated to research and designing, manufacturing makes up a big part in the future of both the product itself, and the world as a whole. For instance, a product may have been perfectly researched and designed yet it could be let down within the manufacturing process by taking far too long, having many inconsistencies and errors within the product lines leading to much shorter life cycles for the products since they hadn't been correctly assembled and produced and ultimately cause great deals of pollution within the atmosphere due to the process chosen. Obviously, we want to avoid this at all costs and so we must put a large amount of thought into the product's manufacture.

Firstly, we must decide whether we want our product to be mass produced through the means of CAD / CAM or be more specialised and take on a more traditional approach incorporating many highly skilled workers to work on a very small number of products using tools such as saws, drills and milling machines, following hand-drawn plans. There is a great deal of room for human error within the traditional method as well as it being much slower and for a product such as a dispenser which is to be produced in great quantities, traditional is clearly not the correct path to take.

Instead, I shall opt for the modern approach incorporating CAD / CAM to mass produce these items in the most sustainable and 'green' way possible to ensure the best possible environmental impact. Therefore, the overall process is fast, cost effective, accurate and high quality with a CAD oriented design process which allows the designers to make quick changes varying in importance to enable the best possible route to a successful and appropriately manufactured product.

Furthermore, if I utilise standardised parts which are components which are of the market standards such as a particular size of screw, it'll allow much easier and cheaper production of the overall product since specialised parts will not have to be constructed as they may simply be bought in. Standardised parts are easy to replace both for the manufacturer and the consumer as they are open for all to buy whereas a custom built screw would be particularly hard to come buy and would increase production costs dramatically since the equipment needed to produce these parts would be required and would ultimately further complicate the process for everyone that is involved.

## COVID

Extremely prevalent in the world of today, the COVID-19 pandemic has caused the loss of millions of lifes and is currently continuing to do so at an increasing rate. Despite this, public buildings remain open with minimal or even no restrictions across the world which can only have a negative impact on the lives of many. The existing PPE is helping fight these climbing numbers yet they aren't perfect and could do with great improvements since they had been rushed out into the world to fight the disease with little being done since their initial use. If I am able to improve these safety precautions in fighting the virus, I will have potentially saved countless lives depending on where my product is utilised, meaning it is very high in my list of priorities. Whilst the existing PPE isn't 100% effective, it reduces the risks an immense amount, therefore if I am able to effectively disperse these items, they will be a great help in fighting the virus.

In order to target each particular piece of PPE, I shall expand upon each potential area and route I may take:

Masks - These help prevent the spread of the virus for both the infected and clean as it creates a form of filtered barrier between the air that we breathe with one another if worn appropriately. Therefore, they should be worn at all possible times time ensure that everyone in the general vicinity is safe, especially when used in conjunction with other methods.

Hand Sanitiser - This serves as a way to fight off not only the COVID virus but as countering the majority of common bacteria as a way of keeping individuals clean and safe. Furthermore if used appropriately by everyone, less surfaces will become contaminated, making the general area far safer than if the sanitiser was never used.

Gloves - In the event that a contaminated surface is touched, the hands of the individual are now contaminated and may spread to other areas such as other surfaces or the user themself causing the spread of the virus whereas if they're using gloves and dispose of them properly after use and dont touch themselves or others, the spread of the virus will be greatly reduced.

Face Visor - Whilst these are almost useless when used on their own due to the massive gaps on all sides, the face visors can prove to be rather effective when paired with the likes of a usual face mask since now there is decent eye protection which the masks don't usually provide. They're also far more comfortable to wear than goggles and will not steam up as much as those.

Barriers - Whilst this may not be a form of PPE (Personal Protective Equipment), these are very effective in preventing the potential spread of the virus as it forms a solid barrier between people and will greatly reduce any chances of anything contagious passing from one individual to another. Whilst these may not be distributed, they can be installed across the intended site.

## Function

Falling into one of the most important categories, function is crucial to a product's success because if a product fails to function properly then there is no reason to have it there at all as it fails at completing its intended purpose.

Some products may not be very clear as to how they are to be operated and so the steps for making use of the products function should be illustrated clearly, linking into previous points made as without this aid, some may find it difficult or just be completely unable to use the product at all.

The product should also take into account two things when it comes to function and that is the primary and the secondary function. Primary function being the most desired and prioritised purpose of the product such as for a dispenser it would be to distribute certain items to a range of consumers whereas the secondary function can be anything from having speakers or an extra way of interacting with the product to say provide food.

## Key Points

Upon completion of this task I have come to the realization of some very important aspects in terms of a products development. All of the aspects included in the mind map and expansion must be considered when designing a product in order for it to be as successful as possible. Some clear examples include how a product must function as intended, manufacture is smooth, environmentally friendly and efficient and that the client's needs are catered to for safe and ergonomically satisfying product.

# Mood Board

Ataraxi

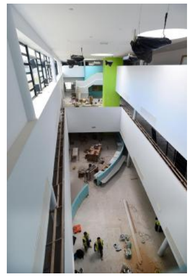
## Introduction

A mood board is a particularly effective way in allocating and presenting a wide range  of thoughts and ideas for the product before its development stage, yet can often be referred back to throughout the process in order to result in the best possible product. Inspiration may be taken from a variety of designs, products and styles to come together and help form a final product, paired up with the work of the designer who shall bring their unique, new and innovative ideas to have a product which makes use of the best parts of all other pieces on the market.

## Dispensing Method

There are many ways in which the contents of the packaging can be accessed by the consumer such as through touch to push something to release what is inside, pull the contents from within, a sensor that detects when to release product or even spraying the product like antibacterial spray onto the hand of the user. Since some of these listed options involve actually coming into contact with the dispenser, surfaces touched by many are becoming an increasingly dangerous risk for the spread of COVID or any other diseases and so foot-operated and no touch systems such as sensors are becoming a more popular and safer choice, showing a variety of options and ways to overcome the issue at hand.



## Lifespan

The lifespan of a product is crucial for its overall worth and also the environment as one time use products such as these smaller hand sanitiser bottles are very bad for the environment if not disposed of properly. Instead permanent wall mounted dispensers are much better thanks to far less waste which may also be refilled at a small cost when compared to individual bottles. Antibacterial wipes unfortunately cannot be reused and are often disposed of, increasing waste and harm to the environment yet this may be countered by instead using antibacterial spray for surfaces over wipes. Masks also play a part in damaging the environment through the amount of single use versions yet it is possible to get reusable ones which can be washed and fitted with filters for extra protection. Another interesting point is that a way of having a longer lifespan is by using appropriate materials which are strong and durable enough to withstand impacts and any potential damage to avoid replacement or repairs.

## Colour Schemes

## Materials

## Shape

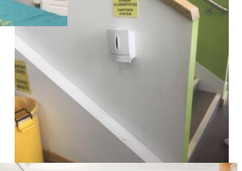



## Size

The aesthetics of a product depend heavily on these listed aspects above as the shape is what defines the object as a whole, the colour scheme and house style brings in life to the product as well as indicating the important parts of it. Furthermore, the size dictates who may use it  and materials impact the physical properties of the item by having particular finishes, strengths and applications. When all areas are considered in the design and development of a product, it goes to show how far it may come in its aesthetics as a whole. Perhaps the shape is curved and comes across as elegant, the colour scheme gives it a sense of organisation and illustrates how to use the product and the materials give it strength and enable its long life of utility.

## Location

The location means a lot when it comes to a proc success and utility and in the case of PPE dispensers, this is even more critical as the equipment could save lives. Therefore the distributors must be appropriately positioned to have the most foot traffic and be the correct height for all to access. Furthermore, the product shall be appropriately catered to the surroundings such as matching the colour scheme and house style fo the area as seen on the right as an example. Perhaps a product could be at a dedicated station, on a wall mount, or just left on a table for use.



## Key Points

Following completion of the mood board, I feel I have been opened up to a great range of new ideas in how to target my product in the best way possible for distributing goods and combating the current virus and any which may appear in our future. Thanks to this incredibly insightful task, I have realised areas containing problems that had otherwise been unknown to me yet now that I have seen the issues, I am capable of avoiding them when it comes to the design and development of my own item. This way, I am bound to have the best all around, multifunctional, successful product. With my aim to create a dispenser, I have made a great discovery in the areas of sensor and spray technology and may look into them for my own product such as indicating on the hand of the user where the sanitser may land.

# Research



## Introduction

A crucial part of a products development and design is the research process which is done both before designing has begun and during, in order to constantly be adding to the product as a whole for the best overall final item. Therefore I have taken it upon myself to conduct a wide range of research across various areas of which I shall add to extensively in great deal since this is such a critical part of a products lifecycle.

## Location

The utility of a product can greatly depend on its placement and what environment it is in and in my case for producing a PPE Dispenser system, location is crucial. Ideally for typical dispensers they will be in areas of high foot traffic since this means more people, more potential consumers and with that comes higher revenue. This also applies to my dispenser however instead of the goal being monetary gain, it'll be to distribute as much protective equipment as possible to maximise the safety for everyone in the area.

Furthermore, if I am able to have more than one product available, I may have multiple dispensers located across a certain area to reduce crowding round them and further spread the distribution of the PPE, maximising safety for the consumers. If I am to look at similar products such as vending machines or soap dispensers, they can be found in suitable locations such as a cafeteria or the bathroom and this is because these are the locations in which they're most likely to succeed. I shall replicate this method in my product as it may be greatly successful in achieving its intended purpose if it is positioned correctly such as the appropriate height from the floor for access and high foot traffic like an entrance / exit or even a hallway.

## Maintenance

A product's lifetime may depend greatly on the way that it is maintained as this is the way of keeping on top of what is happening to it like repairing any minor damages, restoring degrading materials and lubricating mechanisms. This can be seen in product such as current hand sanitising stations which have a easily cleaned high-density polyethylene surface, being a very hygienic option since it is so easy to wipe down and return to sanitary conditions. Furthermore, any mechanical processes happening within a product may require lubrication of one of the four forms: oil, grease, penetrating lubricants and dry lubricants.

There are of course ways of getting around the mundane and recurring task that is maintenance by having the process be as fast and easy as possible by granting easier access to certain components of the product like a removable front plate which exposes the internals. Moreover, the entire process may be avoided for certain products by using materials which don't degrade or require and future work done on them such as stainless steel or certain polymers like carbon fibre. Unfortunately, these come at a high price and will also increase weight in most cases, which as pointed out previous points about safety, it is key that our product remains a certain weight to ensure it doesn't cause any damages or injuries.

## Standards / Reliability

Products are clearly desired by the consumer to be of high quality and standards to ensure that they are receiving the best product possible for the price paid. Unfortunately, a great number of products which do reach the market are let down by small inconsistencies in the design or short cuts taken to perhaps reduce costs, which have a negative impact on the product as a whole. Take the current dispensers as an example as they frequently have faulty or even unresponsive sensors and face frequent issues with the mechanism within which results in jams and an ultimately useless item as they become obsolete following the loss of their function since it can no longer do what is intended, unless of course it has any secondary functions which continue to operate, yet this is very rarely the case.

Following the study and analysis of many products that are rated extremely highly with their respective communities, these items of high standards very rarely fail the consumers and are overall very reliable. Well-known name brands such as Dettol and Purell are seen 'top-tier' in the market as they are successful enough to have greater funding for their products and so they're often more expensive, yet the quality is there as seen in their other products related to the matter:


Dettol Hand Sanitizer Original 50ml

Brand: Dettol

★★★★½ 1,511 ratings | 4 answered questions

## Materials

Many products of the same nature are constructed from high-density polyethylene since this can be mass produced through a range of moulding such as injection and blow moulding (typically for containers) making it ideal for a product that would face this sort of manufacturing path. Other key properties of HDPE is that it is rotting, mildew, mold and environmental impacts such as insects or weather due to its extremely high strength and structure which is also able to be made into very complex forms.

Whilst there are many other options on the market that could be chosen and changed out throughout the design and development stages of a product, some may be ruled out now for the better such as an entire wooden or metal build as these are high in weight, maintenance and cost whilst also being rather difficult to form when compared to many other available materials like countless polymers. In the event however that these materials are included, they should have a finish applied to them to prevent wear and corrosion since this will cut down on the maintenance aspect and have an all around easy upkeep for the product. Examples include varnishes on woods, anodizing on aluminium and galvanizing and various powder coatings and on steel. These also alter the aesthetics of the material.

Ideally, the materials used should be cheap to maintain, perhaps through resistance to corrosion, ductile, easy to turn into various shapes to have a complex product if necessary and cheap to produce whilst not cutting on the overall product quality or restricting function.

## Aesthetics

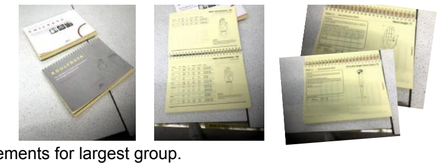
More often than not, first impressions can mean a great deal between the relationship of a consumer and a product and this is typically through the aesthetics of an item since most products are seen before they're even used. Therefore, the presentation of a product is key to whether or not a consumer will take a liking to it. As it can be particularly difficult to cater to multiple specific target audiences within one product as many styles are very different from each other, a universal aesthetic approach may be taken. In terms of medicine and hygiene, this often means white and neutral shades as previously discussed yet the shape must be elegant and somewhat futuristic as it indicates to the consumer that the product is new, further encouraging them to use it.

Another key part of the aesthetics is the communication between the consumer and the product through instructing them how to appropriately use the product. This may be seen in the following: 'Apply the product on the palm of the hand. Rub hands together. Cover all surfaces until hands feel dry.' This one in particular has the instructions as just noted, but images and a time indicator in the top left corner which implies that it will take 20 seconds for the hands to dry. This way, the consumer must be even more informed on how long the process as a whole may take and whether they have used the correct amount for it to dry within the said time, a truly useful little detail that goes the extra mile in helping the user.




## Anthropometrics

The anthropometric data is crucial to a product in ensuring it is sized correctly and the dimensions are appropriate for whomever it is that may use it. Therefore I shall conduct research into many different areas which will be factors to the utility of the product for a consumer such as hand size, the height the hand is from the floor, depth and clearance. In order to get these statistics from accredited source, I referred to two anthropometric data booklets as seen in this image:



I shall base maximum measurements such as clearance needed for a larger hand will be from the adult data since they're larger than children whilst the smaller values which must be considered such as maximum height from floor will be considered.

95th Percentile - Smallest possible product measurements for largest group.

### Hand Sizes

Adult Data - Largest possible

| | | |
|---|---|---|
| Breadth - | 11.6 | cm |
| Maximum Spread - | 24.3 | cm |
| Length - | 20.6 | cm |
| Depth - | 7.01 | cm |

Child Data - not considered as they're smaller than the adult data and we must consider the maximum size hand for the minimum clearance / gap.

### Knuckle Height From Ground

Adult Data - Largest possible
Height - 82.5cm

Child Data - Smallest possible
Height - 53cm

Ideally the deployed height would be in between these two values or variable as then it could be changed for each person using them.

### Arm Extension - Horizontal

Adult Data - Largest possible
Length - 85.3cm

Child Data - Smallest possible
Length - 60cm

The product must be of a certain depth which allows access for people of varying arm lengths as someone may have difficulty reaching the functional part of the product.

### Arm Extension - Vertical Overhead

Adult Data - Smallest possible
Height - 189.5cm

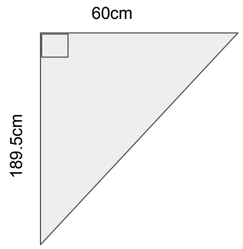
Child Data - Smallest possible
Height - 181cm

Only the child data should be considered here as adults are typically taller than them and if the smallest consumer is able to reach the product, it has succeeded in making itself available and is necessary.

### Arm Extension - Diagonal (Maximum)

Child Data - Smallest possible
Length - 198.77cm

Using pythagoras' theorem we can find the optimum diagonal arm extension from the horizontal and vertical reach to give the maximum reach at a 45 degree angle to the product which can help indicate where it shall be positioned if it is wall mounted. Moreover, only the child data should be considered as these are the minimum dimensions for accessing the functionality of a product.




Pythagoras' Theorem: $c = \sqrt{a^2 + b^2}$

Square root of 60^2 + 189.5^2 =198.77cm

Considering the maximum 45 degree angle reach (diagonal) for a 15 year old within the 5th percentile is just below 2m, this is the maximum height the product should be however it would be particularly uncomfortable for these users if situated that high and so it should instead be mounted around 1 - 1.5m from the ground.

