A-level DT NEA

By Monty Hucknall

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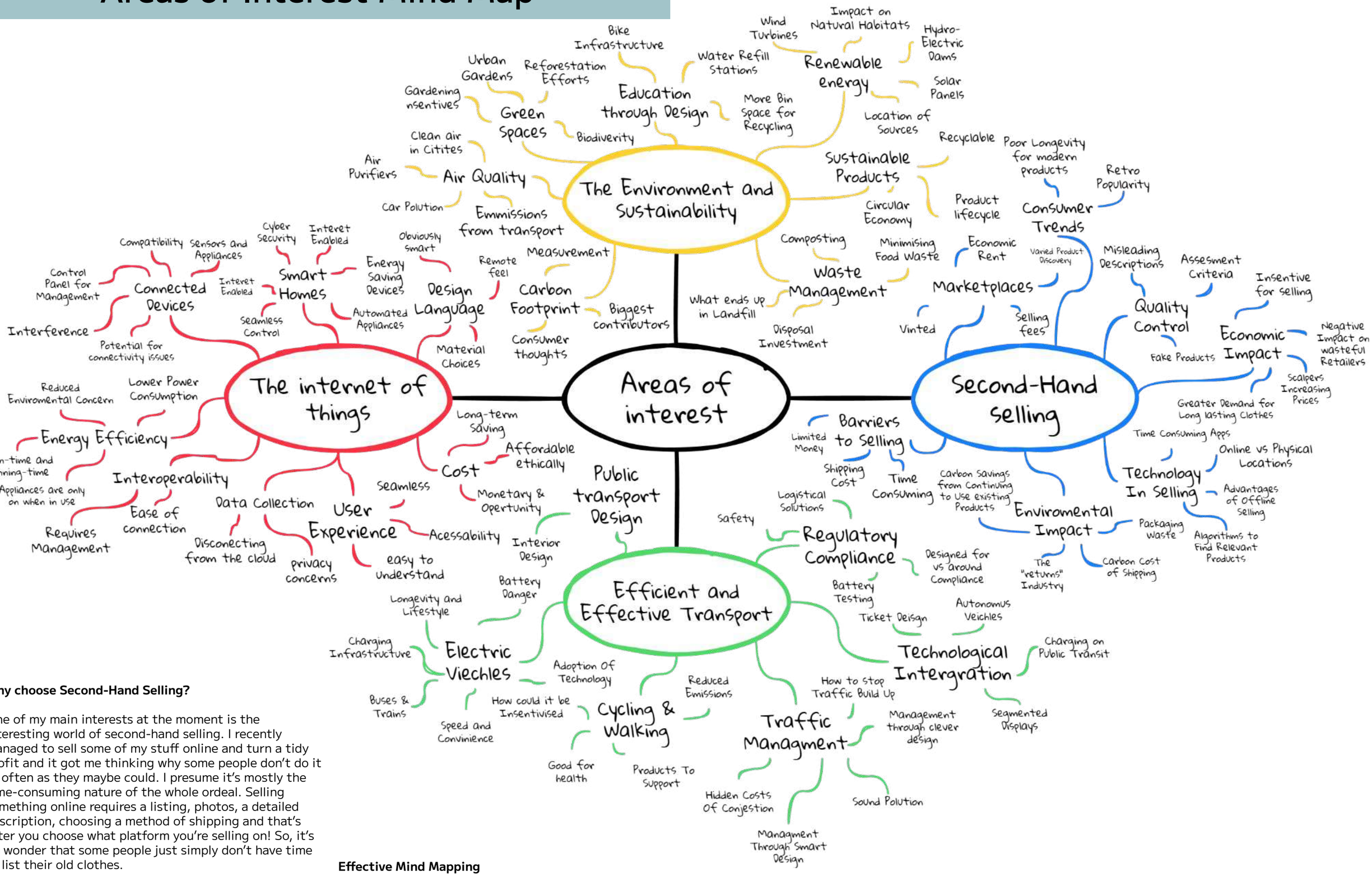
Section A & B

Areas of Interest Mind Map



Why choose Second-Hand Selling?

One of my main interests at the moment is the interesting world of second-hand selling. I recently managed to sell some of my stuff online and turn a tidy profit and it got me thinking why some people don't do it as often as they maybe could. I presume it's mostly the time-consuming nature of the whole ordeal. Selling something online requires a listing, photos, a detailed description, choosing a method of shipping and that's after you choose what platform you're selling on! So, it's no wonder that some people just simply don't have time to list their old clothes.

I would be interested to know what kind of demographics use online second-hand marketplaces and which demographics are seemingly a 'missing market' for this technology.

Effective Mind Mapping

Mind Mapping is such a powerful tool for idea generation when used correctly. The key with mind mapping is to not overcomplicate ideas should be realised the same moment they are captured. This may lead to some elements on the mind map not being relevant to the final decision or idea, but allowing all ideas to flow onto the page ensures that creativity is not limited to simple restrictions of judgement. By doing this sort of Idea association it allows me to create a mind map which shows exactly what I'm thinking about, which can be distilled into relevant topics and scenarios.

Research Plan

Developing a research plan

In order to develop a research plan I decided to use the concept of actionary research developed by Craig A. Mertler. In his concept developing a research plan begins with four key steps. Firstly the researcher must identify their key questions and hypothesis, then they can begin to do basic research on designs then they must consider the ethical implications and finally must look at the practical planning guidelines for their research in my case the specification and design statement once I've developed one.

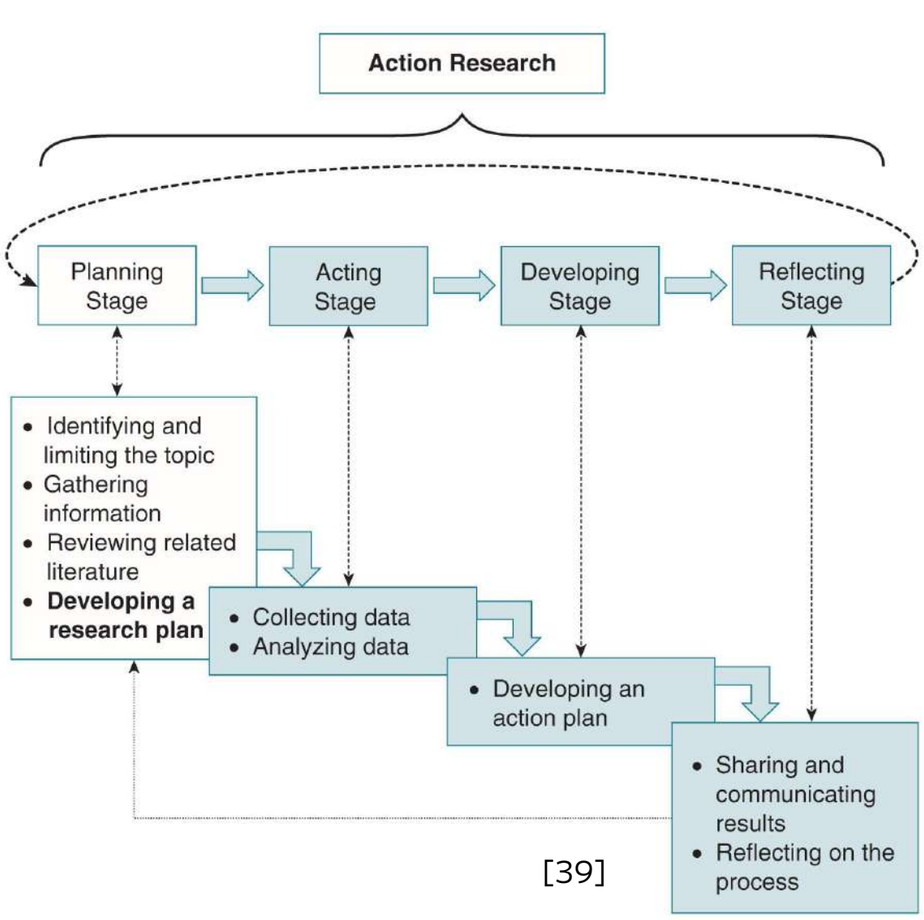
How I'm going to conduct research

First and foremost there are two type of research to which I will engage with and these are the two highest categories of research that being secondary and primary research. Primary research is research that I will carry out myself and secondary research is research that I can gather from books, websites, research papers or any other relevant mediums. The important distinction between the two is that one is the time required and the quality of data which could potentially be received. Primary research is a lot more time consuming, requiring a full plan and some sort of strategy whether that be random, stratified for targeted data points. It also requires me to either go an find something in person or use willing participants online or in person to gauge perspectives. The issue then comes from the potential quality of my data verses and online source. Whilst online sources may be more vague and focus less on the details which actually make up the project if they come from a trusted source its alot more likely that their data will be more accurate especially if its a quantitative research technique which requires a large dataset. This is because they will likely have more resources such as other researches, capital, investment, machinery and advance measuring equipment as well as experts within statistics and biases who will be able to identify potential issues with the data such as the bias caused by the 'stopping rule'. On the other hand I simply do not have the time and resources to conduct research that is as accurate as those professionals so in my research I have to focus on a two-part strategy. The way I will move forward will be using Primary research to gain lots of qualitative data; opinions, thoughts and feelings. However for anything that requires quantitative research such as technical specifications I will likely rely more on the secondary data gathered by professionals. I will of course stray from this when testing components or parts and there will be elements of quantitative primary research but they will be a lot less and a lot further down the road in my project. On the other hand the qualitative research will focus on my target audience once that is determined and after a certain point; once a client from the target audience is identified then I will proceed to enact most of my qualitative research from the client themselves.

Research Questions / Hypotheses

The most salient question in my research will most likely be 'what is the greatest contributor to the most important issue within the project opportunity. That being said the key to successful research is to not let one specific question reign completely over the the rest and I will keep an open mind when it comes to allowing the parts of my research to stray from the most important question to smaller more niche lines of thought. My hypothesis from my research is that I will end up determining a audience that has a very specific issue within second-hand selling a particular type of clothing, I also anticipate a retail rather than wholesale lens due to past experience with the matter.

Stage	Method	Focus	Outcome
1	Survey	Resale channels + user demographics	Identify key channel
2	Desk Research	Situations + behaviours in that channel	Understand context
3	Desk + Comparative	Problem areas + alternative channels	Find design opportunities
4	Client & Expert Interview	Channel-specific insights	Validate assumptions
5	Synthesis	All research	Design proposition + statement
6	Market Analysis	Solution or method	Gauge demand + positioning
7	Technical Research	Ergonomics + anthropometrics	Inform form + function
8	Component Research	Specific mechanisms + parts	Finalise design feasibility



[39]

Research Survey - Resell Methods

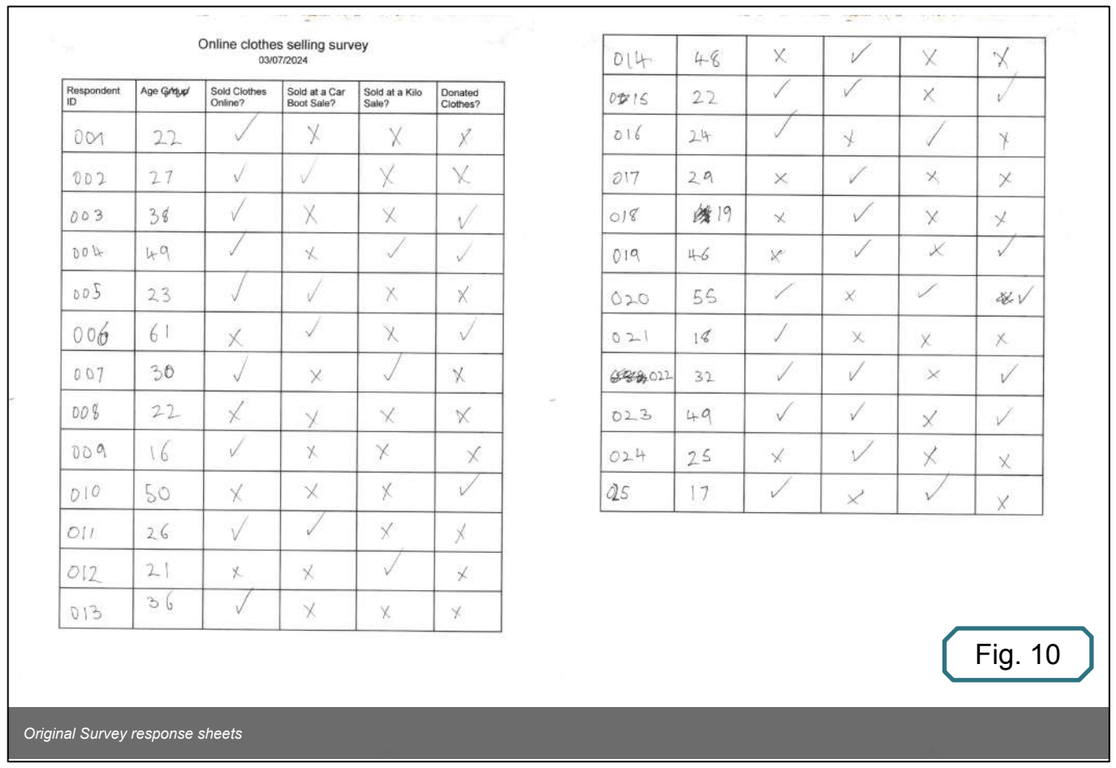
Planning for the survey

Online or In-person
I decided to run an in-person survey to gain more data about how people get rid of their old clothes. I chose to do this in-person because of false data I've received doing online surveys in the past for other projects. Moreover, an in-person survey would allow me to ask a greater demographic of people then if I was to simply ask my friends.

Location
My local Co-op seemed a fitting location for the survey for a few separate reasons. Firstly, it was nearby and easy to get to. Secondly, it's a fairly busy area which gave me the best chances of meeting my response target. Finally, almost every kind of person living in the local area could visit the shop so I would get the widest demographics for my dataset.

Method of data collection
The method I settled on for collecting data was by asking people and recording their responses on a clipboard.

Final details of Survey	
Location survey	Stansted Co-op
Demographics	Preferably all
Time of start	13:00
Date	03/07/2024
Response Target	25



Respondent ID	Age Group	Sold Clothes Online?	Sold at a Car Boot Sale?	Sold at a Kilo Sale?	Donated Clothes?
001	22	✓	X	X	X
002	27	✓	✓	X	X
003	38	✓	X	X	✓
004	49	✓	X	✓	✓
005	23	✓	✓	X	X
006	61	X	✓	X	✓
007	30	✓	X	✓	X
008	22	X	X	X	X
009	16	✓	X	X	X
010	50	X	X	X	✓
011	26	✓	✓	X	X
012	21	X	X	✓	X
013	36	✓	X	X	X
014	48	X	✓	X	X
015	22	✓	✓	X	✓
016	24	✓	X	✓	X
017	29	X	✓	X	X
018	19	X	✓	X	X
019	46	X	✓	X	✓
020	55	✓	X	✓	✓
021	18	✓	X	X	X
022	32	✓	✓	X	✓
023	49	✓	✓	X	✓
024	25	X	✓	X	X
025	17	✓	X	✓	X

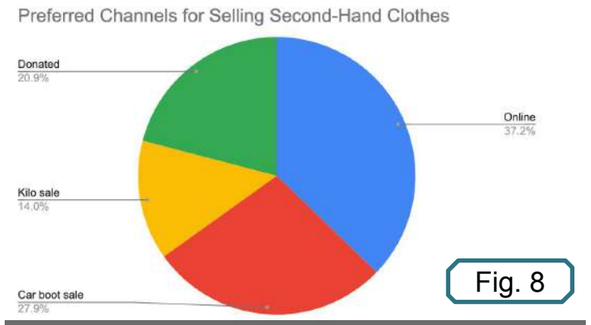
Original Survey response sheets

Overall data analysis

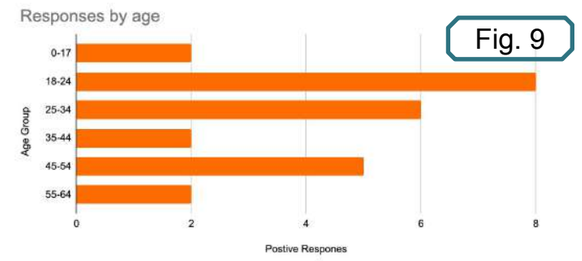
Choice of data presentation
I purposefully chose to separate the bar charts of data rather than having them combined for a few reasons. Firstly, for ease of reading, it's much simpler to understand when separated. Secondly, I wanted to demonstrate the level of engagement for each age group more clearly. Finally, I knew I could do it this way and still have the charts are lined up and share the same scale so that they can still be compared.

What does this data show
My data shows that young people (18-24) dominate the most popular channel of second-hand clothing sales, being online. Due to the nature of the age bias in this survey it's unclear to me whether or not this is 100% accurate I cannot know. Although it does share a similar finding as the the data published by SimilarWeb to Statista[1]. They found that 54.34% of all visits made to the site Vinted.com (One of the largest second-hand clothing marketplaces) in June 2024 were by people between the ages of 18 to 34.

Conclusions
Based on the data observed it seemed clear that although online marketplaces where by far the most preferred method by a margin of 9.3% it certainly was not nearly as popular as with the older demographics as it was the young.



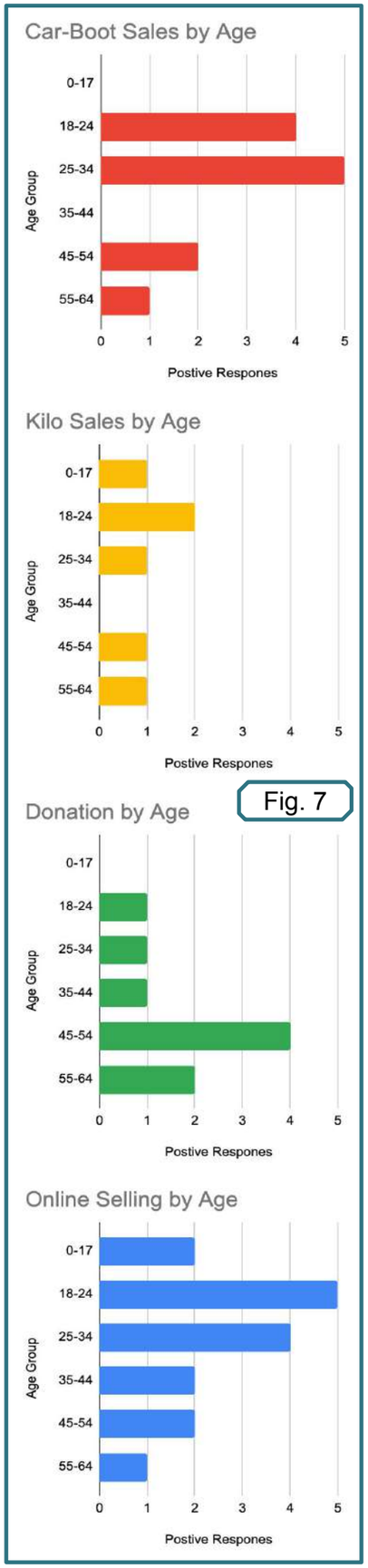
Pie chart displaying the number of positive responses received for each channel used to sell or get rid of second-hand clothes.



Simple bar chart demonstrating how many of each age group I managed to capture in my survey

Overall Preferred Channels
The most popular channel, by a significant margin, was online shopping. Notably, it accounted for a substantial majority of 37.2%, which is 9.4% higher than the second most popular channel, car boot sales, and 16.4% higher than the third, which was donations.

Age bias
Unfortunately, with such a small dataset my figures on age may not be as accurate as I'd wish. The survey did not have a completely even demographic with there being four times more 18 to 24 year-olds than 35 to 44 year-olds, just to name one example.



Online Marketplaces for Second-Hand Clothing

I decided that next I should investigate these second-hand marketplaces to understand how they work. Although this may seem unrelated to a product-design perspective these marketplaces provide a product through the means of their service, if I understand the way their services work then it allows me to spot opportunities.

Marketplace name	Key characteristics	History	Popularity	Distribution
Vinted	Vinted is a peer-to-peer marketplace where users buy and sell second-hand clothing from each other. The main UI is very simple and easy to use and its USP (Unique Selling Point) is the lack of listing fees when using the platform.	Vinted was founded in Lithuania in 2008 and expanded to the UK where it has grown to become one of the most popular platforms of its kind.	As mentioned, it's "no fees" policy has led vinted to becoming one of the most popular platforms in not only the UK but also the whole of Europe. Its hard to estimate a market share	Primarily postal delivery through royal mail and other couriers such as Evri. Orders are fulfilled directly from seller to customer.
depop	Depop is a mobile marketplace that blends social media with an ecommerce environment. Users buy and sell second-hand clothes using the app to communicate and discover listings. Depop's focus is on vintage and unique fashion.	Launched in 2011 Depop grew quickly amongst younger audiences, particularly Gen Z who are perhaps more favorable of it's visual aesthetic and style not to mention it's social media qualities.	One of the most popular platforms in the UK for trendy, vintage or unique fashion.	Items are generally shipped via postal services directly from the seller however some sellers offer local pick-up arrangements.
shpock	Shpock which is short for "Shop in your pocket" is a similar platform to Depop and vinted except made for all categories of items including clothes. The reason I've featured it on this list however is that it does feature a lot more clothes than other all-round second-hand marketplaces.	Shpock was originally founded in Austria in 2012, later it expanded to the UK.	Became the one of the go-to choices when trying to get something quickly and easily due to a more localised approach to selling.	Everything is by default done through collection although some orders can have postage if set up by the seller.
GRAILED	Grailed is a higher end second-hand fashion marketplace which is focused more on menswear. Much like Depop, it specialises in streetwear, vintage clothes and designer label.	Founded in the US in 2013, Grailed is available globally in all countries which accept US imports including the UK.	Popular most amongst fashion enthusiasts, streetwear collectors and fans of vintage clothes. It's most popular for containing rare and limited editions of designer items.	Orders are done all through the post from either seller to customer or from Grailed themselves.
Gumtree	Gumtree is another all-round marketplace which is like Shpock except transactions are not made on the site itself. This is because Gumtree is a classified ads site meaning they simply act as a middleman; no transactions ever involve Gumtree themselves.	Launched in London in 2000, Gumtree quickly became one of the most popular classified ads sites in the UK.	Despite strong competition from other local classified sites, such as Facebook Marketplace, Gumtree remains as a popular option for local deals.	Predominantly local transactions meaning no shipping is needed however some deliveries may be arranged.
remix	Remix is an ecommerce platform based in Bulgaria, much akin to Grailed, it holds inventory of second-hand apparel as well as letting anyone sell their own clothes on the site.	Created in Bulgaria in 2012, Remix has expanded over time to operate in many European countries, including the UK.	Remix gained popularity slowly but has built up a steady user-base who appreciate the platform's affordable pricing and sustainable practices, such as zero plastic packaging.	All items are shipped to buyers by post from Remix's warehouse rather than from sellers directly.
wallapop	Wallapop is a mobile-oriented peer to peer marketplace based on the concept of local transactions. Whilst the platform is a marketplace in the traditional sense, it is more akin to Gumtree since it classes itself as a classified ads platform.	Launched in Spain in 2014, Wallapop took the route of many online marketplaces, slowly expanding to other European countries including the UK.	Wallapop is a far smaller community than other online marketplaces in this table. Notably it's popular amongst eco-conscious shoppers.	Predominantly local transactions although some sellers may choose to arrange postal delivery.

Situation Analysis - Opportunities

Situation	Busy Professionals	Parents with Outgrown Children's Clothes	Young Adults in Shared Housing
Clothing image	 [22]	 [23]	 [24]
Description	In today's world there are many professionals have demanding full-time jobs with little downtime. These individuals may commute, work long hours, or juggle multiple responsibilities, leaving very little time for personal admin tasks, much less auxiliary tasks like selling second-hand clothes online.	Parents with young children, often find themselves overwhelmed by the constant turnover of clothes as kids quickly outgrow their outfits. While there may be large quantities of used clothing at home, each item tends to be low in value, making the time spent photographing, listing, and packaging for online sale hardly worth the return.	Young adults living in shared accommodation such as university students or recent graduates renting houses together often lack the physical space and privacy to sort, store, or manage second-hand clothing sales. They may not have easy access to printers, packaging materials, or quiet areas to handle postage or pickups.
Where the Situation Is	Typically at home, late evenings or weekends, when energy is low and time is limited.	In family homes, particularly children's bedrooms, laundry areas, or storage bins full of outgrown clothes.	Shared homes or student flats, often with limited wardrobe space and communal living conditions.
Key Features of the Situation	- Limited free time - Competing priorities (work, social, fitness) - Fatigue after work hours - May value convenience over profit	- Large volume of small, low-value items - Constant cycle of clothing turnover - Need for convenience or bulk donation - Cost of packaging/post vs. potential earnings	- Lack of space to sort/store items - Inconvenient shared facilities - Limited access to printers or packaging - Possible reliance on public transport for postage
Other Considerations	They may be willing to donate or use a service that collects and resells/donates for them. They value time and simplicity more than maximising profits.	Might benefit more from local swap groups, donation schemes, or bulk collection services that don't require detailed listings.	May want to declutter but lack the logistical means. A drop-off service or clothes bank nearby might be preferable.

Situation analysis

The three situations above clearly describe three situations where the individuals face significant logistical and motivational barriers (i.e they lack inclination and provocation) to reselling second-hand clothing themselves, and would benefit more from convenient, low-effort solutions such as bulk collection services, drop-off points, or donation schemes that prioritise simplicity over profit. What's interesting is that each situation requires a slightly different solution that would require determining exactly what the barrier is in that scenario and determining ways to solve for that particular barrier.

Problem Areas - Online marketplaces

Shipping costs
Shipping is not typically paid for by the customer on a lot of online marketplaces and even in the scenarios where shipping is paid for, that fails to account for the price of shipping materials such as shipping bags.

Sending orders in a timely fashion
Unless an item is particularly high in demand it will probably be sold a good time after the seller has created their listing. This becomes a problem when the seller is not prepared to make the shipment or has forgotten they listed the item all together. Both scenarios result in wasted time for the customer and may reduce their chances of buying from second-hand marketplaces again.

Environmental Concerns
Not only is there a lot of electricity being consumed in the use of these online marketplaces but also the shipping of products sold on them contribute to global carbon pollution and climate change.

Packaging sustainability
Clothes are often shipped in plastic due to its durability and water resistance ensuring the garment is undamaged. However, this comes with the side effect of polluting our planet with more single use plastics which end up in landfill or worse.


A pile of unopened packages demonstrating the amount of plastic used in shipping.

Dormant listings
Because items can sometimes take a while to sell after being listed, issues can arise from dormant listings that are often forgotten by their sellers, leading to problems if someone eventually decides to purchase them.

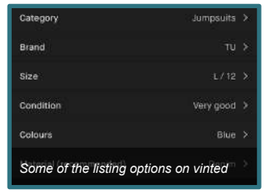
Quality Control
When items are listed on online marketplaces there is almost no way for them to authenticated. This opens the door to listings created with fake or stolen images, manipulated photos of damaged clothing or visually convincing fakes.

Managing marketplace accounts
To sell items faster a lot of sellers choose to list their clothes on multiple sites at a time. Not only does this take a lot of time do but it also leaves the seller responsible for double selling an item and arranging a refund if mis-managed.

Platform fees
A big discrepancy between marketplace sites is their fees for use. Along with the typical cut taken from each transaction, online marketplaces usually charge a small listing fee which is simply deducted from the money received by the seller. This practice is predatory and leaves the seller with no choice other than to comply if they want to sell on that marketplace.

Barriers to selling (time restraint)
Ultimately a lot of people choose not to sell clothes online due to the number of barriers to selling. Mainly the whole process is very time consuming. To reference my comment on "Nespresso" machines, what if there was a way to get rid of old clothes which was as easy, fast and satisfying as a Nespresso machine.

The complexities of listing
Listing products is heavily time consuming and requires; taking high quality photos, writing descriptions and deciding a price. Furthermore, the listing requires a certain upkeep with replying to questions or offers as well as lowering the price if necessary.



Some of the listing options on vinted

Seasonal Interest
Another issue with all marketplaces but particularly bad for any peer-to-peer marketplaces is the level of seasonal demand. The data to the right shows interest in the Google search term "second hand coat" in the UK. Notice how during summer months there are almost no searches? It would be almost impossible for a seller trying to get rid of a coat during this season.

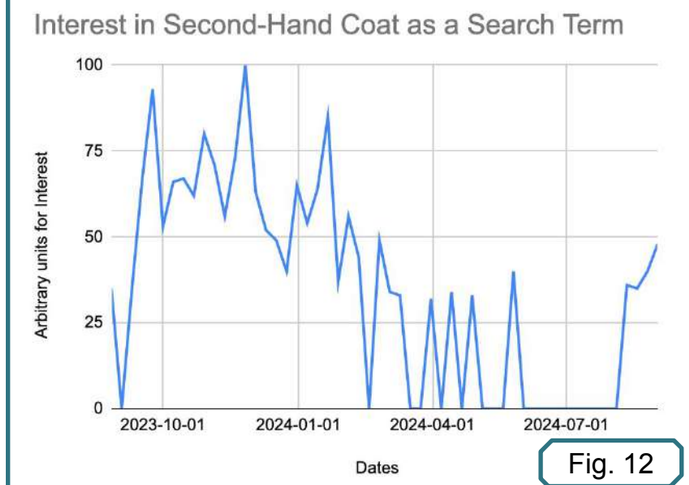


Fig. 12

Market saturation
Since clothes listed online can usually be sold nationally or even internationally the market competition for most items is high. On the one hand this means it's easier for buyers to find a good deal and sellers to decide a price but on the other it means that your items are less likely to sell the more common they are.

Inventory management
Online marketplaces don't come with tools for inventory management making it the responsibility of the seller to device a method of managing their stock.

Conclusions

Clearly from the thirteen issues listed above, shopping for your second-hand clothes online is not always a completely smooth process. Despite the fact there are so many issues though it still manages to be the most popular form of second-hand selling on my survey. Its popularity is due to the numerous user-experience improvements over any other kind of second-hand selling; the convenience, the number of options, filters to search and being able to shop by simply lifting a finger, to name a few.

Three Fundamental Issues

When you read between the lines on these topics you start to notice fundamental causes of issues are usually all linked, this is the case with these issues. I believe each one of the thirteen main issues above can be simplified into three fundamental issues which cause a butterfly effect to create the others. Firstly, the peer-to-peer system. Whilst the idea of a peer-to-peer system looks nice on paper it doesn't often work the greatest. Not only does it require greater work from the end user in both scenarios, whether you're a seller or a buyer, but it also contributes to the greatest number of problems. Secondly, a reliance on flexible postage services. Mailing items sure is convenient for the customer and I'm not disputing mail being a part of the process of moving the clothes but the entire process, causes major problems. For example, since the post is sent directly from the seller there is no way of confirming whether they shipped out what they said they did. Finally, packaging. Every order I've received from Depop or Vinted has been in a single use mailing bag which frustrates me due to the amount of pollution they must contribute to.

3 core issues

Peer-to-peer | Reliance on flexible Post | Packaging

Investigating A Donation Approach

Representative: Sam Shaw (He/Him)

Managing Director of CSR (Corporate Social Responsibility) & Employee Communications at **Charles Tyrwhitt.**

37 years old.

Oversees the Recycling initiative at Charles Tyrwhitt.

Charles Tyrwhitt

British formal-wear clothing brand.

Established in 1986

Recently introduced a clothing recycling scheme.

What did I learn about the Charles Tyrwhitt Donation Scheme?

The Charles Tyrwhitt Donation Scheme encourages customers to return used clothing in exchange for discounts on new items. The returned clothes are donated to the British Heart Foundation, where they're resold to support heart research. This initiative keeps clothing out of landfills and raises funds for charity, combining environmental impact with social good, though it stops short of a fully circular model due to recycling limits.

Introduction

I thought it worthwhile looking into donation to see if there was any potential opportunities there, I did this by interviewing the head of a donation scheme at a big clothing retailer.

What is Charles Tyrwhitt?

Charles Tyrwhitt is a british menswear brand focused on formal garments such as shirts and suits. It was founded in 1986 by Nicholas Charles Tyrwhitt Wheeler and Peter Higgins. The brand is known for creating classically designed clothing with high quality at a mid-range price point though intended for professionals. Its particularly recognised for its shirts which are its most popular item and they offer various fits, collar styles and sleeve length whilst embracing traditional british tailoring influences.

Infographic for the Charles Tyrwhitt Recycling Scheme [6]

Charles Tyrwhitt Shops in London and Manchester [4] [5]

Why Charles Tyrwhitt?

I went with Charles Tyrwhitt because they're a brand that truly embodies the values I want to support as well as providing the particular opportunity for my product. I want to support sustainable practices and circular-fashion throughout my project and it wouldn't make sense to choose a brand that didn't also share those values. Charles Tyrwhitt has made multiple commitments that align with the values spoken about in my areas of interest. On their website they recognise the significance of the fashion industry in global carbon emissions[7] and they're ambitious to minimise it both internally and externally. To do this they teamed up with Planet Mark, an organisation which independently verifies and measures carbon and social data to reduce emissions.[8] Using Planet Mark's verification they've committed to cutting their carbon emissions by 5%[7] each year which to me shows they're serious about actually making a difference instead of simply 'greenwashing'.

What really made me choose them for my project however is their focus on giving clothes a second life through their donation scheme with the British Heart Foundation. After launching the scheme in 2021, they've saved over 230,000 clothing items from being dumped in landfill and raised 2.5 million pounds for the British Heart Foundation[7].

I believe that supporting this effort by creating a solution to simplify the process would provide an excellent opportunity for my project to showcase real-world functionality while also potentially enhancing the efficiency of an actual recycling scheme.

Interview Transcript

Please note that this is a summarised version of the interview transcript edited to ensure that only useful information and important parts of interview where brought into the project.

Interview Transcript with Sam Shaw

Monty: Good morning! How are things?

Sam: Good morning, Monty. Going well, thank you!

Monty: Brilliant. So, where are you based?

Sam: I'm working from home today. How about you?

Monty: I'm in Stansted, near the airport. I was actually supposed to be at school, but it turns out we're off today.

Sam: Lucky you! So, let's get started. Could you tell me more about your project and what you're aiming to achieve?

Monty: Sure. I need a client for my project—someone I can present my work to and who can provide feedback. I thought Charles Tyrwhitt might be a fit since you have a recycling program. I'm designing a vacuum-sealing appliance to prepare clothes for recycling, aiming to make it as user-friendly as possible—almost like an espresso machine or Dyson. Could you explain a bit more about how your recycling scheme works?

Introductory pitch

Sam: Absolutely. First, just to clarify, when you say "recycling," do you mean clothing repurposed in its original form or broken down into raw materials?

Important distinction to clarify

Monty: Great question. I haven't fully decided yet. Upcycling keeps items intact, whereas recycling is a more transformative process. I'm still open to both options.

opportunity

Sam: Got it. In the fashion industry, true circularity is challenging. Most of us, including Charles Tyrwhitt, work in a linear model—producing, selling, and, eventually, these items often end up in landfill. A fully circular model would require clothes to be designed from the start with recyclability in mind. Our approach focuses more on extending product life by encouraging customers to bring back old clothes.

Challenge

Link to reselling

Monty: Interesting. So, what happens to the items once they're returned?

Sam: Customers can bring back any shirts or suits, regardless of brand, and we give them a discount on new purchases. Items are sent from stores to our warehouse in Milton Keynes, where they're bundled up and donated to the British Heart Foundation. About 95% of what we donate is resold in their charity shops, with proceeds going to heart and circulatory research. Since starting this in August 2021, we've donated around 289,000 items, which raised about £3.2 million and diverted roughly 66 tonnes from landfill.

Clear demand & supply

Monty: That's brilliant. Do you think vacuum-sealing the clothes for transport would be beneficial?

Sam: It's an interesting idea, though in our case, we haven't found the need. With our current setup, items travel back to the warehouse within our existing logistics network. For luxury retailers or higher-value items, it might be more applicable.

Opportunity

Monty: Good point. My idea stemmed from research into space-efficient ways of transporting second-hand clothes, which led me into the recycling and upcycling aspects of the industry.

Sam: There's a lot of potential there. You could look into how your vacuum-sealed bags could benefit retailers wanting a more comprehensive, circular solution—one that includes packaging and handling for resold items. Thrift is a good example of a company providing this sort of all-in-one service.

contact?

Monty: I really like that concept—an end-to-end solution. My brief is quite open-ended, so I have the flexibility to create something new or improve on an existing system.

Potential 'missing market'

Sam: Fantastic. Focusing on retail circularity could add value, especially as brands increasingly look at environmental impact. Customer interest in sustainability doesn't always translate into action, but regulatory pressure is increasing. We're working on a project with DPD for a home donation portal launching next year, so customers can send items directly to the British Heart Foundation.

Monty: That's interesting. I didn't realise customer sentiment on sustainability was still relatively low.

Sam: Yes, customers often like sustainability initiatives, but the main appeal tends to be the discounts they receive in return. With new EU regulations, however, there will soon be requirements for reporting on product end-of-life, which will push brands towards more sustainable models.

investigate potential implications

Monty: Absolutely. Regulations can be a great driver of change.

Sam: Exactly. I hope this gives you some good insights for your project. I'll email you some information on other recycling programs, and feel free to reach out if you need anything else.

Monty: Thank you, Sam. This has been incredibly helpful!

Sam: My pleasure, Monty. Best of luck with the project, and keep me updated!

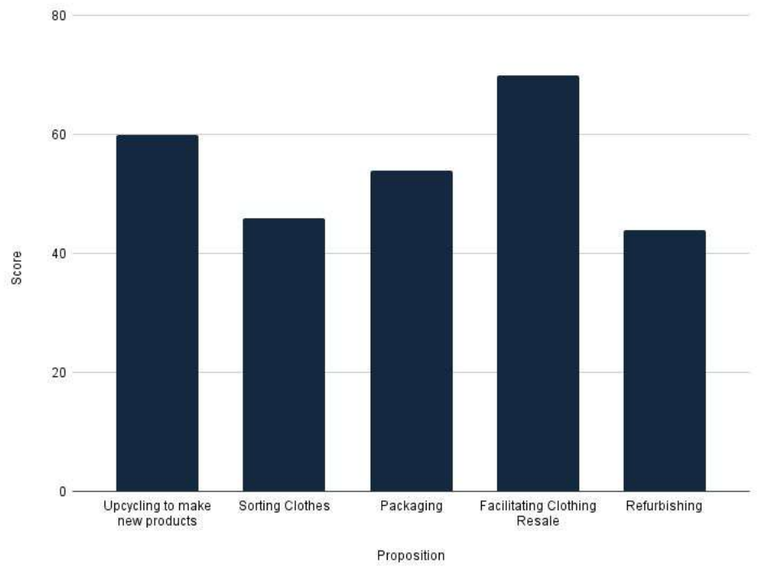
Monty: I will, thank you so much.

Full Interview Video

Determining a Proposition

Formulating and Scoring Project Propositions
In order to effectively begin my specific research for the project, I need to establish a clear proposition. This is done by consolidating what I have done so far into a table of propositions, which will assist me in selecting the one I will pursue. The proposition serves as a rough outline of what will happen in the project, although it does not yet specify the actual details. The goal is to quantify the assessment of each of these propositions to determine which one I should use for my project. I have chosen the criteria for evaluation myself, and I have decided to rate each proposition out of a score of 15. The total score is shown at the end of the table. Based on this total score, I will select the chosen proposition.

How I decided to rank propositions
To rank propositions i needed to use my own personal thoughts and opinions based on what I know about each proposition and how the proposition links to an identified opportunity and situation. The key is to understand that there is not really a sense of biases when approaching this exercise. Since I've yet to determine a client for the project and I still do not fully understand the scope of the project area any conclusions derived from this exercise are biased because they are subjective but it doesn't really matter that they are biased. This is because the steps from here or are where I really determine the specifics of the solution and how specifically will the problem be solved within the project situation and opportunity to hopefully lead to a final design that is appropriate and fit for purpose.

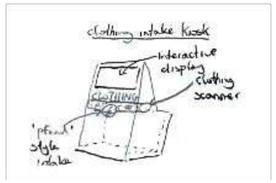
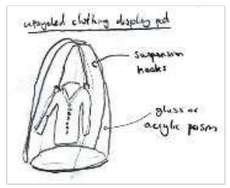
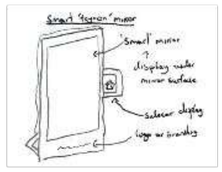
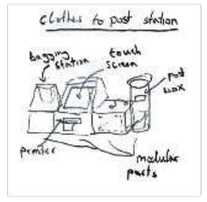
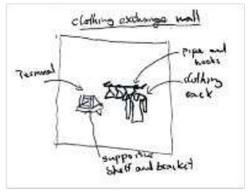


Proposition	Impact	Achievable	Innovative	Feasibility	Scope	Score
Upcycling to make new products	14/15	12/15	13/15	11/15	10/15	**60/75**
Sorting Clothes	9/15	3/15	8/15	12/15	14/15	**46/75**
Packaging	10/15	15/15	9/15	13/15	7/15	**54/75**
Facilitating Clothing Resale	14/15	14/15	15/15	12/15	15/15	**70/75**
Refurbishing	7/15	12/15	4/15	9/15	12/15	**44/75**

Area of evaluation	My Definition
Impact	Refers to the potential social impact of the selected proposition.
Achievable	Describes how likely It is that I can complete the project with my skills.
Innovative	Indicating the level of original thinking required to fulfil the proposition.
Feasibility	Can the proposition be completed within the time-frame and restrictions of the DT department.
Scope	How open the proposition is to generating a wide variety of different designs or solutions.

Initial Ideas - Napkin Drawings

All of these concepts were based off nothing more than the proposition of 'Facilitating Clothing Resale' and of course the specific context within a online or digital approach.

Idea	Interpretive image	Description	Features	Feasibility (1–5)	Chain of Reasoning (→ ↑ ↓)
1. Advertisement Prism from Recycled Monitors		A triangular prism made from 3 old monitors, displaying rotating second-hand clothing ads with QR codes	· Rotating digital display · Recycled materials · QR codes linking to resale platforms	**3/5**	Increased awareness of resale options → ↑ visibility of sustainable fashion → ↑ engagement from passive viewers
2. Automated Clothing Intake Kiosk		A kiosk like Coinstar that scans, values, and prints resale info for clothing drop-offs	· Barcode or QR tag printing · Camera for item recognition · Potential payout/credit system	**4/5**	↓ Effort required to resell clothes → ↑ convenience for users → ↑ overall participation in resale
3. Upcycled Clothing Display Pod		A solar-powered rotating clothes display with tap-to-view info and payment option	· Reclaimed wood and materials · Solar motor · NFC tags for item history	**3.5/5**	↑ Interactivity and storytelling → ↑ perceived value of second-hand clothes → ↑ likelihood of purchase
4. Smart Mirror for Resale Try-On		A digital mirror that lets users list outfits directly to resale platforms after trying them on	· Camera integration · Auto-tagging for listings · Style and lighting suggestions	**2.5/5**	↓ friction in listing clothes → ↑ volume of listings → ↑ platform engagement and resale circulation
6. Clothes-to-Post Station		A kiosk that vacuum-packs clothing, prints a shipping label and estimates postage	· Built-in scale and bagging system · Postage label printing · Data connection to resale/donation sites	**4/5**	↓ effort to prepare parcels → ↑ likelihood of resale or donation → ↓ textile waste in landfills
7. Clothing Exchange Wall (Physical + Digital)		A pegboard with QR-tagged garments for trade or sale; includes a digital screen to browse listings	· Community swap focus · Tablet integration · Print-your-own QR tags	**4.5/5**	↑ accessibility of second-hand fashion → ↑ community sharing → ↑ circular economy in local areas
8. Second-Hand Garment Vending Machine		A vending machine stocked with second-hand clothes, paid for via card or app	· Digital bios for garments · Clear windows or display screens · Compact and portable	**3.5/5**	↑ novelty and accessibility → ↑ curiosity and impulse buying → ↑ adoption of resale culture

Creating a Design Statement

What is a design statement?

A design statement is a focused description that clarifies the intent and overarching goals of a design project, summarising *why* the project exists and *who* it aims to help. Typically crafted after primary research, it highlights the specific needs, challenges, and context that the design must address, providing a high-level vision without diving into detailed requirements.

Unlike a design brief, which spells out precise criteria or specifications, the design statement captures the essence of the project—its guiding purpose. For example, in your project, which targets busy individuals and older adults, the design statement would outline the goal of creating a solution that simplifies the process of selling or recycling clothing in a user-friendly, hassle-free way. This approach ensures the project stays user-centred, making it a reference point throughout the design process to keep your focus on the solution's accessibility and convenience.

