

# MILO TEKCHANDANI

## Product Design

### Automated Pet Feeder Project

I have made edits to this for  
privacy reasons.

# Task Analysis // NEA Brief // Introduction

## Why have I chosen this context?

*I have chosen this context because I am good friends with my neighbours - I go see them every friday and I feel they are very nice to me every time :)*

*I also adore animals in general. In year 7 I used to look after a pair of sausage dogs and ever since I was young begged my parents to get a family dog or cat! Sadly my requests have been declined thousands of times, however I have plenty of friends with animal friends whom I know very well, one of which would be my close neighbours Shalinie and Tom, whom you'll find more information on about, on the next page.*

*(next page)*

## My clients...

*My clients are two of my neighbours who live on the high street. I pass them every time I walk to school and back, and they have a black Labrador that goes by the name of Nester.*

*I have known the pair as well as Nester for over a year by now. They are lovely people who are very respectful and took well to the idea of being my D&T GCSE coursework clients.*

## Other notable information

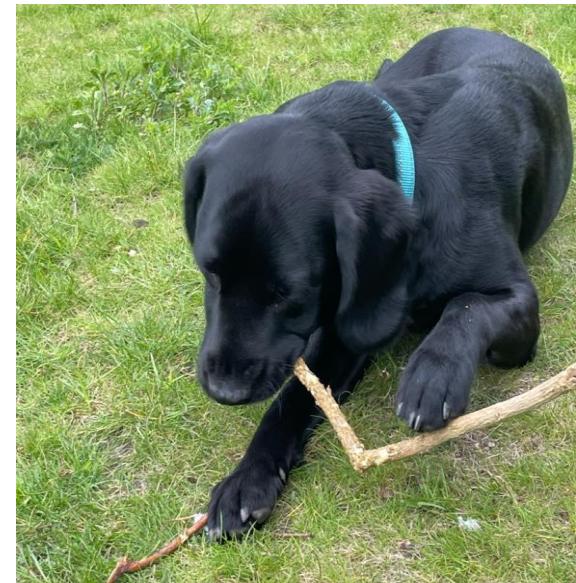
As well as all this I have also chosen to incorporate an element of technology or computers into my design, to additionally tie in with the other GCSE option I take which is Computer Science

In addition to this fact I also would like to improve on my client - producer feedback as this is a forever invaluable skill in business in general, especially in contracting which is what I would like to go into.

# Client Brief / Information

Redacted for privacy.

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privacy.





This is one of the top results for “automatic pet feeder” on amazon. It’s a fairly common product so I acknowledge that my idea is not unique, however I hope to learn about this product to gather useful information for my own project.

Looking further at this I don’t think that it is feasible to make something akin to this. It’s a luxury product and is definitely leagues

The product claims to (condensed):

- >Automatically feed your pets
- >Has a mobile application that can control and configure the whole thing
- >Contain a large amount of pet food to ensure refilling isn’t done all the time
- >Manual feeding, in case of a separate occasion or one off
- >Observe your pet using a camera, connected to your phone

WOPET Automatic Pet Feeder



### Primary Research involved:

- **Researching the best/ most popular auto pet feeder on the market, seeing how and why it is so successful**
- Researching the type of food my neighbours have, important as the product will be designed around this
- Research of a real world example, something I can physically touch and try for myself to see how it functions, problems, benefits etc.

The PetKit Automatic Cat Feeder is a popular automatic pet feeder designed for cats and small dogs. It allows pet owners to schedule and dispense meals for their pets automatically, making it a convenient and reliable solution for busy pet owners. It's one of the top results on amazon for "automatic pet feeder", hence why I chose to research it - I wanted to find out what was so popular about it

One of the key features of the PetKit Automatic Cat Feeder is its customizable feeding schedule, which allows pet owners to set up to four meals per day. The feeder also has a built-in voice recorder that can record a message for your pet, which will play when it's time for their meal.

The feeder is made from high-quality materials and is easy to clean, with a removable feeding tray and hopper. The hopper has a capacity of up to 2.8L, which is enough to hold up to 10 cups of dry food, ensuring that your pet will always have access to food, even when you're not at home.

The PetKit Automatic Cat Feeder also features a unique double fresh lock system, which helps to keep your pet's food fresh and free from moisture and air. The feeder is also equipped with a low food alarm, which will alert you when the food level is low and it's time to refill the hopper.

Overall, the PetKit Automatic Cat Feeder is a reliable and convenient solution for busy pet owners who want to ensure that their pets are always fed on time. Its customizable feeding schedule, voice recorder, and double fresh lock system make it a top choice among automatic pet feeders.

**There's a clear reason why it's the winner in this category.**

**It functions as it should**

**It is cheap in comparison**

**It has all the extra bells and whistles the luxurious, expensive ones have**

**It is aesthetically pleasing**

**It's a simple design - straight to the point without any complicated bits.**

**PETKIT Automatic Cat Feeder, WiFi Enabled Auto Pet Food Dispenser with Stainless Steel Bowl, Battery Powered, Anti-Clog Smart Feeder with Low Food Alarm, Portion Control, FRESH ELEMENT SOLO, 3L**

<b>Material</b>	Stainless Steel, Polyethylene Terephthalate
<b>Target species</b>	Cat, Dog
<b>Brand</b>	PETKIT
<b>Special feature</b>	Portion Control, Android Compatible, iOS Compatible, Feeding Schedule, Smart App
<b>Breed</b>	All Breed Sizes

## PETKIT Automatic Cat Feeder



To conclude, I would assume the reason for this product's popularity across amazon would probably boil down to the fact that it has the features of expensive ones, as highlighted in the previous paragraph, but I'd also say that in comparison to other designs on amazon which can vary wildly in design, it has a simple to understand design and looks quite sleek in comparison

## SUPPORT MULTIPLE TYPES OF PET FOOD



Freeze-dried food



Mixed food



Dry food



Air-dried food

#### Primary Research involved:

- Researching the best/ most popular auto pet feeder on the market, seeing how and why it is so successful
- **Researching the type of food my neighbours have, important as the product will be designed around this**
- Research of a real world example, something I can physically touch and try for myself to see how it functions, problems, benefits etc.

The kibble that Nester eats is a dry feed based one that isn't really specific. He likes to go out in the garden and for someone to throw the bits of cylindrical dry food around in particular! He is a very hungry boy and I will have to take into account his average serving size which he is given on a daily basis, as well as his portions per day, and what time. This is so I could program the feeder before giving it to my clients

Nester has:

- 1) 2 Meals a day
- 2) The cup that you see on the left is poured out 3 times into a cup
- 3) He is taken into the garden where his owner or me typically scatters them across bit by bit and he will try find them eagerly



PETKIT Automatic Cat Feeder

A different type of food that Nester



### Primary Research involved:

- Researching the best/ most popular auto pet feeder on the market, seeing how and why it is so successful
- Researching the type of food my neighbours have, important as the product will be designed around this
- **Research of a real world example, something I can physically touch and try for myself to see how it functions, problems, benefits etc.**

[Product Link: thegreenhead.com/2008/06/lebistro-portion-control-automatic-pet-feeder.php](http://thegreenhead.com/2008/06/lebistro-portion-control-automatic-pet-feeder.php)



PetMate Le Bistro Automatic Pet Feeder



### Online review

First of all, it is very nearly impossible to program this thing. It may have the worst UX of any consumer product I have ever encountered. The controls on it do not make sense and are not labeled in any such way as to indicate how to program it. And even worse, every time you change the batteries, it loses the program. It has no wiring for mains electrical or even an adapter, just D-cell batteries. And those batteries last *just* long enough for you to forget how you programmed it. So you're back to square one.

Second, it *loses time*. Fast. On the order of minutes a week. So a 7 AM feeding becomes a 5 AM feeding within a few months. Every few weeks you have to reset the clock back to the current time. And that's not including adjusting it for daylight savings time - which I usually never bothered to do because this thing is such a bear to deal with. My default setting was just to not touch it until I absolutely had to.

Third, and perhaps most importantly, sometimes it legitimately just would not work. You'd load it up with food and, when the scheduled feed time came, it would either just not feed at all, or do this wimpy thing where kinda tried to spin the motor for a fraction of a second. I even tried only filling it up halfway or a quarter of the way to see if maybe there was just too much weight on the motor. I tried taking it apart and cleaning it out thinking maybe a kibble got jammed somewhere.

But nope. About 50% of the time, it wouldn't even feed my cats despite always incrementing the feed number. Which is a big deal if you're relying on this thing to feed the cats while we're out of town for the weekend.

This is literally one of the most garbage products I have ever owned. 0/10 do not recommend, and if you own one I suggest you set it on fire and mail the remains back to the manufacturer COD.

For the longest time, we just grumbled at how much it sucked and dealt with it...



# Notable design movements

## Brutalism

Brutalism was a fairly hated design movement (at least in the UK) designed to “celebrate” the raw materials which we use to create these buildings. Instead of relying on other natural or nice color palettes, brutalist architects were forced to utilise solely raw concrete or singular materials, relying on interesting structure or natural light, emphasising how something beautiful could become from something so horrible - or *bruta*- hence the name, highlighting the materials, textures and construction of a traditionally styled building, producing highly expressive forms.

You can see brutalism a lot in the UK in some of the more impoverished areas, as flat blocks and alike and they frankly look rather depressing, assumably why the UK took such a disliking to them.

However in the late 20th century architects saw it as a cool new design movement, especially good for cheap housing as it required little decoration and advanced construction, assumably why it was so



## Simplicity

Simplicity, or simplification is something we have seen quite frequently as of recent. It's become quite popular with both old and new brand logos, even becoming a trend aptly nicknamed the “oversimplification of brands”. This could include complex shapes and unnecessary detail being removed or refined to become more primitive, multiple colors being replaced by gradients or turned to a whole averaged shade for one. This led to mixed reactions from many, some saying it removed the personality or tradition of the brand, now transforming it into a soulless, corporation-approved industrialic brand, void of any feeling, while others welcomed the arguably much needed change from original and sometimes even dated logos; an updated version was something to look forward to! Some notable examples include the Pringles logo, Firefox branding and many more notable companies



## Modernism

Modernism is a fairly popular design movement which has seen widespread appeal with a nice neutral colour palette of Black and white, with natural materials and tones like wood and stone being incorporated into block-esque designs. These typically go against the norm of what a regular building looks like and aim to make interesting yet nice looking places! Modernism is an art movement that emerged in the late 19th century and lasted through to now! It was a period marked by a fundamental shift in the way people thought about art, literature, architecture, and design. Modernists sought to break away from traditional ways of thinking and create something new, innovative, and reflective of the modern age.

In architecture, the modernist movement is characterized by a focus on function over form. Buildings were designed to be sleek, minimalist, and efficient, with an emphasis on using new materials and technologies. Overall, modernism was a movement that challenged the status quo and sought to create something new and exciting. Its influence can be seen in a wide range of art, literature, architecture, and design, and it continues to shape our cultural landscape today.

# Client Interview - Shalinie / Nester (Neighbour & Dog)

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# Interview data collection

From the interview I think I can gather a basic sort of view of what the client would like. I think a combination of elements inspired by their house, or at least something that could fit the theme. To give you a picture, their house is very rustic, dating back to the 19th century, but has modern aspects incorporated into the old architecture of the 1800's - for instance solar panels on the roof and floating-esqe stairs whilst the traditional wooden plank flooring and timber beams and pillars integrated into the plaster running along the top. Using their feedback i now have a general idea of what they'd like, as well as dimensions, not too big but not too small, as to not take up too much floor space in the little cottage. In addition, to quote them "I like things that blend into the background. Because I don't like to having living in a really busy environment." is something reflected in their house, so I should try make it fit the general theme.

For the looks aspect, I would say try to fit their expectations but don't go overboard - keeping things to a basic idea and then expanding on top of it later is a good idea and is also iterative design, and especially don't fall into the trap of "feature creep" where it never ends up completed. Use the materials they would like, wood and a durable material such as aluminium so it isn't then too heavy but not light enough for the dog to tip it over with ease.

The project obviously requires some form of technology or embedded system specialized for it. To save money I will use technology my mum's friend has donated to me, which is good because it saves on money and it is appropriate for the design.

