Oscar Holburn

Design Coursework NEA

Wallingford school: 62451

Candidate number: 2618

Rowing screen

A box with this colour outline is for CAD designs done my me.

A box with this colour outline is for opinion of primary users.

A box with this colour outline is for videos taken by me as evidence.

A box with this colour outline is for secondary research.

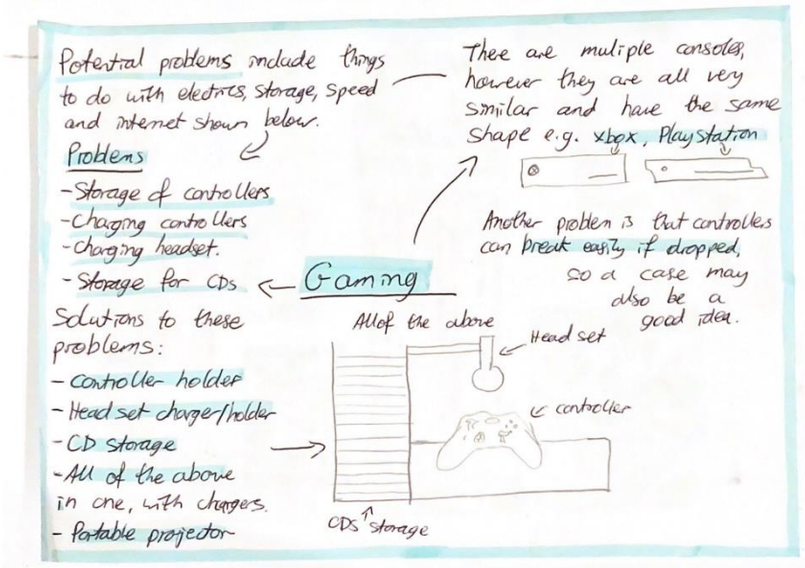
A box with this colour outline is for photos that I have taken of products.

This colour outline is for when I reach out to companies and organisations

A box with this colour outline is the next steps I will cover on the next page.

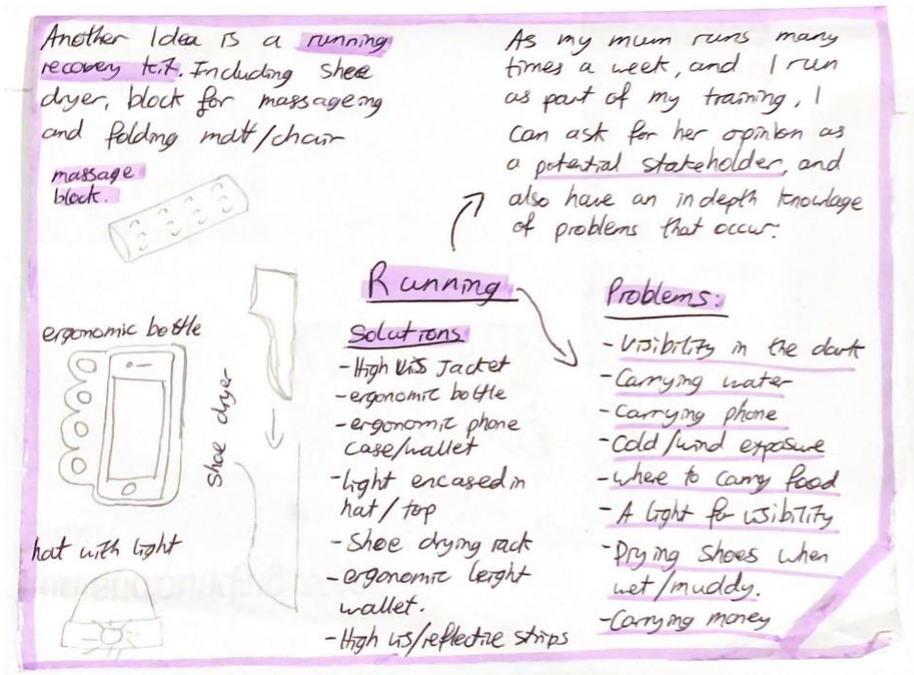
Investigation into context

In my OCR A-level product design NEA I was tasked with designing a product to solve a current issue that we have and experience in our everyday life. To start this I started to look at all of the issues I have in my everyday life, splitting it into 4 categories; rowing, running, gaming and cycling. Below I explore each of these options more and take into account the possible stakeholders opinions of these products and ideas.



Environmental issues

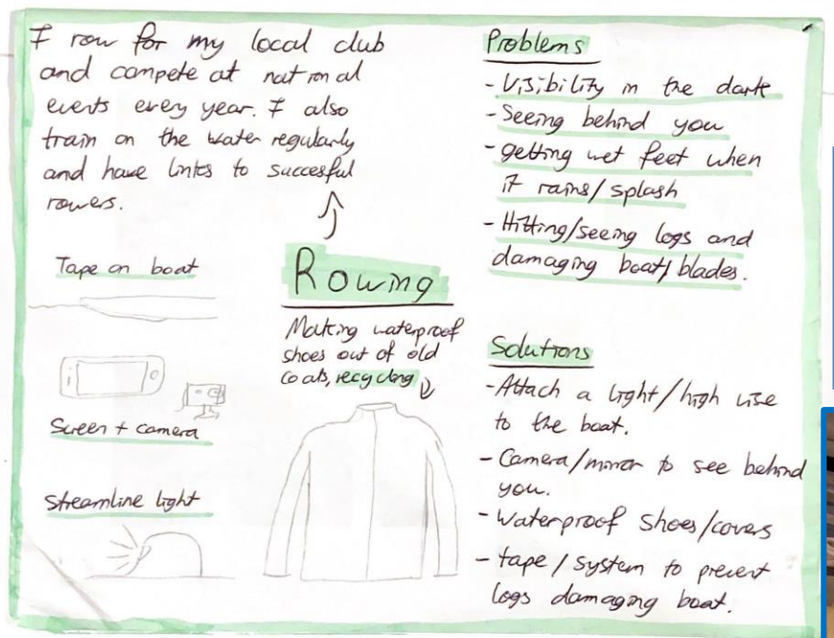
A major issue that I would include and take into account would be the environmental impact of the product I make. I would make the longevity as increased as possible to reduce the waste produced and mean that it I environmentally friendly as possible. This means I would not include planned obsolescence to my design. I could also use recycled materials e.g. shown in the rowing shoes in the rowing design.



Another problem to asses with the electrical products would be about electrocution if they get wet. As they would be used frequently in all weather, they would have to be safe to use in the rain and in wet conditions.

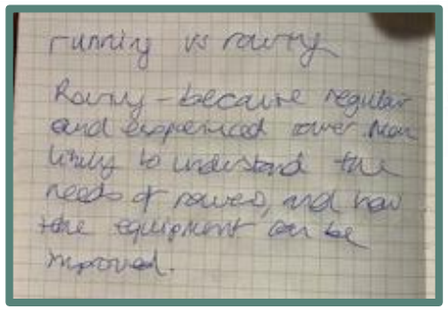
Problems I experience in everyday life.

Here are some of the items that I have found in everyday life, representing some of the problems that I occur.

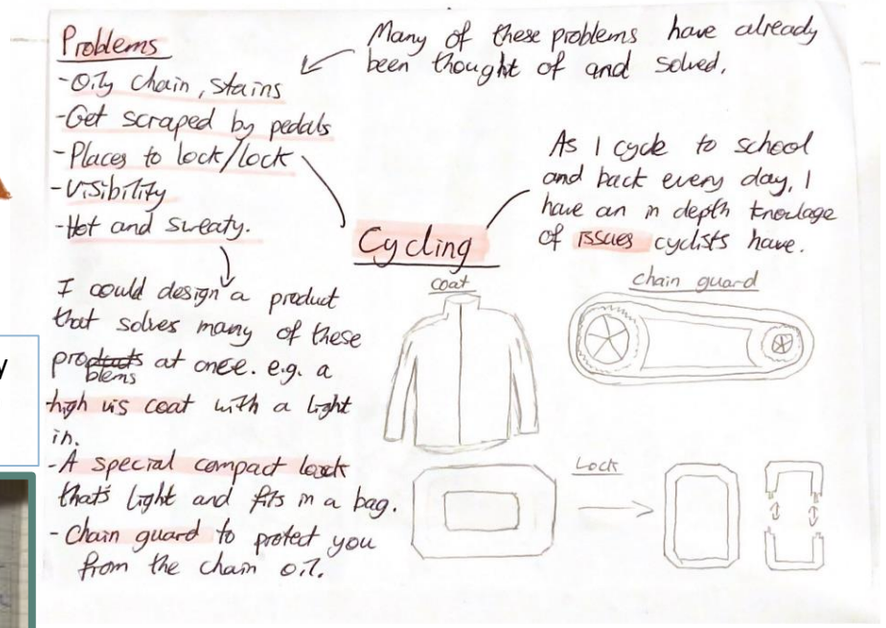


I spoke to my family about which project to develop, and as they would be a potential user to all of the products because they do similar activities, I have asked for their opinion on what to do.

In response I decided:
In response to this, I chose to look more into rowing than the other options. The photo below shows my mum writing down her opinion.



My family's opinion on my initial idea: 'Rowing- because you are a regular and experienced rower. You can easily understand the needs of the rowers and how the equipment can be improved.'



Conclusion

In conclusion, I have chosen to design an innovative product on rowing, as I believe I can complete a full analysis and develop the product to meet the users requirements.

On the next page I go into detail into the rowing section and expand on possible ideas.

Investigation into context

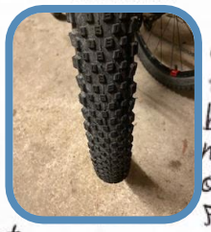
Out of the 4 sections I discussed on the previous slide, I chose to design and create a project on rowing as I thought this the most suitable and relevant to me. On this slide I will asses some possible designs that I could explore. I previously spoke about these on the fist page. As I row a lot of the time at the local club near my school, I thought to make a solution to some problems that I have. I spoke to my coaches and sculling partners and we decided on a few issues that need solving in the current rowing world and what would make rowing easier for us. The issues we came up with were:

- When rowing in the dark there is low visibility and other river users cannot see you
- The number one cause of damage to boats is floating objects that cannot be seen by rowers like logs
- Rowers cannot see where they are going if they don't have a cox
- Rowers get wet feet when wash and splash comes over the boat.

I looked into each of these options and thought about which is most widely an issue. Some of the ideas I came up with for each option were:

- A light that fits onto the bow of the boat and flashes
- A smooth, streamline and lightweight tape that you can stick on and doesn't slow the boat down but prevents bumps and scratches
- A camera that sits on the back of the boat and projects an image to a screen just in front of the footplate.
- Canvas that covers your feet and stops splashes and wash coming in.

An old phone I found that could be used as a screen for the camera.



Old bicycle tyre that I could use as bumper tape, would need to be smoothened out before use.

Old bike light I found which could serve the same purpose as a light on the back, also water proof.

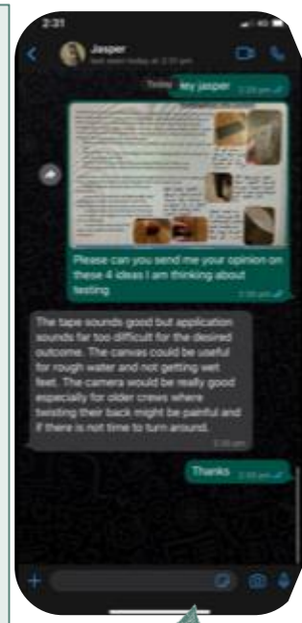
Coat used as an example for waterproof, breathable material. Also easy to get hold of.

The picture of the rowing boat to the left shows an average quad, which is one of the types of the boats that I would design one of my items for. The arrows and colours show where each item would go.

After a long conversation with my piers and coaches, we decided that the screen and camera would be the most suitable. I thought this would be a good idea because all rowers have this issue and have to turn around every 5 strokes to make sure they don't crash, which becomes worse in a race. As well as that it is the only one of the problems on the list that doesn't already have a solution that I can find on the internet, and could be a good challenge to investigate new ideas and solutions to the problem.

Users opinion into each idea

Jasper Tidmarsh: "The tape sounds good but application sounds far too difficult for the desired outcome. The canvas could be useful for rough water and not getting wet feet. The camera would be really good especially useful for older crews where twisting their back might be painful and if there is not time to turn around, it also increases safety because its easier to check what's in front of you and you have a longer time to look at it."



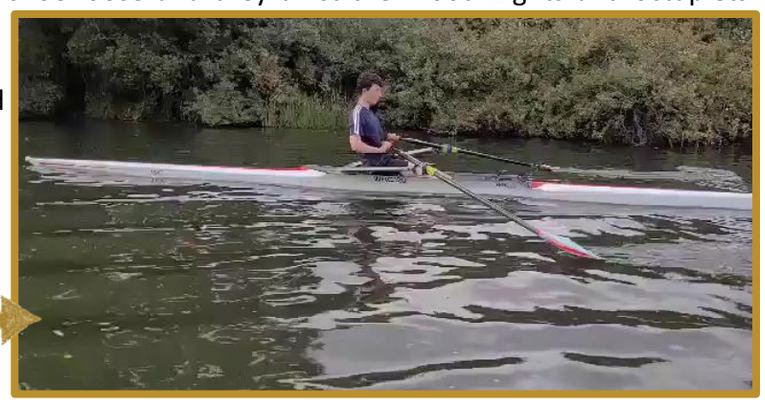
Conversation with my potential user Jasper Tidmarsh asking for his opinion.

On the next page I will investigate my product into context

Idea	Strengths	Weaknesses	Potential developments	Sustainability
Light	Easy and simple design, but still has potential to develop it further.	Too simple, noting that can be majorly adjusted and changed to make it better.	Make it light sensitive so that it turns on when it goes dark. Or is powered by a solar panel.	Using a USB rechargeable battery allows more environmentally friendly running
Bumper tape	Practical, slightly simple but effective and also may be a good challenge to produce it.	Slightly too simple and although it would be useful, it could slow the boat down and drag.	Possibly make them built into junior boats in the future, get in contact with the boat companies.	Environmentally friendly until it is no longer needed and is removed so would have to go into landfill.
Camera and screen	Will show you where you are going and will prevent crashes and improve line on the river.	Hard to make it all waterproof and provide it with power. Also making sure it doesn't fall off.	Have it state the rating and time and have a stopwatch for multipurpose use.	Could be made out of sustainable materials and recyclable materials when its reached the end of its life.
Waterproof shoes	Would stop your feet getting wet and help reduce getting cold in the winter.	The canvas may start to peel and stop working, then would have to be replaced.	Make them fully adjustable /removable for summer rowing, so they can be used in both conditions.	Could be made out of recycled leather or shoes and then double the life of single use items.

Investigation into context

When rowing, steering badly causes you to loose time and become slower, especially on the long races in the winter. E.g. you can loose 30 seconds of time easily just by bad steering over a 5km race. Steering is usually done by the bowman or by a cox (only by a cox if the boat is big enough to have one). The bowman has their left shoe loose and they twist their foot. Eights and octuplets always have
a coxswain who sits in the boat at the bow or stern facing the correct way and steers by a rudder. In singles you adjust by pulling harder on one blade and turning around, as shown in the video.



A video of me rowing and having to turn around to see where I'm going every few strokes.

Potential stakeholders

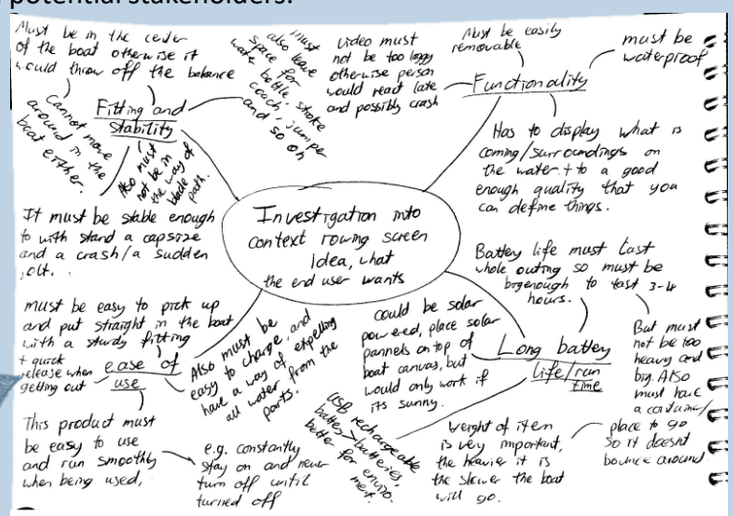
When I started to think about the product to make and problems to solve. I also started to think about the potential stakeholders who would be involved in the process of designing and making:

- The manufacturers
- The rowers who would test and use it (when completed)
- Potentially companies who make boats (if they were one day to be mass produced and built into the design of boats)
- Deliverer of the parts
- Person who attaches it to the boats/ detaches at the end of the session
- Designers (me)
- Buyers and consumers (if they get produced and sold on a large scale)
- Rowing coaches and club members who provide and buy them

After thinking about all of these stakeholders, I came up with a few potential users to get their opinion on, so that when I start to design my product, I can include all of the main user needs and wants and what they would want to get out of the product.

End user requirements

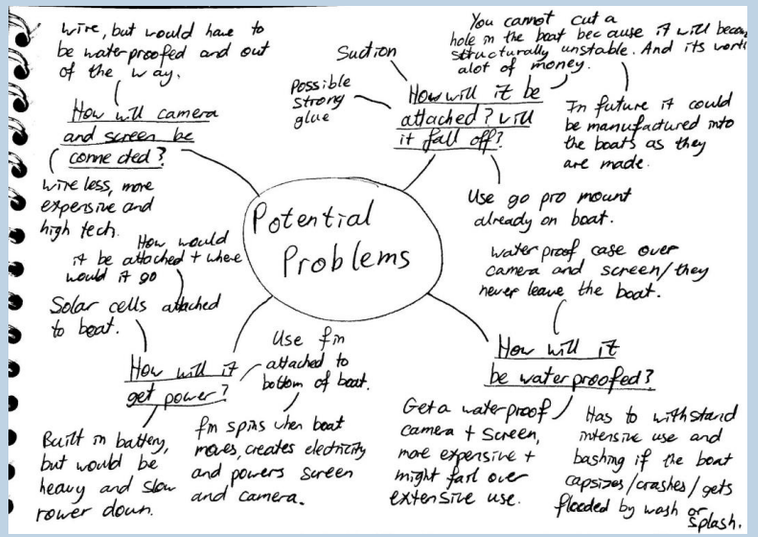
The opinion of the end user is very important when designing a new product. I will try to make this as much of a user centred design as possible to make the outcome as beneficial as possible to the end users and potential stakeholders.
I asses the opinion of my end users in the next slides and try to include it as much as possible.



Thinking of all of the potential aspects that I, as an experienced rower, would want. Also I spoke to my coach, Geoff brown, introduced in the design brief.

Potential problems

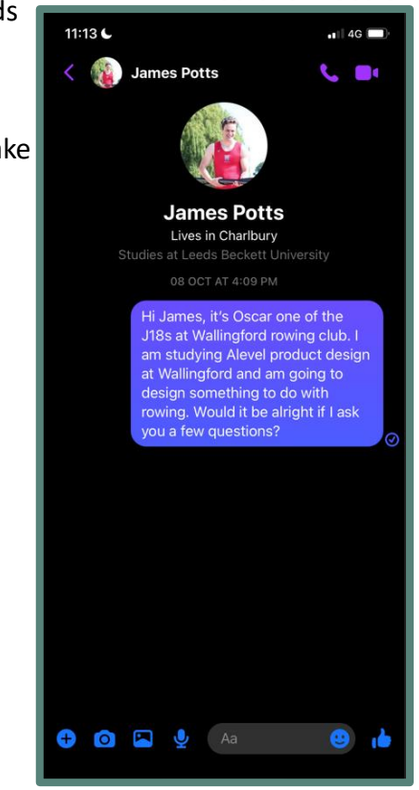
After thinking about all of the potential stakeholders, I made a mind map of all of the potential problems I would face and how they could be solved,



Thinking about initial problems before I started my research on the project, coming up with 4 initial questions then providing solutions.

Some of the other potential problems to think about:

- What material to use, has to be strong and withstand a lot of bashing and
- Where to get the materials from
- If the device stays on the boat the whole time, would it be hit when putting boat on the rack or not
- How the socket connections would be waterproofed in the case of a capsize
- Would the screen and camera stay on the boat in the event of a capsize.
- Would it misbalance the boat/weigh it down.



Here I contacted my club nutrition specialist, James Potts, who helps the juniors stay on top of their nutrition and also rows for the seniors. I asked him what problems he often faced when he was rowing as he has been rowing since the age of 14. leaving the question open as not to insinuate anything to bias his answer.

Sustainability

When making and designing my product, I am going to have to think about the sustainability of my product and what products I use to make it, and make sure that they are either recycled or recyclable. I would like my product to last a long time and have sufficient longevity, e.g. 5-10 years so that the waste produced is minimalised. I could use materials like recycled plastic bottles for the case and screen and maybe the camera cover. However for the camera and screen they will have to be new maybe second hand to make it more cost effective.

On the next page I will introduce my primary users and explain the design brief I will be working to.

Design brief

Primary users:

Name: Jasper Tidmarsh
Age: 17
Occupation: A-level student taking maths physics and German at Wallingford school and a competitive rower at Wallingford rowing club.
Location: Cholsey, Wallingford
Opinion on the idea: It's a very good idea because you don't have to look around and it makes it easier to spot swimmers and paddle boarders who often nearly get hit because of how quiet they are and they cannot see us coming. But it could be hard to mount and keep the camera and screen mounted to the boat

Name: Geoff Brown
Age: 55
Occupation: Head of the junior coaching team at Wallingford rowing club, as well as rowing competitively previously at St Pauls college, London and Edinburgh university, Scotland.
Opinion on the idea: A mirror is not an idea a mirror is an old technique that people do which is not very innovative. But the screen and camera is a good idea because mirrors make people sea sick for the first 10 outings or so because of the tipping. Also its something else to worry about charging and putting away and connecting to the boat but once in habit then that would become less of a problem.

Name: Harry James
Age: 16
Occupation: Currently completing GCSEs at St Brinus's School. As well as playing football for Crowmarsh and Hockey for Wallingford.
Opinion on the idea: That's awesome because then multiple people in the boat would have one not just bow. The fact that it being on the footplate is good for bow not twisting their necks so they can focus on rowing instead. The footplate is designed to stay stationary in the boat so it won't be difficult to read. Might affect posture though but I guess you glance at the screen like every few strokes just like when you look over your back.

Design brief

Design an innovative product that allows you to see behind you when you are rowing, and does not affect the boats balance or stability. It should also be easy to use and be sturdy and have a sufficient longevity. This should be no heavier than 1kg and no larger than 0.3m^3.

Primary users and people who will benefit from it

The primary users of this product will be:

- Rowers who chose to use the product
- The other river users who don't need to move out of the way or tell rowers to take a look
- Those who maintain and supply the products.

Legal and regulatory requirements

Every time you enter a race before you get on the water there are stewards who check that your boat is safe to race in. They check 3 things:

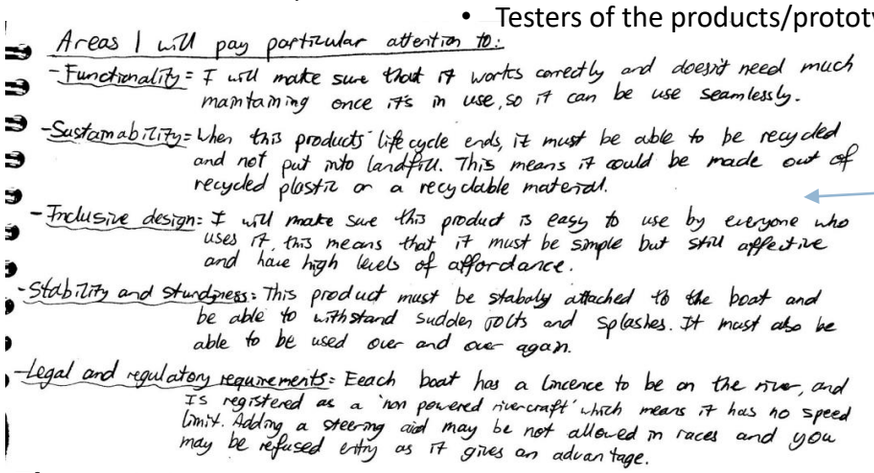
- Bow ball, in case of a crash it reduces damage and injury.
- Heel restraints, in case of a capsize you heels are kept down so you can slip your feet out and get out of the boat.
- Hatch cover, in case of a capsize it keeps the buoyancy in the boat.

A steering aid may not be allowed been as it is a great advantage, especially over long races e.g. head of the river in London where steering is very important, and so the entry might be rejected. On top of that it would be noticed by the stewards checking your boat.

Other potential stakeholders

From when this product is being designed, to when its being manufactured, it includes many stakeholders:

- Designer (me)
- Users
- Rowing clubs who will invest
- Manufactures of the product
- Transporter of the product
- Deliverer of the parts
- Potential companies who chose to invest this into their new products
- Testers of the products/prototype analysers.



Areas I will pay particular attention to:

-Functionality = I will make sure that it works correctly and doesn't need much maintaining once it's in use, so it can be use seamlessly.

-Sustainability = When this products' life cycle ends, it must be able to be recycled and not put into landfill. This means it could be made out of recycled plastic or a recyclable material.

-Inclusive design = I will make sure this product is easy to use by everyone who uses it, this means that it must be simple but still effective and have high levels of affordance.