## Ergonomics

This is the adaptation of the anthropometric data to alter the product to best suit its intended user and for that exact reason, it is imperative it is done properly otherwise there would have been no reason to have conducted any research for the anthropometrics. Examples of products within this general category include the clear face mask which is used to aid deaf people in communicating through lip reading with people wearing masks whilst maintaining safety precautions. A clear panel has been placed on the front to cater to the great help which comes from lip reading for the hearing impaired. Surely I should be able to do the same in my product in the way that I shall adapt it to work best for not only certain groups of people but the entire user base to have the best functioning product for whoever may find themselves using it. Perhaps I may do this by having it appropriately positioned on a wall at a height accessible for all yet this is typically very difficult so if I am able to find some form of adjustable height, it would be greatly helpful to the user, no matter their height and allow them to use the facilities provided.

## Key Points

The data collated and areas looked into here will prove to be truly helpful when it comes to designing my product as these are the areas I will look to covering within my product. Examples include having the product be aesthetically pleasing as well as informative and user-friendly, being of high standards both in construction and utility as well as referring to anthropometrics to ensure the product is usable by my target audience. By including key parts of my research in my specification, I will be frequently seeing the path in which I should take the design since I tend to work against the specification throughout the design process. This way, my product will be the best it possible can be for whoever it is who may use it. Moreover, if I am able to cover all areas studied in my research, I should result in a very successful product which will become reputable in the design community and favoured by the consumers. This is critical in having a well-received and profitable product to benefit the world.

# Research - Client and Demographics



## Introduction

For any product to reach the market, it is to have great research done before it is even designed and this includes research being done on the potential clients as well as finding out a wide range of information on their demographics including age range and preferences. Furthermore, I shall construct a client profile on an example typical consumer to give me an impression of whom my product is to be used by as a way to further cater my design towards them when it comes to that stage in production. Moreover, a personal 1:1 interview will be conducted with this example client and I shall also put together a survey for even more potential consumers to complete, adding to my extensive bank of primary data. If I am to present these here in a clear and logical manner, I shall be able to clearly refer back to the data in the future for maximum consumer satisfaction.

## Survey / Questionnaire

I constructed a survey which was sent out across some classes within college to get a general idea of what the potential consumers think of the existing products within the market as I may take the feedback and use it to alter any future designs to cater towards them, working with the specification and client profiles.

Title - Review on PPE within College

Description - PPE = Personal Protective Equipment

In the current climate of COVID-19, it is imperative that everyone is kept safe during their time in public areas and this may be done by having the appropriate protection in place such as masks, hand sanitizers and anti-bacterial wipes. Please take the following survey as a way of giving feedback on the existing precautions and protection in place and what may be done to improve.

Questions

1) What is your age?
   - 14 - 15
   - 16 - 17
   - 18 - 21
   - 21+
2) What is your gender?
   - Male
   - Female
   - Other
   - Prefer not to say
3) How often do you visit college?
   - 1 day a week
   - 2 days a week
   - 3 days a week
   - 4 days a week
   - 5 days a week
   - Alternating weeks - 5 days every two weeks
4) How easy is it to locate PPE in college?
   - Very easy
   - Easy
   - Possible
   - DIfficult
   - Very difficult
5) Do you use the current resources such as hand sanitiser and if yes, how often? If no, state why in the next question.
   - Yes - many times a day
   - Yes - occasionally
   - No
6) If you answered no to the previous question, please state why.
   - Type box
7) Are there any issues with the existing PPE such as masks or the hand-sanitising stations? If yes, please specify. If no, leave blank.
   - Type box
8) How would rate the current COVID / hygienic protection in place on site?
   - Rating 1-5
9) Do you have any recommendations for any future protection that could be implemented? If yes, please specify. If no, leave blank.
   - Type box
10) How would you rate the protection if these changes were implemented?
   - Rating 1-5
11) Are there any other points you would like to make regarding the PPE and protection of people on site? If yes, please specify. If no, leave blank.

## Client Profile

Andy is currently a teacher within the Deeside Sixth establishment and following a quick conversation, he pointed out to me the various things that he would want from a product of the nature I am planning on designing. Since proper dispensers are few and far between within the building, a permanent option is desirable, more so, needed. With these long term dispensers deployed across site, the client (Andy) is I looking for it to be a hygienic, fast and easy process as this ensures safety and fluidity for the consumer. Furthermore, with speed and reliability comes removing the possibility for the formation of any queue which may lead to social distancing not being followed. The construction should be tough and robust since it is in a public setting meaning it may receive some abuse perhaps from environmental / weather causes or from the users. The product shall be easily repairable using standardised parts / components and materials whilst being able to store the appropriately selected products in suitable quantities.

## Interview - Andrew Peck

Whilst a survey is a greatly effective primary research method, it is designed to be answered by a wide range of people and so it is often generalised as a way of it being able to be answered by many. On the other hand, an interview is much more personal as these are conducted often in a 1:1 situation with back and forth questions. However, it is possible to straw away from the script and ask more questions to further develop the answers provided, making each interview unique as open ended questions may be asked and later developed.

1) What is your role in college? How does this affect the amount of people you come in contact with?

Answer - Product Lecturer - can minimise how many people I come in contact with. Staff - can be limited to only one other individual. Students - variable outside of the classroom environment. In the classroom it is manageable but unknown and unmanageable outside.

2) How often are you in the building?

Answer - 3 Days a week

3) Have you been informed what the PPE packs contain that are taped to the walls and what their purpose is?

Answer - No

4) How do you feel about the current protection such as the distancing tape, anti-bacterial wipes, PPE packs, plastic screens and masks?

Answer - a) Distancing tape = okay as it is a visual method which makes people think of where they should be standing to maintain social distancing. b) Screens = not very effective as they have many weaknesses such as stability and the size of them isn't adequate in most situations (contrary to shops with much better protection). c) Social distancing = impossible in many areas such as the corridors, stairs and elevator. d) PPE packs = so many unknowns surrounding them. Are they only there for emergencies? What classes as an emergency? They should have instructions on them. e) Wipes and hand sanitizer = Not in any sort of long term / permanent dispenser and so they're constantly moved around and touched. They're managed differently in every room meaning it is impossible to keep track of who has touched them showing a clear lack of proper dispensing arrangements.

5) Do you feel enough is being done to provide protection for everyone on site?

Answer - College is following welsh government guidance as they see fit but there are still issues.

6) Is new PPE easily accessible to you through college resources?

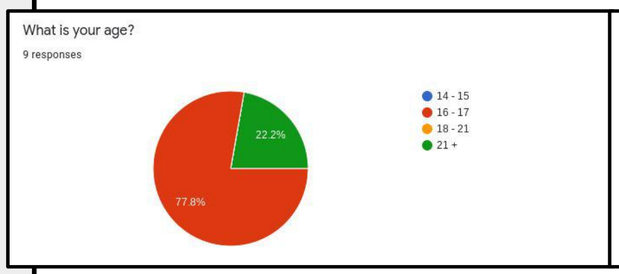
Answer - Yes, not initially but it is getting better as there is more of it since there is proper purchasing in place for certain things like hand sanitizers and wipes whereas there were limited amounts at the start. Staff are also provided with visors but are optional. 2,500 were made but I dont have one.

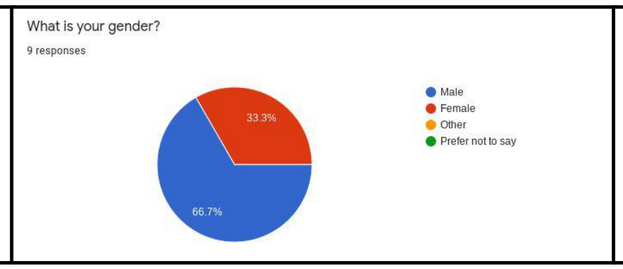
7) What could be done to make you feel safer within the college?

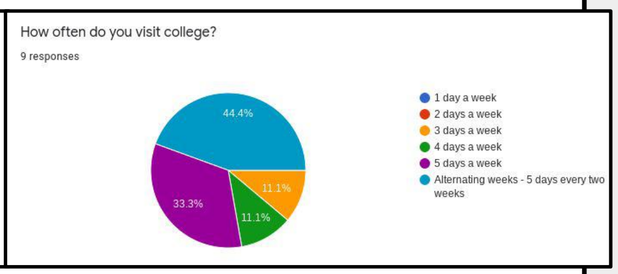
Answer - Most staff feel safe but most students need proper areas for socialising that can be managed, meaning that the spread of covid within students could be higher. Staff feel more unsafe out of lesson times, linking in to how the students don't have managed places to sit with large groups of students. As seen in areas such as Kent where the numbers have gone ballistic due to people not following the guidelines. People without symptoms have potential to spread it around the college. We could test students before entering college if tests become fast enough.

## Survey / Questionnaire Responses

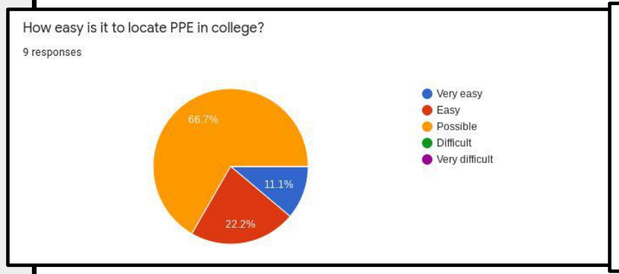
The questions for this survey may be found in the section directly left to this one and I received 9 complete responses. Whilst this seems small, it is a perfect representation of my target audience due to my targeted selection of people who were to complete it. The results may be found and discussed below:

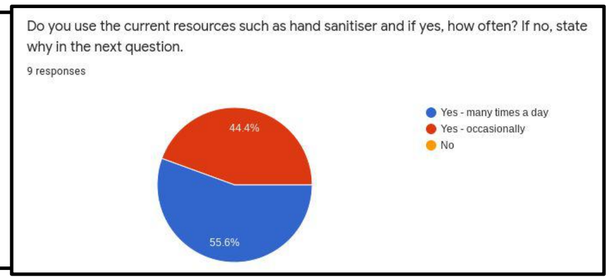



Initially, I decided to create a miniature client profile as a way of indicating who I will be designing a product for. By collecting some basic information on the consumer's ages, genders and frequency that they visit college, I learn more about who my audience is which is crucial in product development. Of course, primary research methods like these are incredibly successful at doing just that. This data will allow me to further cater my product to the target audience in both their needs and typical wants, resulting in a n overall more desirable and successful product.





Next, I asked for opinions on the current PPE within college to then draw up an assessment on the conditions on site as of now / before my product reaches the market. Perhaps I could return to this and conduct the same survey after my products may be found across site yet it is too early to consider this now. From the data received from the survey results above, I have learnt that my consumers frequently visit college and are typically students aged 16-17. They find it possible to find PPE on site and make frequent use of it.

# Research - Client and Demographics



## Survey / Questionnaire Responses - Continued

Are there any issues with the existing PPE such as with masks or the hand-sanitising stations? If yes, please specify. If no, leave blank.

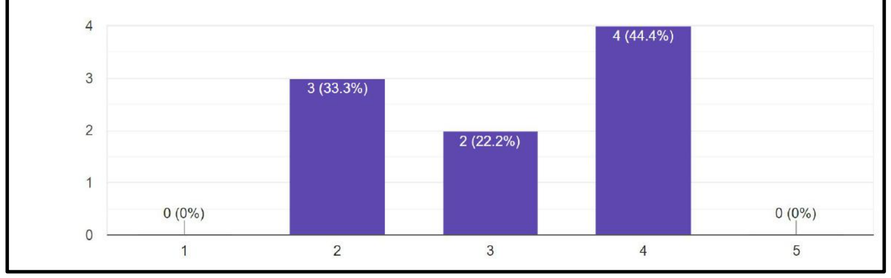
5 responses

- You are unable to see how much sanitiser is left in many of the dispensers and quite often there are issues with accessing the sanitiser such as a faulty sensor or a slippery handle making it difficult to dispense the liquid.
- Uncomfortable
- There are times when some pf the sanitiser stations are empty halfway through the day.
- did not know there was a mask station.
- The hand sanitizer is not very effective becuase everyone touches the bottles

1) Five out of the nine people taking the survey provided issues with the current PPE stations which varied quite a large amount showing how there is a range of problems with even simple products like these. Ultimately, these should be accounted for within my design as a way of eliminating any potential issues which may arise in a means of maximising consumer satisfaction. Moreover, some were unaware that mask dispensers were even present on site, showing a lack of awareness over critical aspects of COVID protection. I should consider this with my design by perhaps including information about the product as a whole and each individual part such as wha1t it houses, where and how to use it.

How would you rate the current COVID / hygienic protection in place on site?

9 responses




2) Whilst nobody rated the COVID PPE conditions to be extremely poor on site, there was still an overall average score. The PPE is somewhat effective in being dispensed and distributed across the college yet it certainly does not exceed the requirements or even raise the bar in the industry which is surely a sign of a sub-par product range. 33%, a third of the answers showed that the facilities were poor and so this a very large portion of consumers being left unsatisfied and feeling unprotected by products that intend on doing just that through their functions. Clearly a change is necessary to these products or at least the conditions within the college premisses. If this is apparent elsewhere, then there is truly a great issue surrounding this industry of health.

Do you have any recommendations for any future protection that could be implemented? If yes, please specify. If no, leave blank.

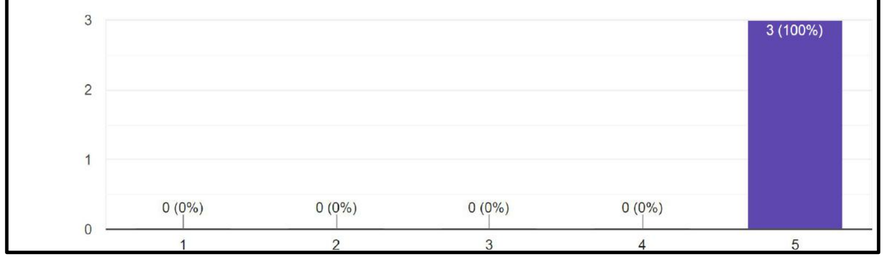
2 responses

- Clearer distancing tape, more efficient sanitising stations to prevent queuing and crowding and places to get masks from.
- It would be more hygenic if it was a sensor or something i don't have to touch with my hands

3) Unfortunately, only two people completed this question and this is a point I wished to expand on a great deal yet I am restricted from doing this to the extent to which I desired since there has been minimal response. Nevertheless, I discovered many ways to make improvements to the industry through my design such as preventing queueing, designated mask dispensers and non-contact dispensary methods. These 'non-contact' systems consist of perhaps using sensors or any other means of going about this to prevent contamination of the consumer and other surfaces.

How would you rate the protection if these changes were implemented?

3 responses



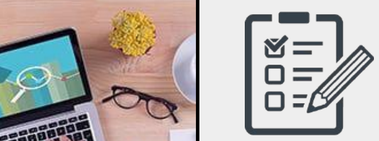

4) Both those who did and those who did not provide ways of improving the conditions within the college believe that there is room for improvement and potential to maximise efficiency and security. This can be reflected in the 100% 5-star rating in the event changes (named or unnamed) or applied. Nonetheless, this shows how the system is flawed in its current state but may be brought up to extremely high standards given the work is put in. I aim to reach these maximum potential standards through my design, whatever it may be. I plan to include the areas highlighted by my peers here and incorporate solutions to them in my design by adding them to my specification.

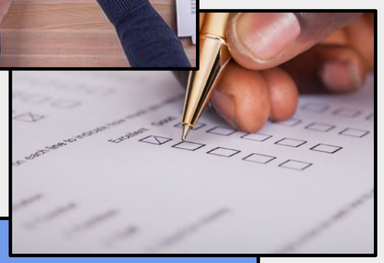
Are there any other points you would like to make regarding the PPE and protection of people on site? If yes, please specify. If no, leave blank.

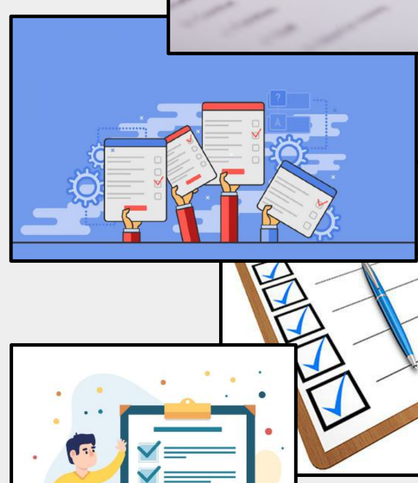
1 response

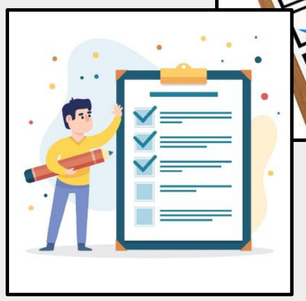
- needs to be more visable

5) On another note, it has been made clear that the visibility of products in the PPE industry may lack eye-catching qualities or any qualities which make them easily identifiable. This is of course an issue due to the fact that someone may completely miss a product that could save their own and other people's lives. Therefore, this is another point for me to include in the specification. I could perhaps add a sign which is visible from all directions which draws attention to the product whilst also educating those who notice it. This will be an area I should develop further within the design process yet something I will keep in mind until then.