My Design Statement Addresses

Who?
Who I am helping with my design?

What?
What am I helping my target audience achieve.

How?
How is my product roughly going to do that.

Design Statement

"Help individuals who are time-poor and uninterested in traditional recycling methods to quickly and effortlessly package their clothes for sale by providing a high-end, consumer-oriented solution."

My Design Statement **DOES NOT** Address

Technology
My design statement does not mention any specific technology.

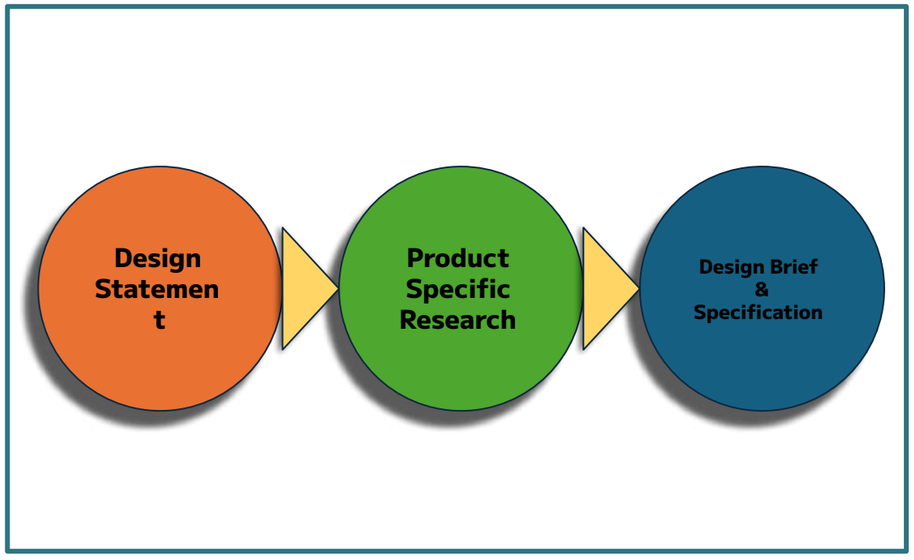
Function
My design statement does not contain specifics on function.

Materials
My design statement does not mention any materials I will use.

How does the design statement inform my brief?

The design statement serves as the conceptual foundation for the design brief, providing a clear purpose and guiding vision for the project. By establishing the "why" of the design, it allows the brief to focus on translating these broad objectives into specific, actionable criteria. The brief is thus informed by the priorities outlined in the design statement, which helps in defining precise requirements for functionality, usability, aesthetics, and any constraints on materials, budget, or time.

In essence, the design statement's high-level guidance enables the design brief to outline measurable goals and practical standards that will direct the design process from initial concept through to realisation. This ensures a coherent and focused approach that aligns with the original purpose throughout the development stages.



Experimentation - Investigating Vacuum packing

Why I performed this experiment

As mentioned from the beginning of the project I wanted to integrate the benefits of vacuum packing clothing into the final product. As part of this research I needed to understand the the actual benefit to vacuum packing in terms of surface area and volume occupied. In order to do this I used a quick experiment as well as some pre-made vacuum bags in order to create an airtight seal around a medium sized suit shirt.

Conclusions

From my experiment I discovered that the actual horizontal surface area of the shirt remains almost exactly the same before and after the vacuum but the interesting part is that the volume that the shirt occupied including the bag shrunk by around 75% which made it a lot smaller. At this volume I could easily slide the shirt into a paper envelope. Another thing I noticed was the rigidity of the shirt once vacuumed. The shirt was so hard that the whole package became more significant and it would be unlikely for the shirt to become unfolded in shipping. Furthermore the vacuum also reduced any air-pockets or loose bag material which could cause a tear in the bag. Any tears or damage to the bag could potentially cause the shirt to be damaged and contaminated by anything it interacts with while shipping. So because of this test I understood that the benefit of Vacuum Packing was not just in size but also inn preserving the quality of the shirt during shipping.

Experimentation - Testing Vacuum on a chamber

Methodology behind performing this experiment

1. **Visualise Pressure Drop**
   The balloon's increase in volume is an immediate, intuitive indicator of how rapidly air is being evacuated.

2. **Estimate Pump Performance**
   Measuring how much the balloon inflates in a given time lets me approximate the pump flow rate and ultimate vacuum level.

3. **Assess Seal Integrity**
   Once the pump is isolated, any slow deflation of the balloon reveals leaks in the chamber or tubing.

4. **Inform Final Design**
   Quantitative data on expansion rate and leak-driven contraction help me size hoses, choose gasket materials and validate pump capacity for the design.

5. **Testing Ball valves**
   I wanted to know whether or not the small valves I was using for the project would be able to withstand negative pressure.

Pressurising the vacuum chamber with pump for the first time

Time (s)	Balloon Diameter (cm)
0	5.0
10	6.3
20	8.1
30	10.4
40	12.9
50	15.3
60	17.6
70	19.3
80	20.7
90	22.1
100	23.3
110	24.2
120	25.0

Short Plan:
To test the vacuum chamber effectiveness, I placed a balloon inside it and gradually removed air using a diaphragm pump. I observed and measured the balloon's diameter at regular time intervals over a 120-second period to see how it responded to the falling pressure.

Variables:
In this experiment, the independent variable was time (measured in seconds), as I tracked changes in balloon size over a set period. The dependent variable was the diameter of the balloon in centimetres. Control variables included the type and size of the balloon, the internal volume of the vacuum chamber, the strength of the diaphragm pump, and the ambient temperature.

Hypothesis:
I predicted that as the air was removed from the vacuum chamber, the external pressure acting on the balloon would decrease, causing the balloon to expand steadily. I expected the diameter to grow from around 5 cm to 25cm over the 120-second period.

Safety Precautions:
To ensure safety, I made sure the vacuum chamber was securely sealed and structurally sound to prevent implosion or sudden leaks. I avoided over-inflating the balloon to reduce the chance of bursting, and I kept all electrical components, especially the pump, away from any liquids or unstable surfaces.

0 seconds	30 seconds	60 seconds	90 seconds	120 seconds
				

Solution Research - What is a kiosk?

Automated Kiosk

also known as a self-service kiosk, is a touchscreen device that allows customers to interact with a company without the assistance of a staff member. Defined as by squareup.com[3]

Kiosks	
Location	**Purpose**
Restaurants	Ordering food at quick-pay restaurants
Transportation hubs	Purchasing tickets for trains, buses, and cruises
Airports	Checking in to flights
Shopping centres	Wayfinding
Amusement parks	Ticketing
Train stations	Purchasing transit passes and train tickets
Reverse Vending Machines	
Public Areas	Collecting Post, Converting Money or Trading in Phones & Other Items for Cash

Benefits of using a Kiosk
(for businesses)

- Can Operate 24/7
- Remove waiting time
- Cost Efficiency
- Scalability

Downsides of Using a Kiosk
(for businesses)

- High initial cost
- Maintenance
- Technical issues
- Accessibility challenges

Marketability - Kiosk Market Map

Why make a market map?

If I want to go down the route of building a kiosk I need to fully understand the market in which I would be creating the design within. Products have to be functional for the user but also have to function within the market that they are created for. This could be portrayed from multiple perspectives as different market maps using the various categories of kiosk. For example I could sort the map based on Quality and Price. The most important thing to highlight is that market mapping is a marketing research technique and therefore does not necessarily help me define product specifics but rather gives me an overview of potential gaps in the market or how other solutions function from a value proposition point of view.

Why Price and Versatility?

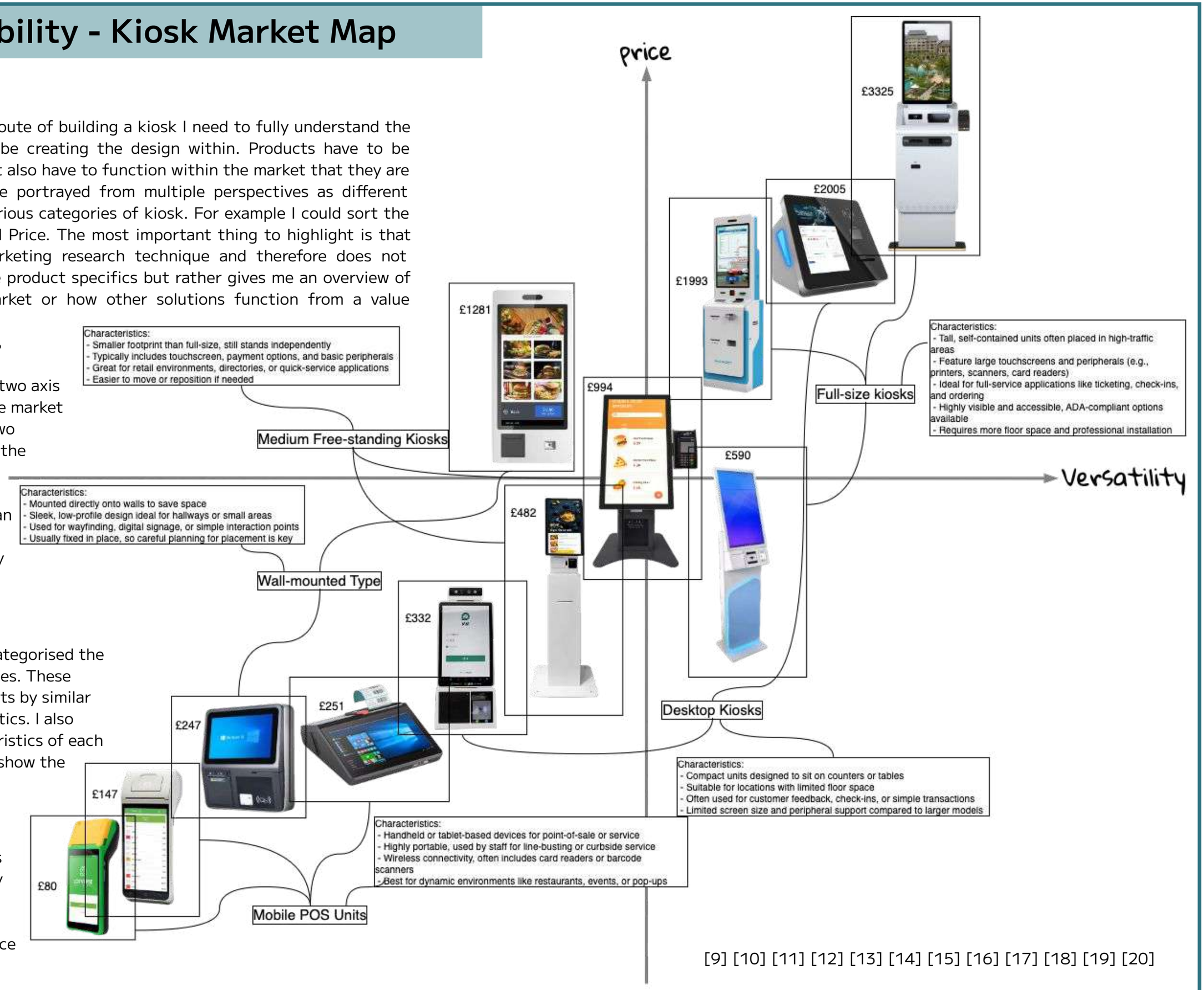
Price and versatility were two axis I decided to use to map the market for kiosks. I chose these two because they present how the market functions without over-fixating on quality Because that is not really an Important metric for this Particular market or for my project.

Patterns and Categories

After creating the map I categorised the products into five categories. These categories sort the products by similar properties and characteristics. I also highlight the use characteristics of each category in a small box to show the similarities.

Conclusions

Overall my main takeaways from this exercise is simply identifying the main five categories of kiosk and understanding how the price effects the versatility.



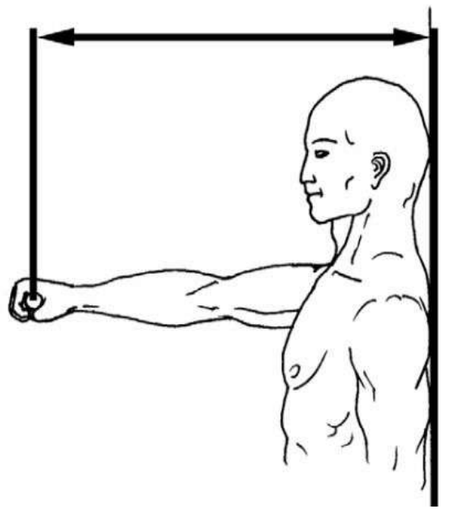
[9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20]

Ergonomics, Anthropometrics & Safety [21]

Functional Grip Reach

The Data on Functional Grip[21] Reach tells us how far someone can comfortably extend their arms while maintaining control. With mean reach values around 99.8 cm for females and 107.3 cm for males, positioning elements like handles, printers, or drop-off slots within a 90–110 cm range from the user's standing point ensures accessibility for most. This supports ergonomic efficiency and inclusivity, particularly important for quick-use, public-facing machines like kiosks.

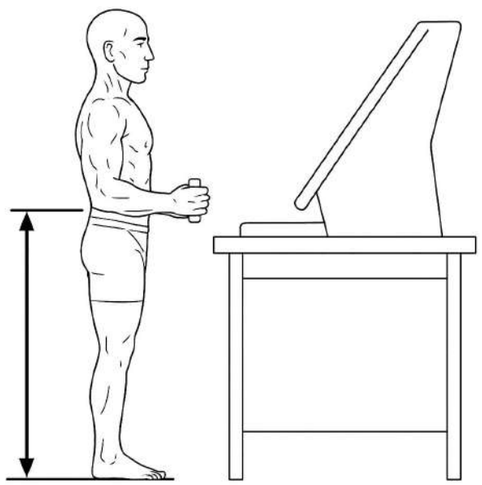
FEMALE N = 2208			MALE N = 1774		
Centimeters		Inches	Centimeters		Inches
68.61	Mean	27.01	75.07	Mean	29.55
3.39	Std Dev	1.33	3.68	Std Dev	1.45
83.20	Maximum	32.76	92.10	Maximum	36.26
57.50	Minimum	22.64	62.60	Minimum	24.65
	Percentiles			Percentiles	
61.51	1st	24.22	67.26	1st	26.48
62.12	2nd	24.46	68.04	2nd	26.79
62.55	3rd	24.63	68.55	3rd	26.99
63.19	5th	24.88	69.28	5th	27.28
64.26	10th	25.30	70.45	10th	27.74
65.03	15th	25.60	71.27	15th	28.06
65.66	20th	25.85	71.93	20th	28.32
66.22	25th	26.07	72.52	25th	28.55
66.72	30th	26.27	73.05	30th	28.76
67.19	35th	26.45	73.54	35th	28.95
67.64	40th	26.63	74.02	40th	29.14
68.08	45th	26.80	74.49	45th	29.33
68.51	50th	26.97	74.95	50th	29.51
68.95	55th	27.15	75.42	55th	29.69
69.40	60th	27.32	75.90	60th	29.88
69.86	65th	27.50	76.40	65th	30.08
70.34	70th	27.69	76.92	70th	30.29
70.87	75th	27.90	77.50	75th	30.51
71.46	80th	28.14	78.15	80th	30.77
72.15	85th	28.41	78.91	85th	31.07
73.03	90th	28.75	79.87	90th	31.45
74.36	95th	29.27	81.31	95th	32.01
75.24	97th	29.62	82.25	97th	32.38
75.90	98th	29.88	82.94	98th	32.65
76.97	99th	30.30	84.03	99th	33.08



Elbow Rest Height

The anthropometric data on Elbow Rest Height is relevant for determining the appropriate height of user interaction points on the kiosk in particular the touch screen. The bottom of a screen should fall ideally just above the elbow rest point. According to the data[21], the average elbow rest height for both men and women range between approximately 68.5 cm (50th percentile females) and 75.1 cm (50th percentile males). This suggests that any interactive elements should ideally fall within this range or slightly above to accommodate the majority of users without requiring them to hunch or overreach.

FEMALE N = 2208			MALE N = 1774		
Centimeters		Inches	Centimeters		Inches
99.79	Mean	39.29	107.25	Mean	42.22
4.48	Std Dev	1.76	4.81	Std Dev	1.89
118.50	Maximum	46.65	126.10	Maximum	49.65
85.60	Minimum	33.70	88.80	Minimum	34.96
	Percentiles			Percentiles	
89.51	1st	35.24	96.18	1st	37.87
90.80	2nd	35.75	97.56	2nd	38.41
91.58	3rd	36.06	98.40	3rd	38.74
92.63	5th	36.47	99.52	5th	39.18
94.20	10th	37.09	101.21	10th	39.85
95.24	15th	37.50	102.34	15th	40.29
96.06	20th	37.82	103.23	20th	40.64
96.77	25th	38.10	104.00	25th	40.95
97.41	30th	38.35	104.70	30th	41.22
98.00	35th	38.58	105.35	35th	41.48
98.57	40th	38.87	105.97	40th	41.72
99.12	45th	39.02	106.57	45th	41.96
99.67	50th	39.24	107.18	50th	42.20
100.23	55th	39.46	107.78	55th	42.43
100.79	60th	39.68	108.40	60th	42.68
101.38	65th	39.92	109.05	65th	42.93
102.02	70th	40.16	109.73	70th	43.20
102.71	75th	40.44	110.47	75th	43.49
103.49	80th	40.74	111.31	80th	43.82
104.41	85th	41.11	112.28	85th	44.20
105.60	90th	41.57	113.50	90th	44.68
107.40	95th	42.28	115.28	95th	45.39
108.59	97th	42.75	116.41	97th	45.83
109.47	98th	43.10	117.21	98th	46.15
110.87	99th	43.65	118.41	99th	46.62



Feature	Ideal Dimension Range	Reasoning
Control panel / screen height	~70–75 cm	Matches elbow rest height of most users for ease of touch interaction
Reachable depth into kiosk	Max ~90–100 cm	Keeps buttons, bags, or drawers within functional grip reach for all users
Handle / grip placements	~90–100 cm from ground	Comfortable, safe reach range for loading/unloading clothing
Optional drawer height	~60–75 cm from ground	Avoids bending for short users and awkward height for tall users

Center of Mass and Stability

For stability and safety, the kiosk's centre of mass should be kept low, ideally around 25% of the kiosk total height from the ground, it should also be positioned centrally within the base footprint. This prevents tipping when users press, lean, or interact with the machine. To achieve this, heavier components like the vacuum pump or ballast weight should be placed near the bottom, ensuring the kiosk stays secure during use. This stability is so important when designing kiosks as more people are killed by falling vending machines than shark attacks so its a real danger[24].

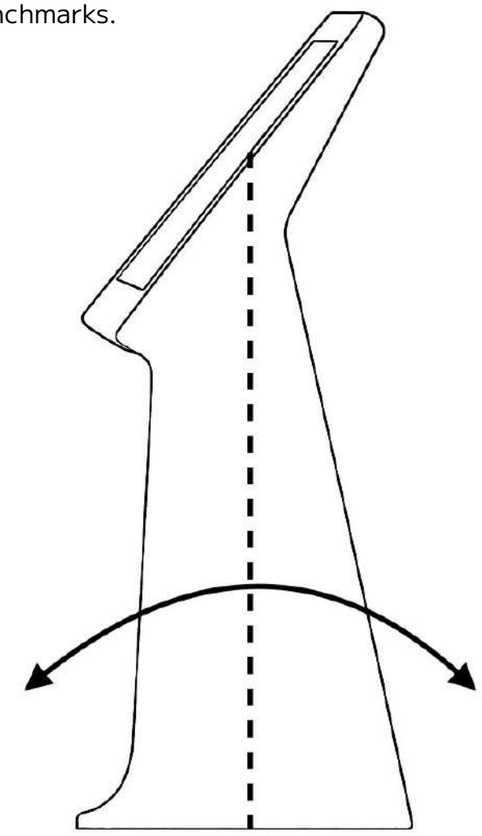
Component Certifications

Whilst looking for electrical components for the kiosk it's important that I ensure they are compliant and have been assessed by the following organisations to prevent fire risk or electrical hazard caused by sub-par component quality. This is especially important when browsing sites like Aliexpress, where I will likely purchase components, because they are imported products which can sometimes skive regulations in the home nation of where they were manufactured (typically china.) For this reason I will check product descriptions to ensure at least. UKCA and CE compliance

UKCA – The UK Conformity Assessed mark is the UK's mandatory product safety certification for goods placed on the British market.

CE – The CE mark indicates a product meets EU safety, health, and environmental protection standards and is required for sale in the European Economic Area.

BSI – The British Standards Institution sets UK standards and certifies products with the BSI Kitemark to show they meet high safety and quality benchmarks.



Audience Profile - My Ideal User

Category	Audience
Demographics	
Age	35-55
Income Level	£52,500 avg
Employment Status	Employed, A London City Professional
Family Size	N/A
Education	Secured Higher Education
Location	London
Psychographics	
Financial attitude	Open to Saving and being Frugal
Spending Habits	Spends Money On Long-Lasting Clothing
Technological Use	Doesn’t use a second-hand online marketplace
Motivations	The Environment, Political Change and Economical Living
Lifestyle Choice	Busy, Working Professional
Concerns	Climate change, Fast Fashion

Client Profile

Introduction to [redacted]:

[redacted] Hucknall is the head of Private Banking at C. Hoare & Co he is a confident professional who is busy and concerned by appearing sharp and well dressed for his employer and co-workers.

He wears a selection of shirts in the mid to high range from a variable selection of brands such as;

- Charles Tyrwhitt
- T.M Lewin
- Spier & Mackay
- Thom Sweeney

Since [redacted] has a fairly senior position at C. Hoare & Co Bank he holds immense value in the condition of the shirts he wears. While he owns many high-quality shirts that still hold value, the process of selling or donating them is too time-consuming and inconvenient. Traditional methods require effort, organisation, and often in-person drop-offs, which do not fit into his busy lifestyle. He needs a solution that allows him to part with shirts effortlessly while ensuring they are presented well for resale or recycling.

Throughout the project I will be using [redacted] as the voice of the chosen audience and also as the voice of decision upon various project factors including design, material and function. By using his feedback and iterating with a loop back to client approach I aim to create something that matches [redacted] unique personality and perspective and something that appeals to the wider demographics of the chosen audience.

[redacted]

Client Profile:

- Name: [redacted] Hucknall
- Occupation: [redacted]
- High-ranking professional with a demanding schedule
- Values the crisp, fresh quality of new shirts and purchases them frequently
- Has accumulated a large collection of shirts he no longer needs or uses
- Lacks the time or inclination to engage with traditional resale or donation

Interview methodology
My main methodology for conducting an interview with [redacted] will be that I need to determine the specific pain points and the user insight of what exactly prevents the target audience from engaging with the online marketplace medium. I will likely use that vector as an approach for my plan and will continue to plan open-ended questions based specifically on that context.

Interview Plan
My plan for the interview is to ask at least 5 open-ended questions and then use clarifications to hopefully prompt [redacted] into telling me exactly it is that I want to know. To come up with questions that were relevant to to the conversation I came up with a list of relevant issues and slowly whittled them down to a few key issues before turning them into questions.

Hypothesis
I believe the interview will likely demonstrate a similar set of issue to the ones identified in my 'problems with online marketplaces' page but I hope that there will also be some other information that will be useful

Why [redacted]?
[redacted] is a brilliant representative of my ideal user and specific audience. Yes, I acknowledge that he is my dad but that does not particularly influence his role within the project and it does not mean that he will have any particular involvement other than being the client. The good thing about being so close to the client is that I already know so much about him and his personality furthermore I will be able to communicate with him on a regular basis because we both live in the same household. Reducing the friction for client feedback and evaluation will hopefully make the iterative design approach fly by much quicker and lead to a shorter project window being achieved as I can stick to the time schedule as set out by the gantt chart.

How does he represent the target audience?
[redacted] almost perfectly represents the target audience with some exceptions. Although he falls within the targeted age group he is at the older side of if but since the age group is based of limited data from the questionnaire and not some large dataset it cannot be completely used to exclude the ages above and below the specified range. That is to say that the range could be bigger or smaller than I portrayed with my questionnaire but the range set out by the ideal user table covers [redacted] age. His demographics including employment status and education level also match those set out in the ideal user table although its important to note that the income level described in the table is simply an average and isn't that important to the specific demographics of the client. In terms of psychographics [redacted] matches the portrayed psychographics well and doesn't really stray from the listed details in the ideal user table.

How frequently will he be updated?
Rather than a specific time interval between project discussion [redacted] will be updated every time there is a major or minor development in the project that requires some sort of feedback or evaluation from the clientele. I will be making the decisions on whether or not these developments will need to be brought to [redacted] based on the relevance that the development has to the final product.

Who else does he know from the target audience?
[redacted] is an experienced professional with decades of experience in the city and therefore his network of co-workers and colleagues, past or present covers a diverse range of personalities which will hopefully come useful further down the road.

Identification of Pain point (the multistep process)

Client Interview - understanding the issues

Interview Transcript with [redacted]

Monty: Thanks again for doing this. It's just a few questions about your shirts and why you don't really sell them.

[redacted] Yep, all good. Go on.

Monty: So first off, roughly how many shirts do you reckon you've got that you don't wear?

[redacted] Probably 20. Maybe more if I actually looked properly.

Monty: And do you ever think about selling them?

[redacted] I do, yeah. Usually when I'm struggling to close the wardrobe door. But then I just move on and forget about it.

Monty: Why not just chuck them on Vinted or something?

User Insight -> Time Constraints

[redacted] just haven't got the time. You've got to dig them all out, take photos, measure stuff, fill in all the details. It's not worth it after a long day.

Monty: Do you think you'd do it if the process was a bit quicker?

[redacted] Yeah, if it was dead simple. But even then, it's still another job on the list. I'm not keen.

Monty: What about the money? Do you think it's not really worth the effort?

Shutdown price incentive

[redacted] Depends. If it was like a 15 quid a shirt, maybe. But sometimes it's like £3 or £4 and it just doesn't feel worth it. Especially with how long it can take to actually sell.

Value = effort to sell

Monty: So how long is too long?

[redacted] I don't want it hanging around for weeks. If I decide to get rid of something, I want it gone. Not sat there waiting for someone to message me.

Insight to ideal time-frame

Monty: Have you ever had someone buy and then just vanish?

[redacted] Yeah. Sold a shirt once, buyer never paid. Had to relist it. Total waste of time.

Monty: Have you tried charity shops?

[redacted] A few times. But it's usually when I've already got the stuff bagged up. I don't really plan ahead for it. And they're not open when I'm about.

Kiosk -> open 24/7

Monty: So, it's not really about not wanting to get rid of them. More that you've not got the time or the headspace?

Another identification of multi-step process as a problem

[redacted] Exactly. I'd be happy for them to go. It's just the process that puts me off.

Monty: If there was something easy—like a machine that just took the shirts and sorted it all out for you—would that make you more likely to do it?

Instant removal -> Induced demand

[redacted] Absolutely. If I could just drop them in and be done, I'd clear the lot. Especially if I didn't have to mess around with photos or listings.

Monty: What if you didn't even get paid, just got rid of them instantly?

[redacted] I'd still probably use it. Space is more valuable to me at this point. Getting anything back's a bonus.

Willingness to lower shutdown price incentive for absolute convenience

Monty: That's helpful. So would it matter where the machine was? Like in a shop or train station?

[redacted] Nah, as long as it's somewhere I pass by. If it was in town or outside a supermarket, I'd use it.

Focus on locationary convenience

Monty: And would you rather cash or store credit?

[redacted] Either's fine. Credit's good if it's somewhere I'd actually spend it. But again, it's more about convenience for me.

Monty: Cool. Last one—do you think other people like you feel the same way?

[redacted] 100%. Everyone I know's got stuff they want to get rid of, but no one can be bothered. If you make it easy, people will use it.

Acknowledgement of wider issue

Monty: That's great. We'll talk more once I've done some more work towards the machine.

[redacted] Anytime. Looking forward to seeing this machine of yours.

Identifications from the interview

After completing the interview there was a few interesting things to note which i had previously not known or understood about the reason why busy professionals are such a missing market within the online clothing resale platforms. Firstly although i knew that the incentive to resell was too low on these platforms I did not fully understand the reason why. My initial prosumption was that it was because the shirts worth bought for much higher prices. But the real reason is actually because busy professionals value their time and the profit received from selling the shirt was not an incentive enough for them to use their valuable time on the multi-step process. Another interesting point was that convenience is absolute king for any questions regarding specifics of the kiosk, location has to be convenient and quick, payment has to be convenient and easy to use once received, the machine has to be quick and easy to use so its convenient. Understanding the most important thing is convenience is really going to to help me narrow down specific design choices further down the road for the project from everything to the components to the interface.

Client wants and needs

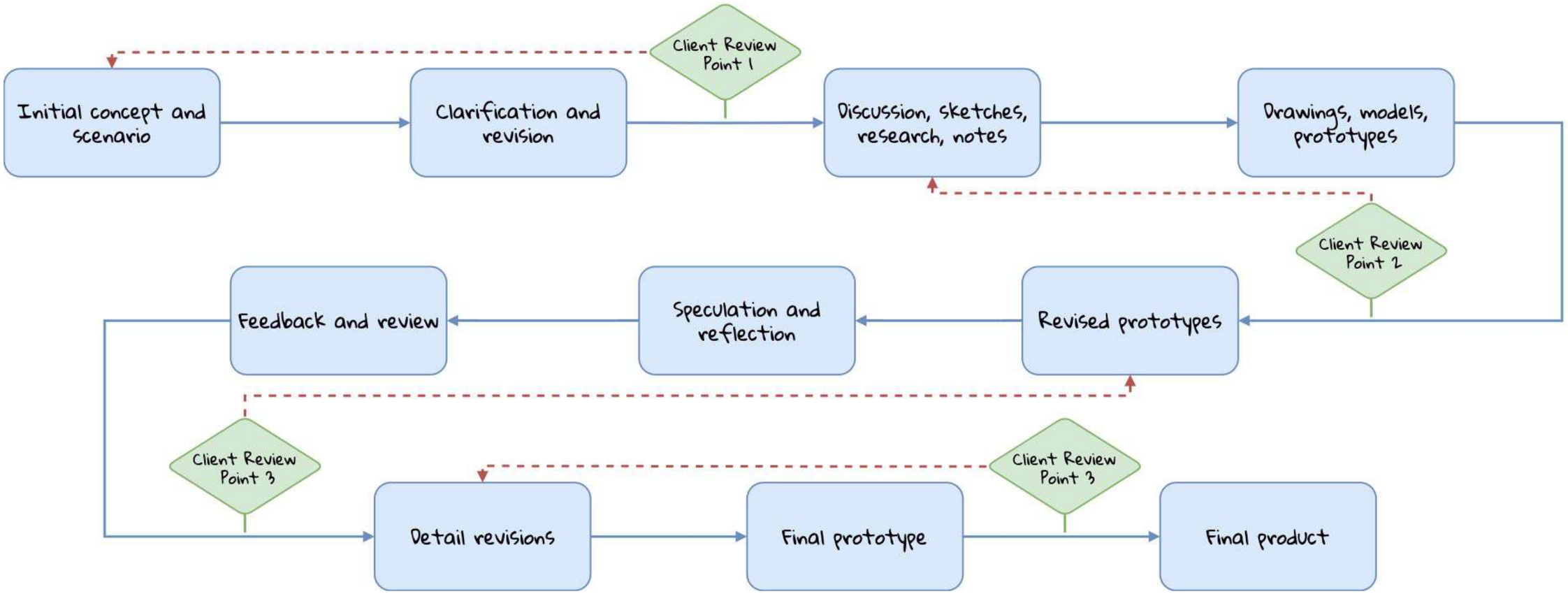
Category	Client Quote / Insight	Want / Need
Quantity of Shirts	"Probably 20 or 30. Maybe more if I actually looked properly."	**Needs** a solution to clear out a significant number of shirts
Selling Intention	"I do, yeah. Usually when I'm struggling to close the wardrobe door."	**Wants** to sell when prompted by lack of space
Barrier: Time	"I just haven't got the time. [...] It's not worth it after a long day."	**Needs** a time-efficient, low-effort solution
Barrier: Complexity	"You've got to dig them all out, take photos, measure stuff, fill in all the details."	**Wants** to avoid effort-heavy processes like photos & listings
Effort vs Reward	"If it was like a tenner a shirt, maybe. [...] £3 or £4 [...] doesn't feel worth it."	**Wants** decent value, or instant trade-off like space-saving
Immediacy	"If I decide to get rid of something, I want it gone."	**Wants** immediate results — no long wait to sell
Reliability Issues	"Buyer never paid. Had to relist it. Total waste of time."	**Needs** a reliable system that doesn't depend on buyers
Charity Shop Timing	"They're not open when I'm about."	**Wants** 24/7 or flexible accessibility
Mental Load	"It's just the process that puts me off."	**Needs** a low-mental-effort, automatic solution
Automation Appeal	"If I could just drop them in and be done, I'd clear the lot."	**Wants** a machine/kiosk that handles everything automatically
Payment Not Essential	"I'd still probably use it. Space is more valuable to me at this point."	**Wants** decluttering more than money — convenience is key
Location Preference	"As long as it's somewhere I pass by."	**Needs** to be conveniently located in high-traffic areas
Reward Preference	"Either's fine. Credit's good if it's somewhere I'd actually spend it."	**Wants** useful compensation — flexible between cash or credit
Social Norm Insight	"Everyone I know's got stuff they want to get rid of, but no one can be bothered."	**Indicates a need** for a widely accessible, easy solution

Understanding Client Wants and Needs
Part of the purpose that comes with conducting a client interview is getting enough information to create a table of client wants and needs. This exercise is extremely important to end up with a product that actually works for the client and follows their specific guidelines
If the project didn't identify these key features then I would struggle to create a brief and specification further down the road.

Client Priorities
One potential downside to this exercise is that the priorities are sort of vague when it comes to exactly what is the most important want and what is the most important need. It is assumed of course that all needs are higher than all wants in priority and that all needs are equally important since they need to be completed. However I disagree with this view because needs are not always entirely equal. Take Maslow's hierarchy of needs for example. In Maslow's hierarchy not all needs are of equal importance and that is why it is a hierarchy. Similarly the project can only begin to satisfy the wants once it has satisfied the needs in a similar way to how maslow's hierarchy requires the needs beneath the higher needs to be completed before the higher needs can be achieved

Pros and Cons of this Exercise
Whilst this exercise is very useful because it simply sets out what the client demands. It must be noted that it is an imperfect exercise and potentially liable to bias through the decision of want or need. Furthermore by categorising the wants and needs in a table like this there is a potential to get fixated on potential solution if others don't solve all the wants and needs set out.

The Design Process - My Project Management Approach



The Cyclical Nature of the Design Process

Although it may appear linear at first glance, the design process is inherently cyclical. Each stage naturally leads to the next, but the real value lies in how ideas are constantly revisited, refined, and reshaped in light of new information. This back-and-forth motion is what makes the process dynamic, flexible, and ultimately more effective in developing a successful final product.

Ongoing Clarification and Development

The project begins with an initial concept and scenario, which sets the foundation for your design. However, as soon as you begin exploring ideas through sketches, discussion, and early research, you often uncover new needs or limitations that were not immediately apparent. This leads to clarification and revision, where your understanding of the problem becomes more accurate and detailed. This process of refining your perspective does not occur just once, it recurs throughout the project.

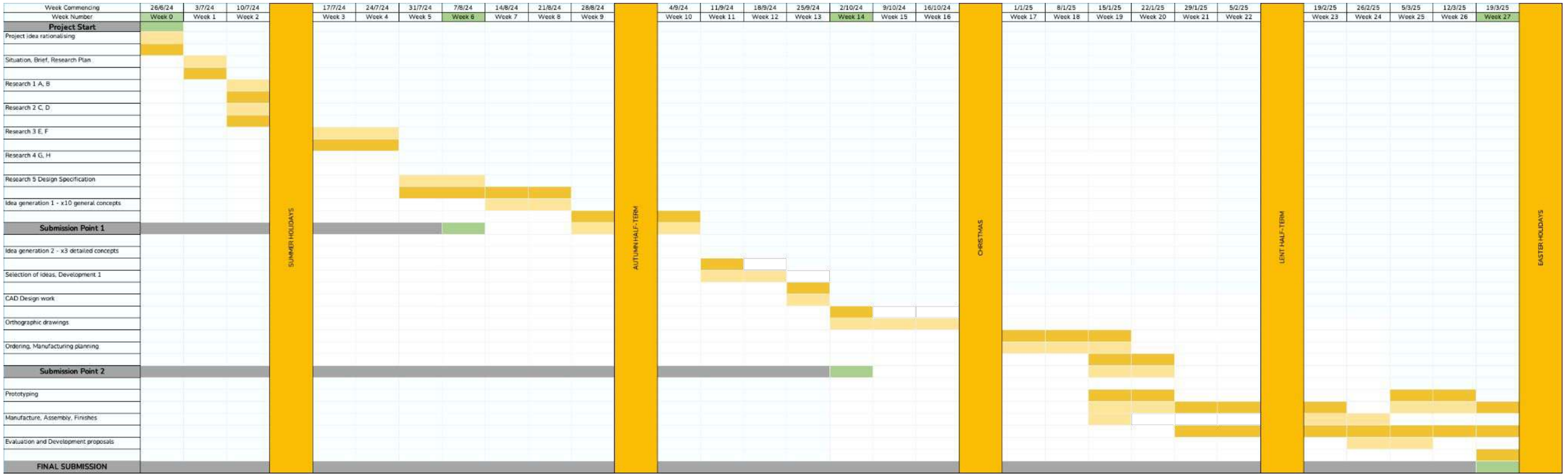
Iterative Prototyping

The development of drawings, models, and prototypes forms the heart of the practical work. Early prototypes are used to test out key features and mechanisms, but they are rarely complete solutions. Instead, they serve as learning tools, revealing what works and what needs improvement. Each prototype generates feedback and new insights, leading to revised designs and further iterations. This cycle of prototyping, evaluating, and refining may repeat several times before a design is considered ready to move forward.

Reflection and Response

Speculation and reflection play a crucial role in guiding these iterations. After each phase of development or testing, it's important to reflect on what has been achieved and how it aligns with the original goals. This may prompt further questioning and sometimes even a return to earlier stages, such as rethinking the problem scenario or revisiting earlier sketches. Likewise, external feedback (whether from teachers, users, or peers) can expose weaknesses or inspire changes that trigger another loop through the process.

Project Time Management - Gantt Chart



What is a Gantt Chart?

A Gantt chart is a chart used to track the project, schedule deadlines, and allocate time. Henry Gantt is the creator of the Gantt chart, and he is said to have developed the chart around the early 1900s. The chart works like this: On the left-hand vertical axis, there is a list of tasks and their deadlines, and on the top horizontal axis, all the relevant dates for progress or scheduling are displayed. When progress or scheduling is added, the task is represented by a bar under the column where the work is scheduled or has taken place. Conditional formatting can also be used to indicate progress on a task if needed.

The Importance of a Gantt Chart For Me

Having done DT GCSE, I now fully understand the importance of not only creating but using a Gantt chart throughout the project. The first major benefit is not having to worry about not knowing progress on a particular section of your project. If you recorded the task progress everything will be on the Gantt chart which can be inspected for guidance on what to complete next to make the next deadline on time. Secondly, I love being able to add to the chart with my progress and it feels really rewarding to do so, every time I put significant work toward a task I can add at least one progress bar to the Gantt chart. This motivates me to work on the NEA even when I might be tired or burnt out from my other studies. Finally, the Gantt chart can always show me how far I've come in the project by visualising the commitment to tasks being completed.

How the Chart Above Works

My chart above works almost the same as a typical Gantt chart with a few minor differences. Notably the grey rows indicate deadlines for submission dates, the dark yellow cells indicate planned progress and the light yellow, actual progress. Furthermore, the tall yellow columns mark school holidays and short breaks. I've also coloured the submission dates in green so that they stand out on the page.

The process of making this Gantt chart

I made chart on Microsoft Excel for my familiarity with the platform. I used a function to add in the dates associated with the start days of each week during the project.
I spent far too much time merging and splitting cells to create the school break columns and submission rows. I added the left-hand axis featuring the tasks needed to complete based off the AQA mark scheme and added extra details to them such as the number of concepts I wanted to generate.

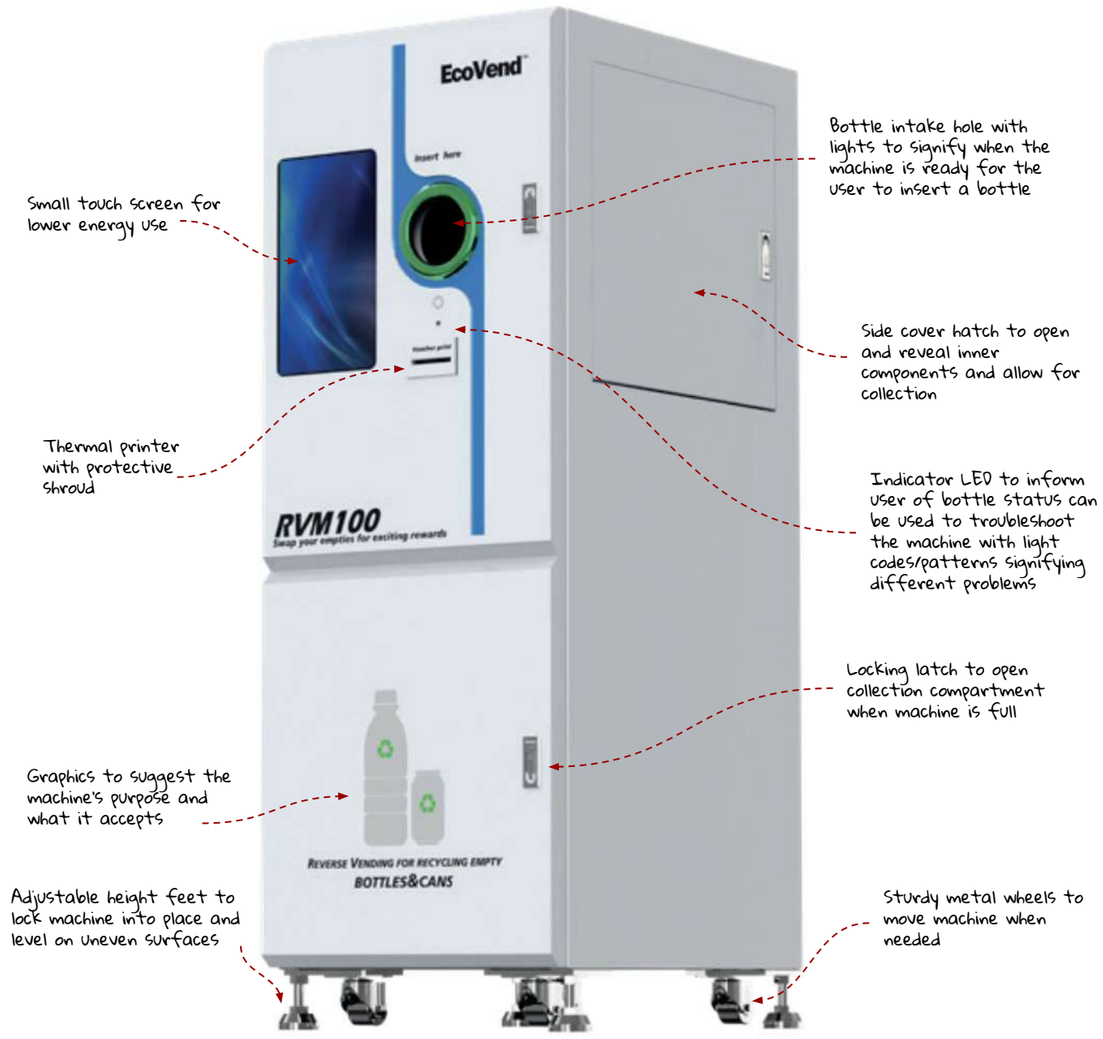
Existing Product Analysis - Reverse vending Machines

RecyClever RVM5-1000

Above is the Recylclever RVM5-1000, a medium-sized reverse vending machine designed to automate the collection and recycling of empty PET bottles and aluminum cans. Built by Recyclever® a division of Magrini (UK) Ltd It has a barcode scanner which can scan 360 degrees around the bottle and AI-powered shape recognition to ensure bottles are the correct shape and haven't been misshapen. It also has a 32-inch screen which can be used for advertising or live updates. Overall it's a compact standalone design which makes it suitable for various different environments, especially since it only requires a one standard power socket for operation.

EcoVend RVM100

Below is the EcoVend RVM100 is a reverse vending machine designed by EcoVend, a subsidiary of Re-Economy, an environmental consultancy based in London. The machine offers similar capabilities to the Recycler machine, equipped with a barcode scanner and weight sensors to accurately identify and process PET bottles or aluminium cans. It can accommodate up to 250 PET bottles and 300 aluminium cans in a single chamber. The machine features a smaller 11.6-inch screen for user interaction and supports both digital and paper rewards, such as vouchers or loyalty points. Notably, it accepts bottles up to 3 litres in size, which is comparable with competitors such as the Recylever RVM5-1000.