-Stability and sturdiness = This product must be stably attached to the boat and be able to withstand sudden jolts and splashes. It must also be able to be used over and over again.

-Legal and regulatory requirements = Each boat has a licence to be on the river, and is registered as a 'non powered rivercraft' which means it has no speed limit. Adding a steering aid may be not allowed in races and you may be refused entry as it gives an advantage.

I made a list of the 5 key areas I would pay particular attention to while designing the product.

The next steps

Next I will carry my investigations into:

- Investigation into user and stakeholder needs and wants
- Investigations of existing designs and practices
- Exploration of possible materials and technical requirements

A variety of different types of research e.g. primary and secondary will be used. I will get this by talking to various different people in the sector and looking online for other solutions.

On the next page I will investigate wants and needs of users.

Investigations of user and stakeholder needs and wants and outlining the stakeholder requirements

Survey of potential users

I spoke to all of my primary users, e.g. rowers, coaches, boat makers and friends about the project and asked them how they would feel about the uses, works, and attachment to the boat. I came up with pie charts for what they though of the idea and what potential problems they thought I might face. This is the survey that I gave to 11 potential users of my product.

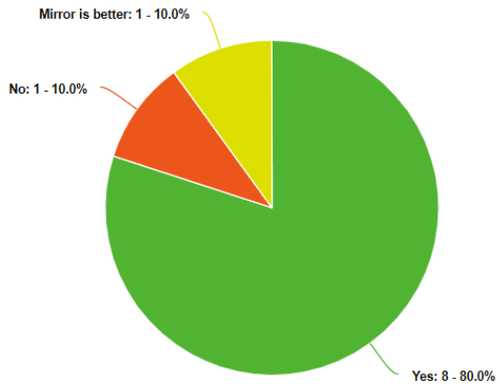
Rowing survey questions

1) Do you think the screen is the best way of seeing behind you on the river?
   A) Yes B) No C) The mirror idea is better

2) What potential problems do you think I could face?
   A) Water + electronics failure B) Attaching it to the boat C) Battery problems
   D) Stability of the boat E) Will it be allowed in races F) Other e.g. glare

3) Will it affect the speed or stability of the boat?
   A) Not if designed correctly B)No C)Yes D) Mabey

1.



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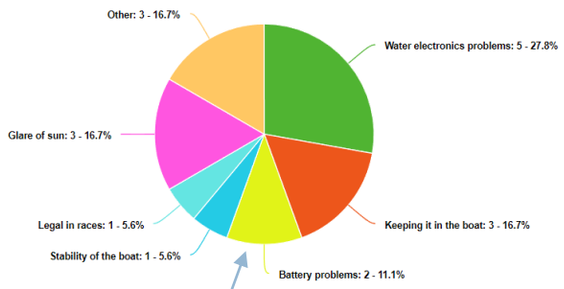

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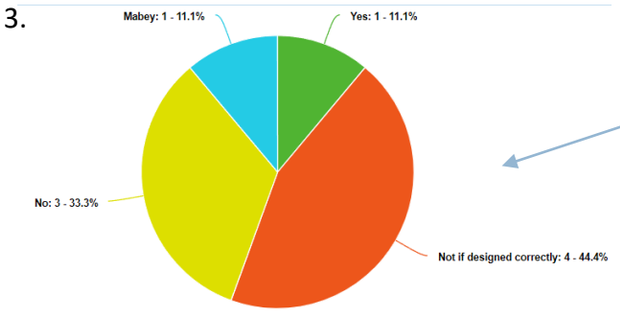


From these surveys I concluded that the majority of my primary users thought that it was the best way to see behind you on the river.
The main problem would be water and electronic problems in case of splashing followed closely by glare of the sun and keeping It in the boat.
Also that it shouldn't be a problem if it is designed correctly and all problems are taken into account.

This is my mum, one of my potential stakeholders, filling out the survey.

Making a list of requirements that I need to meet that my stakeholders require in this product for it to be successful.

Requirements that I need to meet:
- My product must not affect speed or stability of the boat
- It must sleekly fit in and not cause wind resistance.
- It must be fully waterproof in case of a capsize or splashes or rain.
- It must have protection from glare from the sun.
- Must be easy to slide in and out of the boat
- Must have battery life longenough for a full outing.

Considerations of users and stakeholders and their needs and wants

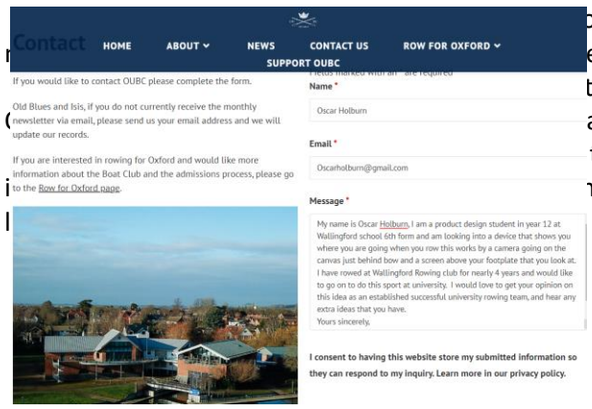
I spoke to 2 of my main users and asked them for their opinions on the project and what they wanted and needed out of this product. This is what they said:

Jasper Tidmarsh:" I just want subconscious view of where I'm going and the obstacles ahead so I don't crash or damage the boat or blades or other people. It would also be good to be able to see the rate and have a stopwatch all on the same device and not having to have 2 or 3 separate devices."

After speaking to my main users and stakeholders, I came to the conclusion that the most important things to consider are that it works constantly without failure and

Me interviewing one of my primary stakeholders Jasper Tidmarsh and taking note of his opinions.

From listening to one of my 3 main stakeholders, Jasper Tidmarsh, I thought of the idea of including other devices into the screen, e.g. a stroke coach, a stopwatch , a clock, and so on. A stroke coach is a device that shows you the rate of strokes you are taking per minute and the speed at which you are travelling. Some of the Philippi singles even have a tiny propeller on the bottom of the boat which spins at the speed at the water passes by, then you can connect the stroke coach to it and it tells you your speed relative to the water. As one of my main requirements that I need to meet is to have it fitted securely in the boat, I will explore all possible solutions to make sure that I find the best one for securing it in place. On the next slide I continue this investigation into where it would sit in the boat, anthropometric data, sustainability and regulations and requirements.



owing club, only a few hundred
er from us. Oxford University Boat
t club famous for the
at race also known as 'The boat race'.
the matter and if they had any
n. Hopefully they reply and I can
on the subject.

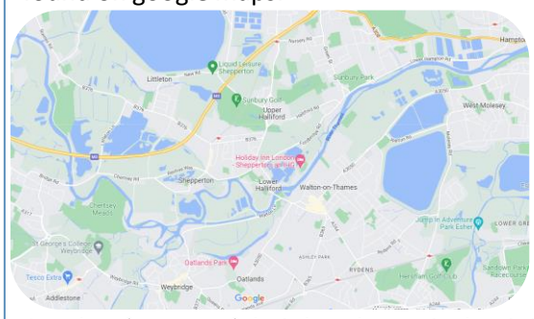
On the next page I look into existing clubs and potential buyers, before looking into where I might sell it.

Example users and manufacturing

Example users

Walton rowing club

Positioned south west of London on the south bank of the Thames in the borough of Surrey, England. This is a successful rowing club that holds a head race every year over the space of 4km. Having competed in this competition myself, I have an in-depth knowledge of the river and the area they row in. This rowing club rows on the middle section of the Thames, before it reaches London, this means that the river is wide enough for many boats but also curvy and can be difficult to steer, this is shown on the picture of the river highlighted in red, found on google maps.



Another feature of their boathouse is that it is on the wrong side of the river. This means when boats get on the water they have to pull out onto incoming traffic and have a risk of getting hit. Having to check behind you here would be very important and a camera would make that easier.

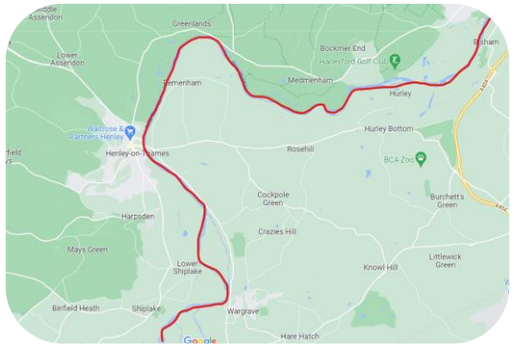
Where they buy their equipment

Their personalised equipment is of the kit supplier 'crew kit' which offers personalised colours and designs on bulk. However their boats and blades are mainly concept 2. This is a very popular rowing brand that offers a lot of high level and high performance equipment. The boats range from brands like Philippi, Hudson, Kanguah and wintech.

I believe that my device would be an investment as there would be less collisions and less repairs to me made. It could also help them become more safe as a club.

Leander rowing club

Leander rowing club are recognised as the most successful rowing club in the UK, they contributed 23 rowers out of the 45 entered in the Olympics in 2020, this shows that it is the default place to go to be successful. Furthermore, their junior team is second best in the country, behind Windsor boys, which I asses next. They have the highest level coaching and equipment, as well as a well kept up boathouse on the Henley stretch of the river. As well as that, they hold the most prestigious regatta in the world, Henley Royal Regatta, where national teams come from all over the world e.g. Australia, Canada, USA and Germany. The stretch of river that they row on is shown on the map by the red line.



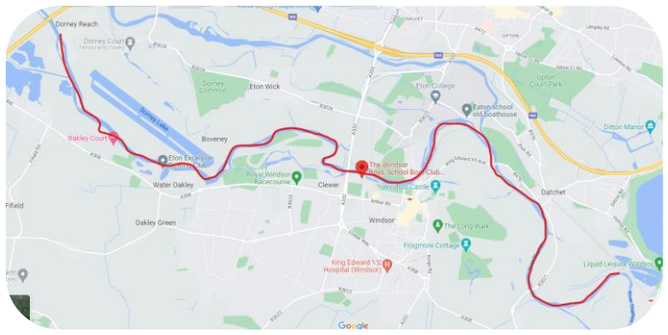
Where they buy their equipment

Leander have the highest level of racing and competition so buys the highest level equipment. This includes empachers and kanguahs. The boats can sometimes cost up to £80,000. This means that the repairs will be more expensive and they are looked after well. As well as that, they use concept 2 skinny blades which are lighter and more efficient.

I believe that my device can aid them when training and make their rowing more efficient. Especially on head races where there are bends and steering makes a big difference.

Windsor boys rowing club

Windsor is located near London, between Henley and London. This is another very successful rowing club, in 2022 their junior quads won the 'Top 3' summer races; Head of the River, Henley Royal Regatta and British National Championships. One of their rowers, Marcus Chute represented GB in the international championships in Czech Republic in 2022. They have been the most successful junior rowing club this year and use high level equipment. The stretch of river that they row on is shown highlighted in red on the picture below.

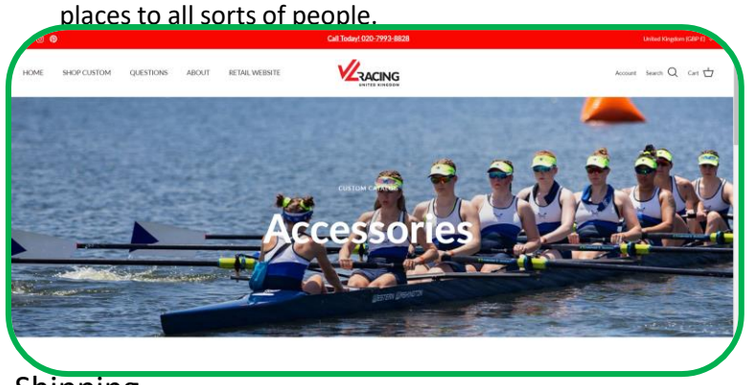


Where they buy their equipment

Their fleet of boats is mainly wintech's, and their blades are concept 2s, which seem to be the most popular brand of blades for successful crews. My device on their boat would be very useful and especially when training. Clubs like this invest in small items like strokecoaches and waterproof shoes to make the rowing experience more enjoyable and more technical. My device would also make it safer and more efficient.

Manufacturing and selling

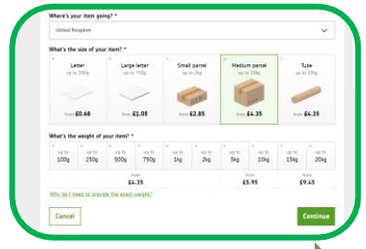
Most rowing equipment in the UK is brought online, then delivered through special delivery. There are rarely specific 'shops' that sell boats an blades however there are small shops that sell equipment like a rigger jigger and a strokecoach. An example of this is Bridlington Rowing boats, selling second hand equipment and sportswear. This is located in Henley-on-Thames and shown in the picture to the right. I could potentially sell my device in shops like these, as well as online and then they would be accessible in many places to all sorts of people.



An example of where I could sell online are websites like this; Racing UK. This website sells a range of accessories from a range of different brands and is used by many clubs. I would manufacture the item in batch production and distribute to warehouses and shops, like the ones shown above.

Shipping

Another aspect I would have to consider is shipping, many website offer it free but then I would have to pay for it. I would select a medium sized parcel which would cost me £4.35 per parcel. For this reason I would require the buyer to pay for shipping, and because it would be made in the UK it wouldn't have to be transported overseas. This would also reduce the price of shipping.



On the next page I will look into anthropometric data.

Investigations of user and stakeholder needs and wants and outlining the stakeholder requirements

Ergonomic and anthropometric considerations

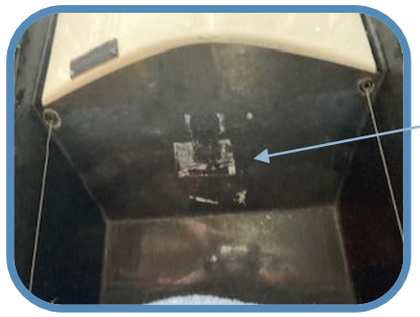
This device may be a thing that doesn't always stay in the boat, e.g. you put it in the boat when you take the boat off the rack and use it for the outing, then take it out again when you come off the water. This would mean that it would have to be ergonomic so that it Is easy to out in and out and is fitted securely without hassle. There would be a clip that Is also used for stoke coaches, devices that clip into the

ur speed and rate, which prove
race situations. This could be the same
r the screen, however they are rarely
of the boat and it might offset the balance. When
e centre of the boat they are between the feet, in
be enough space for a screen. It should also be appropriate to the average hand size so that everyone can hold it correctly and use it without uncomfort or pain.

S. No.	Dimension	Min.	Max.	Mean	SD	SEM	CV (%)	Percentile values 5th	50th	95th
24	Palm length	90.00	123.00	106.08	5.55	0.19	5.23	97.00	106.00	116.00
25	Fist length	85.00	120.00	100.75	5.78	0.19	5.74	92.00	101.00	11.00
26	Fist circumference	202.00	323.00	279.73	14.52	0.49	5.19	259.79	280.00	305.00
27	Internal grip diameter, maximum	27.50	55.00	43.08	4.91	0.17	11.40	35.00	44.00	50.00
28	Hand circumference	214.00	280.00	245.41	11.47	0.39	4.67	225.00	245.00	263.00
29	Maximum hand circumference	291.00	390.00	346.05	16.80	0.57	4.85	318.00	346.00	373.00
30	Grip span	82.32	120.21	98.81	7.05	0.24	7.13	86.71	99.31	111.32
31	First phalanx digit 3 length	55.00	76.00	66.36	3.32	0.11	5.00	61.00	66.00	72.00
32	Index finger circumference	46.00	80.00	67.70	4.19	0.14	6.19	61.00	68.00	75.00
33	Arm length	676.00	868.00	774.32	32.98	1.11	4.26	723.00	776.00	826.00
34	Wrist circumference	115.00	205.00	165.89	9.80	0.33	5.91	152.00	165.00	180.00
35	Elbow length	400.00	515.00	462.62	19.33	0.65	4.18	432.00	462.00	495.00
36	Elbow flexed	175.00	337.00	265.79	19.89	0.67	7.48	233.00	266.00	295.00
37	Middle finger-palm grip diameter	12.00	22.50	16.63	2.82	0.10	16.96	12.50	17.50	22.50

This is a list of anthropometric data I found on the internet for hand sizes and measurements as part of my secondary research. This means that I wouldn't want my screen to be thicker than the average hand width, so that it could easily be grasped in one hand and you can hold other things in the other hands. Specifically looking at the highlighted data. The arm length could also be important when looking at how far forward to put the screen so that its not out of reach.

One of my primary users, Geoff Brown, suggested the idea of just using you phone and connecting to the camera off of that, because everyone has a phone and they could just slot it in and use that, instead of using a screen. This would also mean that the camera can also stay on the boat at all times and not need to be taken off. After taking note of his opinion, I further investigated this idea, shown later on.



There is a mark in this cockpit where there was a strokecoach holder but it has broken and fallen off. Showing that my device, a bit heavier than a strokecoach, would need sturdy and sufficient support to stay in place in the boat. This is after going into my club and looking at the boats.

Sustainability and environmental impact

All of my stakeholders and potential users said that this product should be sustainable and have a minimal environmental impact, especially when it is no longer needed. Of course if they are mass produced this impact would be way bigger and much more harmful to the environment if done incorrectly. This means that it should be made out of recycled materials, where possible and it should also be recyclable so that when it is at then end of its life it can be disposed of correctly without harming the environment. There are several ways that I can do this:

-use a used screen/e.g. buy off ebay to prevent waste
-use old materials, e.g. old wires and plastic and seal, as long as it doesn't affect the functionality of the product
-make sure that when my product has reached the end of its lifecycle it can be recycled.
-extend its lifetime so that users don't have to buy multiple of them.

Placement in the boat

I will start on placement in the boat now but go into more detail later on. As some primary research I went to my local rowing club, where I row, and took photos of the cockpits of lots of the boats and where my device could potentially go. As I said earlier, there is a universal connection point where stroke coaches are connected to, as shown here. However this may be too small for a full screen or a device of that nature. Red circles are other potential places for my device.

I went to a design show in London on the 8th of July 2022 and looked at ideas for attaching the camera and screen to the boat. This is what I found, a case for a camera which was also waterproof, could be a good idea for the camera attachment.

What my potential users say

All 3 of my main potential users said that it would be preferable if the device sat just above the footplate, although it would be useful to have it on a strokecoach support, it may not be strong enough and it wouldn't necessarily be in the right position, but if it is then it would be a good alternative. Also thinking about camera placement, it will be suction cupped onto the bow of the boat, where there is also occasionally a gopro mount.

Next I will look into existing similar products and assess them

Investigations of existing design products and practices

Mirror on cap

Very easy to put on and take off, doesn't need any technical ability.

Not too expensive if you loose it

Mirror is small so only gives a small range of sight

Glare of water would blind you.

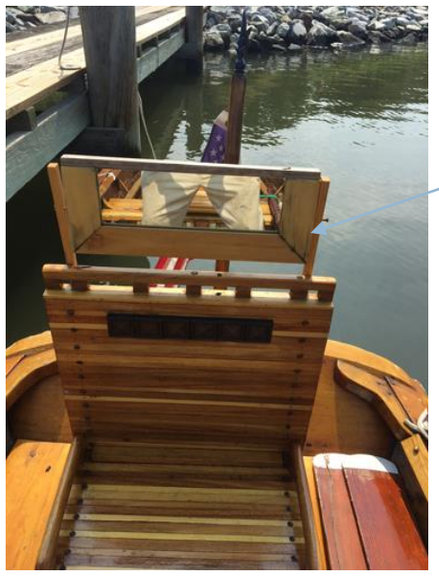
Cheap and available

Takes you a few weeks to get used to, makes you sea sick because of the instability.

Not the most secure, could slip off your head and fall into the water.

Sophie Sutherland 'I think it would be very good in insuring that I'm safe and I don't crash. It looks a bit stupid thought.

<u>In conclusion</u>, it is a good idea for a cheap alternative to seeing on the river, but it takes a few weeks to get used to and doesn't give a full range of vision of the river. However it would be very easy to produce on a large scale and package and sell because of its size. This compares to my product because my product may also give a small range of vision and may also be affected by glare.



This is another item I found during my research, which is similar to the mirror clipping onto the rigger, however it is not on a rowing boat its on a cruise boat and it wouldn't be so practical because of the size of the mirror.

Solar panel

During my trip to Henley royal regatta, I saw people presenting a sea rowing boat that had been over the Atlantic ocean. It had a solar panel on the top which helped power it, I thought I could use a similar device on for my mechanism for power on the river, however this only applies when the sun is out.

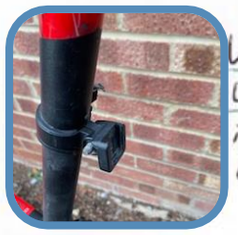
Good solution for power e.g. its lightweight, can blend into the boat and wont rattle around in the bottom of the boat like batteries.

Connection may fail between screen and because other things may get in the way of it, like a magnet is affected by other metals

As it is on a sailing boat that has been across the Atlantic and back, it shows that this was the best solution over others e.g. hydro-electric power. As it has been used in the correct way I can take note of this and look into this idea for my design. The only problem is that it does rely on the low cloud cover.

Another example I found was a solar charging power pack that we had, although this was quite heavy, it was durable and worked effectively.

Bike tail light/camera



Very easy to use, and put on and take out.

I have found a device on the internet that is a camera that records behind you and doubles as a light. I am also analysing a bike light and attachment from home.

Provides a solid image straight to your phone.

Can go either way, 90° or horizontal.

Easily attaches to bike too

Little lever releases it when you want to take it off.

Small so can easily fit in you pocket or bag.

Well designed so that it is not too big or heavy

Expensive and would be a big deal if it was lost of broken.

Battery life won't be that long because its quite a small device.

Also doubles up as a light for visibility

<u>In conclusion</u>, I can take influence from the mount mechanism because its secure and simple, and it is a good device overall because its light and provides visibility. It may be hard to market and sell because you don't always need to see behind you on a bike and can just turn your head when you do.

Investigations of existing design products and practices

Trieve

This idea called 'Trieye' is what I found during my secondary research and shows glasses with a mirror in them, intentioned for cycling but could be used for anything e.g. rowing. The reviews for it were good, although there were not many.

Doesn't show large range on vision behind you.

Might fall off in the river.

Not everyone might like that style of glasses

Also polarized to take out the suns glare.

Relatively discreet and looks like normal glasses.

Pretty cheap, not so bad if they fall in the river.

Simple mechanism, no technology required, so wont break if comes into contact with water.

Easy to store, all you need is a glasses case.

Easy to package and sell because its small.

Bethany Bright: 'looks like it would be quite comfy to wear and you don't need much equipment as it comes all in one.'

In conclusion, I think that this is a good innovative idea and simple but effective. It compares to my product and influences me because it made me realise that it doesn't have to be a large, complicated thing just to see behind you, it can be small but simple and still be as effective.

Moving feet and stroke coaches

I went to Henley royal regatta in June, debatably one of the most prestigious rowing events in the world and looked at some of the intervention stores. Here I found some good new ideas that I could use in my research.

At one of the stalls they looked at, they were displaying attachments for stroke coaches, and shoes for a rowing boat.

The pole might be in the way if the footplate is all the way forward.

The stroke coaches have a rubber coating to protect them if they get dropped on land.

Jay Bridges: 'It looks great, very fancy and innovative. Nice and colourful'

Video example of a moving stroke coach

This video represents the moving parts of an example stroke coach that I found at Henley royal. This is attached to a metal pole which moves forward and backwards as you need.

Phone holder for a bike

Sophie Sutherland 'That's good it will keep your phone waterproof and you wont be able to drop it. Looks a bit uncomfortable but I'm not sure.'

This is a phone holder that straps onto your bike and also has side pockets for other things like keys. My brother uses this regularly when cycling to work and back and it is designed that the touch screen still works.

Not fully watertight so If boat capsizes then phone will get wet.

Good idea for holding phone, and it can still be used whilst in the case.

Has other storage, for e.g. charging pack, but pockets may not be waterproof.

May have trouble attaching it to the boat securely.

Easy to put in and take out, and feels secure

In conclusion, this is a good product for an idea for holding a phone and the phone can still be used because of the plastic covering. However in the case of a capsize it is only splash proof not water tight so the phone would get wet and may even fall out.

Next I will look into the potential positioning of the item on the boat.