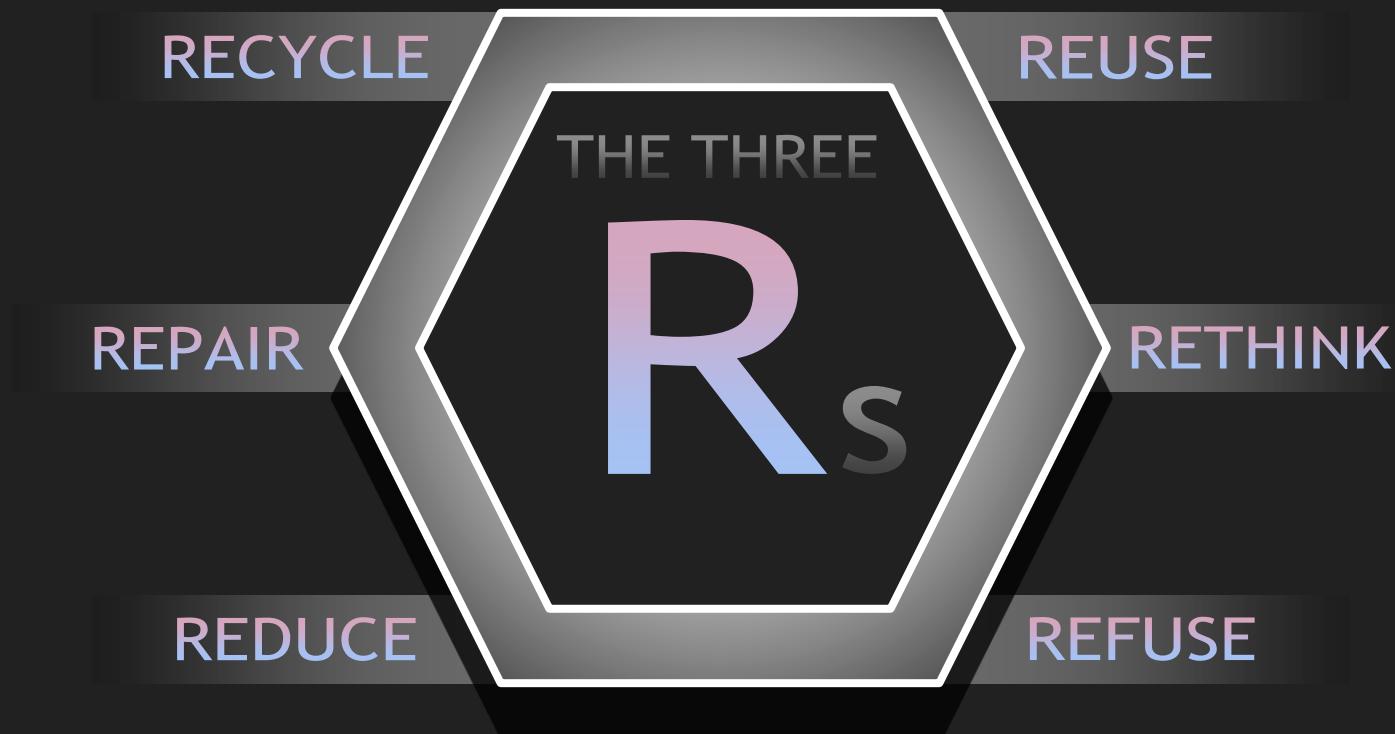
Beveled edges on the sides will reduce harm to the dog if it runs into it, which it might to try forcefully get the food which is something not unlikely. As well as this it will overall look nicer. I do however want to keep the top sharp, as this makes a nice aesthetic choice but because of the size of nester (black labrador) it's very unlikely he'll injure himself on this but not impossible considering they will be having this product long term.

It is crucial I pay attention to their specified conditions here and if unsure on anything to contact them at any given point. As clients they can help me with any proprietary decisions throughout the manufacturing process of the whole

A =	<b>Aesthetics, meaning what the product looks like</b> - colors, shapes, textures, patterns, appearance, feel, weight and style	<ul style="list-style-type: none"> <li>My client requested a modern feel to semi-contrast the feel of their home.</li> <li>In addition, a strong material is required should Nestor try to brute-force it.</li> <li>The main frame is to be made of a light metal, i.e: Aluminium with beech highlights for an aesthetically pleasing final look.</li> </ul>
C =	<b>Cost - i.e: the client's budget</b> , and/or the price range they would like to sell it at (if it's a product mass produced / sold).	<ul style="list-style-type: none"> <li>Cost for my client isn't necessary because it's a one off, however we estimated should this be a real world product around £150-200 GBP</li> <li>However it is in my personal interest to keep costs down as much as I can.</li> </ul>
C =	<b>Customer - or client;</b> who will buy or use or is commission our product?	<ul style="list-style-type: none"> <li>Shalinie and Tom, and most of all Nestor are our clients</li> <li>Remember to design the entire product based around their needs (as highlighted by our ACCESSFM or Design Specification).</li> </ul>
E =	<b>Environment means how the product will affect the environment in the sense of sustainability.</b> Remember the 6 R's	<ul style="list-style-type: none"> <li>Considering I am making a one-off product, and hand making it, it should have very minimal impact on the environment as-is.</li> <li>However, I should still take care to utilize the 6 R's, currently I am doing this by using some donated Raspberry Pi's one of my mum's customer donated.</li> </ul>
S =	<b>Size: How big or small is the product?</b> Remember to take into consideration/account your client's size.	<ul style="list-style-type: none"> <li>It shouldn't be too big for the dog, nor too small for the humans to refill.</li> <li>Capacity of the actual food + water storage could be about 2 Litres &amp; 2 KG</li> <li>Separate, secure containers for each one, so about 4-5 KG total capacity.</li> </ul>
S =	<b>Safety</b> , and in this case it is especially important considering it's being used by a not so clever dog :)	<ul style="list-style-type: none"> <li>The dog shouldn't be able to hurt itself on the sharp edges, so I've filled all the edges in order to make them softer, say if he runs into them</li> <li>Should also have safety precautions in terms of the electronics/mechanics so no human or dog will be harmed by it, say if there is a malfunction.</li> </ul>
F =	<b>F is for FUNCTION</b> - how does the product work and what functions does it have - in essence - <b>what it does.</b>	<ul style="list-style-type: none"> <li>The product should dispense a set amount of food at set intervals (i.e: two scoops every x hours)</li> <li>Alternatively, it could dispense a set amount of food at a set time (ex: 12pm &gt; Lunch)</li> <li>This should all be configurable by the end user/client (food amount, time dispensed)</li> </ul>
M =	<b>Material - what's the product made of?</b> <b>What metals, woods, or a mixture for different parts in my case.</b>	<ul style="list-style-type: none"> <li>The product will be made of ABS plastic for a 3d printer or alternatively steel as these have appropriate properties like density, weight among others that make them ideal candidates for the main shell material.</li> </ul>

# The 6 R's of design:

Recycle // Reuse // Repair // Rethink // Reduce // Refuse



# Design Specification

My client requested a modern feel to semi-contrast the feel of their rustic, old-style historic baldock home. In addition, a strong material is required should Nestor try to brute-force it. The main frame is to be made of a light metal, i.e: Aluminium with beech highlights for an aesthetically pleasing final look.

The product at its core will be a pet food dispenser that is automatically triggered when it hits a certain time. I.e: at 12'o clock it will dispense 2x scoops for food for the dog's lunch. This will be completely autonomous and configurable by the end user (client)

Cost for my client isn't necessary because it's a one off, however we estimated should this be a real world product around £100-150 GBP, costing quite a bit for the materials. Because it's 3d printed for the initial one off design I will have to ask Orlando for a

However it is in my personal interest to keep costs down as much as I can. Shalinie and Tom, and most of all Nestor are our clients. Remember to design the entire product based around their needs, as highlighted by our ACCESSFM or this design specification. Considering I am making a one-off product, and hand making it, it should have very minimal impact on the environment as-is. However, I should still take care to utilize the 6 R's, currently I am doing this by using some donated Raspberry Pi's one of my mum's customer donated.

It shouldn't be too big for the dog, nor too small for the humans to refill.

It should only have a small

Capacity of the actual food storage could be about 2.5kg - 3kg

Separate, secure containers for each one, which will be connected to a servo and technology which will dispense it by turning the servo an increment, in a "scoop" motion to let it out. The electronics will be located in the lower half of the body, the raspberry pi has a purpose built hole, which will fit it into it with  $\pm 1\text{cm}$  tolerance up and down, at the base of the product.

The holes on the left and right sides are for as follows:

- Circular hole - for the food dispensing. A bowl can be placed at the exit of this and a bendy tube like on the right
- Rectangular hole - to connect to the display with a cable

*Continued on next page..*



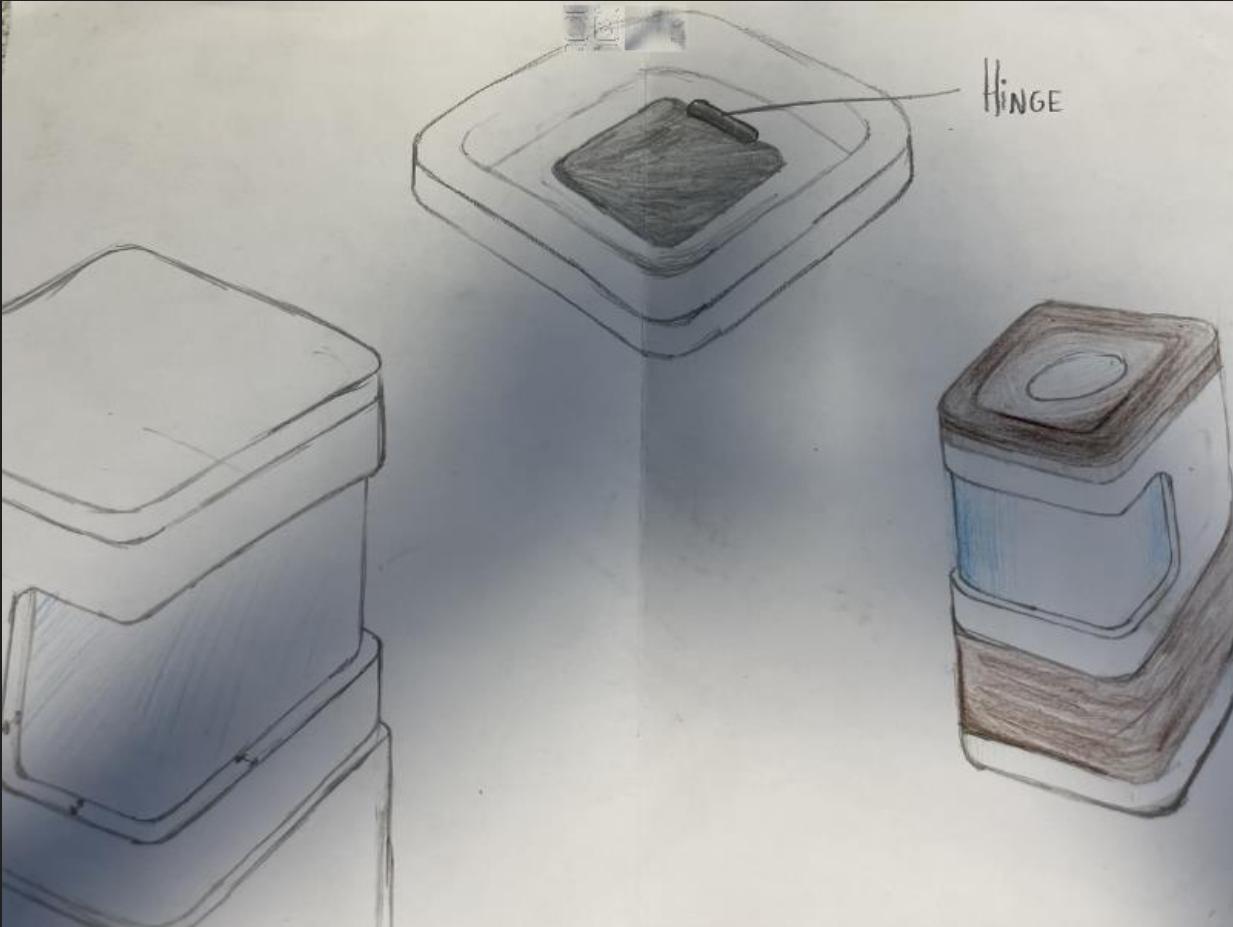
# Design Specification Continued

When designing an automated pet feeder in CAD, or in my case specifically, Autodesk Inventor 2022, several considerations must be taken into account. Firstly, the curvature of the feeder should be carefully designed to ensure that it is both aesthetically pleasing and practical. The curvature of the inner tube should also be designed in a way that facilitates the flow of pet food to the feeding bowl. Secondly, enough space should be left for wiring and electronics to be installed in the feeder. This will ensure that the feeder is fully functional and that the wiring and electronics are not cramped, leading to malfunction. Additionally, the feeder should have a storage capacity of 3kg of pet food, which will ensure that the pet can be fed for an extended period without the need for frequent refilling. Finally, the design should be 3D printed, which will provide high accuracy and precision. 3D printing will also allow for the creation of a custom design that is tailored to the pet's needs. With all these considerations, a carefully designed automated pet feeder in CAD Autodesk Inventor 2022 will provide an excellent solution for Tom and Shalinie, looking for an efficient and reliable way to feed their pets.