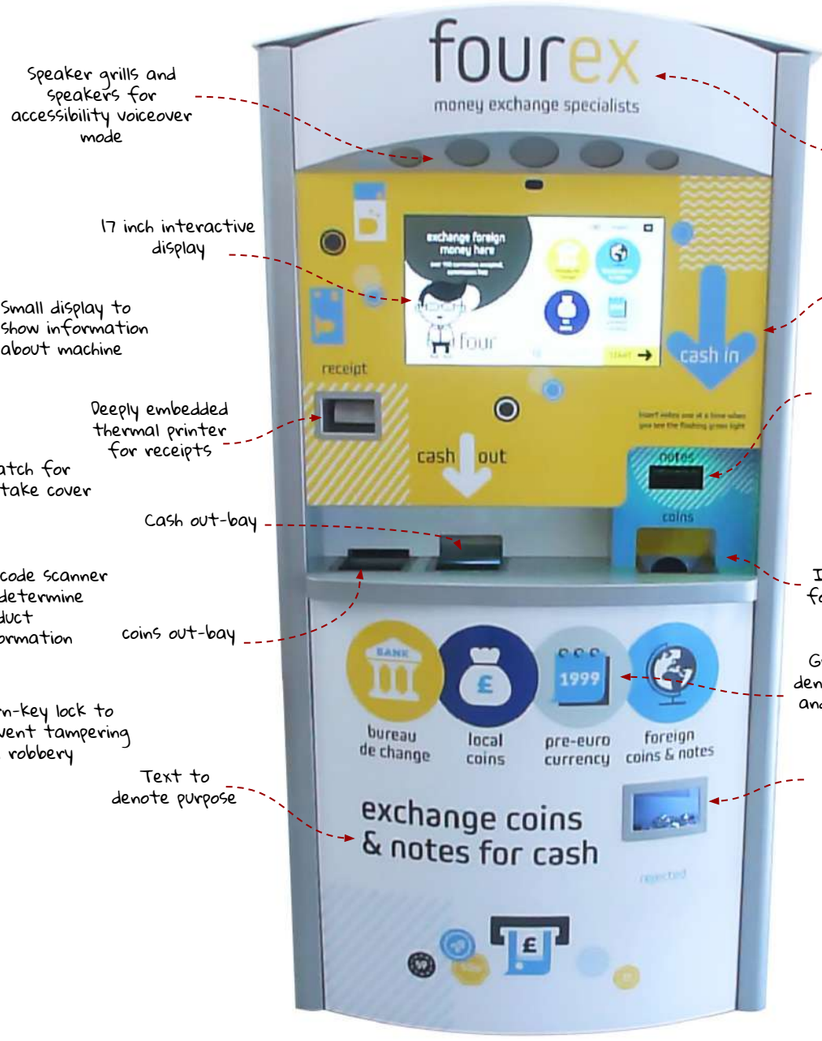
Existing Product Analysis - Reverse Vending Machines

SWOP-Box

The SWOP-box is a brand new piece of reverse vending technology that was designed by the company SWOP and is a first of its kind in the category, being designed from the ground up for clothing. It was developed to promote sustainable practices within the fashion industry and was unveiled to the public at the Euroshop retail trade fair. The machine allows customers to deposit there unwanted garments for recycling and in exchange they would receive a cash incentive. Unfortunately other than this image there was very little I could find about the SWOP machine or its functionality but the image does demonstrate the key features of the product.

The Fourex Machine

The Fourex World Money Exchange Machine was an innovative self-service kiosk designed for personal currency exchange. It allowed people to convert foreign coins and banknotes into British Pounds, Euros, or US Dollars, handling over 150 currencies, including those that were no longer in circulation. Unfortunately, the company behind it went bankrupt in October 2021 and was officially liquidated in August 2022, leading to the shutdown of all their kiosks. The machines were first introduced in 2015 and were strategically placed in high-traffic areas, such as King's Cross and Canary Wharf stations in London. Using advanced camera technology, the Fourex machines were able to accurately identify various currencies and ensure they were legitimate.

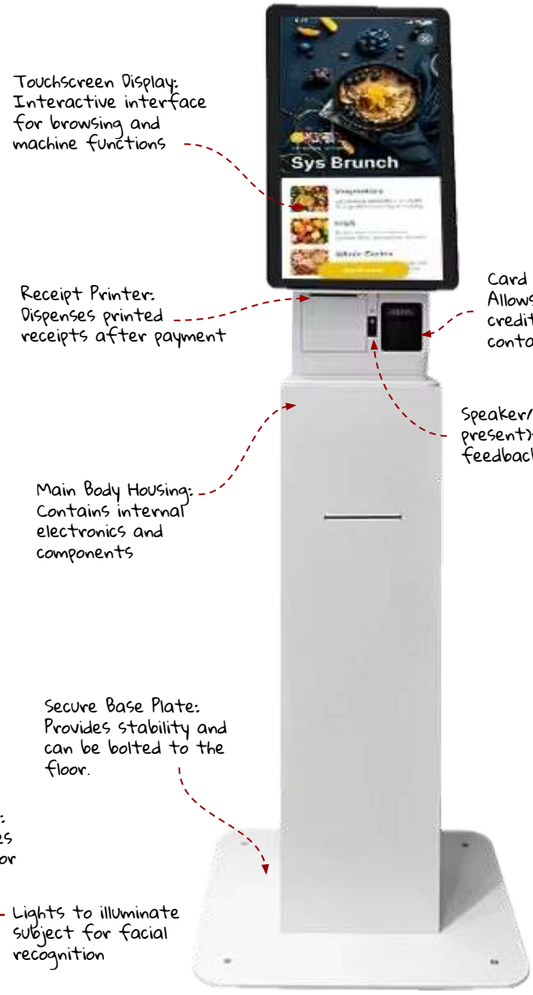


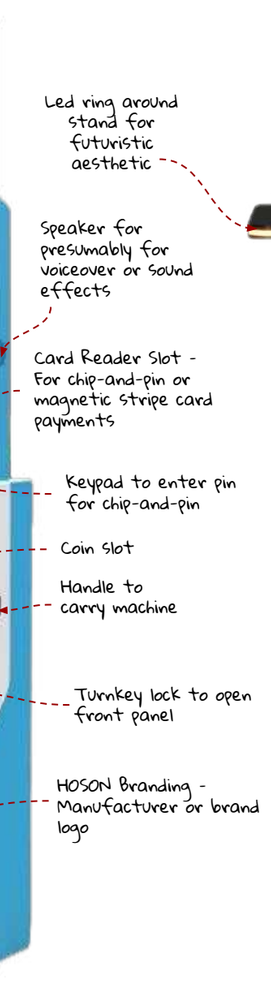
The EcoATM

The EcoATM is a self-service kiosk that recycles electronic devices like mobile phones and tablets for instant cash. Introduced in 2009, these machines are found in shopping centres and supermarkets across the US and Europe. Users place their device into the kiosk, where advanced AI and camera systems assess its condition and verify its authenticity to provide a cash offer. The machine then securely stores the device for resale or recycling. EcoATM accepts devices in any condition, making it a quick and convenient way to dispose of old electronics responsibly. It has a similar purpose to what I want to create but for phones.

Existing Product Analysis - Kiosks and POS systems

About these machines
These Kiosks are all OEM meaning that they manufacture the kiosk for another company who change it to suit their needs. That's why most of these machines have multiple conflicting components and systems that might seem strange to have on the same machine but really it's just demonstrating the manufacturer can put it on machine without modifying the design of the kiosk at all.





Design Brief

Proof Point: Why busy professionals?

They don't have the time nor the inclination for traditional or modern resale methods. They wear high value clothing that would benefit from resale. I found that in particular shirts were a key clothing item that all professionals wear which has not seen as much popularity and listings on online marketplaces. Furthermore their unique situation and opportunities is what has lead me to the idea and concept of creating the kiosk. In order to decide on a target audience and use busy professionals as a subject of my design lens I had to exclude other, less relevant demographics and market segments.

Proof Point: What are the problems with traditional resale methods?

As addressed in my questionnaire online second-hand selling is by far the most popular channel of reselling clothing by a margin of almost 10%. As a result it lead me to investigate the problems with that specific method of reselling which boiled down to; reliance on flexible postage methods, peer to peer transactions and varied packaging solutions. However in my interview with [redacted] I discovered that there are plenty of other issues with more traditional methods such as thrift shops and their opening times.

Proof Point: Why specifically dress shirts?

Dress shirts, particularly those worn by professionals, are often high-value items with extended life spans due to their durable and timeless nature. This makes them ideal for resale markets. Charles Tyrwhitt emphasis on longevity in shirt design supports their appeal in resale markets as durable, high-quality garments. However some shirt manufacturers charge even higher prices for shirts which have such long lifetimes that their use would be wasted if the shirt was disposed of after it starts to show only minor signs of wear. Many high ranking professionals take this wasteful approach to their shirts due to this focus on appearance.

Help busy professionals who find traditional resale methods tedious to quickly and effortlessly prepare their dress shirts for sale or recycling with a high-end, consumer-friendly kiosk.

Proof Point: Why focus on sale and not recycling?

During my discussion with Sam Shaw from Charles Tyrwhitt Shirts, he explained how their clothing model is far from circular. In fact, their model is very much linear, with a particular focus on longevity. This gave me two choices: either I could attempt to connect both ends of their linear model, which might extend beyond the scope of my project, or I could offer a way to extend the linear model. After discussing this possibility with Sam, he highlighted that Charles Tyrwhitt shirts are designed to last, so we decided to focus on rehoming (resale) rather than recycling.

Proof Point: What does it mean for a design to be "consumer-friendly"?

A consumer-friendly design prioritises ease of use, efficiency, and accessibility. Automated kiosks and user-oriented technologies provide convenience by simplifying processes like clothing resale. Consumer studies underline the importance of user-friendly interfaces in driving adoption of new technologies and services. Since this machine would be somewhat of a first of its kind in this particular category of kiosk/reverse vending machines I decided that using the most user friendly design language is imperative to success.

Proof Point: Why Automated Kiosk?

Automated kiosks, like those used in recycling or vending, provide convenience and efficiency, making complex processes accessible to a wider range of users. Furthermore they have the extra benefit of being always open or on typically in a public area accessible to all. Examples like Coinstar and ecoATM illustrate how automated kiosks simplify tedious processes like currency exchange and device recycling, boosting consumer engagement.

Mood Board - Determining an aesthetic

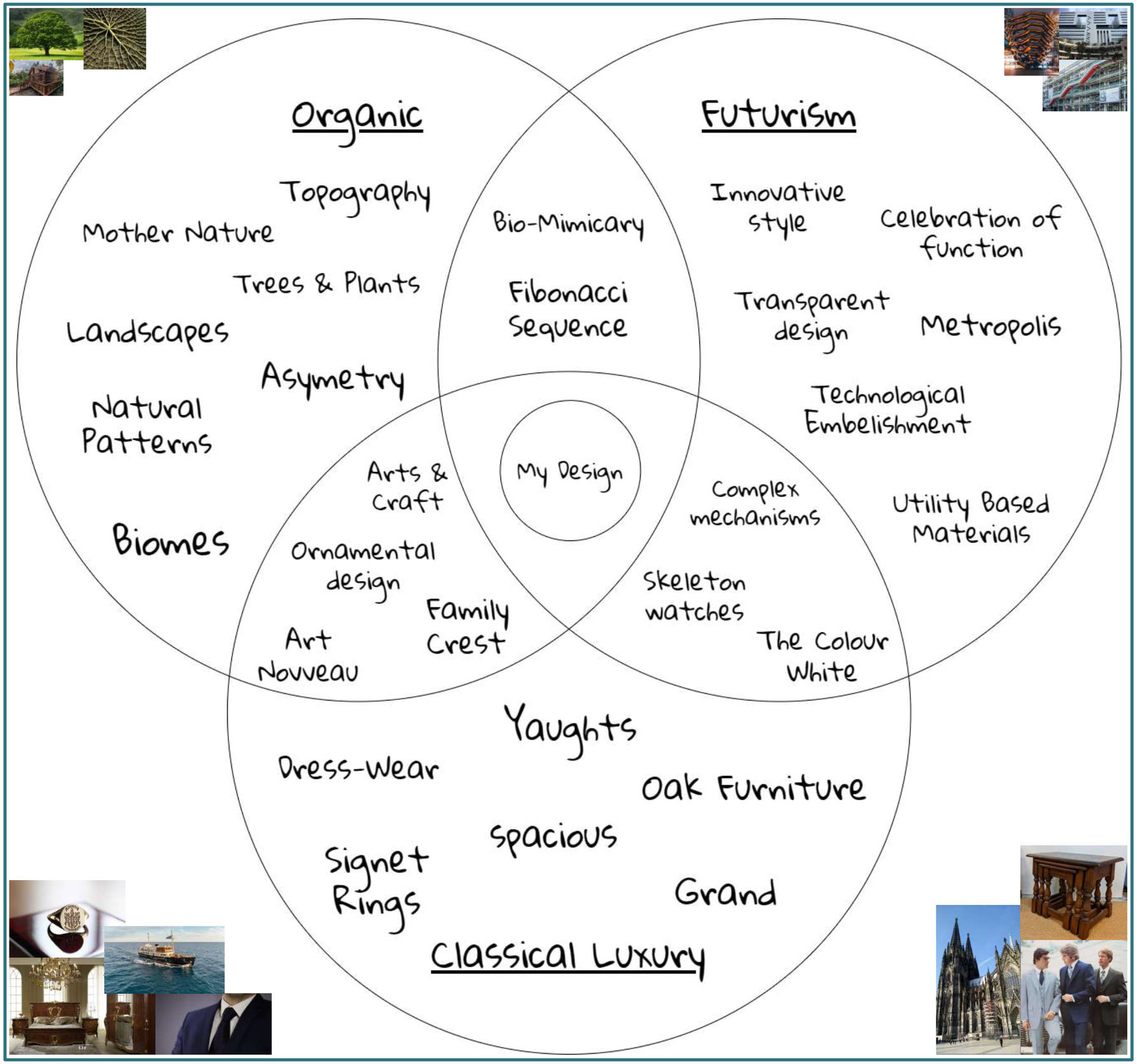
Introduction
In order to create my initial concepts I must determine a angle for how I will shape and create ideas. When creating initial concepts it's important to not limit yourself with unnecessary criteria, however in order to create unique and interesting concepts you must determine some sort of aesthetic lens. For example figuring out which style, genre and movement to look at. In my project I want to try and blend multiple styles into the design.

Discussion with [redacted]

After discussing matters with my [redacted] he came to the decision that that I should have freedom over the actual aesthetics of the design with his input only to approve or disapprove. This lead me to creating a venn diagram to express my unique aesthetic plans for the project.

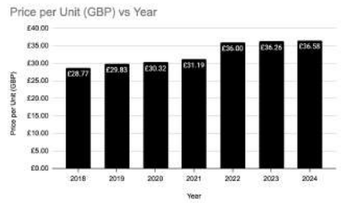
Parametricism

While researching my Aesthetic I came across Parametricism, a form of avant-garde architecture invented as a supposed successor to post-modern architecture Although what I will be designing is not inherently Architectural I still feel as though the design of Parametricism fundamentally ticks each box of the venn diagram. The flowing round shapes symbolises organic design, like something seen in nature. The use of the colour white demonstrates classical luxury, as explained in the specification. Finally the simplicity and minimalism, gives the whole style a futuristic look.



Design Specification

Criteria	Detailed Description Of Criteria	Importance/Justification
Safety	Ensuring the product is safe to use. Avoid hazards, follow safety standards, and include features to protect users.	Although it may not initially seem dangerous, vending machines and similar types of machines are known to cause more deaths per year than sharks. The primary concern is the potential for the machine to fall or tip over. To mitigate this risk, the design should prioritize stability or incorporate a bottom-heavy structure to prevent crushing hazards. Additionally, any motorized movement, such as a closing compartment, must include a fail-safe mechanism to prevent limbs from becoming trapped in the machine. This can be achieved through the use of an inference sensor or a pressure sensor. Falling Risk - [24] Crush Protection - [25]
Function	How well the product does its job. It should work reliably, be easy to use, and meet the user's expectations.	I have determined that the resurgence of suits in London post-covid will likely increase the velocity of shirts moving around the second hand market and such the machine should have a high capacity. Furthermore I've determined that the machine should be very quick to use since the average lunch break is only 34 minutes, leaving little time for using the machine. Demand - [26] Time - [27]
Material	The materials used in the product. They should be durable, cost-effective, and environmentally friendly if possible.	Since the machine is intended to be used and left in a sheltered environment, it's important to consider how I will partially weatherproof the machine whilst maintaining the aesthetics. I will use wood and use durable materials that can withstand weathering once coated and have a resistance to stain and degradation. Alternatively I want the machine to have a futuristic, organic and luxury aesthetic which will likely require using white plastics and painted metals. Weatherproofing - [28]
User experience	How the user feels when using the product. It should be easy, comfortable, and enjoyable to use.	One of the primary objectives is to have a premium user experience with my machine. From my research into user experience I have decided there are 3 characteristics which make a design user friendly and user premium. Firstly it must be seamless, operation or use should go without interruption if avoidable. Secondly feel, the machine should feel premium and satisfying to the touch with smooth surfaces on the places designed to be interacted with. Finally the machine should be fast, working quick enough to not keep the user waiting. User Experience Research - [29]
Sustainability	Making the product good for the planet. Use renewable materials, reduce waste, and make sure it lasts a long time or can be reused or recycled.	Sustainability is key to the project and this will be reflected in all material choices. Since packaging is part of how the machine will function when in use, it is only fair that I eco-friendly packaging options such as paper or biodegradable polymers.

Criteria	Detailed Description Of Criteria	Importance/Justification
Aesthetics	How the product looks and feels, including its shape, colour, and texture. Should be attractive and match what users like.	In my research, I have found that simplicity is key to successful kiosk design, as it draws people in while complexity pushes them away. White is an ideal colour for this, representing light and being essential for seeing other colours. It has also become a symbol of luxury, linked to royalty and spirituality. Using circular shapes adds to the design's appeal, as the circle represents flow and continuity. These elements together create a design that is both stylish and easy to use. Design complexity - [31] Colour - [32] Shape - [33]
Price Incentive	The cost of the product. Should be affordable for the target audience and match the quality and value of the product.	The average price of a shirt in the UK in 2024 is £36.58 demonstrating there is clearly enough value for a high incentive. Price - [34] 
Customer	Who the product is for. Understand their needs, preferences, and habits to make the product suitable for them.	My ideal customers are busy professionals working in formal attire in central London. They require a seamless, fast experience that feels luxurious and premium. These individuals tend not to recycle their clothing, as they recognize the value and longevity of their shirts. They are also typically frugal, which makes them likely to appreciate the financial incentives offered by the machine, proportional to the worth of their shirt. Audience profile - [page 16]
Environment	How the product affects the environment. Use eco-friendly materials, reduce waste, and make it sustainable.	Professional, office jobs are the ones more likely to require formal attire. My Kiosk will be located outside next to one or more office buildings. The aim is for it to be in the most convenient location so that it takes the customer minimal time to get to a machine. Specific Professionals - [35]
Size	The product's dimensions. It should be the right size for its purpose, easy to use, and convenient to store or transport.	From my research the average size of a kiosk in the style of a reverse "reverse vending machine" average machine is around 1-2m in height and around 0.75m in width and depth. Since the average size of a folded dress shirt is around 28–36 cm x 18–24 cm x 3 cm the machine must be able to process that size of payload. Folded Shirt Size - [36] Reverse Vending Machine size 1 - [37] Reverse Vending Machine size 2 - [38]

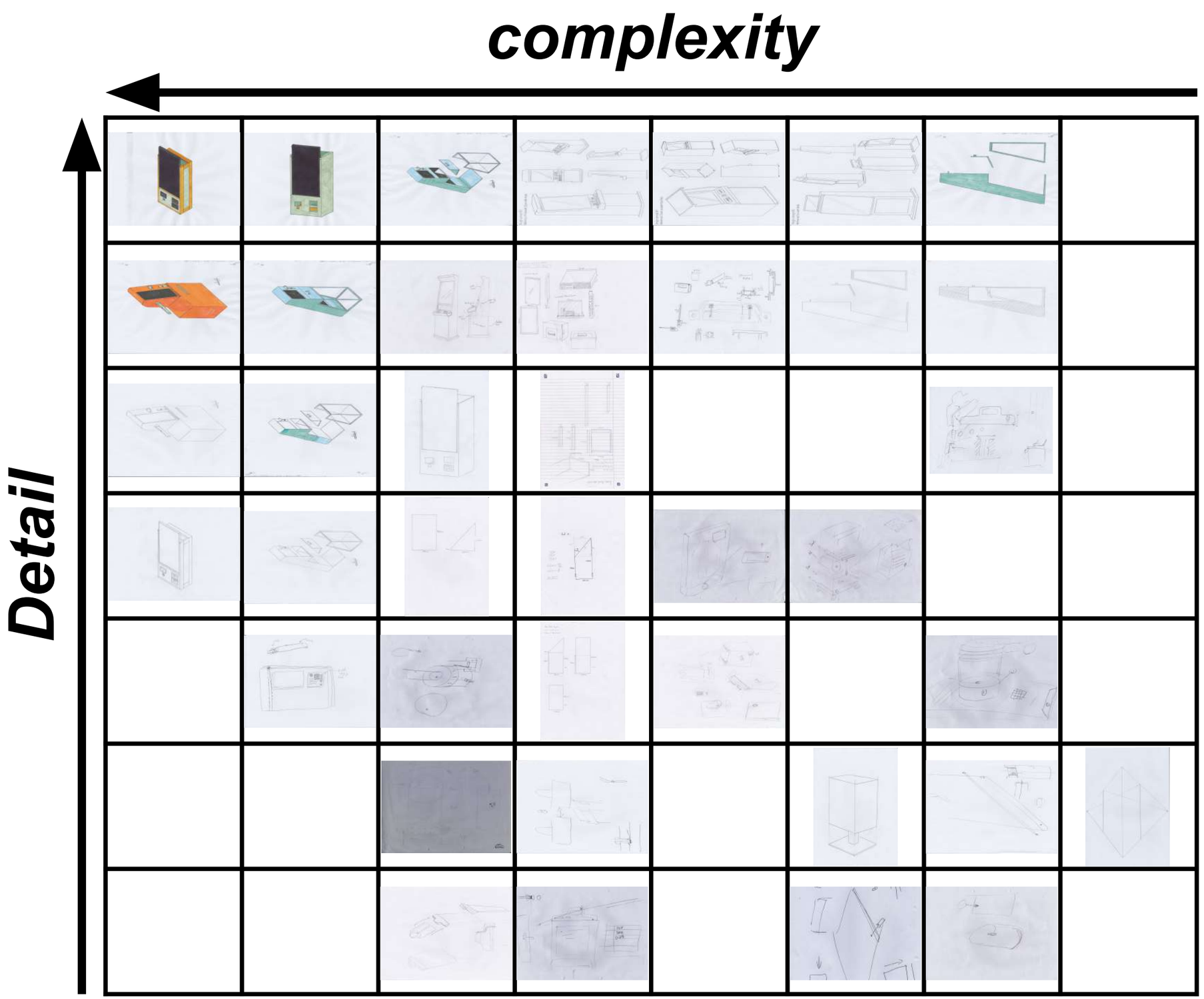
Section C & D

Design development - sketches

The Sketch Matrix
The graphic on the right is what i've called the sketch matrix and it demonstrates all sketches I did for the project sorted by both complexity and detail. The reason I did this was not only because it visually represents all the different types of drawings and the different levels of detail achieved in these drawings.

I purposely organised it based on complexity and detail because I believe although they sound rather similar they are the two most vague ways to categorise sketches without discluding any for reasons such as colour. I was originally going to use level of completion along the y-axis but this metric is very difficult to use because some of the drawings are done and yet lack major details. They were simply rough sketches and were never created to give lots of detail but rather visually put down what I saw in my head to either create a more detailed sketch or just use CAD to make a model to show my client. The difference between complexity and detail is that the complexity of a drawing overall depends on so many factors, firstly is there multiple views of the drawing if not then is it coloured does it include small details and if coloured is it rendered to show lighting and shadow. Detail on the other hand refers to the micro scale of the drawing. Are the lines perfectly orthogonal so they create the desired perspective? Are the colours rendered within the sketch lines? Is the drawing done with fine liner or has pencil been used for the final version? These kinds of things make up the detail of the sketch. In my opinion the way you define complexity and detail varies from person to person so while this isn't a bullet-proof approach, it works for me and helped me get a holistic view of my sketches.

The Purpose of Sketching in My Design Process
Whilst sketching is an important part of the design process I will be the first to admit that I am not the best artist and I do sometimes find the sketching to be a tedious process. Because my skills are more with CAD modelling software where I can simply throw together a simple model within a couple of minutes i find sketching to be almost a slightly dated way of creating designs. That being said sketching is incredibly important for some people and I do see some benefit to sketching out initial concepts. As I will talk about in my CAD process slide I use small sketches and tiny orthographic shapes with dimensions to aid me whilst 3D modelling. Personally the only reason I create fully rendered sketches is to demonstrate the project Idea to my client before modelling, in my head I understand it perfectly but the sketching does allow me to show that logic to the client before I model it.



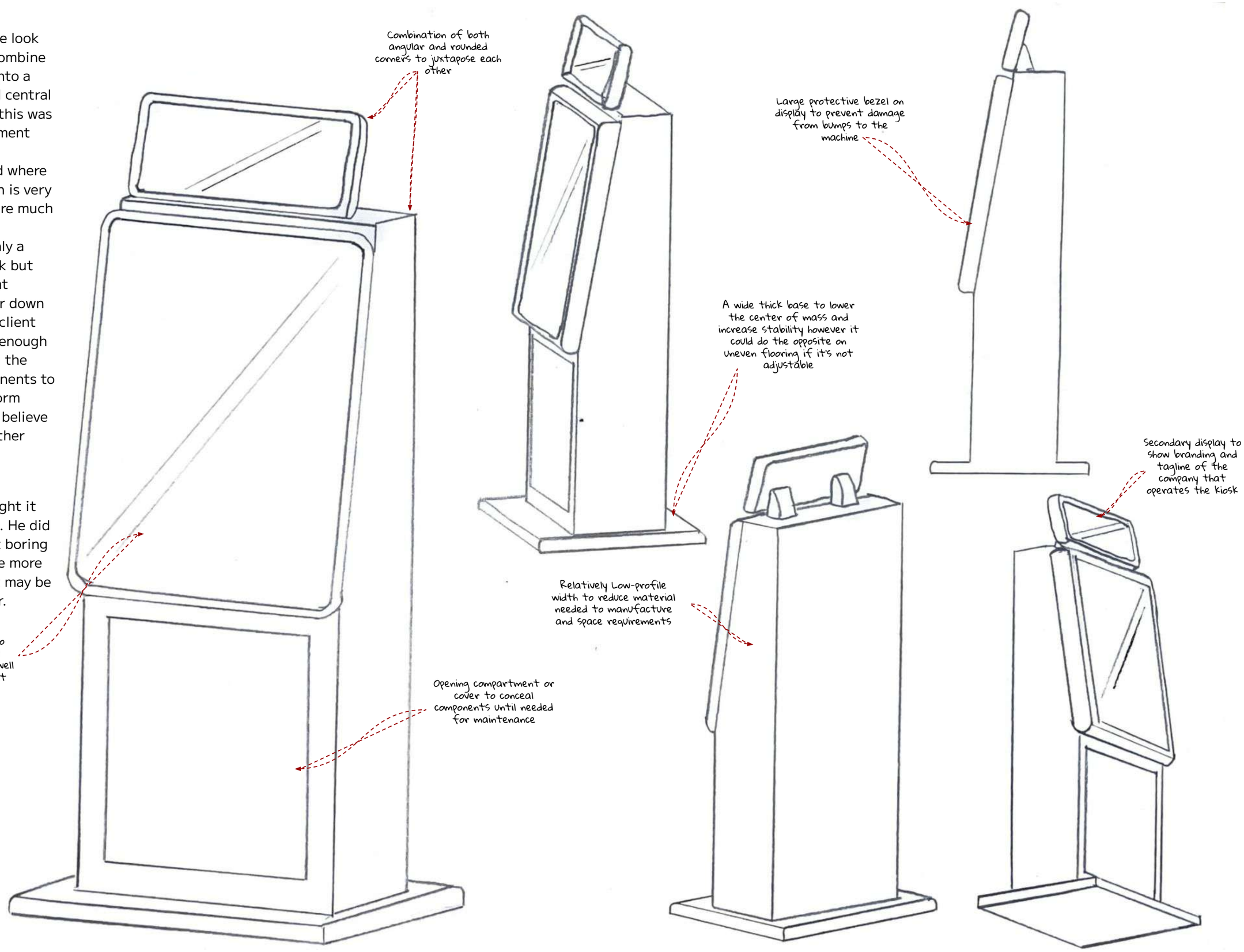
Initial ideas - Idea one inspired by Ecoatm

Methodology of this design

This design was inspired by the look of the eco-artm and aims to combine a variety of geometric styles into a singly cohesive shape via a tall central structure. The way I achieved this was by focusing on the central element and it's stand before I started designing the components and where the parts would go. The design is very minimalistic and doesn't feature much other than two displays and a compartment. This was not only a purposeful choice for the kiosk but also as a potential development opportunity to be seen further down the road in the project. If the client and me both liked this design enough then we would work on adding the necessary features and components to it. This is a function follows form approach to designing which I believe is often more effective than other strategies.

Client feedback

[redacted] liked this design, he thought it was friendly and approachable. He did mention that it was somewhat boring and that he'd like to see a little more flare however I anticipate that may be to the lack of detail and colour.



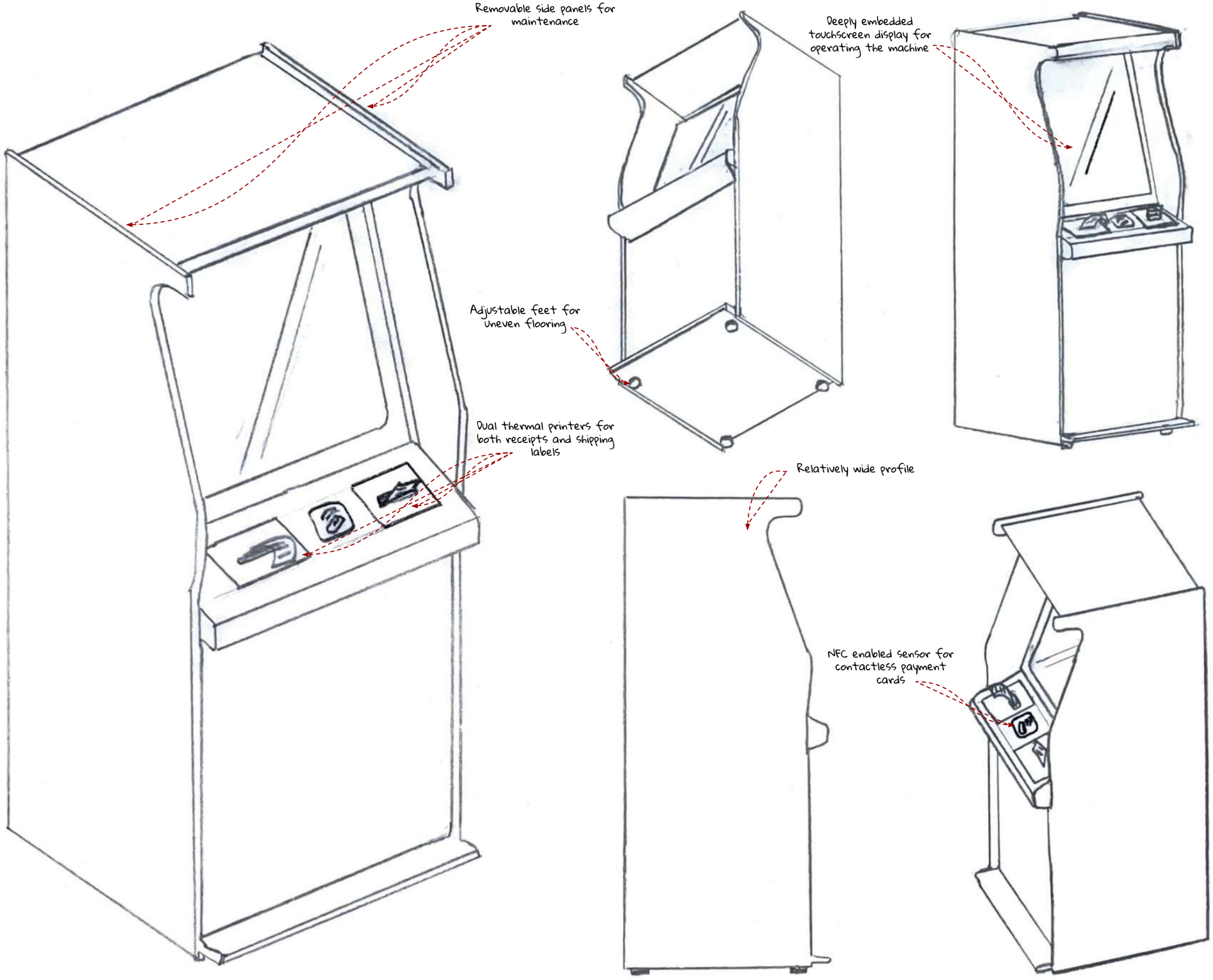
Initial ideas - Idea two inspired by Classic Arcade Machine

Methodology of this design

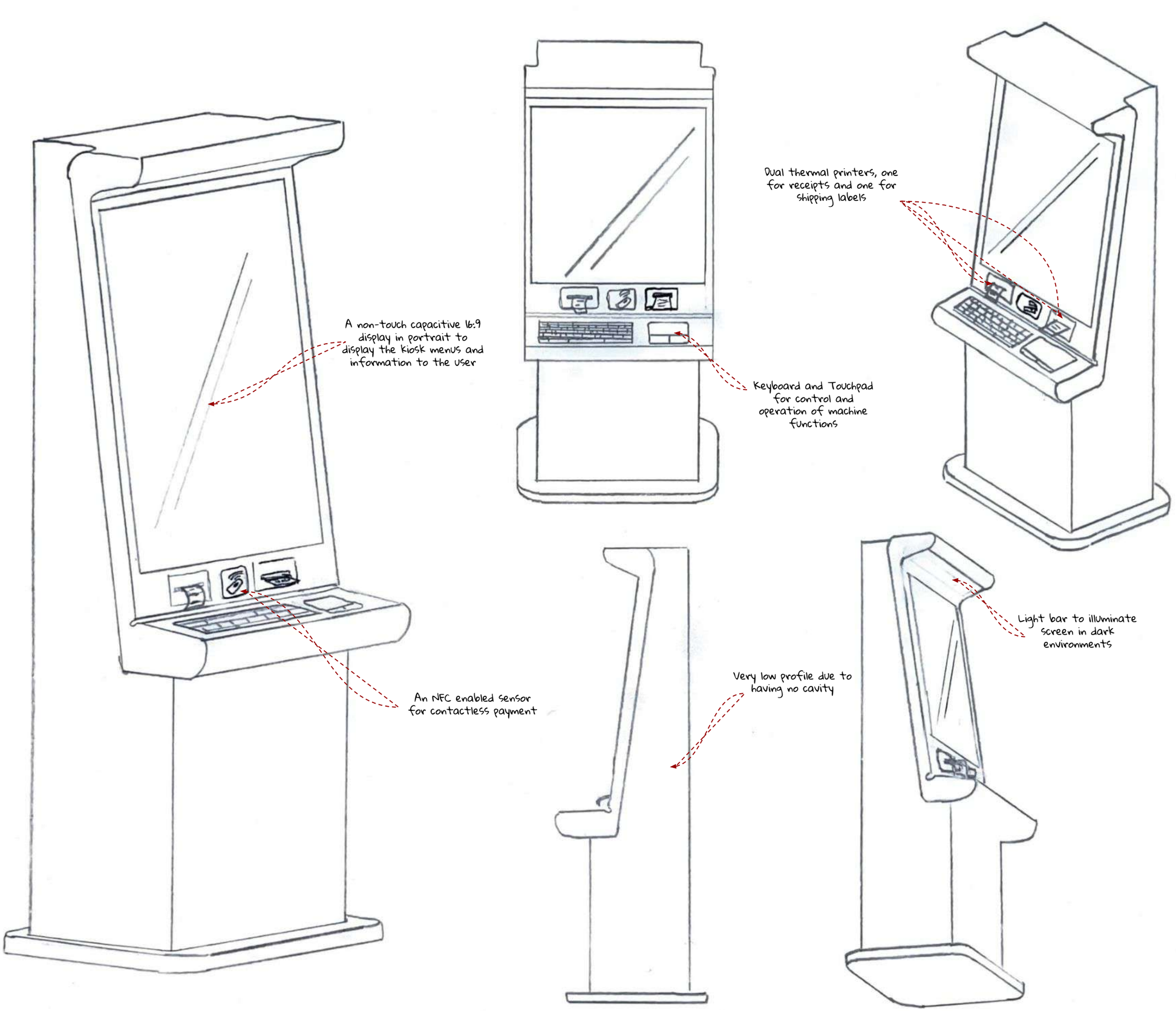
This design was based off the look of classic style arcade game cabinets. I wanted to try and capture that same retro but futuristic vibe with this design. One issue with it though is that it doesn't really fit with the rest of the aesthetic specifications. As clearly stated in my 'determining an aesthetic for the project' page I want the final kiosk to be a mix of organic, luxury and futurism. Whilst this machine delivers a hint of futurism and the paneling could be portrayed as somewhat organic it fails to truly deliver on those key areas in a way that is meaningful and satisfying to me. I also designed this originally with the idea of the cavity being inside the machine to allow for shirts to be put into the machine, but coming to develop it I came up with the idea of having two thermal printers and just having one print an adhesive-backed shipping label with a pre-determined address so that the machine never has to have any staff visit it to collect shirts and the shirts are simply posted for free by the customers at their convenience. The trick is that the customer wants to receive their cash from the machine as quickly as possible so they will be incentivised to quickly drop the package off at a local post office and move on. The problem with this solution within this design is that now the machine is overly cumbersome and has a much larger profile that what is needed to store the components.

Client feedback

[redacted] shared my thoughts on the machine being much larger than it needed to be without a cavity. He said to not entirely give up on the idea of having a shirt cavity because he said that would make the machine maximally convenient which, as we identified in the first interview was the primary goal of the machine but he said the shipping label idea was not too much of a compromise.



Initial ideas - Idea three inspired by Mcdonalds Ordering kiosk



Methodology of this design

This design was inspired by the look of the mcdonalds ordering kiosk. Obviously it strays quite heavily from the the inspiration if you know that that looks like but there a few reasons why I changed the design to how it looks here. Firstly the mcdonalds style kiosks use a fully detached round rectangle design where the machine is actually separate from however it is fixed. This is visible if you go to enough locations the way the kiosks are mounted; weather that be a stand that's bolted to the floor, rails that come from the floor and go to the ceiling or just mounted along the wall they are clearly stand alone units and it’s left to the franchise to decide how to mount the machines if they aren't going to use the stands made by mcdonalds because the restaurant requires the kiosks to be in a space where that is not the best looking or most functional approach. In my designs I want to create something that is free-standing meaning that it does not need any mounting or installation rather the machine can be wheeled to a spot and left there. That is to say that smaller and less cumbersome machines would still be considered say a desktop machine could still satisfy that requirement as long as it doesn’t have to lean or be mounted to anything it can just sit on a raised platform such as a table or shelf

Client feedback

I had some quite interesting feedback from [redacted] about this design. He told me that he wouldn’t actually stop for this design unless it had some very unique branding and also that he thought it looked a little same-ish to all other kiosks that he's seen. Something that he said which I found to be quite puzzling was ‘The design could be a simple as a regular cuboid, as long as it was made out of the right materials and looked fresh it would stand out from these kiosks’. He also mentioned that he wanted the kiosk to be touchscreen because kiosks with integrated keyboards and touchpads were too archaic it gave the machine a ‘outdated’ feel. The one thing that [redacted] particularly liked about this design though was how the dual thermal printers eliminated the need to store shirts which meant the machine can be simpler.

Design Development - Detailed Solution 1

Client feedback

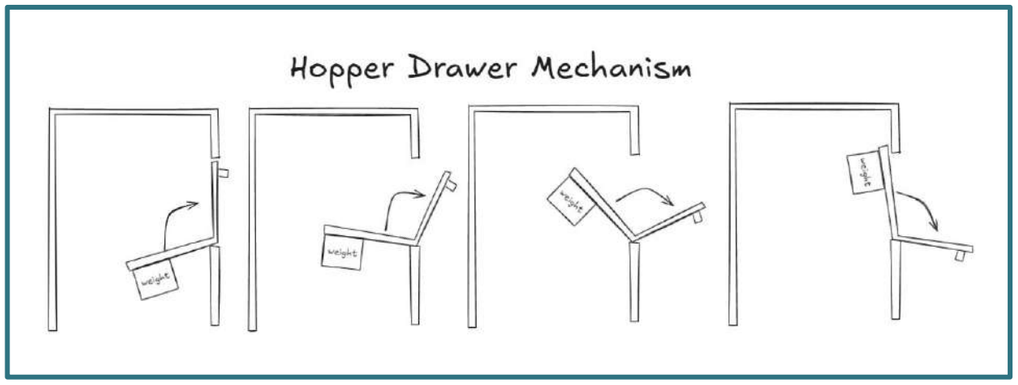
My feedback from [redacted] with this particular design is that the angularity made it quite striking and he appreciated the return to a cavity-style approach with a transparent bin. However he made some reservations about how nice the machine would look once there was lots of shirts piled up in the machine how how that might not look as luxurious but more like a wholesale or donation of expensive shirts. He also did not appreciate the slanted back of the machine as he said it would simply look weird against almost any wall that you put it up next too which is a very fair point.

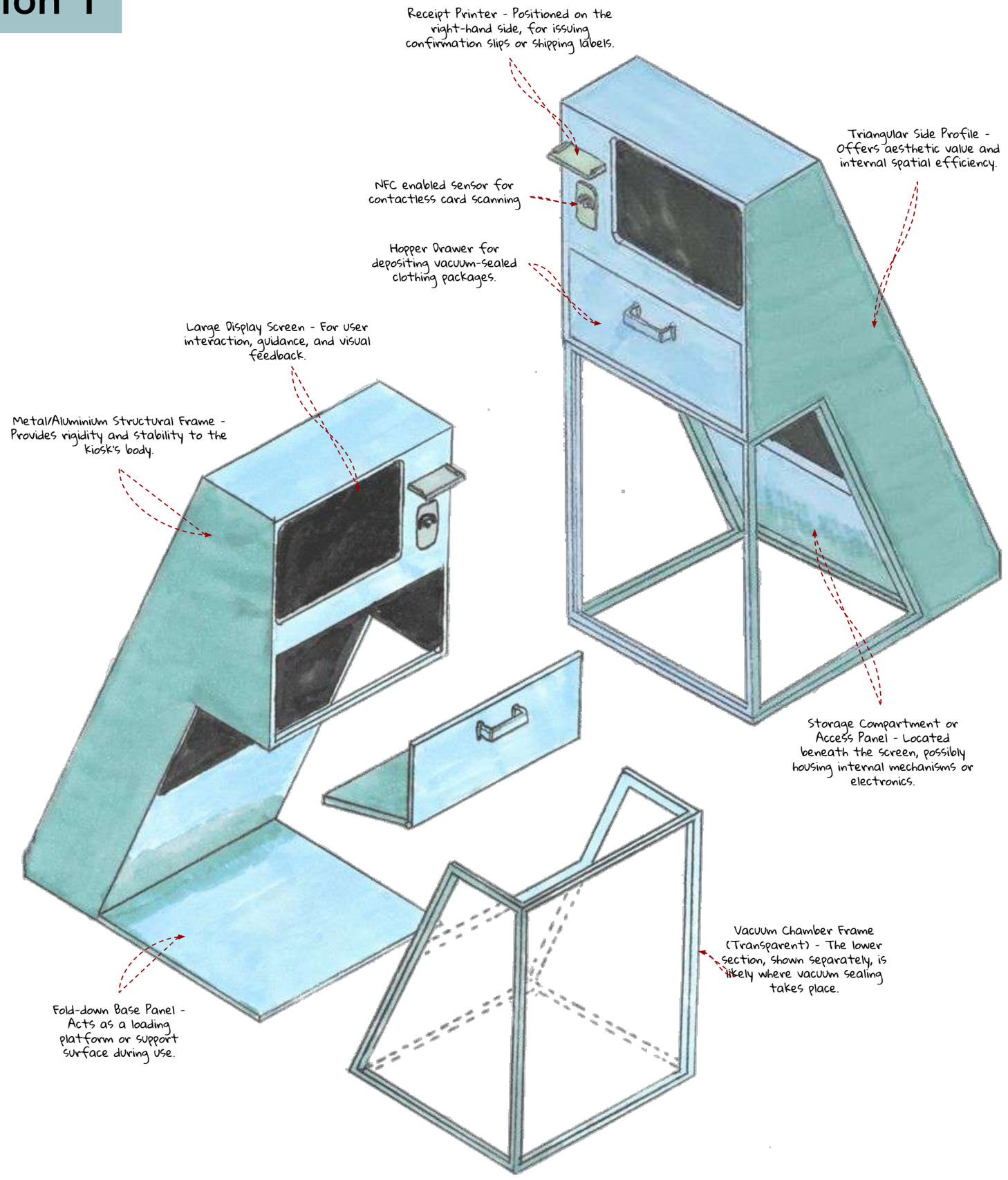
Personal thoughts

Personally, although I initially thought this design was great I've since come to see the inconsistencies. I do like the integration of the hopper-door mechanism which prevents anyone from reaching into the machine but unfortunately it did make me think of belly bins and clothing donation boxes at the dump. This was not at all what I was going for and certainly detracts from the idea of luxury. I also don't really think that this design screams organic in any way at all. The blue colour was simply a choice to render the drawing with appropriate shadows and if I was to go ahead with this design it would certainly not be baby blue but a darker hue, that being said even with a darker hue the angularity and lack of natural materials make it it a tough sell in the organic design department. Whilst it does look somewhat futuristic I think it also lacks heavily in the classical luxury appeal to. Luxury usually comes down to the materials that make up a design but classical luxury is also the complete opposite to full minimalism. Things that are classically luxury have intricate details and small designs because that would've been difficult to craft back in the day, but this design is about as minimalistic as it gets.