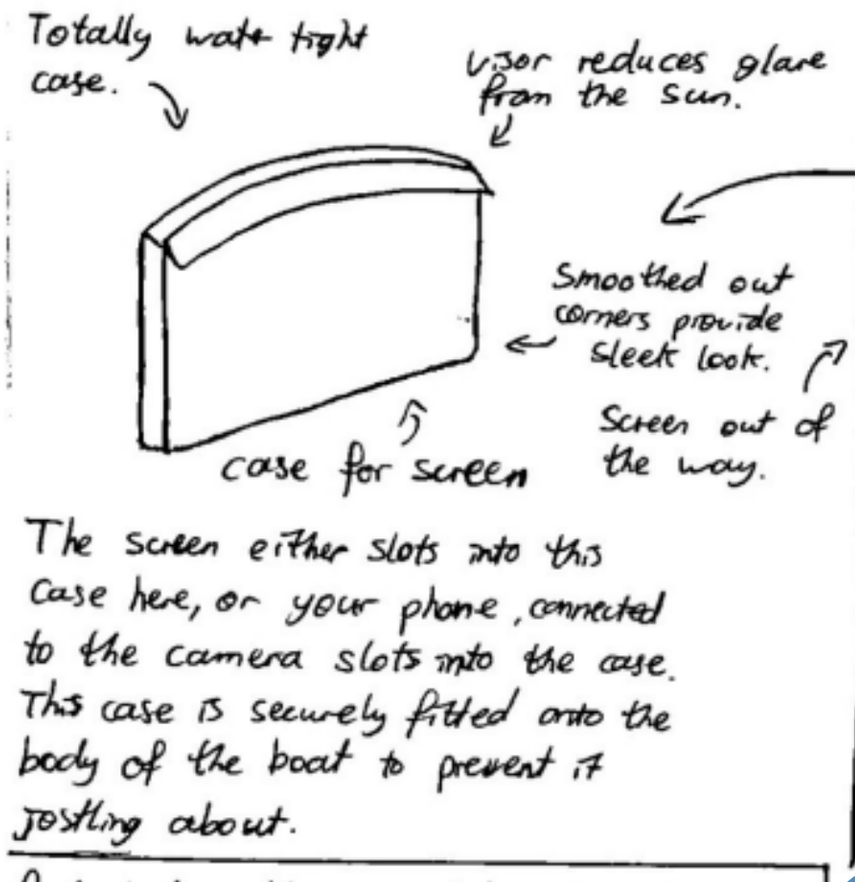
Potential positioning and diagram of the concept

How its watertight

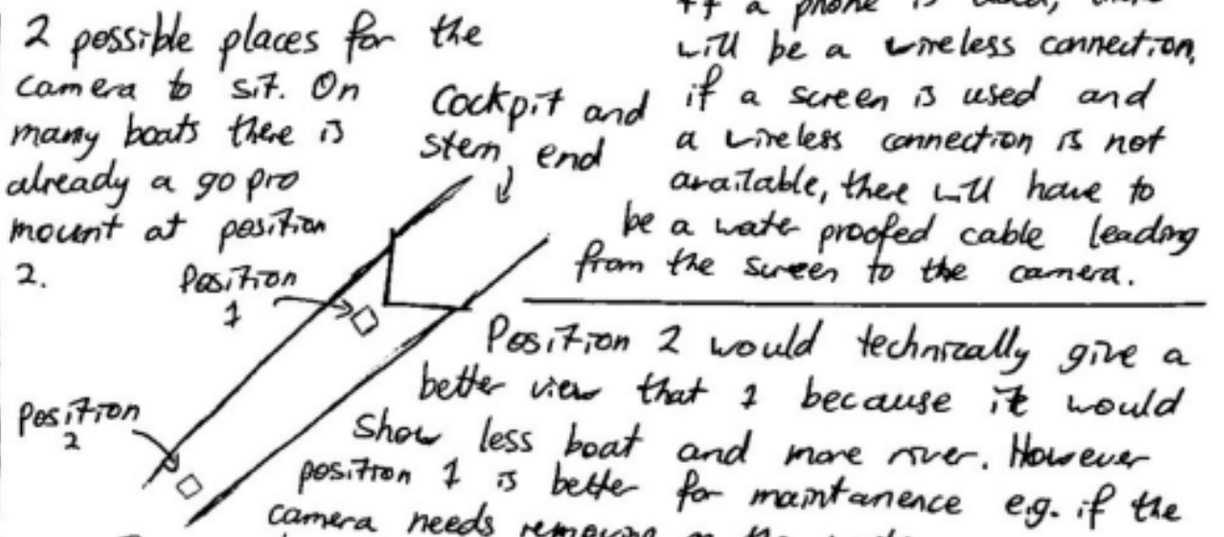
As shown previously, I figured out that plastic with a rubber seal is the best option for a watertight box. On top of it performing better in my experiments, it is lighter, just as strong, cheaper and can blend in more because you can change the colours. The rubber seal fits around the opening compartment, and clips keep it firmly shut. This is a replica of the waterproofing mechanism on the plastic box I tested.

Materials of the box

The materials I will use for the box is a plastic, if possible I will mould a plastic too so that the only hinge/joint is where the phone/screen enters and exit. This is covered by a rubber seal that Is kept firmly shut. This will also mean that it is more waterproof and has less chance of the joints cracking over time and letting water in. There will be a transparent film over the area where you have to see the screen. This Is another reason for using plastic, it can become thinner in places so its more see through.



The screen either slots into this case here, or your phone, connected to the camera slots into the case. This case is securely fitted onto the body of the boat to prevent it jostling about.



Potential problems and how they have been solved.

- Water + electronics failure, fixed by making whole case water-tight in case of capsize
- Glare, Sun visor on case to prevent most of suns rays affecting you.
- Attatching it to the boat, firm stroke coach/ go pro mount keeps it in place.
- Battery, both built into the phone and screen, if not a compartment will be created below

Position 1

Position 2

Next I will test individual materials to find the best one

Exploration of materials and possible technical requirements

Key properties my material would need

It would need to be strong, very water resistant for many times of getting wet, and be a relatively cheap material so that if it gets mass produced the costs would be low. I would also like it to be malleable, so that when manufacturing the product it is easy to shape into precise shaped and the margin for error would be much smaller. On top of that, it would have to be long-lasting e.g. last and perform its function for several years of heavy use, so that it does not have to be replaced every so often, and the environmental impact is little.

Materials I might use	Strengths	Weaknesses	Is it watertight?	Weight	Environmental sustainability	Is it suitable?
Heavy duty polypropylene	Very strong, very water resistant and sturdy material.	Highly affected by UV degradation, poor bonding properties/ a hard material to paint.	YES Usually used for heavy duty water and air tight storage boxes.	Low weight/ low density, so won't add much extra on.	Its much more environmentally friendly then other plastics/ biodegrades quicker.	YES
Thermoplastic Polyurethane (TPU)	High abrasion resistance and shear strength.	Not as cost effective as some other plastics, and has a short shelf life.	YES Sometimes used for inflatable rafts and medical devices.	Low weight	Biodegrades in 3-5 years and is environmentally friendly	YES
Aluminium	Light, cheap, easily available and strong	Very easily dented or scratched.	YES If built correctly	Low weight and low density	Environmentally friendly and easy to recycle.	MAYBE
Stainless steel	Doesn't rust, useful for common contact with water.	Difficult to manufacture and high costs	YES but with great deal of manufacturing	Reasonably heavy	Environmentally friendly but not recyclable	NO Hard to construct and not recyclable
Acrylic	Very strong, light and easy to work with.	Not so resistant to scratching and wear and tear.	YES And its transparent	Very light	No because it take so much energy to create.	MAYBE

Testing a waterproof metal box

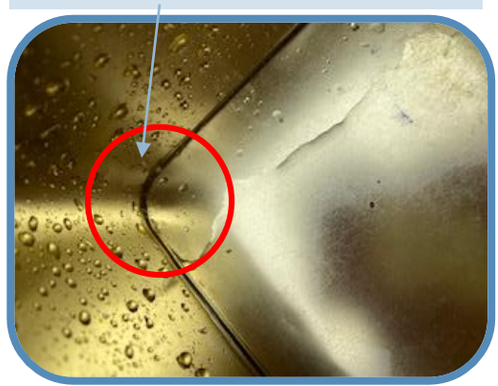
For this I used a metal box that was quite large however replicated the sort of use that my box would go through, it has a rubber seal and is welded so very similar to what mine would be like. As shown in the photos I tightened the box and placed it under water, upside down for 2 hours. I put tissue on the inside to detect if any water got in and bashed it around a bit too to simulate capsizing in a boat. I held it under with bricks on top

You can see bubbles leaking out of the cop corner of the box, this shows that water was going in at a reasonable rate.

In conclusion, this metal box failed the water test because as soon as it was submerged water started to leek in fast. This would prove useless in a capsize because it can sometimes take a few minutes for someone to come and help you and get the boat the right way around again.

Tissue inside is sodden.

As shown here, the circled area is the bit where most of the water was getting in from, however it was also breaking the seal at the top.

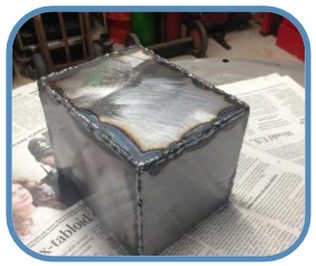


Exploration of materials and possible technical requirements

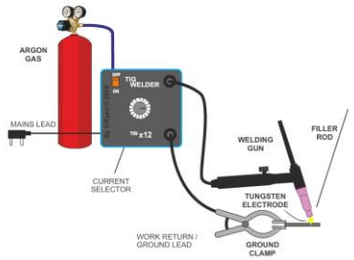
Processes of making

When I create my final prototype/ design, I will have to figure out a way of creating my product so that it can be repeated many times over in many types of production. This means I should use industrial methods of designing and planning so if it starts production, it can be easily done so with little transition to the designs. First I started thinking about the making processes for the screen case. I will either use a screen/phone inside a case in the boat. I will expand on the joints, cases and cameras in the initial ideas section in the later pages. I will also think about extra appliances needed like a battery pack, wiring and a solar panel. The screen/phone would also need a cover or sunshade so that if you are using it in bright conditions your vision is not obscured. This I explore in my initial designs on a later page.

Using metal

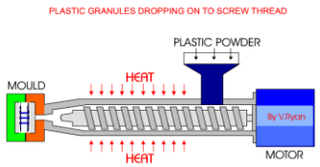


I may chose to use metal e.g. stainless steel or aluminium for my design. If I do this I would buy the metal in sheets and then cut and assemble them accordingly. This would mean welding to fasten the sheets together. I would use TIG welding as shown in the picture to the right. This would however make the box look ugly and obtrusive as the welding leaves a mark. This also takes a lot of energy and pure argon gas. This is bad for the environment as it depletes the ozone layer and requires a lot of energy to run, which would be going against one of my requirements to be environmentally friendly. I feel like this would not go well in the boat because if it comes loose it may cause damage if it bounces around in the boat because of its weight. I have decided not to use this technique because it is bad for the environment and it is a lengthy and a complex process, which results in a heavy and ugly product.



Using plastic

On the other hand, if I used a plastic I would have to use processes like injection moulding, vacuum forming, rotational moulding or compression moulding. I go into more detail into injection moulding later.
I would use heavy duty polypropylene, it can be coloured to a desired colour and is very durable and long lasting, increasing the longevity e.g. the box that I tested for waterproofness. As well as that, the case would need some sort of rubber seal to take out the phone/screen every now and then and make sure it is charged and in good condition. As shown on this box here, it has a rubber seal, clear lid and clips to keep it firmly shut which are easy to undo in case of an emergency/ needing to get your phone out quickly. As well as that, as the box I tested performed well, I believe that it is a good solution to the problem.



The process of injection moulding includes melting pellets in a hopper then them being forced into a mould systematically using Archimedes screw. This is shown in the picture to the right. The mould is also reusable, unlike sand or wax casting, because once the product has melted, it can be taken out and the mould can be reused. Even turned inside out to produce an exact replica but the other way around. I would then do a quality control check to ensure that the plastic is even thickness. This would also mean that it is more waterproof because there are less joints. This would also be more aesthetically pleasing. This would also make it more liable for mass manufacturing. For this I would use injection moulding as a manufacturing method.

When assessing the joints I could use to clip the lid onto the rest of the box, I have a number of options. The clips used on the box I tested prove useful because they exert pressure on the rubber, which seals it. I have to have the same effect. The ones shown in black represent similar ones to the box, but in metal and require screws to attach. As I want my box to be sturdy as well, these are a good option and can be used repetitively without breaking. I will look into the clips that I would like to use later and how they can be installed.

What my primary users think

Harry James: 'The metal box is quite ugly and would be chunky and large. I prefer the plastic ones because they can be any colour and its lighter and easier to clip in and out of the boat.'

Testing a waterproof plastic box

For the plastic box, I had to do the same process as I did for the metal box e.g. keeping it submerged for 2 hours and bashing it around to simulate a capsize. I also put bricks on top to keep it submerged, as shown in the photos.

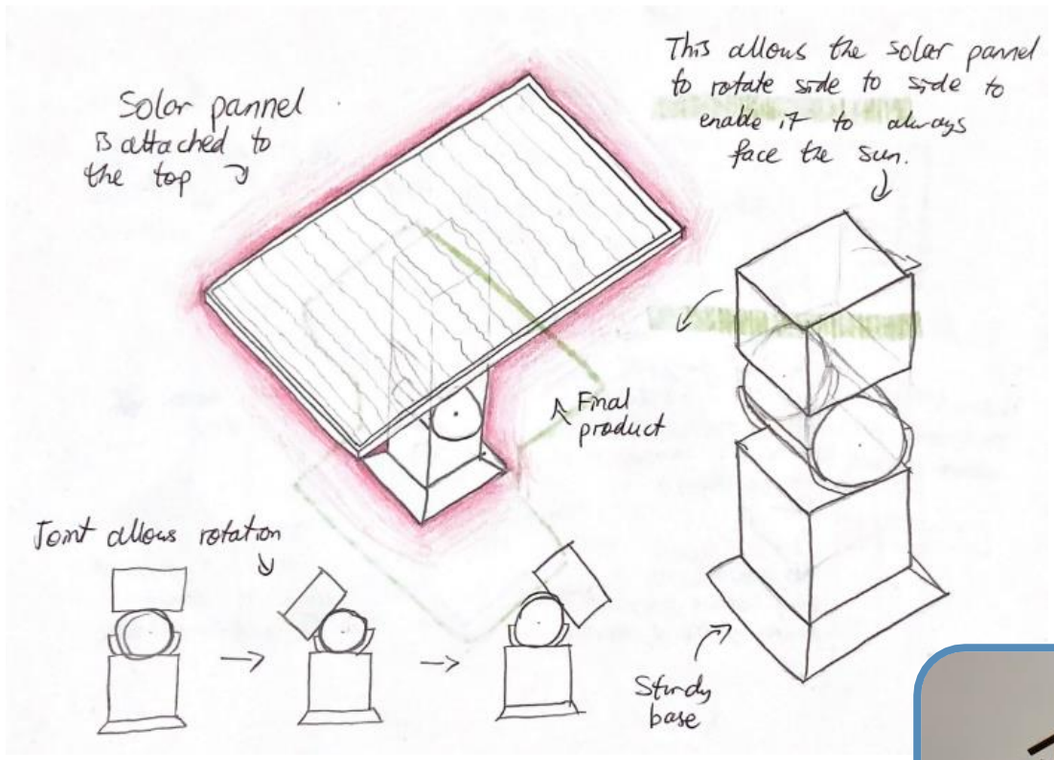
These clips are easy to use, simple and effective in keeping the water out. I will be influenced by this and explore the possibility of using them in my final design.

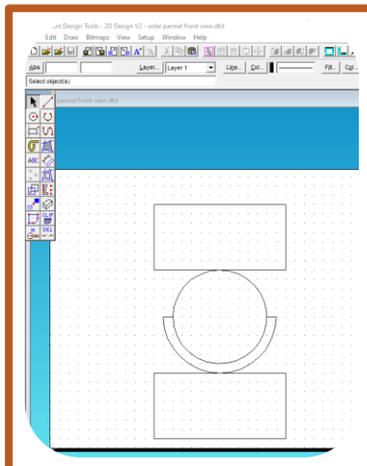
As shown in these photos, the box did not leek at all and the contents (paper towel) stayed fully dry. This proves that this method of waterproofing is effective and reliable to put a phone/ screen in.

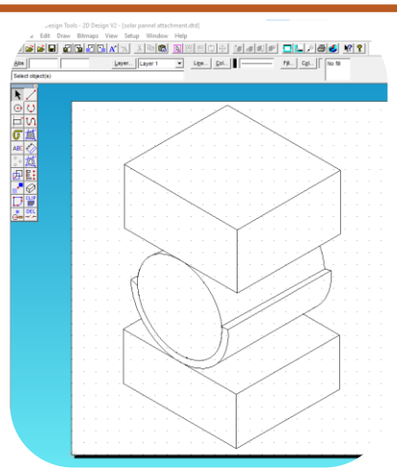
In conclusion, what I have leaned from these tests is that a plastic box with a rubber clip seal is not only the better looking option, but also the more effective, which is one of the key elements that I want my material to have.

Later on I start my initial designs and look at possible items I could make to assist rowing and help you see behind you.

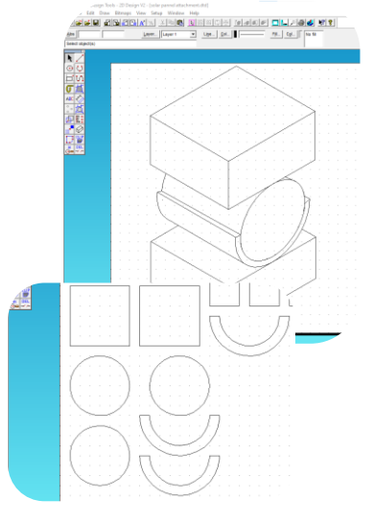
Initial ideas: 1. Rotating solar panel mount







CAD designs for the net of the model I made and lasercut.



CAD designs of the idea, using the concept of having an item on top and bottom, and the top one rotating.

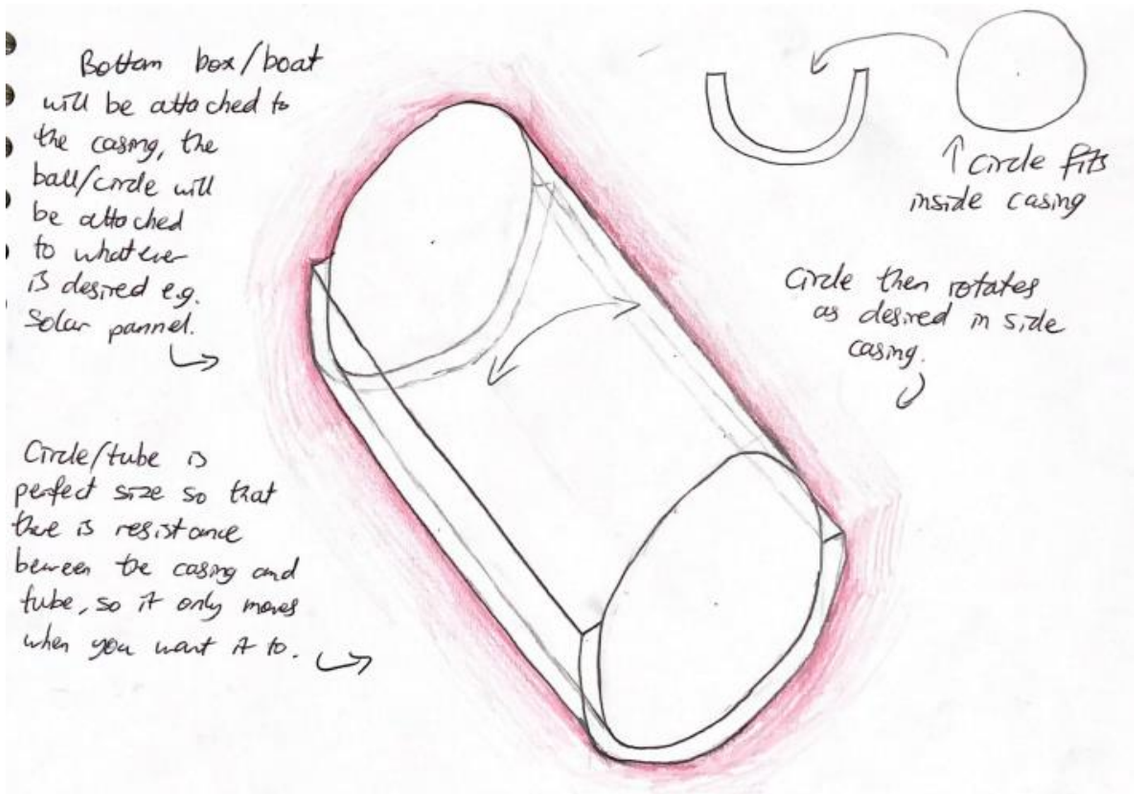
Circle fits inside joint and can rotate as shown.

Boards on the top and bottom can rotate freely.

Circle could fall out the front or back if experiencing a sudden jolt.

Modelling helped me to understand the concept of this design and show that it is effective when holding items

The circle and casing are the exact same diameter so there is friction so it doesn't randomly move/fall.



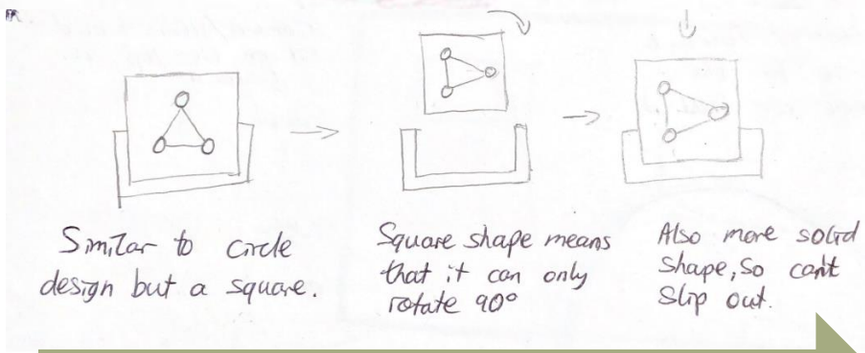
Feedback

Kate: 'Could be very useful because it can be pointed at the particular thing that you want to observe, so could be a good training tool. Also if boat is on tilt it doesn't mean the picture also has to be tilted.'

I responded to this by taking the thought of it being a training tool and thinking of adding a camera onto it as well as a solar panel

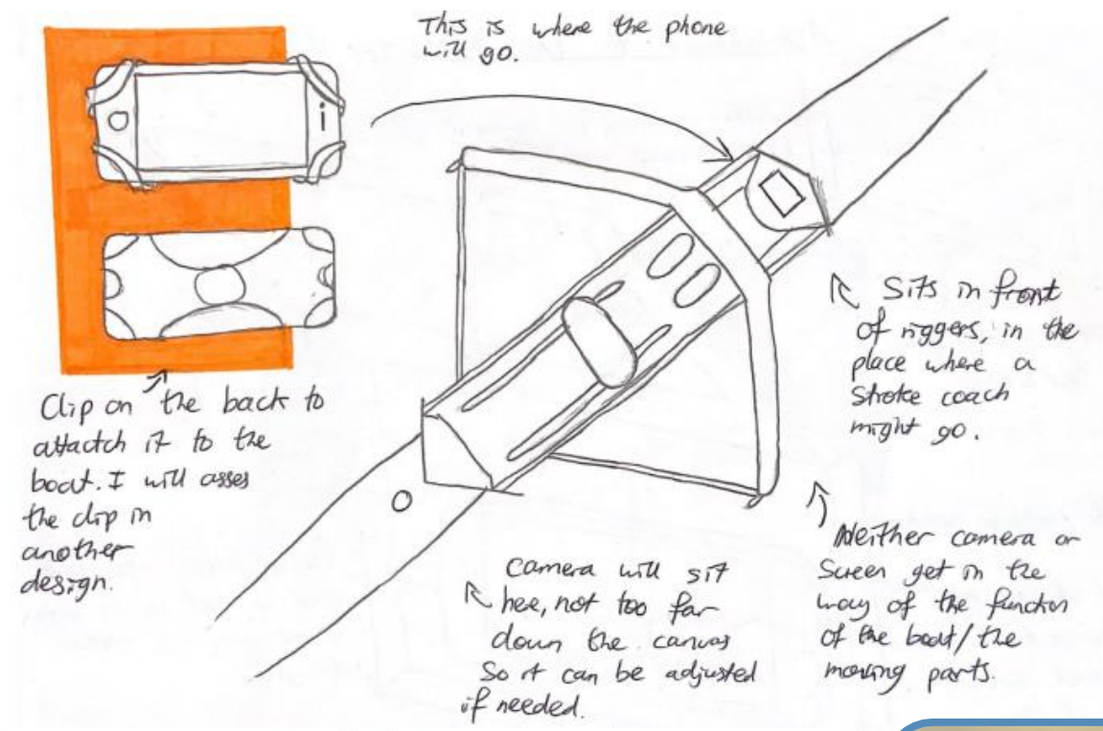
Materials to consider

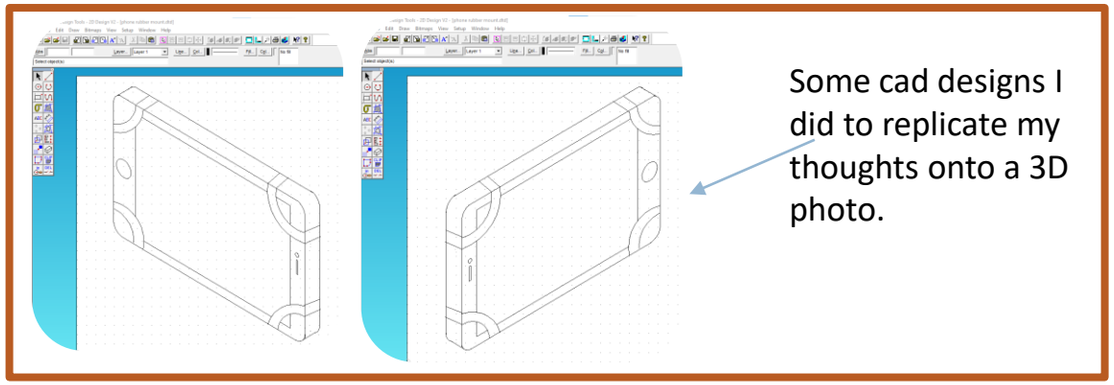
For this design I considered plastic, because of it being easy to form. I decided wood would not be suitable because it would get worn away then not be effective. I decided that metal plastic with a rough texture would work to get the resistance high.



Next steps: On the next pages I explore my other designs before developing and choosing my final design and exploring the possibilities of it.