## SPECIFICATION POINTS:

- The feeder shall have sufficient food storage capacity for the desired feeding schedule.
- The feeder shall permit customisable portion sizes to accommodate different dog breeds.
- The feeder shall provide programmable feeding times with the flexibility to adjust.
- The feeder shall be compatible with various types of dog food
- The feeder shall have a reliable power source with backup power options
- The feeder shall be made from high-quality, durable materials that can withstand daily use.
- The feeder shall be easy to clean and maintain with removable components
- The feeder shall have a tamper-proof design to prevent dogs from accessing food storage.
- The feeder shall include an optional voice recording feature for personalised messages.
- The feeder shall offer remote control and monitoring connectivity through a smartphone app.
- The feeder shall have a sensor to alert the owner when the food storage is running low.
- The feeder shall incorporate safety features such as automatic shut-off and chew-resistant power cords.
- The feeder shall have a sleek and modern design that complements most home decor
- The feeder shall be compact and lightweight for easy moving and storage
- The feeder shall be an appropriate size, proportionate to the size of their home

# First Idea quick sketches



These first ideas are the earliest possible drawings I have of my first ideas, improved on a random thought I had while brainstorming ideas in an english lesson.

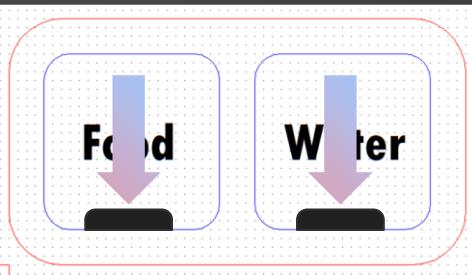
If you look back on these from a later perspective like from the final product you can see a definite resemblance.  
Initially you can see there was a plan to have a openable hinge on top however I decided against this in the end as it was pointless to limit the area that you could pour food into - why not just use the whole thing? A detachable roof works just as well

# Cardboard prototype iteration model #1.

Looking back on this initial prototype to gain ideas for the first one, (22/03/2023) I would say that it is not too dissimilar from the final design. Although the highlights and colours are no doubt very differing the base idea is still here!

The cardboard design net has been lost to time (i.e: floating around on an unknown USB stick) but remembering it, it was designed to have multiple slits within the corners to make a nice rounded radius, but this semi-backfired as it decided to make the thin brown paper layer atop of the corrugation fall off in cases where the glue didn't touch it (wasn't straight enough)

Overall however I would say this design was a general success as it was a huge influence on my final design which I am very proud of.



The shape of it is largely based on a sonos speaker, mainly because they had one in their home at the time I was interviewing them, but also because the rounded edges meant for better safety, should the dog run into it. The shape of it is largely based on a sonos speaker, mainly because they had one in their home at the time I was interviewing them, but also because the rounded edges meant for better safety, should the dog run into it, and looks for a nicer finish, too.



If I had to change something about my designs I would add these holes to top, so it could be easily opened, however this could let the dog open it and get to the food so I will have to reconsider or develop further this idea.

# Cardboard prototype iteration model #1.



The initial idea here was to create an initial design that could simply be reiterated on and added to, not in a modular sense but more like 'upgradable'. It was shaped after a sonos speaker which both me and my neighbours have. I thought it was a good choice as it's a simple, primitive shape making it easy to both make and modify . This would later aid in the actual physical model, as it gave me a sense of scale to work with as well (1:2 scale ratio)

## Client Feedback at this stage. (paraphrased quote)

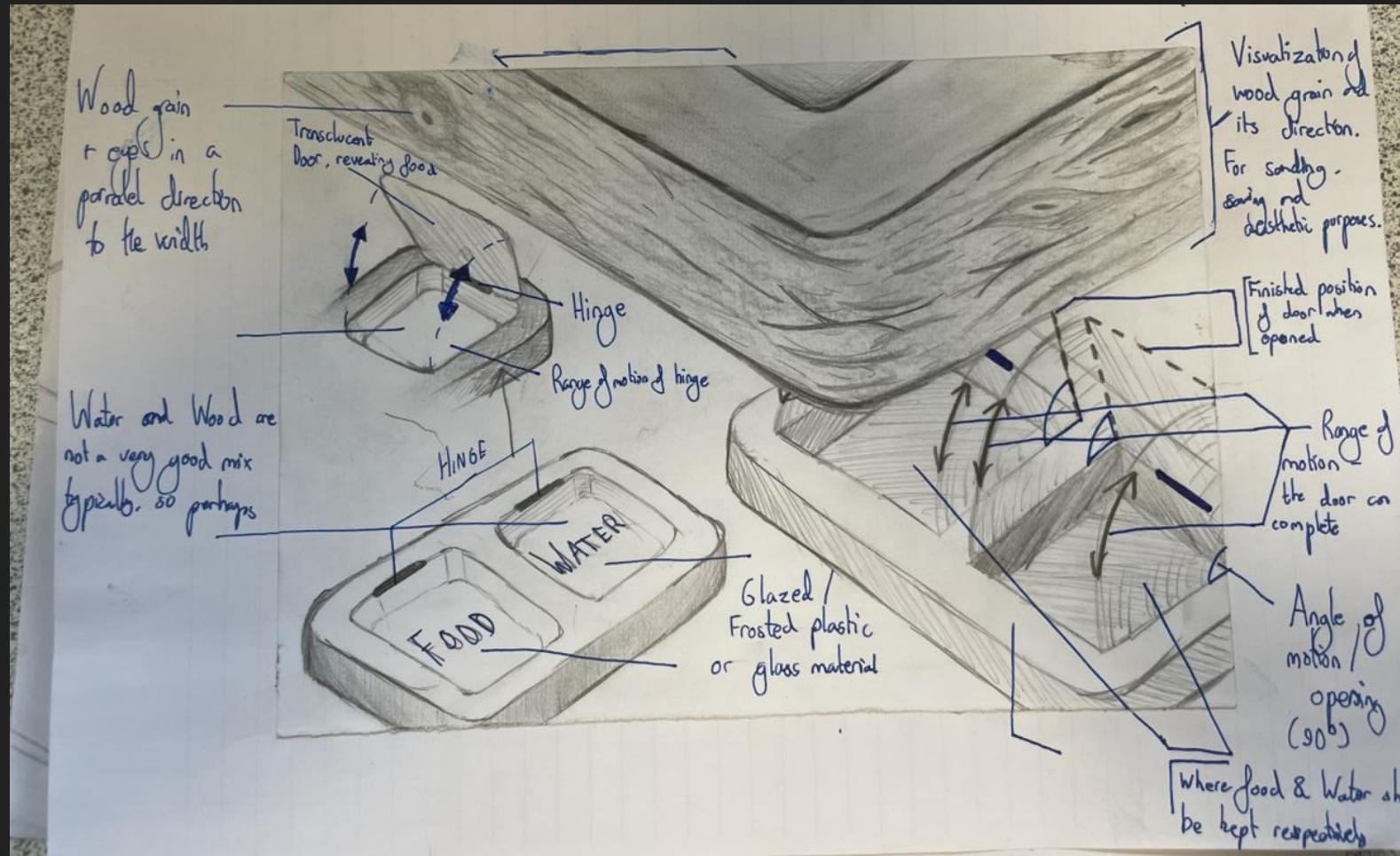
Wow! This looks really promising. It's got almost everything I asked for, I only question how it's going to work for the real thing, but I think you can work that out for yourself.

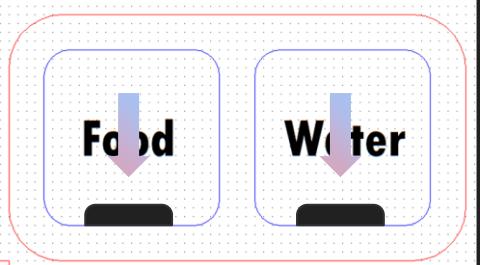
My only complaints:

I would prefer a nicer look. I know it's a prototype but I hope you don't plan to have solely a singular colour by the end. In addition I'd also prefer to know how the food stays inside and gets dispensed. I also wonder how the food stays in there and if it wil damage the inside of it? I don't want it to smell too much so you could consider adding a plastic wrap to the inside to further protect it from food related damages



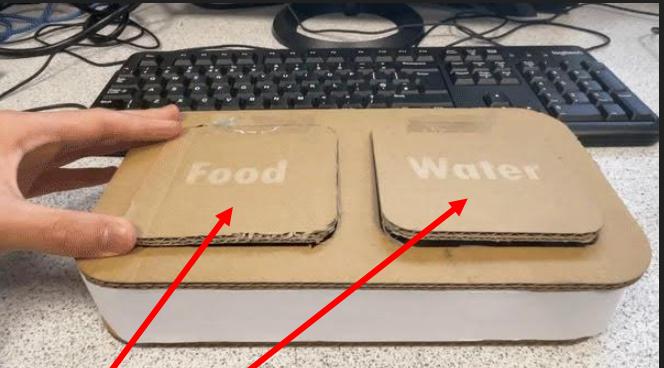
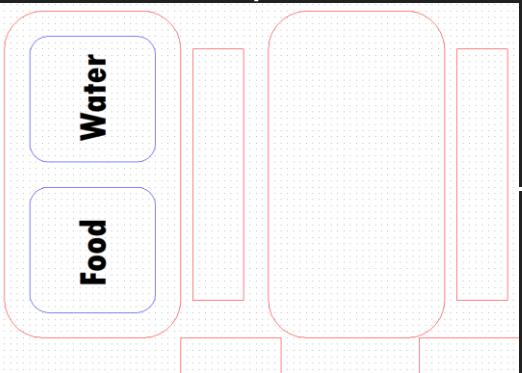
# Initial ideas, design of second model // test





If I had to change something about my designs I would add these holes to top, so it could be easily opened, however this could let the dog open it and get to the food so I will have to reconsider or develop further this idea.

Another solution would to just rely on a dog's sheer stupidity (in comparison to humans) and have a gate lock mechanism that slides into place



The design was made so it could be easily made like a paper net (however you can't use cardboard, because it has thickness).

This model is supposed to be flatter and therefore more portable, therefore suited best to travel, perhaps people who take their dogs on holiday, or move about often. However maybe with the cost of less complexity and capacity. Like I said, it is a good solution for travellers on a trip as it securely holds the food until a timer, albeit only once

My other problem with this is that although it does look nice with the white and brown contrast than the other one when compared, it also lacks in other areas. There is no clear way for anyone, dog OR human to open it to refill/eat. You could argue therefore it'd be better suited for a cheap version but then again there are plenty of these on ebay and the entire problem is left unsolved as it's for long term trips. You could just leave a bowl of food out at a set amount and the dog was be the exact same, essentially defeating the whole purpose of it. And if one is free, what's the point of buying into a solution for a solved problem?

However I would say I am proud of it. Designing it was a challenge as I had to think about how a net design would not work in this case, so other things had to be considered, i.e hot glue. As well as how to match up the curvature of the top and bottom to the uncurvable cardboard sides, so a paper blockade was installed to clear up the imperfections.

You could however argue that this would still be beneficial as a nice cheaper version. It could run on a manually turned timer like a kitchen egg timer, and then mechanically released at the end of it.

This would be a very nice choice for those who don't already have a dog feeder and this would be a nice, cheap edition with the added alongside benefit of coming with a timer. The mechanism would also benefit from it not being needed to be plugged into AC power.