## Key Points

Using primary sources proved to be truly effective in various ways. These include being able to cater my questions to cover the areas in which I require for my work in both numerical data and 1:1 interviews with extended answers. Using the data here I will summarise it and include it within my specification to ensure I am meeting the requirements of the consumer. These include proper instructions, visibility improvements, a hub for all things COVID / PPE sanitation and an ergonomic product that the consumer doesn't have to touch with their own hands or this can be catered for within the product by perhaps providing hand sanitiser.

# Research - Market / Product Analysis

## Introduction

In order to gain a greater understanding of ways that existing products solve similar design briefs, it is very useful to have a look at what is currently on the market. These items may be disassembled in order to see exactly how and what they're made out of to complete the task at hand. The best of these products may be made note of for later use in my product perhaps due to the use of certain materials or an efficient mechanism that very rarely encounters jams as opposed to an outdated older product which would encounter issues frequently to find the best of what is currently available to us and improve upon in many ways.

## Hand Sanitiser Bottles

These are typically found near the entrances of many rooms and establishments as a whole on a surface, whether it be a tabletop or a specific stand catered to making it clear that the product is there so it is used more frequently. Ordinarily, these are found in 250ml bottles or lower which at first appears to be a small amount yet when you consider that only a couple millilitres (maximum) are dispensed per each use if it has a push-down top, the amount truly goes a long way. Due to their small size, many may be placed across a variety of locations making them easily accessible and the prices are typically very reasonable considering the longevity of each bottle unless it is placed in an area with hundreds of people using them then it will of course need replacing, ultimately making them less cost effective than larger options.

Despite these good aspects, they unfortunately have an extremely negative impact on the environment due to the amount of waste coming from each bottle. Constructed from a PET plastic bottom and the dispenser caps of HDPE (High Density Polyethylene), these bottles are entirely recyclable yet many consumers fail in carrying out this task and allow them to go to waste and harm the environment by not correctly disposing of them.


Further flaws with this product come from since they are so oddly shaped, meaning mass transport is difficult and less efficient than if they were in a different mould and in most cases, people use two hands to produce the hand sanitiser from the dispenser cap. This is leading to many people touching the same surface which is of course a safety hazard, despite the hands being sanitised afterwards the consumer always runs the risk of missing a spot and having their hands still be contaminated. We of course do not want to put the consumer at risk with our product.


## Spray Hand Sanitiser Dispenser

Whilst the majority of hand sanitisers go about providing the liquid itself to the user to ensure they get the appropriate amount and most prevent any waste since they aim for all to go onto the hands of the consumer, these dispensers take a completely different route. Spray tops are used such as in some sun creams and cleaning products to cover a wider area in certain amounts depending on the distance the user is away from the source of the spray. These are typically chosen over other options in many products due to their ease of use and speed yet when it comes to hand sanitisers it is completely different.

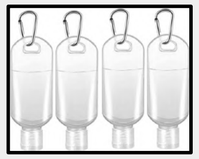
A minor inconvenience that comes with the use of spray tops is that it is very easy to get it on your clothing as the spread is rather wide and also varying amongst products meaning it is effectively always a gamble on how much product may miss the intended target such as the hands. In the event of a miss, some product is lost when sprayed on the consumers hands are they typically release much less sanitiser than the majority of liquid dispensers. Therefore, a large portion of the product could go wasted as well as a potential uneven distribution of hand sanitiser for the user, meaning some areas may go unnoticed and left contaminated, risking the health of the user. Unfortunately there is yet another health issue with these products which is in fact very severe for the people it may impact. SInce these are an aerosol based form of hygiene, the spray could cause many issues for people with asthma which may develop into asthma attacks that could become so bad, death occurs as a result. Therefore, these must be used only in certain controlled environments to maximise the safety for everyone involved.


## Sensor - Activated Hand Sanitising Station

For the majority of dispensers, the liquid inside is released by pushing down on a handle or the lid to either let gravity bring it down or have it be sucked up a tube to reach the exit, yet implementing sensors eliminates this need for any physical contact. The consumer will usually produce their hand underneath the dispenser where a sensor detects that they are there and consequently activates the mechanism to release the hand sanitiser. Already, it is sounding like a better system than the others available on the market as it removes this touching of potentially contaminated surfaces, creating and additional layer of protection for the consumer. Nevertheless, there are still issues with this method too.

Quite often, the user isn't notified whether or not the sensor has been activated meaning it takes a while for them to find the appropriate spot to do so, extending the overall time for the process. Furthermore, users may accidentally activate the sensor multiple times leading to an excess of sanitiser being dispensed, of course being wasteful as well as the possibility they have removed their hands from underneath and it falls to the floor, resulting in a mess caused by the confusion which doesn't ordinarily occur with other products on the market.

This product line surely does have promise, especially when considered to the other options yet it requires some fine-tuning to its design in communicating with the user ro notify them of when it is releasing sanitiser ahead of time as usually when the mechanism is audible, it is too late as they are already too far. Furthermore, since there are more components which are also more complex than a usual push-release mechanism, more parts are subject to break and repairs with prices being higher since a sensor is involved.

## Falling Mask Dispenser

As much as masks have very rarely ever had an appropriate dispensary system until recently due to the push form COVID-19, there has been quite a considerable gap in the market for a great deal of time which hadn't been taken advantage of until this year. Unfortunately, many of these products which claim to be safe mask dispensers are false since in order to receive a mask, you must grab it yourself whilst there are many others which you are potentially making contact with. Some improved designs include using gravity to allow masks to fall down to where they're taken from the bottom reducing the risk of making contact with the others yet not removing it entirely.

Clearly a dispenser for PPE should be as safe as possible and so if there is absolutely no contact being made when using a certain product, it has achieved just that. This may be done through using both the gravity system and some way of moving only the base mask to be produced slightly for easier access whilst being sheltered from external factors such as perhaps someone coughing and sneezing as this may contaminate the mask and actually increase the spread of disease.

## Glove Boxes

## Anti-Bacterial Wipes

These may be two different types of PPE used in defending against diseases such as COVID yet the majority of them come in the same form of dispenser-packaging combo. Simply a portion of the packaging is taken from the top section of the box which exposes the contents within which the user has to pinch and pull out from the box. Unfortunately, many things can go wrong with this style of packaging such as the difficulty in fitting fingers through a small space to then remove only a single piece of equipment yet many times multiple are revealed accidentally, contaminated all of them.

Moreover, contact is made with the packaging in both instances as the gaps are only very small and the packaging moves all over the area when trying to remove what is inside. Since this contact is made, there are further risks of touching a contaminated surface and so this is yet another product to put its users at risk. The anti-bacterial wipes are less of a hazard however, as they will most likely sanitise the hands of the user yet the gloves fail to do this and ultimately eliminate the purpose of wearing them in the first place as you are exposed to danger as the consumer before the product is even being used.


What really needs to be done about this form of distribution is a way of producing only one piece of equipment to the consumer if desired and reduce or even better, completely eliminate the contact made between the consumer and any contaminated surfaces.

## Aesthetics

In most industries, it is typical for the products to be very similar looking even if they're produced by different companies and designed by different people and this is because the market often has a particular 'look.' When this comes to PPE (part of medicine) the case is the same and often products look very similar as they follow the same general style. This will of course be illustrated in the mood board as I can clearly show an extremely wide variety of medical products there however I have included some here as well.

As you can see, they all have a very sleek and elegant look to them whilst maintaining white and natural shades as their main colour scheme. This is because white is often associated with cleanliness like inside of hospitals or other sanitary products as for white tp appear so nicely, it needs to be clean. Therefore, if I am to produce a final design under the medical nature, it is only right for me to follow these market standards as they're there for a reason: they show cleanliness. Furthermore, it will be easier to identify and dirt or medical threats on the surfaces if they're smooth as they'll stand out clearly from the smooth whiet background, indicating whether it is safe or not to use it as well as if it needs cleaning and maintenance making it an all around safer product.

Furthermore, the aesthetics can tell the consumer a lot as previously discussed since the colour scheme and colour coding could indicate which parts of the product to interact with. Moreover, any visible instructions also fall under the category of aesthetics as these could be through infographics, diagrams or simply just written instructions. As seen below, there are various ways of going around telling the consumer how to make use of a products function and these may incorporate the colour scheme as well to maintain consistency throughout.




## Key Points

Having looked at the wide ranges of existing dispensary methods on the market, I have really received an insight as to what can help a product succeed in serving its purpose, as well as what can make it fail. Ultimately, I'll take both into consideration when designing my product to counter any products which arise and prevent the rest from occurring from the very start. Furthermore, a range of PPE has been discussed here and I shall take it upon myself to prioritise the equipment which makes the greatest impact in protecting the consumers as therefore the space used will be used to its maximum potential in removing or wasting any room on unnecessary items to prioritise those which really do matter.

# Research - Product Analysis - Dismantle and Tests

## Introduction - Product Analysis and Selected Products

For this section I have selected 2 separate products similar to the one I will pursue in design as these will allow me to investigate the individual components of each part of the products to later use for my own, perhaps in different iterations or simply refined versions. These include:

1) Wall mounted reusable hand sanitising station
2) One time use hand sanitisers

(Key points may be found on a later page)

## #1 - Wall-Mounted Reusable Hand Sanitising Station

I decided to venture out into the college in search of my 3 required products and discovered the wall mounted permanent hand sanitisers first. I questioned the head caretaker and they used a key to open the top of the dispenser. This first one (yellow border) however was unfortunately full and this proved to make examining it particularly difficult since the liquid restricted my vision through to the mechanism. Upon doing this, we went to a storage room containing empty unused shells (blue border). I studied these and pictured them and discovered that it was a spring and user force operated system, meaning that as the user pushes in the spring compresses and forces some sanitiser out for use. This sanitiser is placed into the box section and is easily refillable in theory yet spillages are frequent and waste is high due to the difficulty of the process, often requiring multiple people to complete.

### Function

There is a lever / push system on the front face of the product which the user pushes with their hand allowing sanitiser to fall on it directly. In the event the consumer uses two hands for it, this will not pose any problems but the option for one handed use is so smooth and seamless it makes the product very user friendly. The mechanism is somewhat complex, consisting of the front lever / button (as mentioned before) which compresses the spring and releases the sanitiser through a whole at the bottom using the pressure generated.

### Materials

Constructed from various ABS components which are secured together using screws, nuts and bolts, this dispenser has been built with materials that will stand the test of time due to the selection of such materials. ABS is a high-impact resistant material that is capable of withstanding great use and not losing its form.

### Aesthetics

This particular dispenser has a style which is very common in this industry, consisting of bright colours, curved edges and an overall sleek and ‘medical feeling’ design. These qualities allow it to fall into the hygienic product category and so even if its a product the consumer hasn’t seen before, it can still be recognised as a hand sanitiser which is truly beneficial in having people use it in the first place instead of being confused. Additionally, there is a slit down the centre of the front face which gives the user the bare minimum of information about how much sanitiser there is remaining within. Ultimately, this appears to be an aesthetic stylistic decision instead of being functional yet the product would be better if it served both of these purposes.

### Build Quality

Whilst this may only be constructed from thin pieces of ABS and held together with screws, it is clear the product was made with quality in mind since it performs as desired and can withstand a good deal of force and strain. Even the one seen pictured above has seen much use in college over the course of roughly four years and is showing little sign of wear or deterioration. The mechanisms continue to function and overall it is successful in fulfilling its purpose.

### Dimensions

The product has been designed with the average human anthropometrics in mind which have been catered to within the design to provide a fluent and ergonomic use for the consumer. The dimensions used to accomplish this are a total width of 15.5 cm, a height of 19.5 cm and a depth of 10 cm. The handle has been designed for the average hand and is 5 cm high by 15.5 cm wide.

### Shape

Separated from the main body of the sanitiser, the handle may be found at an angle from the rest of the design. This results in the shape being crucial to the designs aesthetics and functionality by indicating to the user that this is what must be pushed in for the product to work as is made obvious by standing out from the rest of the design. Furthermore, this provides additional qualities to the physical appearance of the product by having additional edges and pieces on it.

### Location

The product has been appropriately placed at the correct height for most consumers ease of use. This is at the optimum measurement of 80 cm from the floor, along with the placement in high foot traffic areas within the college to maximise utility. The placement of a product has a direct impact on its utility and this is an example of it being done correctly which I should keep in mind for my own designs.

## #2 - One-Time-Use Hand Sanitisers

These can typically be purchased for a relatively low price yet will not last as long as a traditional dispensing station due to the smaller volume and one time use and lack of refill capabilities. Due to their small size, low cost and simple design, these are more often used as personal dispensers as opposed to wall mounted dispenser systems as seen in the other section.

### Function

The user can dispense liquid using one hand if its secured on a surface, or two hands as one will be necessary in holding it properly. The consumer pushes down on the lid at the top which causes suction and pressure in the tube which reaches the base. This then causes the liquid housed within the container to be pulled into the tube and up to the lid at the top. Since the valve / door is now open, the liquid can simply exit the tap like top for access from the consumer.

### Materials

Polypropylene is primarily used in the design, mainly for the bottle itself and then smaller plastic components such as the lid are constructed from the likes of ABS and other strong plastic materials. Nonetheless, polypropylene is an appropriate choice for these bottles due to its ability to be blow molded not just for the shape as a container but to also improve its properties in the stretching properties. Polypropylene may also be recycled as it is a material that can stretch, unlike plastic bags and others alike this, of course making it a more desirable material than other options.

### Aesthetics

Despite being a cheaper product by a large margin in comparison to the permanent wall mounted products, this dispenser does not let cost impact the general aesthetics of it. Instead of a simple box design that may be expected for something of this price range, the product consists of many curves and sloped edges, giving it a very sleek look which is often associated with medical and hygienic products such as these. Aesthetically, this product also works alongside functionality since a clear material is selected for the base of the container, indicating how much liquid is left inside. The lid has a contrasting approach by using a bold, solid white colour to indicate to the consumer that it is usable and not all seamlessly a single piece.

### Build Quality

Once again, despite low prices this product manages to perform very well. It must be noted that the material selection and production processes were catered to this products size and purpose appropriately to maximise performance at a low cost and this is evident when simply picking up the product and using it for a very short period of time. It is rare to find products of such a high standard at a cost like this but due to the low cost of polypropylene and polymers, it is possible here.

### Dimensions

Dispensers like these can be bought in large quantities and may have different volume options, arriving already full unlike wall mounted ones that must be set up by the consumer. In many ways these are more appealing for the average consumer since they are small and can be taken with them as a personal dispenser whereas wall mounted systems are provided by facilities instead of by the consumer. This one in particular is 14 cm tall and has a diameter of 6.5 cm, yet as previously mentioned, they may be bought in countless sizes from different companies.

### Shape

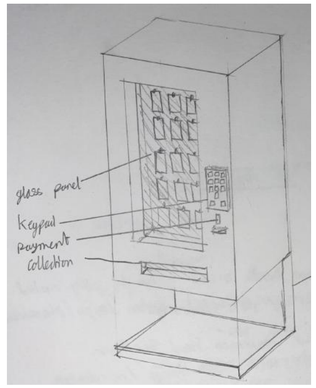
On the lid, there is a curve to make gripping it / placing a finger in this slot easier to have more strength for dispensing the liquid based on the angle it is on. Small features like this are what makes a design truly ergonomic and are crucial to producing a successful product. On another note, the general construction of the hand sanitiser is a cylinder that as it approaches the top comes to a more narrow diameter. This is to accommodate the lid which is secured here as it needs a place to be fitted to.

### Location

These can be found in almost every room in college due to the freedom with moving them around easily and placing them wherever can house them. This is as simple as a flat surface such as the floor, a table or really anything that is not uneven. This is essentially the most freeing form of dispenser apart from ones provided by facilities yet with this product, the consumer doesn’t need to depend on anyone else, consequently making it even better.

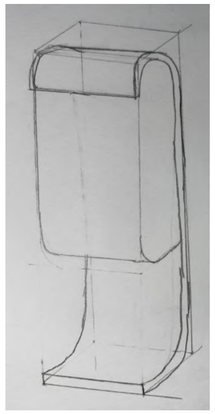
# Design Development - 1

## Initial Idea

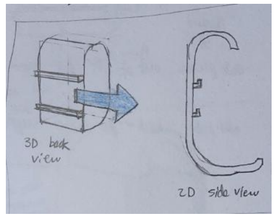



The initial idea consisted of a very basic shape for the product body and a flimsy stand, with the components simply placed onto the front face of the product. How can this be improved?