Initial ideas: 2. Rubber phone holder



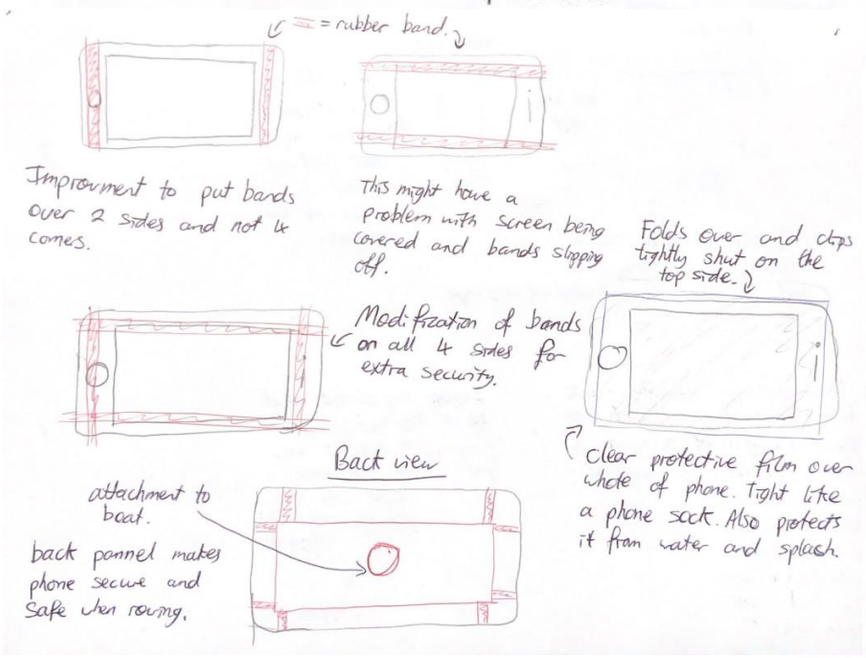


Some cad designs I did to replicate my thoughts onto a 3D photo.

Feedback

Finbar Wilson: Is it going to be easy to put in and if its easy to put in will it fall out straight away. If it falls out on the river then it will be bad because you will loose your phone in the river. It would need some sort of extra securing mechanism just in case it falls out.

I responded to this by using this idea to develop a new idea that is more secure and wouldn't fall out.



These improvements show the bands going horizontally over the screen as opposed to over the corners

Photos of me using rubber bands to imitate the effect of a silicone case. They held well and were elastic but held the phone securely in place.

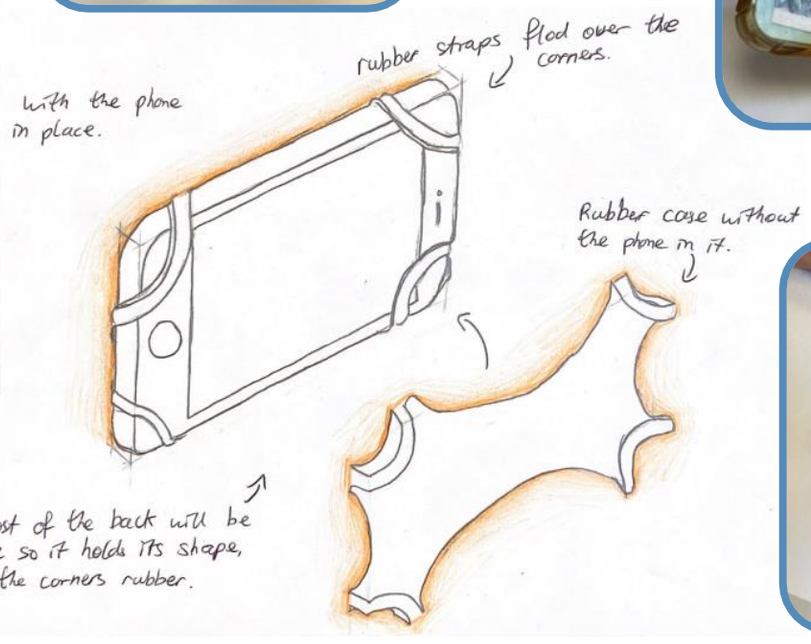
Does not waterproof the phone or protect it from the elements

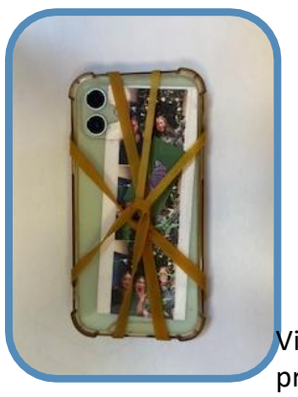
It can be easily taken out as well as put in

Very elastic movement so if boat jolt phone will shake and might fall out.

Easy to use, and is stretchy so will fit pretty much any phone

Video of me shaking it to prove that it is sturdy.



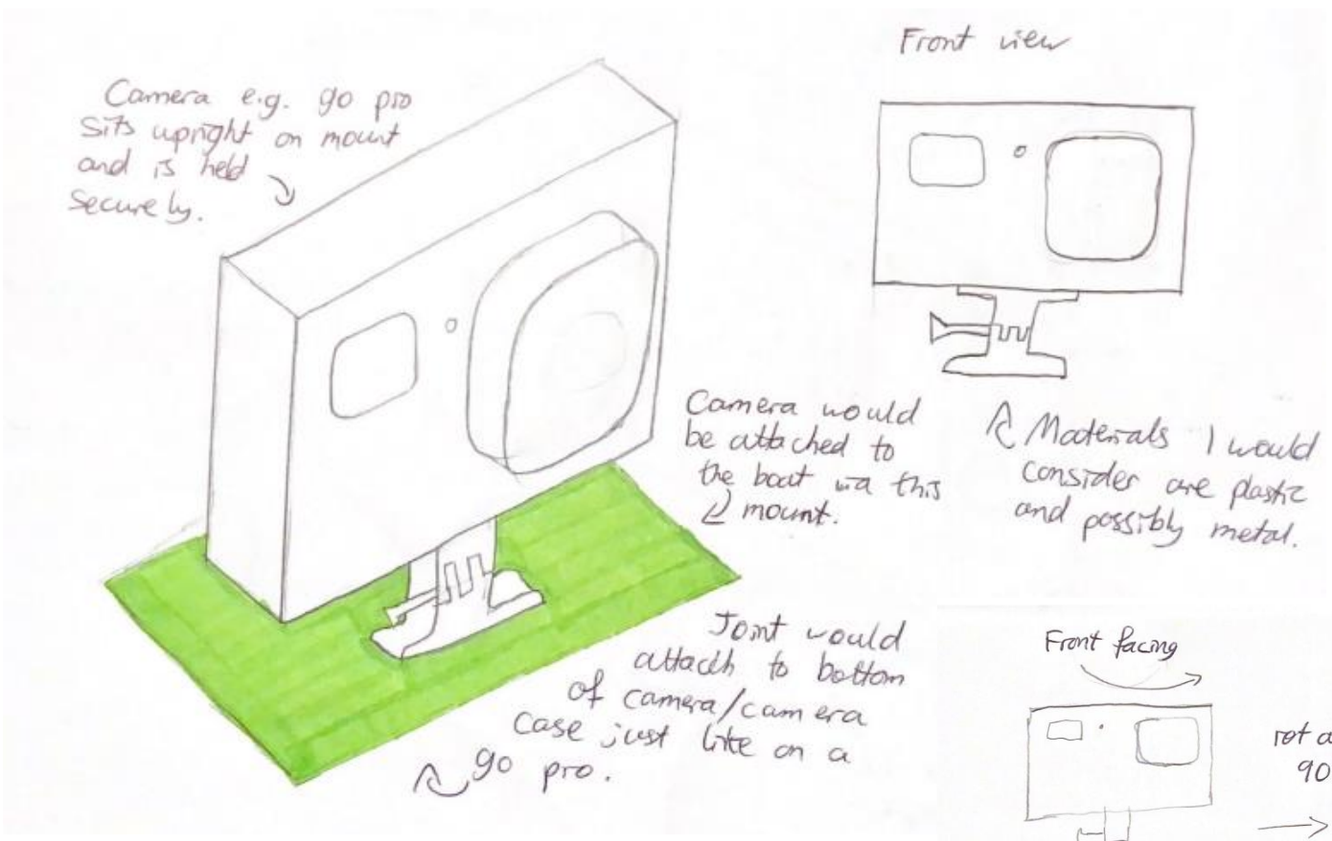


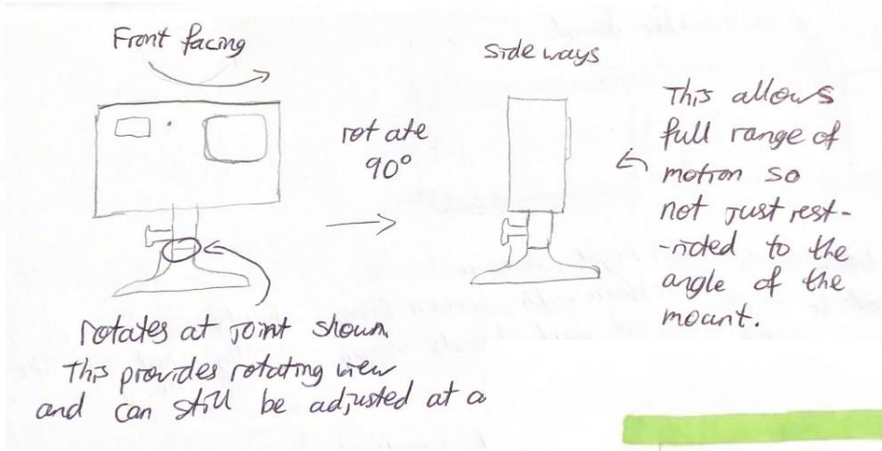
Materials to consider

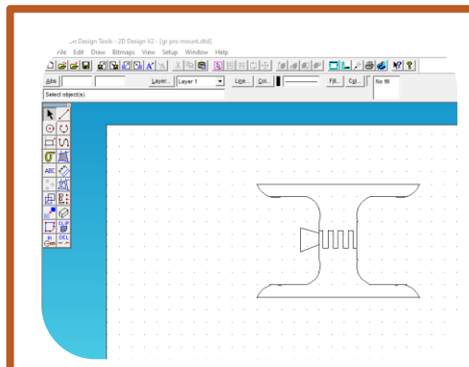
For this design I used rubber bands to imitate the silicone which I would use. Silicone is good because its grippy, so the phone won't fall out. Its also is very stretchy so will fit most phones, and as phones develop and become bigger/smaller they can still fit. It can also hold its shape reasonably well and is easy to replace/repair. On the other hand, if it snaps it will have to be replaced, but isn't too expensive.

Next steps: on the next page I asses the aspects of attaching a camera to the boat via a mount.

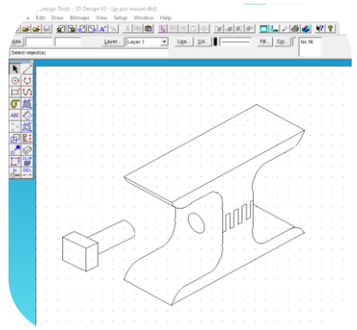
Initial ideas: 3. Adjustable camera mount

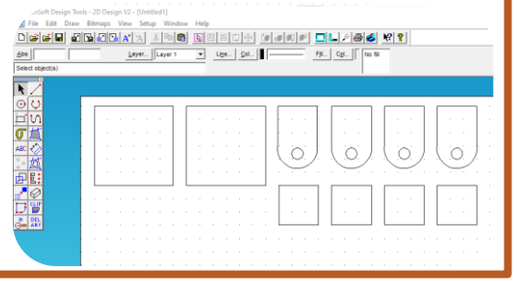






Shows net for models





As shown in demonstration, pin slides into the side when the 2 finger joints are connected together, this attaches them firmly and as the screw is tightened it is squeezed together more firmly.

Materials to consider

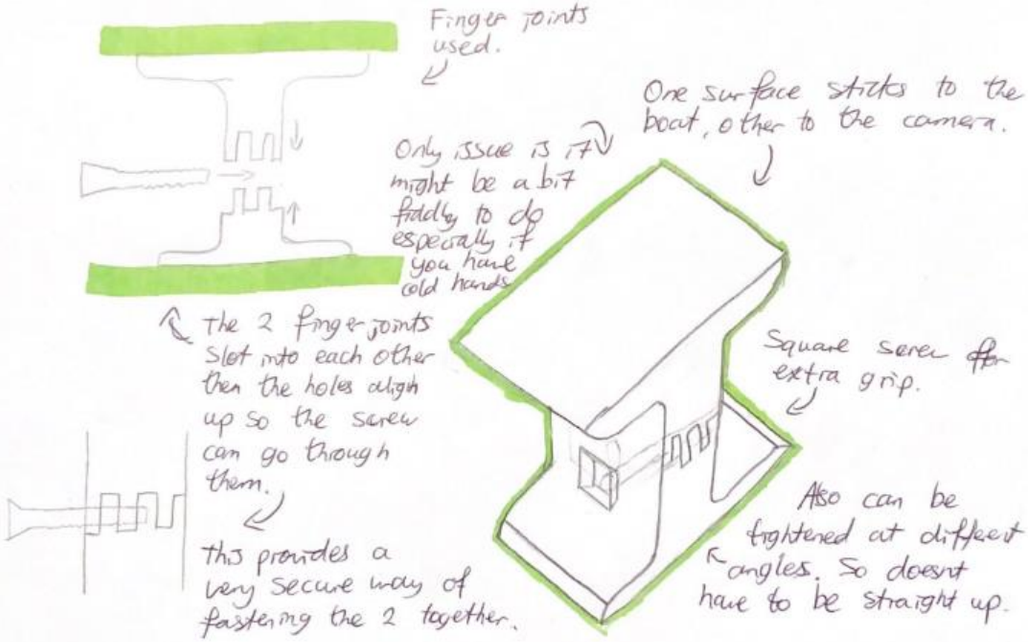
For this design I considered plastic, metals and wood. I decided that wood would be too brittle, and plastic could not be strong enough in case of a drop. I decided on metal, however it may be difficult to manufacture and it may need to me produced in a factory with specialised equipment.

Wood can be brittle, so might snap, metal would be more suitable

This is what it looks like when the joint is in 2 pieces.

Models fit together nicely, there might need to be a seat for the top joint to fall into so it doesn't slip around and put lots of stress on the pin.

I used a dowel for the screw, to represent how it holds it in place. It can also hold it at angles, and with only 2 wooden teeth is held securely.



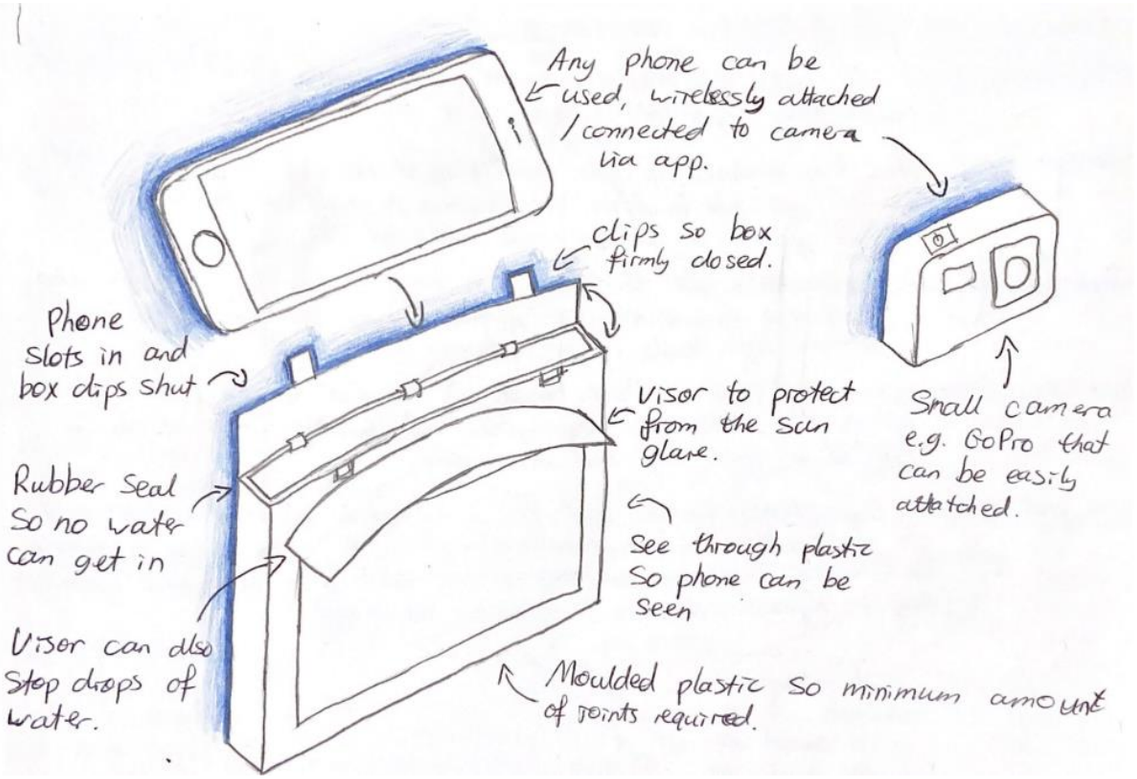
Feedback

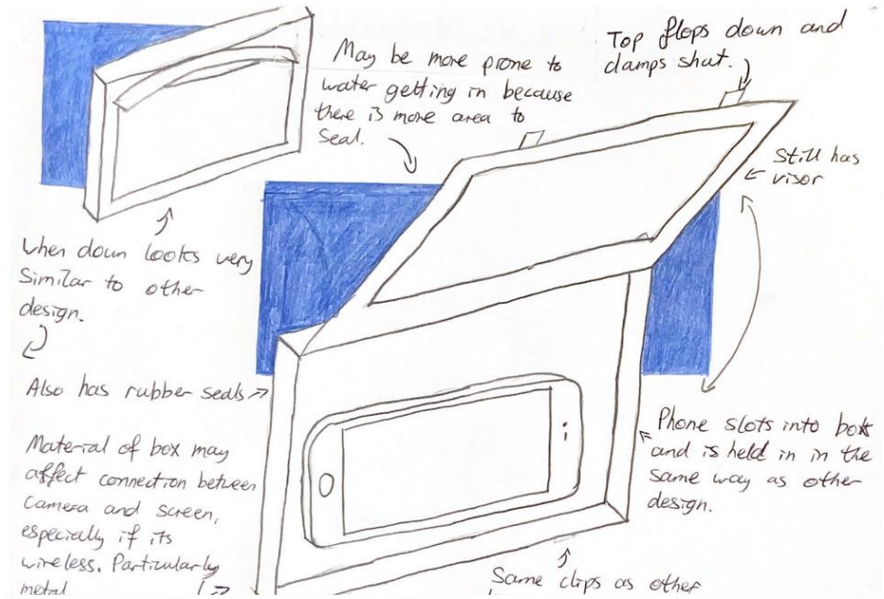
Kate: 'There is a risk that the fingers will be difficult to slot into each other, there is also a risk that they may snap over time, and if I brought it I would want it to last a decent amount of time.'

I responded to this by coming up with a mechanism where there is an indent on the other set of fingers so it doesn't slip about and fall out when attaching it.

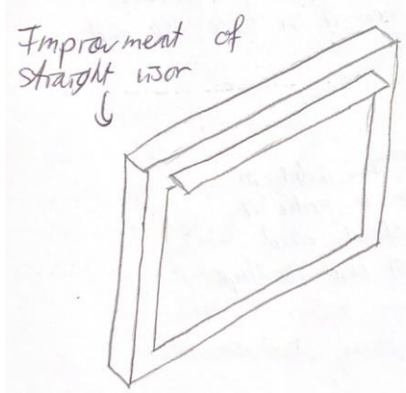
Next steps: On the next page I explore the idea of a box that holds a phone which could be used for the screen and camera idea.

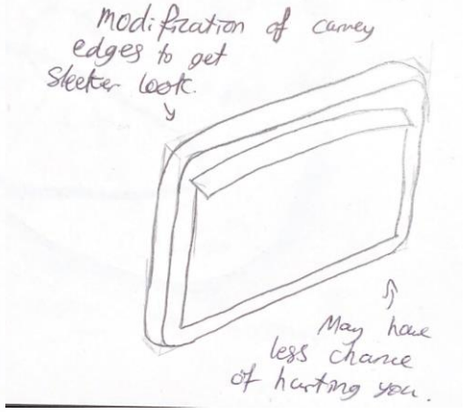
Initial ideas: 4. Phone box





This modelling helped me visualise my product and see how the different variations could come into play and help improve the item. The sketches show improvements and designs for the best possible outcome.



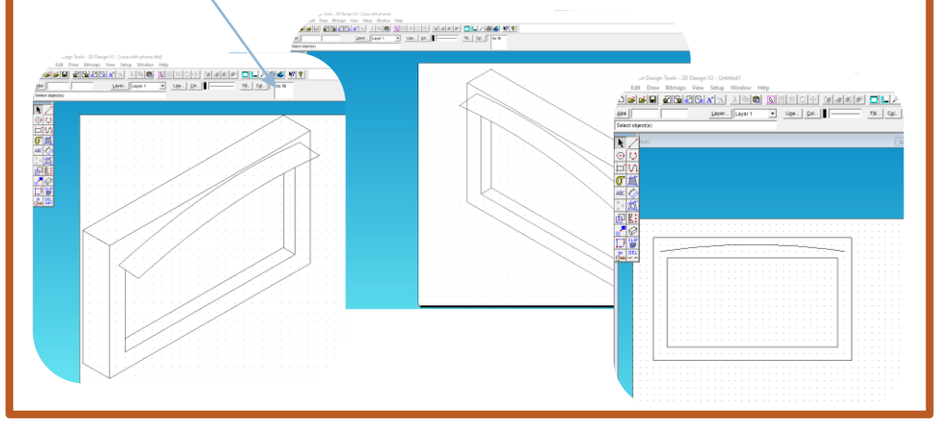


Possible materials

For this design I would use a mouldable plastic, e.g. polypropylene that can be possibly made on an industrial scales with blow/injection moulding. This means that the only joints would be where the phone enters and exits, which would remove extra error room. Prototypes show examples of both variations. The joints could also be made out of metal, and brought in bulk for cheaper prices and

CAD drawings to prove my principle of the case

I looked at the different sides to see how an end user would view it and to help me understand how it would look in real life.



Feedback

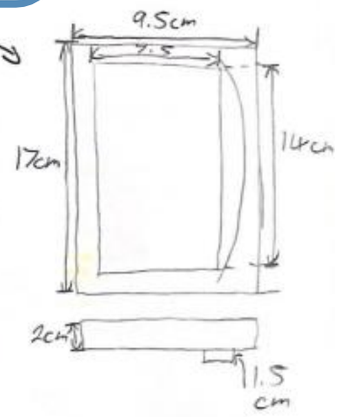
Jay Bridges 'When phones begin to adapt further, will this become outdated? My phone is very well protected though also the top opening feels safer than the front hatch opening.'

I responded to this in another design, when I thought of a design that would fit all phones.

Modelling the case with a real phone and seeing how visible it is.

Phone is a bit loose but padding can be added inside to cushion it.

Sizes

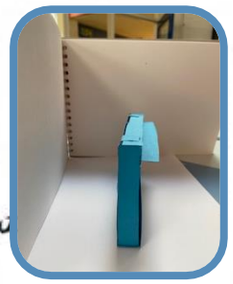


These models are also to scale as a real phone fits inside of them.

Proper seal will need to be attached

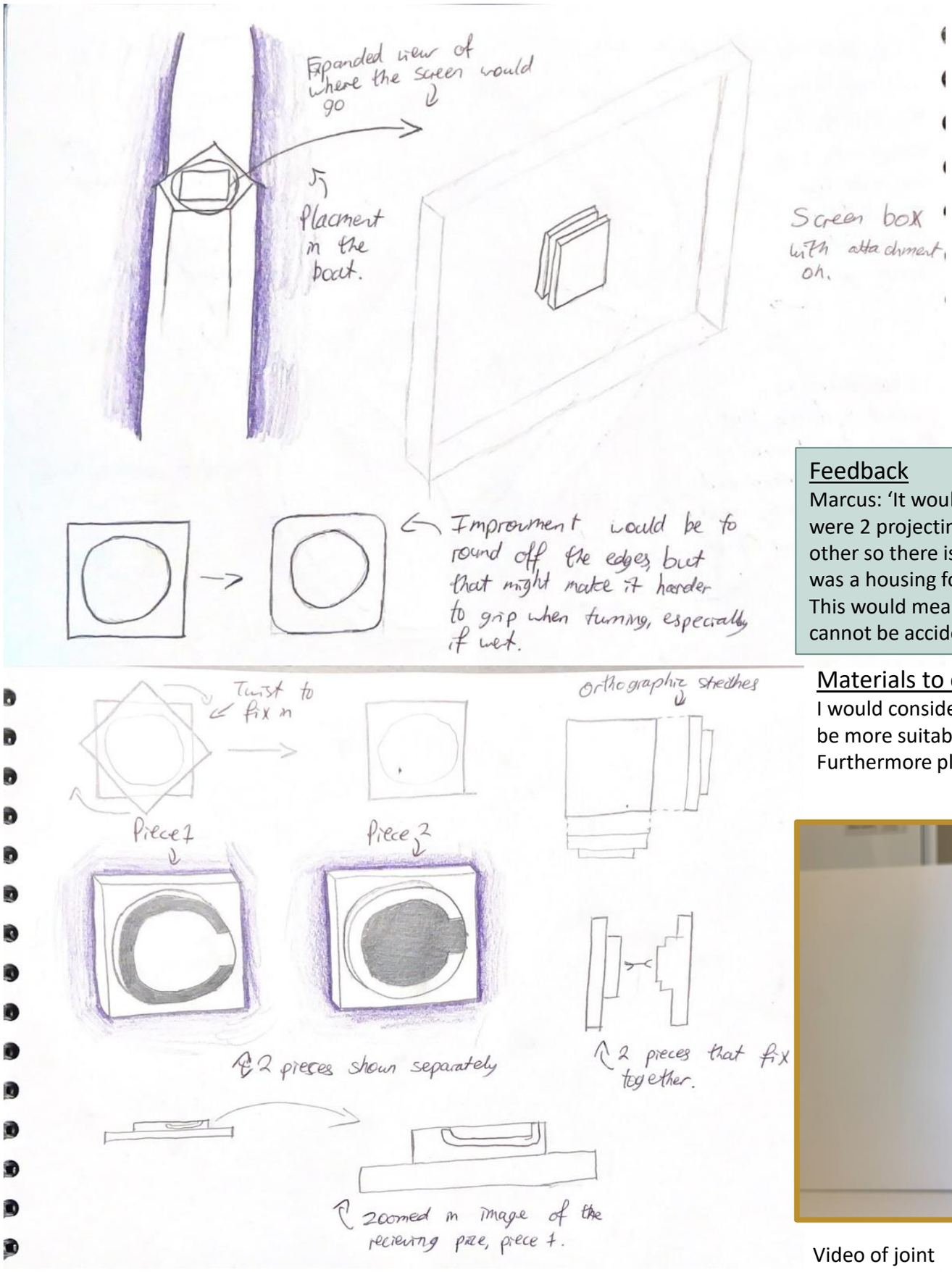
Example of case opening at the top.