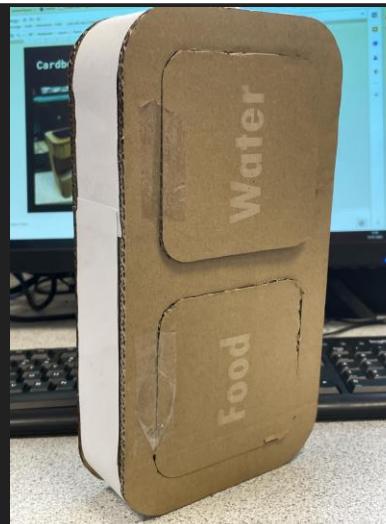
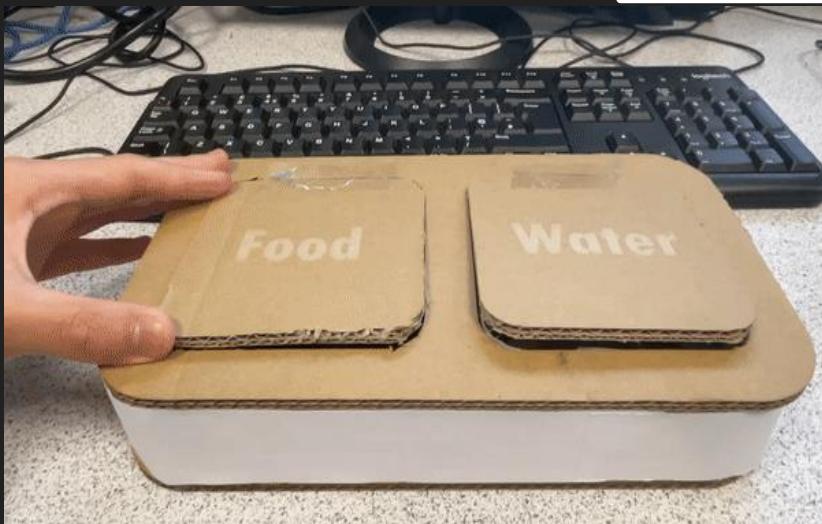
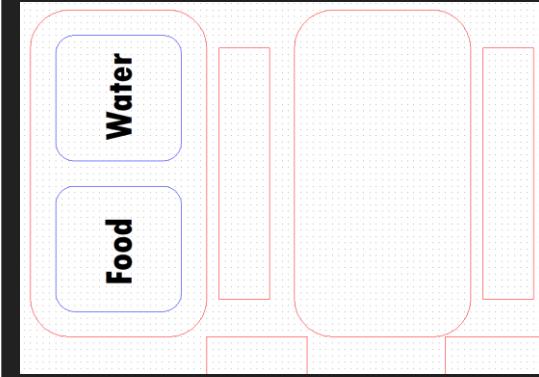
In my opinion this would be a nice dual solution to the storage of both water and food and an ideal general product - albeit one that does not fit my design specifications.

# Cardboard prototype iteration model #1.



This model is supposed to be flatter and therefore more portable, however maybe with the cost of less complexity and therefore less room to wire electronics (may be mechanical, which comes with its own benefits and downsides like requiring no power but more tricky to design in some cases). The mechanism on the inside could be that it automatically opens on a timer, spring loaded so force works against it until it is unlocked.

An additional problem with this is that it only has room for one single feed, so it would be better suited for day trips as opposed to long term journeys



# Client Feedback at this point

After messaging her about the models, and showing the models over facetime, the pair had this to say regarding my progress / modelling.

Hey there, I must say I am impressed with your product. The automatic pet feeder you designed could definitely be a game-changer in the market! The fact that it can be programmed to feed pets automatically, freeing pet owners from the stress of having to do it manually, is a fantastic feature. Also, I like how it is compact, so it doesn't take up much space in the house. The price is also reasonable, making it affordable for most people, like me and Tom :)

However, I think there are a few areas you could improve on. Firstly, the design of the feeder could be more attractive. I believe people would be more willing to purchase it if it was aesthetically pleasing. Also, the feeder could be made more durable. Pets can be tough on things, and a more robust feeder would last longer. Additionally, the feeder could be made to be more versatile, allowing for different types of pet food to be used.

Another suggestion I have is to make the programming process easier. While it is a great feature, the programming process can be a little complicated for some people. Simplifying the programming process would make it easier for pet owners to use your product.

Your product has great potential, and with a few tweaks, it could be even better. Keep up the good work!

My reply:

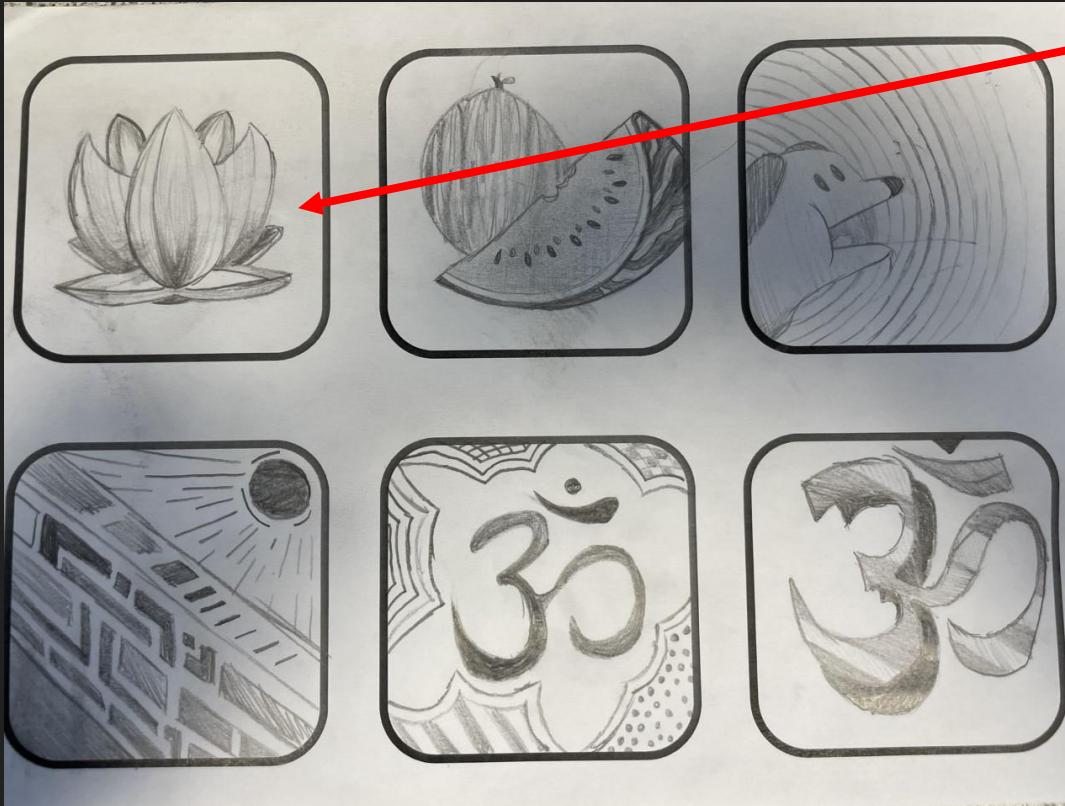
Thank you so much for your feedback on my automatic pet feeder. I appreciate your honesty and your suggestions for improvement. I completely understand your concerns about the size and weight of the feeder, as well as the difficulty in cleaning it. In order to address these issues, I am looking into materials that could make the feeder lighter and easier to clean. Additionally, I am considering reducing the overall size of the feeder while still maintaining its capacity to hold a sufficient amount of food. I also appreciate your positive comments about the feeder's design and its reliability. I will continue to focus on these aspects of the product and ensure that they remain a priority during any redesign or improvement process.

Overall, I am grateful for your feedback and will take it into consideration as I work to make my automatic pet feeder even better. Please don't hesitate to reach out if you have any further suggestions or comments.

Redacted for  
privacy.

# Indian & Hindu/Sindhi patterns.

*These are patterns that are relating in some way to either hindu or indian/south asia culture. I have tried to use some I am familiar with as coming from a hindu background myself, but some are referenced off google. I should contact the client to see if there is anything they specifically want.*



- 1) Is supposed to be like a lotus flower, which is commonly found around india in water, it's pinky-red and represents beauty
- 2) The watermelon is a food commonly eaten in india! It is grown all over the country, being cultivated as early as the 9th century! They are synonymous with the hot landscape there, as well.
- 3) The dog barking has nothing to do with india, although you could argue that dogs are very popular with pets in india at a stretch
- 4) This design is supposed to be representative of a random, nondescript wall in india scribbled with some abstract bricks, cobbled together to create an intricate, lovely looking wall, blocking the hot beating sun India is known for, sheltering the people with shade.
- 5) + 6 Is a "Om" symbol. Initially I decided to google what the meaning of it meant but nothing came up, so I took to my indian parents and rang them, apparently it is a big representation of the universe, as it's spoken before every prayer and heavily associated with hinduism

# Electronic Equipment // Raspberry PI Stuff



One of my mother's clients was kind enough to donate us some robotic parts randomly - which is helpful in creating the electronic side of things. He is a kind man who works in the field of electronics/engineering and in addition provided me with advice and extra help throughout the course of making the internals.

The specific list of ELECTRONIC parts I used are:

1. Raspberry Pi - 3B: £79 (at the time, v. inflated price atm)
2. USB-Mini Cable/Power cable - £3
3. Micro SD card with Raspbian OS install - free n/a
4. Raspberry PI 3.5" Screen - £40
5. Various USB Accessories - free n/a

However all of these were of course of free value for the one off time. In the future I should take into account the potential value of these items and therefore, considering their high price point, look for alternatives which could come at a lower cost if I wish to keep it at a sensible price yet retain a larger profit margin. In addition to this Raspberry Pis are considered semi-rare nowadays because the manufacturer for them had major troubles during the coronavirus lockdown due to supply chain issues!

Perhaps a better alternative would be an Arduino..?

**You can't buy a Raspberry Pi right now**

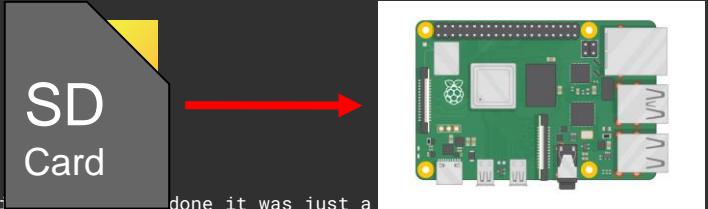
October 3, 2022

...or at least, not without a *lot* of patience or a fat wallet.

Source: <https://www.jeffgeerling.com/blog/2022/you-can't-buy-raspberry-pi-right-now>

# Development of Software

A kind soul was nice enough to have already made a program similar to something I wanted, and even better made it open source (no copyright, free to use by all etc.), which made it very easy to integrate into my solution. All I needed to was essentially install a copy of Raspberry PI OS onto it. The thing I am installing it onto is a raspberry Pi. It is an extremely power microcomputer of which is extremely cheap and is used for a wide variety of things. For instance they have quite a few onboard the International Space Station (ISS)



After this, I did some minor modifications to the code and then it was just a matter of putting it all together.

I did have to install a script from github which has the entire code backend on it. It's based on the Raspberry Pi OS mentioned earlier so practically the only thing I had to change was the servo, which is controlled by short bursts of electrical impulses to turn it either left or right a set amount, helpful to move a set amount of food past it!

<https://github.com/peckrob/petfeedd> is this github code repository. You may have a look at the inner workings through this link although it seem daunting at first.

The only other issue is figuring out if having a cable leading to the AC socket to the product is a good idea. Luckily they have a dog which typically don't bite through those. If I place it close to the outlet or use a secure braided cable this risk is drastically reduced. Another possibility would be to use a power bank that runs inside the bottom half. This wouldn't be a too far fetched idea in all honesty as I could just wire the charger for the battery out where the wall adapter would be.



# Material Research // METALS



Aluminium is a pure metal known for its lightweight and malleable properties and capabilities. It's used in a huge variety of products including cans, foils, kitchen utensils, window frames, beer kegs and aeroplane parts. It is a common metal hence why is it widely used, and it is naturally corrosion resistant as well as impermeable and recyclable (i.e: the four R's)



Steel is regarded as the world's most important engineering and construction material - it is used in almost everything ranging from modern architecture in buildings to tools which people depend on as well as heavy machinery. Due to its high demand, it's widely produced by many places around the world and comes in many different stock forms (shown on the left), and variants like High-Carbon steel, and consists of mainly iron and carbon in differing formulas for different purposes suited for a job. For an example, high carbon steel is considered very strong but also brittle, prone to shattering, and used in tools like files for metal for example while low carbon steel has been used due to its ductility and the fact that it is highly formable, making it a popular choice for car manufacturers



Stainless steel is similar to regular other steel in the regard that like all other kinds of steel, stainless steel is made primarily from iron and carbon in a two-step process. What makes stainless steel different, however, is the addition of chromium and other alloying elements such as nickel to create a corrosion-resistant product. This may be more suited to outdoor products or ones involving staining food (like mine, possibly)

# Material Research // WOODS



Oak wood is a classic and an easily recognizable wood. It's an iconic choice backed by many years of being the preferred choice of wood by many tradesmen. This is due to it being a time tested wood - an extremely durable hardwood with a beautiful natural finish. I was enough to source some from the school as part of the roof and internal food/electronic divider



Beech is a hard, yet bendable and easily split with a straight grain, the timber is tough and heavy, which makes it hard to use with hand tools. It is widely used for joinery and carpentry engineering purposes, such as for carcase construction and furniture framing. Although rarely used for aesthetic purposes, it does heavily feature in the framing and interior of some forms of architecture such as chalets and log houses.