- Remove sharp corners / edges
- Consider the medical theme
- Rethink the stand, something with a stronger / less brittle build



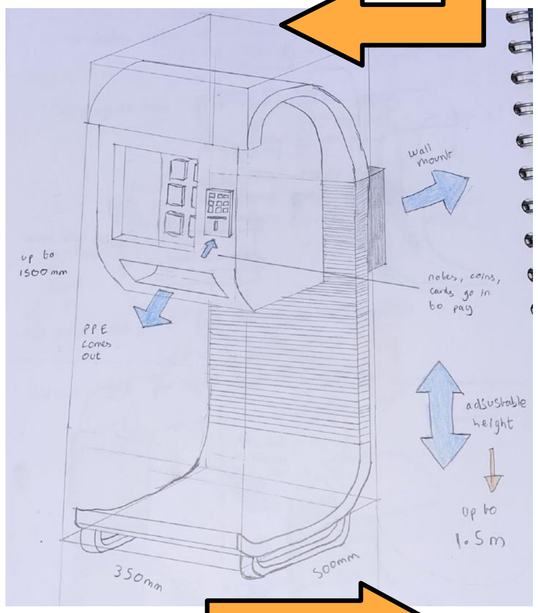
How is this dispenser fitted? Permanent or temporary fittings? Are they screwed in, moulded into the product or simply slide in? SLIDE IN would be easiest, fast and cheapest option. SEE BELOW

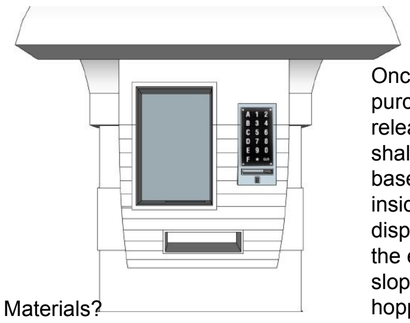



When I think about a dispenser, the image of a vending machine comes to mind, as this is the most common dispenser seen in our everyday lives. They're functional and ideas for businesses as the consumer can clearly see the product they wish to purchase and they simply insert the money, select the item and collect it whilst providing a passive monetary gain for the business.

How is the PPE refilled? Does the product need dismantling? YES - Deconstruct by sliding the product out and open the top to reveal the dispenser mechanism

CAD Adaptations? These will give me a greater understanding of the mechanism as well as precise dimensions



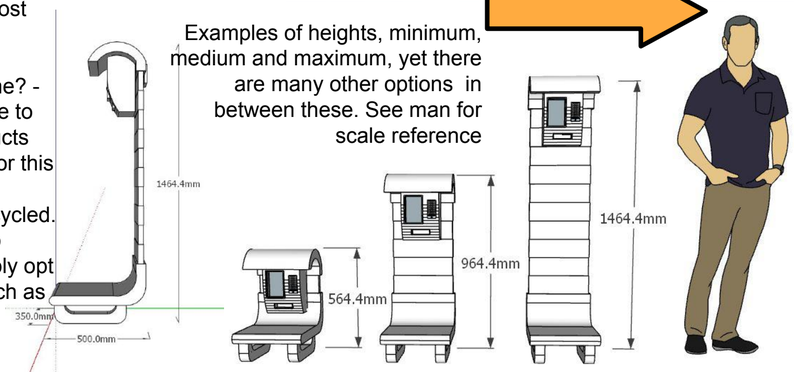



Once items are purchased and released, they shall fall onto the base of the inside of the dispenser where the edges are sloped like a hopper to lead them to the collection area.

Materials?

1) Aluminum - too heavy and expensive - Potentially use for the stand as a metal will most likely be required for the strength
2) High density polyethylene? - too flimsy and won't be able to support dispenser or products
3) ABS - strong and ideal for this product, can be injection moulded, can be easily recycled.
4) Clear panel - glass? Too expensive and heavy, simply opt for a clear plastic panel such as ABS as mentioned before

Examples of heights, minimum, medium and maximum, yet there are many other options in between these. See man for scale reference




## Introduction

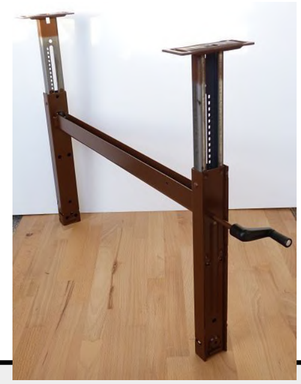
In order to reach the best final design, the initial ideas and sketches must be taken further through the design development section. Some sketches have been selected and brought over to these following pages and improved upon whilst taking additional points into consideration such as the pros and cons of the designs and what materials shall be used leading to the moral and social factors as a result of them.

## Model

Before constructing the card model, I constructed a basic mockup on SketchUp (CAD) (as seen to the left) to give me an idea of how I shall go about constructing the model without risking any wasted material to then be later cut and assembled in person. Upon construction of this model, it became clear to me that the stand wasn't the appropriate shape or weight to hold the dispenser above securely. Therefore, the shape must be changed to account for this or the base should have a mass added to bring down the centre of gravity and improve the overall balance. A further point to be made is that the feet would be under additional mass,posing the risk that they would become damaged and they could potentially be removed altogether if the product is capable of balancing on the flat bottom, also saving materials.

## Research - Adjustable Height Mechanism

When considering the various mechanisms used to adjust lengths and heights, a few come to mind such as adjustable locking systems as seen on rifles due to their great sturdiness. Unfortunately, these systems are only for fairly short ranges but they can be altered by having a long metal rod (perhaps steel or aluminium) with holes cut into it where screws may be inserted to support the product at that particular height. Unfortunately, these are more time consuming to change when really a fast change is needed. Perhaps a mechanism that requires holding down a release clip / handle which will then allow the product to slide up and down vertically. This will of course be a risk as many people could be touching the same surface but the hand sanitiser should counter this. Moreover, handles that can simply be held to lift the dispenser up and down in the stand would be perfect especially if they are long enough to be reached by all users.



## Against Spec

- Products are paid for, therefore neglecting a very important part of the spec which requires altering
- The cost to manufacture a product such as this one would be particularly high due to all of the mechanisms and electronic parts within
- The product falls within the desired dimensions in all stages of its use as the maximum height remains under 1.5 metres and within the 1m x 1m base area
- As the base may need to be weighted to prevent balance issues, the product may exceed the desired 7.5kg depending on how much weight is necessary to lower the centre of gravity. Extensive research must be done on this and overall materials should be considered.
- As the product can contain every type of PPE, it caters to the specification as they're all available
- Unfortunately, the process of using the product may not be fast as desired since it requires payment, selection and collection
- The clear panel shows the consumer how much PPE is remaining, just as wanted in the specification

## Strengths / Weaknesses

It is imperative to assess the strengths and weaknesses of the designs in order to find any particularly crucial flaws or areas of further improvement, as seen below.

| Strengths | Weaknesses |
|---|---|
| - Very modern and sleek design, fitting in with the medical aesthetic / theme<br>- Adjustable height allows for users of all sizes to access the product as well as the mounting systems used, the product shall be located in countless areas<br>- This product can be fitted with a wide range of PPE<br>- The dispenser can be switched out for other dispenser as long as the fitting system is prevalent on both products<br>- Easily adjustable height by simply lifting up or pulling down on the dispenser to bring it to the desired height<br>- Can have the colour scheme be adapted to any area it is placed in due to the ease of changing the material's colours during production<br>- As vending machines are seen and used by many, it'll be clear to them how to use this product with no prior knowledge | - Have to be refilled with PPE (although every dispenser will require this)<br>- Weight in base bring up cost and overall mass, leading to potential health and safety risks<br>- Expensive setup as keypads, card and money readers are very expensive, especially when compared to other dispenser methods which use other factors to help with the flow of the product such as gravity<br>- Each product inside would require its own individual packaging for maximum hygiene, leading to great amounts of potential waste and harm to the environment if not recycled or disposed of properly.<br>- The dispenser must be removed from the stand to be refilled, adding another step to the refill process and so it would be better if it could simply have the front face removed to have access instead.<br>- There are very few instructions or branding and so these should be added |

## Social / Moral

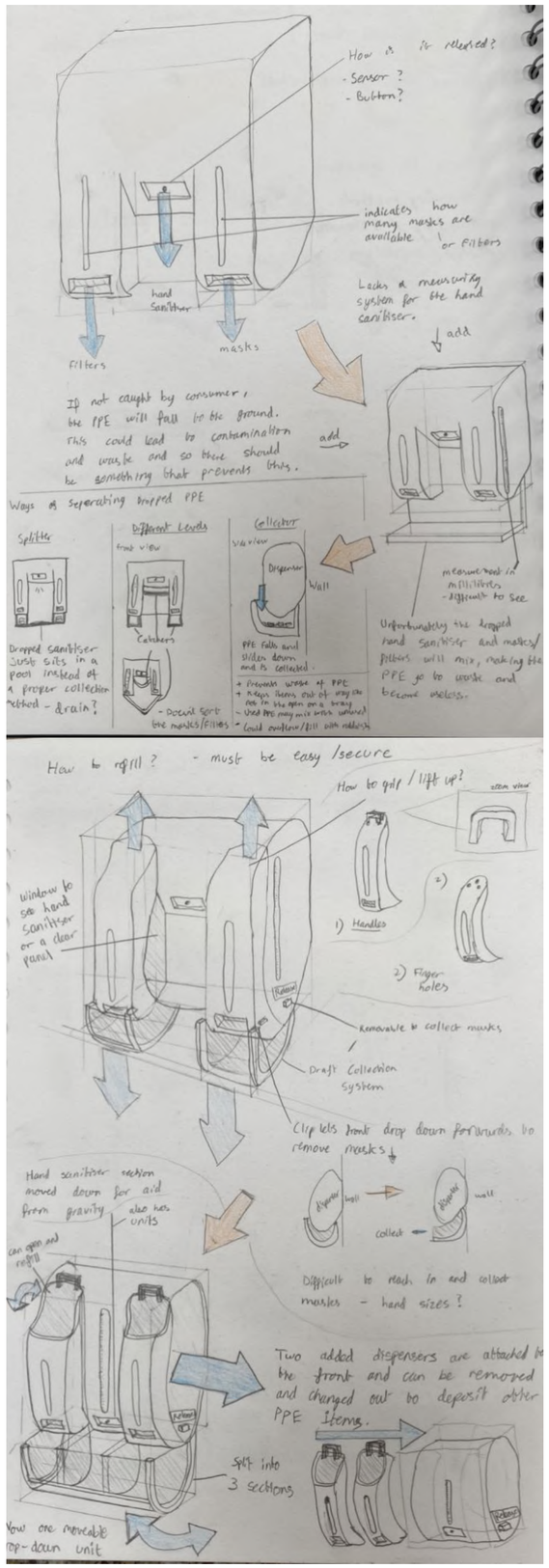
In the current climate of a COVID-ridden world, many families have run into financial issues for various reasons such as perhaps through the loss of jobs. Therefore, it becomes increasingly difficult to provide most things for their families and something as crucial as PPE should be free since it is used to protect the user. To even think of charging someone for not only their own safety, but the globe's safety is horrifying as this may even be seen as a way of people capitalising on others suffering and so this product is the embodiment of that very thing. Therefore any monetisation factors of the product should be removed in order to provide a one-stop hub for the consumer's protection, completely free of charge.

In terms of materials, ABS is a perfect choice for most parts of the product as it is easily recyclable and its injection moulding freedom. The heavier components such as a weighted base however will increase pollution during transport as more energy is required to move greater masses, potentially leading to factors such as global warming, which must be avoided if possible.

# Design Development - 2



## Initial Idea




I started off with a rather basic and traditional shape resembling that of the current dispensers used with an additional dispenser on either side. These included filters and masks, opening the product up to a wide range of new possibilities. It must be noted however, that the dispensers on either side are fixed and do not have a clear way of refilling them. Despite these mask and filter areas having indicators as to how many are left, the sanitiser is lacking in this area and so it should be improved upon later.

A common issue that occurs when using this style of dispensers is the amount of waste due to product falling to the floor or other surfaces, having not been caught by the consumer and so I considered 3 different ways of countering this common fault. Ultimately, I settled upon a 'catcher' which acts as a sort of tray to prevent items from falling to the ground. They will now be collected in specific sections as dividers are used to separate them for easier replacement and collection.

These side dispensers may now be removed as as way to open up other parts of the product to be more easily accessed, repaired and cleaned as well as the possibility to add other dispensers for other items or simply leave the base on its own as a sanitiser dispenser. The method of attachment is still unclear as there are many methods of doing this yet to be explored.

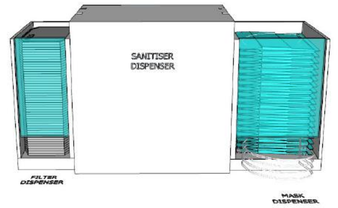
The catcher system beneath the main product can be released using a button on the side that allows it to swing down for further improved access to the products. Now the additional dispensers for masks and filters can have the top removed / opened up to reveal the internals where more products can be placed and refilled.

Another section of the catcher has had a sanitiser section and the sanitiser dispenser has been moved down for the aid of gravity and a reader has also been included.

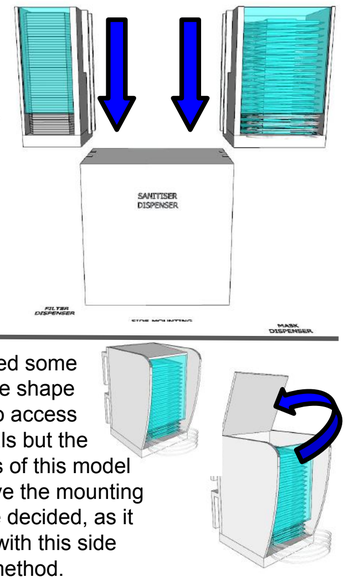
## CAD Adaptation and Development

In order to construct a scaled CAD model, it is crucial that I have the appropriate dimensions for the products used such as the filter and the masks and so I took a range of masks and selected the largest one (accounting for the extremes / possibility of large products) and measured that one and converted it into CAD. Additionally, I did the same with the filter, as seen here:

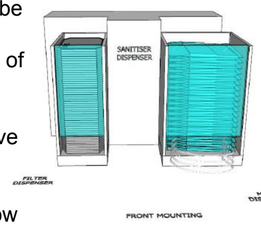

The main reason that I am taking a route involving CAD here is because it allows me to experiment with the various ways of mounting the additional dispensers as it is far easier to manipulate and easily change the shape compared to a drawing as well as the ability to view the product from many more angles. Firstly, I experimented with mounting the additional dispensers on the side:




Whilst the positioning is adequate, the way of which it is attached is still up for debate and so I added long strips for insertion into the main body:

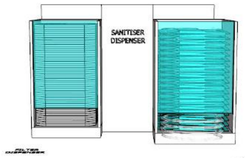



It is always important in the design process to experiment with the various ways of doing things and in this case it is the placement of the dispensers. Therefore, I placed them on the front this time.



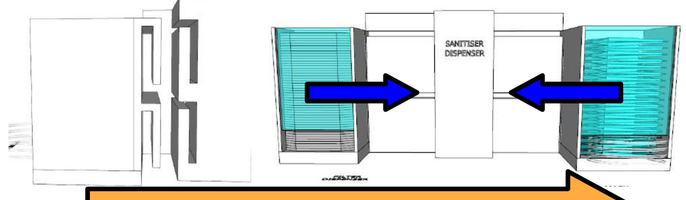

I find this arrangement to be not very aesthetically pleasing due to the sense of symmetry that is lost with the dispenser being sized differently. Moreover, I have filled the dispensers with masks and filters to simulate / demonstrate how it may look during use.

Could injection mould with HDPE for main body and clear panel - avoid use of glass




As previously mentioned, I found the design to be slightly irritating and so I rotated the filter dispenser (on the left) to display the filters lengthways.

Here you can see a new mounting system, this provides a great amount of support and due to its layout, needs to be slid in from the side as seen on the image following this one.




I then added some detail to the shape and a lid to access the internals but the main focus of this model was to have the mounting method be decided, as it has been with this side insertion method.



## Social / Moral

This product will most likely be constructed out of ABS and other impact resistant, high strength plastic due to the nature of the design and this is a recyclable material. This is of course beneficial to the environment yet there is still damage done to the environment through the process as a whole and so reusing old ABS / materials would be ideal both for the environment and the cost of new sheets.

On another note, the design isn't very accessible for a very large audience. This is especially apparent in the way that there are small, hard to access gaps to reach for the products. This can be very difficult for an ordinary consumer yet other people may find it even more difficult and ultimately have the products be inaccessible to them.

## Against Spec

Unfortunately this design doesn't cover all areas of the specification such as how it doesn't fit entirely into the aesthetic of medical products in the industry. The curves and complex shapes seen in the early sketches reflect a closer representation of this style yet the CAD model is lacking this. Perhaps the design above could simply be used as reference for the mechanism and act as the shell / base of a more complex design to later be constructed.