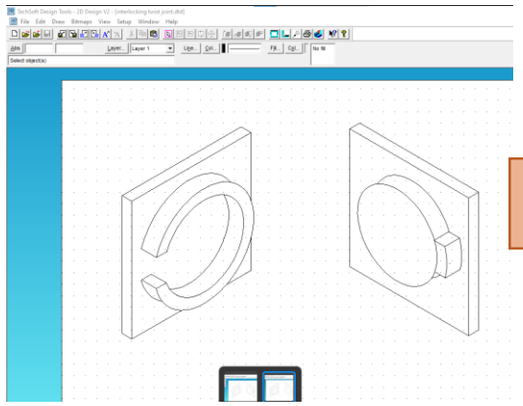
Hatch opens easily and phone can slide out

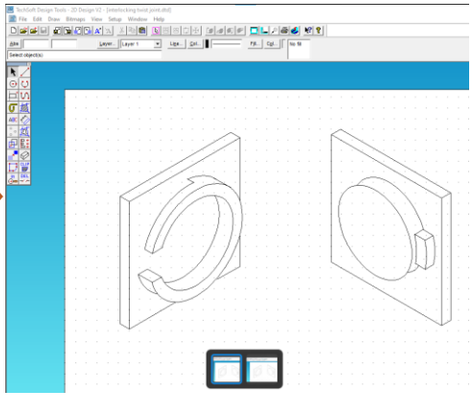


Next steps: On the next page I will come up with another design and asses the possibilities of it.

Initial ideas: 5. Rotating mount







The original design is shown here, but I realised that if the boat jolted it might just fall out. This led me to coming up with an improved variation of this idea.

This improved variation shows that the 2 pieces slot together and then twist to make the fitting secure. This should mean that even if the boat jolts or bumps, the item will stay securely on.

Feedback

Marcus: 'It would be stronger if there were 2 projecting ledges opposite each other so there is more stability. If there was a housing for the knobble to fit into. This would mean it clicks into place and cannot be accidentally undone.

Response to feedback

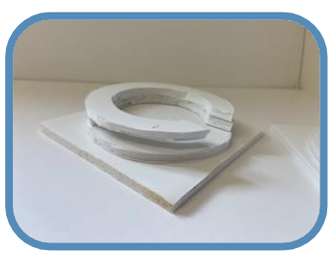
In response to this feedback I considered having it spring loaded so that it clicks into place. This would also help people understand how to use it, if it clicks when its correct so people know when its fully secure.

Materials to consider

I would consider using are wood, however it might be a bit brittle and therefore may snap. Metal would be more suitable but may be hard to form unless using a professional manufacturer would be easier. Furthermore plastic could be used by it may have a larger affect on the environment in that case.

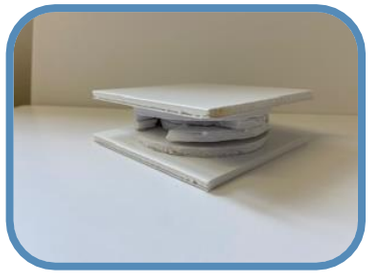
Video of joint clipping in and out to show how it works.

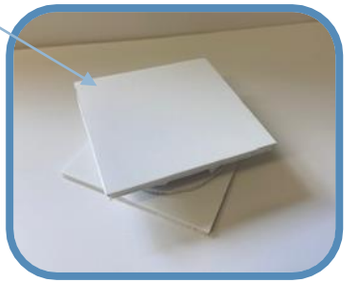
Very secure once closed, and squares match up with each other when locked shut.



Both separate pieces shown here, they slot together then twist to secure.

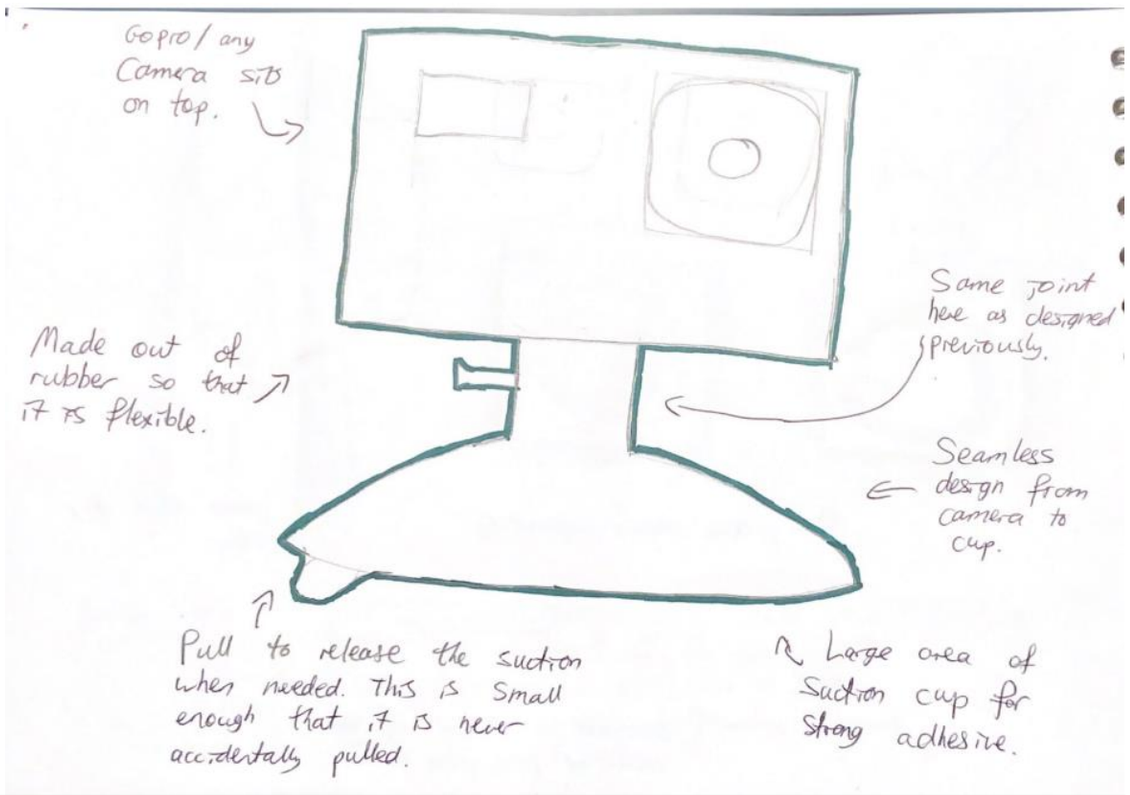
Process of putting together is shown in these 2 photos and the video.



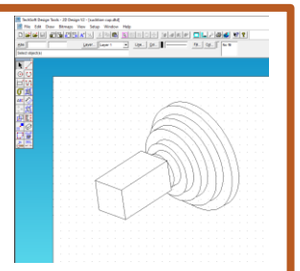


Could twist apart again accidentally, but spring could be put in place to prevent that.

Initial ideas: 6. Suction cup



2D design shows my concept here. The block represents where the camera would attach and the steps are space for the suction cup to form a vacuum. This technique has been used on many other designs and is proved a secure fit, especially in wet conditions like it would be on the boats. Also on this slide I asses the effectivity of the suction cups and how much they are retailing for on the market.



<u>Feedback</u>

Jay: 'I think that it is a bit of a risk because it might not be that sturdy. The camera /screen might be quite expensive because if it falls into the river then it is instantly lost. '

<u>Response to feedback</u>

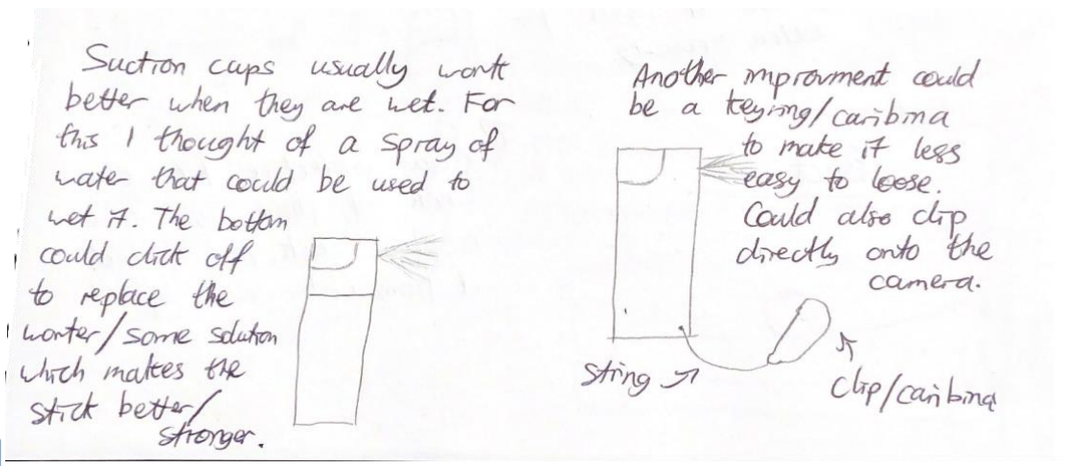
I have researched stronger suction cups and looked into pumps and clips that make it stronger. Also a plastic cover with a rubber seal underneath means there is less chance of it falling off.

I looked online for suction cups and assessed the strength of them. Some heavy duty ones I found (shown on the right) claimed to be able to hold 100kg with 'pump action' to create even more of a vacuum. This would bring more complication to the design and although would make it stronger, it might not be necessary as a camera does not weight much over 1kg.

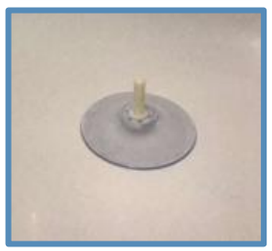
The design below this is an average suction cup that I found on amazon. This buyer also offers a discount when buying in bulk and free delivery. This suction cup is smaller but uses a clip not a pump to create a vacuum. It has 4 star ratings from 80 users and has 3 levels of force represented by 3 red bars on the woven thread attached.

<u>Materials to consider</u>

The correct material to use would be rubber /silicone as it has to be able to shape to the shape of the boat. This would also mean it can keep a vacuum so it stays tight onto the boat even when wet.



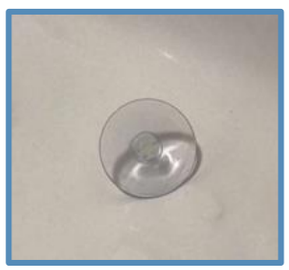
Weak so would not be able to hold a camera. Simple to use and doesn't require time



This is a simple suction cup that only needs to be stuck on and doesn't take up much room

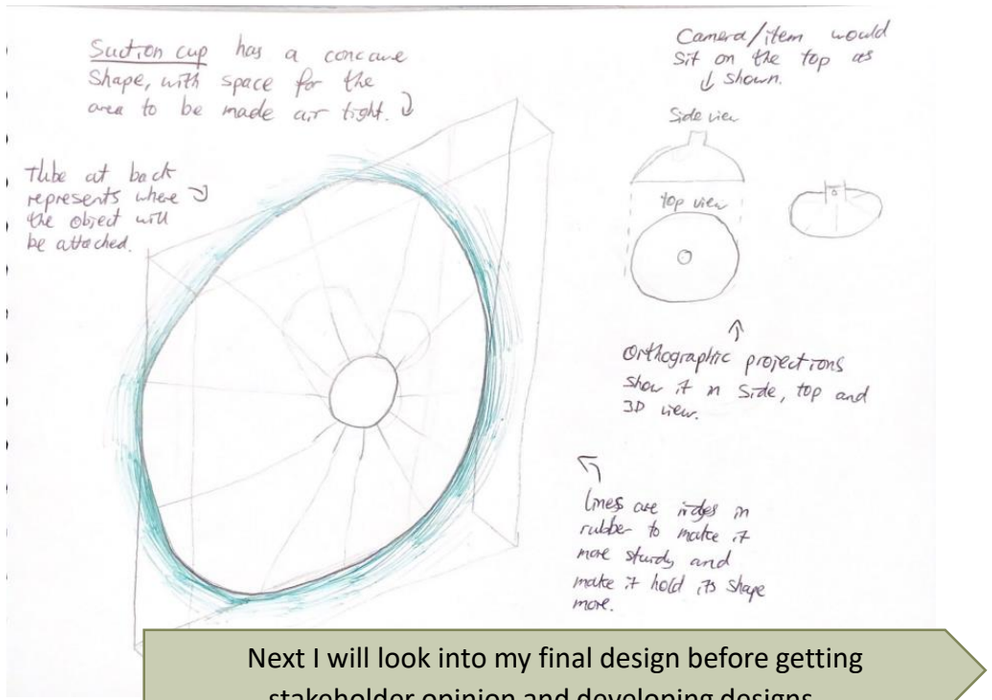
<u>Here I asses 2 different types of household suction cups;</u>

Overall I would go for the black one on the right because it seems more secure and higher quality.



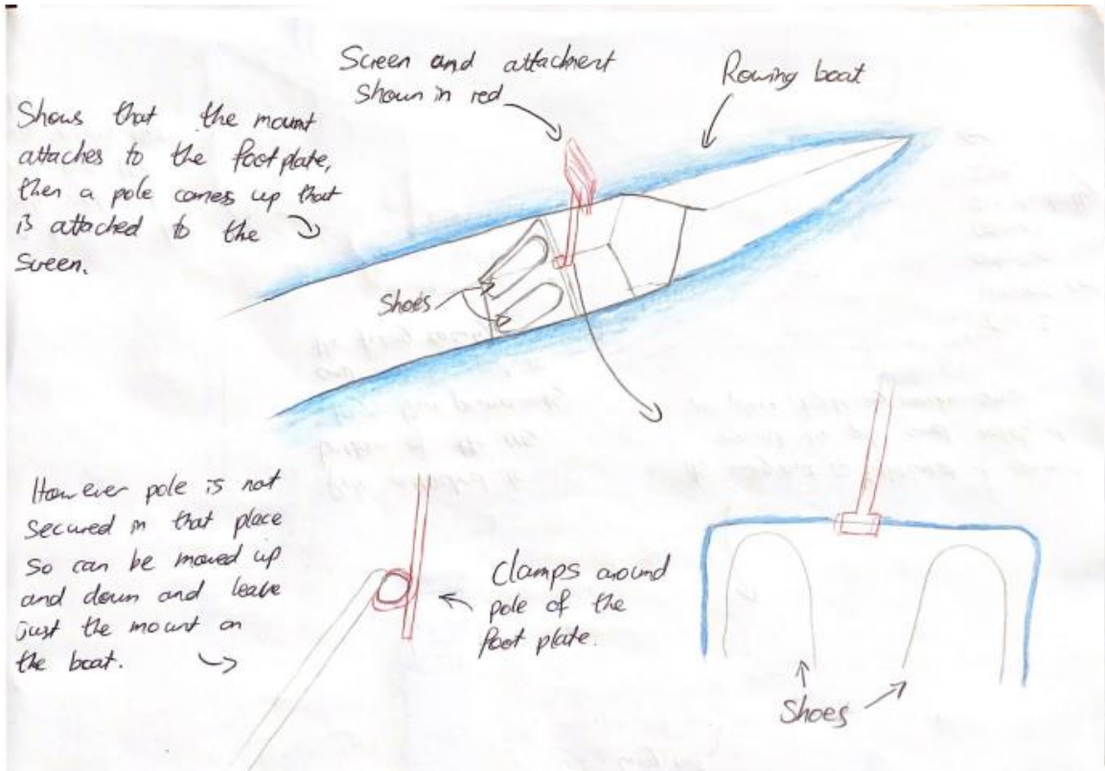
Will be stronger so may be able to hold a camera/screen, but not securely.

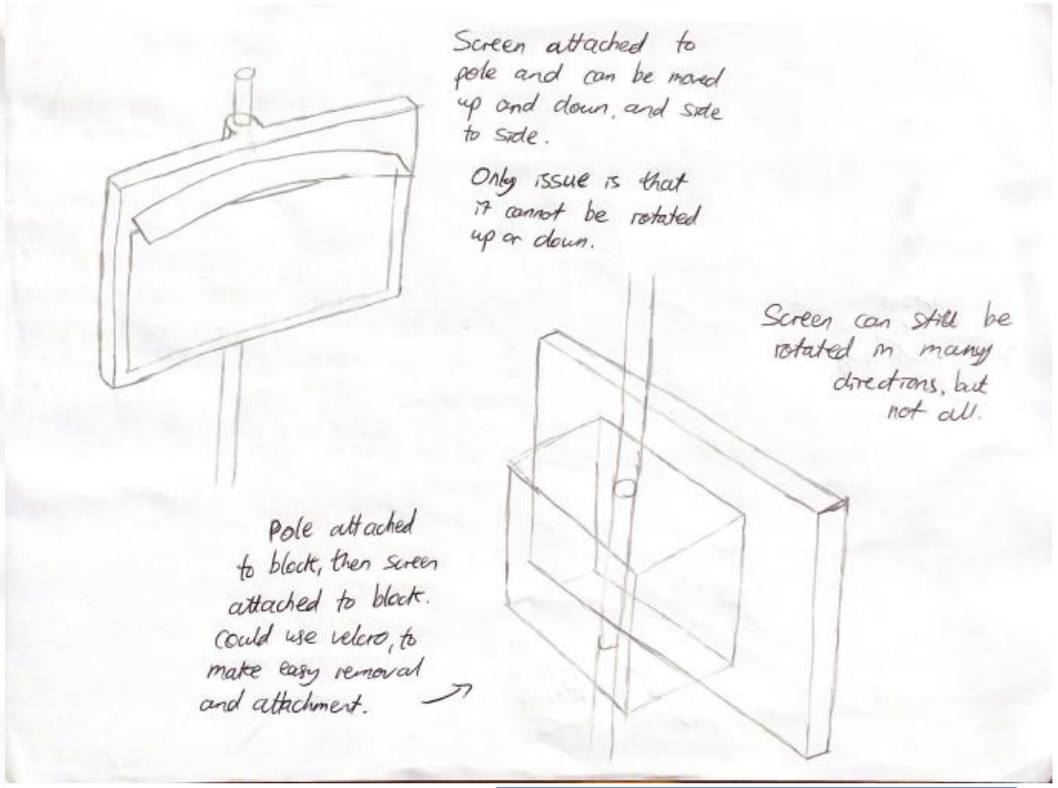
This design has a plastic cover so has less chance of falling off.

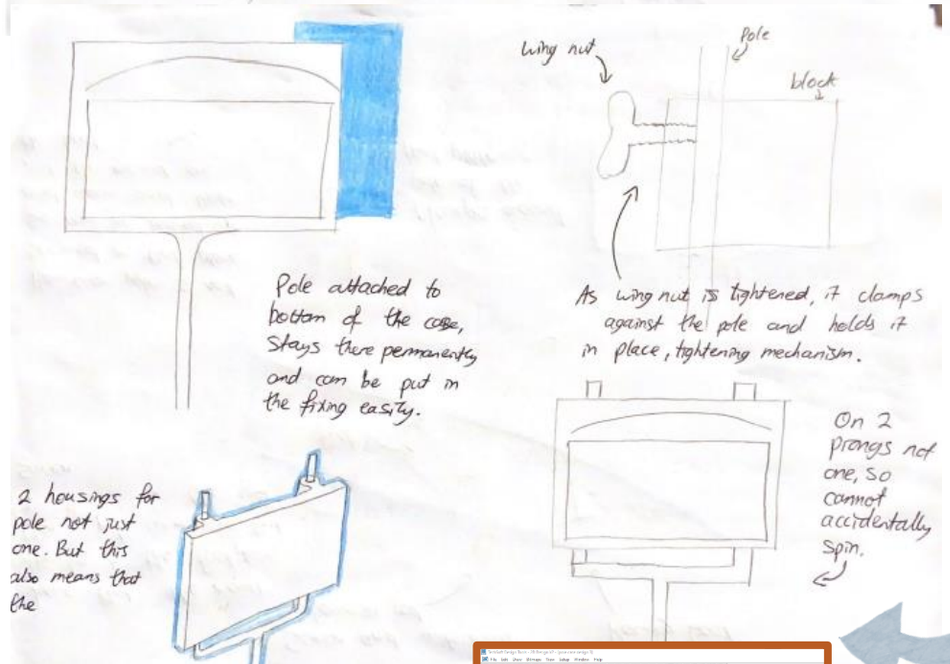


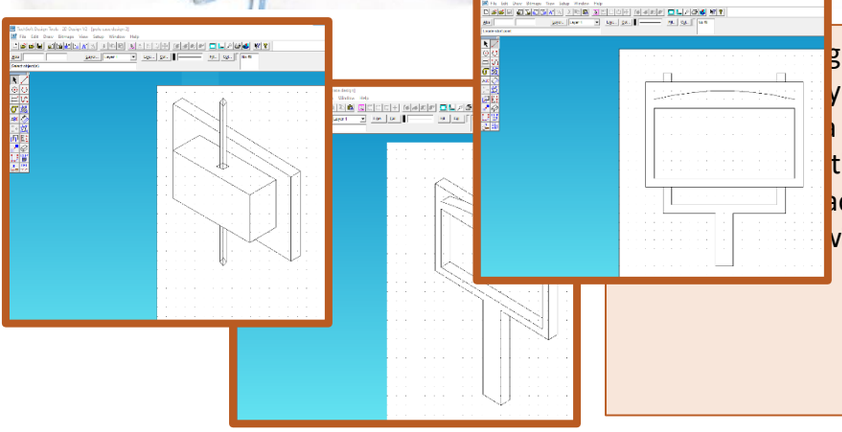
Next I will look into my final design before getting stakeholder opinion and developing designs.

Initial ideas: 7. Pole design









gns show the
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then using it in
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vings.

Materials to consider

I will consider using plastic, polypropylene as it can be thermoformed, and if product reaches large scale manufacturing, it can be easily replicated over and over again by a simple mount. Earlier I assessed how unsuitable metal is, because its heavy and ugly. I will consider using recycled plastic to reduce the impact on the environment and make sure that it is recyclable when its at the end of its life.

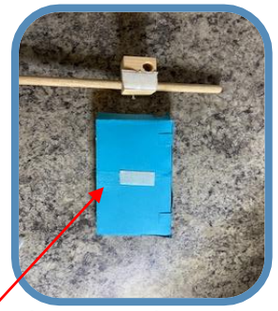
Feedback

Thomas: 'It's too top heavy so when the phone is inside it will just fall over. It needs to grip more on the pole so It doesn't swing.'

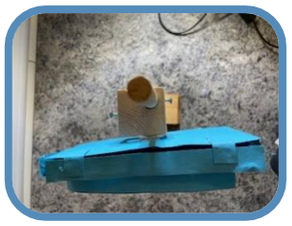
Response to feedback

I have listened to the feedback and considered adding extra legs to increase stability. I will also look into clamping the attachment on to reduce the chance of it falling over.

One pole may not be strong enough when trying to hold the phone up, so I experimented with 2.



Models show wooden pole and screen attached by Velcro. With enough Velcro this will hold



Velcro is good because it means that the surfaces are not affected when wet and it still sticks

If phone is too heavy it will be knocked off balance, and fall in or out of the boat.

May be awkward for storage and if pole holder snaps off item would have to be wasted

If boat ends up capsizing, the phone may slide off the top.

Separate model shows design with just the pole and screen.