Beechwood is excellent for structural woodwork and wears well. However, this does not mean durable: once cut, beech cannot resist outdoor elements or changes in moisture. This makes it unsuitable for outdoor and external use without a varnish or layer of protective coating



While pine wood is softer than hardwood varieties, it offers a good deal of stiffness, strength and shock resistance. Pine wood is also more resistant to shrinking and swelling, however it does come with downsides. It is often presumed as being weak due to its cheapness (mainly because of its fast growing rate) and the fact it is a softwood. While of course hardwoods will always been infinitely more sturdy, this makes softwoods like pine more better suited in comparison for handworking like manual tools and special processes like bending (curves being a prominent part of a few of my first designs for safety aspects)

# Material decisions

Over the course of the project I knew what shape I wanted - tall and vertical with rounded corners. Initially I was going to get into contact with a metal/steel supplier or go to a local store like BnQ or Wickes however I eventually decided with the help of one of my enthusiastic teachers that perhaps a different thing. 3D printing. This was fine as I had an Autodesk generated model I created in CAD. More on this on other slides.

When deciding between ABS and PLA for 3D printing, it's important to consider the specific application and properties required for the final product. ABS plastic is known for its strength, durability, and high-temperature resistance, making it a popular choice for industrial parts and automotive components. However, it is also more difficult to print with due to its tendency to warp and crack during the printing process. PLA, on the other hand, is a more user-friendly option that is easier to print and produces less warping, but it is not as strong or temperature-resistant as ABS.

When considering the use of ABS plastic as opposed to PLA for printing the shell of an automatic pet feeder, there are a few factors to consider. Since the shell will likely be exposed to some wear and tear, ABS plastic may be a better choice due to its strength and durability. Additionally, if the feeder will be used outdoors or in a location with varying temperatures, ABS may also be a better option due to its ability to withstand higher temperatures. However, it's important to note that printing with ABS can be more difficult and may require a heated build plate and enclosure to prevent warping and cracking.

The other durability related concern was regarding the flimsy plastic sheeting. While initially during the design process I settled on clear acrylic which would be for the most part completely solid with almost no bend to it.

This was fine initially, as the first design had a place I could horizontally slot in the acrylic if I bent it on a line bender, and all would have been well and secure and practically impenetrable by any things, sharp or blunt (like a dog's paws or claws!), and would slide in perfectly alongside the However, when the design changed to the diagonally centered one I have now it, it would be practically impossible to insert it as it'd require a slight amount of flexibility, something acrylic is NOT.



So my teacher suggested that instead, I could use some of his PVC clear plastic roll. The PVC plastic, or Polyvinyl chloride, is the "world's third-most widely produced synthetic polymer of plastic". It comes in two basic forms, either flexible like how you can see on the left or a rigid, solid piece. I opted for the first one due to the shape of my product it was practically impossible to fit into the ridges otherwise. I had to readjust my Autodesk design to make the tolerance in this gap a slight amount littler so it wouldn't budge at all. It's also a good thing to have as opposed to solid, opaque plastic for the reason that the only can

Another main reason why I chose ABS plastic was also because it is BPA FREE, a crucial thing when you are handling food. If either the plastic or divider had BPA on it, it could and probably would end up rubbing off into the food, and when Nester the dog ingests that food it can only lead to bad things happening to his poor stomach and health.

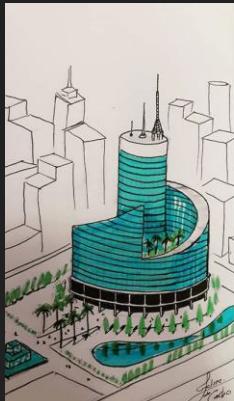
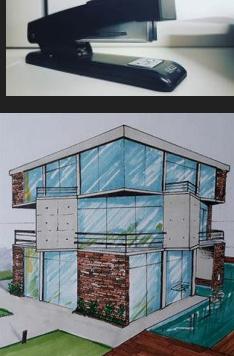
So since ABS is BPA Free, this makes it a completely appropriate choice. Alongside all of the other benefits it brings, with the minor drawback of having to be printed at a marginally higher temperature, and being less malleable for more complex shapes (which, does not apply to us as we have a very primitive basic shell), then it is a obvious no brainer to go for this massively beneficial material! It's a common cheap choice and it suits us well.



# Architecture/Artist reference

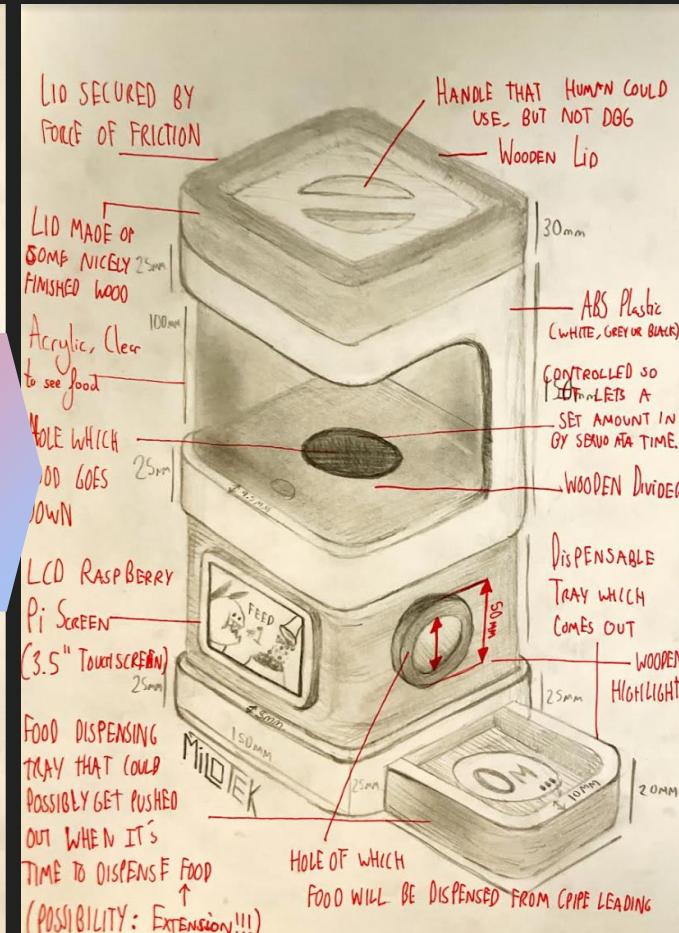
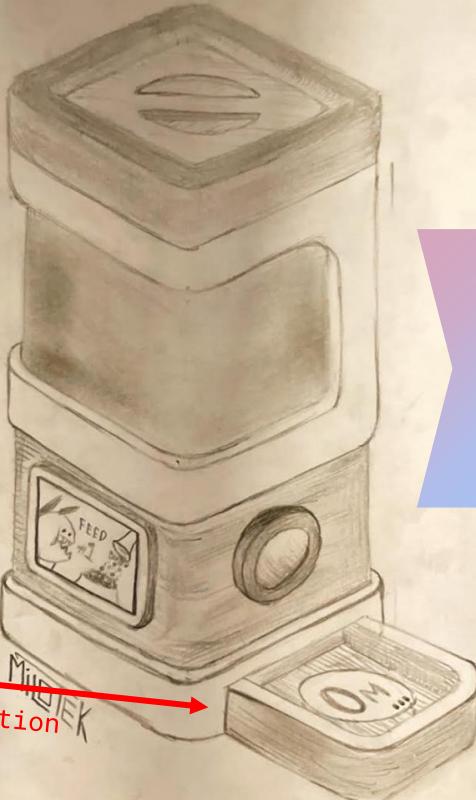
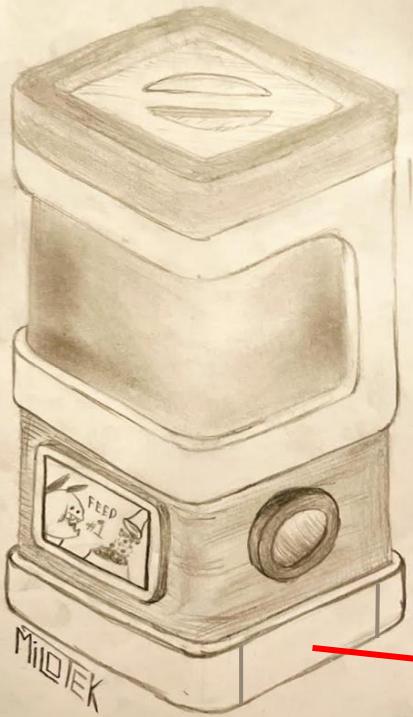
While some artists hunt for inspiration in strange locations, others make the most of their surroundings. Felipe de Castro is a Brazilian architect, urban planner, construction expert, and art enthusiast who creates extraordinary architectural designs out of commonplace items, locations, and cuisines. In his irrational imagination, a face mask becomes a hospital, a microphone a hotel, a sandwich an unusually shaped structure, and a stamp an office block.

Since he was a little child, the Rio de Janeiro-based artist, 33, has enjoyed sketching, and today he instructs professionals and students in perspective drawing techniques. Since he was little, he has had a highly vivid imagination and used to envision everyday objects in various scenarios, but he only started bringing these ideas to life in 2013, when he started drawing and sketching.



# Final Design Sketches

## Annotated



# Autodesk development stages

v1

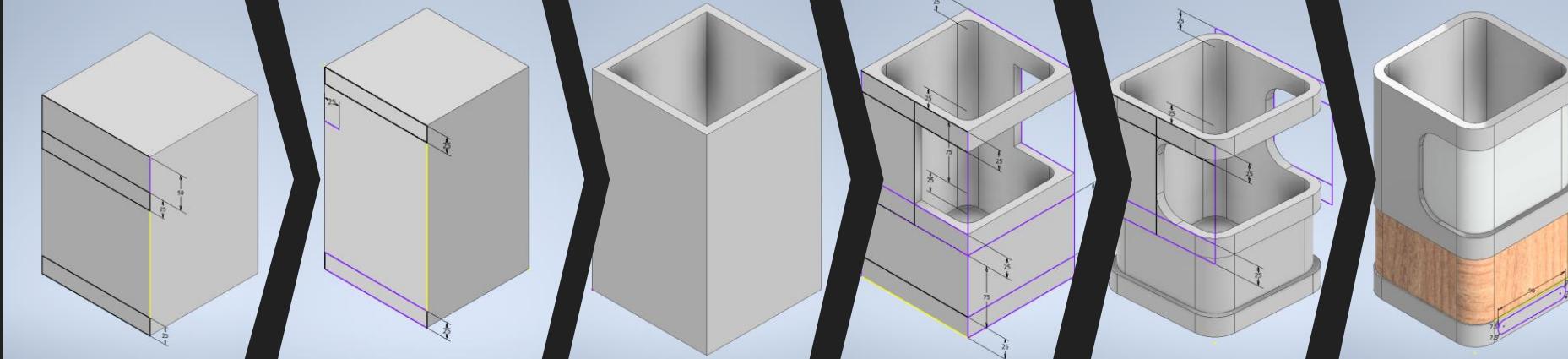
v2

v3

v4

v5  
(lost v6)

v7



This model is extremely basic and in different proportions - it is a primitive start but it helps to establish a feel. After this point I elected for a model made of cardboard to help get a better feel of proportions and dimensions, albeit on a ½ scale (1:2).

This model in comparison is not much different from the first, in the sense that it's just another cuboid but with different proportions! However that is just the main difference and it really shows. This one stands tall and is more taller as opposed to less wide - increasing the storage capacity of food which is always a good thing!

Now here you can see a basic hollow hole - arguably not much but you could say it was a step in the right direction after I had experimented with many other designs, finally settling on a hollow one, but with a solid base at the end. This was almost like the basis - the starting point.