On another note, the product in the design houses clear panels at the front which provide excellent views to the remaining items inside as a clear indicator to the consumer, just as desired in the brief. I would have to do some additional research into exactly what material to use to prevent this from fogging up / decreasing in visual qualities over time.

Furthermore, my product doesn't have sensors in this iteration of design and contact would be necessary for taking the products which is a big factor of contamination which must be avoided. I suppose I could counter these risks to a degree by having hand sanitiser in one of the other holders yet multiple layers would be required if this is not a 360 degree system and is instead wall mounted.

The design has some successful features but could be catered to the spec even more.

## Strengths / Weaknesses

Strengths

- Easy access to refill - do not have to remove the additional dispensers to refill as the lid may just be opened up

Weaknesses

- Unclear to the consumer as to how they should use the product and when combined with the complex and unique design it may lead to confusion
- No clear way of replacing the sanitiser
- Complex shape would require difficult manufacturing methods - injection moulding could counter this yet other methods may lead to a lot of waste of material, cost and time

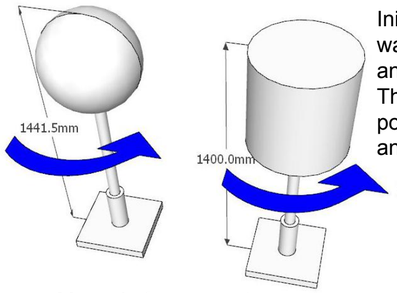
# Design Development - 3

Selected for Further Development

Ataraxi

## Initial Idea

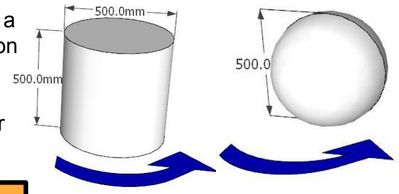
The changes made across the products life may be seen below along with explanations for why I have altered them in certain ways.



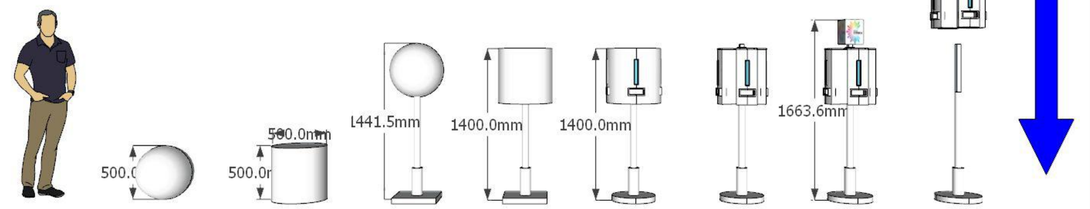




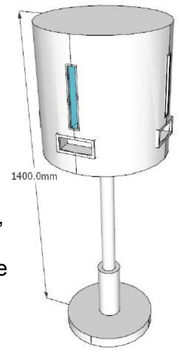
Initially I toyed with the idea of having a spherical design as a way of innovating within the dispenser industry yet production and designing would be truly complicated and wasteful. Therefore, I kept a similar idea in mind and opted for the possibility of using a cylinder instead as this is much simpler and possible in comparison to the entirely spherical route.




Below, the entire progression of the design may be seen due to all being constructed on the same file in a row.

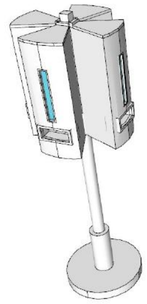


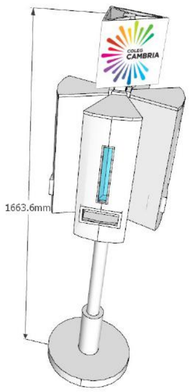

My main focus was to produce a dispenser that was capable of accommodating consumers on all angles as a 360 degree option. The product was placed onto a stand which I plan to allow the mounted product to rotate in all directions, as shown by the blue arrows (which indicate movement).



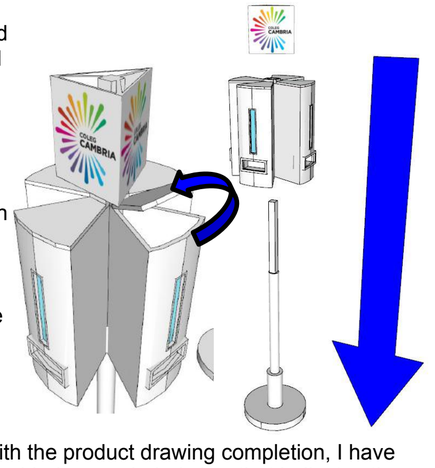

With the removal of the option for the spherical product, I entirely focused on the cylinder and began adding the dispensary systems. Four separate dispensers are located on the one horizontal face of the cylinder which shall accommodate various types of ppe and hand sanitiser with clear panels indicating the remaining quantity inside. Furthermore, to cater to the aesthetic chosen within my specification, I rounded off the stand, adding yet another small detail to what was an otherwise particularly lifeless product.

Having the product be constructed of a single cylinder would be rather wasteful and restricting for the design and so I split it up into 4 segments, one for each PPE dispenser. These can be attached to the rotating pole in the centre and so it is now easier to rotate the dispenser to the desired PPE whereas with a smooth cylinder, it is much harder to to grip and so these separated segments counter this. Moreover, the option to have removable parts opens the product up to so many more possibilities and freedom, which is ideal for every product in which this is possible. If this can be maintained throughout the design and included in the final product then it will be truly beneficial to the consumer to customise it to have it e best adapted to the area of which they place it.






It is crucial to have the refilling method be accessible, quick and easy for the consumer as stated in the specification following an interview with a potential consumer, therefore the PPE can simply be inserted through the top as seen here, using gravity to fall down to the section of which it is to be collected by the user. This may also be used for sanitiser or a seperate container could be placed inside with the majority of the product composing of ABS.



Whilst many changes and advancements have been made on this design, I added the college branding to the top of the design as a way of indicating how it may be used for instructions or advertising by using a simple 3 sided sign of appropriate size for reasonable amounts of information to be applied.

With the product drawing completion, I have provided an exploded view that indicates the individual components to demonstrate assembly and freedom.

## Card Model

In order to further understand and experiment with the construction of this project / design, I modelled out of cardboard a version which is correctly to scale of the CAD drawing. I found that more support could be given if the supporting tube of the main stand was dug into the base as this held it very securely and could also be removed with a little force to allow for easier storage and transport if necessary, further catering to the consumer's needs. When creating the circular base, I found the centre point and drew out a circle with a compass of 20 cm radius and cut the side panel out to the correct length of 126cm using 2 x π x r as a way of finding the circumference as well as it being 5 cm in thickness. The additional dispensers would simply be placed on top and are capable of rotating 360 degrees which is why the circular beam was used.

## Against Spec

- This dispenser is capable of housing up to 4 different types of PPE meaning that the prioritised options may be taken and had in multiple quantities across dispensers as this design provides freedom to choose what to have in each separate area. Ultimately, this caters to the specification appropriately in this regard yet hand sanitiser could lead to problems due to a different form of dispensary required.
- This product can be positioned almost anywhere and opens itself up to use across 360 degrees and so this definitely caters to making itself available to the consumer, as noted in the specification.
- The height of this product exceeds the listed measurement in the spec of 160cm as the stand, dispensers and sign result in an overall height of roughly 166cm. This could be easily countered by bringing the height of the dispensers and sign down by having a shorter stand which would also prove to be at the appropriate and accessible level.
- This product is not wall mounted and it doesn't have that option as of yet but I could definitely create panels to attach to the wall desired which have the same slots which the dispenser fall into and rest on yet this would eliminate the 360 degree capabilities, being one of the unique selling points of this product in particular.
- My product is not exactly very easy to clean in the sense that accessing the internals can pose to be a problem. The top doors are blocked by the sign and so that would have to be removed for maximum access.

## Social / Moral

The fact that the product can be accessed from all angles means that it can be used by multiple people at any one time, even up to 4 and above when queues are considered and so this brings people closer together and they may not follow the rules of social distancing. Therefore, this must be altered or regulated and so perhaps large clear screens could be put up which separate consumers when using the product for maximum safety.

Moreover, the use of ABS involves injection moulding and this process is not entirely good for the environment so other options in terms of materials and manufacturing should be considered such as having specialised hand made parts as this could bring down any negative impact the product or its creation has on the environment and world around us.

With these slight improvements, it would be greatly improved.

## Strengths / Weaknesses

Strengths

- Includes an information board / blank space open to branding, instructions and many more possibilities.
- Rotation allows ease of access for consumers.
- 360 Degree design allows the product to be placed in the centre of a room as it accommodates users from all directions.
- Multiple people may use the product at any one time whilst exercising social distance, as long as they are stood on opposite sides.
- Can be customised as the parts are removable and simply fall into place making changes fast and efficient.

Weaknesses

- Due to the information centre above the dispensers, the doors used to access the internals open to only about 30 degrees, making them particularly annoying to the consumer due to it being so difficult to refill the PPE without removing the sign. Perhaps the sign could be placed elsewhere?
- Without a locking mechanism the dispenser may simply be lifted off the stand and so this must be accounted for.
- Lubrication and maintenance will most likely be needed for the rotating parts.
- The dispensers get thinner as they stretch on, making them fit PPE awkwardly.
- The stand is not adjustable and so the dispenser is at a fixed height.

## Key Points

With 3 products thought out, sketched, developed and assessed, I have explored many possible areas for improvement and even potential paths to take the product down in the future for maximum success in all possible areas whilst satisfying all needs of the consumer and the specification making this a truly effective way of making progress with the designs.

# Design Development - Modelling



**Used**

1) Masking Tape
2) Scissors
3) Cardboard

## Gravity Orientated Dropper System

Upon review of some of my CAD drawings I have used a form of dispenser which uses gravity to help replace the recently dispensed items. Therefore, I would like to experiment with this using a model as seen in the following images: Moreover, there are two different ways I may have this vertically positioned as one is a flat bottom yet another is sloped. The sloped could make access easier but also unwanted masks and other internals may fall out unexpectedly.

It goes without saying that without a front panel it would be almost impossible for the contents to stay in position and not just fall out and so I added a front piece which should counter this. One thing to note is that card has been used here yet a clear panel would be much highly desirable as this shows the consumer and even people refilling it how much it contains. Unfortunately, depending on the material chosen in a later design this could raise costs but could be experimented with in ways of saving money and materials, perhaps by having only a slit being clear with less vision as a price.

Products can be found in sorts of positions and locations, henceforth it should be considered that the product may not be vertical but instead be horizontal, perhaps on its side or its back and the design should be catered towards these possibilities. Furthermore this could mean the product has to be altered in other ways such as the mounting methods and positioning yet for products to be 'pushed' into the consumers access points, an additional mechanism would be needed such as a spring yet further maintenance and issues come with this which don't come with a gravitational system.

In terms of refilling the product, typically I used the method of removing the top as a lid and having it be a door system but even this can be experimented with such as by removing parts of the back as the contents can be slid in horizontally instead of dropped vertically making the alignment more accurate in some ways.

I decided to experiment with the way products are dispensed with the steeper slope. This proved to be a difficult task as with such a smooth surface the items just slide out and onto the floor and so this could be countered with added friction. Unfortunately this could be counterproductive since if a surface is too bumpy / sharp it could damage the dispensed products and have a negative effect on their protective properties. Therefore I proposed the use of a shelf that the products rest on with a slit to reach into and pull them down as seen in the image (numbered 1). Another approach is to use a stopper at the bottom which catch the products (numbered 2) yet once these build up they could simply fall out far too easily.

The attachment method is crucial to the products strength and flow for countless reasons and so I plan to experiment with the idea of a rotating hub that the individual product dispensers are mounted onto. One potential issue with the rear mounting could be that it has less support due to the rear refilling access door depending on the way it opens and locks i so many of these combinations should be with as well as the tension depending on t what is deemed to be safe, yet it is rather this point.

## Simulating Refilling and Use of Product

In order for the dispensers to have actual products in them, they must be refilled in preparation for later use by the consumers. This may be done by accessing the rear door or the lid. The process of these can be seen below as well as the advantages and disadvantages to demonstrate that there are countless ways of going about a certain part of a product.

Top Lid

Rear Door

1) Open the lid

2) Drop items in

3) Shut lid

4) Collect products

\+ Fast
\+ Easy - just drop products through hole
\+ Don't have to remove product from hub
\- Products don't fall into correct place

1) Open the rear doors

2) Place the items in

3) Shut doors

4) Collect products

\+ Much easier access to inside of product and not restricted like with the lid
\+ Can fit more products
\+ Products are aligned perfectly
\- Takes a large amount of time and products are placed individually
\- Have to remove product from hub to refill

## Research and Further Exploration of Dispensing Methods

With the existing system mentioned on this page, the products would need to be removed and placed individually inside the system, contaminating them, increasing time to refill and causing frustration with the finicky nature of the task. It is crucial that if an improvement may be found, it happens as early on as possible in order to aid the design process in the best way possible and shape its future:

The majority of each individual PPE product comes in a form of dispenser. These are often left around on tables at entrances to rooms and entire buildings and are far from perfect. However, taking the products directly from these saves an immense amount of time and increases hygiene and safety, henceforth it would only make sense to utilise this in one way or another.

I measured the 3 existing PPE dispensers available to me and found that they are all of different dimensions except the widths are extremely similar. Further research into the dimensions would be helpful as I could find the most common or even standardised sizes for these products if any exist - unfortunately there is no such thing as standardised sizes thing as this in this industry. Instead, I should select the exact products I chose to include in the dispenser and ensure that they will not change the design and dimensions of them and so I can base my product around these. Furthermore, there could also be different dimensions for different products and this must be considered.



| Item | Length (cm) | Width (cm) | Height (cm) |
|---|---|---|---|
| Face Mask Dispenser | 19 | 10 | 8 |
| Antibacterial Wipes (Orange) | 21.5 | 12 | 7.5 |
| Antibacterial Wipes (White) | 20 | 10 | 3.5 |

Combinations of the products and their arrangement is diverse and open to experimentation for what is the best for the consumers.

# Design Development - Modelling

## Research - Dispensing Methods

As seen on the previous page, I have conducted some research into how different types of PPE are dispensed and these were small individual pieces (typically dry) yet this is quite the contrary to hand sanitiser which I also plan to include in the system. At this point I know very little about how this is provided to the consumer and so I will look further into this area:

**REFILLING**

Typically, hand sanitiser is found in a bag to replace the old bag once it runs dry (see included image). This can be done by simply opening the access door, disconnecting and lifting the old bag and placing the new one and connecting it to the system found inside.

Instead of a bag, some systems may use a more structurally sound method such as a form of lightweight transparent polymer as this can confirm to the dispensers body much better than a bag, capable of slouching and being easily punctured.

**DISPENSARY**

‘Squeezing’ the container to force the sanitiser into the access of the consumer is one method of dispensing the contents. Typically this is found in smaller systems where the pressure is applied by the user yet it could be possible in a larger system provided experimenting with this takes place. Foot operated systems are also very plausible for success.

Gravitational systems include having the sanitiser in a funnel system with a door that when opened releases the product to the user. This can be triggered by sensors or by manual methods such as pushing a lever to move the door.

Amount of product can vary depending on the system such as having it be released in controlled amounts so that one action supplies the user with the optimal amount or how long they hold the button or how many times they activate it.

## Research and Experimentation - Dispensing Methods

Foot operated systems are very appealing to me as they eliminate a great deal of risk that comes with the contamination of surfaces touched by our hands, making it much more hygienic and ultimately safe for the consumer. It would be truly effective if I can include this in my product.

Initially, I toyed with the idea of having the hand sanitiser be alongside the other PPE on a rotating piece yet this could be very problematic. Instead of many small levers, a large disc part of the circular base could pull down the lever operating system of each of the sanitisers. Unfortunately, this would cause every sanitiser to release liquid all at once, making it only effective if they were all being utilised at the same time which is incredibly unlikely and could lead to a great deal of waste.

SOLUTION? - separate floor levers / steps, one for each dispenser which stays in the same place. If it was to move with the rest of the system, the mechanism may become misaligned and need adjusting for it to appropriately dispense the product, making it far less ergonomic and more time consuming.

If the sanitiser was stationary and on a different / lower level than the rotating PPE sections this would eliminate many of these arising issues. Moreover, the pressure plate of the foot operated system usually is seen as being particularly narrow in other systems and so if it was extended to be as easy to access as possible, any potential difficulties in this area would be no more.