This design may be better because the screen is not off-centered so it will balance better

Stakeholder opinion

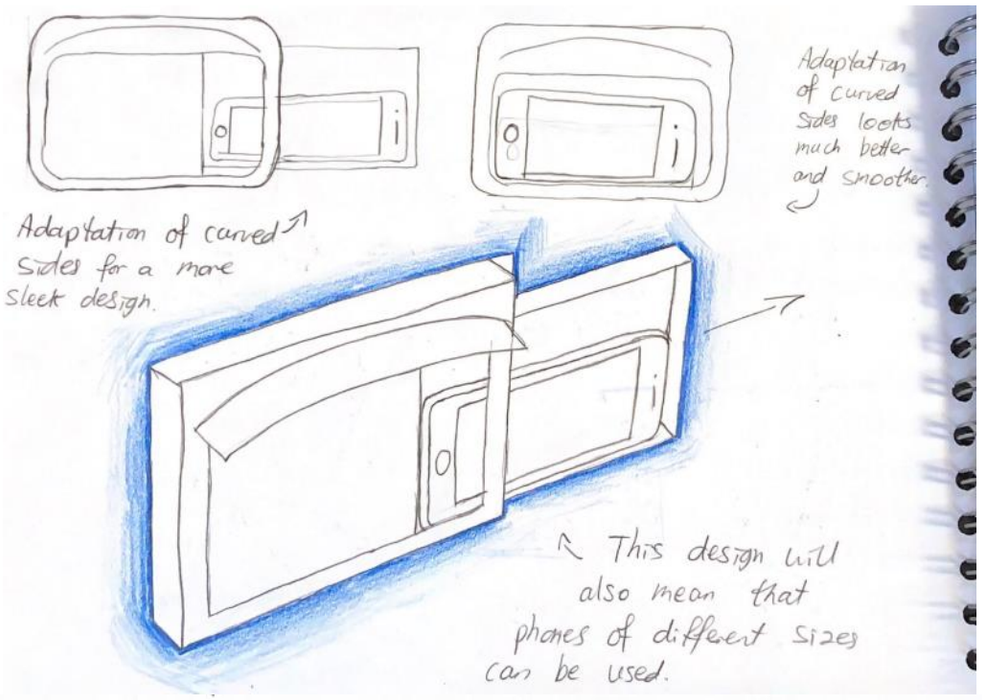
Pictures if me showing and interviewing my users.

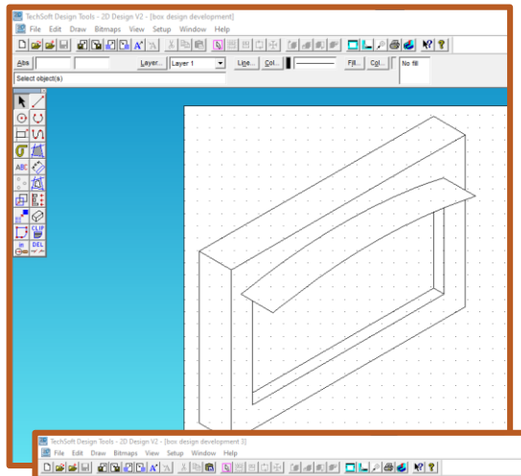
Stakeholder	Design number	Reason	Improvments
Marcus	7	Pole attaches to foot plate and can adjusted or removed.	will it hold the phone firmly in place, without wobbling?
Katie	4 and 1	① provides phone protection from water and impact ④ ⑤ Allows you to angle the phone to get best photo	① Needs to have padding to fit phone snuggly. ④ ⑧ would be even better if it combined with ⑤ and rotated laterally. Hence 3D movement.
Ben	6	It is time efficient and Means the boat will not need Modifications	Is there a way to test the strength of the Suction for each use So it does not fall off.
Dylan	4	Visor is good. I like the water proofing and minimalist design.	Make the visor larger and adjustable. Be cautious of materials to make it out of.
Dylan	Not 1	Its not sunny lots of the time when rowing So it may be useless half the time.	Add a portable battery for more charge in all weather. Get rid of the Solar panned.
Bethany	4	There is larger surface area for the holder to be attached and will ~~stop it~~ keep it in a more fixed position	Will it still protected the camera if the boat is capsized?

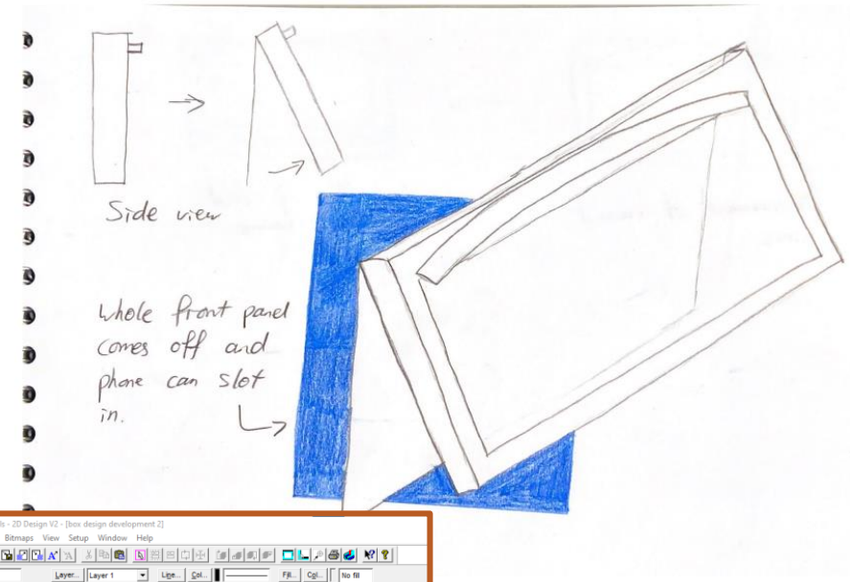
In conclusion, 4 was a popular decision, therefore I will evaluate it further. 7 and 6 were also liked, however many others were not mentioned. When I evaluate my product I will go into more depth of what could have been improved and what could have been used swapped out to make it more effective.

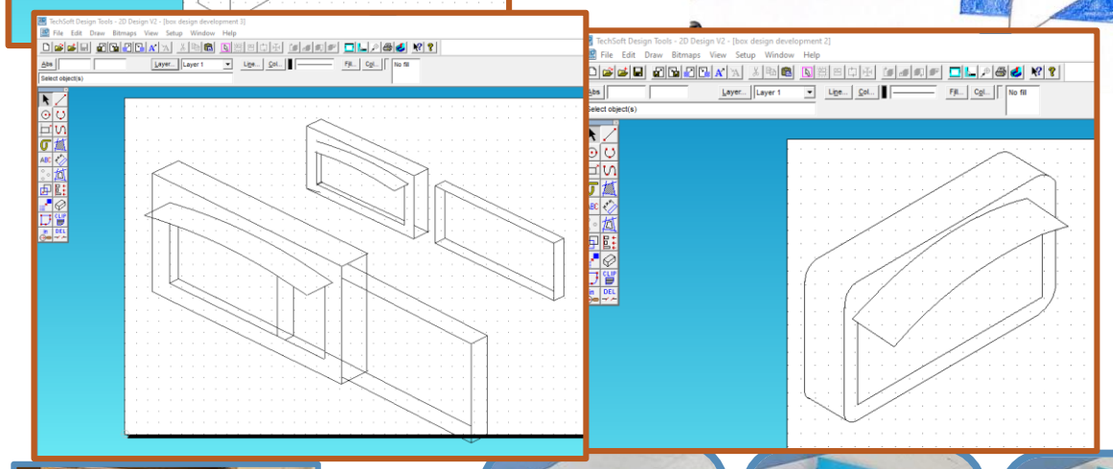
On the next slides I will start to develop some of the popular and most feasible designs.

Design developments

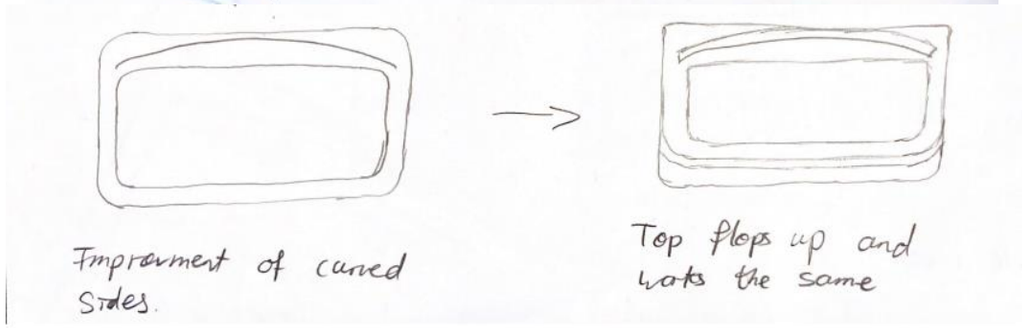


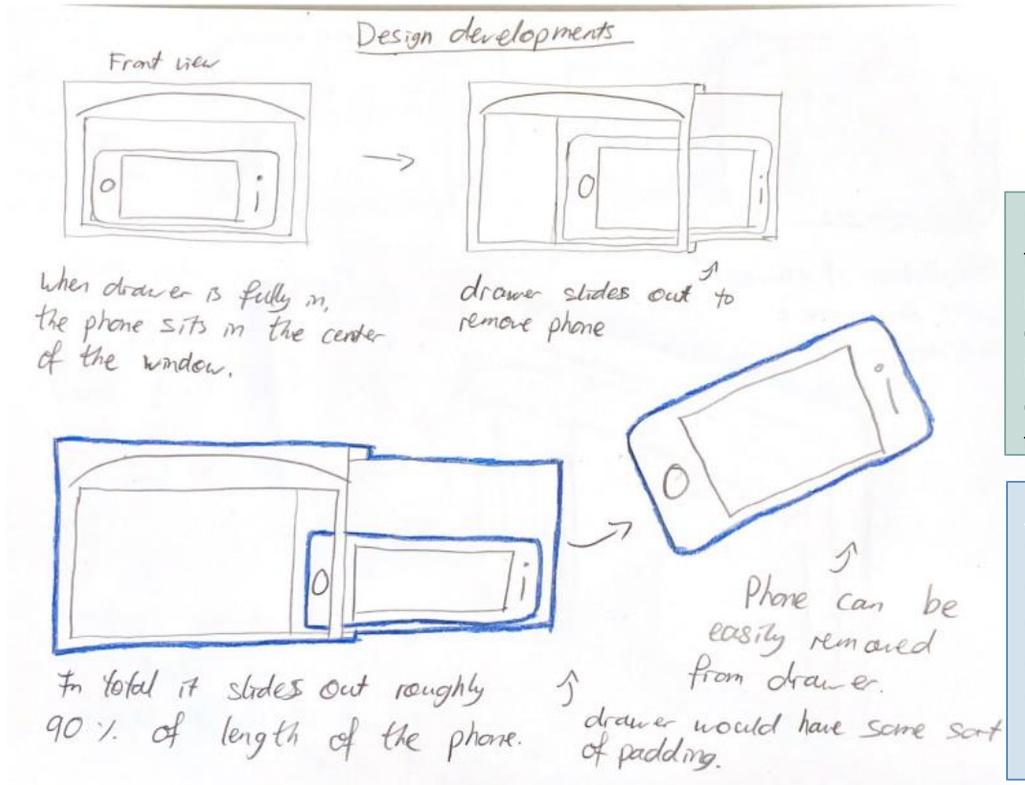






Showing the process of putting the phone in and out of the case with the drawer

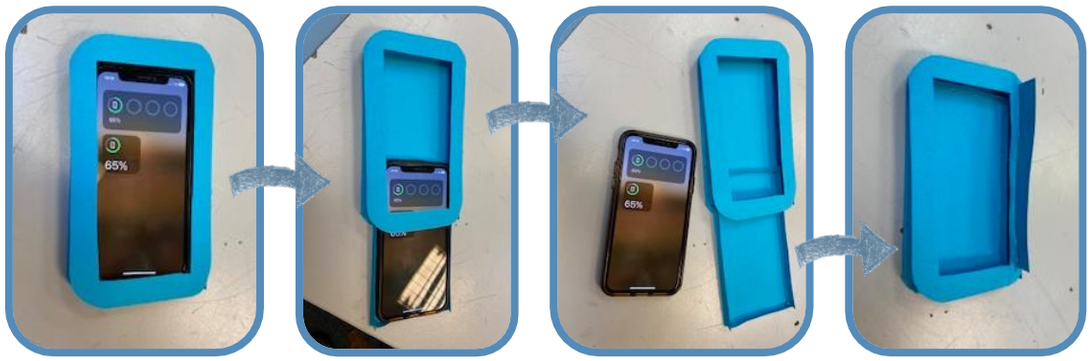




End user feedback: Bethany; the phone looks like it's the perfect size and I like the curved edges because it makes it looks more sleek. However I cannot tell that it is the visor in the photos.

In response to this feedback, I will design more on curved edges and assess the feasibility of more sleek designs. I will also look into more minimalist designs and what sort of things I could add/subtract to make it look better.

Showing the process of putting the phone in and out of the case but with curved sides as explored in the drawings above.

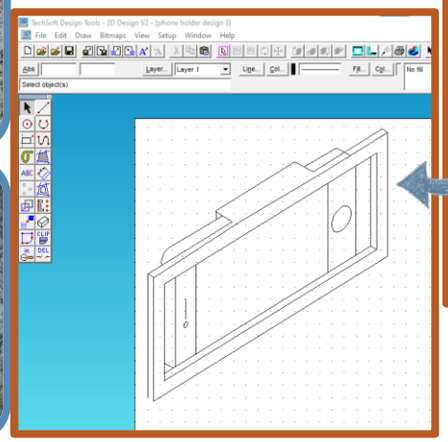


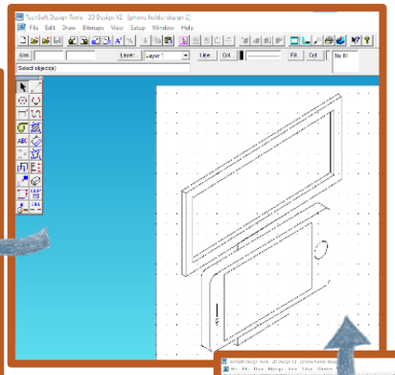
Next steps: on the next page I explore the developed ideas on the next initial design.

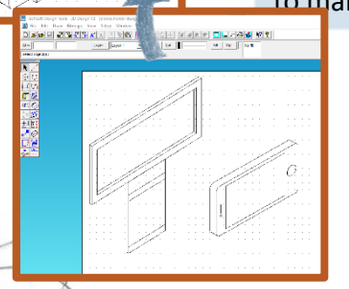
Design developments

Could tighten like a car phone holder, by pushing or by twisting a knob on the back.

Models show the design shown below, with a clamp-like phone holder that tightens around the phone.

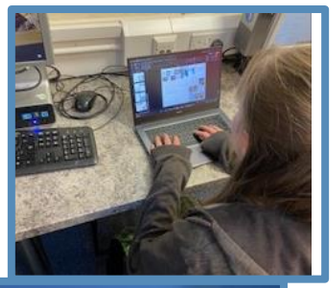






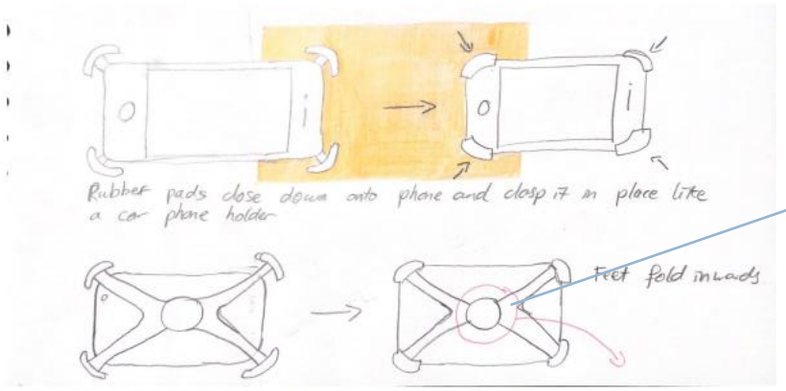
Opinion of Rebecca cousins: I think they are cool and I like the way it closes because it gives it more protection and it makes it more waterproof. However it might fall out with the other one.

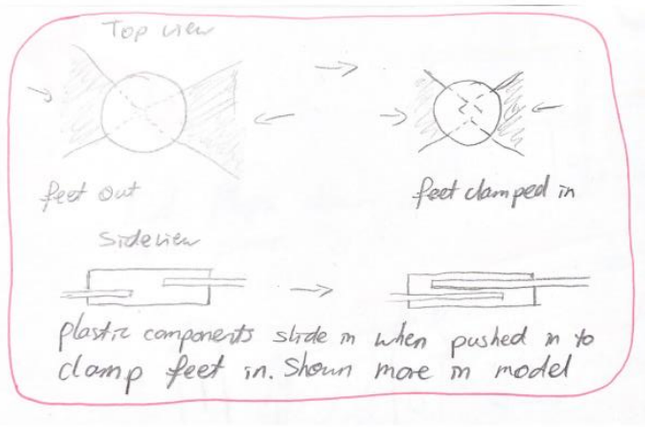
Response: In response to this I will try to make it more secure and add a rubber seal to make it more waterproof.

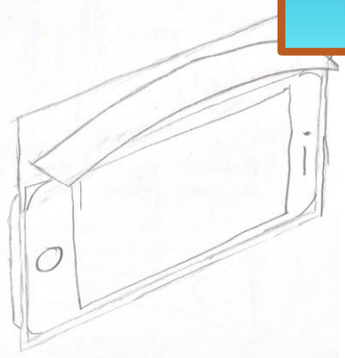


Doesn't keep the phone waterproof

Light and sturdy if made out of a material like aluminium. The feet on the end of the arms are rubber to keep the phone secure.



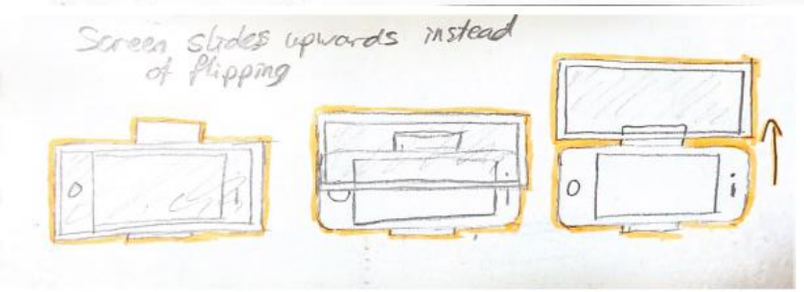


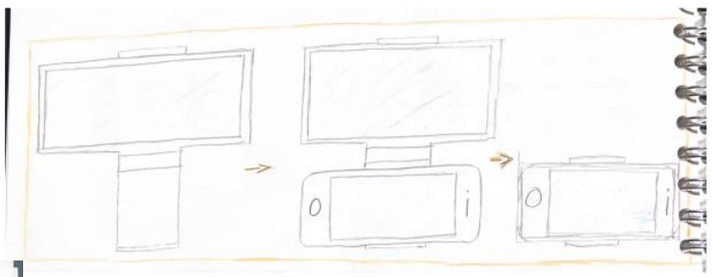


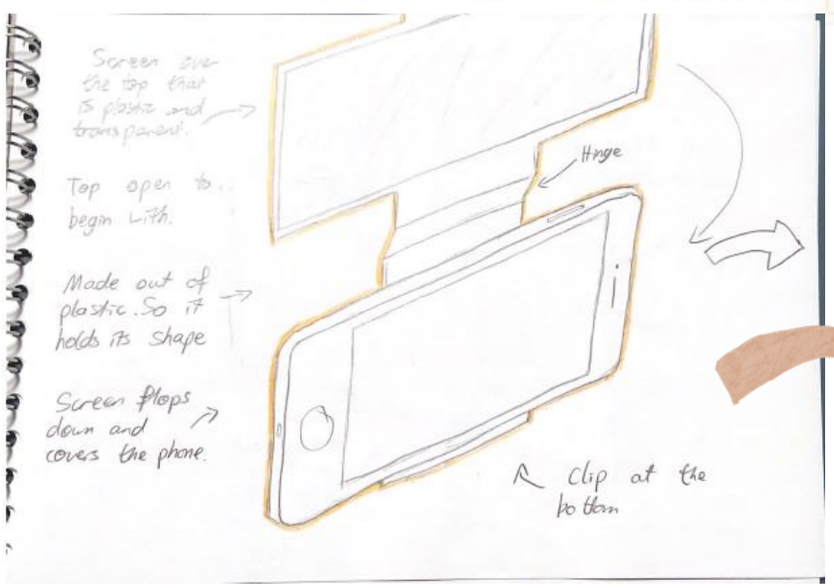
Showing clip that the plastic comes onto.

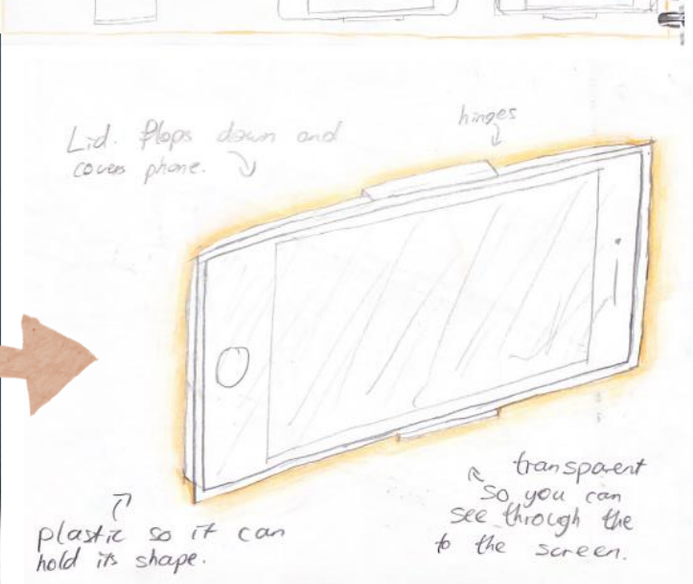
Clip mechanism is similar to the one shown here, apply force to shut then prise open to open.

Plastic cover fully uncovers to reveal the phone, visor attached is shown in the sketches above.



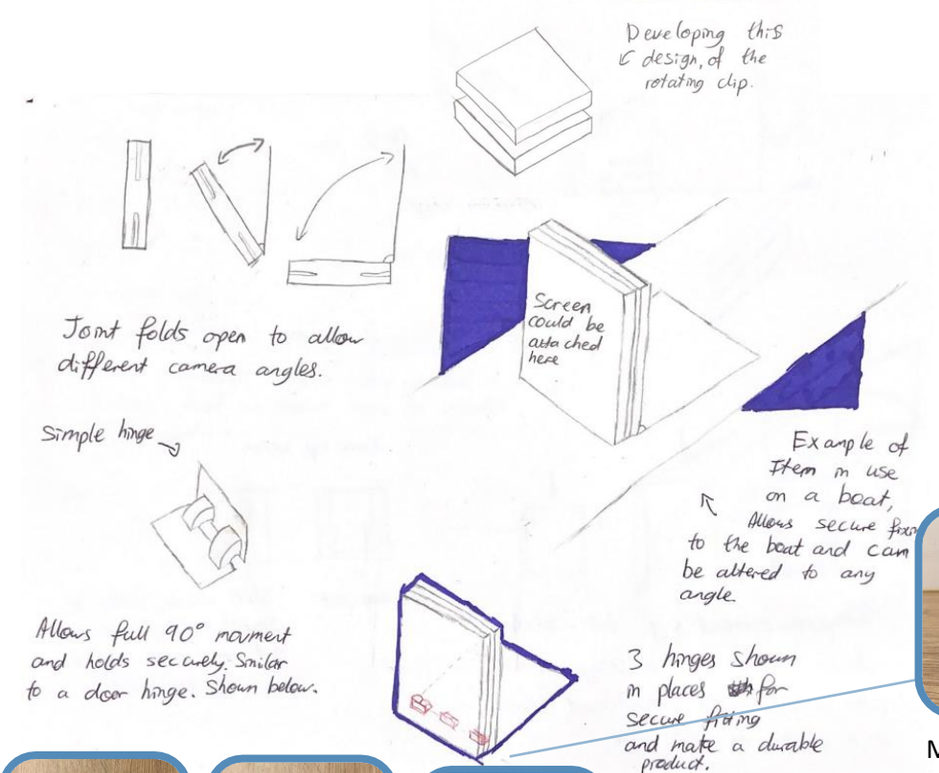


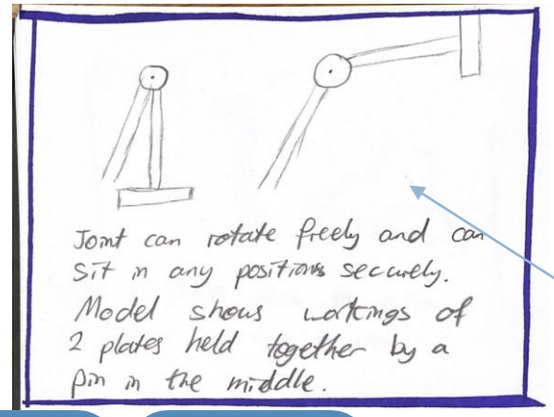


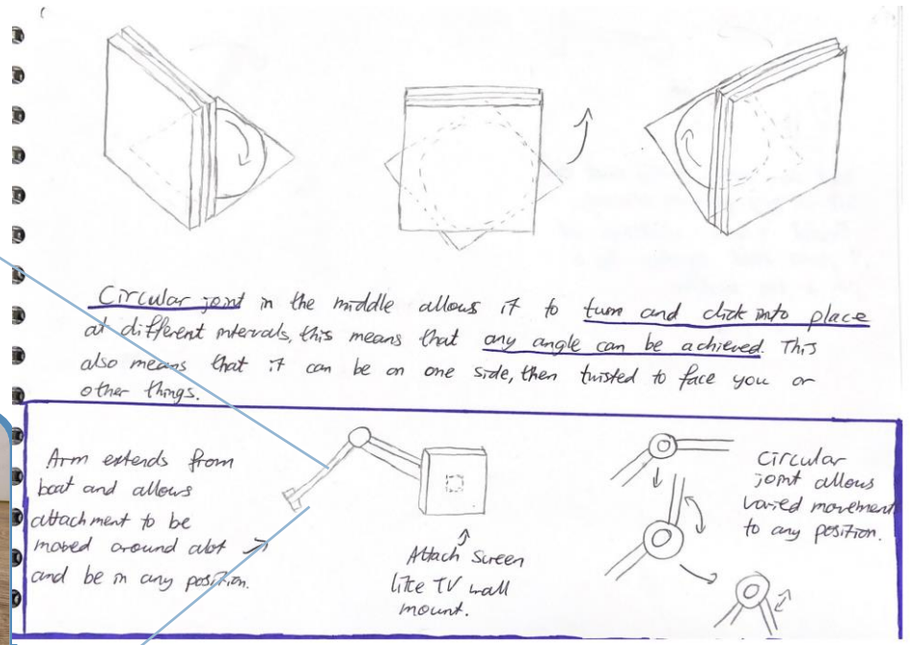


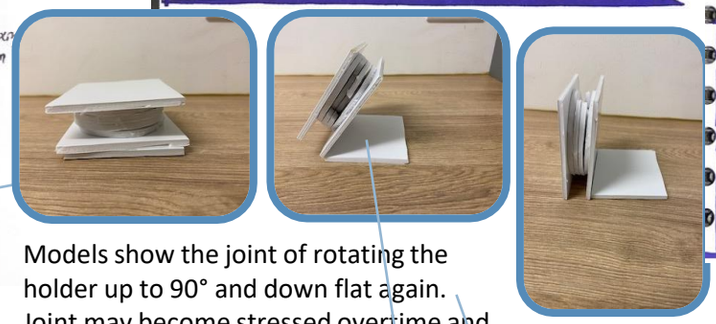
Models showing the design shown above, with a screen that flops over the phone and clips shut as shown. This represents a simple design to keep splashed off the phone, but it is not fully waterproof.