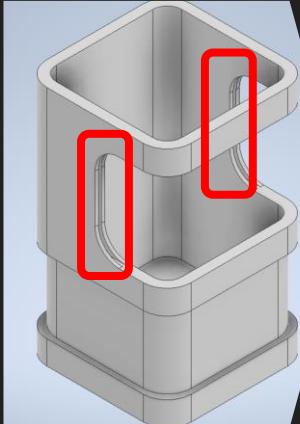
Now the model is starting to take shape. After drawing the final design (previous slide) I essentially modelled it off of that

At this point I filleted the corners as you don't want to the dog to injure itself say if it runs into it. In addition to a safety purpose it also added aesthetically to the build as curves are always a nice touch to any build.

This was initially supposed to be the "definitive" design, hence the shading and materials selected. You can find more

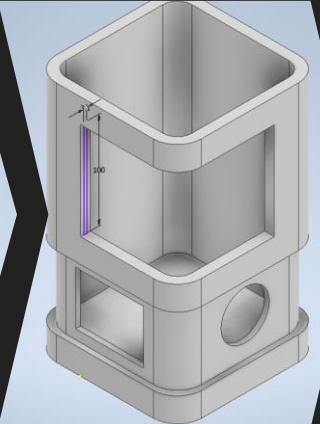
# Autodesk development stages

v8

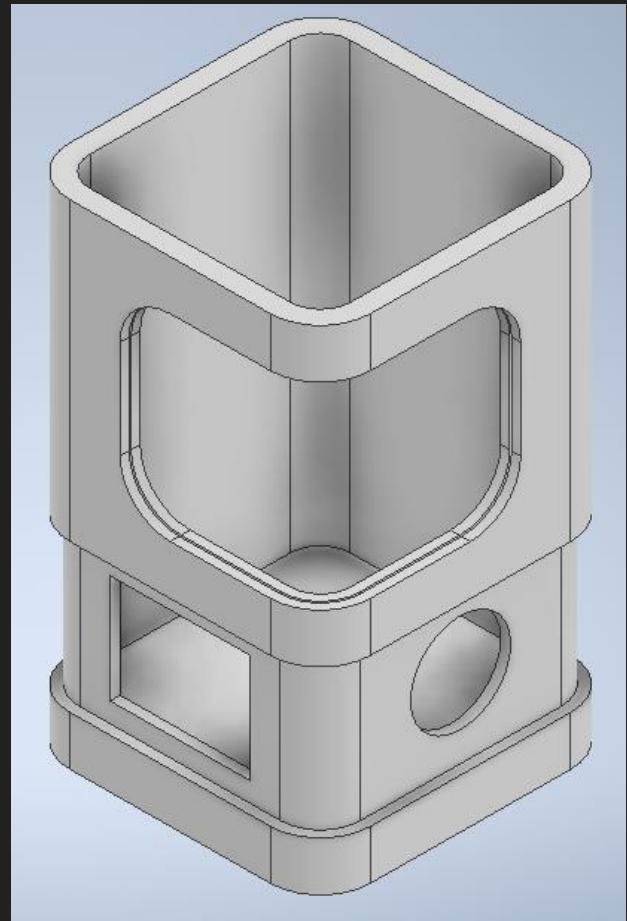


This was supposed to be the final 3d printable design, without the looks so only the section meant to be printed/made of plastic. Note the added ridges to allow a piece of clear acrylic to slot in. This is for a

v9



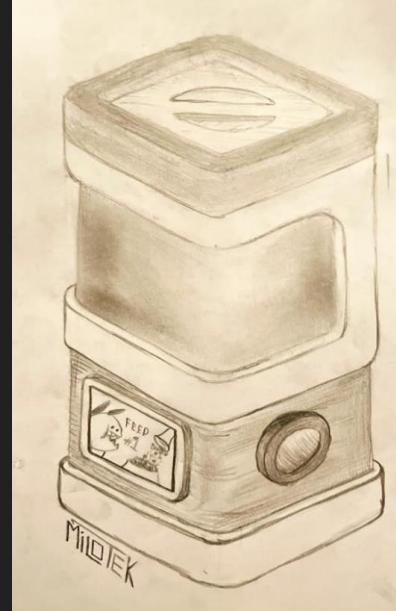
This model in comparison is one not too unfamiliar but it's also a completely new design



Final Product!

# Old “Final” design.

This design is something at least similar to a final design, and includes textures and shading to reflect a real world thing. I did this to both have a nice presentation for my client as well as to have a nice general idea of what the completed thing would look like by the end, allowing me to visualize how it would appear for both me and the client, and also my teachers to show them what I was trying to achieve. This general idea wasn't perfect but by making sure it was physically feasible to create as a product and fully functional, proportionate, looks aesthetically pleasing and appropriate for a dog etc. it helped me throughout the design process, as I had something to base all my ideas off of. This gave me a playground of sorts, a thing to experiment with and make questionable design choices that wouldn't normally be reversible on say, a real world model, in order to gather unusual ideas I wouldn't have otherwise dared of doing.

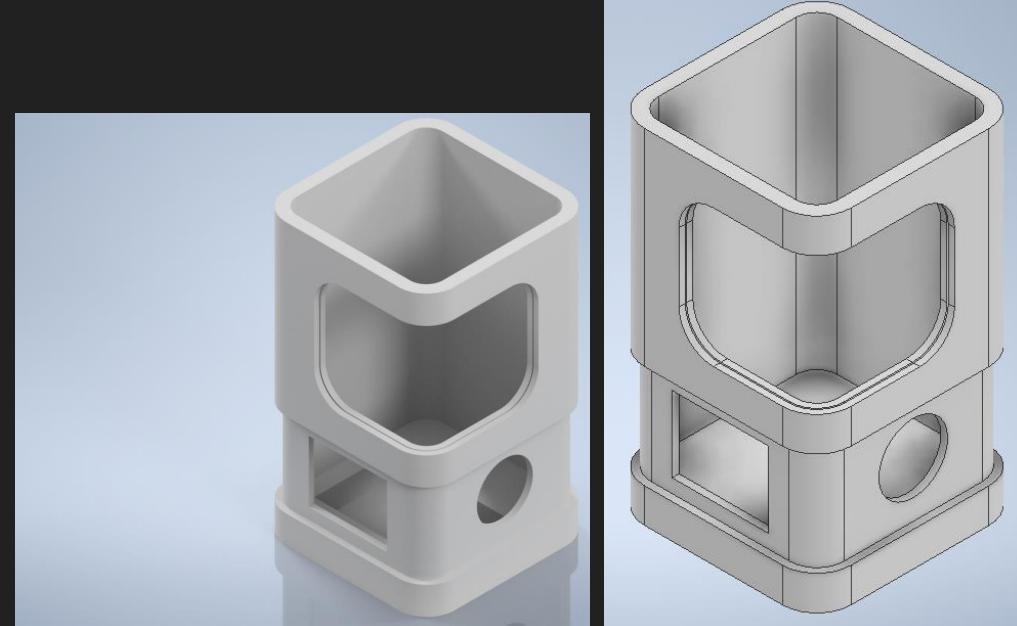


# HOWEVER! - Final iteration of design

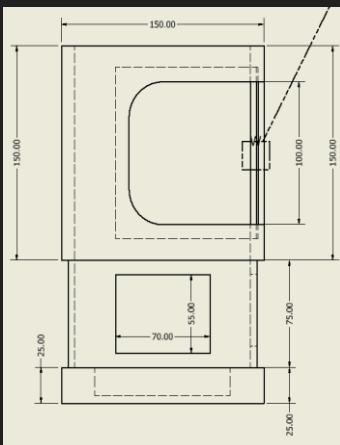
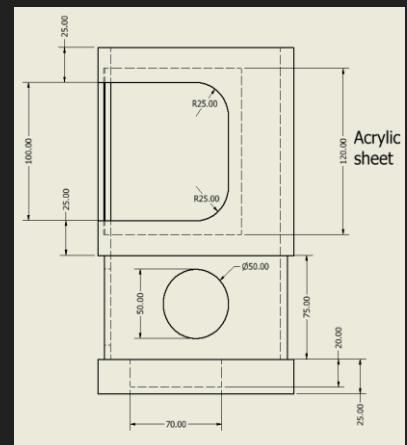
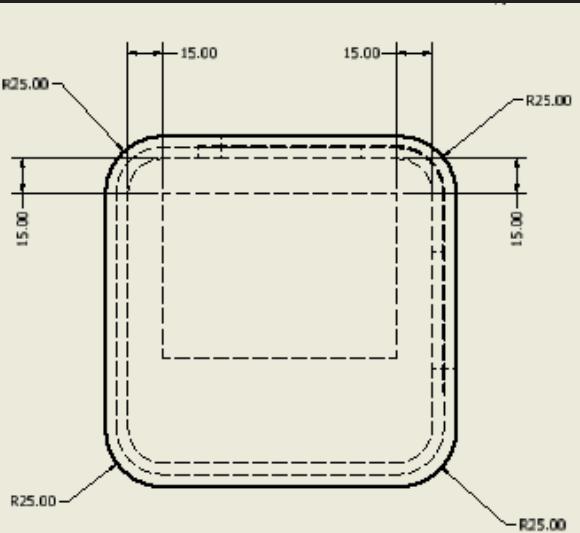
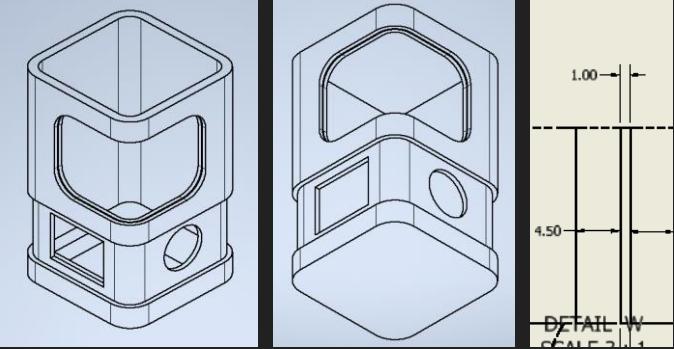
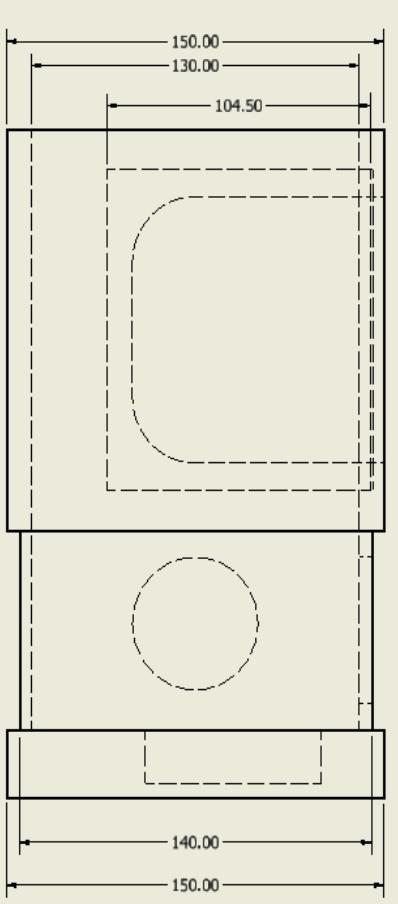
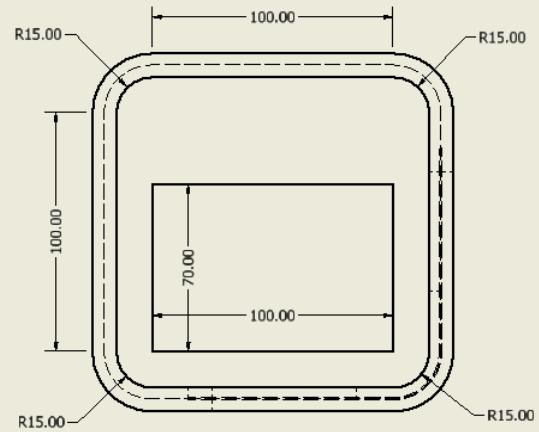
This final design was created after the realization there was no output for the food - the rectangular hole was for wiring! Because of this I decided to overhaul the front and see if there was a better way. This ended up become a "diagonal" front, which still has a similar effect but vastly different aesthetics and functionality - now it would have room for both the feeder hole and rectangular screen display, but still remain "central". On top of this, it was not hard to modify the pre existing design to be like this. The slots for the window had to be reimagined though and the material changed from the nicely rendered and textured wood and aluminium shine and clear acrylic back to default, although perhaps this was for the better, as it made it easier to 3d print at the cost of looking a little less polished and realistic, which would be better to show my clients

The diagonal design was created by editing an earlier version of the project - yet another reason I thank my earlier self for saving each iteration of the design, on top of being able to think back and reflect on previous versions.