S W O T

S	W	O	T
- Simple angular design makes construction relatively easy - minimalist designs tend to stand out in busy environments	- Client was not a massive fan of how the machine functioned or the aesthetics - Would not look right against a wall	- Could be improved aesthetically with some unique materials - Could still achieve classical luxury by tampering with the design a bit	- The base is thin and relies on the strength of the connection between the whole machine and base whilst being emptied so it could collapse and fail.



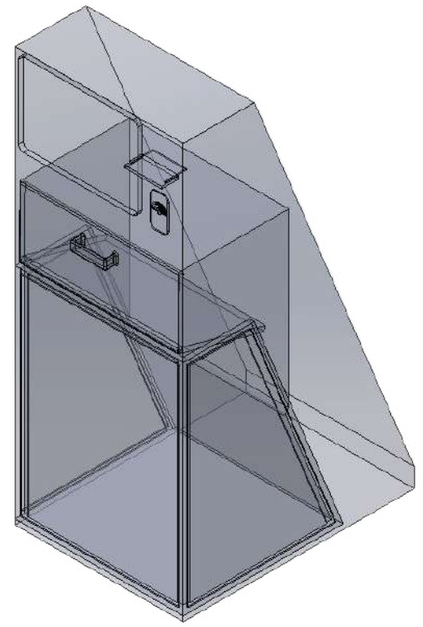


CAD model of Detailed solution 1

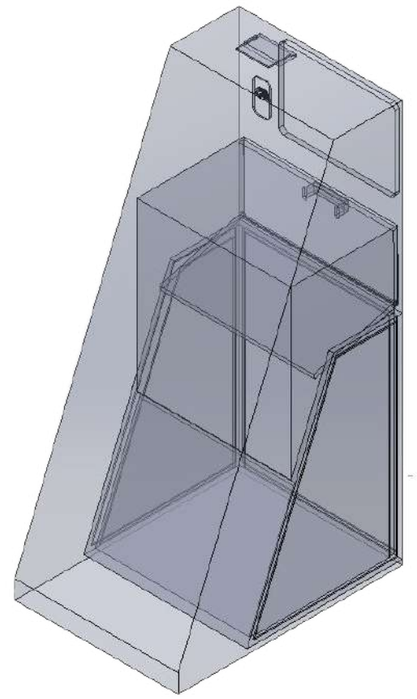
Final Photorealistic Visualisation

Skeleton/Translucent Views

ORTHOGRAPHIC VIEW FRONT



ORTHOGRAPHIC VIEW BACK



Client Feedback

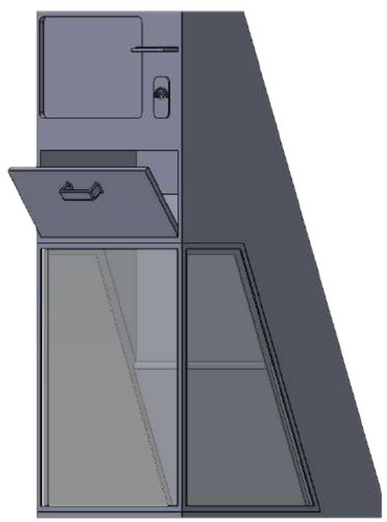
With the help of the photorealistic render [redacted] now understood the luxury element but still thought that aligned more with modern luxury than classical. He also thought that the metal hopper drawer looked a lot nicer than he originally thought but said that build up of dirt and debris would make it look look alot more ugly quite quickly

Personal Thoughts

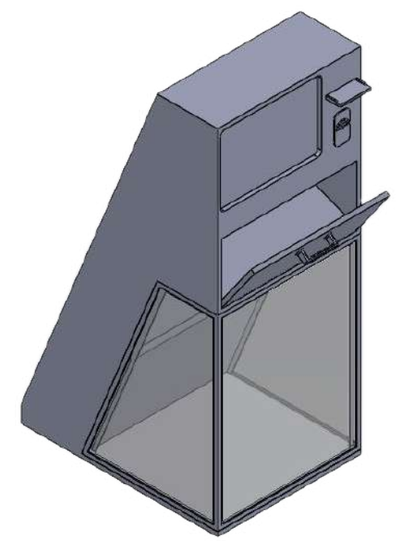
Personally my view of the design did not really change once I'd created the model and render, I knew before in my head how the machine was going to look and this did not change that. One thing that it did bring to my attention though was how difficult it was to add materials to a design where in the creation of sed design there was zero thought of which materials would be used for the bulk of the machine, eventually I realised that It doesn't really matter all that much because I would certainly be moving on from this design to something else but I learnt that some consideration about materials is essential when designing even the shape of a project like this because on the larger scale, some materials are just much harder to work with and require more resources with than I have available to me.

Mechanism views

BIN OPEN VIEW PARTIAL RIGHT



BIN OPEN VIEW ORTHOGRAPHIC



Design Development - Detailed Solution 2

Client Feedback

[redacted] liked the feel of this design and was at first confused by the function but once explained that the metal cylinder spins the shirts into a roll to be easily packaged he was on board with the concept. He said ‘although I don’t see much benefit to spinning the shirt instead of folding it would certainly make the machine more convenient and for that reason I like it.

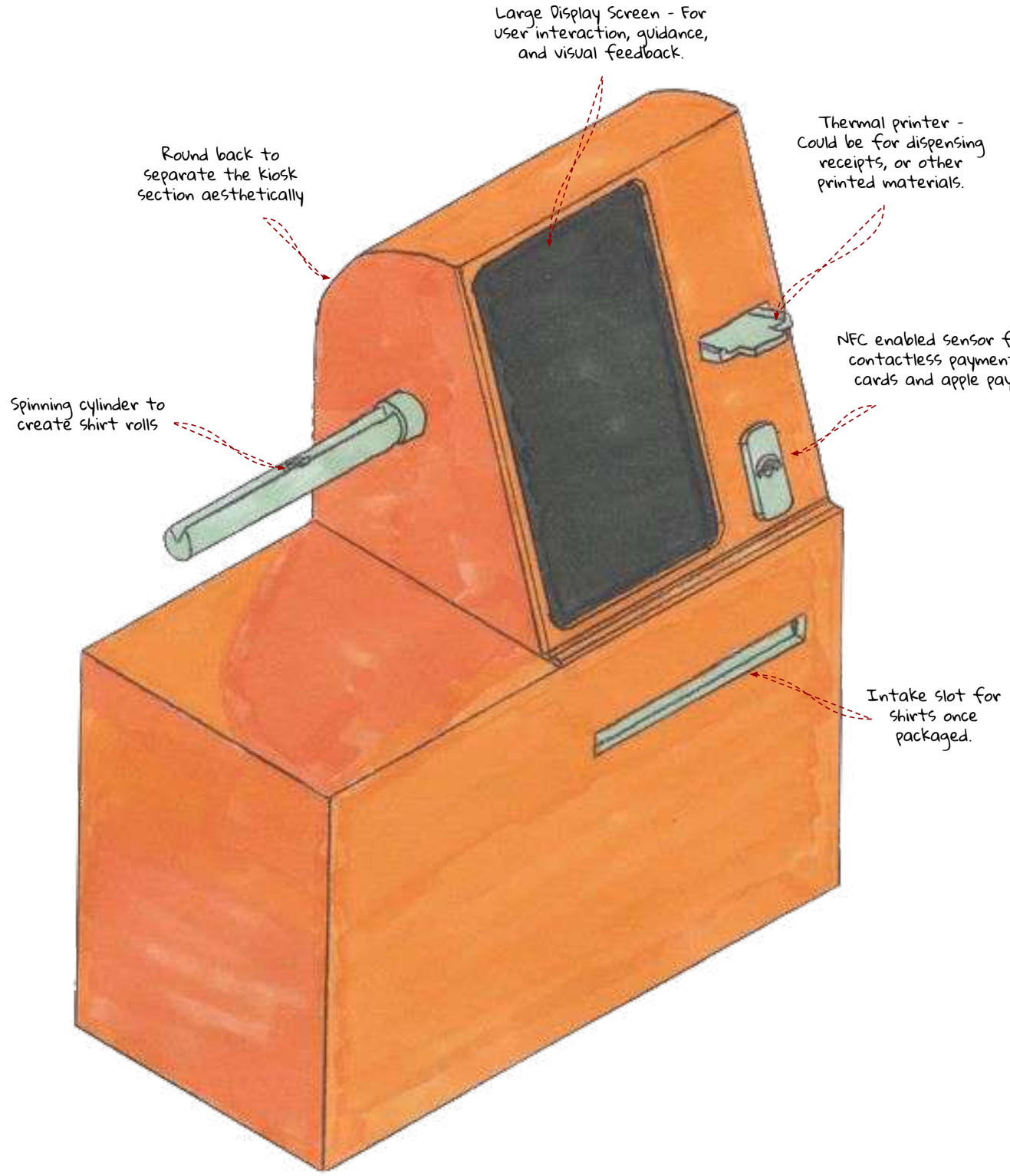
Personal Thoughts

At first glance, this design felt more refined than the last, especially with its smoother edges and more integrated appearance. I like the direction it is heading in; the overall form feels a bit more like a piece of home technology rather than industrial machinery, which is a step in the right direction for what I am trying to achieve. That said, there are still some fairly big misses here. The large protruding cylinder on the side looks far too medical for my liking and it also just makes the machine alot more intimidating. It almost resembles something you would see on hospital equipment or a dentist’s chair, which instantly pulls the aesthetic away from anything remotely luxurious. It is also unclear what the cylinder is at a glance, which might confuse users.

The orange tone does hint at wood or natural materials, which is a better nod to the idea of organic design, but it still reads as too blocky and geometric overall. The shape is quite boxy, and that does not do much for visual flow or elegance. There is no real sense of layering or fine detailing here either, just flat faces and straight edges. The inclusion of the digital interface is nice, but it is not framed or styled in a way that gives it any presence. It feels tacked on, not integrated. From a classical luxury perspective, there is also very little intricacy or craftsmanship being communicated. The design feels overly functional, almost kiosk-like, rather than considered and premium..

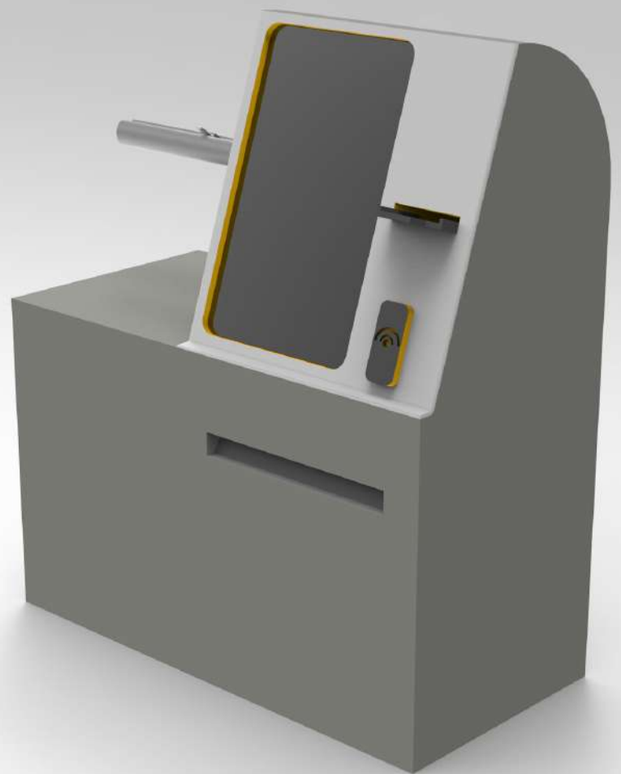
SWOT analysis

S	W	O	T
- Curved screen makes for a more modern and inviting interface - Feels less clinical and more consumer-friendly - Scanner and slot layout is symmetrical and visually balanced	- Might be harder to construct due to the curved elements - Screen size is reduced compared to other options - Could benefit from stronger physical presence to avoid toy-like 1ook	- Can be easily modified or upcycled - Potential to improve aesthetic with finishes - Space allows for adding more functionality	- Glue may weaken over time and cause panels to detach - Cheap materials may compromise durability - Competitor products may be more refined in appearance



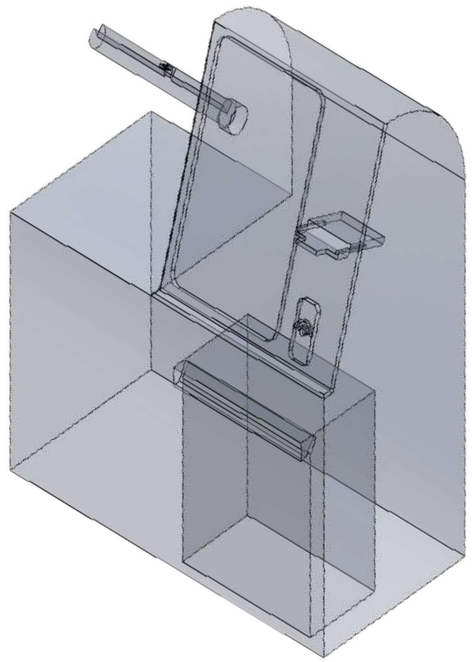
CAD model of Detailed solution 2

Final Photorealistic Visualisation

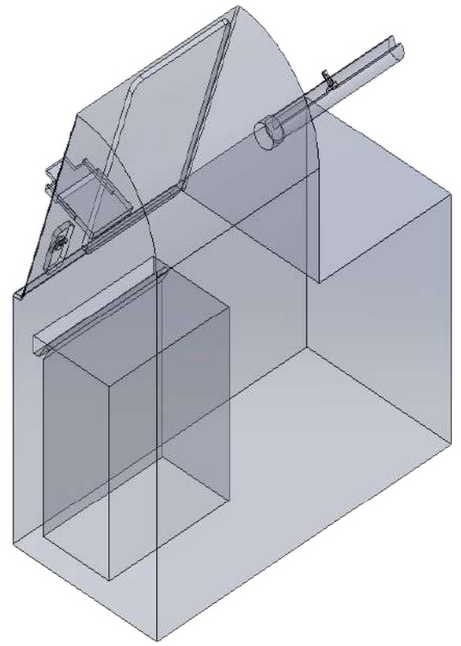


Skeleton/Translucent Views

ORTHOGRAPHIC VIEW FRONT



ORTHOGRAPHIC VIEW BACK



Client Feedback

[redacted] said that the 3D render did not make him much more confident about the actual function of the machine but he said it did improve his perspective of the aesthetics. Furthermore he said that the neutral colours combined with the bright accents was a lot more pleasing that the entire machine being brightly coloured. Although I already mentioned that the colourful renders are simply to demonstrate the shading without drawing every picture the same he is certainly right about how the colour effects the looks and approachability of the machine. Strangely enough the neutral tones actually make it seem more friendly than the bright orange body for me. Perhaps that's because bright orange is a colour often associated with hazard or risk or maybe I'm just experiencing some sort of plasebo created by the suggestion heuristic. [redacted]'s final observation was that the machine lacked details and I told him that's because it would likely not be the final design.

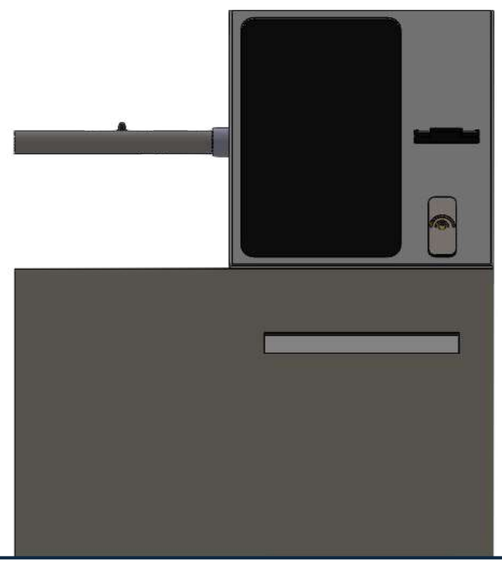
Personal Thoughts

Personally I am not a huge fan of this design and I think the CAD models only accentuate that, the rather peculiar shape combined with the distinct lack of features other than on the face plate makes the whole design look almost rushed and put together the wrong way. To me the sidecar section, whilst functional breaks the idea of what a kiosk functionally should look like, by adding it there's a possibility that users will be confused on the machine's purpose even despite branding. As humans we tend to analyse unimportant things like the purpose of some irrelevant kiosk with the left side of our brain which is a lot more bias because it release mostly on habit rather than critical thinking. Perhaps the unique shape would cause the brain to focus in and use the right hand side but that would likely only be for e highly motivated individual who was focused using the service.

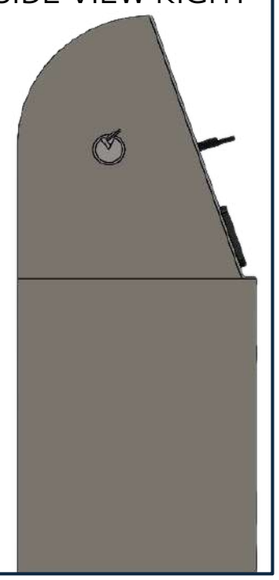
Projection Views

SIDE VIEW LEFT

FRONT VIEW



SIDE VIEW RIGHT



Design Development - Detailed Solution 3

Client Feedback

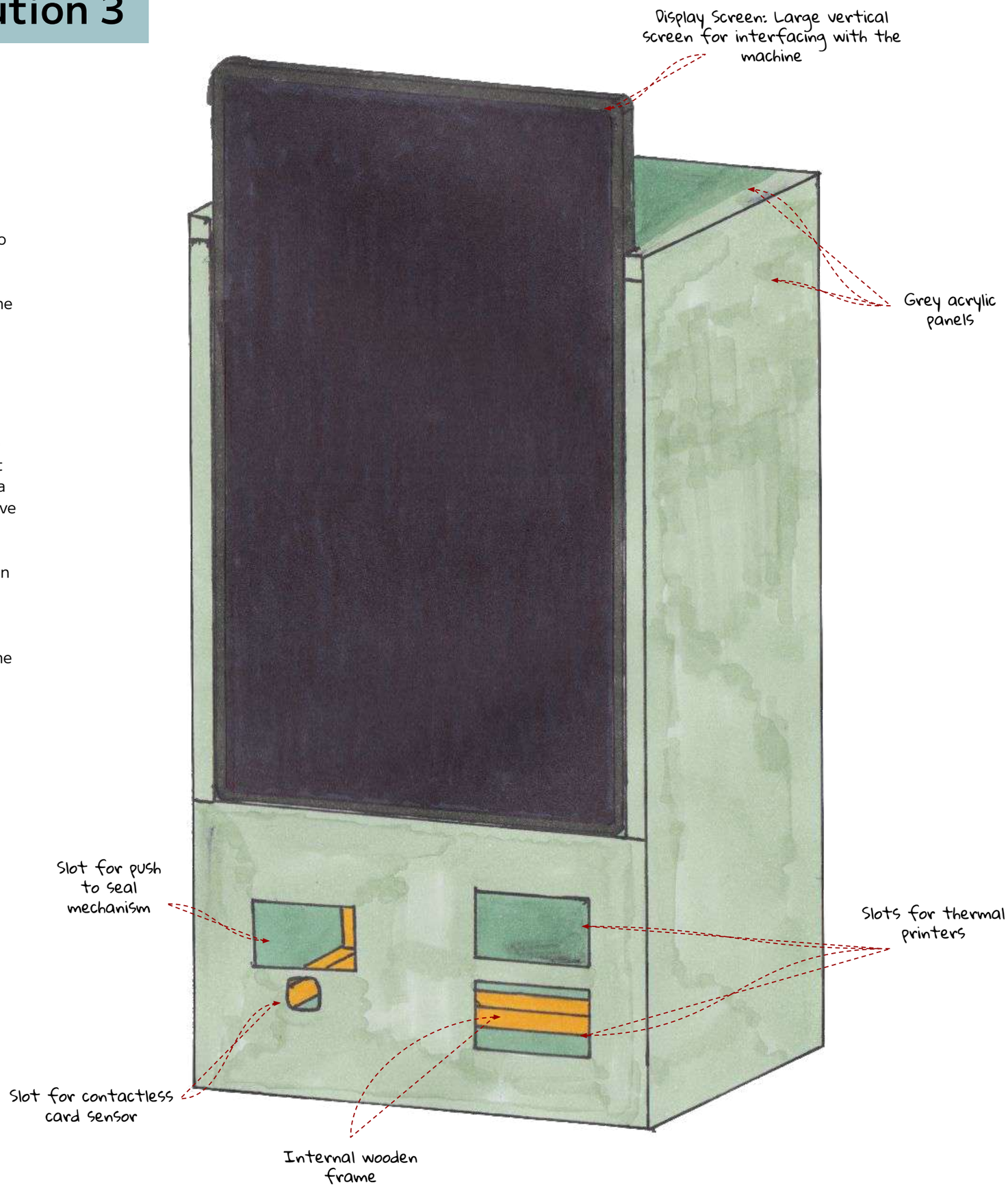
[redacted] said that this was his favorite design yet, although I hadn't sketched in the front panel components it didn't matter because the subtle parts of this design make it nice. He also noted that the seamless paneling certainly is something to admire. He said 'I also like how the monitor gently breaks the concept of the box by poking its head above the sand'. I believe hes referencing a sort of 'thinking outside the box type metaphor and I agree with him. [redacted] thought that having the display poke out the top not only makes the design more approachable but also is more futuristic because it partially exposes a component.

Personal Thoughts

For me, this specific design marks a shift in the project. It moves from vague ideas of what might be nice to create, to something that is not only realistic to produce but also genuinely aligned with what my client is looking for. It supports the proposition without overcomplicating the design process. If you think about it, this is basically as simple as a kiosk can get, and yet it feels less tacky and far more luxurious than any of the others I've drawn up until this point. Furthermore, simplicity itself is futuristic. As technologies advance, they become more hidden and less visible, as seen with almost every piece of tech in our era. This, combined with an organic wooden frame, creates a poetic symbol in the form of a design. Personally, I just want to use elements from this concept. I can clearly see it's not perfect, but I do want some form of wood to be visible to emphasise the organic element. Ideally, a combination of both polymer and timber in the external frame would secure all the aesthetic points while also making the design appealing to the target audience and to [redacted].

SWOT analysis

S	W	O	T
- Captures most of the aesthetic project goals - Sturdy and stable looking construction	- rectangular framed, not particularly exotic - A lack of exposed wood on show for the organic aesthetic	- Plenty of ways this design could be modified to account for the lack of exposed wood and to make the frame seem move interesting by perhaps shortening the profile	- May be to unassuming and go unnoticed due its somewhat simple aesthetics that aren't overly garish

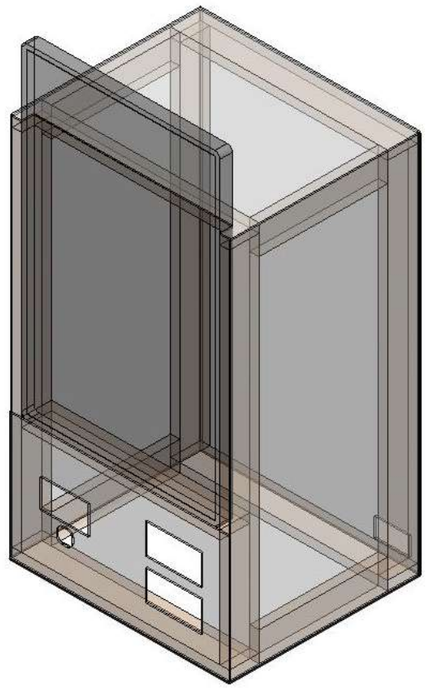


CAD model of Detailed solution 3

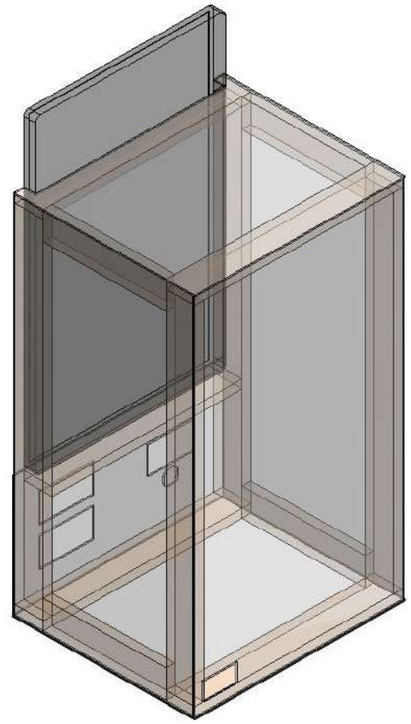
Final Photorealistic Visualisation

Skeleton/Translucent Views

ORTHOGRAPHIC VIEW FRONT



ORTHOGRAPHIC VIEW BACK



Client Feedback

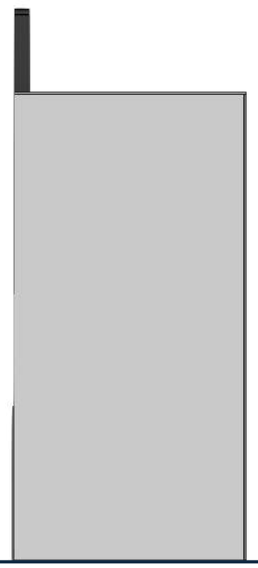
[redacted] was relatively unfazed by this 3D model. As mentioned, the excitement for this particular design came mainly from the extended monitor above the frame and the exposed wood. It seems my sketch may have made a slight mistake in where the wood would have been visible, but [redacted] still felt there was not nearly enough on display for a design that is intended to reflect an organic perspective. Furthermore, he said that although the grey acrylic on the sides was soothing and simple, it was also a bit boring, since there was nothing bright to contrast it except for a small accent on the front. However, this was too minimal to make any real visual impact across the whole machine. [redacted] final comment was that he would like to see something similar developed using the criteria he had already provided, but approached with a fresh perspective and a new document.

Personal Thoughts

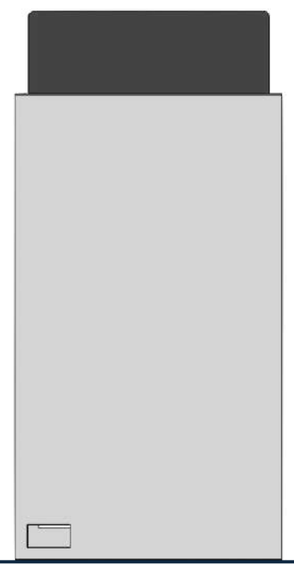
For the most part, I agree with [redacted] feedback, although there are a few points where we differ. For example, I personally think that the slivers of wood on the front are enough to contrast the front panelling. It is more the size of these pieces that needs adjusting to create a stronger visual effect. That said, I do agree with him about the need for more exposed wood overall. Even though I think it just about works, it is probably still not strong enough and would benefit from much more. I am in favour of adding more visible wood to the kiosk. Since I have been given creative freedom over the aesthetic direction of the project, I believe it is worth exploring. [redacted] as the client, ultimately has the final say on which type of design he prefers, but I still want to reflect the original vision I had in mind.

Projection Views

SIDE VIEW LEFT



FRONT VIEW



SIDE VIEW RIGHT

Design Development - Detailed Solution 4

Client Feedback

[redacted] said that this was by far his favourite solution and even went so far as to tell me to construct it exactly as it is in the sketch, without changing anything. Of course, this is an over-exaggeration, but it was very encouraging to hear such positive feedback about a design. He also mentioned that he liked the relationship between components in this concept, particularly how the front panel components serve as a neat frame for the kiosk display. He appreciated the new approach to panelling, integrating the panelling within the wood rather than using it to cover the wood, which leaves much more of the wood's organic beauty on display. I agree that this is a brilliant decision, as it certainly makes the kiosk more eye-catching and, I would argue, more luxurious.

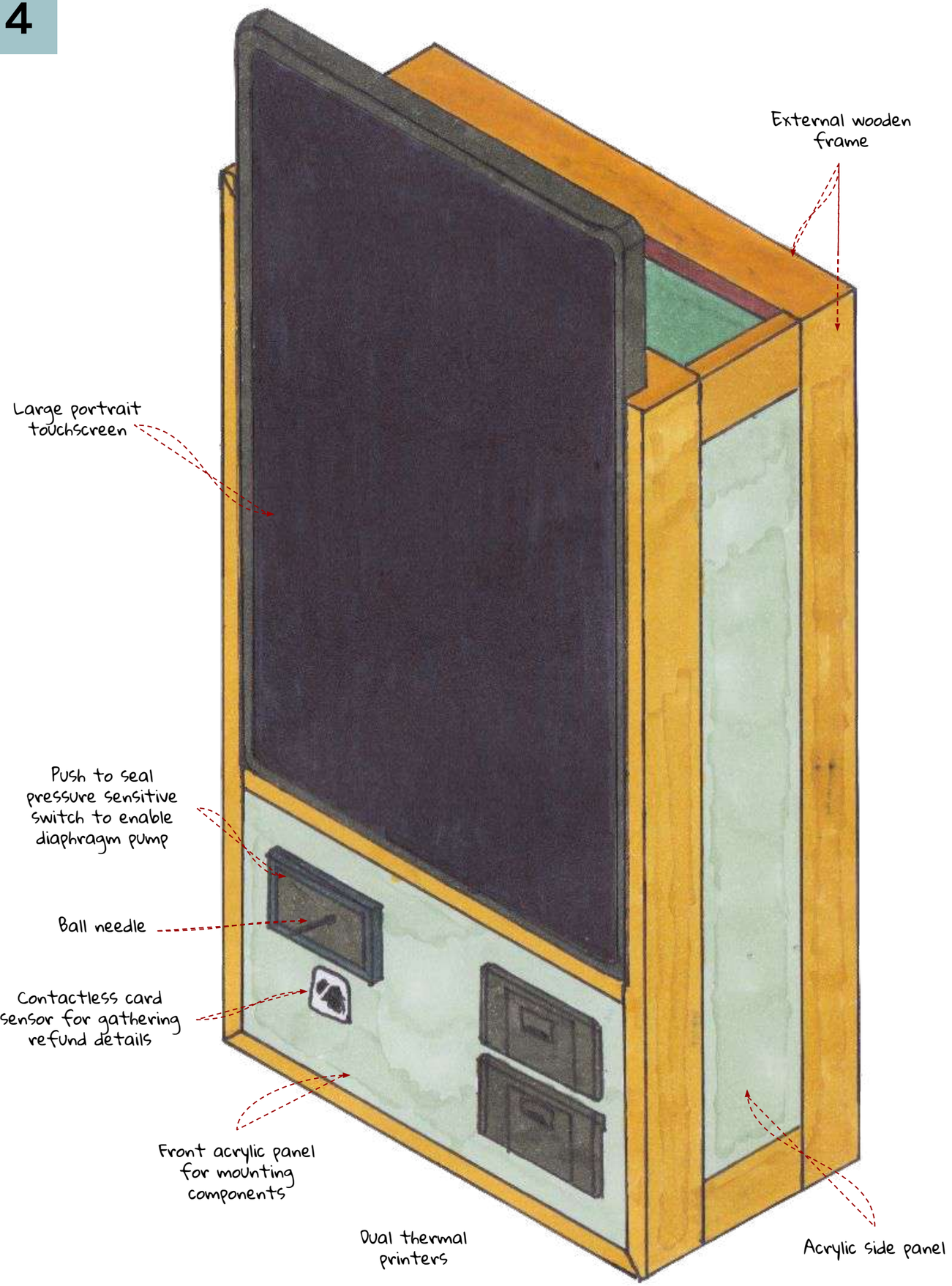
Personal Thoughts

I feel as though this design is a high-quality representation of what my design skills can achieve in this particular proposition and scenario. I agree with [redacted] on how the wood enhances the natural, organic beauty of the piece while also increasing its sense of luxury. I do feel, however, that the machine may not appear quite as futuristic as I had originally intended. That said, I think the grey acrylic contributes to a more futuristic design language.

Furthermore, the continued motif of the monitor being larger than the frame it is enclosed within is something I have noticed on several high-end kiosk designs, particularly those used in Austria for digital ski pass ticketing. This machine would not look out of place in such a luxury environment, and that gives me confidence in the versatility of the design. Its low profile and simple shape contrast nicely with the more complex organic beauty of the materials used.

SWOT analysis

S	W	O	T
- Low profile shape - Organic material beauty - Versatile in environments	- Less structural stability - Higher tipping risk - Smaller base, less balance	- Can be easily - Joinery on corners - Improved mounting hardware - Subtle added complexity	- Misaligned components - Complex diagonal profiles - Construction accuracy needed

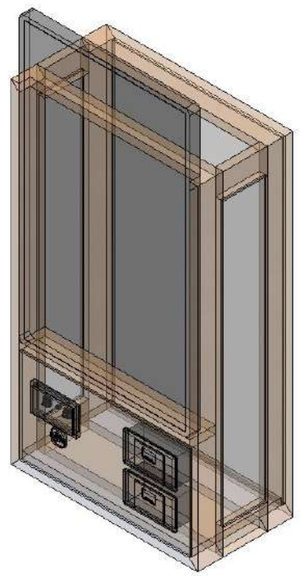


CAD model of Detailed solution 4

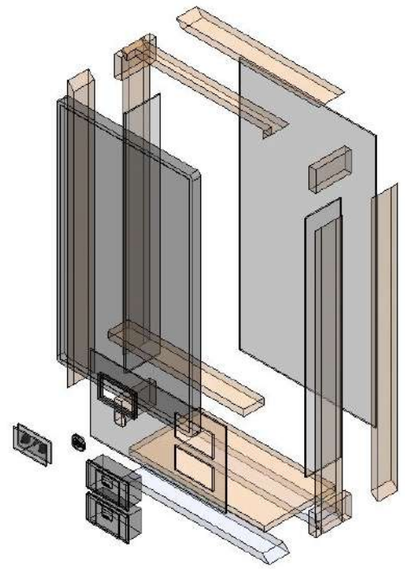
Final Photorealistic Visualisation

Skeleton/Translucent Views

ORTHOGRAPHIC VIEW FRONT



ORTHOGRAPHIC EXPLODED VIEW



Client Feedback

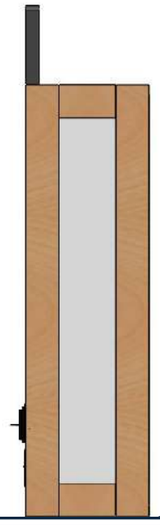
[redacted] was satisfied that the CAD model represented the original sketch with a high degree of accuracy. He expressed that he is genuinely looking forward to the possibility of this machine, or kiosk, becoming a reality. He is particularly eager to see how the machine is built over the coming weeks. However, he did note that he would first like to see foam models of the kiosk to ensure that it looks just as effective in real life before committing to any kind of final build.

Personal Thoughts

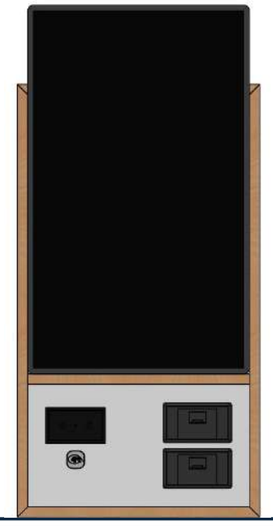
Although I'm slightly disappointed that I won't be building a full-size freestanding kiosk, one that doesn't need to sit on a table, I still feel this particular design presents a brilliant opportunity. It allows me to showcase a variety of woodworking and machinery skills within the DT Lab, while also giving me the chance to demonstrate my technical capabilities in building the web interface that will power the kiosk. This means that the final product will not only be a physical prototype, but a fully functional system with a complete user experience. The CAD model gives me confidence that I will be able to realise the product description in full, including a detailed analysis of how the business and customer-facing components will operate.

Projection Views

SIDE VIEW RIGHT

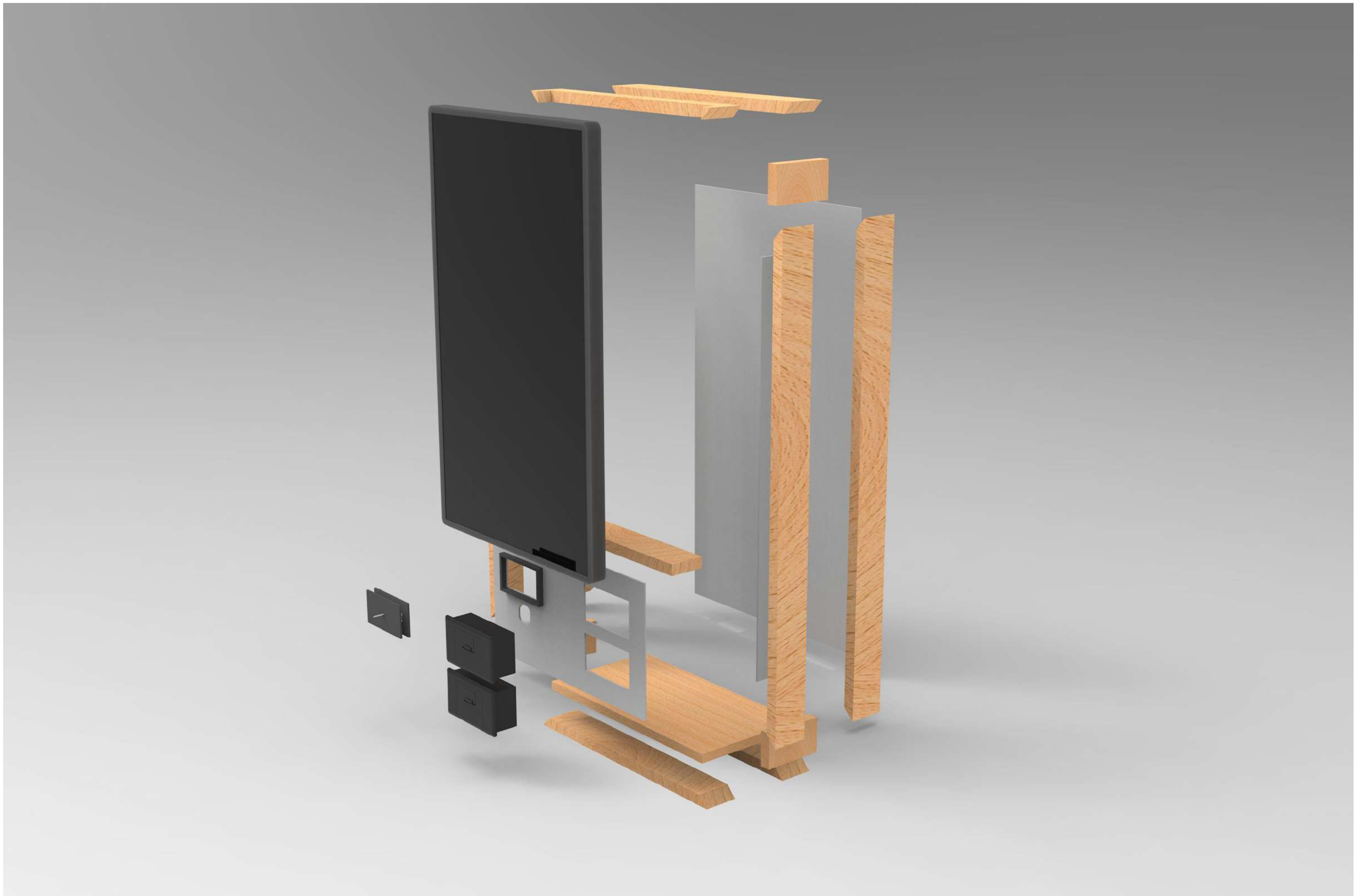


FRONT VIEW



BOTTOM VIEW

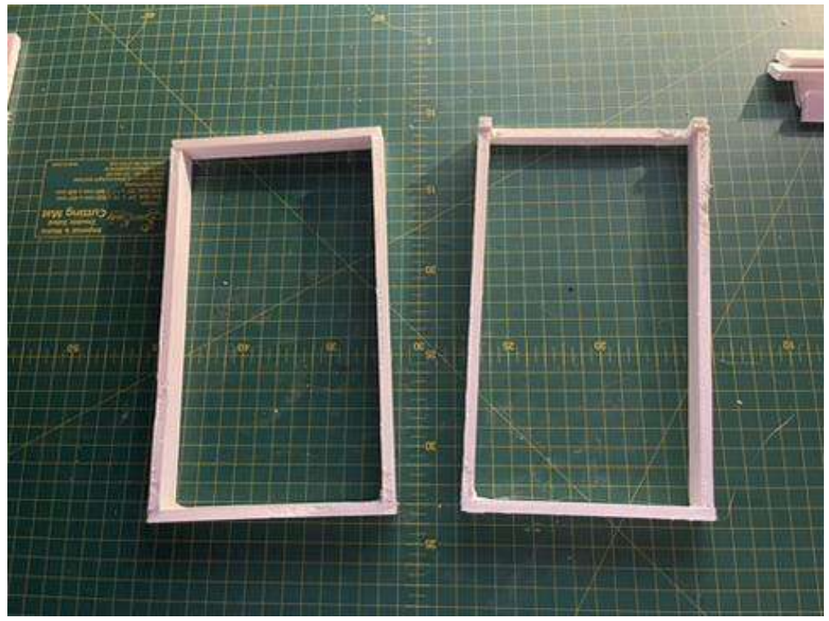
Exploded CAD Render - Solution 4



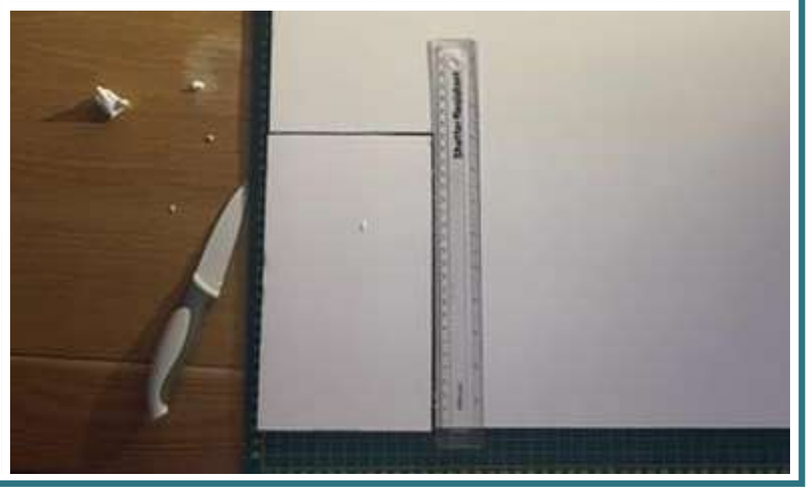
Close-up CAD Render - Solution 4

Foam board model making - version one

introduction
Now that I had a finished 3D model I decided it was about time that I create a physical model to present the idea to my client. To do this I decided to use foam board modelling. To do this I simply took rough visual estimations of part widths and sizes to create a simple model using the CAD assembly. Unfortunately, my first attempt was riddled with mistakes such as rough and messy edges, an unflat base, damaged parts and wonky cuts. After completing the model to a mostly complete standard I decided to re-do the model as the current version did not uphold to the standard to which I believed would properly represent the ascetic and function of the project. Below I will discuss further mistakes that I made, what I learnt and how I will approach my second attempt

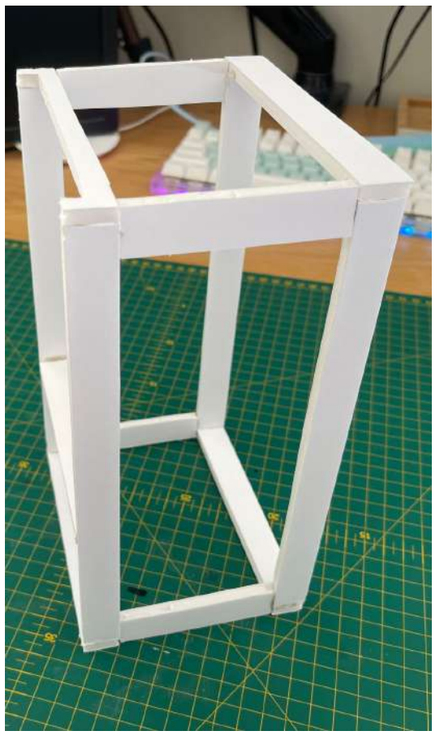


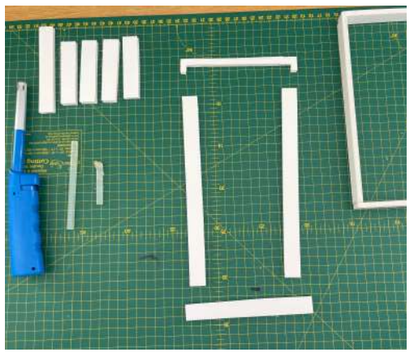
My Process, Challenges, and Lessons Learned
Understanding what went wrong with the model creation process is essential to understanding how I can improve for a second version. Essentially the process boiled down to 4 steps, firstly I'd use the part directory in the solidworks assembly to identify which part I was making next, crucially determining the number of identical parts and their relative size compared to the others. Secondly after making a visual estimation based on the size of the panels which i cut first, I would mark out a cut on the foam board with my ruler and knife making a small indent in the board surface. Thirdly once I was satisfied that the line was straight and correctly positioned I'd just repeat the indentation pressing harder so that the knife would penetrate through the paper top-layer and seperate the foam, because I was using a knife not intended to cut this kind of material I'd usually have to run the knife up and down a few times to cut entirely though both the foam and second layer of paper. It should also be note that due to the thickness of the knife the foam would be dragged in small clumps which made the edges rough and bumpy which contributed to the final product not being of a high enough standard. Finally I used my glue gun and hot glue sticks to put the parts of the model together. So far as I know this is typically how foam parts are connected however my glue gun was too hot and it actually made the glue hot enough to melt and damage the foam if glued on a surface not protected by the paper lining. Finally the last issue I had was loosing track of which panels went where, this resulted in confusing the monitor and side panel pieces which lead to me improperly cutting one to amend the shape. Going forward I need to find another way to determine the measurements, cut the card neatly and accurately, label and manage all the individual parts and bind the parts together to create one cohesive model.