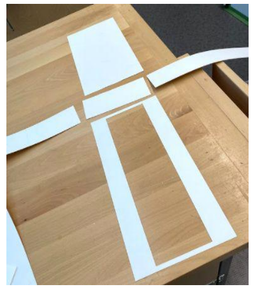
## Modelling - Updated Shell

**Measurements** (Space Required Inside + 1)

- 22.5 cm length
- 9 cm depth / width
- 45 cm height

Individual Pieces:

- Base = 22.5 cm x 9cm
- Lid = N/A as it’ll be card for temporary use
- Sides x 2 = 9 cm x 45 cm
- Back = 22.5 cm x 45 cm
- Front = 22.5 cm x 45 cm but with middle taken out for access



I used the measurements found above to create a flat packed version of the product with the individual components to be cut and assembled. I first made this out of paper as seen above.

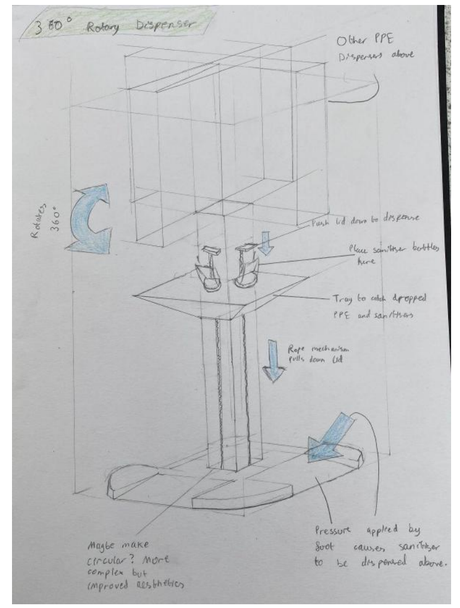
**After making paper model**

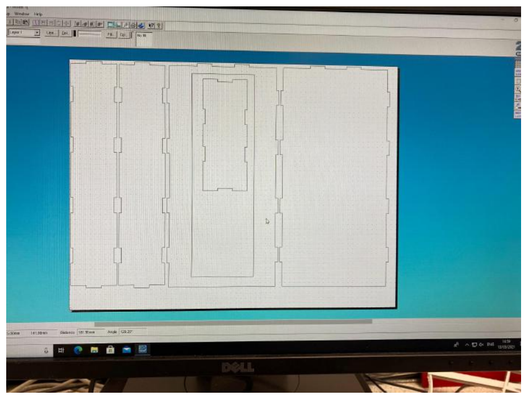
- Some parts appeared to be the incorrect height but that was simply because the paper had sloped down leading to inconsistencies in the dimensions.
- Masking tape was used but this proved to be too weak and so for the next model I should opt for stronger tape.

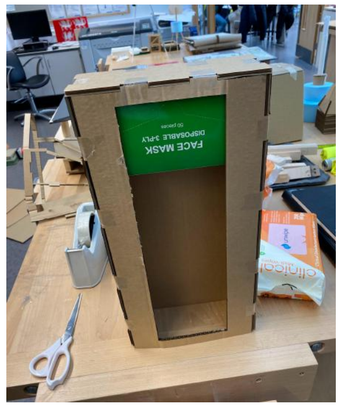
**Cardboard Model**

Following the process of the paper model, I felt it was time to refine and improve the design and translate it to a stronger yet still cheap material as this would give me a better idea of the final product and its design whilst still being a cheap option. I added some finger joints to the drawing and sent the new drawings to the laser printer:

## Dispensing Methods Sketch





**After making cardboard model**

I forgot to remove some finger joints on top of the side pieces and so I should remove these for the next iteration of the product. Finger joints were very good but slightly off due to thickness of material varying, which could lead to later issues in product development if I opt for different materials.

After PPE packaging was placed in I noticed it was a very tight fit and the card was gradually stretching out indicating that it wasn’t deep enough to house all products of that size. Furthermore when they are taken out the products can prove to be very difficult and in a tight fit making them frustrating to remove as seen by the image here where the dispenser was placed vertically and the box stayed inside.

Also see the packaging for these masks, sometimes when they’re opened people may rip them and this could alter their fit into the product itself, meaning that a large front opening in the box is absolutely necessary, which could lead to a weakened front face.

# Design Development - Modelling

## Box Progression

Ultimately, the boxes underwent a great deal of changes throughout the development process of my product as a whole. This is due to them being a focal point of the project which consisted of many other components which had their own development as well, which will be explained in the coming pages. Nonetheless, the boxes themselves did undergo many tweaks, as listed below:

The finger joints were removed and replaced with a far superior connection method for this particular product. I extended the front and back panels to accommodate holes that could accommodate screws to be passed through and threaded into the side panels for great strength and a sleek appearance.

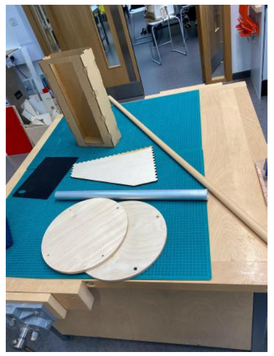
As a means of accommodating the attachment method (explained later), I aligned the components with the back panel and marked the locations for attachment holes. These were applied to the CAD drawing and new versions were laser cut and tested, being successful.

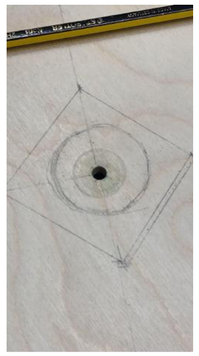
In order for my product to be high quality, I felt it was necessary to improve upon the appearance of it. Therefore, I added detailing to the front panel in the form of a more complex and curved opening, engraved bar sections and integration of the Coleg Cambria logo. Additionally, I extended the sections for the threading holes to disperse the strain on the product and prevent cracking during assembly, whilst also rounding off any sharp edges. These steps lead to a safer and far more aesthetically pleasing design which fell in line with my specification points.

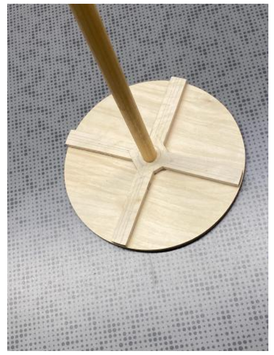

## Base Progression

Initially, I constructed a base of plywood at a diameter of roughly 300mm. One layer acted as a general support, with the other acting as a 4-way divider. This area was intended to feature a foot-pedal system and so the sections were measured accordingly for the average foot size of a user. This showed consideration for my users as well as great ambition for the future. On another note, if this system were to ever be removed, it could still act as an aesthetic quality which also adds to the overall strength and stability of the product.

In terms of the beam, a precise section was removed from the center of the base pieces, allowing the wooden pole to pass through with ease yet remain fixed in place. For later iterations of the product, a different pole section may be used and so I can alter the diameter of the holes for a similar effect as seen here.

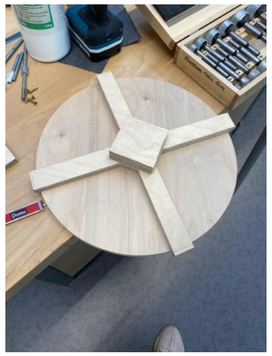


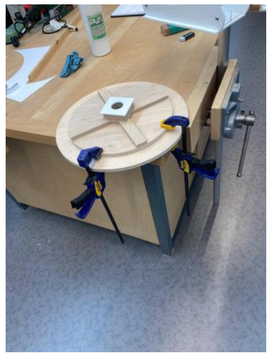




As mentioned previously, a different pole could lead to necessary changes to the base and that is exactly what occurred here. I planned to develop a prototype later into the products' development featuring materials that the real life finished product would, including a 35mm diameter aluminium pole. This was a far larger increase than anticipated, leading to many vital changes. These included a far larger base piece as a whole, featuring the appropriate hole size, many layers of plywood and an array of construction methods. Whilst the first base was held together entirely by force / friction, this base consisted of screws that had been drilled through separate segments and others which had been glued in place.

In order to satisfy my specification points and overall product goals, I utilised the laser cutter to create a white plastic covering for the top of the base which hid any exposed screws as a means of maintaining a complete and high quality look across the build. Unfortunately, after many tweaks to improve my products' stability such as with the additional two plywood square layers atop the divider, my product still failed my stability tests and very prone to being toppled over from little force. Therefore, I constructed the widest possible plywood circular piece possible on the band saw and attached this to the bottom of the existing components. This granted the product far more stability and also improved the aesthetics of it as prior to this change, the base appeared far too small for the rest of the product.





# Design Development - Return to Product Analysis

## Foot Lever Operated Bin

### Introduction
I decided to return to completing product analysis because I require the mechanism in order to have a foot operated, non-contact system within my design for dispensing hand sanitiser. As this is the last of the three in-depth product analysis, I have included the key points for all three product analysis here to mark the end of an extended section.

### Function
The function of a bin is an extremely simple one and that is to store waste product before later going on to proper and conventional waste such as recycling or destruction. What is truly interesting about this bin is not the premise of the bin itself, but the way in which it allows itself to be opened for items to be stored inside. This is by using a lever operated by the force of a user's foot. Nonetheless, the product is simply taking advantage of a system / mechanism to satisfy its function in a clean and easy way for the consumer which is very admirable and should certainly be considered when developing my own product.

### Materials
The vast majority of the bin has been constructed from a very thin / flimsy stainless steel. This is to prevent any corrosion or damage from what has been placed inside the bin. One thing to note is that it is particularly easy to bend and dent the materials used here, as seen in my images when taking it apart. I would like to stray away from materials that can receive long-lasting damage from very little impact and so this must be considered during my material selection process. The lever itself features a pattern texture which boasts increased grip for the foot of the user. This increases the friction between the user and the product, increasing grip massively and allowing the product to be used even if the user or product is slippery or wearing shoes with little grip, another factor I would love to incorporate in my own design if I use this mechanism.

### Aesthetics
Similarly to the product that I wish to create, this bin adopts an extremely clean and almost 'medical' aesthetic. This has been achieved by having reflective and clean surfaces with minor outline features such as the black rim and pedal. Therefore, the product has been broken up into different sections yet the colours are kept very simple. This simplicity ties into the overall medical approach that may be taken towards products, where the materials link the product to a particular theme.

### Build Quality
As previously mentioned, the product was particularly easy to damage and this is a result of the material selection as well as the overall structure of the product itself. Given the fact that it is a hollow item, there is plenty of room for the materials to be pushed into as a response to impact. My product may be similar due to how the boxes will be hollow once there is no PPE inside, henceforth it is crucial that my product is constructed with strong materials and a structure that prevents such abnormalities being possible from force.

### Dimensions
This bin was particularly small as it is only intended to be used in bathrooms or small kitchens yet it was still suitable enough for product analysis to be conducted upon it due to the mechanism and systems inside not being very complicated or intricate.

### Shape
The shape leads to a rather impressive aesthetic, especially when combined with reflective materials as this produces rather fascinating reflections. Nonetheless, the circular structure lead to the product being weak whereas the likes of a triangle would be far stronger. Strength is not everything though and I feel the circle was a perfect choice for this product's aesthetics. Nonetheless, it will be placed on the floor and be prone to being knocked and kicked frequently, meaning a stronger shape / structure may be more desirable.

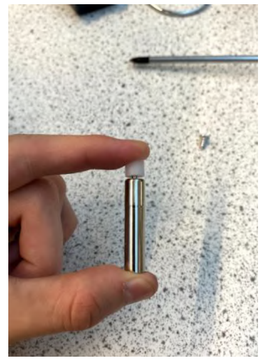
### Above and Below the Line
Whilst the product may appear extremely simple on the outside with its straightforward colour palette and shape, the impressive part of the product lies within. Rods that stretch across the product and are hidden from view are located throughout, protected by their own plastic casings all become part of the body necessary for the product to function. This indicated to me that a product can adopt a very simple appearance to make it less intimidating for consumers yet still boast the advantages that can be achieved with complex internals.

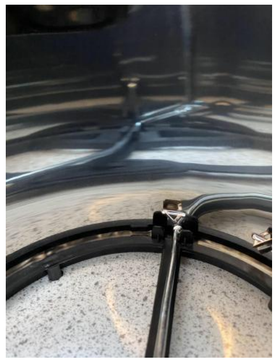
### Advantages of Mechanism
The mechanism is particularly simple upon further analysis due to being made up of only a few rods and a pedal. Moreover, the system integrates a soft closing mechanism, which features a compression pod (seen in research box) which prevents the lid from being slammed shut. This leads to a more pleasant user experience and prevents damage to the components, benefiting the product all around.

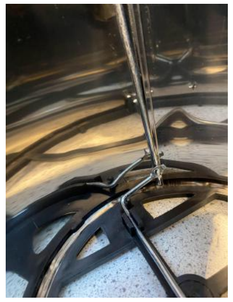
### Disadvantages of Mechanism
The system relies on the strength of the user to operate and carry out certain actions. In the case of this bin, that is no issue due to the low weight of the lid, yet if this were to be adapted for larger and more demanding processes, issues may arise depending on the user. For example, a 30 year old man would be able to operate systems that a young child could due to the difference in strength. Additionally, if I am to adapt this mechanism for my own product, I would have to reimagine parts of it due to the difference in opening the lid of a bin or squeezing the lid of a hand sanitising bottle. This could be experimented with on CAD and modelling if it is to enter production.

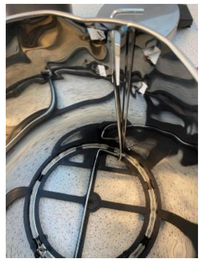
## Further Research - Compressing Soft Close System

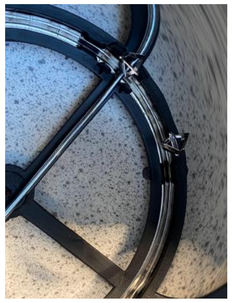
Upon disassembly of the product, I found what appeared to be a small tube with a section on r ails that protruded from the rest of the system, This could be pushed in and out of the tmain tube and upon doing so, you would be met with an opposing force, leading for the system to slow down. I believe that is because there is some sort of oil or liquid inside that once compressed, prevents any additional movement. Therefore, this can be strategically placed into products to prevent great forces being dissipated across raw materials and leading to damage, making this a particularly useful safeguarding tool.











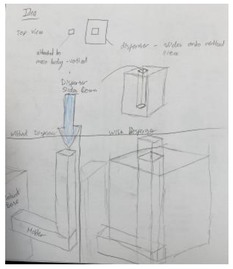
## Key Points
I find that product analysis gives me an incredible insight into what is currently on the market and how I may utilise the systems and methodology within those into my own product. Therefore, I am capable of bringing the best features from different points and bring them together to create something truly special. Whilst the system here is rather simple, implementing it into the base and center beam of my product would be rather complicated and require a great deal of time which I am not sure is possible given the time permitted by my educational institution. Failure to bring it into my prototype in real life would disappoint me and I would certainly like to see it at least in CAD as it could be a truly drastic addition to the product as a whole,

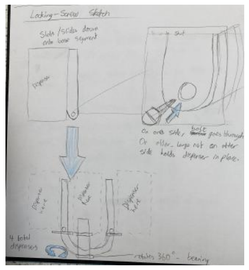
# Design Development - Modelling



## Attachment System Progression

Very early into my products development I was certain that this would be crucial to my project and began experimenting with different ways that I could attach the boxes to the remainder of my product. Given this, there were still a large number of hurdles during the production of this aspect of the product, yet after countless iterations of design and small tweaks, I found the perfect version.

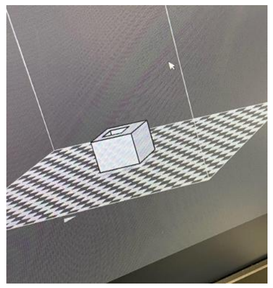


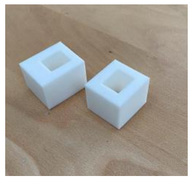


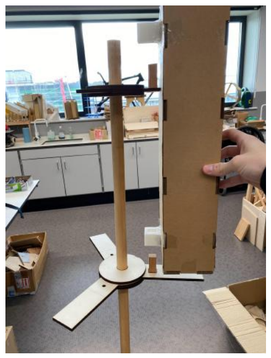

Before going onto modelling, I sketched out some quick and very basic drawings of how I could attach the boxes to another component. I began with utilising two card tubes of slightly different diameter, which allowed me to pass them through one another. I taped one to the rear of one of my boxes as an example and found that it was functional. Unfortunately, there was a great deal of movement present with this and so I set out to find a means of locking it in place. This brought me to an existing product which featured something very similar to a large nut and bolt. I aligned the two tubes and marked where they intersected and cut completely through, leading me to have a clear passage between them.I removed the nut and bolt from the product (as seen in the images with a yellow sign) and fed them through the holes I had just made in my own model and was happy to see that once tightened, the box was secured in place. This system also allowed me to easily attach and detach boxes for whatever reason, leading to great ease of disassembly for the user which is of course a positive and plays into my specification points.