I would say I prefer this over the starting design, even though I made nice renders with HQ materials/reflections, and this one was made quite quickly in comparison, I still prefer it. In retrospect I would probably have to say the design makes more sense and also a little bit more "organic" feeling. It's no longer a perfectly symmetrical pet feeder, it feels more human and friendly in design in a way. It displays itself as more nicer , one side for x, the other for y in a clearly defined manner - no mess and abundance of ambition - it just works!



# Final Design Drawing



# 3D printing process

- The model designed in AutoDesk Inventor 2022 was export as an .STL file which most modern 3d printers understand. It was not an easy process! First we opted to try the fastest 3d printer in school, and we found due to its closed design we would need to orientate the design to fit the restrictive dimensions.
- In the end we managed to barely fit it in, by rotating it to be on its side as opposed to vertical, but this would pose more problems than it solved. For one, it had an estimated time of 53~ hours total! And this was on the fast printer, and although this was an estimate it was likely to be true.
- Also this ended up making it malfunction 3x in total, after two attempts on the main printer with black ABS plastic, we switched to another (slower) printer, and yet again it failed! This was indeed frustrating but we chose to take a different approach rather than boil it down to "computer error" and try once again.
- Finally, by making the decision to cut the design into two segments (top and bottom parts) it managed to successfully print in two halves which could be stacked on top of each other to achieve the same look. In addition, this design was even better as during the electronic wiring/production process it was easier to access the bottom halve (as opposed to sticking your hand all the way through). On top of all this the notches / stacked design was made so that it wouldn't slip out of place when stacked, thanks to some notches, and in addition we could easily slot in the thin plastic sheet/window because the underside had a finely placed thin slot for it.
- All we would do to do to permanently seal it is a bit of superglue, although we should consider if we *want* complete security to maybe have an interlocking mechanism to make it easier for us to work with. This would provide both inner security, preventing the top half from detaching from the bottom yet making it accessible to those who needed to. Even screws would work, but ABS plastic and screws tend to not mix well as the inner structure of ABS plastic is a hollow diagonal, diamond mesh.
- We opted to go with black ABS plastic initially as it's considered structurally superior to PLA plastic. For an example some real world products consist almost entirely of ABS plastic! Namely LEGO bricks for an example. In addition, Thanks to its lower printing temperature, PLA is easier to print with and less likely to warp (when properly cooled). You can use PLA to print sharper corners and finer features than with ABS, which is one advantage, but in all other areas/applications ABS would regardless be the sensible choice. Tough and resistant to impact to a certain point, ABS has superior mechanical properties to PLA while being lighter and more durable.
- However, the trade-off is that it's harder to print with and often requires higher temperatures for effective printing. The material can deflect heat more effectively than PLA, but it's absolutely not known for total heat resistance.
- After three failed attempts we finally got it to work! A lengthy process however worth it as it came out beautifully, as you'll see on the next slide :)



# 3D printing process

This is a video (well, .GIF) of the 3d printing process, where you can see in detail the inside of one of our earlier attempts - in fact our first - as well as how the printer works.

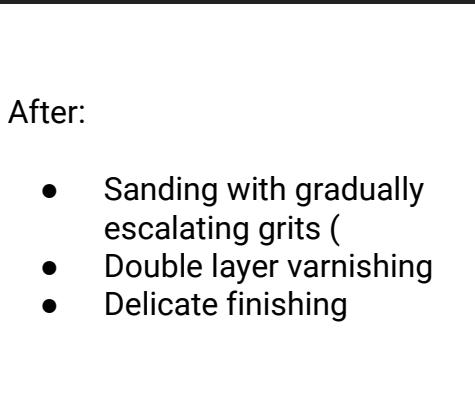
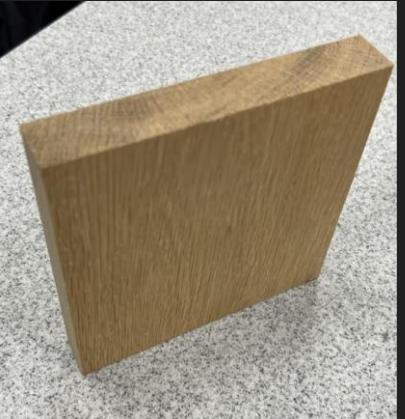
The plastic we used (ABS) needs a higher temperature to melt than the common (but cheaper) alternative, at the benefit of being more strong. This is why there is a roof on the printer, to help insulate the plastic and keep it malleable for the printer.





# 3D Printed Product





The wood is 130x130mm width square, with a depth of 18mm. It is pure oak and fits within the divided to screen height perfectly coincidentally!



# Wooden lid - Oak or not?



The wood here is oak wood which, as I mentioned before is fairly rare due to it being highly sought after for high-end furniture products. This piece alone is worth approx. £1.40!

To clarify why it's so expensive, it's because oak wood is an extremely popular and widely used wood material in furniture and home decor products due to its natural beauty, durability, and strength. It has a distinctive grain pattern and a warm, rich color that can add a touch of elegance and sophistication to any product.

In the case of an automated pet feeder, the use of oak wood can enhance the aesthetic appeal of the product and provide a premium look and feel that Shalinie and Tom would've appreciated. Oak wood can also offer a strong durability, making it a suitable choice for a product that will be used frequently and exposed to wear and tear - you know - like a pet feeder!

However, it is key I note that the use of oak wood may increase the production cost of the whole thing, which could affect the overall pricing - I still want to gain a decent profit right?

And also, there may be cheaper wood alternatives that offer similar aesthetics, like as pine or birch wood, which could be considered as well.

Ultimately, the decision to use oak wood or a cheaper alternative in an automated pet feeder product would depend on various factors, including the target market, production cost, and overall product design and functionality. Conducting market research and assessing the cost-benefit analysis would be crucial in determining the most appropriate wood material to use in the product - which is something I'd definitely benefit from if I were to begin mass manufacturing.'

On the left here you can see a very pretty fully finished piece of oak wood with all the proper sanding in ascending grades, double coated varnish, all that jazz along with some nice lighting for no apparent reason. It looks cool and I wanted to show how it went from almost dull and bland to shiny and reflective. A definite upgrade for sure both in terms of aesthetics and functionality, meaning it should be defensive on the outside layer.

# Client Feedback at this point

Moreover on client feedback at this stage they seemed very impressed with how far I had taken the products, expressing satisfaction at the current stage, appreciative of the intricate details and overall design. In particular they seemed to appreciate the simplicity of it all - the ease of use seemed to be a great selling point, as they are "not very technological people", to quote them themselves.

They seemed to like the fact that they

They spoke on how Nester would be happy to receive it, especially since it was food related. However, they had some questions regarding the safety once again. They said how they were worried about if it could cause harm to the dog, as if Nester got inside it would potentially mean disaster. I told them that if that in the unlikely case it did happen because the ABS plastic is pretty strong, then it would pose quite little risk as the electronics are set up internally so that they were extremely hard to piece apart unless you knew what you were doing. It's setup in a way so the electronics essentially encase each other, like a sandwich. Plus, even if it still happened it would be extremely unlikely that the voltage running across the board would be enough to seriously harm the dog. You can run your finger along the surface of the chips just fine. They have electronics all over their house so it's same to assume Nester isn't one partial to chomping down on cables any time soon.

Their other durability related concern was regarding the flimsy plastic sheeting. While Initially during the design process I settled on clear acrylic which would be for the most part completely solid with almost no bend to it.

This was fine initially, as the first design had a place I could horizontally slot in the acrylic if I bent it on a **line bender**, and all would have been well and secure and practically impenetrable by any things, sharp or blunt (like a dog's paws or claws!)

However, when the design changed to the diagonally centered one I have now it became questionable how I was going to fit it in!

So instead I opted for the PVC you can see on the right. It is a nice mix between acrylic's strength while retaining a bendability to fit it in.

It is very strong!



# Completed exterior (minus internals)

The completed exterior looks really nice and even better than I envisioned it! I think the wood highlights really bring out a nice textured feel and look within it. I'm very proud of how the whole thing turned out and it looks to be structurally complete minus the





Completed exterior pictures

# Client Feedback at this point

Speaking to the clients at a later point they said they liked how the project was coming along!

They liked the overall look of the design but expressed some concern for the dog's health. For an example the varnish, worried about the possibility it

Understandably this is a legitimate concern, so afterwards I went to my teacher enquiring about the varnish that we use at school. He replied with mentioning that it should be non toxic if left out. If it was dried/aired for about a week then it would be practically impossible for it to contaminate anything, so it shouldn't pose any risk at all.

They seemed to love the design! They said it was an amazing feat that someone like me could create something so amazing in such a short amount of time and seemed very impressed by my "determination and perseverance" with the electronics side of things. They did comment on how they liked the looks and thought about where they would place it, before deciding next to Nester's bed underneath the stairs.

Redacted for privacy.

# *Design Specification - End Product Checklist*

No.	Category	Requirement Statement	Compliance
1	Capacity	The feeder shall have sufficient food storage capacity for the desired feeding schedule.	Yes
2	Portion Control	The feeder shall permit customisable portion sizes to accommodate different dog breeds.	Yes
3	Feeding Schedule	The feeder shall provide programmable feeding times with the flexibility to adjust.	Yes
4	Food Compatibility	The feeder shall be compatible with various types of dog food	Yes
5	Power Source	The feeder shall have a reliable power source with backup power options	Yes
6	Durability	The feeder shall be made from high-quality, durable materials that can withstand daily use.	Yes
7	Cleanliness	The feeder shall be easy to clean and maintain with removable components	Yes
8	Tamper-Proof	The feeder shall have a tamper-proof design to prevent dogs from accessing food storage.	Yes
9	Voice Recording	The feeder shall include an optional voice recording feature for personalised messages.	Yes
10	Connectivity	The feeder shall offer remote control and monitoring connectivity through a smartphone app.	Future feature
11	Low Food Indicator	The feeder shall have a sensor to alert the owner when the food storage is running low.	Future feature
12	Safety Features	The feeder shall incorporate safety features such as automatic shut off and chew-resistant power cords.	Yes
13	Aesthetics	The feeder shall have a sleek and modern design that complements most home decor	Yes
14	Size and Weight	The feeder shall be compact and lightweight for easy moving and storage	Yes

# *Manufacturing Specification*

I present to you a detailed, formal, and official manufacturing specification for this innovative product. This specification aims to outline the critical aspects of the product's design and production, focusing on size, cost, safety, customer satisfaction, environmental impact, aesthetic, material, function, durability, timescale, and overall quality.

## **Size:**

The product shall have a compact and space-efficient design, with dimensions optimized for placement in various home environments. The feeder shall accommodate pets of different sizes, allowing them to access their food comfortably. The product's size specifications shall ensure that it remains unobtrusive while maintaining the necessary capacity for food storage and dispensing.

## **Customer choice:**

The customer should be allowed the choice of plastic colour. While PVC comes in many different colours, and it would be possible to have them all as options, it would be more appropriate to allow them to pick from a couple or few pre-set colours. I think a few colours should be pickable from a palette of mainly grey colors.

Another design decision we should allow the customer to make is to define the times it should dispense at. The prototype currently needs to be manually configured by a person who knows how to change those, which is me. The software I use does have a setting enabling both feeding editing times via a website, as well as a manual feeding option triggered by either *email message* or *text message*. I should be able to do this in the future, but it would require an extended knowledge of networks, something I may have by the time I complete my GCSEs, or A Levels.

## **Cost:**

The manufacturing cost of the product shall be optimized to balance affordability with quality. The product shall offer advanced features and reliable performance while maintaining a competitive price point compared to other automated pet feeders on the market. This approach will enable pet owners to invest in a dependable and efficient feeding solution without incurring excessive costs. We should pick an appropriate price point which offers us both profit and a good value price for the customer to entice them into buying it.

## **Safety:**

Safety shall be a top priority throughout the design and manufacturing process of the product. All materials used in its construction shall be food-grade and BPA-free to ensure the health and well-being of pets consuming food from the device. The product shall also feature a secure locking mechanism to prevent pets from accessing the food reservoir, further promoting their safety. Safety should be a vital important aspect to be considered as electronic parts could serve as a very, very dangerous, even fatal risk to any pets who might accidentally break into that area! This isn't an unlikely situation as well considering the entire thing houses food on display for the dog to see!

# *Manufacturing Specification*

## **Customer Satisfaction:**

The product shall be designed with a focus on customer satisfaction, ensuring ease of use, reliability, and customizable feeding options. The feeder shall cater to the needs of pets and their owners, and the manufacturing process shall be continuously improved based on customer feedback and experiences. This commitment to customer satisfaction shall guide the product's development and production.