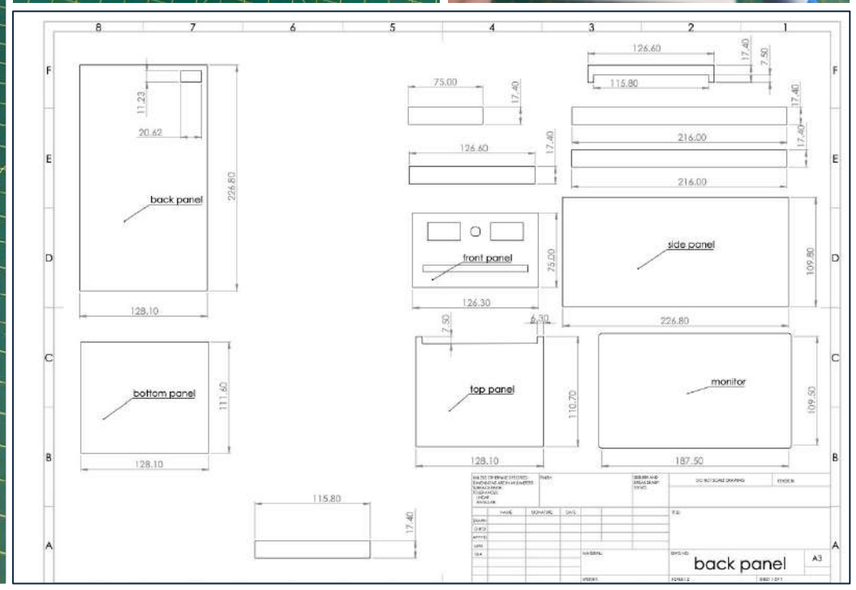


Foam board model making - verison two

Introduction
After Identifying what mistakes I made with the last model I concluded that creating the second one would likely take more time but I was ready to spend more time in order to have something good to show my client and gather his thoughts. Before jumping straight back into the modelling though I instead went back to my CAD assembly and created duplicate part files for each component so that I could adjust each with a scale factor, although I knew this would likely interfere with the assembly, that didn't matter because I didn't need a fully assembled scaled version, rather I needed to see the dimensions of each part individually. To do this I decided to create a solidworks drawing of each part with their respective scaled dimensions and combined each into a A3 size drawing complete with labels. This made it so much easier to not only identify the individual parts but also use exact measurements to create a piece which turned out to be far superior in accuracy and quality.







Amended step by step modeling process
After my first attempt I learned my lesson and switched to using the proper tools;

- Scalpel with a fresh blade
- Box cutter/stanley knife
- Metallic Ruler
- Hot Glue sticks
- Grill Lighter

Also to note I would've like to use a set square to ensure that all the edges were properly aligned and that all my cuts were at 90º but I didn't have a set-square at the time and so ended up not using one. Here is the process that I used:

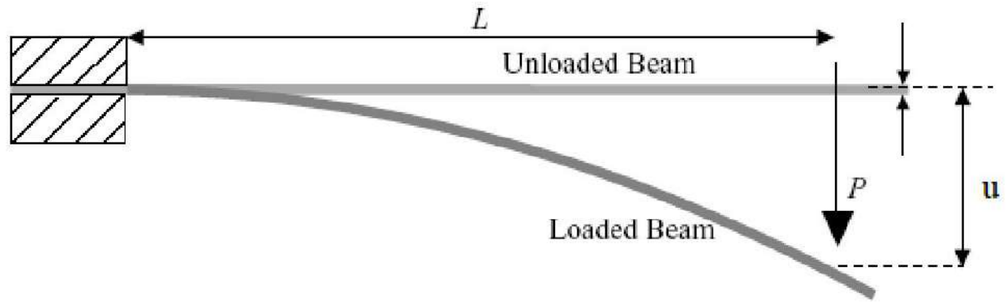
1. **Planning** - As mentioned in the introduction this involved creating the detailed design drawing with all the scaled dimensions but it also required me finding a proper knife to cut the foam and a more gentle way to heat the hot glue.
2. **Measurements** - using the metallic ruler I would draw out a box of the total dimensions of multiple parts which had the same length, then once cut id make small indents with the knife on both ends of the box to indicate where to line up the ruler.
3. **Cutting** - carefully and only penetrating the paper by the edge of the material as to not cause the foam to clump I would drag the knife along the length of the ruler being sure to apply about 20% of the total force perpendicular to the cutting direction as to ensure the line did not stray from the ruler.
4. **Inspection** - After making a cut i would test the length against the ruler and other parts to compare if the cut was to size, id also examine the edges and determine if the piece was good, sometimes recuts are necessary.
5. **Assembly** - Carefully and gently I'd heat the glue sticks with my grill lighter as to melt the glue just enough to be effective but not enough to melt through the foam which was an issue that I experienced with the glue gun, once two parts were connected i used a flat surface to try and ensure that the glue connection was somewhat square.

Client feedback
[redacted] thought that constructing the frame in combination with existing 3D renders of the kiosk was enough for him to visualise the concept. He mentioned that although simple, this kind of design was exactly the kind of thing that stands out amongst a busy street or shop floor. He also noted that classical luxury could still be maintained through this design via some nice wood used to construct the frame and something to accent that with the panels.

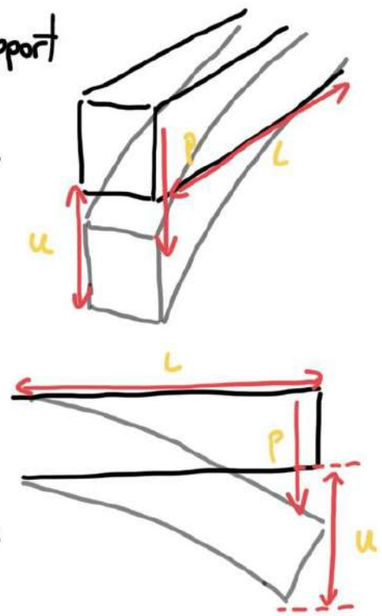
Testing & Technical Research - Snap-fits

Calculations and Their Purpose Within My Project
As part of the design of the handle I wanted to create a snap fit connection which would allow the two parts of the handle to simply click together. Since the handles also need to be air tight creating a clip which is both small enough to fit inside the handle and one capable of holding handle together tight enough that it can compress whatever soft material I will use to create an air-tight boundary will be a challenge.

In order to determine exactly how the clip should be made I decided to first start with using some basic mechanical calculations on deflection. This would allow me to discover exactly the dimensions of both the beam/prong of the clip and what kind of hole size it needs to deform it to the level where the part will not shatter it will click together and not be so difficult that it's actually hard to close. My goal was to make the total force required to snap the two parts together to be around 1.5N which is a satisfactory level of pressure that results in a strong enough connection due to the elastic potential energy of the deflected beam. As shown in the calculations below, I made a few assumptions about how exactly the material is deflected, but nonetheless my final conclusion was that there should be a 0.2mm tolerance between the beam starting point and maximum deflection which results in a 1.4N force to achieve deflection as according to young's modulus of PLA which I took to be 3500N/mm^2 after doing some research online.[30]



L: The length of the beam from the fixed support to the beam end.
P: The applied force (point load) at the free end of the beam.
u: The deflection (displacement) of the beam at the free end due to the applied load.



In order to determine P using data points L and u we must use the beam deflection equasion.

$$\delta = \frac{fL^3}{3EI}$$

fL = free lenght of the beam from the fixed point
E = Young's modulus of the material
I = The second moment of area of the beam's cross section

Dimensions of the beam

1mm x 1mm x 5mm
W x H x L

Lets start with 0.5 mm of deflection and work down.

for the push-fit, we want the beam to deflect at about 1.3 - 1.5 N of force. At this level we should be able to achieve a seal without making the handle hard to close.

δ = 0.5mm (deflection)
L = 5.0mm (beam free length)
E = 3500 N/mm^2 (Youngs modulus of PLA)
$I = \frac{bh^3}{12}$ (Moment inertia for a rectangular beam)
B = 1mm
H = 1mm

moment inertia for a rectangular cross section:

$$I = \frac{bh^3}{12} = \frac{(1)(1^3)}{12} = \frac{1}{12}\,mm^4$$

$$f = \frac{3EI\delta}{L^3}$$

$$f = \frac{3(3500)(\frac{1}{12})(\frac{1}{2})}{5^3}$$

$3 \times 3500 = 10,500$

$10,500 \times \frac{1}{12} = 875$

$875 \times 0.5 = 437.5$

$5^3 = 125$

$\frac{437.5}{125}$

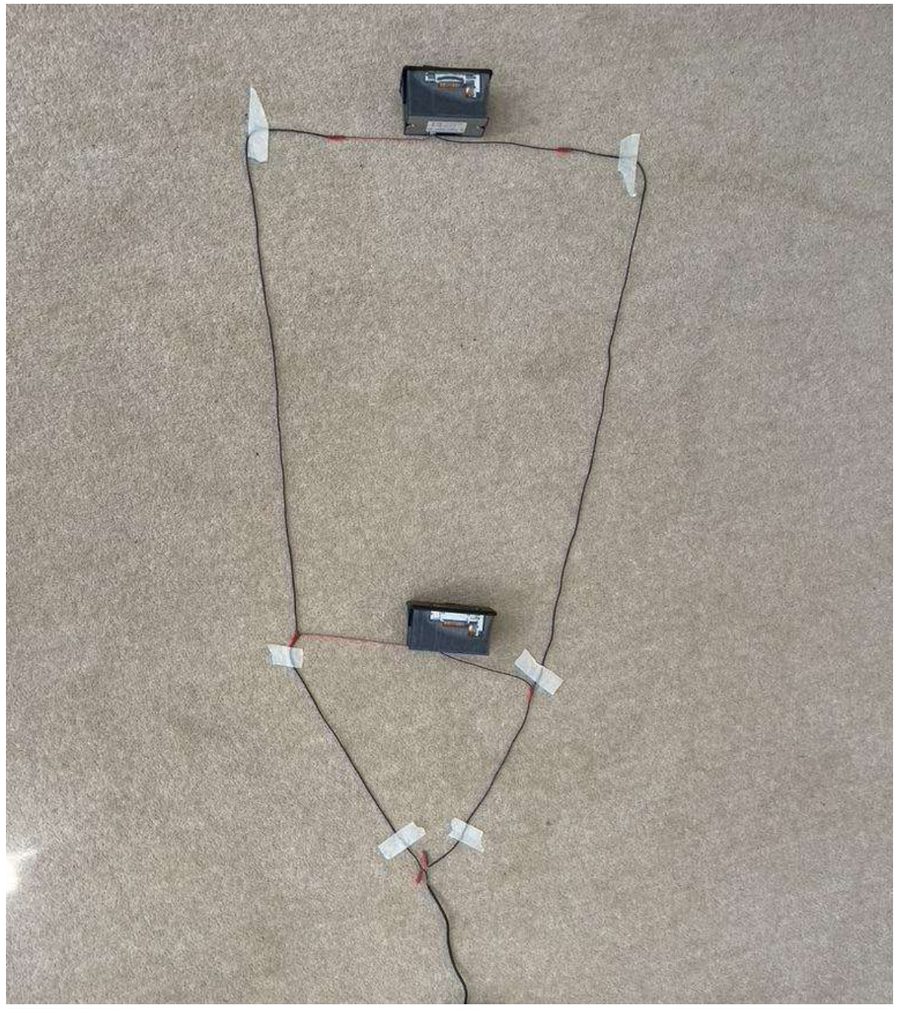
$\frac{437.5}{125} = 3.5\,N$

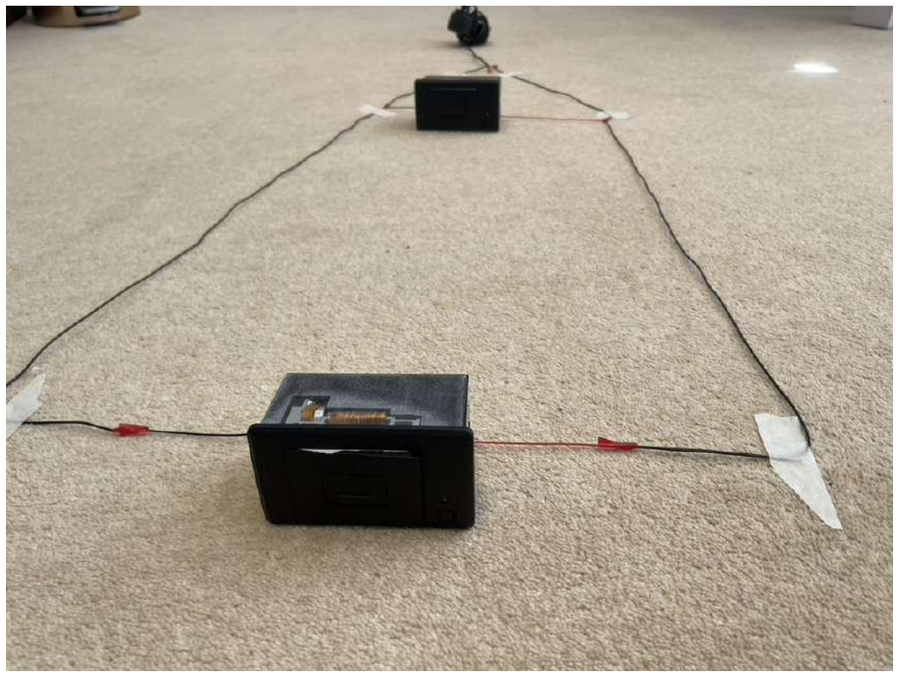
Okay now we have that result lets try it with different deflection values

Deflection	N of force
0.1 mm	0.7 N
0.2 mm	1.4 N
0.3 mm	2.1 N
0.4 mm	2.8 N
0.5 mm	3.5 N

∴ The tolerance between both sides of the push-fit mechanism should be 0.2 to achieve a preferable deflection force of 1.4 N

Technical Research - Power Supply and wiring

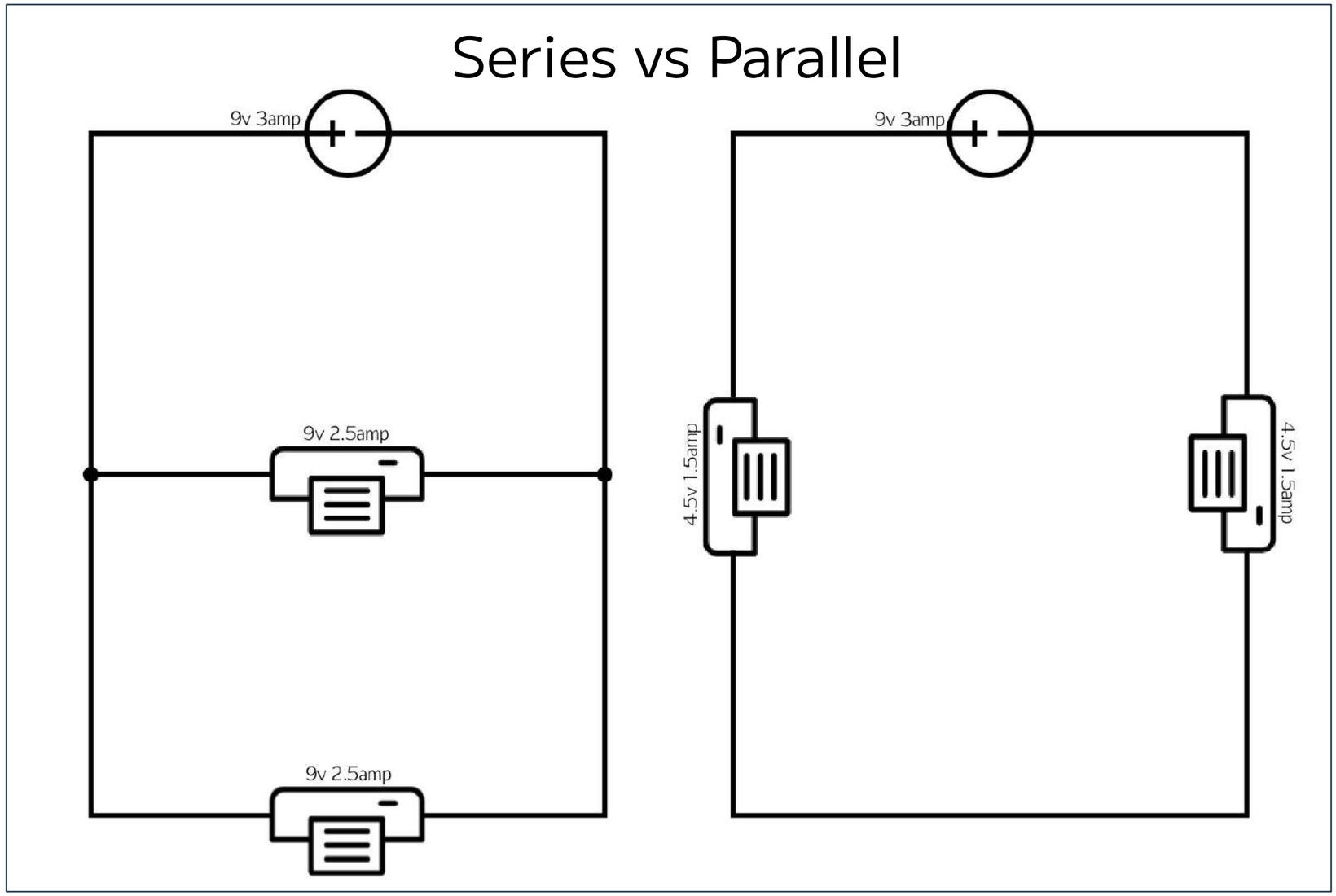




Circuit types

Parrel and Series are two different types of circuit which I used in my project, deciding on which one came down to a simple factor, power supply. For the thermal printers they required at least 9v at 2.5amps for a total power draw of around 22.5 watts. Had I have split the circuit using the printers, the electrical current has to pass through the first printer before reaching the second, effectively halving the power available for both. If I instead separated the the circuit with a intersection of a third wire so that the electrical current has two paths it now allows me to use full power on both printers at the same time because the power source which I'm drawing from and the power adapter that I'm using supports up to 75w maximum throughput.

On the other hand for the vacuum pump circuit I needed to wire everything in series. This is because I was using two separate switches to connect the whole circuit system to power. If they were connected in parallel the switches would have no effect on the circuit because the electricity would just take the path of least resistance and skip right past the switches. However because they're in series the switches have to be pressed to connect the electricity around the circuit and activate the pump. By wiring two switches it just means it requires both to complete the circuit.



Technical Research - Creating a functional Receipt

Introduction

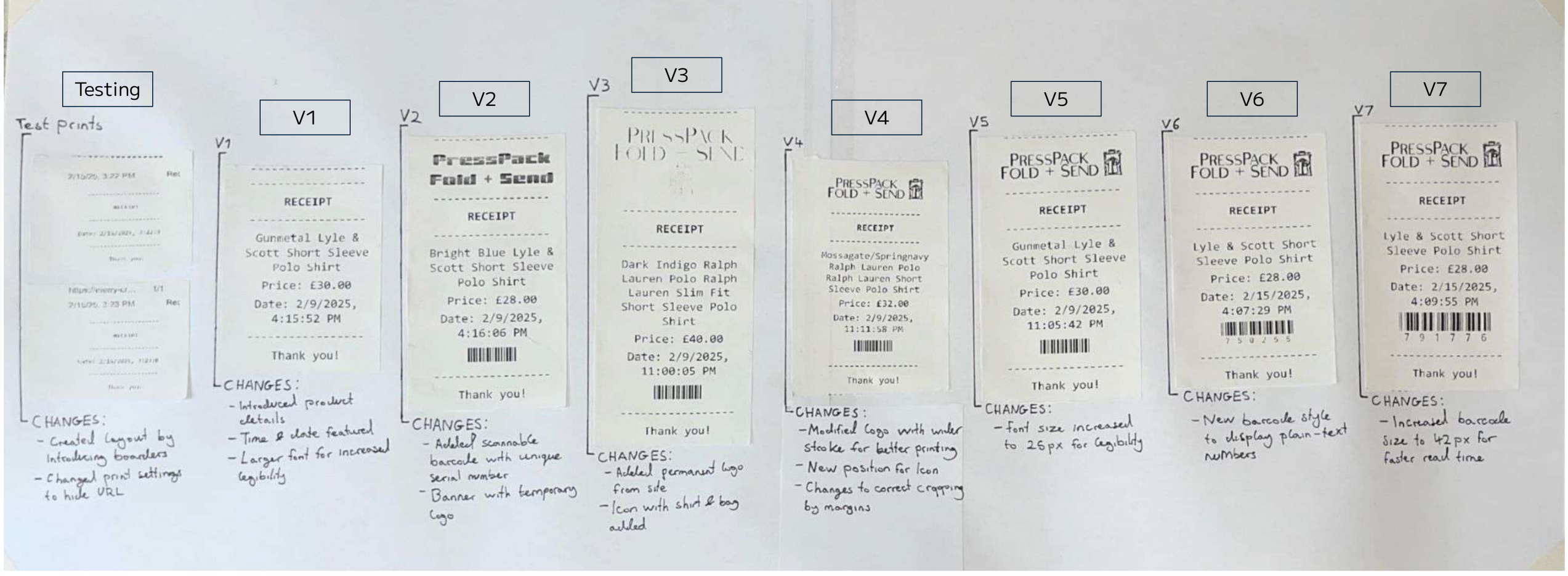
An unexpected point of development, making a fully functional receipt actually took a bit of time to get just right, so I'll share my process and what I learnt. Initially I was starting off with a template of 52mm thermal printing paper with a 48mm printing area assuming a 2mm margin for the print alignment and size of the print head inside the thermal printer. After having established these metrics I began to test the printer on some paper by using slides and formatting the page size until it looked right. One of the biggest problems with creating the receipt was ensuring that the text was not too small as to be printed incorrectly by the low resolution print quality of the thermal printer I was using, but not to big as to overload the small print head which even when supplied with above the recommended power supply could only print about 80-90% of its width at one point. To hone in the font size I did a few practice prints before finally deciding to move on to using the actual chrome print service on the website.

I made a small test website using simple html and JS to test printing through Javascript and learning how to properly set the code to provide a favourable result when pushed to the chrome print service.

One I figured out exactly how to use javascript to push prints through the print dialogue it was on to creating the design of the receipt. Receipts are usually made up of 3 parts, a header/banner with a brand name a central section with information about the transaction sometimes a small list of various expenses, a barcode so that the transaction log can be held and used if the customer comes back with the receipt and finally the footer. The footer usually just contains a short message or thank you to the customer to encourage them to come Back and buy again. Using this framework I created an initial concept, then a logo which I used in the second design. After rethinking the logo a third design. Ensuring the logo would fit and print properly was the forth design. Fixing sizing and formatting was the fifth design. Switching to a new barcode font with included numbers was the sixth design and finally increasing the barcode size was the seventh.

Client feedback

[redacted] liked the final design of the receipt and was pleased with the overall legible text and clear print. He thought the design of the logo was interesting and certainly demonstrated the key purpose of the kiosk without being too garish. He also said that for him the barcode was a big deal since barcodes on receipts add an extra layer of security to the whole ordeal. Since the barcodes are generated randomly and stored each time a transaction is processed I can ensure whether a receipt is authentic or not and when the transaction occurred.

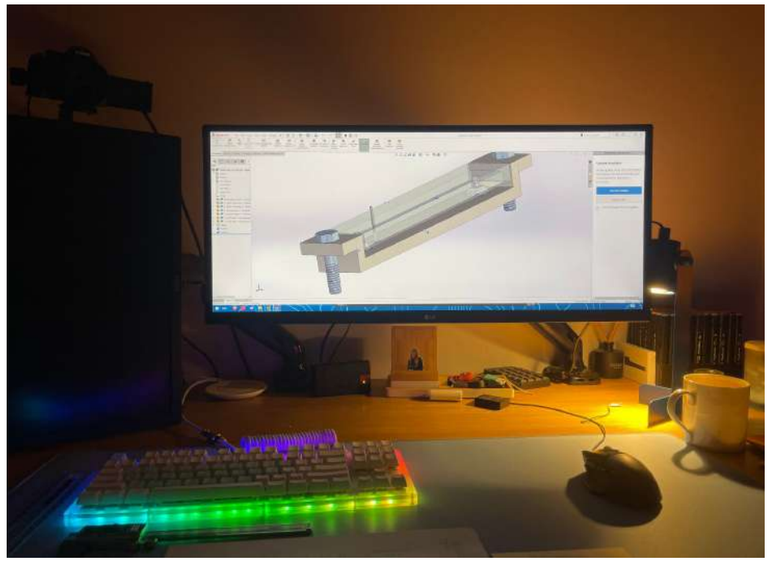


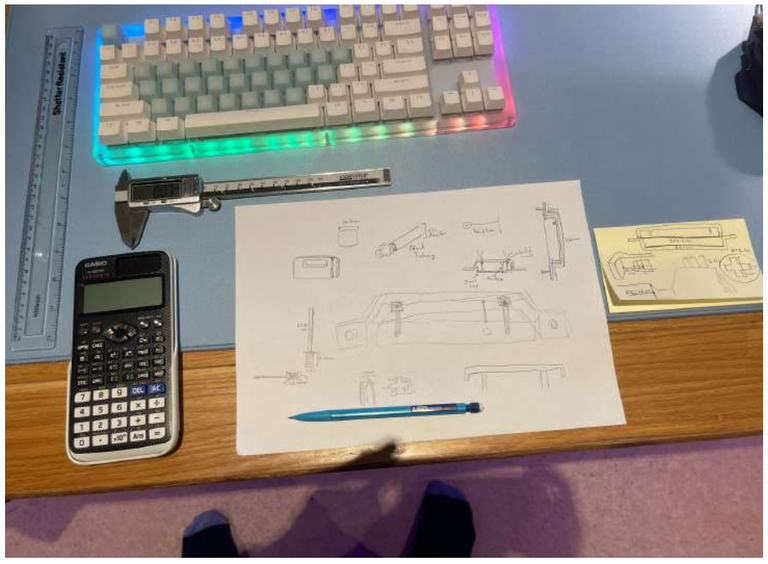
CAD Modelling - My Process

Whilst I'm 3D modelling, there are a few tools that I keep within arm's reach to speed up my workflow. These tools are used to work in tandem with the software's own automations, combining both integrated software tools and physical tools. Modelling in this way is the only way to accurately 3D model CAD drawings quickly and easily. A few tools I always have with me are:

- Calculator (Casio FX991-EX)
- Digital Vernier Calipers
- 30cm Ruler
- Mechanical Pencil
- Paper and/or sticky notes

Each of the tools I keep with me has a specific purpose that speeds up my CAD workflow. Whilst software like SolidWorks is highly automated, requiring little calculation to create bodies and shapes, there are still tasks where using an actual calculator is necessary to quickly perform fully defined and to-scale modelling within the required dimensions. For example, when centring an object on a sketch plane, you typically have to create a centreline at your desired longitude on the part and then use a shape creation tool such as the centre circle or centre rectangle tool, which creates unnecessary reference geometry. This means that when you need to edit the dimensions of other lines or shapes that reference the centre shapes, a message will be displayed indicating that the number of references will make the shape dimension-driven, which breaks our reference geometry and uncentres the shape. A much simpler way of centring shapes on the sketch plane is simply using a calculator. By creating a shape in the rough position of where we want it to be, we can then align it by doing some simple maths. For example, if we're trying to centre a rectangle within a larger quadrilateral, we can take the length of the side we are centring along, such as the height of the quadrilateral, subtract the height of the internal rectangle, and divide by 2. Now, all we have to do is smart-dimension to the adjacent or perpendicular side of the quadrilateral and input the dimension listed on the calculator display. This is just one of many methods I've found to avoid getting into a sticky situation when trying to alter a heavily complex model after the fact.





The 30cm ruler and the digital vernier calipers serve a similar but separate purpose. The main reason for always modelling with a ruler is that it allows me to visualise the dimensions I'm assigning within the software. For example, when I create the size of a non-ergonomically important component that doesn't hinder functional performance, such as a component or dimension that can be a multitude of sizes without affecting functionality, I use the ruler to determine roughly what length looks right in real life, since trying to gauge the actual size of something in 3D modelling software is almost impossible. The digital vernier calipers serve a similar purpose by allowing me to quickly and easily obtain dimensions to use within SolidWorks. However, I use the vernier calipers more for determining the dimensions of smaller components that I intend to integrate into the design. For example, whilst creating the bracket and cap to facilitate the push-to-activate vacuum mechanism, I had to understand the dimensions of small components such as the ball valve, needle, and keyboard switch. It is imperative that I know the exact dimensions of these small components, as being offset by even 0.1mm could lead to an improperly functioning part, requiring a revision and reprint. This is expensive, time-consuming, wasteful, and very annoying. For this reason, I always keep the vernier calipers and small components with me whilst I'm modelling. Typically, you can find technical drawings online that display the exact dimensions of small components; however, I always like to double-check to ensure they were built to the same specifications as my components. Often, I find small deviations between the components I have and the standardised dimensions listed online.

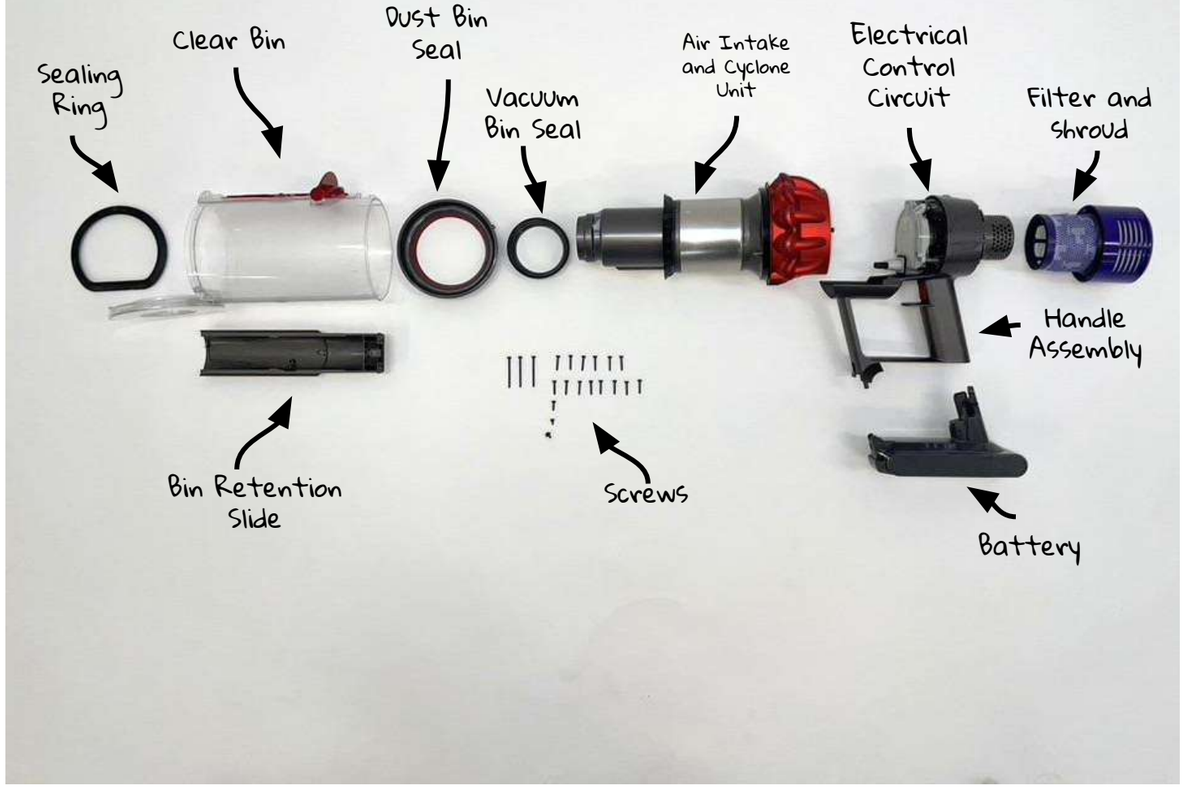
Finally, I'll combine the last three tools of paper, sticky notes, and a mechanical pencil into one main reason: thought capture. Whilst I'd love to be able to CAD model all day and all night, my time for modelling is usually quite limited, meaning I won't create a model in one sitting. When I return to a project, I want to remember where I was and what I was doing so that I can immediately jump back into making progress with my model. To do this, I like to create small orthographic drawings of details or even entire concepts so that I don't forget what I was doing. I also find that this thought capture comes in handy when creating two interlocking components or two components that need to fit together in an assembly. I've scanned in some examples of my thought capture sheets that look a bit more detailed. However, the goal of these sheets is not to express the full design in great artistic detail but rather to allow me to understand and process my own thoughts.

Product Disassembly - Dyson Vacuum and EcoATM

The Methodology of Disassembly
Disassembly is the process of taking a product apart to learn about how it works and how various functions are achieved through the combination of functional design and components. By doing this the idea is that by performing disassembly on an existing design I will be able to create a design of my own which functions to a similar level.

What I Learnt From Disassembling the Dyson
Firstly the reason I decided to disassemble the dyson was because I knew that my design was going to feature some sort of vacuum sealing/packing element and I wanted to understand how the dyson handheld vacuum worked so I could integrate a similar system into my design. However what I ended up discovering by disassembling the dyson was tha the dyson-patented cyclone vacuum was too complex to replicate myself and it didn't make sense to embed the vacuum inside of the machine so it led me down the path of looking for diaphragm and other miniature pump types. This lead me to seeing that what I needed was a self-priming diaphragm pump.

What I Learnt From Visually Disassembling the Ecoatm
Part of the difficulty of my project is that I don't get the convenience other projects have of being able to disassemble something of a very similar nature to what you will be creating. It's not like I can go out and buy a kiosk to disassemble. However whilst looking online for kiosk machine specifications I found an image of the EcoATM kiosk with the front panel opened. There was no labels on it but with some inference and educated guesses I was able to figure out what each part did. This actually really helped me with deciding on what parts I needed for my kiosk and how I should organise them internally within the machine for space efficiency.



Investigating components - Air Pumps

Diaphragm Pumps			
	Pump 1 - small	Pump 2 - medium sized	Pump 3 - Large
Pump Name	R385 12V Mini Pump	Fockety 24V Mini Pump	EC5 Dry Running Vacuum Pump
Picture			
Price	£7.99	£24.32	£289.99
Typical use	Oxygenate fish tanks	Medicine & Gas analysis	Composite Materials
Suction force	-20 kpa	-80kpa	-91.19 kpa
Suggested flow rate	1.8L per min	15L per min	90L per min
Voltage	DC 6V/12V	DC 12V/24V	AC 220V/240V
Current	500mA	1A	0.52A/0.62A
Wattage	6W	24W	148.8W
Noise	50db	105db (foam mounted)	90db
Price to run (per min)	0.0027p	0.0108p	0.067p
Value for Money (1-10)	10	6	3
Overall Rating (1-5)	3	4	2

Analysis of each pump

There are a few reasons why each compressor/vacuum pump is preferable over the others. The R385 12v diaphragm pump is the lowest in power consumption and volume. This is beneficial for the overall noise pollution of the machine. Furthermore it vibrates much less vigorously than the other two which makes it easier to mount and use because it doesn't require padding or a secure base. On the other hand the Larger EC5 Pump is by far the strongest performer in terms of suction force and flow rate. Furthermore its relative noise and vibration is not that high considering its power. Despite it's cumbersome size it's actually the price of the EC5 pump make it entirely inaccessible for my project. The next best option then is the Fockety 24V which delivers a solid flow rate at a decent price, is cheap to run and small enough to be mounted in the kiosk taking up relatively little space. Furthermore it's speed to reach 80 kpa of suction was a lot faster than the R385 12V pump.[see video below]

https://www.youtube.com/embed/icsb-q8CO2I

Investigating components - Pressure Switches

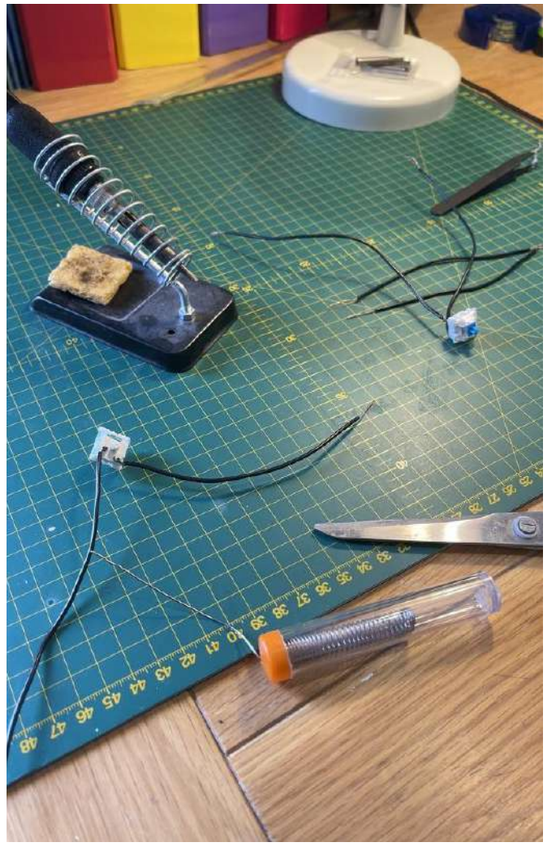
Justification

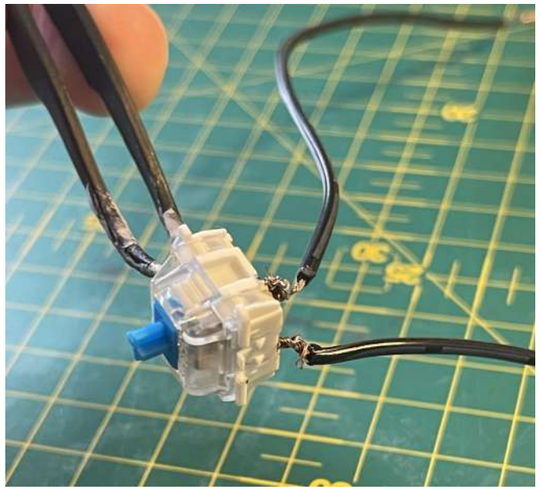
Part of my final solution would be to have a push to seal button, whereby the diaphragm pump circuit is activated by pushing the bag onto a pressure switch. This would allow the pump mechanism to operate entirely autonomously of the rest of the machine no need for it to be switched on and off by some machine system or by the user, the user simply has to use the machine and the pump will only prime and activate when needed.

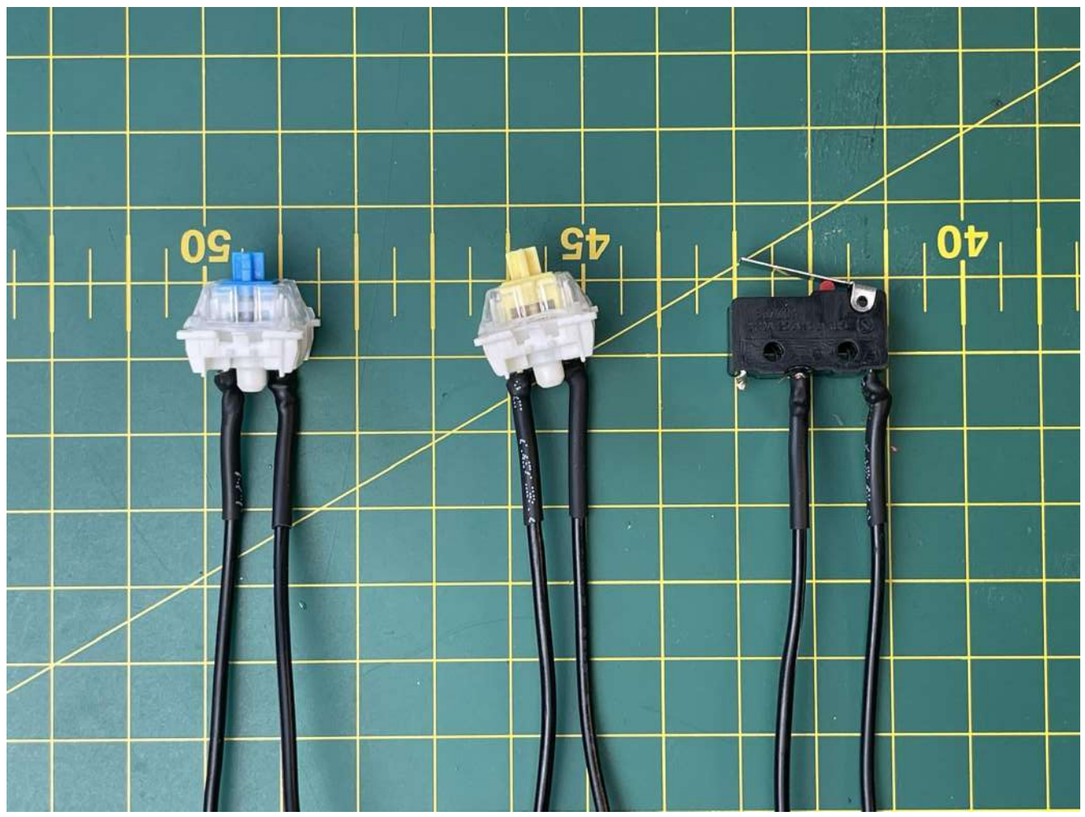
Conclusions

From this analysis of pressure switches I eventually came to the conclusion that a keyboard switch would be ideal. Not only are they easier to mount and fit but they also have a handy stem which makes attaching a cap to the front quite easy as well. Between the two switches I decided to go for the blue as the slightly higher actuation force and clicky movement makes the switch more appropriate for this setup.