Design developments

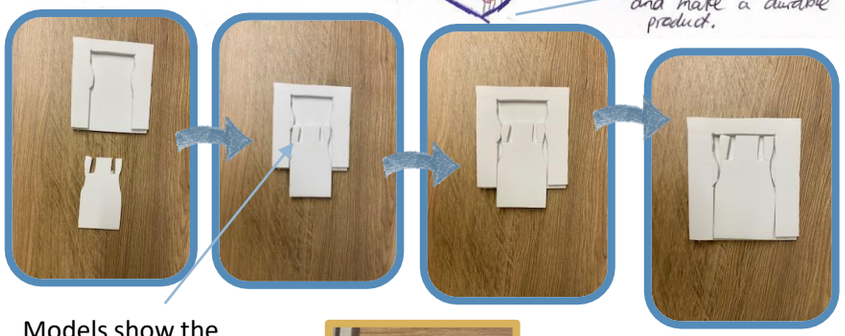






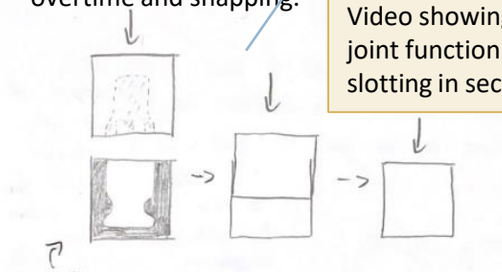


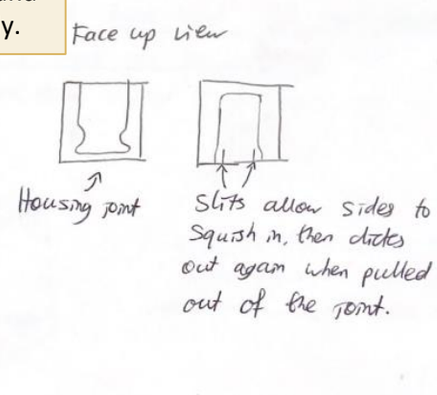
Models show the joint of rotating the holder up to 90° and down flat again. Joint may become stressed overtime and break so hinges will be used as shown.



Models show the process of the parts sliding together. The arrows show the part that is cut out to allow movement and bending to slot in. When in it is in the arms bend back out again. There may be an issue of the arms becoming weak overtime and snapping.

Video showing the joint functioning and slotting in securely.

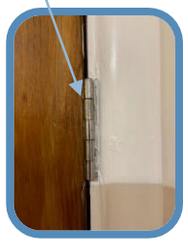




2D designs show the idea and how it would look in a working drawing.

Opinion of my mum: For the arm, it is more likely to shake out of position when the boat is moving. And the turning option is much better because its more secure.

In response to this: I have made my drawings more clear and decided against using the arm for the camera because it will create a destabilised picture.

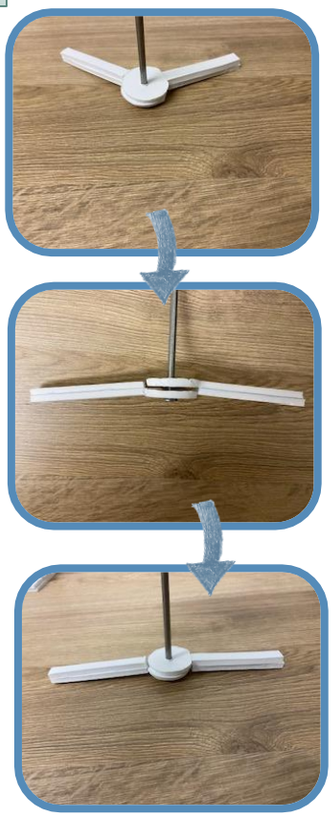


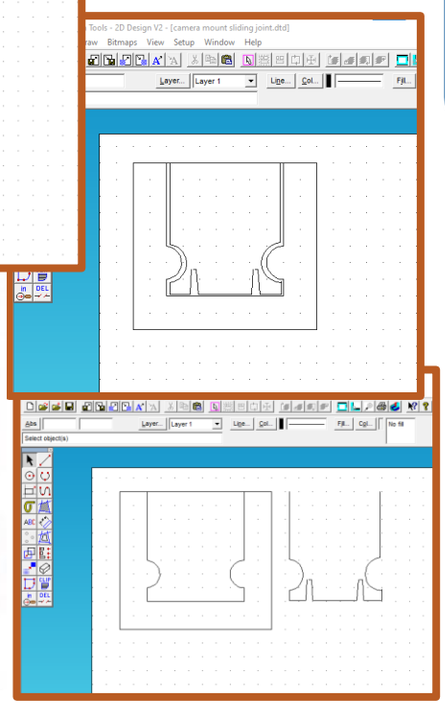
Photos show that the joint can sit in a range of positions and hold.

Nail used in example is heavy and sets off balance but in real prototype a lightweight and strong pin will be used.

After so many times rotating the friction between the pin and disks will go and it will become loose and floppy.

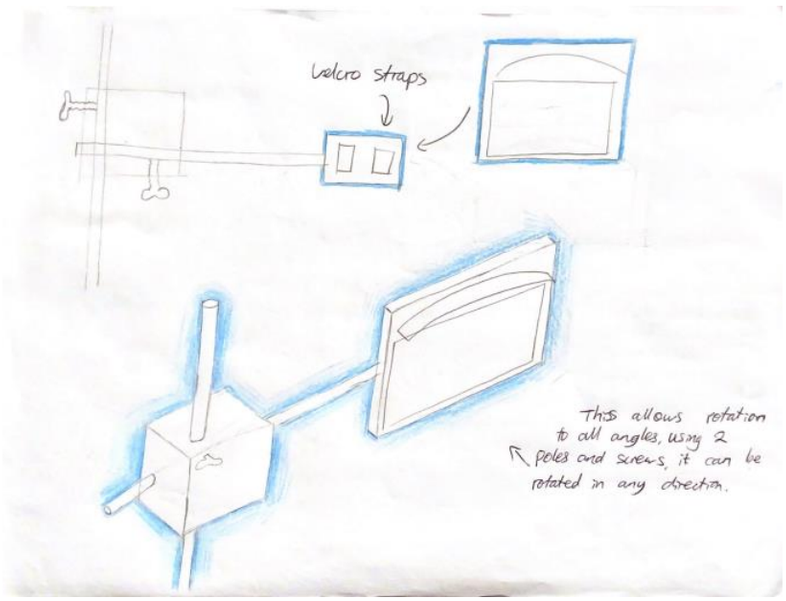
In conclusion I think that this model successfully shows the idea and makes it feasible. It will also have to be very strong to hold the weight of the camera

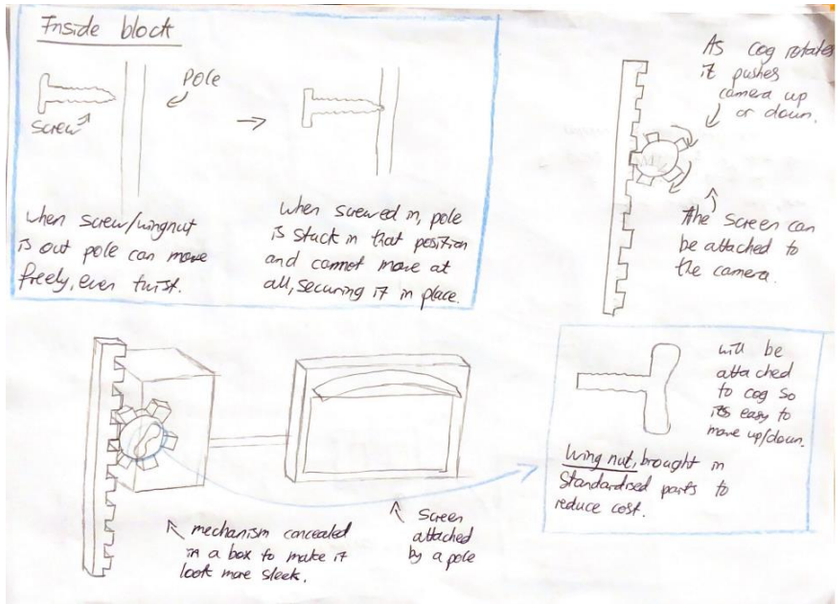


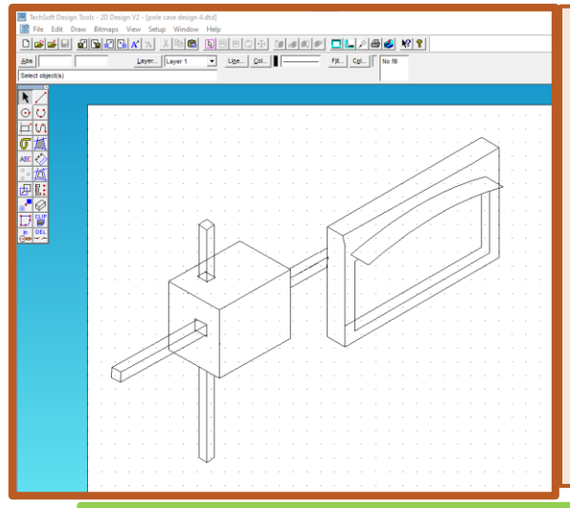


Video shows the joint moving to a range of positions and siting securely in that position. A nail is used as an example of a rod to hold the 2 parts

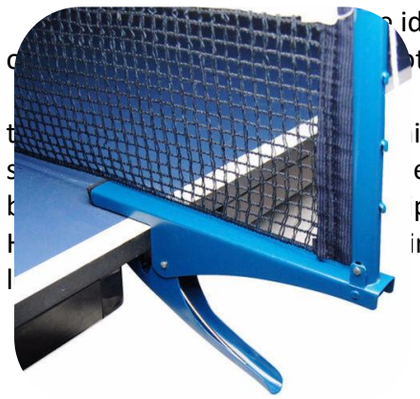
Design developments







CAD design shows the possibility of the item going into large scale/batch production. If a working drawing of the item can be devised, it means anyone can understand the concept and print it

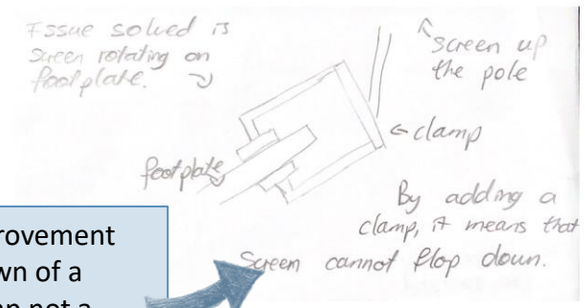


idea of a clip
tplate just like a
off. I came to
is might not be
e phone as the
p when in use.
into consideration when

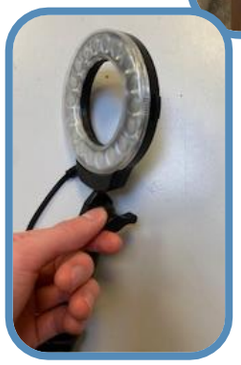
Feedback
Thomas: 'The wingnut might be too small to grip especially when you have cold wet hands so it would be better if it could be made bigger. Also it might need counter weights if its not balanced enough as it might tip either end as the boat rocks.'

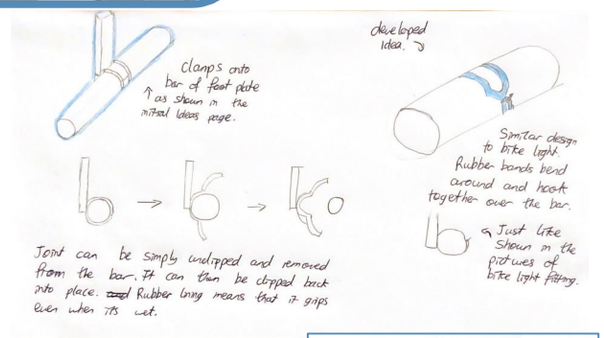
Response to feedback
I will look into making the nut bigger so its easier to turn and maybe 2 nuts for extra grip. As well as that, there could be a clamp instead of a device to hold onto a pole. This would mean that there is less chance of it falling over.

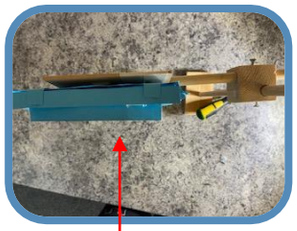
Improvement shown of a clamp not a rubber band



When looking for products that have this mechanism, I found a light with a screw to tighten it. The video shows me using the tool and tightening it again with the screw. This proves that my idea would be effective and useful in the environment of use. It will also not be affected when wet and as long as the nut is big enough it should be easy to use and grip even with wet and cold hands.



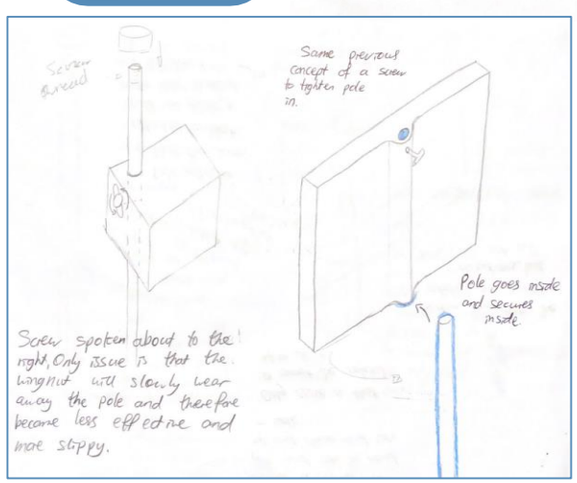


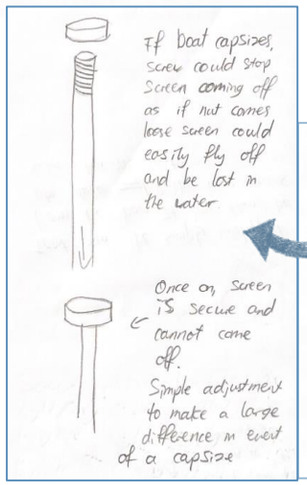


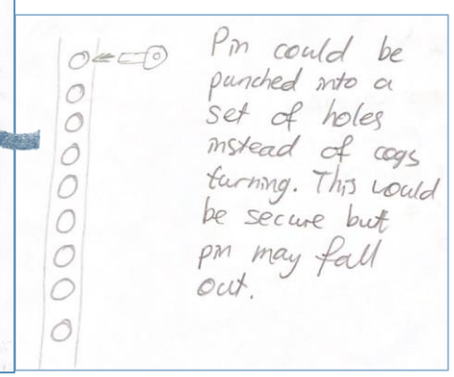
Picture shows Velcro on both sides, showing that you can simply stick them together, proving efficiency.

This covers all angles so the screen can be put to any angle it needs to be at in the boat.

Screwdriver shown in the bottom which I used to loosen and fasten screws, but will be large wing nuts so It can be done with hands.







Photos show that it can move to all angles and still be secured, however at some lengths it can become unstable, so adjustments will need to be made to ensure that it stays upright at all times eve if the boat capsizes or jolts.

Final design: Screen

Speaking to my final users to make a decision:

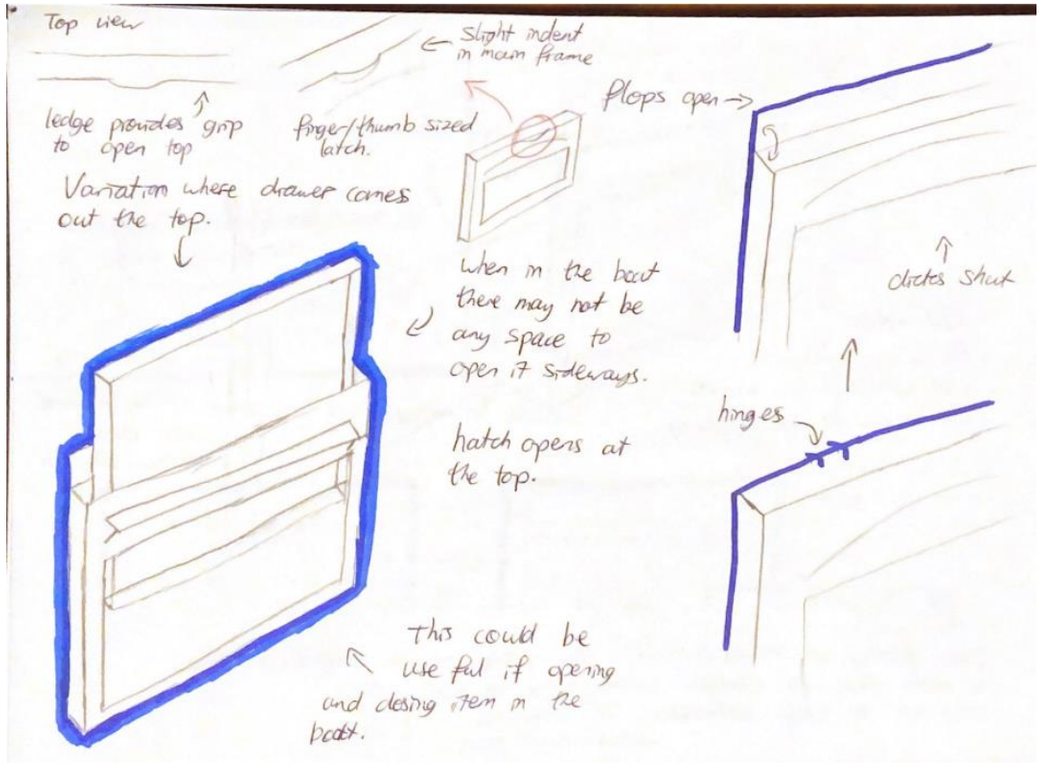
I have spoken to 3 of my users, and used their opinion on which design to follow through on. I asked them qualitative questions like 'What do you think are the problems with this design and how could it be made better?' and 'Is this the best solution for solving my initial problem?'. Their answers are shown below:

-Rueben Isaac- "I think the box design is my favourite but could be better with some adaptations like a polarised screen like sunglasses have. I do think it solves the initial problem because it will hold your phone securely and safely, then you can add a camera to the back."

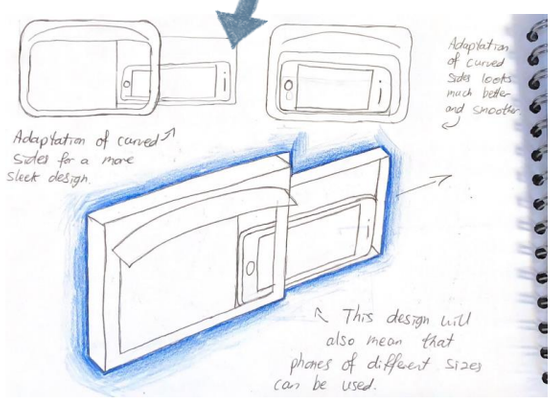
-Finbarr Wilson- "I think that the box design is the best design because it can hold the phone securely and it also keeps it waterproof. The joint is a good idea but it doesn't hold the phone or keep it waterproof so I don't think that will cover what you said in the design brief."

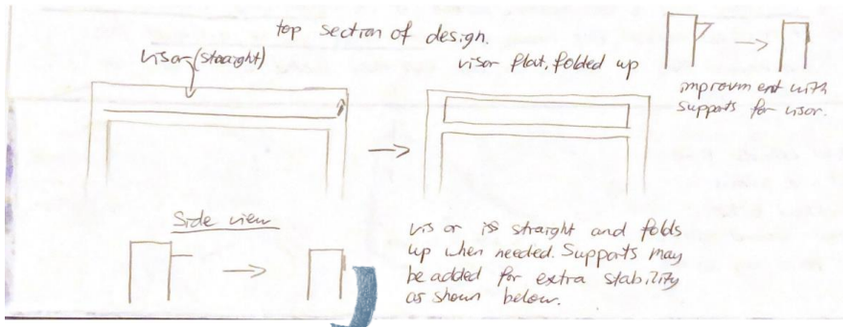
-Marcus Holburn- "The problems (with the box) are its big and an awkward size, which may prove hard when trying to manoeuvre it, so I would suggest that with any design to do with the phone its as small as possible and compact. The mount is a good idea but does not agree with your design brief so there would be no point in making it."

After listening to the opinion of my users, I have chosen to make the box design as my final product.

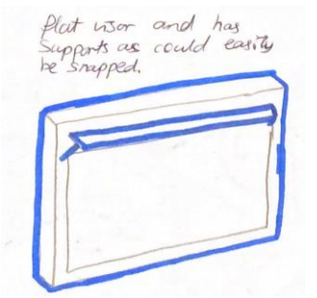


This is the design that I have chosen basing off the opinion of 3 of my users as shown to the left. I develop it further here then show the final product on the next page.





Here I explore the advantage of having the flap for the phone at the top, which means it can be taken in and out inside the boat, where they may not be space if the flap is on the side.

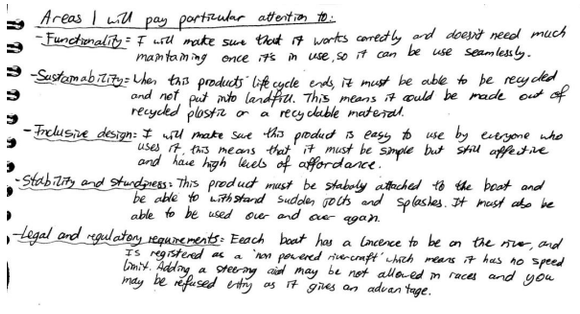


How this solves my problem

I believe that this solution will solve my problem as it will agree with my design brief, of assisting a rower see behind themselves when rowing. This product will hold their phone sturdily and safely in the boat. It will also not affect the stability or boats balance when in use. In the event of a capsize the phone will stay in the boat and be waterproofed until the boat is turned the right way up. I have also added a sun visor as one of the key problems that people mentioned was the glare of the sun affecting the view, the second largest issue raised in my survey of the 11 potential users I asked. The design brief and areas that I previously said I would pay particular attention to are shown below.

The areas I have paid particular attention to are shown below:

- Functionality- adding a drawer has helped put the phone in and out and the visor has reduced the affect of the glare of the sun.
- Sustainability- potentially using a second hand phone screen or recycled plastic/ hinges for the design, this reduces plastic waste and prevents my buying a new one.
- Inclusive design- by using anthropometric data to find the average hand size, I have made this product useable to everyone and not small intricate designs for the moving parts.
- Sustainability and sturdiness- I will make this product as stable as possible by using light materials which are durable. This will also increase the longevity of it, which features in my design brief.
- Legal and regulatory requirements- This product should be allowed in races as it is a holder for the phone, which can act similarly to a strokecoach, which is an aid to but still allowed.