## **Environmental Impact:**

The environmental impact of the product shall be minimized throughout its development and manufacturing. The feeder's energy-efficient design shall reduce electricity consumption, and its durable materials and construction shall contribute to its longevity, reducing waste. The product shall promote responsible pet ownership by helping owners manage their pets' food portions, resulting in less food waste.

## **Aesthetic:**

The aesthetic of the product shall feature a sleek and modern design, characterized by clean lines and a minimalist matte white finish. This design shall ensure that the feeder blends seamlessly with a variety of home decor styles, making it an attractive addition to any living space. Aesthetically I decided that either black OR white plastic with oak wood highlights would look very nice in contrast each other, and my clients felt the same way. A modernistic, simplistic approach was taken here to make a pleasant looking model as would fit in nicely with their renovated home they have!

## **Material:**

The materials used in the construction of the product shall be chosen for their durability, safety, and ease of cleaning. High-quality, food-grade plastic shall be used, ensuring that it is BPA-free and safe for pets consuming food from the device. Additionally, the product shall incorporate removable components for convenient cleaning and maintenance.

In this case the outer shell was 3d printed using ABS plastic, as it is a relatively cheap material yet incredibly versatile in use. This makes it suitable for us as we want to keep costs down but build a complex product. The colour doesn't matter to an extent - however it would be preferable to have it in a "sensible" colour for your client. Mine wanted black or white colouring. This contrasts well with the nice oak wood finish I picked; however do note that a cheaper alternative may be used, as this choice was completely for an aesthetic reason - admittedly it is nice however expensive, and was only used for the reason it was a one off.

If this is to be mass produced surely cheaper materials could be used, quicker processed picked etc., because 3D printing is admittedly slow, albeit precise. In reality, a more suitable method like blow moulding would be used with PVC plastic (polyvinyl chloride), which is appropriate because of the hollow shell shape of the plastic housing.

Oak wood was chosen for a nice, personalized touch. If we are making a "luxury" product its use could be considered, however it would assumably be infinitely cheaper to use a cheaper wood, especially considering the internal divider is barely seen! It doesn't even have to be made out of wood, it could be yet another part of the plastic shell

# *Manufacturing Specification*

## **Function:**

The primary function of the product is to provide pets with a consistent and reliable feeding schedule. The device shall feature an easy-to-use LCD screen for programming meal times and portion sizes, as well as a built-in voice recorder for personalized mealtime messages. The product shall also incorporate a low-food alarm system to notify owners when it is time to refill the food storage.

## **Durability:**

The product shall be designed and manufactured to withstand the rigors of daily use, ensuring a long service life. Its construction shall utilize robust materials resistant to wear and tear, and its mechanical components shall be engineered for consistent performance. The product's durability shall contribute to its overall value and appeal to pet owners.

## **Timescale:**

The manufacturing process of the product shall be streamlined to ensure efficient production and timely delivery to customers. This includes optimizing the supply chain for materials, implementing quality control measures at all stages of production, and coordinating logistics for shipping and distribution. The timescale shall be managed to meet market demand and maintain customer satisfaction.

## **Quality of product:**

The quality of the product as a whole can be attested to by my clients, whom were very happy with the overall feel, look and build quality of it. As for me I tried to use only the highest quality materials for the prototype however some corners may be cut. It doesn't have to be sanded to perfection for example.

# Parts price list

Part	Dimensions	Material	Price
Plastic Shell	150x250, hollow shell with 10mm thickness	ABS Plastic	About £26.45
Divider	130x130x18	Oak Wood	£0.90 approx.
Lid	150x150x30mm + 130x130x10mm combined	Oak Wood	£1.95 approx.
Electronics (sum)	N/A	N/A	£75

I would probably charge about £150 for the completed product with all the features and such

Sum of all: £104.30

Keep in mind prices are high because of supply chain issues especially with electronics

# Peer Review (Joshua Williams)

I like the geometric design - because I'm massive fan of modern designs in general. The finished product looks sleek and the colours work well together. I think that the weight of the product could mean it gets knocked over, however this would depend on how heavy it is once the food is in it. I think that the product may be a bit small for the automatic dispensing to reach its full potential - if the feeder needs to be frequently refilled, the product loses some of its usefulness, and therefore the whole function of it is thrown into question right? On the positive side of things, the window is a very good way of being able to check food levels and I like how it appears to seamlessly fit into the design, a great feature that adds both aesthetics and functionality into the design. I do not know if the plastic used is recyclable, but the plastic is made from finite resources which is not too environmentally friendly, although the wood's biodegradability and renewability is good to see. I'd probably say however that, say I were the owner, I'd be worried about the risk of putting a live wire next to where a dog eats, and the electronics are not very environmentally friendly - finite and non recyclable assumably!

All in all however I'd say this is a great product, probably one of the most polished I have seen, and although it does have its flaws I'd argue that the intricacy of it all is very admirable in the ample time you had considering you had that 2 weeks off because of covid. I particularly admire your while ambitious goal of including electronics, perseverance throughout because I sure could not have pulled something like that off, even the design alone is particularly impressive!

As with everything in life, however, it could be improved. For me I'd prefer a different colour and although I do prefer the tactile feel of the PCB layers this could raise some concerns on the dog's side of things - what if it manages to break through? As I said before it could just be a silly unlikely thing that's uncommon to happen, but you should always plan for the worst when you manufacture a product like this on a large scale, otherwise you could potentially have a large lawsuit on your hands!

**To conclude, a brilliantly engineered product, but as with all there are definite areas you could improve Milo!**

Redacted for privacy

Joshua Williams is a good classmate & friend of mine who offered to peer review my work in exchange for me to review his.

Redacted for privacy.

# Evaluation

As the creator of the product, I am pleased to provide you with a comprehensive, formal evaluation of this innovative product. My ultimate goal has been to create a solution that caters to the needs of pets and their owners while maintaining a high level of quality and efficiency. In this evaluation, I will cover the following areas: size, cost, safety, customer satisfaction, environmental impact, aesthetic, material, function, durability, timescale, and quality of the product.

## Size:

The product has been designed with a compact and efficient size, ensuring it can be easily incorporated into various living spaces without occupying too much room. Its dimensions have been carefully chosen to optimize food storage capacity while remaining unobtrusive, which is a key consideration for pet owners with limited space in their homes.

## Cost:

In developing the product, I aimed to strike a balance between affordability and quality. The pricing has been carefully considered to provide a cost-effective solution for pet owners without compromising on the features and functionality they require to ensure the well-being of their pets.

## Safety:

Safety has been a paramount concern throughout the development of the product. The product has undergone rigorous testing to ensure that it adheres to the highest safety standards. Features such as a secure lid, a stable base, and a built-in timer guarantee that the feeder operates reliably and securely, preventing any potential hazards to pets or property.

# Evaluation

## Customer Satisfaction:

Customer satisfaction has been a top priority in the design and development process. I have actively sought and incorporated feedback from my clients, Tom and Shalini and even the dog himself Nester to ensure that the product meets their needs and preferences. The positive appraisals from them and feedback attest to the successful fulfilment of this goal.

## Environmental Impact:

In an effort to minimize the environmental impact of the product, I have carefully selected eco-friendly materials and employed energy-efficient manufacturing processes. The product is designed to have a low power consumption, which contributes to reducing its overall carbon footprint, taking in only a small amount of power as it's a microcomputer, the whole thing being powered solely off a raspberry pi – you could run it off a battery pack if needed!

## Aesthetic:

The product features a sleek, modern design that seamlessly blends with contemporary home decor. The minimalist aesthetic, characterized by clean lines and a matte white finish, ensures that the feeder will be a visually pleasing addition to any living space.

## Material:

The materials used in the construction of the product have been carefully chosen for their durability, safety, and sustainability. High-quality plastics have been utilized to provide a sturdy, lightweight, and easy-to-clean product that can withstand daily use and maintain its appearance over time.

# Evaluation

## Function:

The product has been designed to provide a seamless, reliable feeding experience for pets. Its user-friendly interface allows for easy programming of meal times and portion sizes, while its large storage capacity ensures that pets will be well-fed, even during extended absences of their owners. The mobile app and low-food alarm are additional features that enhance the functionality of the feeder further, in the future when I have time.

## Durability:

In designing the product, I have emphasized the importance of durability. The feeder is constructed with high-quality materials and has undergone extensive testing to ensure its ability to withstand long-term use without compromising performance or safety.

## Timescale:

Throughout the development process, I have tried to have been mindful of the need to bring the product to market in a timely manner. By employing iterative design I have managed to create multiple versions of the product on Autodesk as well as show how the product has developed as a prototype throughout this, eventually settling on a final design. By utilising iterative design I can look back on the versions which have failed, or even some things that were better on older or different designs ☺

## Quality:

The quality of the product is once again up to personal taste but I would say it is a somewhat high quality product, however I am biased. Although, if what my clients say is true, then they consider it a high end product which with a few more improvements could possibly be a commercial project!

# Product General Description / Selling Presentation / Advertisement

By Milo Tek Corp.

As a proud pet owner, I understand the need for an efficient, reliable, and convenient pet feeder to make our lives easier and to keep our furry friends happy and healthy. That's why I am excited to share my creation, the product, with you. Here is my evaluation of this smart pet feeder from my perspective as the creator, but also taking into consideration your needs and preferences.

## Design and Aesthetics:

The product features a sleek and modern design that will fit seamlessly into your home decor. Its minimalist appearance, with the matte white finish and clean lines, ensures it won't be an eyesore in your living space. The compact size of the feeder makes it easy to find a spot for it in your home without occupying too much space.

## Capacity and Portion Control:

The product has a generous food storage capacity of up to 3 liters, making it ideal for pet owners with multiple pets or those who want to ensure their pets have ample food supply while they're away. The portion control feature allows you to set the exact amount of food to be dispensed per meal, helping you maintain your pet's ideal weight and preventing overeating.

## Ease of Use:

The feeder is incredibly easy to set up and operate. With a user-friendly LCD screen, you can program meal times and portion sizes with just a few button presses. The lid of the storage container is designed for quick refilling, and the removable food tray makes cleaning a breeze. The only minor drawback is the lack of a mobile app for remote control and monitoring, which some pet owners may desire.

## Reliability:

The product is designed to ensure that your pet never misses a meal. Its high-quality construction and materials ensure that the feeder operates reliably and consistently. However, as with any electronic device, occasional maintenance may be required to ensure optimal performance.

## Smart Features:

The feeder comes with a built-in voice recorder that allows you to record a personalized message to be played at mealtime, creating a sense of comfort and familiarity for your pet. It also has a low-food alarm that notifies you when it's time to refill the food storage. However, the absence of Wi-Fi connectivity and a mobile app means that the product does not offer some of the smart features found in other models on the market.

Overall, the product is a good one. It offers a sleek design, large capacity, and excellent portion control. While it may lack some advanced smart features, its reliability and ease of use make it a fantastic choice for busy pet owners seeking a dependable and convenient solution to keep their pets fed and happy.

# Final Thoughts

All in all, I would say that the product was a general success, or at least a good step in the right direction. This is because given the deadlines I did not manage to complete the electronic side of things in time, so the functionality was a loss. Although it does function I haven't gotten around to fully implementing it inside of the product - I have things up and working fully however it's just a bit of general mess to put it on the inside of the entire pet feeder – yet that did not stop this whole journey being a learning experience. Never before have I used 3D printing for prototyping business like this, nor on such a grand scale; It's frankly a massive technological feat I can actually, feasibly do it as well!

I would say I really enjoyed the whole process, the making, coursework and electronics helped provide a mix of challenges I had to tackle along the way and I am actually quite impressed that I managed to do it all. If I can in the future set up the electronics (separate to the coursework) it will be proving to myself that I can indeed make something on a grander scale like this, and by myself, single handedly create a product that could one day be sold on a shelf! '

WWW:

- My ability to design in Autodesk which I feel I have drastically and greatly honed throughout the entire process, possible because I did work experience at an architecture place
- The whole design and colour scheme I am really proud of
- The 3D printing process. As in years back I used to 3d print with my dad and brother at home back when it was relatively new and gimmicky and now I see it is fully fleshed and a viable manufacturing process, especially for precise parts or one off prototypes to be made quickly and with high precision.

EBI:

- I made some curved veneer wood to go around the outside for a nicer finish
- I had a tray at the bottom that could slide out and food would be dispensed into it
- I spray painted the ABS plastic to the client's liking, however this could pose a possible risk

I am proud to have created the "Pawsome Automated Pet Feeder" for my GCSE Design and Technology coursework and my client is honoured too ☺