I changed the circular poles and holes to instead be square sections. Furthermore, I replaced the styrofoam by, using the 3D printer on a 20% fill setting and changed the poles for square beams. This countered some of the issues of the previous design, yet some glaring issues remained. These were that the system could not be locked in place to the product and that they were very weak, even with a lightweight model like this. Consequently, there was still work to be done.

I set the attachment system production to one side for me to continue on other aspects of my product (as follows in the production diary) as I felt that these other areas were restricting in their current state. Therefore, once I returned with a functional rotation system (next page), I was able to construct my attachment system around these. Therefore, I adapted the premise of my previous system through utilising styrofoam cuboid sections which were connected to the rotator by passing through small plywood beams. These allowed for easy attachment and removal of boxes yet also presented a wide array of issues. The circular shape of the holes lead to the boxes being able to move in place instead of by moving the rotators, effectively making them obsolete. This was not my intention and so I needed to find another option.

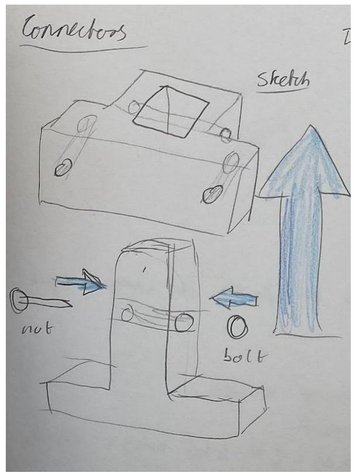


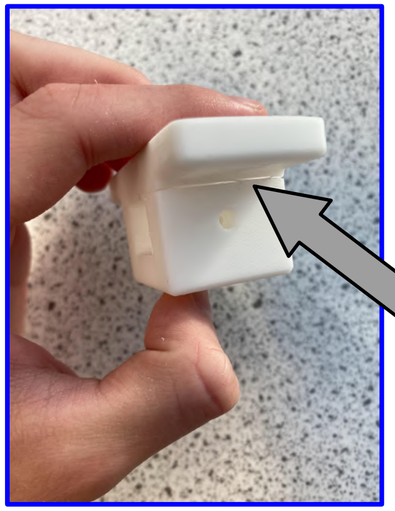




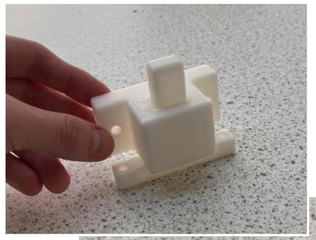
As seen in the image highlighted in blue, countless tweaks to the products size were necessary in order for a snug fit to be achieved due to inconsistencies in measurements, 3D printer accuracy and material thicknesses. These lead to too much strain on the parts sometimes and in this case, resulted in cracking. This was solved by a slightly wider hole for the male section to pass through. Additionally, for greater strength, the product could be printed with a thicker fill. I was using only 20% and found it to support far more weight than I expected for its size and so this will increase drastically given higher percentage thicknesses are used. This opens up many opportunities for the product and its weight considerations because attachment systems for varying weight classes could be produced, which I hadn't even anticipated when I began the development of such components.

Once again, I returned to the drawing board and reconsidered my attachment method design. I had a clear sense of direction which fell perfectly into my specification points. I needed to develop a system which was easy to attach and detach to the product, be able to be locked in place and also be strong enough to support the weight of PPE products inside the boxes. I ultimately sketched a simple design of two connectors which could interlock with one another and would both be attached to their respective pieces. The male piece would be attached to the rotators, whilst the female would be attached to the boxes. On the contrary, if the design was completed as desired, they could even be assembled in a number of ways such as attaching the box to the already assembled connectors. This leads to a great deal of freedom for the consumer and satisfies my specification points as desired.



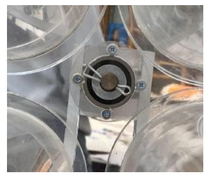
Cracking damage



# Design Development - Modelling

## Rotation System Progression

This section was absolutely vital to the development of my product as it allowed the PPE to be accessed by the user with very little effort from all directions. Additionally, it was another connecting piece necessary in bringing the various components together and leading me to have a complete product. Whilst it is simple in construction, it plays a very important role in the systems I have constructed to allow the product to function to its maximum potential.



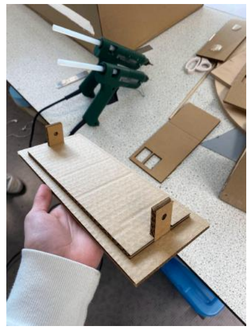
I first conducted a very brief product analysis on something constructed by someone else and found that they had utilised a stopper on their center beam which the rotator would sit on. For less friction and ease of mobility, a rotating bearing may also be used.

My rotating system needed to be strong enough to support the weight of my boxes and their contents and so I opted for a simple yet thick design. During development of the rotation system, I discovered that having 3 boxes instead of the originally planned 4 would result in a more ergonomic design and overall experience for the consumer. Whilst this does decrease the amount of total PPE available, it improves aesthetics and takes a great deal of weight off the main centre pole. In turn, this will distort the distribution of weight as originally desired for the better by having the lower mass be more of a factor to the centre of mass, making it harder to tip. Once I felt that it was ready, I cut the design into laser ply and constructed a basic assembly.

Whilst my rotators were nearing a complete state, they still lacked the ability to facilitate the 3D-printed attachment system and so I extended the appropriate segment area and tested where the attachment holes would be. Once aligned, I edited my drawings and cut new rotators, finding them to be perfect in facilitating the attachment system, just as I desired. These could also move around without a bearing due to the limited friction between the materials of the stopper and the rotators.

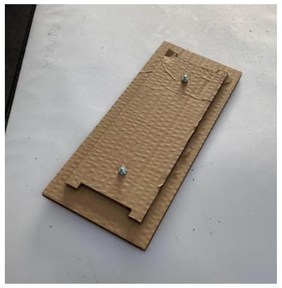
## Locking Lids Progression

Evidently, the box system has been successful in housing the PPE products, yet they are vulnerable to falling out or being removed with no restriction due to the lack of a lid. Therefore, I set out to construct a lid with a mechanism which allowed it to be locked in place and keep the internals safe.



I opted for a rather simplistic type of lid for this the boxes, with a lower section which fits perfectly into the space inside the boxes as well as a weir upper section which has an overhang over all sides of the product. This makes it easy for the user to grasp it if they are disassembling / removing it. Moreover, I cut some sections out and placed some pieces with a hole in them vertically on the lower section of the lid. These are used to lock the lid in place when a pole is passed through. Due to this being a very early iteration of the system, I am simply gluing all these pieces together with a glue gun.

Fortunately, the system worked very well with the side panels which I had modified earlier with a hole in the correct place for the lid. Despite this, I found that the process of passing the pole through was rather tedious due to how narrow the hole was, meaning a slight inconsistency lead to the mechanism not functioning properly. Therefore, I experimented with different aligner hole sizes as well as the dimensions of the aligners as a hole. Consequently, I was left with a wider and stronger lid section that was easy to assemble and fit snug in the boxes. In fact, once locked, the boxes could actually be lifted by the lids as they were secure enough to support the weight of the whole box.



I was conscious that using glue for my final prototype would pose many issues such as poor quality, not being aesthetically pleasing and even mess which could damage the product such as from the heat of the glue gun. Therefore, I aligned some holes on the two sections of the lid and was able to secure them together strongly using nuts and bolts.

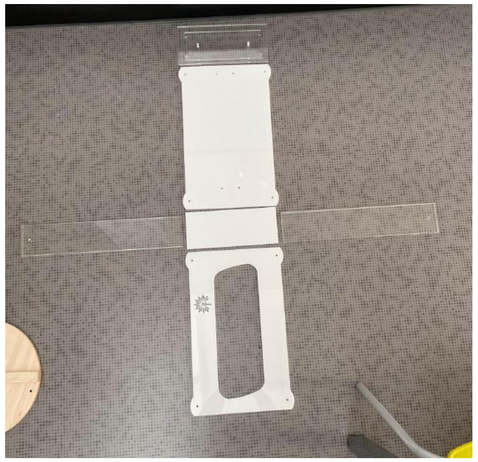
# Design Development - Modelling



## Prototype Featuring Final Material Selection

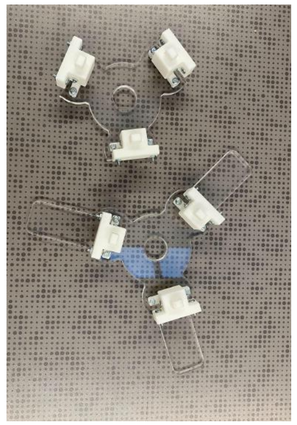
With the vast majority of my product completed on my first model after being sketched many times and constantly altered, I felt that it was suitable for me to create a prototype consisting of the materials that would actually be used if it went into production. This saw me remaking almost every aspect of the product apart from the attachment system.

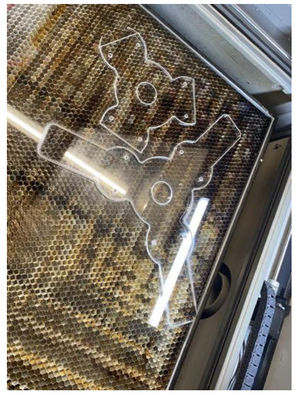
### Boxes



The boxes were cut on the laser cutter and cleaned to remove as much damage as possible. They were constructed from white ABS panels of 5mm and clear ABS panels of 8mm and 10mm thicknesses. The pieces were assembled by using threading, a particularly simple yet repetitive process which leads to extremely strong and aesthetically pleasing results. Ultimately, the boxes were successfully completed, despite the hurdles that occurred when constructing the drilling jigs like finding the appropriate dimensions.

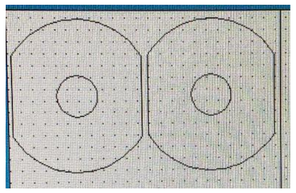
### Rotators

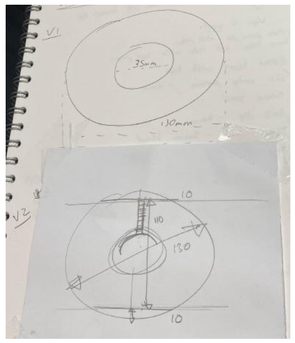


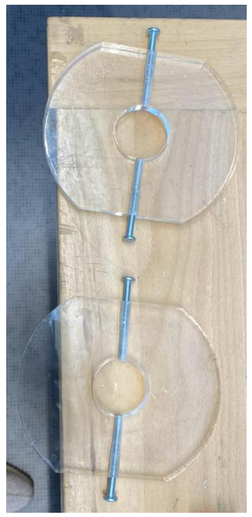


The rotators had been cut into 8mm clear acrylic / ABS.

### Stoppers





Despite the stoppers being functional for the previous model, new versions were required here to fit onto the larger pole diameter of 35mm as well as be able to be secured in place. This was done by cutting some circles with flat edges into 10mm clear ABS and drilling clearance holes to the appropriate threading points. These were prepared and bolts were secured in place. Then they were slid down the pole into position where a slight indentation into the aluminium was drilled, giving them extra strength.

### Base

The base required no additional work to what had been done prior, meaning that it was all ready for assembly already and so the beam was fed through and secured in place due to the tightness of the hole made.

### Beam

I applied a finish to the aluminium beam by rubbing it down with a cloth and a special type of sandpaper to result in a very high quality surface finish. Unfortunately, I had to redo this after mounting the stoppers due to the tightness causing minor damage and scratches. Once repeated, the process was capable of bringing the pole back up to code.

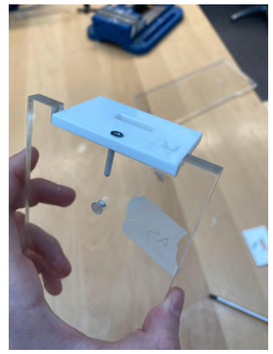
## Lid Adjustments

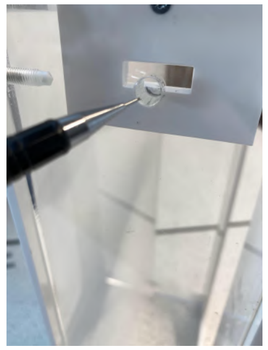
Unfortunately I had not considered how I would mount the aligner components to the lid section for my final prototype. The previous method of using a hot glue gun would potentially damage the materials and lead to a low strength and low quality finish to the product and so I opted to use the same method I had done on the construction of the boxes. This was of course, threading.

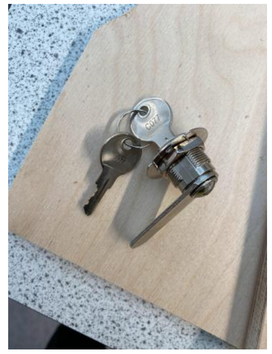
I aligned the sections and marked where holes would need to be cut on the laser cutter and then did so on my CAD drawing. Then, using a drill I managed to create a hole in the appropriate place to complete some threading. Once both were complete, they were simply assembled by screwing them together.

Unfortunately, once I tried passing through a beam (now a 300mm aluminium pole), the holes were misaligned. This is likely due to the variance in material thicknesses to my previous model. Therefore, I marked on the aligners where they should be extended and cut them in the laser cutter. Once assembled again, the pole passed right through and my lids were functional, despite there being slightly more movement in comparison to the previous snug fit.

Yet another issue was that one of the lids was unable to fit into its section due to it being a couple mm narrower than the others since the side panels were 10mm instead of the usual 8mm. As a result, I disassembled the lid and sanded the sides down a little, allowing it to fit in with no issue.







I also experimented with utilising an actual lock and key for my mechanism, yet the ones available to me were not suitable for the pole and how it passes through back and forth. In order to integrate the lock like this, I would need to completely redesign the lid, which was already exceeding initial expectations.

# Design Development - Modelling

## Final Model

With all the components created in their respective materials, it was now time to assemble and test the final prototype. Assembly went extremely smoothly with no issues. I can certainly see a user being able to do this with no issues unless there is PPE inside of the boxes as this could add a great deal of weight, making it harder to move. Nonetheless, it was now complete.

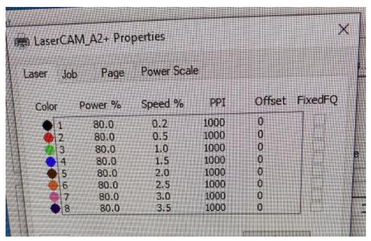



## Testing

Throughout the production of my product, countless testing had occurred. These are as follows:

### Laser Cutter Settings

I find that it is an absolute necessity to test cutting powers and speeds on scrap material before cutting the real components as this allows me to see which method of cutting results in the least amount of damage and cuts through the material best. This has great moral benefits as you are preventing material wastage due to large amounts of damage, as well as social benefits due to not needing to clean parts which would otherwise be boring.




### Potential User Testing

By recreating the conditions which would be present for the product to function and be utilised by the consumer, I filled the boxes with PPE just how it would be in a real scenario and used the product how a consumer would. This, as well as focus groups using the product and giving me feedback led to many discoveries about my product and opened up avenues for things I hadn't before considered. Moreover, it showed me exactly what did and did not work about my product. Examples of this can be in how the gap at the front was the perfect size for reaching the PPE within and how rotating the system was rather easy, yet could be improved by a weighted base and perhaps bearings to eliminate friction. Further expansion upon this may be found in the production folder ‘End User Testing’ section.

### Product Stability

Another necessary part of my product is that it is strong enough to remain upright and not topple over. If it were to do this then then product is effectively useless and cannot function and may even be damaged. Therefore, once the product was full with example PPE, I tested it by pushing and pulling the product in ways that it may be be the consumer. Upon discovering the existing base was rather unsturdy, I created a wider and more secure base which greatly improved the stability. Therefore, the testing process has proved to be very successful and effective in aiding product design and development.