Specification	Gateron Yellow	Gateron Blue	Rocker-Style (Micro) Switch
Image			
Type	Linear Mechanical Switch	Clicky Mechanical Switch	Lever-Actuated Micro Switch
Dimensions (L×W×H)	~14×14×23.5 mm	~14×14×23.5 mm	~27×16×10 mm
Actuation Force	~50 g (±5 g)	~55 g (±5 g)	~100 g (±10 g)
Total Travel Distance	~4.0 mm	~4.0 mm	~2.0 mm
Actuation Point	~2.0 mm from top	~2.2 mm from top	~1.0 mm from lever start
Mounting Method	PCB/Plate Mount	PCB/Plate Mount	Chassis Mount
Mounting Difficulty (1–5)	1	1	4
Electrical Rating	Low-voltage DC	Low-voltage DC	Up to 5 A @ 250 VAC
Operating Temp Range	0°C to 50°C	0°C to 50°C	-10°C to 85°C
Lifespan	~50 million actuations	~50 million actuations	~10 million cycles
Noise Level	Low	High (clicky)	Low–Medium
Cost Range (per unit)	~£0.20–£0.50	~£0.20–£0.50	~£0.50–£1.00







Material Research

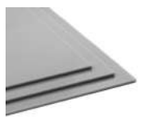
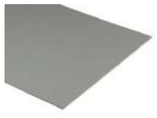
Client feedback:
[redacted] was happy with the materials selected. He mentioned that after visually reviewing each one he was happy with either pine or oak and overall since pine was the better option for all categories that's what I should use

There are two parts of the project which I need to determine a material for:

Frame Material - Woods

image	Material	Cost	Strength	Sustainability	Workability	Aesthetic	Total Score (/5)
	**Pine**	✓ Affordable	✓ Suitable strength	✓ Widely sustainable	✓ Easy to cut and join	✓ Light, clean grain	**5/5**
	Oak	✗ Expensive	✓ Very strong	✓ Sustainable hardwood	✗ Difficult to machine	✓ Traditional look	3.5/5
	Plywood	✓ Cheap	✗ Moderate strength	✗ Not always eco-friendly	✓ Comes in sheet form	✗ Unattractive edges	2.5/5
	MDF	✓ Very cheap	✗ Weak when stressed	✗ Not eco-friendly	✓ Easy to shape	✗ Needs covering	2.5/5
	Beech	✗ Pricey	✓ Strong and stiff	✓ Often sustainable	✗ Tough to cut by hand	✓ Pale, tight grain	3.5/5

Paneling Material - Plastics

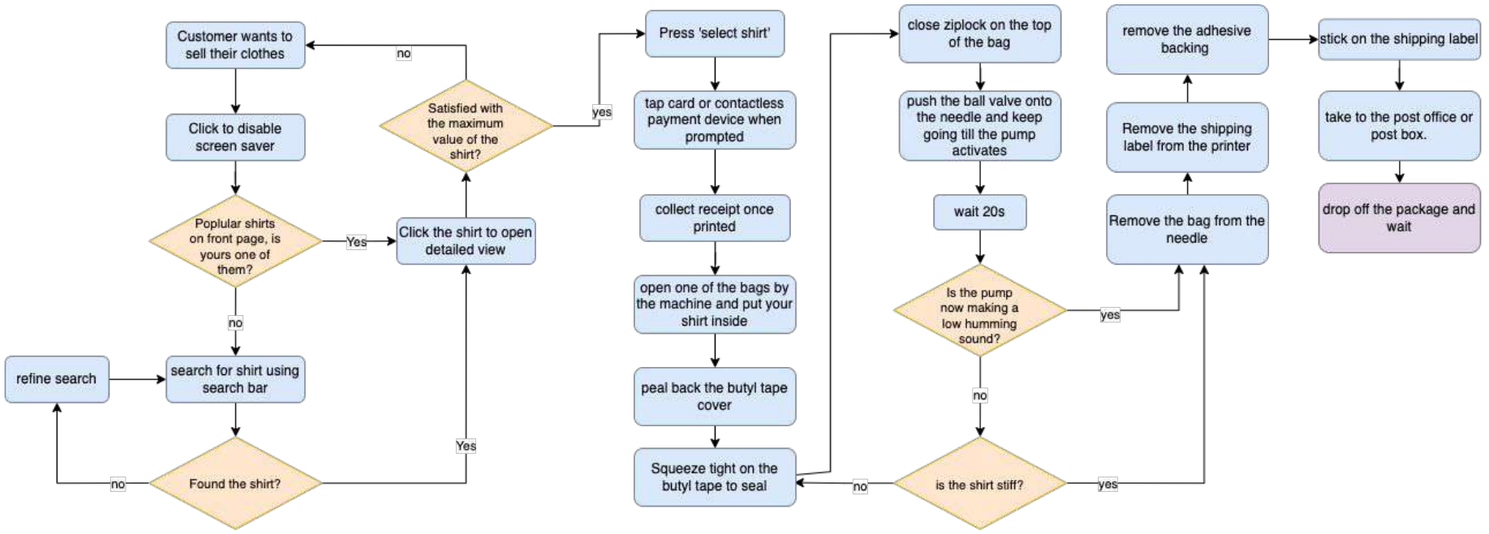
Image	Material	Cost	Durability	Ease of Cutting	Recyclability	Finish Quality	Total Score (/5)
	**Acrylic**	✓ Moderate cost	✓ Rigid and tough	✓ Cuts cleanly with laser	✓ Thermoplastic, recyclable	✓ Glossy and modern	**5/5**
	Polycarbonate	✗ Expensive	✓ Very tough	✗ Melts easily when cutting	✓ Recyclable	✓ Slightly duller look	3.5/5
	PVC	✓ Cheap	✓ Weather resistant	✗ Tricky to cut cleanly	✗ Poor recyclability	✗ Low visual quality	3/5

Manufacturing Specification

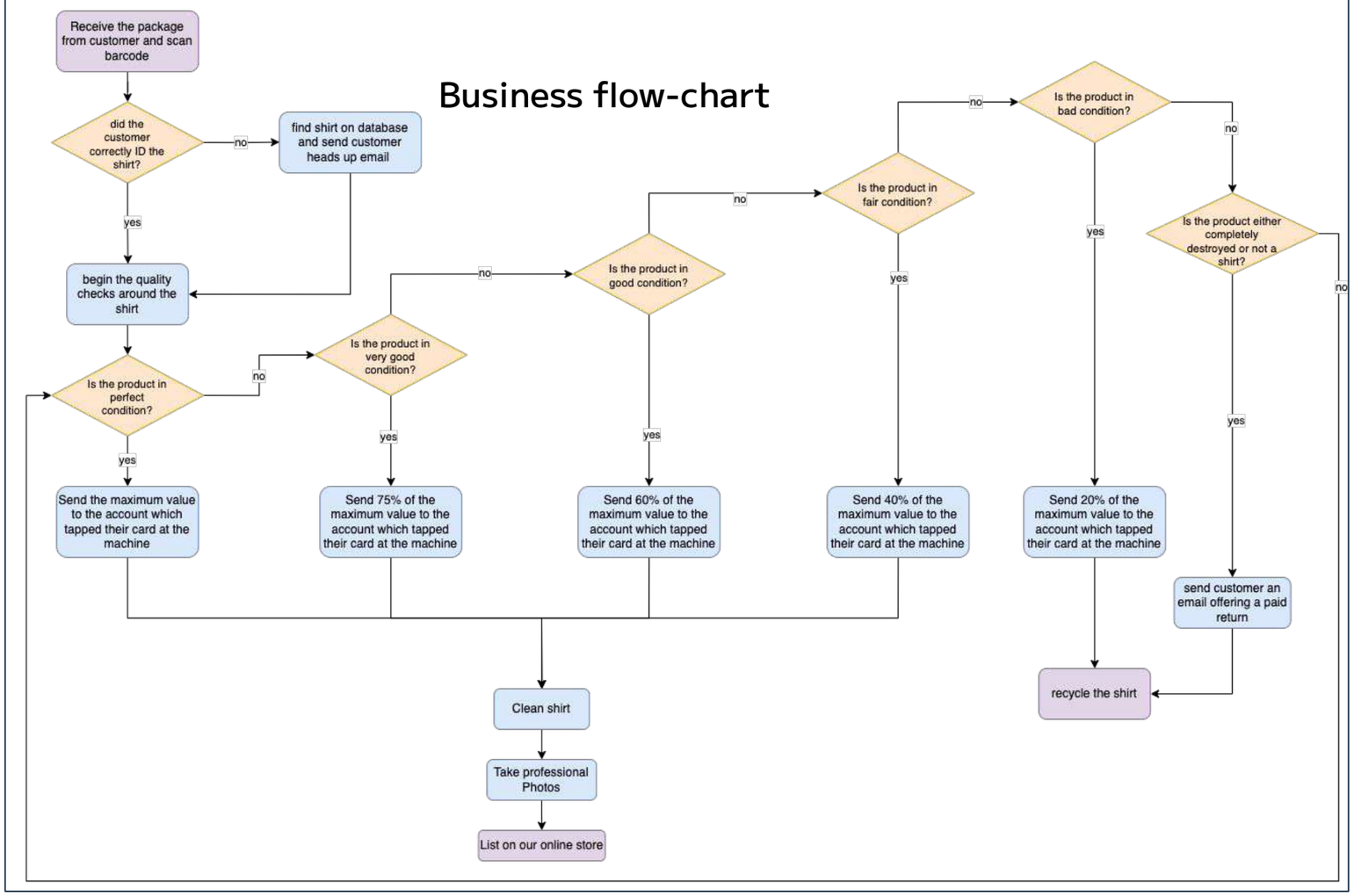
Criteria	Detailed Description of Criteria	Importance / Justification
Safety	Kiosk must be physically stable, tamper-resistant and protect users from the vacuum needle and electrical components.	Prevents injury and misuse in public settings.
Functionality	Must identify shirts, store user transaction, print receipts and labels, and operate a vacuum packing mechanism.	Each step must work smoothly or the process breaks down.
Vacuum Mechanism	Must use a miniature diaphragm pump to extract air and compress shirts via a valve and needle system, stopping when pressure is equalised.	Ensures sealed, compact packaging and reliable vacuuming.
Thermal Printing	Dual thermal printers: one for receipts and one for shipping labels, both with peelable adhesive and scannable barcodes.	Enables efficient tracking and labelling for shirt resale.
User Experience	Should take no more than 2 minutes from shirt identification to label application.	Speeds up process for busy users and encourages repeat use.
Materials	Constructed using pine for the structural frame and acrylic for smooth, wipeable front panels.	Durable and visually appealing with a modern, tactile feel.
Accessibility	Touch interface must be usable by standing adults, with clear fonts, audio prompts, and simple language.	Makes kiosk easy to use for a wider range of people.
Aesthetics	Clean, modern, neutral styling using white or matte finishes, rounded shapes and soft lighting.	Builds trust and fits in with office or retail environments.
Sustainability	Bags and kiosk components should be recyclable where possible, and shirts not resold should be recycled or returned.	Reinforces circular economy values.
Modularity	Design should allow access for restocking printers, servicing vacuum pump, and replacing internal storage.	Easier for maintenance staff to operate efficiently.
Data Handling	System must securely store and delete shirt data and transaction information in line with GDPR regulations.	Essential for user trust and legal compliance.
Incentive Scheme	Must issue varied payouts based on shirt quality, condition and brand after inspection.	Encourages high-quality shirt submissions and user honesty.
Target Customer	Aimed at professionals with surplus formalwear and limited time; people looking for quick resale without posting online.	Defines the tone, branding and functional priorities of the product.
Installation Site	Kiosk should be designed for indoor or semi-sheltered use in high-traffic areas like station corridors, shopping centres, or office foyers.	Ensures high visibility and usage rates without needing weatherproofing for full outdoor exposure.
Digital Interface	Interface should use clear shirt search, brand recognition and condition input tools.	Makes it easy to get accurate shirt identification with little friction.

Final Product description

Customer flow chart



Business flow-chart



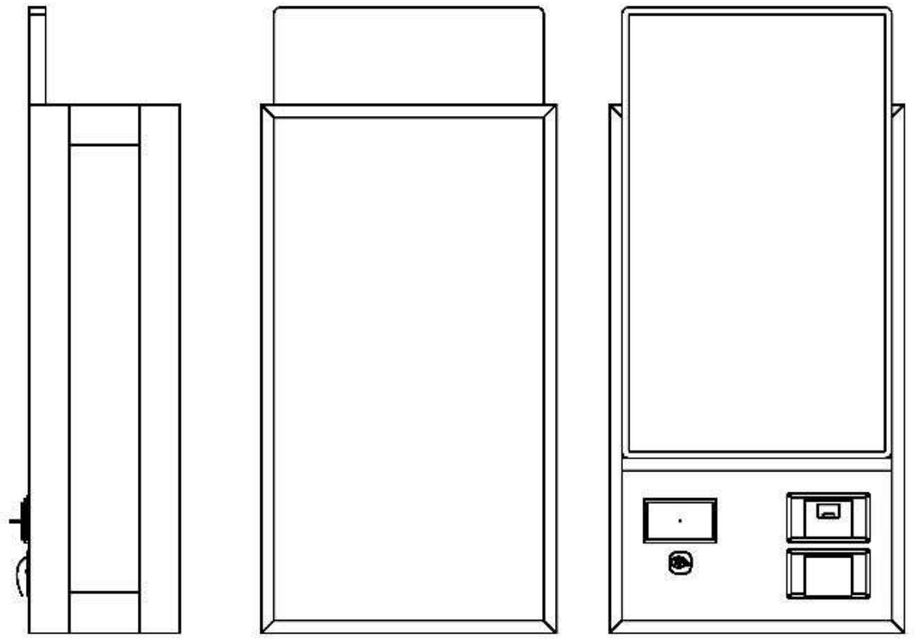
Full Description
To understand exactly what the final product is and what it does it's imperative to read through these flow charts, that's because what I have created is a solution for consumers which requires a business in place to enact the management of the kiosk back end which is as important to the function as the project front end which is where the actual product is.

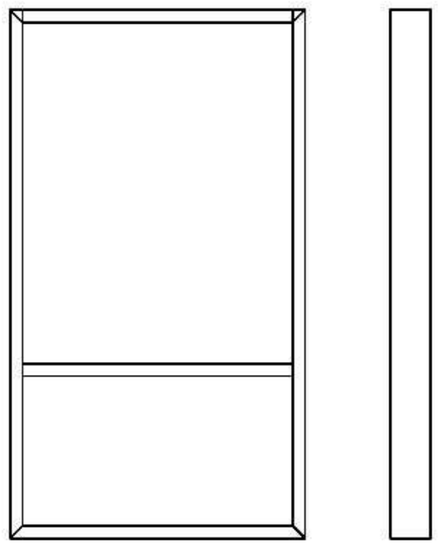
Essentially the kiosk is an interactive desktop style interface system which allows the user to sell their suit shirts to the machine. The way it does this is by allowing the user to identify their shirt and once they've selected the specific shirt it will process their transaction and ask them to tap their card. The machine does this so that it knows your bank details for the payment after the shirt is quality checked later on. After a few seconds a receipt will be printed with a unique barcode of the user's transaction and some brief information regarding the transaction.

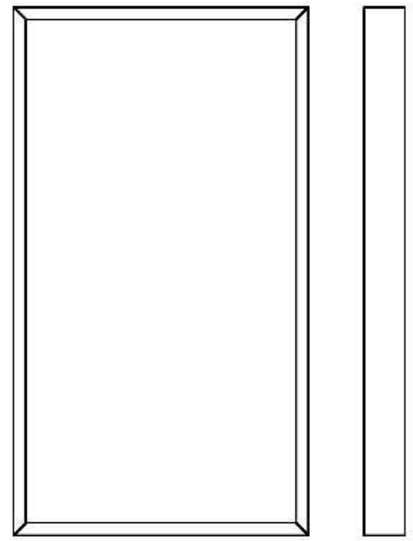
The user is then expected to bag the shirt and seal it by peeling off the butyl protective paper and squeezing the bag tightly enough to close the air pockets and bubbles around the tape ensuring there is no airflow through the bag's opening. Then the user will push the bag valve onto the needle to vacuum pack the clothing bag. Then they will wait until the bag is stiff or until the vacuum pump makes a low humming noise indicating that the pump is no longer pulling air through the system because the pressure in the bag has equalised with the strength of the pump's suction force.

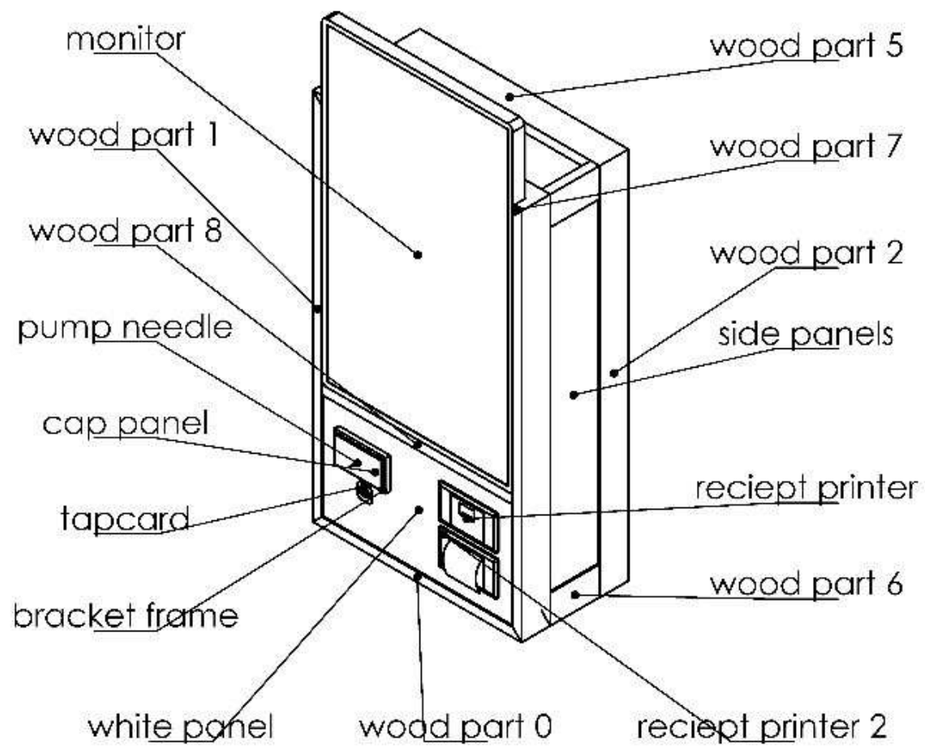
At that point the customer is expected to remove the shipping label from the second thermal printer and peel of the adhesive backing to the label. Then once the label has been stuck onto the bag they can choose when to bring it to post at their convenience however they know that the sooner they post it the quicker they will receive the cash intensive so they will likely post it quickly. After a week the customer will either receive a portion of the maximum value or all of it if the shirt is in perfect condition or if it is completely destroyed they will receive an email offering a return to their address for a small fee. If they deicide against that then the shirt will be recycled free of charge..

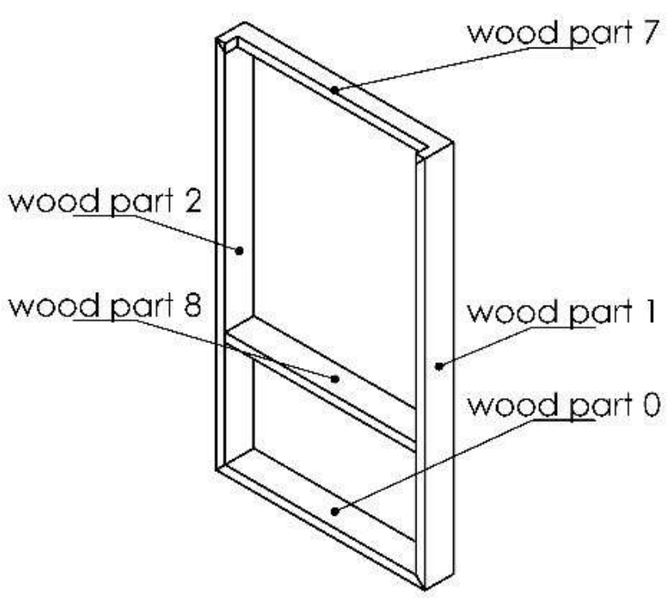
Technical Drawings - assembly guides

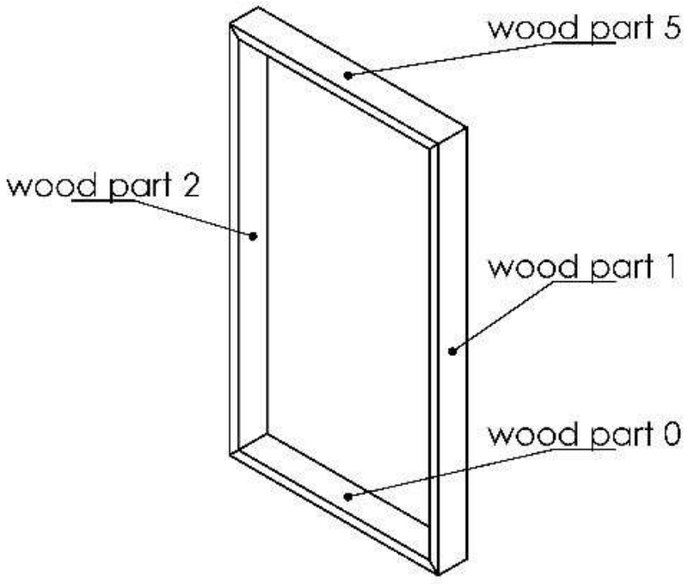








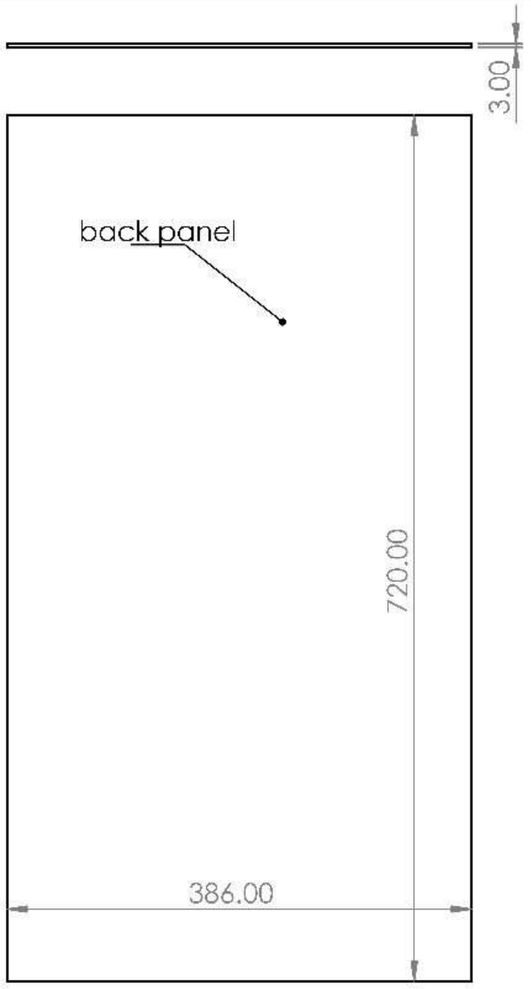


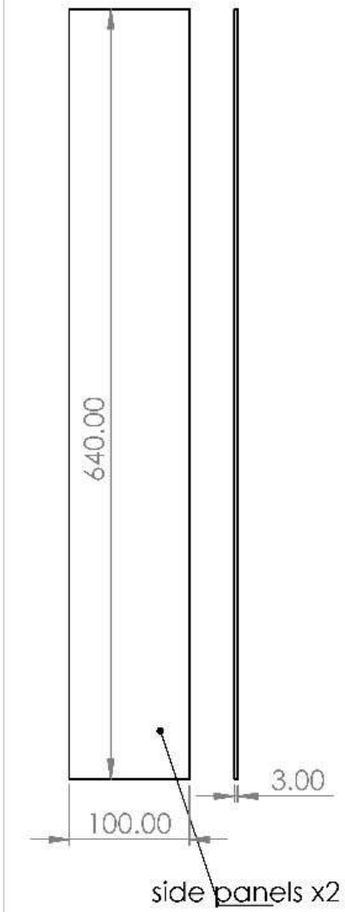


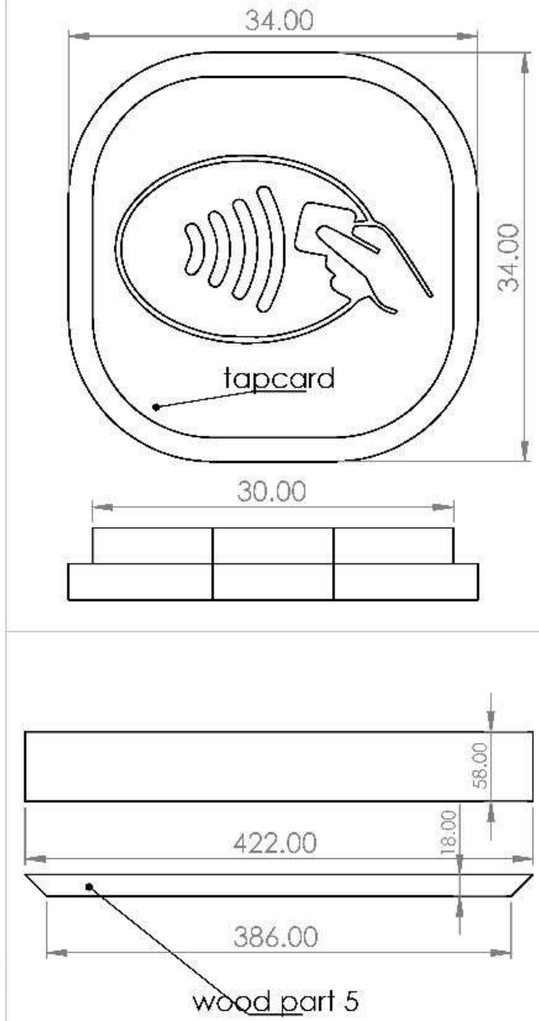
Balloon **annotation**

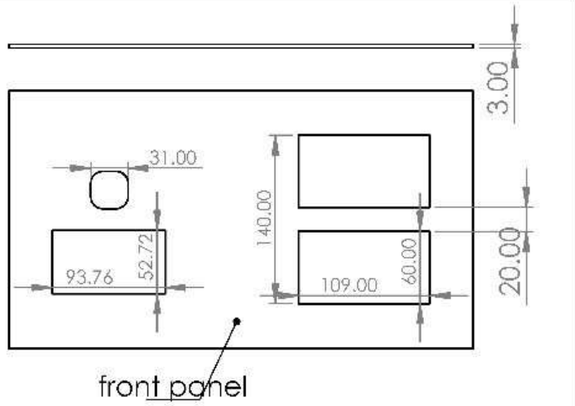
The style of annotating technical drawings known as ‘balloon annotation’ is an industry standard adopted by many professionals, firms and organisations to show the assembly composition. Typically balloon annotations are labeled with circular part number annotations however I don’t think that works as well because it just means I have to decode whatever part number responds to whatever part using the key. Since my part names where relatively simple, just setting the annotation to be the file name and replacing the formatting with an underline was all I needed to create these fantastic drawings. Another brilliant part about these annotated assembly drawings is that I don’t have to communicate with the technicians helping me exactly where each part of the frame goes, I can simply let the Technical drawing talk for me and explain where the parts are located in a very simple visual representation.

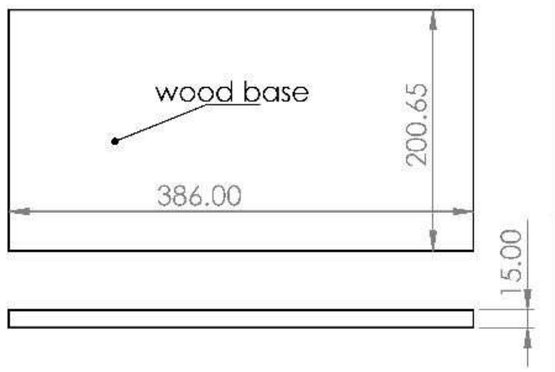
Technical Drawings - all part dimensions

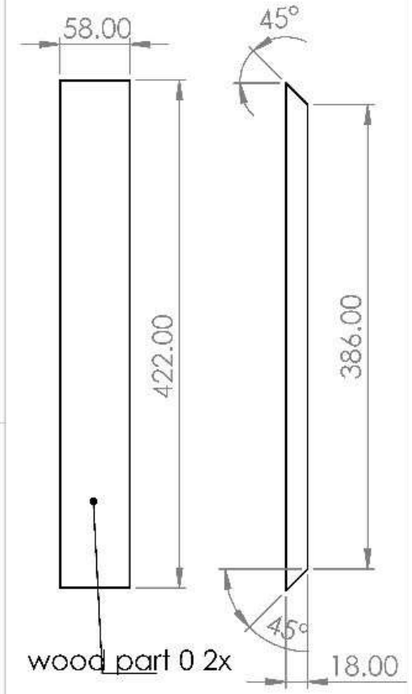


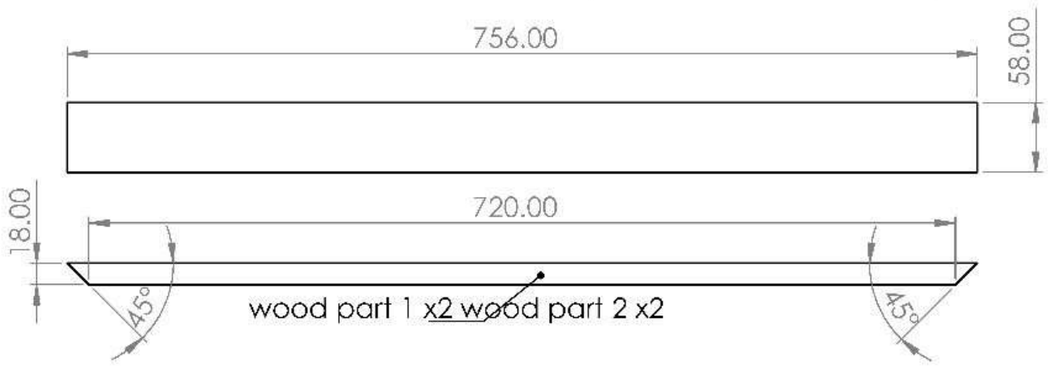


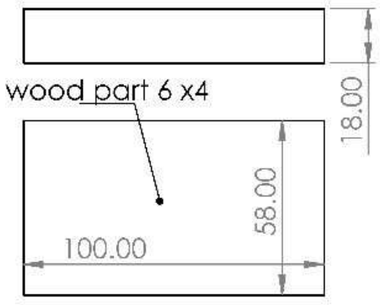


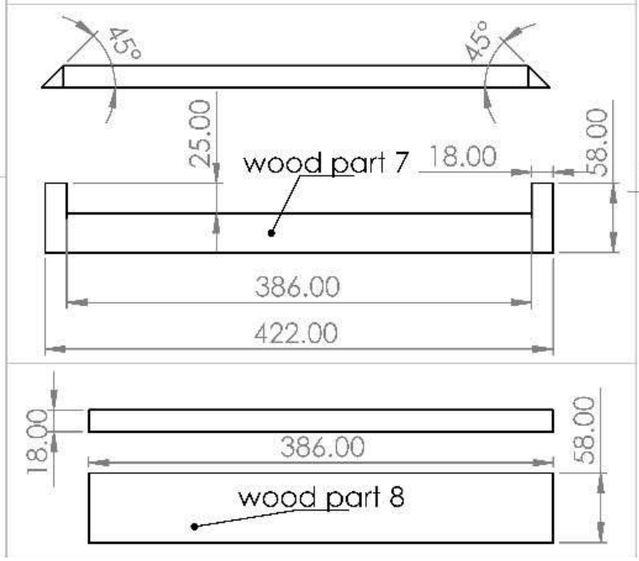


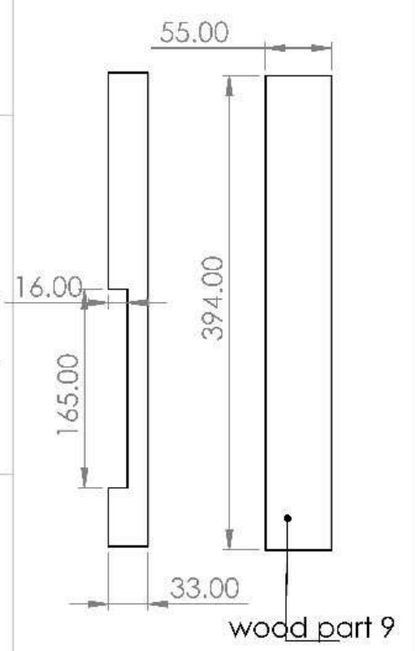








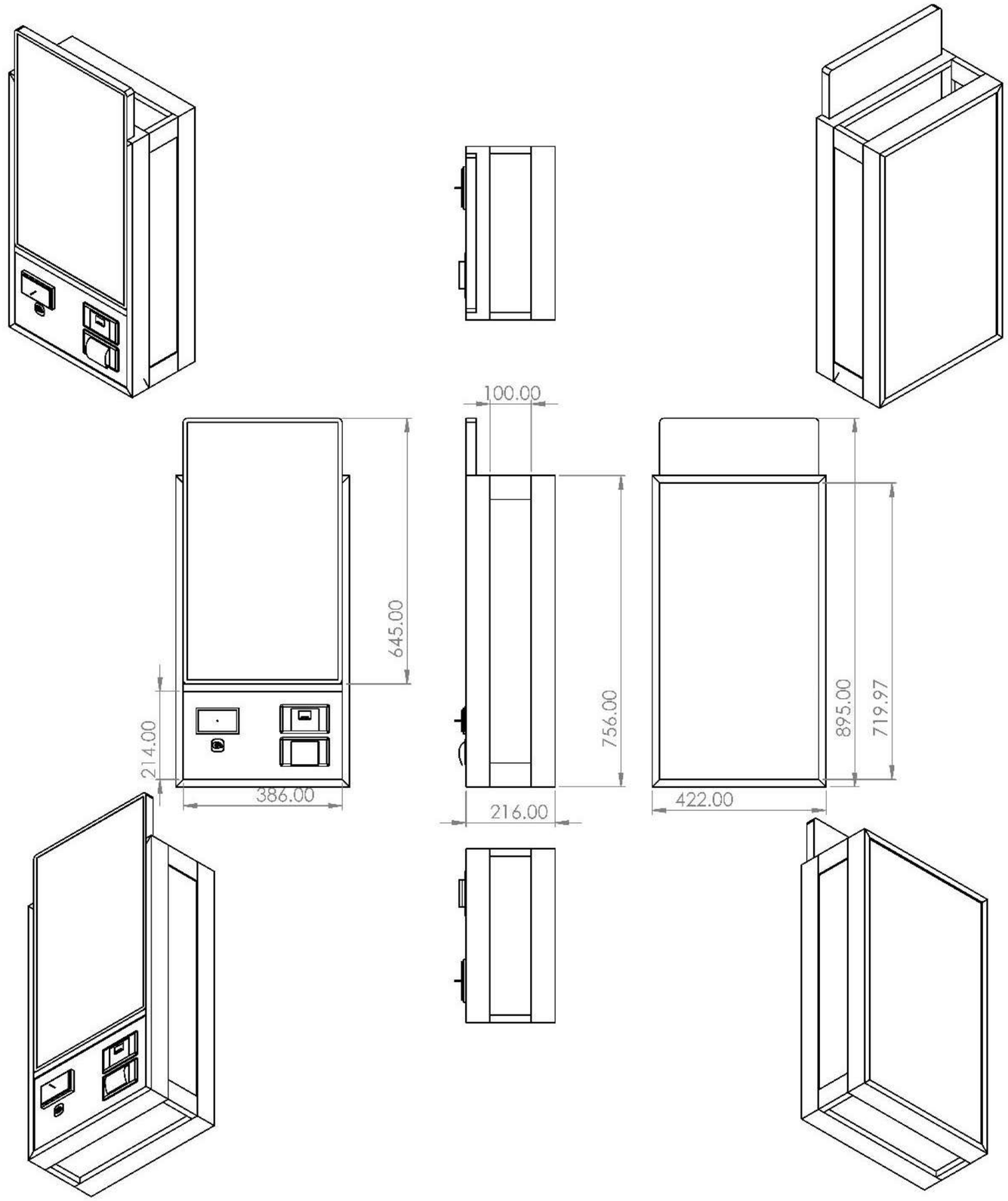




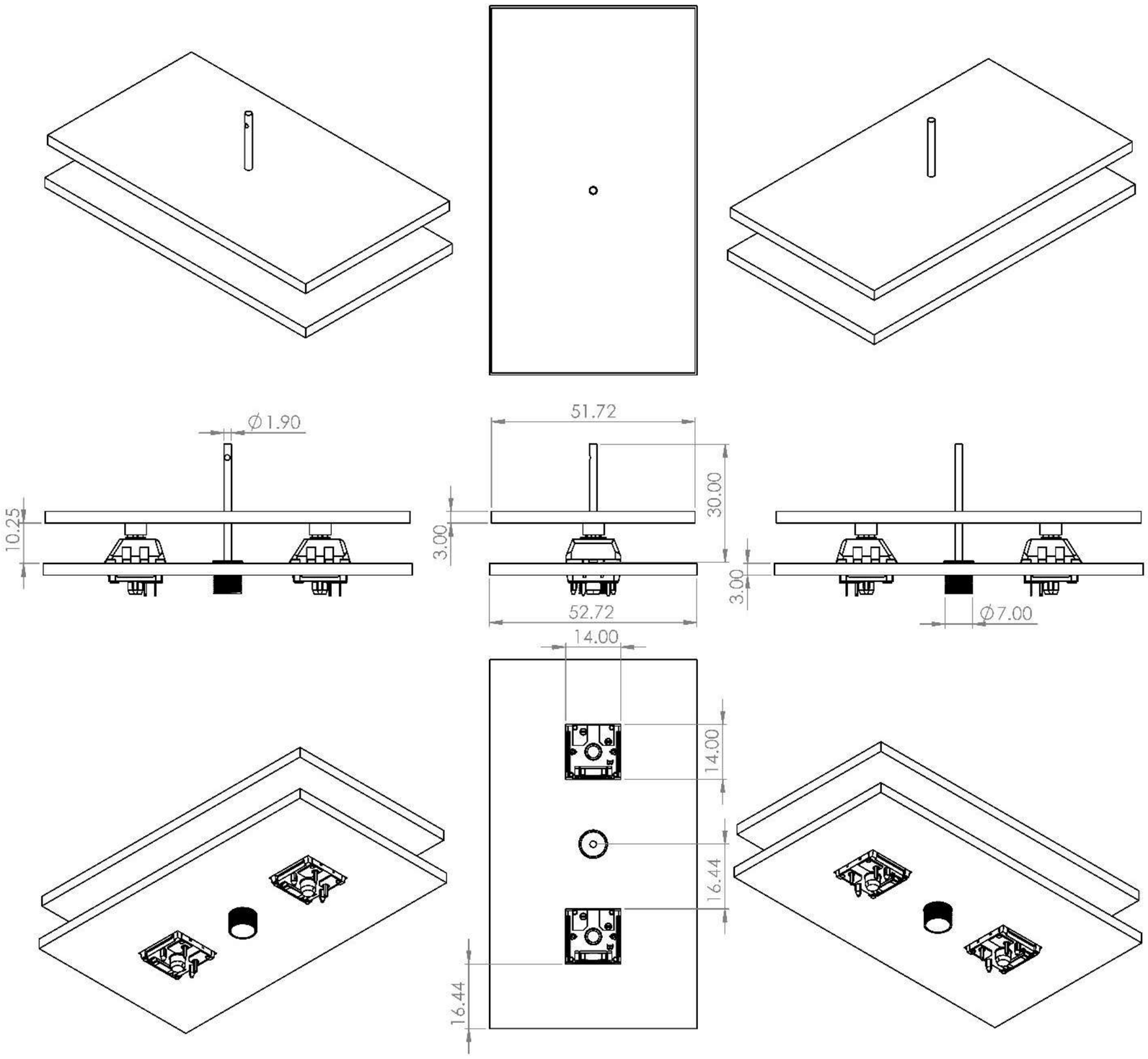
Why are dimension drawings like this useful?

Well these kinds of technical drawings that feature all of the part dimensions are the primary guide used whilst in the workshop for the first part. Being able to know what part you need to make next and the size of that part in exact measurements down the the tenth of a centimeter is invaluable. It means I don't have to continually go back and check measurements from the CAD model, I simply printed this sheet out and used it as the guide for all the parts in the project. Another reason why part sheets like this are useful is because they allow me to identify which parts I've made and which parts I have left to make. This can come in handy if you're completing a project like mine with sub-assemblies, however in order to see how those sub-assemblies are constructed we need to look at the other technical drawings which have balloon annotations.

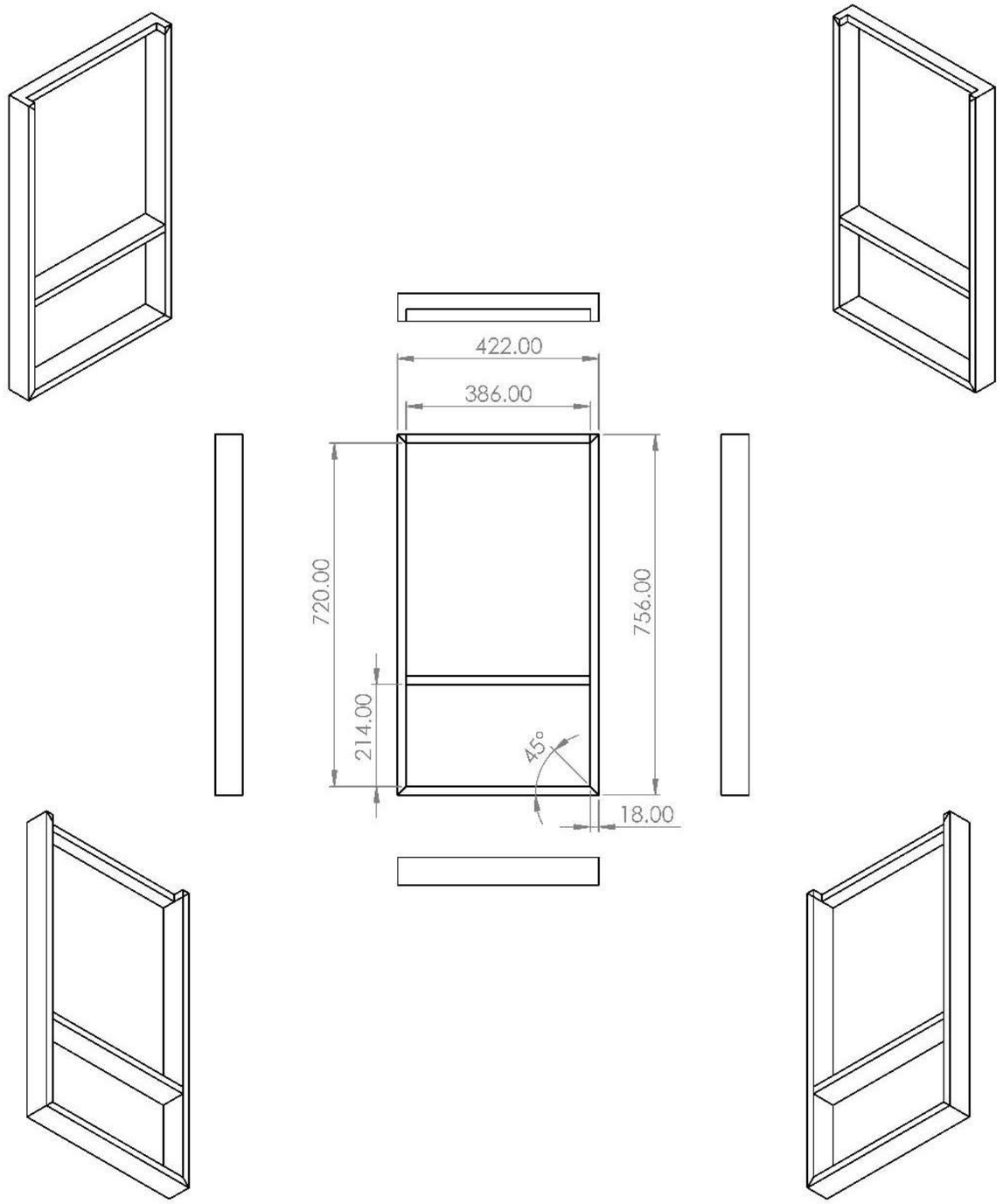
Technical Drawings - Main Kiosk



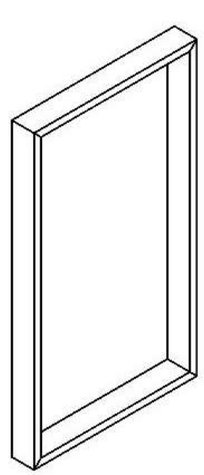
Technical Drawings - Push to Pressurise

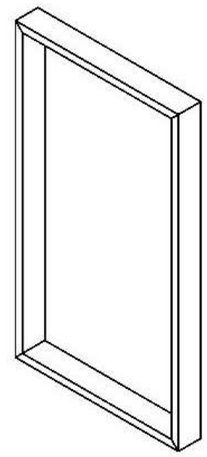


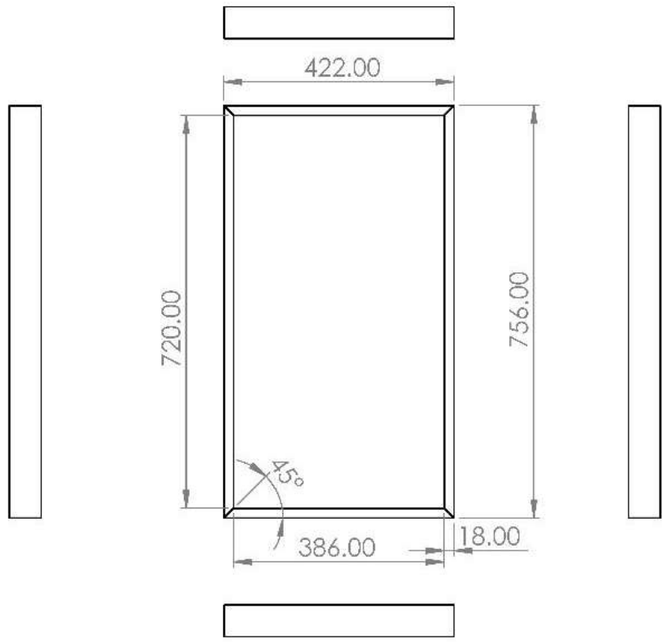
Technical Drawings - Frame One

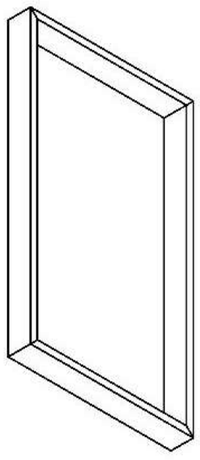


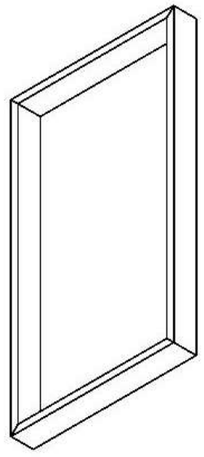
Technical Drawings - Frame Two



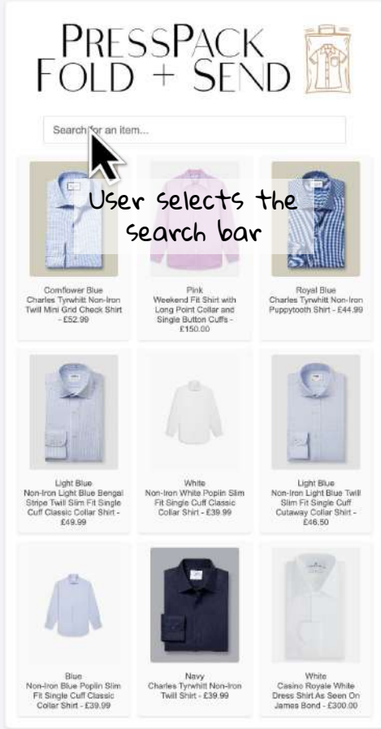


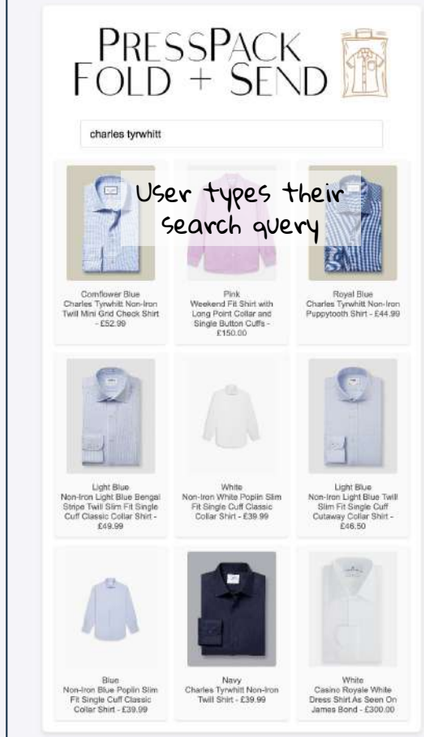


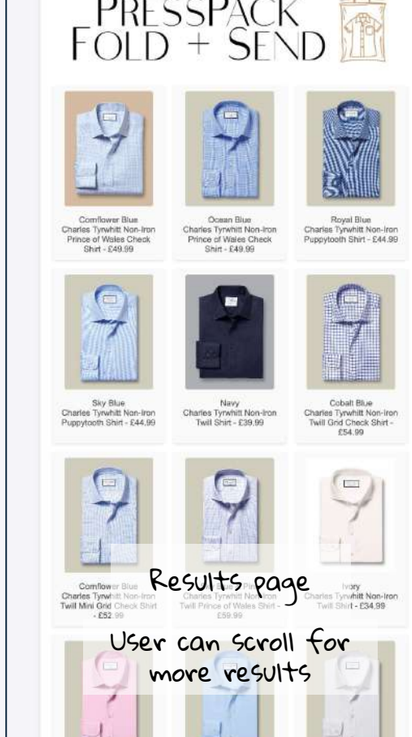




Kiosk Interface Site: User-flow



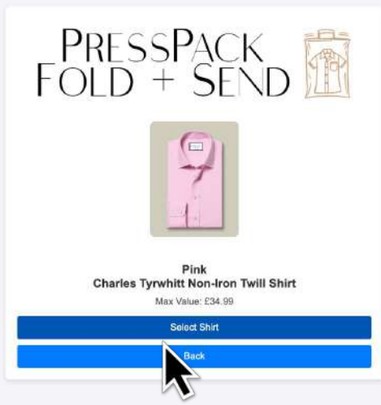




User-Flow Demonstration
This slide shows the complete journey a user takes when using the kiosk. It starts with a simple search, where the user types in the item they're selling. They can scroll through a clear list of matches and select the exact shirt they've brought in. Once they've confirmed the item, they tap a card to link it to their account or payment method, and the machine automatically prints a shipping label and receipt.

The interface is designed to feel familiar, like using an online store or a self-checkout machine, but with fewer steps and no need for a login. I wanted to keep things as fast and user-friendly as possible, especially for people who are busy, not very tech-savvy, or just want a quick way to pass on quality clothing. The system is aimed at encouraging more people to recycle or resell good clothing by making the process effortless.

The QR code on the slide links to a working prototype of the site, so testers or users can interact with the interface and explore how it works in real time.



QR code to working test site

Scan the QR code to try the interface as it is on the kiosk.

Bill of Materials & Components

Bill of Materials

Item No.	Material / Component	Additional Information	Quantity	Unit Cost (£)	Total Cost (£)	Supplier
1	Acrylic Sheet	Grey 3mm thick	3	£12.00	£36.00	https://kitronik.co.uk/
2	Pine timber	116mm Wide 18mm Thick	2	£10.00	£20.00	actimber.co.uk/
3	Touch Screen Monitor	27 inch diagonal Area	1	£55.00	£55.00	Ebay.co.uk
4	Ball Valves	Set of 4pcs	1	£3.99	£3.99	Amazon.co.uk
5	Mini Vacuum Pump	DC 12V/24V	1	£20.40	£20.40	Amazon.co.uk
6	Vacuum Pressure Gauge	-1~0 Bar -14~0 Psi	1	£9.49	£9.49	Amazon.co.uk
7	Power Supply 24V 3A	72W output	1	£12.80	£12.80	Amazon.co.uk
8	Power Supply 9V 3A	27W output	1	£15.44	£15.44	Amazon.co.uk
9	Ziplock Bags for Clothes	40 x 30cm, 50 pcs	1	£13.98	£13.98	Amazon.co.uk
10	Extension Lead	4 Gang way, 2m long	1	£5.94	£5.94	Amazon.co.uk
11	White Butyl Tape Roll	3mm*19mm*9.1m	1	£9.99	£9.99	Amazon.co.uk
12	Spring Loaded Rocker Switch	10pcs, max 5A 250v AC	1	£1.78	£1.78	aliexpress.com
13	Cable Solder Connector	400pcs, heat shrink	1	£5.68	£5.68	aliexpress.com
14	Thermal Receipt Printer	58mm, USB/RS232	2	£17.19	£34.38	aliexpress.com
15	Ball needles	Set of 20pcs	1	£2.99	£2.99	Amazon.co.uk
16	Adhesive Thermal Paper	6 rolls, 57mm	1	£6.99	£6.99	Amazon.co.uk
17	R385 Vacuum Pump	DC 6/12V	1	£7.99	£7.99	Amazon.co.uk
				Total expenditure	£262.84	
			Actual Expenditure		£206.84	

The bill of Materials is a way to quantify the budget of a project

In my case the bill of materials revealed to me that the total i was going to spend on the project was more than initially anticipated, this may be because of duplicate purchases such as the vacuum pump which I had to get another pump since the first was not powerful enough to compress the shirts in the time I wanted so I had to go and buy another more expensive pump which pressurised a lot quicker, see the ‘investigating components - air pumps’ slide for more information about the diaphragm pumps. Out of all the components and the most expensive materials the most expensive was the monitor which makes sense, despite the fact that it was purchased at liquidation price which was a lot cheaper than it should have been theoretically compared to market prices, It was anticipated to be my most expensive purchase. Luckily for me it came with all the cables needed which is not a guarantee when shopping for second hand equipment but the cost of those cables adds up when you have to buy a few different ones. In fact because it came with 3 different display cables, a power cable and power adapter, and a usb data cable I estimate that the price of the cables is at least two thirds of what I payed assuming the cables were purchased retail. The difference between the ‘total expenditure’ and ‘actual expenditure’ is that actual takes into account the components and materials which were already in the workshop. Whilst these will have to be replaced eventually and therefore contribute to the total expenditure for my project they were essentially free so they don’t contribute to the actual expenditure of the project.

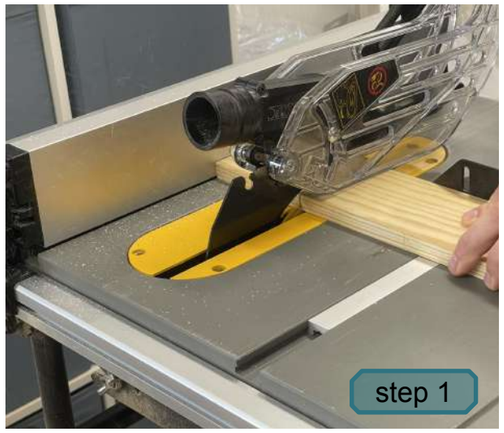
Comprehensive Risk Assessment

Tool / Machine	Hazard	Risk	Control Measures	Risk Level
Cutting & Shaping				
Table saw	Sharp rotating blade	Cuts or serious injury to hands/fingers, kickback of material	Use push stick, wear safety goggles, receive training, keep hands away from blade	High
Band saw	Moving blade	Cuts, especially during curved cuts or slips	Keep hands at safe distance, use guides, wear goggles, ensure guard is set correctly	High
Bobbing sander	Abrasive surface, moving parts	Friction burns, trapped clothing or fingers	Avoid loose clothing, tie back hair, use with flat surfaces only, don't apply excessive force	Medium
Planer thicknesser	High-speed rotating cutter, noise	Severe finger injury, wood kickback	Never adjust while operating, use push paddles, ensure wood is flat before feeding	High
Laser cutter	High-intensity laser, hot material, fumes	Eye injury, burns, inhalation of toxic fumes	Use under supervision, keep lid closed, ensure ventilation is on, wear safety glasses if required	Medium
Drilling & Marking				
Pillar drill / Hand drill	Sharp bits, rotating chuck, entanglement	Cuts, snagged hair/clothing, slipping off target	Secure workpiece, wear goggles, keep hair/clothes secure, use correct speed and pressure	Medium
Centre punch	Impact tool, sharp tip	Hand or finger injury if misused	Hold away from striking point, use light hammer taps, work on a stable surface	Low
Assembly & Fastening				
Soldering iron	High temperatures, fumes	Burns, inhalation of fumes, fire hazard	Use in ventilated area, never touch hot tip, always place in stand when not in use	High
Soft mallet	Impact tool	Bruising or injury if struck awkwardly or rebound occurs	Strike gently, keep fingers clear, use on stable work surface	Low
Bessey clamps	Pinching fingers during tightening	Bruises or crushed fingers	Tighten slowly and carefully, keep fingers away from moving parts	Low
Screwdriver / Drill driver	Slipping off screws, rotating bit	Cuts, hand strain, wrist injury	Use correct bit size, apply steady pressure, wear goggles, keep workpiece secured	Low

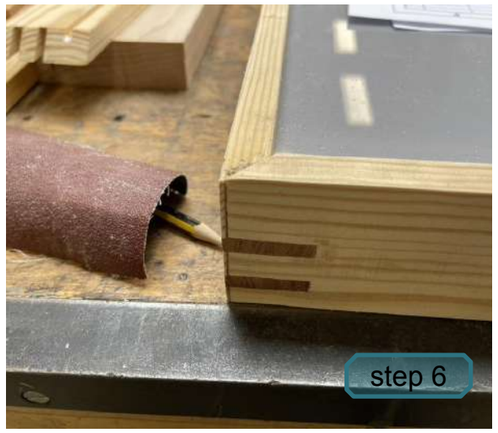
Why create a risk assessment?
Hazard is unavoidable in Product Design, particularly when manufacturing a prototype however risk is not. The tools we use to cut and form materials can also cause serious bodily harm if used incorrectly. To combat this risk we create the risk assessment. All the risk assessment essentially does is helps us identify what the potential risks are so we're aware of them whilst using the tool/machinery it also allows us to try and minimise the risk by putting in place control measures such as safety equipment or best practices.

How I created the risk assessment
Creating the risk assessment was fairly easy and only took a few steps. Firstly I identified the tools that I would be using during manufacture. Then once i'd Identified the tools I simply identify the potential hazard and the risk caused by it, then it was as simple as going through and creating control measures. Finally I ranked them in order of potential risk for the sake of the assessment.

Build Log - Creating Frames 1 & 2



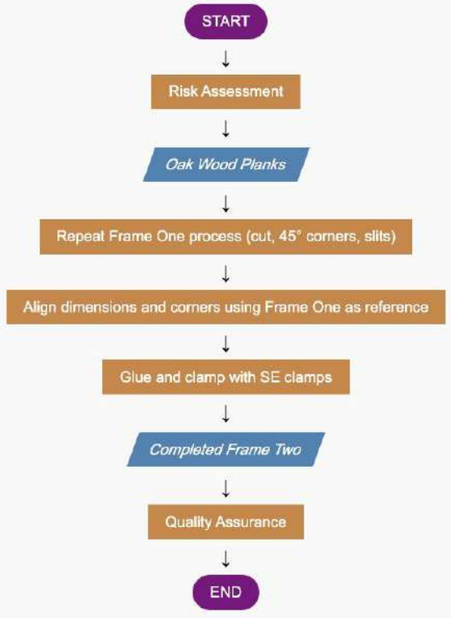
Building Frames 1 & 2
Firstly using the table saw cut the pine into the appropriate size and length using the technical drawing dimensions, then I check to ensure that it was a square cut. After that I take a 45º mitres on each corner with the table saw as specified by the technical drawings. After that I use the table saw to create the slits for the mahogany joints which I cut to 3mm thick so I have to use the table saw twice on each slit to ensure that It's wide enough to fit the joint without causing it to fracture or crack. This is a very important part to get right because damaging the frame in this way could cause much bigger problems later since we will be using each corner as a mounting point for the intermediary pieces any cracks will only be made worse. Once I've measure slites I roughly align the parts to make the frame and then start to glue it together one step at a time, once there is glue on both sides of the frame joints i push them together and use a set of bessey clamps to hold the joint together. Then as show in step 3 i used a soft wooden mallet to carefully push the mahogany joints into the splits within the wood joint. To create the final joint and then I allow that to dry. Once that's dried I take it back on the table saw to remove the excess mahogany and then sand till flat. Typically there will be some sort of gap and crevice around where the joint is so I mixed some PVA wood glue and sawdust from the CNC router in a 1:1 ratio and used a small spreader to push the mixture into the cracks of the joint. Once I'm satisfied with the gaps being full I ensure that the frame is square and then allow to dry for a few hours. Once it's dried I come back and use some sandpaper to carefully remove any high spots in on the joint caused by the PVA and sandpaper filler, it comes off very easily so a few swipes is all that's required to remove any uneven parts of the joint.



Issues and Challenges I faced
One of the first problems that I had when attempting to construct these frames was that I had no experience with using the table saw, fortunately due to the risk assessment only the technicians are allowed to operate the table saw but I still had to learn to adjust the bed, blade height and other parameters. Another compilation was juggling where the joints were with the component sheet, although it may seem obvious to some for me, imagining the components in 3D space can be challenging. And I did make one minor mistake when cutting the joints but luckily I stopped myself and it's not too noticeable. The error occurred at the top of frame one where the special top part with a cut-out for the monitor meaning only one side of the part can have a joint because the other joint would be going into an empty part of the frame.

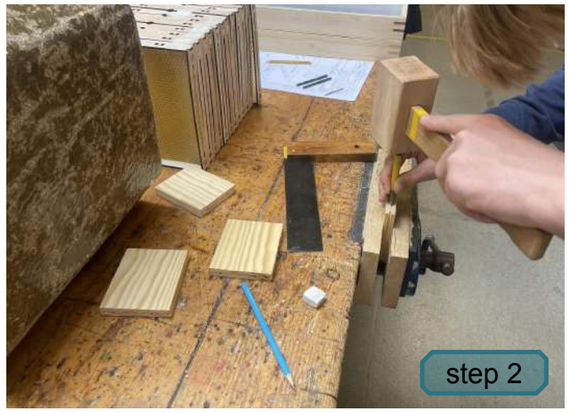
Flowchart 1: Construction of Frame One

Flowchart 2: Construction of Frame Two



Build Log - Creating Monitor Stand and Intermediary components


step 1


step 2


step 3


step 4

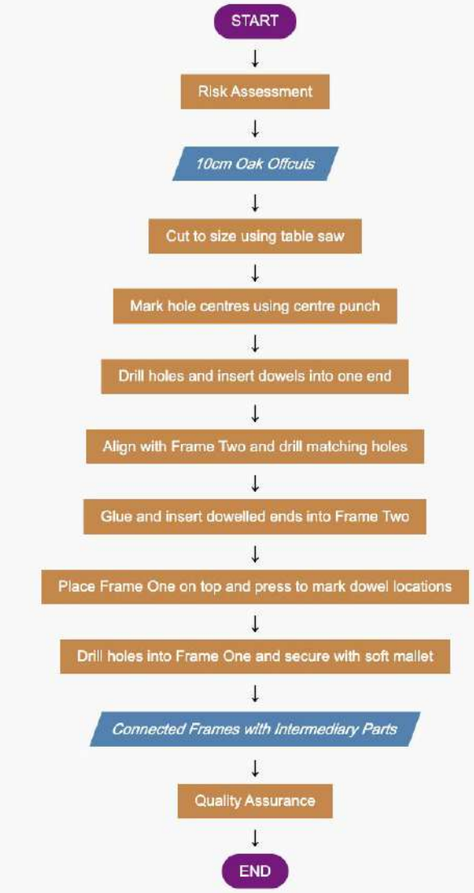

step 6


step 8

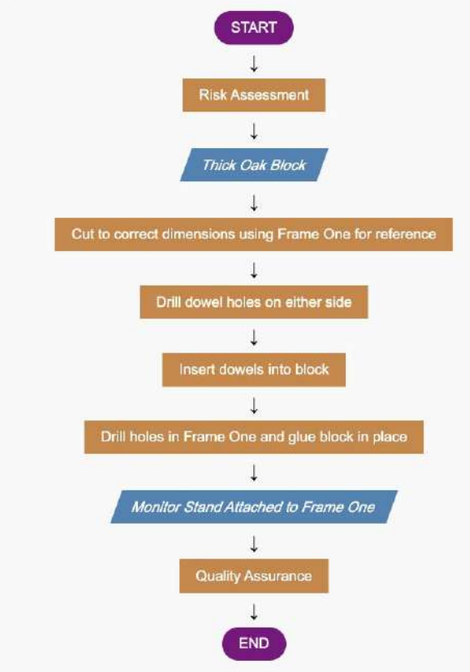

step 7


step 5

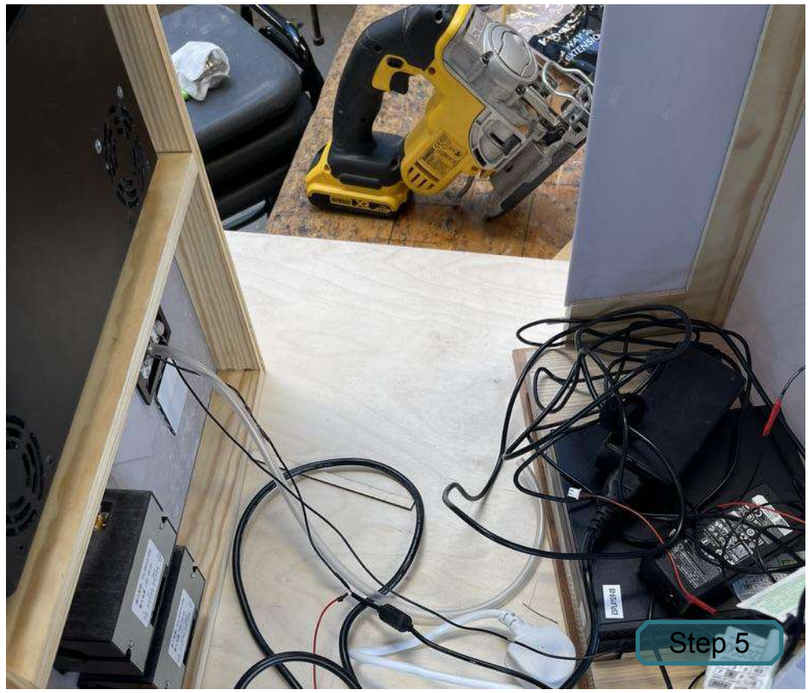
Flowchart 3: Intermediary Components



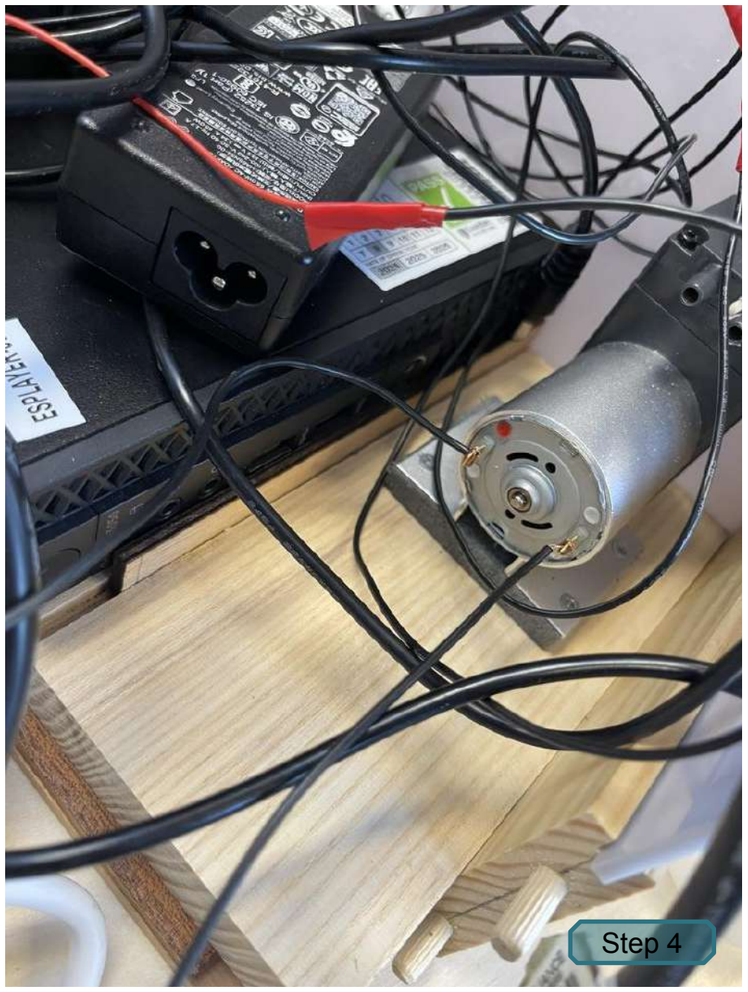
Flowchart 4: Monitor Stand Construction



Build Log - Creating the Base


Step 5


step 1


Step 4


step 2

Flowchart 5: Construction of the Base

START

↓

Oak Offcut

↓

Cut to shape using table saw

↓

Smooth and flatten surface using bobbing sander

↓

Cut slits for mini PC supports using table saw

↓

Add laser-cut acrylic profiles to secure mini PC

↓

Mark and drill holes for diaphragm pump

↓

Screw diaphragm pump into place with foam riser

↓

Completed Base with Components Secured

↓

END


step 3

Setting Up the Table Saw

Step 1:
Unlock the cutting guide (also known as the fence) by releasing the locking mechanism on its base. This allows you to freely move it along the table saw bed.

Step 2:
Slide the guide to roughly the desired cutting length. Adjust it visually so it lines up close to your intended measurement.

Step 3:
Use a ruler or measuring tape to precisely align the guide with the correct distance from the blade. Double-check the measurement from the blade's inner edge for accuracy.

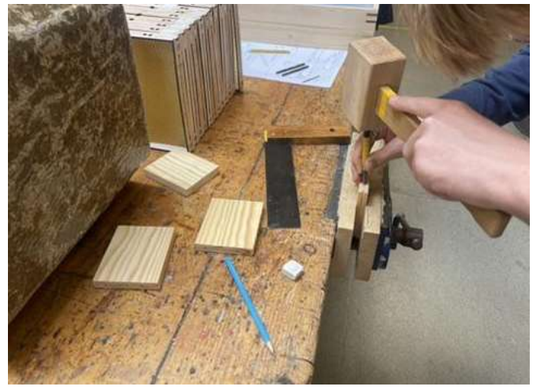
Step 4:
Unlock the blade rotation angle if necessary and ensure the blade is set to 90°, squared to the bed and material. If unsure, you can do a quick test cut to check alignment.

Step 5:
Place the material firmly against the guide, keeping it flat on the bed and flush along the guide's edge. Make sure your hands are well clear of the cutting line.

Step 6:
Flip down the protective plastic blade cover, then switch on the machine using the power button or switch. Wait for the blade to reach full speed before proceeding.

Step 7:
Slowly push the material forward through the blade while applying sideways pressure to keep it tight against the guide. Maintain control throughout the cut and let the blade do the work.

Step 7:
Once the cut is complete, carefully remove the cut piece from the bed. You can now begin incorporating it into your design or assembly.



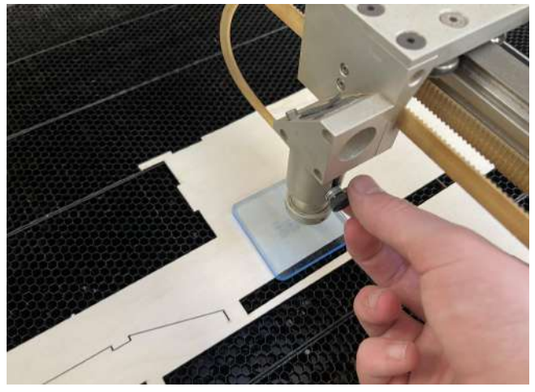
The Laser Cutting Process

Step 1:
Open the cutter and remove any materials currently in the print bed. Quickly survey the machine for any obvious faults before switching on the power.

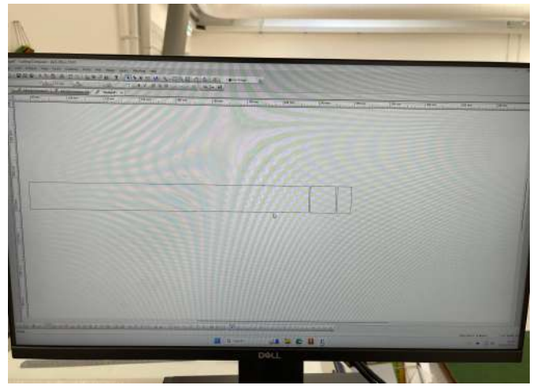
Step 2:
Put the material into the print bed and align the bottom of the material horizontally with the last stip of the of the honeycomb table.

Step 3:
Close the lid of the printer and click the hand button to put it into offline mode where the print head can be moved. Move it over part of the material.

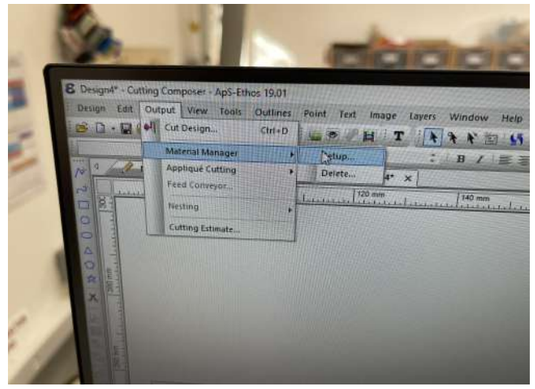
Step 4:
Using the small 5mm acrylic slab adjust the laser height to its new level by loosening the screw until the head rests on the slab and then tightening. Then set the machine origin using the control panel.



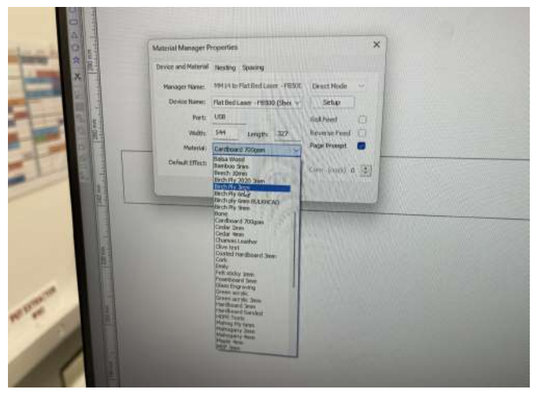
Step 5:
Log in to the computer connected to the machine and load up your design file within APS ethos.



Step 6:
Select the output option in the control bar and navigate to the material manager setup.



Step 7:
Use the dropdown menu to select the correct material and confirm before sending to the printer



Step 7:
Remove the cut parts from the print bed and use them in the design.

The Soldering Process

Step 1:
Gather all required soldering equipment, including a soldering iron, solder wire, soldering stand, and a damp sponge. Make sure everything is in working condition before starting.

Step 2:
Ensure you have appropriate safety gear, such as safety glasses and a fume extractor or fan. Soldering produces fumes that should not be inhaled.

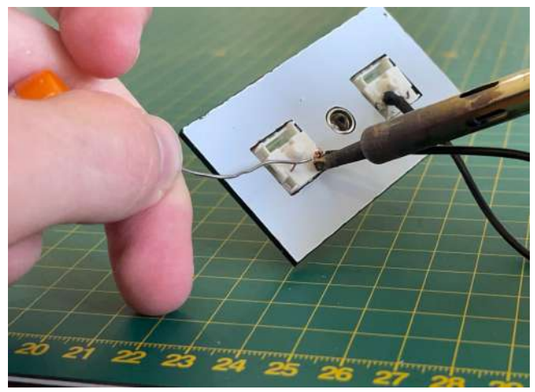
Step 3:
Saturate the sponge on the soldering stand with water until it is damp but not dripping. This will be used to clean the soldering iron tip.

Step 4:
Place the soldering iron on a heat-proof or sacrificial surface, such as a cutting mat or soldering station. Keep the workspace clear of flammable materials.

Step 5:
Plug in the soldering iron and allow it to heat up. Avoid touching the metal parts during this time as they will get extremely hot.

Step 6:
Wait for the indicator light on the soldering iron to illuminate, showing that it has reached operating temperature. Do not begin soldering until the iron is fully heated.

Step 7:
Hold the soldering iron in one hand and the solder wire in the other. Carefully position both just above the joint or connection you intend to solder.



Step 7:
Touch the solder wire to the heated joint and let the solder flow smoothly onto it, then remove both tools. Allow the joint to cool naturally before handling.

Build Log - Push to Seal


Figure 3

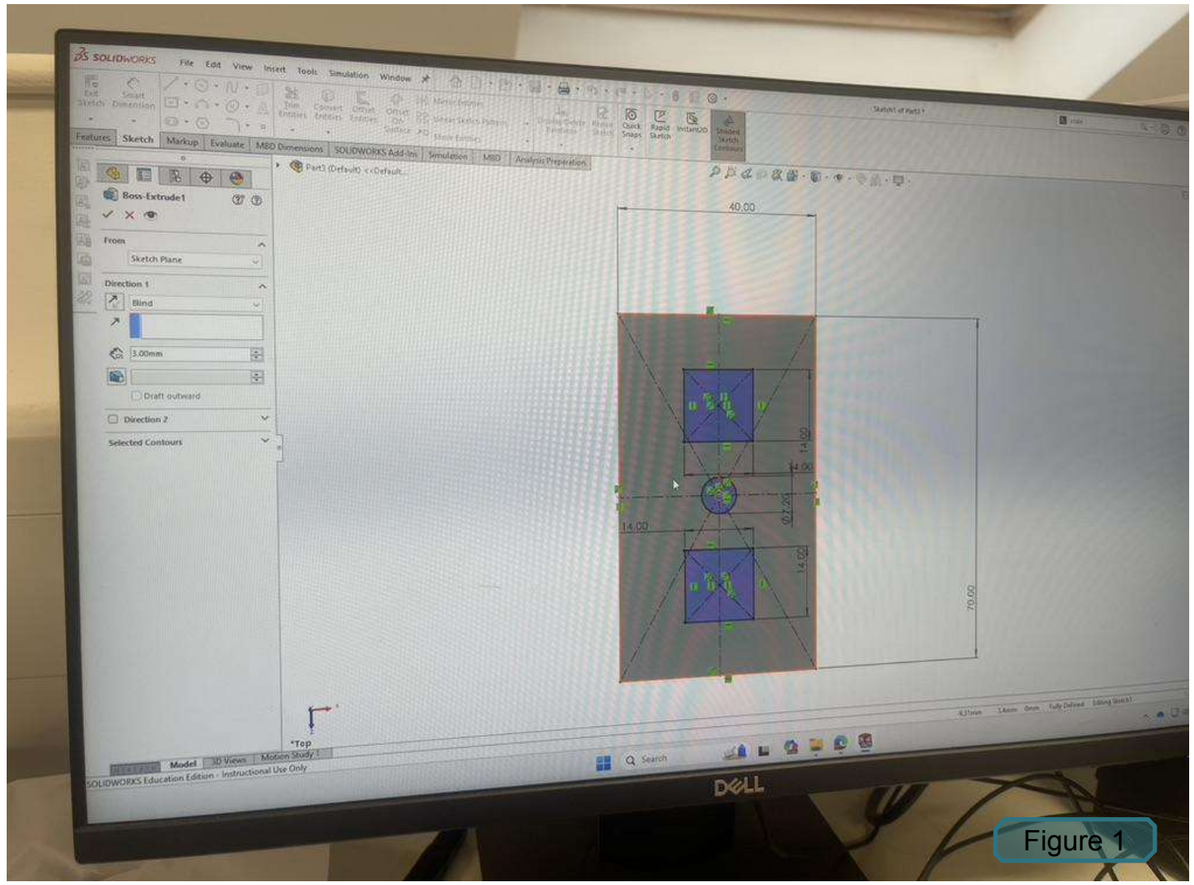


Figure 1

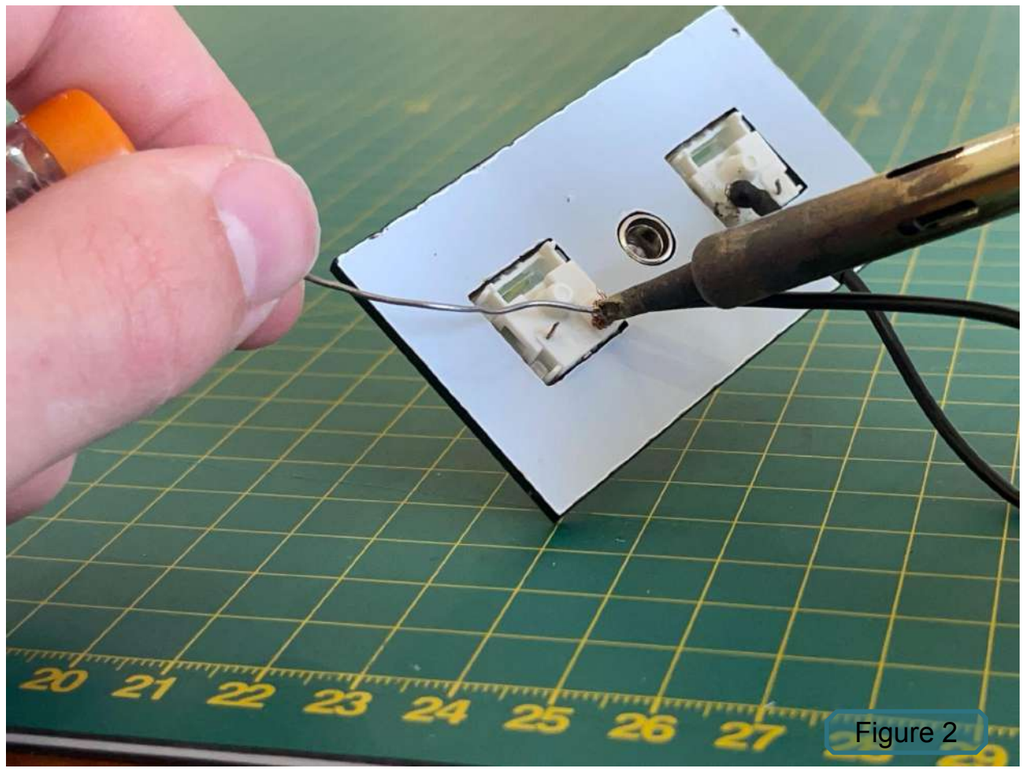
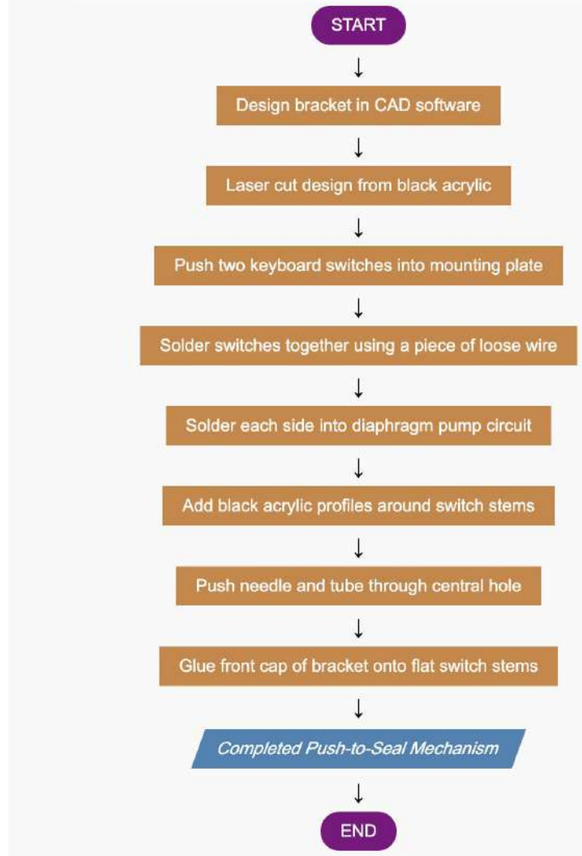


Figure 2

Flowchart 6: Creation of Push-to-Seal



How I created the clickable "push to seal" mechanism

First before I explain how I made it it's important you understand what the mechanism is intended to do. Essentially I all I want this mechanism to do is house two switches around the vacuum needle. I want for the vacuum to be activated when the valve is pushed all the way down the needle because at that point the head of the needle will be inside the bag so the vacuum can start to remove air and increase the pressure inside.

The first part to creating an intricate design like this of course is to use solidworks to create a decent design template with proper dimensioning. I likely would have created this digital design file on the aps-ethos system which is what controls the laser cutter but I wanted to have more flexibility to come back and alter dimensions after the fact if needed. Once I cut the mounting plate out of black acrylic I simply had to push to fit two gateron blue switches inside the frame where I could then use the soldering iron to connect them with a short piece of wire. When I was satisfied with the connection between both switches I tested it on the diaphragm pump circuit using crocodile clips to temporarily make contact with the other switch pins still available on both. This test was successful and showed that the pump was only activated once both the switches were pressed at the same time. Then I used the soldering iron to to permanently attach both of mechanical switches to the diaphragm pump circuit so they wouldn't come loose during assembly or maintenance. It was at this point I also had to remove the needle and squeeze a new one in with rubber tubing around it. The tubing was meant to facilitate the the vacuum pump by allowing airflow to go through the needle and pump system, essentially a way of hooking up the pump to the face plate. I managed to squeeze the tubing in before gluing the shafts t the fron to the switches as seen in figure 3 before I glued the whole face plate on.

Quality Assurance Table - Testing Whilst Building

Component / Stage	QA Measure	Target Tolerance	Result	Pass/Fail
Frame One & Two construction	Mitre joint angle	±1°	All corners matched flush	Pass
	Frame external dimensions	±0.5mm	Within tolerance	Pass
Base manufacture	Flatness of pine base	No warping / flush fit	Slight unevenness pre-sanding	Partial Fail
	Width/length of base	±0.5mm	Within tolerance	Pass
	Slot width for laser-cut profiles	Snug fit – ±0.2mm	Fit correctly with no glue needed	Pass
Laser cut bracket (push-to-seal)	Hole alignment for switches/tube	±0.2mm	Minor sanding required	Partial Fail
	Switch stem hole size	±0.2mm	Perfect press fit	Pass
Drilled holes (pump + dowels)	Hole alignment	±0.5mm	Accurately marked and drilled	Pass
	Diaphragm pump pressure	±0.25 PSI	Delivers expected pressure (tested)	Pass
Electronics (push switch)	Soldered connection continuity	100% connection	All working, circuit tested	Pass

Build Log - Creating an airtight vacuum bag

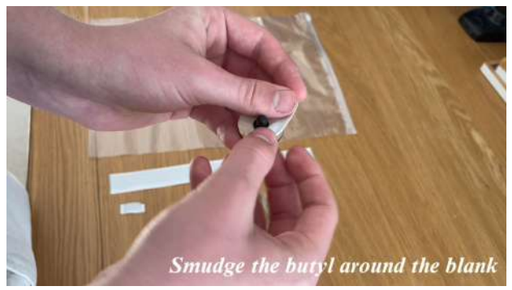
Solution:	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Image:				
Changes:	This is the first version of the bag, there is no spot for the valve and the vacuum needle is pushed through the butyl tape to enter the bag and the handle is squeezed to re-seal once the needle is removed. This solution didn't work great to actually keep the bag at vacuum because it was prone to air leaks.	In this version we inserted the ball valve from the experimentation. This time it was much easier to hold a seal on the bag because the valve was inside of a blank that used butyl tape to close the bag and was then not disturbed after that. However it still did not really seal fully.	In this version we added a handle to make the bag easier to hold and more premium but this meant laser cutting the handle out of thin birch ply which made it difficult to create a proper fitting blank. Furthermore the bag kept getting torn around the needle when inserted from the top.	On the fourth try we finally ended up with something that could seal and wasn't so prone to tearing. It was created by using drill core drill bit. By moving the valve in front of the shirt the strong pressure at the end of the needle is dispersed through the shirt fibres, leaving the bag untouched.