### Material Strength

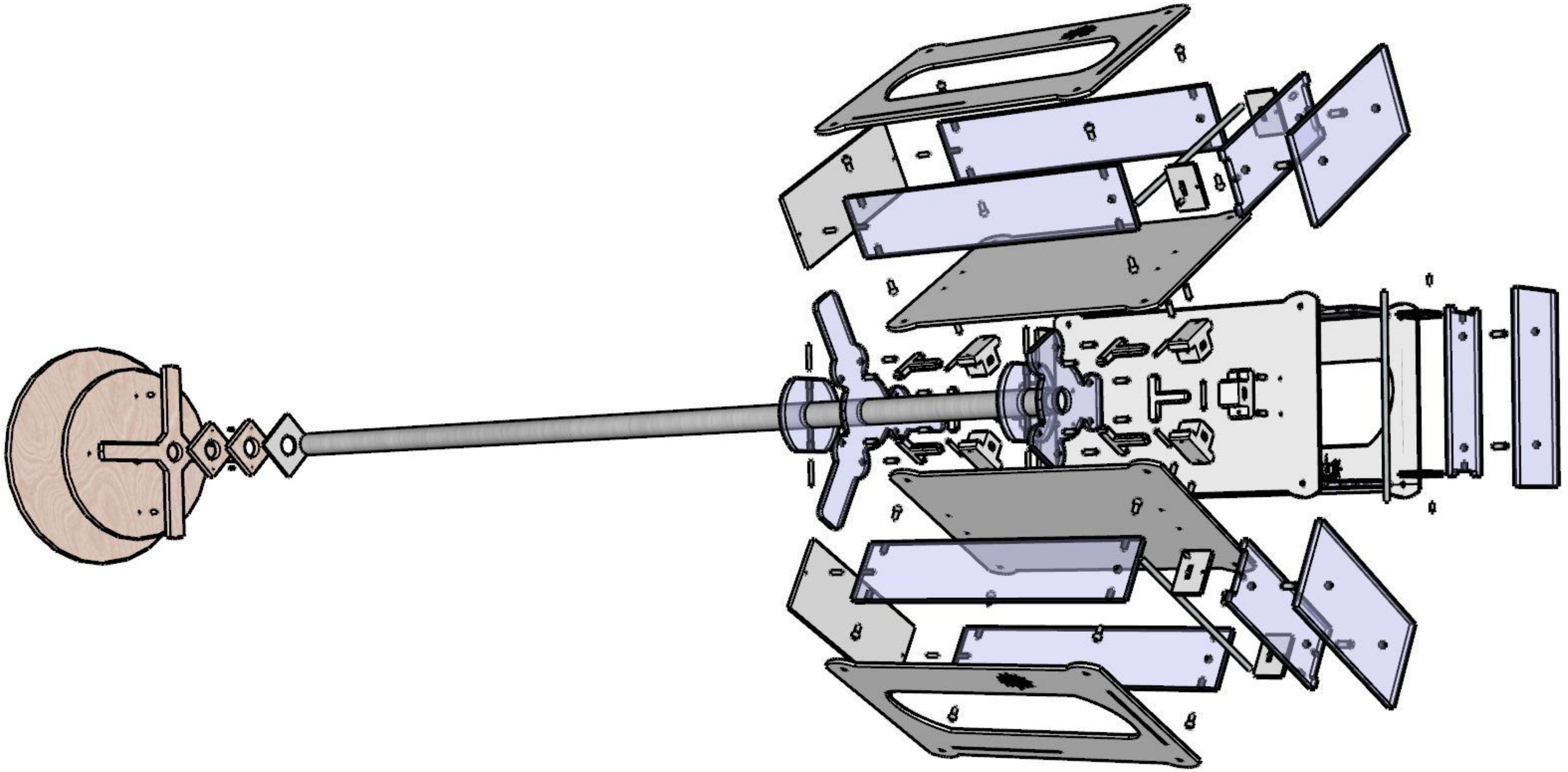
Conducting physical tests on the materials I would use for my product helped me narrow down which should be used and which to avoid. A prime example of this would be when using the 3D printer, a combination of low fill settings and an extremely narrow gap that components had to be forced through led to cracking of the material. This indicated to me immediately that the fill settings or gap must be altered before leading the products to larger scales of production and integration in my product.

# Exploded Drawing



**Key Points**

Exploded drawings may often be found in the instruction manual of products and shows a complete breakdown of the assembly. Evidently, my product consists of a rather complex build up, making an image like this initially appear intimidating yet upon closer inspection, is understandable. The connection system leads the area behind the boxes to appear rather cluttered, yet once these are all assembled, it is actually a particularly sleek looking area. Nonetheless, exploded drawings are particularly helpful for any product, with this being no exception.



# Working Drawing

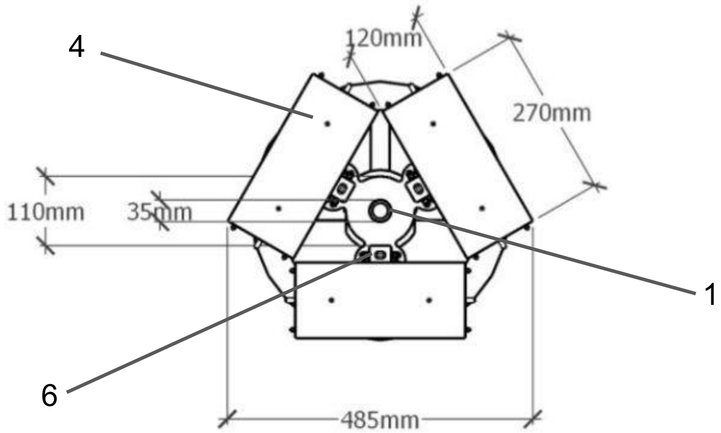
**Ataraxi**
**17th April 2022**

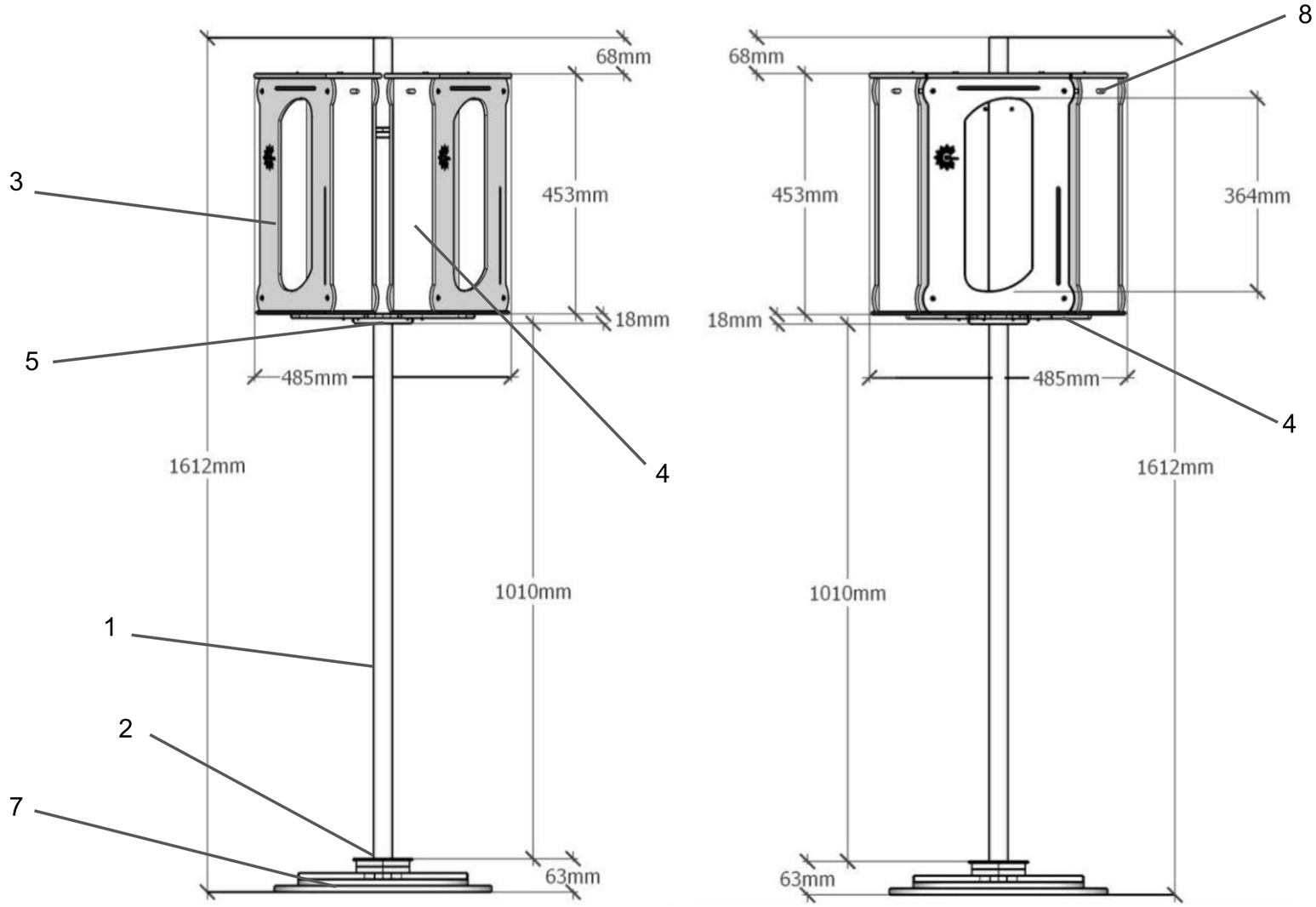
| | |
|---|---|
| 1 | 35mm Diameter Aluminium Beam |
| 2 | 3mm White Acrylic |
| 3 | 5mm White Acrylic |
| 4 | 8mm Clear Acrylic |
| 5 | 10mm Clear Acrylic |
| 6 | 3D Print 20% Fill |
| 7 | 12mm Plywood |
| 8 | 6mm Diameter Aluminium Beam |

**1:7 Scale**

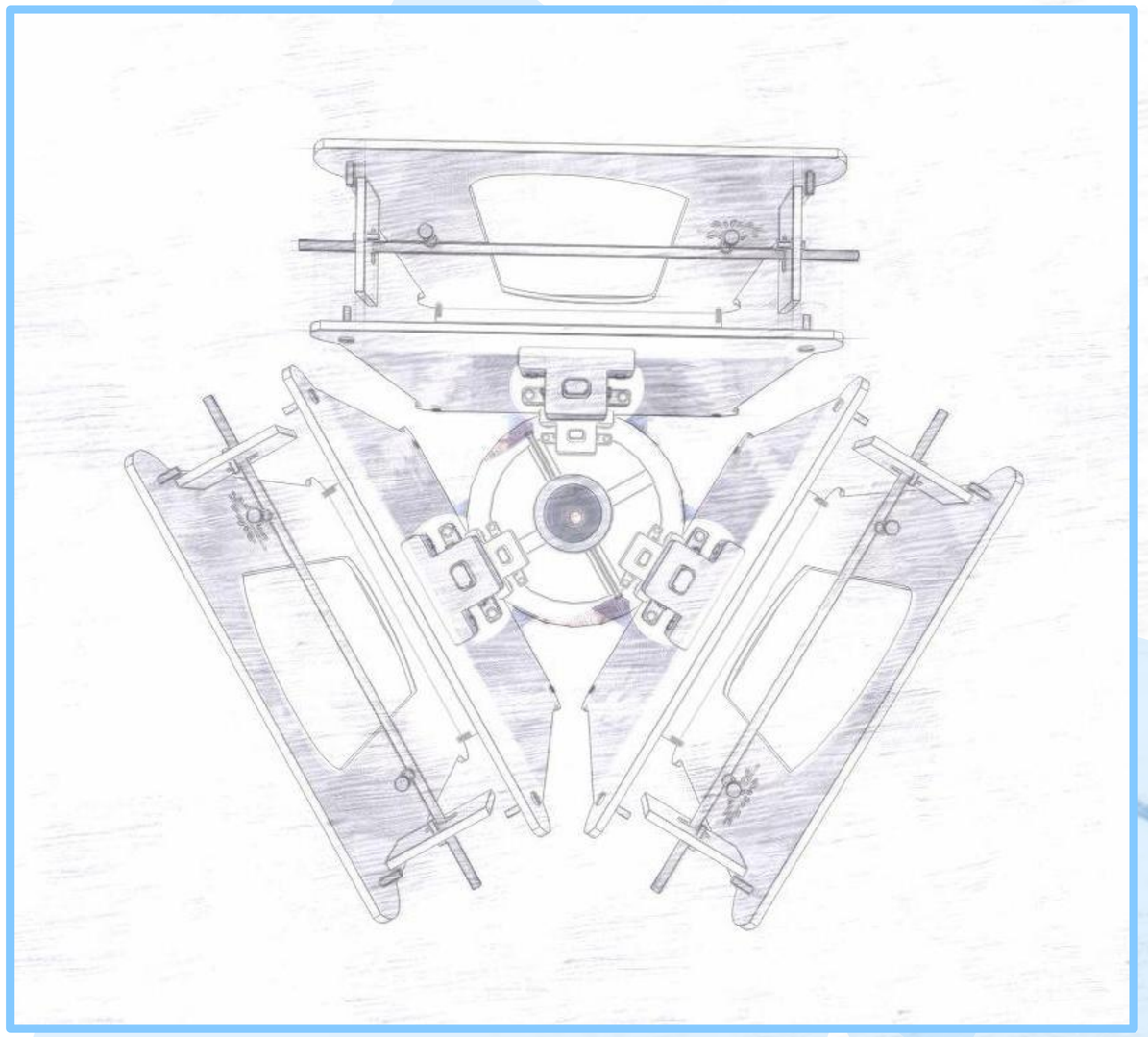
**See previous page for exploded view, another way of viewing the product. Additionally, this has the locations of the screws and bolts present for additional instructions.**

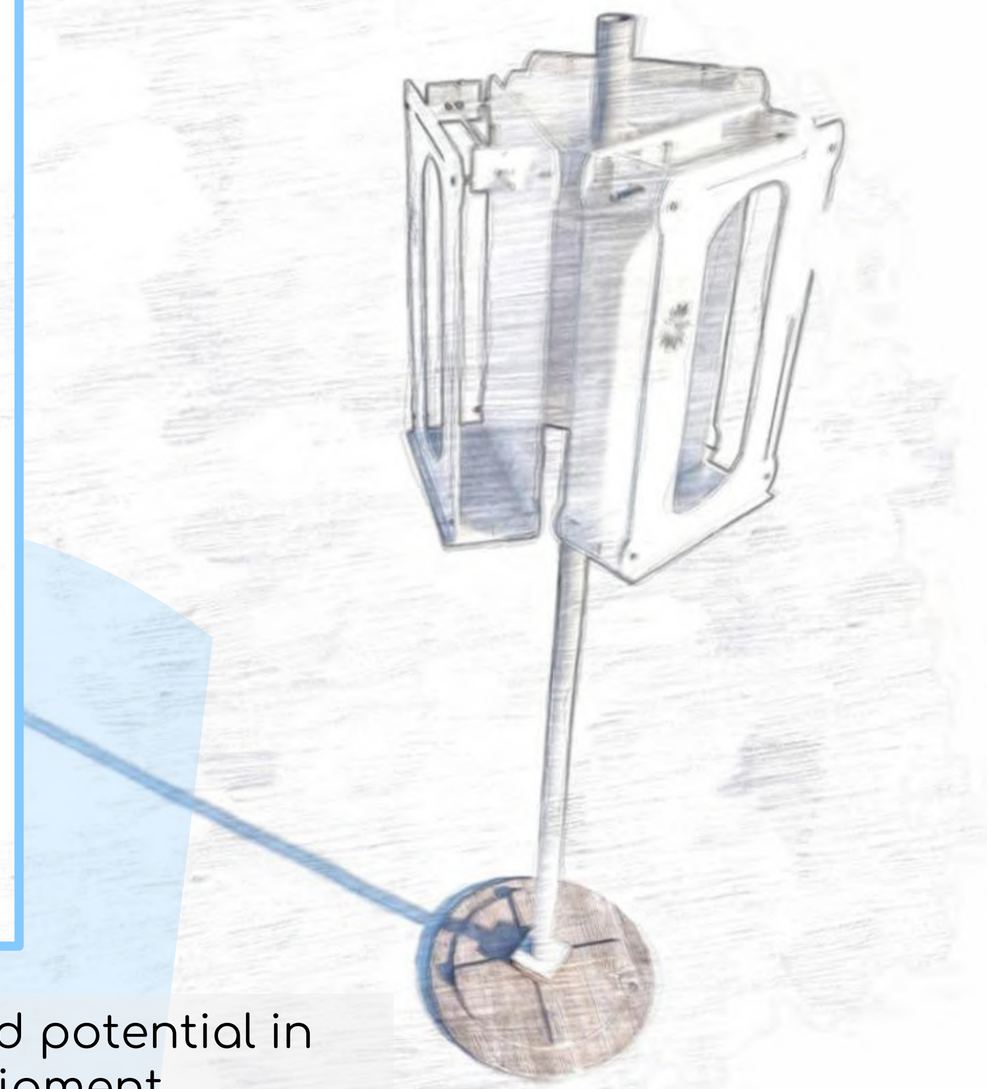
**Also included are various screw, nut and bolt sizes. Due to the restricting scale since the product is of such a great scale, these have not been included and will instead be found in the A4 manual provided for the product.**



# Final Design





A product capable of providing unlimited potential in providing users personal protective equipment.

# Renders

**Key Points**

Using a combination of my SketchUp CAD drawing and my experience with the Lumion rendering software, I was able to produce some extremely high quality and realistic renders of my product. These could easily be utilised for product promotion images or help aid myself as a designer as to what is missing from the product.