Solution:	Prototype 5	Prototype 6	Prototype 7
Image:			
Changes:	In this version I switched to a 3D printed approach which worked by screwing together on either side of the bag, sandwiching the valve and using the rubber of the valve like an o-ring for itself. This worked really well but it didn't really look great nor was it as good for the environment.	In this version I used the laser cutter to create the wooden blanks as with prototype 4 and this time it worked to seal the valve inside with no air leaks - see video above. I also removed the handle and bag-zip for this version because the handle was not at all easy to use and caused frustration for users.	In this version I brought back the zip to prevent the butyl tape sticking to things during shipping. I also reduced the size of the valve blank to save on materials, it still worked just as well and the bag was perfectly sealed every time I tried it. The key is that the bag is assembled right

Iterative methodology

This piece of the design was created using pure iterative methodology. This means that other than a few small sketches there was no complete design plan for the bag. Creating the bag was not a challenge in design but a challenge in engineering. At this level I cannot design a system that I will be 100% confident it air tight on the first try. So because this challenge was more about function and less about form (the design) the actual functionality of the bag was all I was aiming to achieve. In the end I did achieve the goal I was aiming for but it didn't come without challenges. The idea with iterative design methodologies is that each design only changes a very small amount from the last, alone these changes may seem small, but together they can shape a product from nonfunctional mess to a working solution. Sometimes intervention is needed into the process to prevent a design entering a rabbit hole of issues caused by one change made, I believe adding a handle to the bag was one of those changed. If I had more time and resources I would've like to have made a proper handle, but the one being used for prototype 5 bag would not suffice.

Build Log - Vacuum bag final design assembly process

Step	Image	Step	Image
1. Insert the ball valve into the 10mm hole in the corresponding blank.		**5**. Align and press the blank with the valve into the one inside the bag, so the valve pokes through the hole in the inner blank.	
2. Smudge butyl tape around the inside of that blank, where the bottom of the valve sits. Then do the same for the other blank.		**6.** Squeeze the two wooden blanks together, ensuring a tight seal.	
3. Ensure there is a full, even ring of butyl tape inside the blank around the base of the valve, this helps create a seal when compressed.		**7.** Slide the 300mm strip of butyl tape into the bag and stick it along the top edge, inside the bag.	
4. Open the biodegradable Ziploc clothing bag and place the blank with the 6.5mm hole inside.		**8.** Zip the bag closed and fold it neatly to finish.	

Part	Quantity/Description
Ball valve	1 (with top removed)
Birch ply 30mm blank (with 6.5mm hole)	1
Birch ply 30mm blank (with 10mm hole)	1

Part	Quantity/Description
Butyl tape (10mm)	2 pieces
Butyl tape (300mm)	1 piece
Biodegradable Ziplock clothing bag	1

Section E

Evaluation Plan

Evaluation Activity	Purpose
3rd Party Testing	To test the product on a new unrelated individual and observe how intuitive and functional it is.
Questionnaire	To gather direct user feedback on usability, aesthetics, and effectiveness.
Client Evaluation	To assess how well the final product meets the needs of the target client.
Commercial Evaluation	To consider the product's market potential, comparing it to existing alternatives.
Personal Testing	To identify any technical bugs, issues or usability flaws before final completion.
Specification Evaluation	To check how successfully the final product meets the original design specification.
Modifications & Alterations	To improve the design based on feedback from testing and questionnaires.

How does evaluation work?

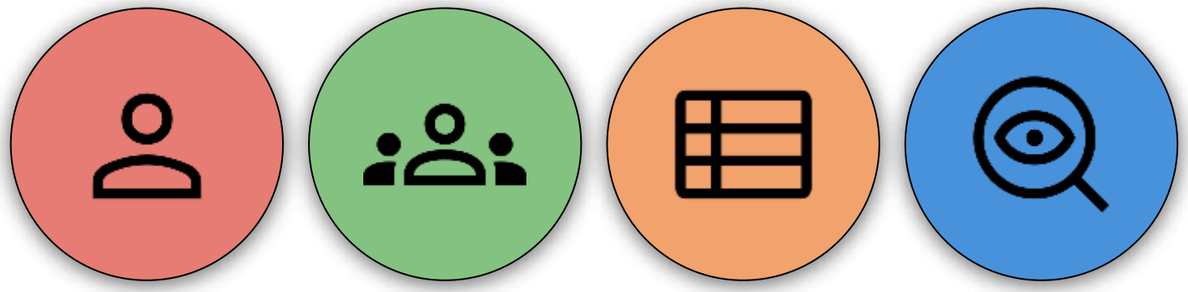
To evaluate is to form an idea of the amount, number, or value of; assess. There are multiple sections to evaluating the core success of any project and for a project such as this we are spoilt with metrics to evaluate the product against. First and foremost we can test the product with a completely new user to see how they perform with device and how well the product works without any prior knowledge. If the product can pass a test like this it likely means that either product is so fit for purpose that it doesn't seem new or different to an un-initiated party or the customer experience of using the product is so seamless and intuitive that no prior knowledge is needed to use the product. My aim is to have my kiosk be completely functional and easy to use even for someone who doesn't know what the project is about or what it is. On the other hand a questionnaire is typically given to a select group of people from the targeted demographic which means they are more likely to click with the product context, compared to a less relevant party. However it is also important to gauge the perspective of the target audience in order to find potential modifications and alterations which could be made to the product to enhance its functionality by making it easier or more convenient to use.

Next is where we bring in the client to evaluate based on their view point and most importantly what their want and needs were as identified by the 'client wants and needs page' this is essentially just a box ticking exercise to ensure that I properly followed the direction given to me by the client.

After that we'll change pace slightly to look at the commercial viability of the product via commercial evaluation. For me this is a very important section since my project has a hefty business and commercial plan behind its function, it simply doesn't make sense unless there is the context of the business which operates it and how they function with regards to the machine.

This will then allow me to enter the further testing stage where I really get to spend some time trying to put the machine through its paces. Since my machine has an interface I will try and cause mayhem on the interface to identify any bugs, i might test if the machine is liable to falling over if nudged or if the protruding ball needle could be dangerous. These are all factors that I'll need to consider and look at whilst testing the final product. This links very nicely to the specification evaluation where I look at how successful the product is in the lens of my original specification. That will lead me to my final thoughts where I can conclude any unfinished ideas or evaluative statements and give overall thoughts on what I thought the project successes and shortcomings were.

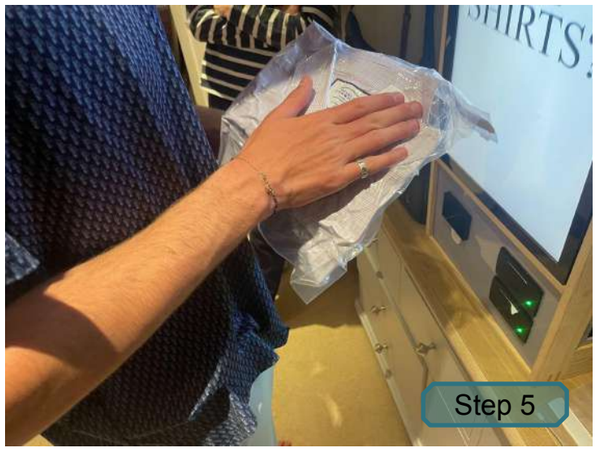
Key data-points for evaluation:



Third-Party testing

Introduction to third party testing
The concept of third party testing is that in order to determine how well the kiosk functions I need to use a third party. In this context a third party is someone entirely unrelated to the the project. This means they must satisfy a few conditions, firstly they need to have not heard about any of the project details nor should they know what the project is about holistically. They can know what they are going to do but no more, the party must also not be from the targeted audience. This is because any member of the targeted audience is more likely to have information that could help them decode how to use the project based on shared knowledge and identity within the target demographic.

How I conducted third party testing
My third party testing took place in my room with the kiosk resting on a set of draws leaving enough room for the testing user to operate the machine. The testing user was my brother Oli. He has been at university for the entirety of my project and therefore does not know anything about how the kiosk functions or even necessarily what its meant to do. My general approach was to let Oli get on with using the machine and simply observe what potential barriers arose. The key here is that I do not interrupt nor intervene and help him to use the kiosk but instead I simply watch and take notes about what he is doing. If he was to get very stuck what to do next then I would prompt him by suggesting what the machine has or what he hasn't yet used instead of simply telling him the answer to see if he could figure it out for himself. By letting him figure out what he had to do next with a small prompt it allows me to conceptualise the pain-points in the process for what needs to be prompted to the user.



Conclusions From Third Party Testing
My primary conclusion from testing with the third party is that the machine simply lacks explanation. The interface was designed to be as simply as possible and using the machine was meant to be as quick as possible as according to the client wants and needs and the specification. However whilst building out the functional interface I simply overlooked the difference that fresh perspective would have.

Another thing that I noticed from testing was that the bags are a little bit tricky to use. Because the butyl layer is about 3 mm thick it makes holding the bag open a little bit fiddly and interesting the shirt with one hand whilst holding the bag open with another is certainly a slight issue in the process. Furthermore Oli simply zipped the bag without removing the butyl paper on first use, this meant his bag didn't seal and I had to to prompt him on how to do it.

The final observation I noticed was that the needle and pump system is not entirely intuitive in the first part which is just knowing where to put the needle. The valve and blank are relatively small and it's not entirely obvious how the needle is meant to penetrate the bag until you try to do it. The user is also potentially worried about doing it wrong so their more hesitant to trust their instinct on using the ball valve.

Planning the Questionnaire

Kiosk Evaluation Questionnaire

Please help evaluate the usability and design of this shirt resale kiosk.

User Experience & Usability

How easy was it to understand how to use the kiosk?

- ◯ Very easy
- ◯ Easy
- ◯ Neutral
- ◯ Difficult
- ◯ Very difficult

The process of selecting a shirt and generating a receipt was:

- ◯ Very smooth
- ◯ Smooth
- ◯ Neutral
- ◯ Frustrating
- ◯ Very frustrating

The on-screen instructions were clear and helpful.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

Aesthetics & Physical Design

The design of the kiosk is visually appealing.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

The kiosk looks like a product that could be placed in a public space.

- ◯ Yes
- ◯ No
- ◯ Not sure

Functionality & Performance

The receipt printed correctly and displayed the expected information.

- ◯ Yes
- ◯ No

True or False: The kiosk correctly identified the shirt I was searching for.

- ◯ True
- ◯ False

True or False: I experienced technical errors or bugs while using the kiosk.

- ◯ True
- ◯ False

Overall Impressions

Would you use this kiosk in a real-world setting to resell or recycle clothes?

- ◯ Definitely
- ◯ Probably
- ◯ Not sure
- ◯ Probably not
- ◯ Definitely not

True or False: This kiosk improves the user experience of reselling second-hand clothes.

- ◯ True
- ◯ False

What would you improve or add to the kiosk?

Your answer

Planning the survey questions
After writing groups of question sets that would be ideal to include I whittled the suggested groups down to just 4 which would help in writing the questions

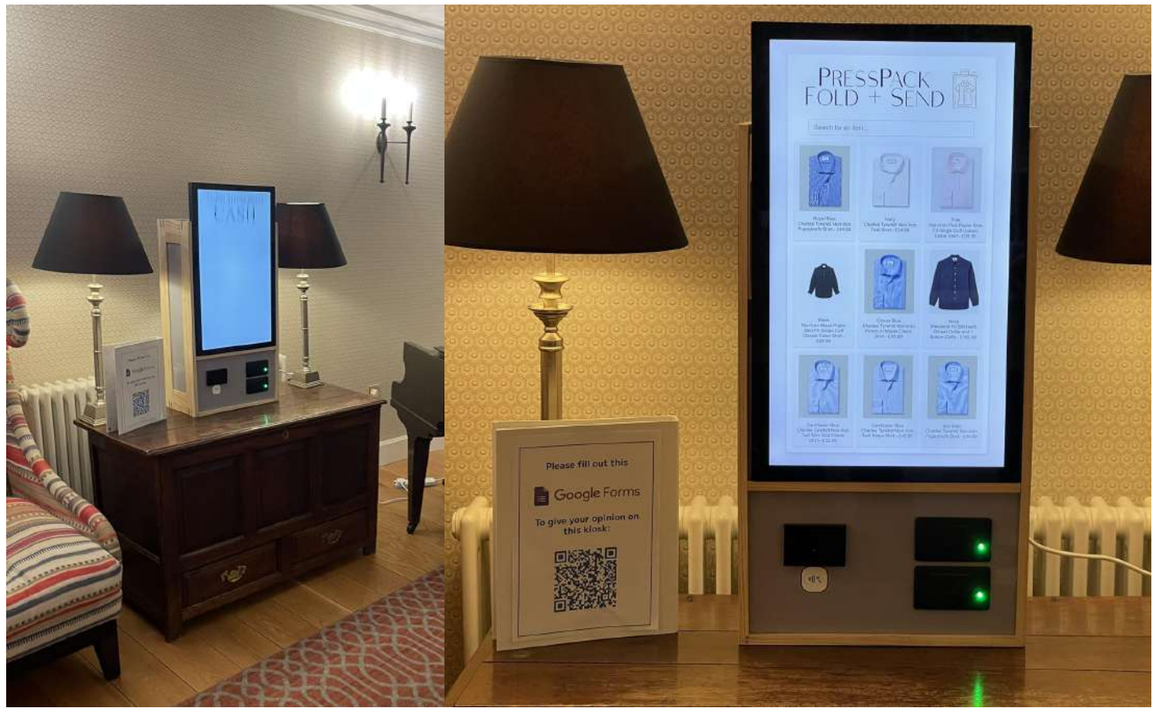
- **User Experience and Usability**
- **Aesthetics and Physical Design**
- **Functionality and Performance**
- **Overall impressions**

Methodology behind creating the survey
To create the survey, I began by identifying the main aims of my DT project and considering which aspects of the product needed user feedback. I focused on making the questions clear, concise and unbiased to avoid leading responses. I chose a mixture of multiple choice, Likert scale, and open-ended questions to gather both quantitative and qualitative data, which would allow me to evaluate different elements of the product effectively.

Deciding on key areas to include
I prioritised areas that would give the most insight into the user experience and performance of my design. This included usability, aesthetic appeal, Functionality and Performance, and whether the design met its intended purpose. These key areas were chosen based on earlier research and initial testing, which highlighted what aspects mattered most to users in a second-hand clothing vacuum-bagging product.

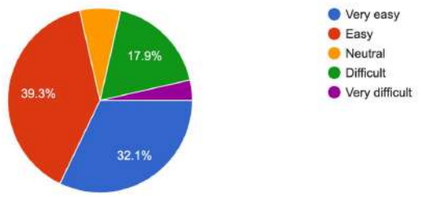
How I found respondents
Respondents were actually friends of my parents who came over for a dinner party. Since my dad's co-workers were very similar to the targeted audience I planned to have a survey ready for when the party happened. I also got other people to come and use the kiosk during various other times that week when relevant visitors came other. In total I was looking for around 30 respondents as a high but realistic target to achieve.

The Questionnaire Environment
To ensure consistent and reliable results, I made the questionnaire digital using Google Forms, allowing respondents to complete it at their own pace in a familiar setting. I encouraged honest feedback by keeping responses anonymous and optional, and by clearly stating the purpose of the survey at the beginning. This helped create an environment where users felt comfortable sharing constructive opinions.

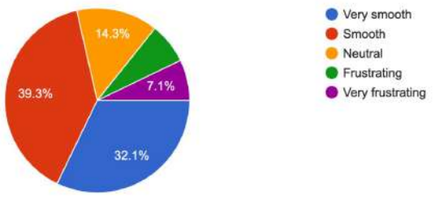


Questionnaire Results & Analysis

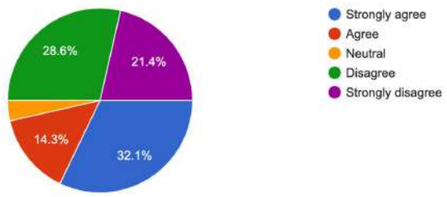
User Experience & Usability



I'm very happy that 71.4% of my questionnaire respondents thought that the kiosk was either easy or very easy to understand. To some extent this was one of the questions that I thought would have bad reception since the user interface could do a lot more to prompt the user.

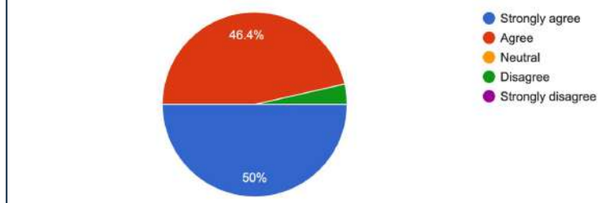


Overall I was slightly surprised and somewhat disappointed by the results of this question. The overwhelming majority of respondents thought the process was smooth or very smooth but to see 14.3% of people finding the process frustrating was quite a shock, although I anticipate the reason is that I could have developed the interface more.



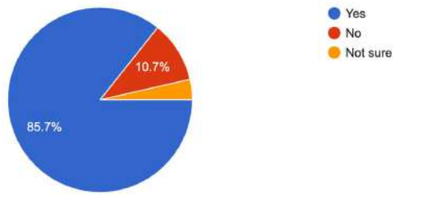
This question is quite similar to the last two but it regards particularly the instructions given which to be fair was not many. 21.4% of people strongly disagreed that the instructions were helpful. This is most likely due to the lack of on-screen instructions for the entire interface with the only main instruction being to tap your card.

Aesthetics & Physical Design

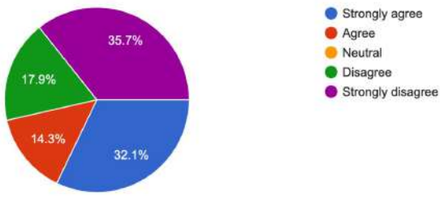


This question was a very satisfying one for me, to have 96.4% of respondents either agree or strongly agree that the visual design of the kiosk is appealing was really nice to hear. Especially since the survey was completely anonymous and I told all the respondents before hand to be as honest and brutal as possible.

Aesthetics & Physical Design

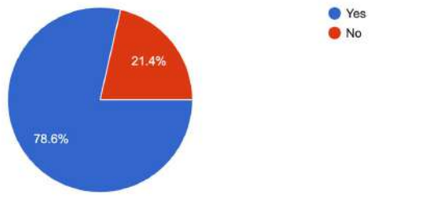


This is another question I was very satisfied with, as it received an 85.7% approval rating, which is an encouraging result regarding whether it should be in public spaces. I'm not concerned about the others since even majoritively beneficial additions like electric rentable vehicles face pushback about whether they belong in public areas.

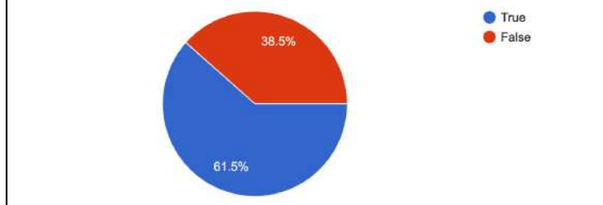


I initially was slightly confused by the result of this question because the 53.6% of respondents either didn't think that the size and layout was appropriate. The main feedback I got about this from people I asked was that more shirts could've been featured on the main page and the shirt should be larger in the detailed view.

Functionality & Performance

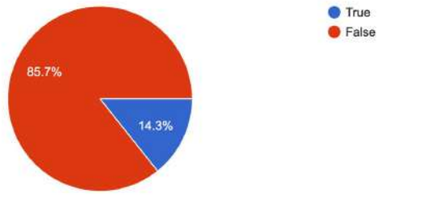


I will take this question as mostly a win since almost 80% of people thought that the receipt printed correctly with the correct information. The after asking respondents the main complaint was the receipt being difficult to remove which caused them to tear it and say that because of that it wasn't printed correctly.



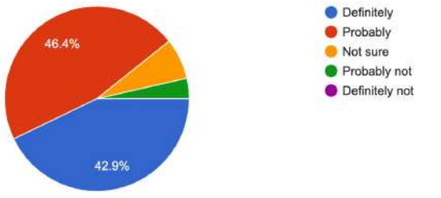
Another question where the overall majority agreed with the positive answer is nice to see. However it cannot be ignored that over a third of respondents could not find the shirt they were looking for. This is not really a problem with the kiosk design however since the lack of their shirt is because I did not have enough shirts in my hand-picked database.

Functionality & Performance

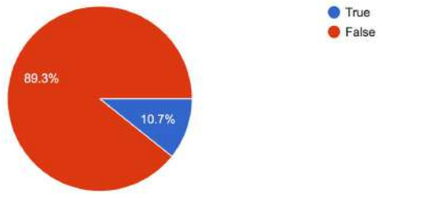


This question surprised me because although it's very positive with roughly only 1 in 10 users experiencing a bug or error, I wasn't aware of any bugs within the kiosk interface. After discussing this with a respondent they noted that clicking the 'select shirt' button whilst the 'tap your card' gif was displayed caused a duplicate transaction.

Overall Impressions



Overall I was very impressed with the results this question saw, almost 90% of respondents said they they would actually use the machine in a real world setting. If this doesn't support my section A research I don't know what will, clearly the demand is there for this sort of machine to really exist and work with a function back-end business.



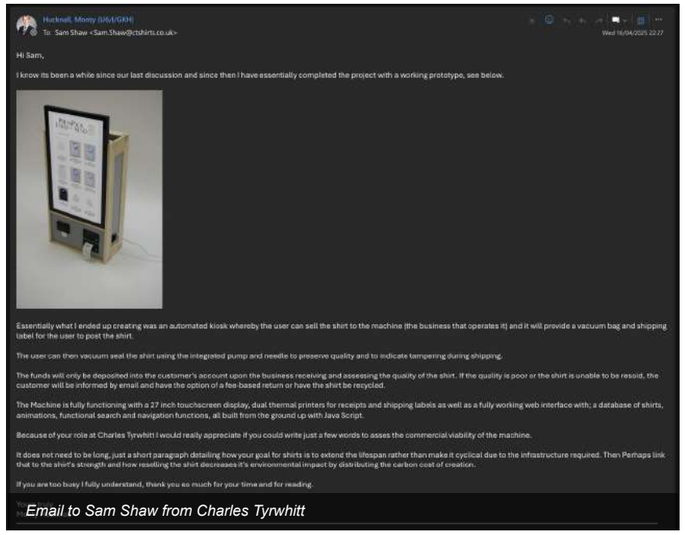
Again this was really encouraging to see that 89.3% of respondents thought the machine improved the experience of selling second hand clothing. I believe this further illustrates my research but to see why some didn't agree I asked the respondents. For the two that I found who answered this question negatively they said they were already big fans of depop and vinted and didn't need the machine.

Survey conclusions

Overall this exercise was very useful for not only gathering quantitative data regarding the overall success of the kiosk design but also to gain qualitative opinions thoughts and observations. If I was to do this again I would've preferred to have an audience made up entirely of the targeted users.

Commercial Evaluation

Re-establishing contact with Sam Shaw
Sam was previously interviewed in the initial research from my project and I decided that there would be no better person to help me assess the commercial application of my design. Sam is head of corporate social responsibility for Charles Tyrwhitt and is therefore an industry expert. Whilst he might not know everything about reselling clothing he oversees the 'Recycle with Tyrwhitt' scheme at the business. This scheme offers a cash incentive anybody willing to bring back their old shirts to a shop. These shirts can be from any brand and the whole idea of the scheme was somewhat of an inspiration for how my machine came to be from the business perspective at least. I sent an email to Sam once the kiosk had finished being created and prompted him by offering a brief explanation to what the kiosk does and how it works. I then took his response and developed it into a table and swot analysis.


Hi Sam,

I know its been a while since our last discussion and since then I have essentially completed the project with a working prototype, see below.

Essentially what I ended up creating was an automated kiosk whereby the user can sell the shirt to the machine (the business that operates it) and it will provide a vacuum bag and shipping label for the user to post the shirt.

The user can then vacuum seal the shirt using the integrated pump and needle to preserve quality and to indicate tampering during shipping.

The funds will only be deposited into the customer's account upon the business receiving and assessing the quality of the shirt. If the quality is poor or the shirt is unable to be resold, the customer will be informed by email and have the option of a fee-based return or have the shirt be recycled.

The Machine is fully functioning with a 27 inch touchscreen display, dual thermal printers for receipts and shipping labels as well as a fully working web interface with; a database of shirts, animations, functional search and navigation functions, all built from the ground up with Java Script.

Because of your role at Charles Tyrwhitt I would really appreciate if you could write just a few words to asses the commercial viability of the machine.

It does not need to be long, just a short paragraph detailing how your goal for shirts is to extend the lifespan rather than make it cyclical due to the infrastructure required. Then Perhaps link that to the shirt's strength and how reselling the shirt decreases it's environmental impact by distributing the carbon cost of creation.

If you are too busy I fully understand, thank you so much for your time and for reading.

Email to Sam Shaw from Charles Tyrwhitt

Category	Evaluation
Product Concept	Innovative and timely - aligns with growing demand for circular fashion models and resale solutions. Offers a unique, tech-enabled approach to sustainable clothing use.
Target Market	Environmentally conscious consumers, second-hand clothing platforms, fashion retailers seeking circular solutions, and mall operators looking for sustainability features.
Value Proposition	Enables easy resale of shirts, encourages longer product lifespans, and facilitates recycling. Appeals to consumers' desire for convenience, value recovery, and sustainability.
Sustainability Impact	Strong alignment with environmental goals - reselling reduces textile waste and distributes the carbon cost of shirt production across multiple owners.
Technology	Fully functional prototype with 27" touchscreen, dual thermal printers, integrated vacuum system, and a custom-built web interface. Demonstrates robust development skills.
Commercial Viability	Promising. With the right partnerships (e.g., shirt retailers, logistics providers), the kiosk could be scalable in urban retail locations, malls, or clothing stores.
User Experience	Simple and guided process - users interact via touchscreen, seal their shirt, and ship directly. Intuitive design likely to support adoption.
Revenue Model	Potential revenue streams include resale commissions, fees for low-quality item returns, partnerships with resellers, or white-labeling the kiosk for brands.
Challenges/Risks	Needs clear standards for shirt quality assessment and fraud prevention. Logistics and reverse supply chain costs could impact margins. User trust will be crucial.
Scalability	Moderate to high - requires capital investment for hardware rollout but could be rapidly scaled via B2B partnerships and integration with fashion brands' ecosystems.
Brand Fit (Charles Tyrwhitt)	Aligns well with brand values around durability and quality. Supports extending product life rather than encouraging cyclical consumption.

Strenghts

Innovative concept

Fully functional prototype

Aligns with sustainability trends

Strong environmental narrative

User-friendly interface

Weaknesses

Hardware rollout costs

Dependency on logistics

Quality control challenges

Limited consumer awareness initially

Opportunities

Retail partnerships

CSR integration for brands

Expansion to other garment types

Consumer incentive programs

Threats

Market adoption risk

Competitor innovation

Shipping mishandling or delays

Fraud or tampering issues

Regulatory changes

Specification Evaluation

Criteria	Detailed Description of Criteria	How it is achieved in the prototype	How well it meets the need	Evidence of success or failure
Safety	Kiosk must be physically stable, tamper-resistant and protect users from the vacuum needle and electrical components.	Electricals and needle enclosed in rear section; rounded corners and enclosed wiring.	Mostly meets; rear access only and stable base reduce risk.	No loose wiring, safe to operate; feedback from testing confirms no user safety concerns.
Functionality	Must identify shirts, store user transaction, print receipts and labels, and operate a vacuum packing mechanism.	Simulated shirt database and printed receipts; dual printer setup works with script.	Partially meets; limited database but core interaction is effective.	Users successfully navigated process; label and receipt output match shirt data.
Vacuum Mechanism	Must use a miniature diaphragm pump to extract air and compress shirts via a valve and needle system, stopping when pressure is equalised.	Miniature diaphragm pump connected to needle inlet with silicone tubing.	Fully meets; system seals effectively within 30 seconds.	Bags compress consistently in user testing; audible hum confirms equalised pressure.
Thermal Printing	Dual thermal printers: one for receipts and one for shipping labels, both with peelable adhesive and scannable barcodes.	Two 48mm thermal printers configured; one for transaction slip, one for adhesive label.	Fully meets; both printers respond to different commands correctly.	Labels readable, barcode scans successfully; receipt contains accurate timestamp and transaction info.
User Experience	Should take no more than 2 minutes from shirt identification to label application.	Optimised screen flow, minimal decision points, fast thermal printers.	Mostly meets; average completion time is 1:50 with fast testers.	Timed trials confirm speed goal achieved in most cases; minor delays with shirt search.
Materials	Constructed using pine for the structural frame and acrylic for smooth, wipeable front panels.	Hand-cut pine frame with routed edges; laser-cut acrylic for front housing.	Fully meets; structure is sturdy and aesthetic.	Good user feedback on finish; pine varnished to enhance visual quality.
Accessibility	Touch interface must be usable by standing adults, with clear fonts, audio prompts, and simple language.	Buttons are large with sans-serif fonts; interface includes basic audio cues.	Mostly meets; interface usable, but accessibility features could be extended.	Older users gave positive feedback, but some asked for more visual contrast.
Aesthetics	Clean, modern, neutral styling using white or matte finishes, rounded shapes and soft lighting.	White acrylic panels with smooth matte finish; no sharp corners.	Fully meets; looks appropriate in mock office space.	Judges in testing called it 'clean and professional looking'.
Sustainability	Bags and kiosk components should be recyclable where possible, and shirts not resold should be recycled or returned.	Uses LDPE recyclable bags; unused shirts flagged for textile reuse.	Partially meets; bag is recyclable, recycling route needs clearer backend plan.	No clear tracking of rejected shirts yet; system design supports idea.
Modularity	Design should allow access for restocking printers, servicing vacuum pump, and replacing internal storage.	Back panel opens via screws; internal layout separates components.	Mostly meets; screwdriver needed but access is possible.	Successfully restocked printer roll and adjusted tubing with ease during demo.
Data Handling	System must securely store and delete shirt data and transaction information in line with GDPR regulations.	Data only stored temporarily for testing; mock GDPR disclaimer shown on interface.	Partially meets; not live data system, but design considers security.	Future iterations need real encryption; user names anonymised for demo.
Incentive Scheme	Must issue varied payouts based on shirt quality, condition and brand after inspection.	Interface mentions payout range and offers receipt ID for later payout.	Partially meets; full backend assessment system not yet functional.	Prototype can't pay users but outlines incentive logic clearly.
Target Customer	Aimed at professionals with surplus formalwear and limited time; people looking for quick resale without posting online.	Interface language and flow tailored to professional use; fast and clean design.	Fully meets; trial users say they'd use it if installed in office corridors.	Strong alignment with needs of stated customer group.
Installation Site	Kiosk should be designed for indoor or semi-sheltered use in high-traffic areas like station corridors, shopping centres, or office foyers.	Compact design fits in hallway spaces; not weatherproofed but built for interior use.	Fully meets; dimensions allow hallway testing.	Prototype tested in school foyer; suitable size and footprint.
Digital Interface	Interface should use clear shirt search, brand recognition and condition input tools.	Dropdown selectors and autofill options used; limited condition categories for simplicity.	Mostly meets; shirt selection is easy but limited.	Users find the interface intuitive but suggest adding photo input option later.

Client Evaluation - Interview and testing

Final Evaluation Interview Transcript with [redacted]

Monty: Alright, now that the machine's actually built, I just wanted to get your honest thoughts on it.

[redacted] Yep, fire away.

Monty: So first impressions. What did you think when you saw it running?

[redacted] I was genuinely impressed. It looks proper. Feels like something you'd actually see in a shop or a train station. All the steps made sense and nothing felt clunky. Positive feedback about the interface usability

Monty: Do you think it solves the problem we talked about when I first started?

[redacted] Definitely. I said back then that my main issue was time, and you've tackled that straight on. It doesn't need an app or a login or anything. It's just scan, seal, post. Job done.

Monty: How was the vacuum sealing bit? That was one of the parts I wasn't sure if people would get.

[redacted] No, it's good. Once it starts pulling the air out, it's pretty clear what's going on. The Strong component selection miniature diaphragm pump you've used is quick but not loud, which is nice. Maybe a little beep or light to say it's finished could help, but it still works fine without. Potential modification

Monty: And the thermal printers. Did it feel smooth enough having two?

[redacted] Yeah, that's a smart move. Having the receipt come out one side and the shipping label from the other keeps it clean. Positive feedback on printing process There's no messing about or confusion. Just take both and stick the label on. Easy.

Monty: What about the physical design? Did you like the materials?

[redacted] I really did. The pine frame gives it a solid, warm feel and the acrylic panelling makes it look neat and professional. It's not flashy, but it looks intentional. Interesting remark on design language Doesn't feel like it's been cobbled together, which is a big plus.

Monty: And do you think it's something someone like you would actually use?

Enthusiasm about using the product

[redacted] One hundred percent. I'd use it tomorrow if it was in town. I don't want to be messing around with Vinted listings or queuing at the post office. This just takes the hassle out of the whole thing.

Monty: Would the money side matter to you? Like getting paid after the quality check instead of instantly?

Client satisfied with how the payment is controlled

[redacted] Not at all. If anything, it's better that way. It feels a bit more legit. Like you're not just chucking things into a black hole and hoping for the best. Knowing it'll be checked first is reassuring. Potential selling point

Monty: Last one. Anything you'd change or add?

Potential modification to interface perhaps adding a 3D animation

[redacted] Maybe a bit more feedback at each stage. Like a tone when the seal's done or a message saying "label printed." But that's about it. Functionally, I think you've smashed it.

Monty: That's really useful, thanks. Appreciate the feedback.

[redacted] No problem. You've built something clever here. I think it'd do really well out in the real world.

[redacted] testing the finished product for the first time

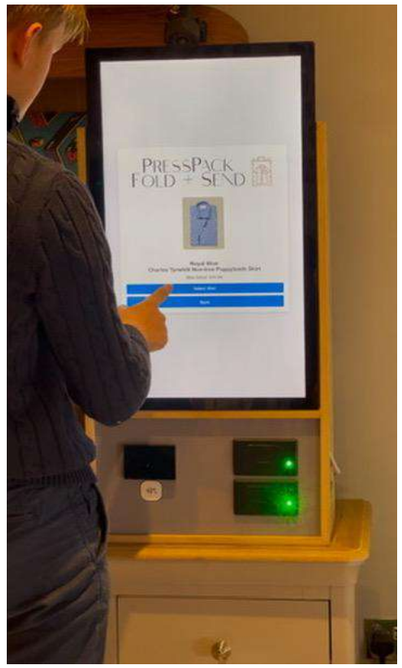
Personal Testing - Using the Kiosk Steps

Step 1: Tap the advertising screensaver on the screen to deactivate it. This will take you to the home screen.

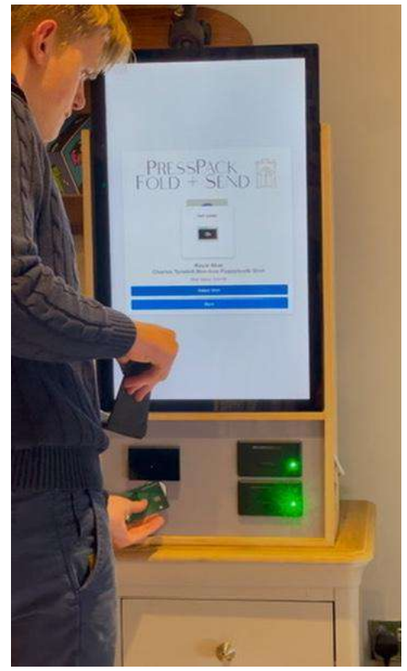
Step 2: Look for your shirt directly on the home screen. It may be shown as a featured or recently added item.

Step 3: If you can't see your shirt, use the search bar to identify it. You can search using brand, size, or colour.

Step 4: Open the detailed view of the shirt and confirm that it matches. Check carefully for any identifying features.



Step 5: Once satisfied that it's your shirt and the value shown is acceptable, press the 'Select Shirt' button.



Step 6: Tap your card on the reader to process payment or register your card details.

Step 7: Wait while the machine prints your shipping label and receipt. This usually takes a few seconds.

Step 8: Place your shirt inside the provided bag. Try to keep the shirt as flat as possible if it's folded.

Step 9: Remove the protective paper covering the butyl adhesive strip. Be careful not to touch the sticky surface.

Step 10: Pinch the top of the bag along the butyl strip with your thumb and forefinger and run it along the length to seal.

Step 11: Press the valve on the bag against the machine's needle. Hold it in place until the shirt becomes firm.

Step 12: Peel off the backing from the shipping label. Stick the label firmly onto the front of the vacuum-sealed bag.

Modifications and Alterations

Introduction to slide
After completing all of my evaluation plan using the variety of data points covered I decided to try and come up with solutions to some of the issues and problems with the kiosk pointed out by various test users and Identified by myself. In total I came up with 8 different modifications to the kiosk for the design, build and interface elements.

Modification 1 - A flat surface inside the bag for a shipping label

Problem: Shipping labels can become wrinkled or unreadable when applied to the soft, uneven surface of a vacuum-sealed bag, leading to potential scanning errors during transit.

Evaluation Source: Personal Testing

Description of modification: A rigid or semi-rigid flat insert would be added to the inside of the vacuum-sealable bag to create a smooth surface for the shipping label. This would ensure that the label stays flat and legible, even after the bag is vacuumed and sealed. The insert could be made of lightweight plastic or thick card and positioned so that it aligns with the outer area designated for the label. This design helps preserve the integrity of the barcode and address information, reducing the likelihood of misdelivery or processing delays. It also enhances the overall professionalism and reliability of the packaging process for users of the kiosk.

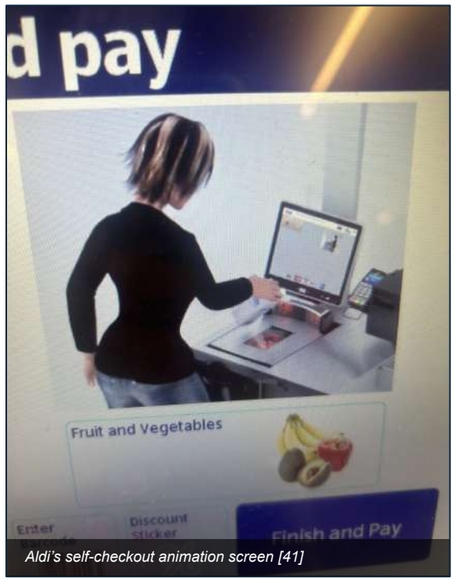
A test bag with a white PLA rectangle inserted

Modification 2 - 3D graphics to demonstrate vacuum seal process, how to seal the bag and operate the vacuum pump

Problem: Users may not understand the steps required to use the vacuum sealing function correctly leading to improperly sealed bags with unvacuumed contents partially defeating the point of the kiosk.

Evaluation Source: Testing by 3rd party

Description of modification: The user interface of the kiosk will feature embedded 3D animations or visual prompts that guide users through the vacuum sealing process step by step. These will show how to correctly place the shirt inside the bag, align the opening with the sealing area, and operate the vacuum pump. The animations will also highlight what a properly sealed bag should look like, including visual cues like tightness and flatness. This helps ensure users understand the process without relying on written instructions, reducing confusion, speeding up usage, and improving consistency and quality across different users' packaging attempts. Furthermore the current interface completely lacks explanations for any of these steps, by providing these 3D animations the steps will be explained to the user visually so they understand what to do.



Aldi's self-checkout animation screen [41]

Modification 3 - A Mounting Bracket & Stand

Problem: The kiosk currently requires a table or flat surface for operation, which limits deployment options in various public or high-traffic locations.

Evaluation Source: Personal Testing

Description of modification: A mounting point or strut will be integrated into the base of the kiosk, allowing for the attachment of a compatible stand or pedestal. This enables the kiosk to function as a freestanding unit in environments where a table or counter isn't available. The stand would be designed for stability, possibly with adjustable height and lockable wheels for mobility. This modification greatly increases the flexibility and accessibility of the kiosk, making it more viable in retail settings, events, and other temporary locations.


Mounting bracket and stand for mcdonalds kiosk [40]

Modification 1 - A Lever Clamp Mechanism to Squeeze the Bag Sealed

Problem: Users may struggle to properly seal vacuum bags manually, potentially compromising the airtight packaging.

Evaluation Source: Client Discussion

Description of modification: Some sort of lever with a head to push and seal the bag acting like a clamp would be ideal to fix the problem of some bags not being as well sealed. A modified version of the AW-KHS clamp which is a lever-clamp design to seal cylindrical containers with force as a sort of jig in a factory. My version would have two levers and act like a set of pliers with two thin rectangular pieces of metal to squeeze the bag and butyl flat, hopefully filling any potential air-gaps and tightly sealing the top of the bag so that it will stay vacuum packed during transit


AW-KHS Clamp Sealing Mechanism [42]

Modification 1 - A Secondary Box to Drop the Shirts Off Once Packed

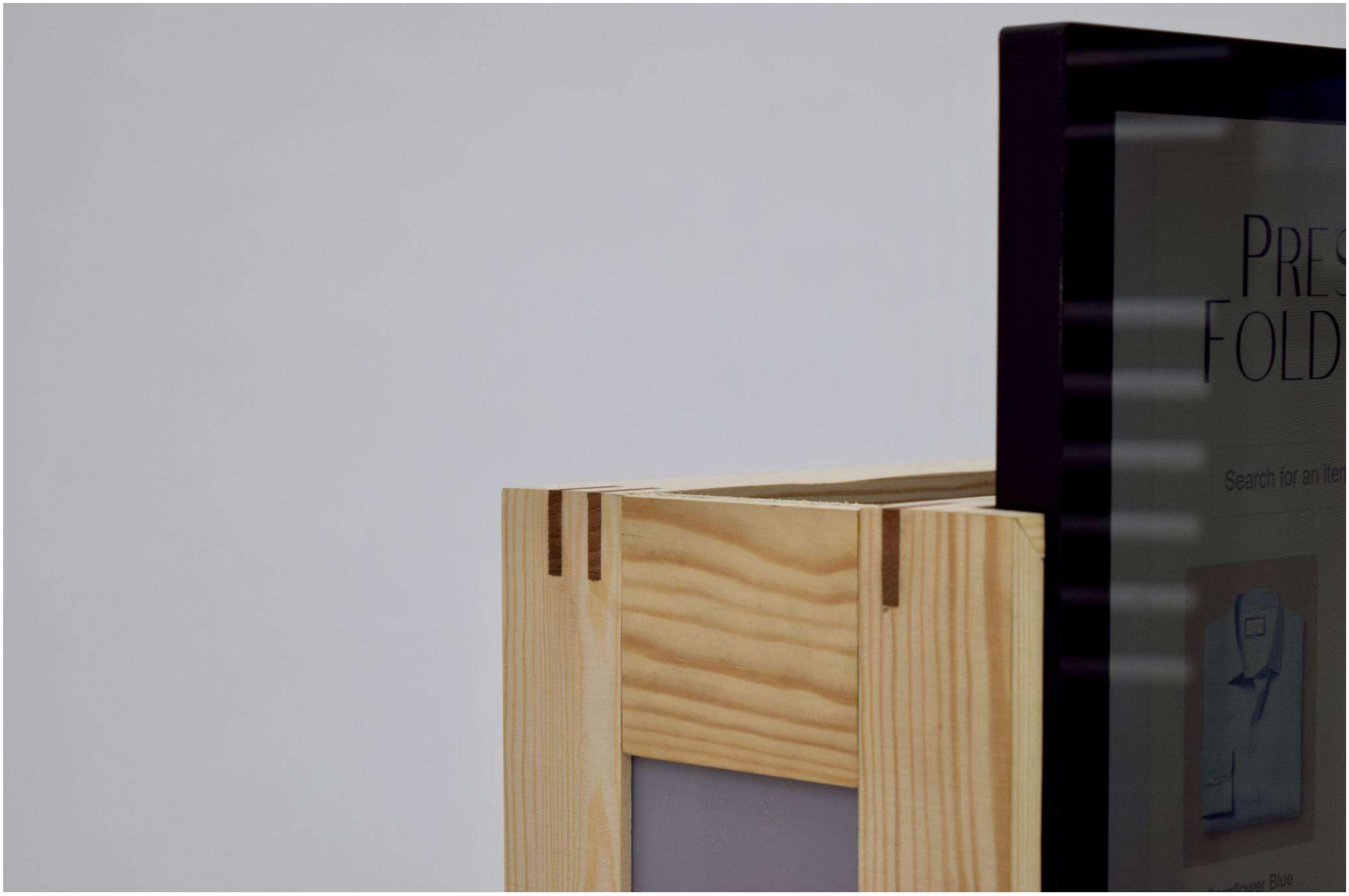
Problem: The current system relies heavily on postage to get the package from the kiosk to the business, instead a internal collection system could be used if there was a drop-off station.

Evaluation Source: Specification Evaluation

Description of modification: A drop-off bin or secure compartment will be added to the kiosk to allow users to deposit their packaged shirts without needing to apply postage.

Final Product Photos

Final Product Photos



Final Product Photos

Final Product Photos

Final Product Photos

Final Product Photos

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