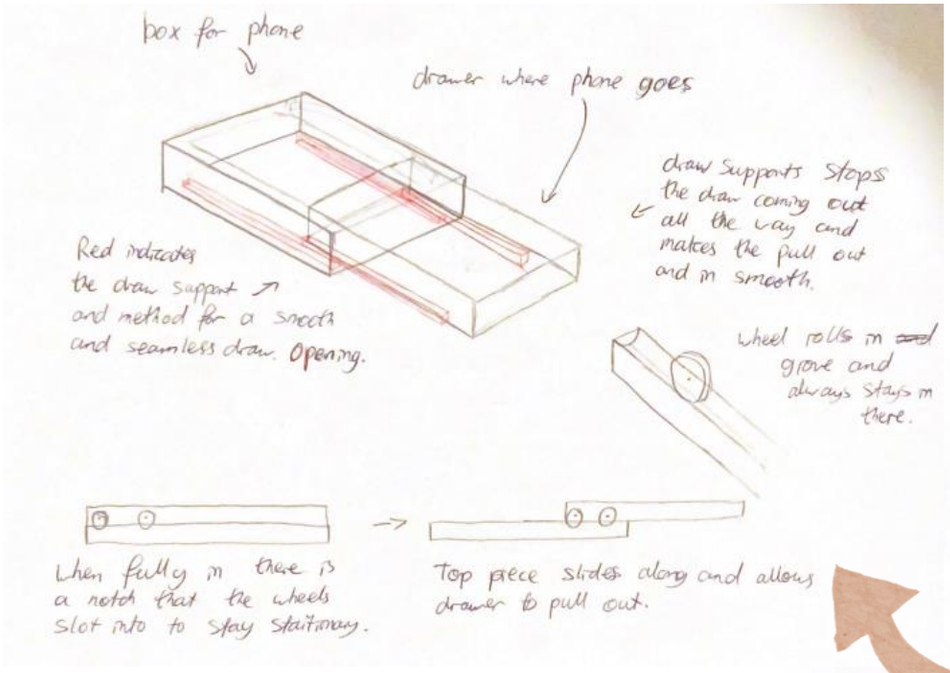


Design brief

Design an innovative product that allows you to see behind you when you are rowing, and does not affect the boats balance or stability. It should also be easy to use and be sturdy and have a sufficient longevity. This should be no heavier than 1kg and no larger than $0.3m^3$.

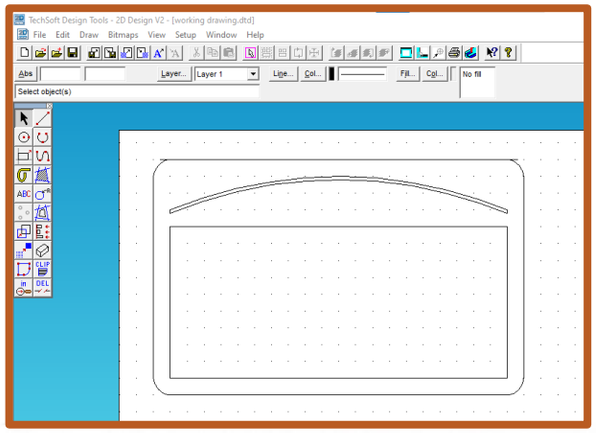
Next steps: On the next page I will assess the final design of the box and explain all of the key features which will be important when making.

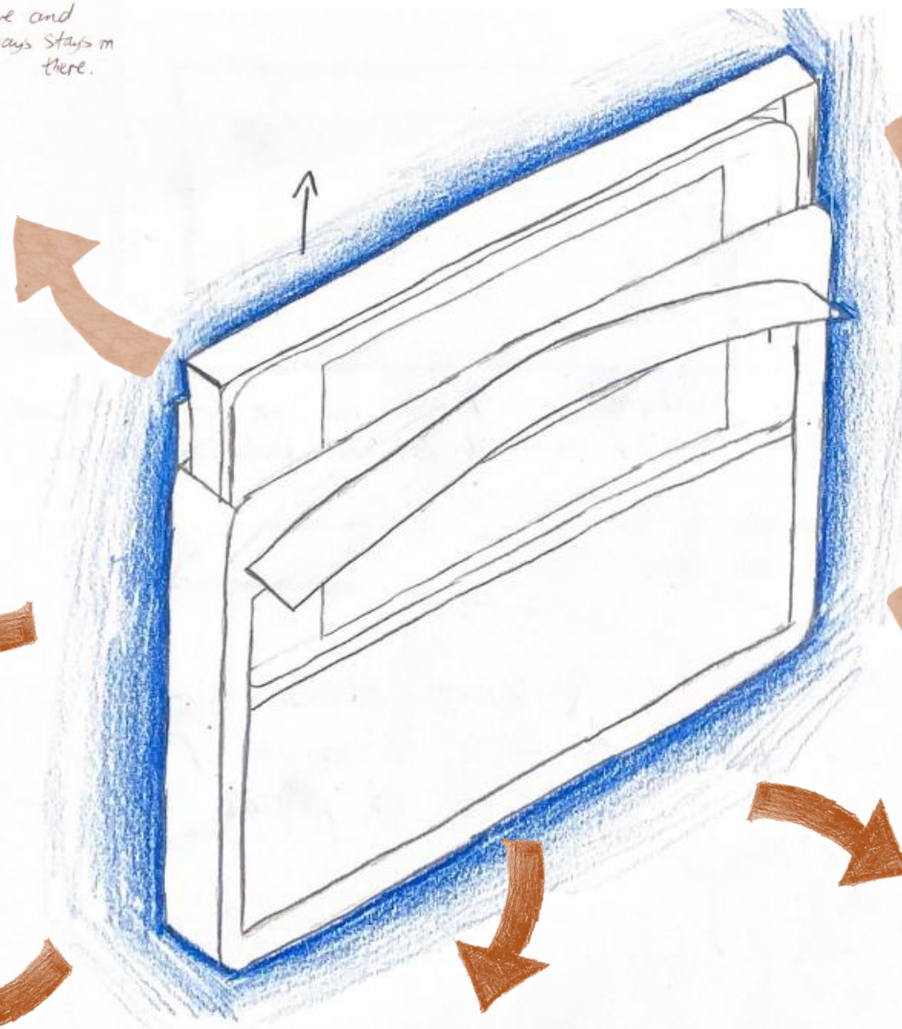
Final design: Screen

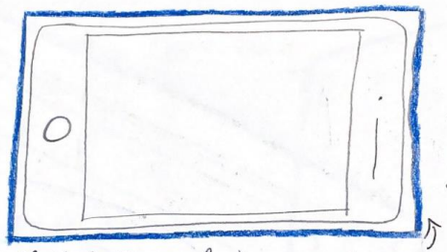


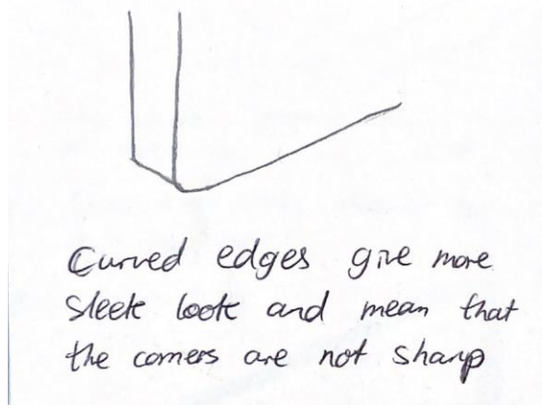
Environmental considerations

To make this environmentally friendly I have considered using a second hand screen to reduce electronic waste. I will also make the product out of recycled plastic if it goes into mass production. On top of this I have made it as durable as possible to increase the longevity of the product, so it lasts longer so people have to buy a new one less frequently.



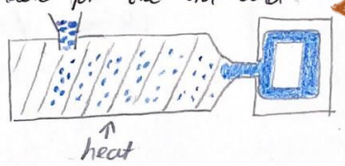


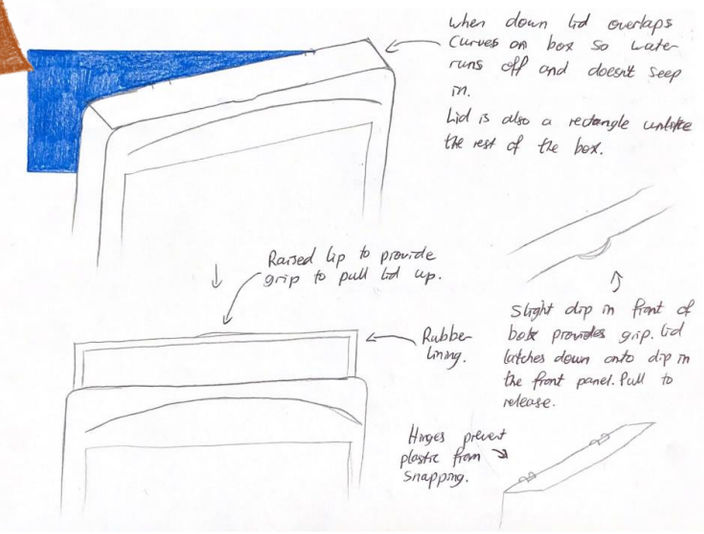


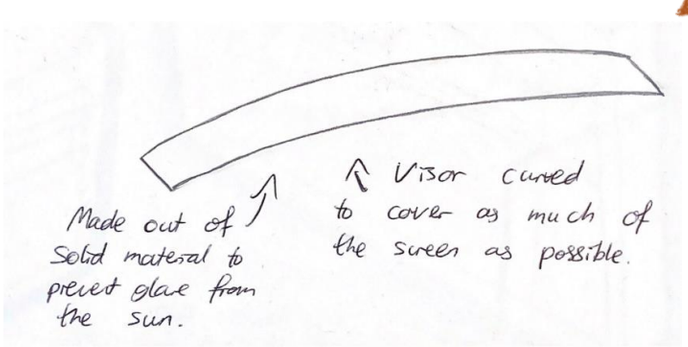


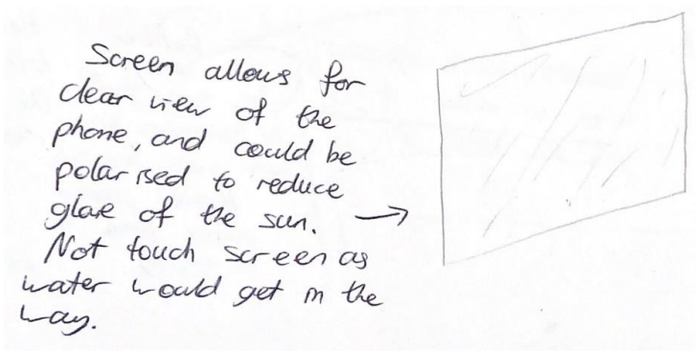
Manufacturing

- When manufacturing for batch or continuous production, injection moulding will be used and although the original setup price will be high, the overall cost per unit is very low.
- First a mould will be made for the lid and main body. I will use polypropylene as its strong and can be coloured. Pellets are melted in the screw chamber then forced into the mould. It is then cooled and the mould is reused.
- This will mean that there is only 1 opening, so less chance of a leak.



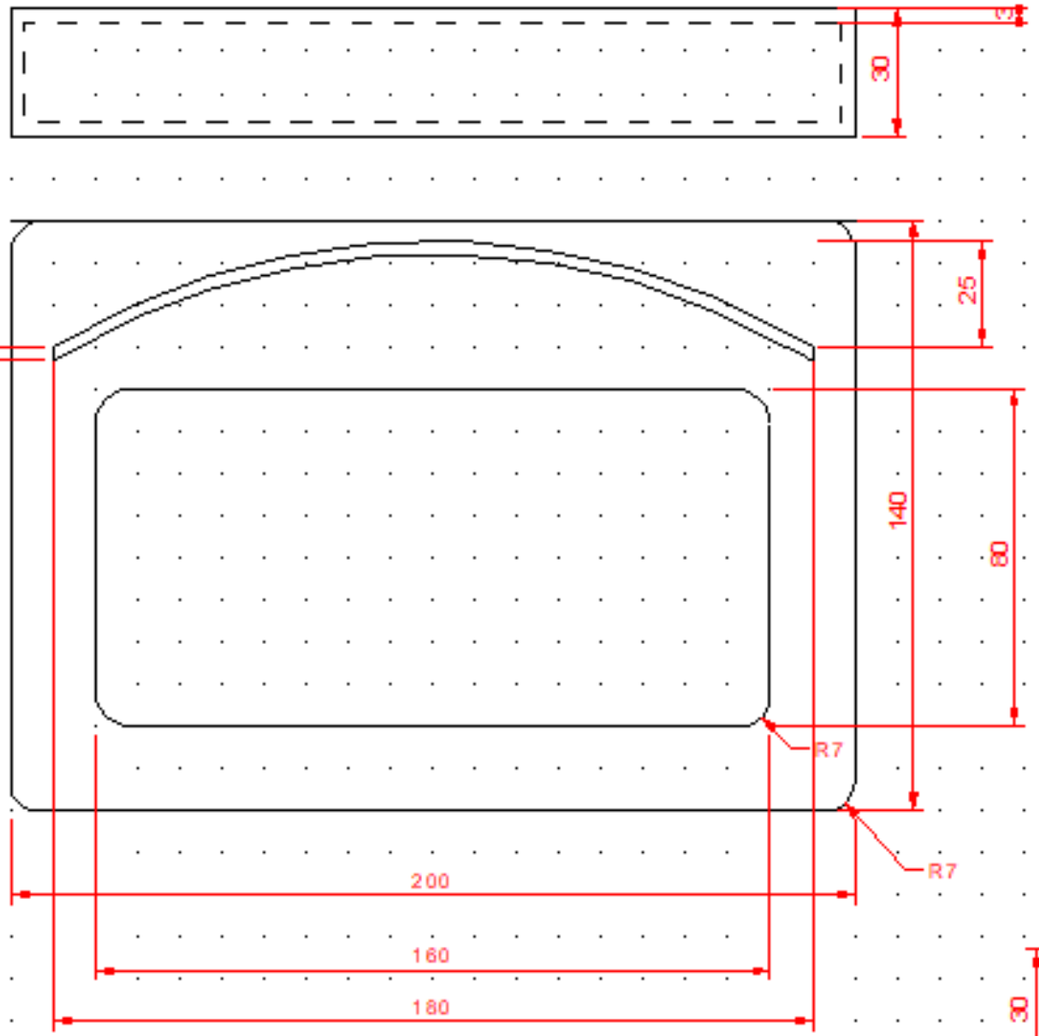


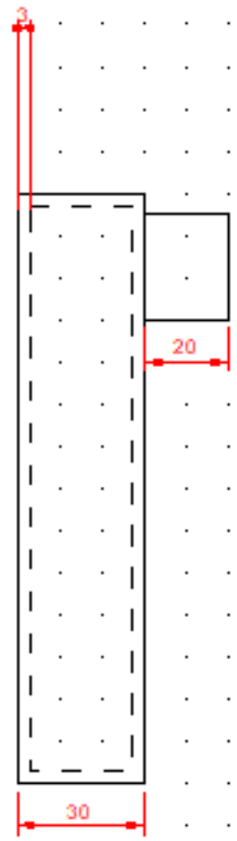


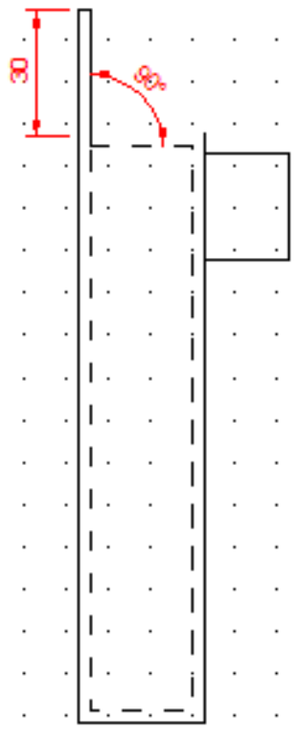


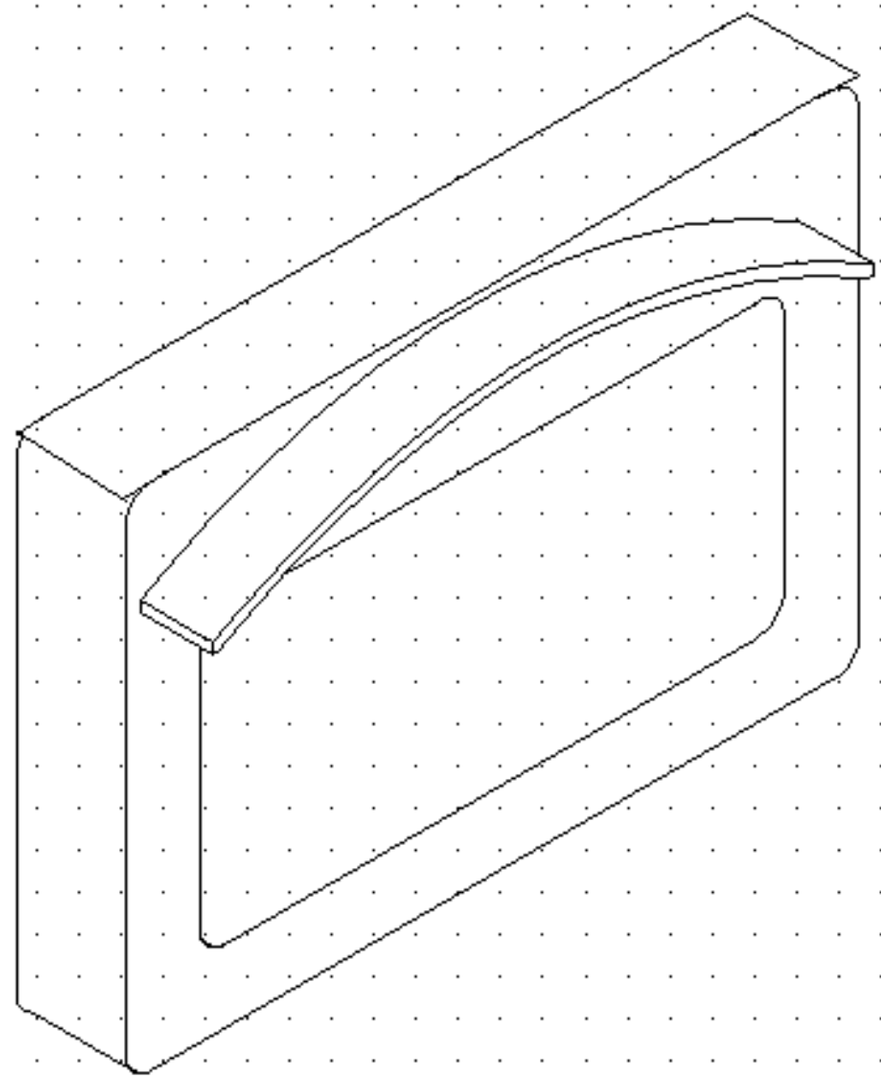
Next steps: On the next page (after the technical specification) I will look into the design of the item to attach the screen to the boat.

Technical specification









All dimensions in mm
Drawn full size

Top panel folds up using hinges to secure it, it then clips back down using a clip on the main body.

Final design: Attachment method

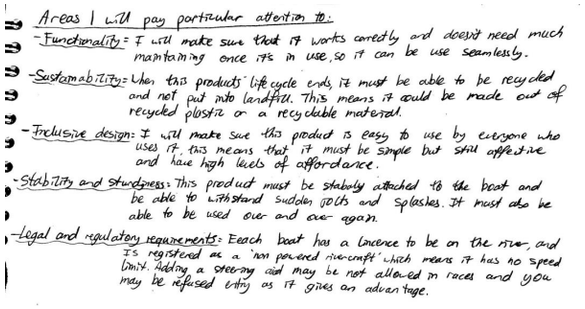
The design which I have chosen to use for the attachment method to the boat is number 7, the pole design, as shown in the sketch below. This is because it is effective in attaching to the boats footplate without having to permanently be attached to the boat or damage it in any way.

How this solves my problem

I believe that this solution will solve my problem as it will agree with my design brief, of assisting a rower see behind themselves when rowing. This part of the product will hold the phone at a desired height to assist the rower in seeing behind them. As it will be attached to the footplate mount, it will not affect the boat at all or require any permanent fixing. By using the footplate to attach it to, it means that when rowers adjusted the footplate (to fit the boat to their height) the phone will move with it so it is always at optimal distance away from the rowers face. The design brief and areas that I previously said I would pay particular attention to are shown below.

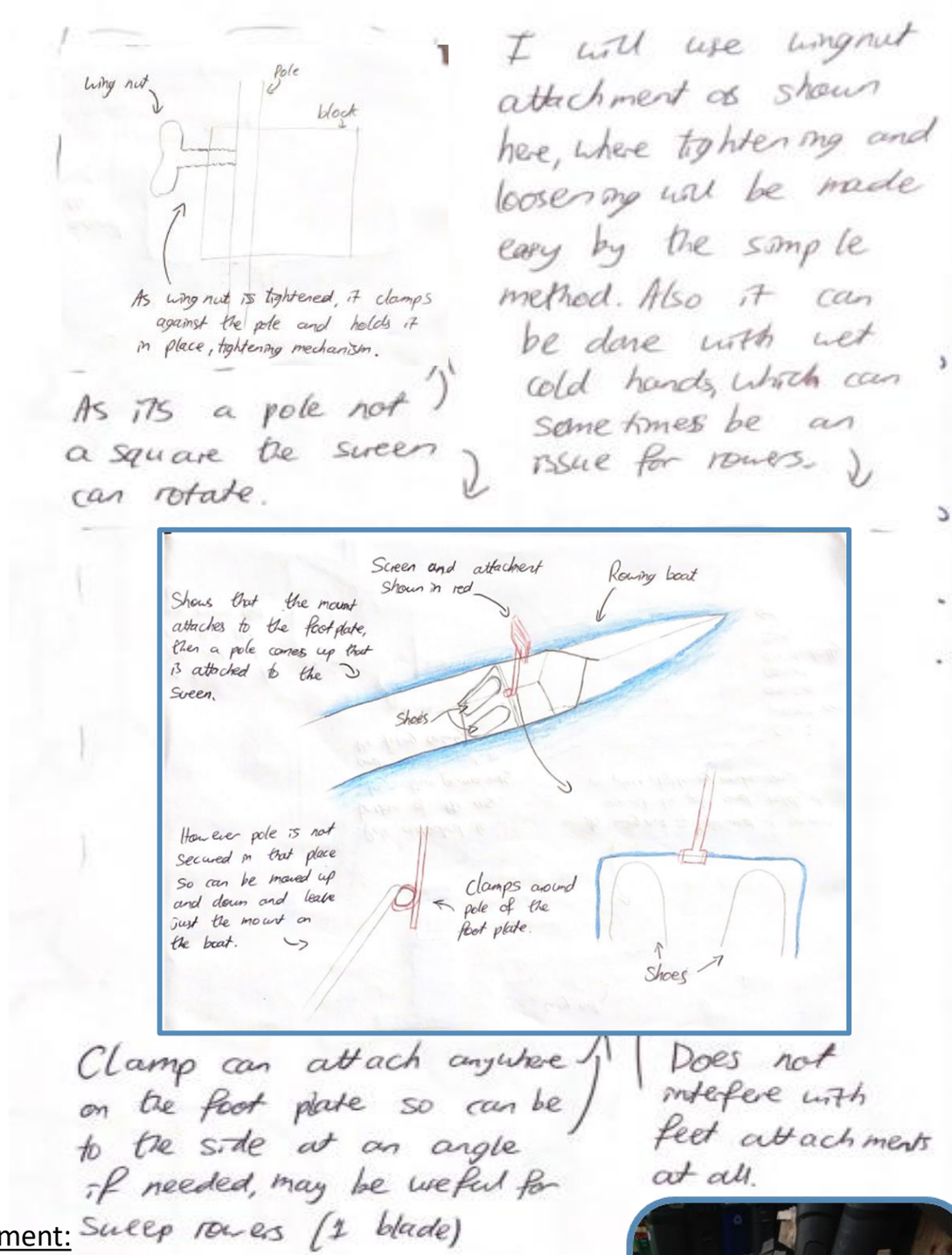
The areas I have paid particular attention to are shown below:

- Functionality- making it easy and practical to attach it to the boat.
- Sustainability- potentially using second hand metal or plastic tubes to reduce waste going into landfill
- Inclusive design- by making the height variable, it means anyone of any height can put it at their desired height and it will still function.
- Sustainability and sturdiness- I will make this product as stable as possible by using light materials which are durable. This will also increase the longevity of it, which features in my design brief.
- Legal and regulatory requirements- This product should be allowed in races as it holds the phone, and is an aid similar to a stroke coach, which is allowed in a race.

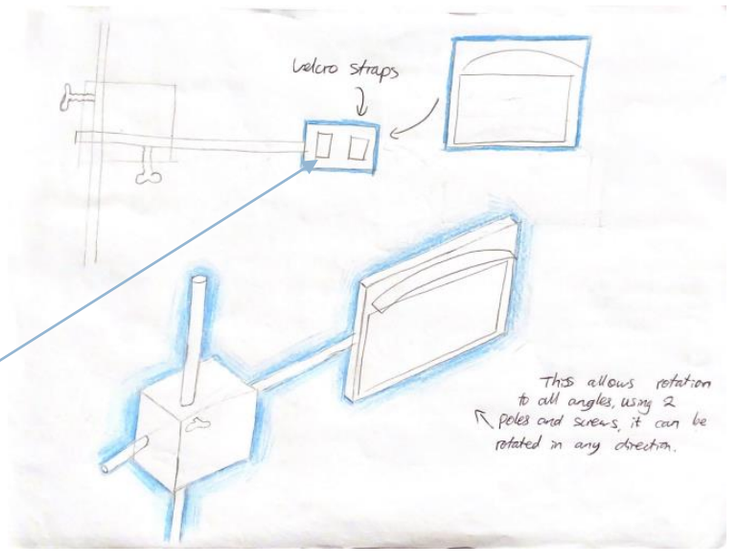


Design brief

Design an innovative product that allows you to see behind you when you are rowing, and does not affect the boats balance or stability. It should also be easy to use and be sturdy and have a sufficient longevity. This should be no heavier than 1kg and no larger than 0.3m^3.



When developing my design I came up with this idea. This would allow me to rotate the phone in any direction and any angle to support all users, however I chose not to do this. This is because when the phone was out at the end of the pole, it produced a strong moment which would put considerable pressure on the joint and attaching part to the boat. This would increase the risk of it falling over or into the river. As well as that, there would not be a situation where you would not want the phone directly in front of you in your full view. Therefore I will not include this development.



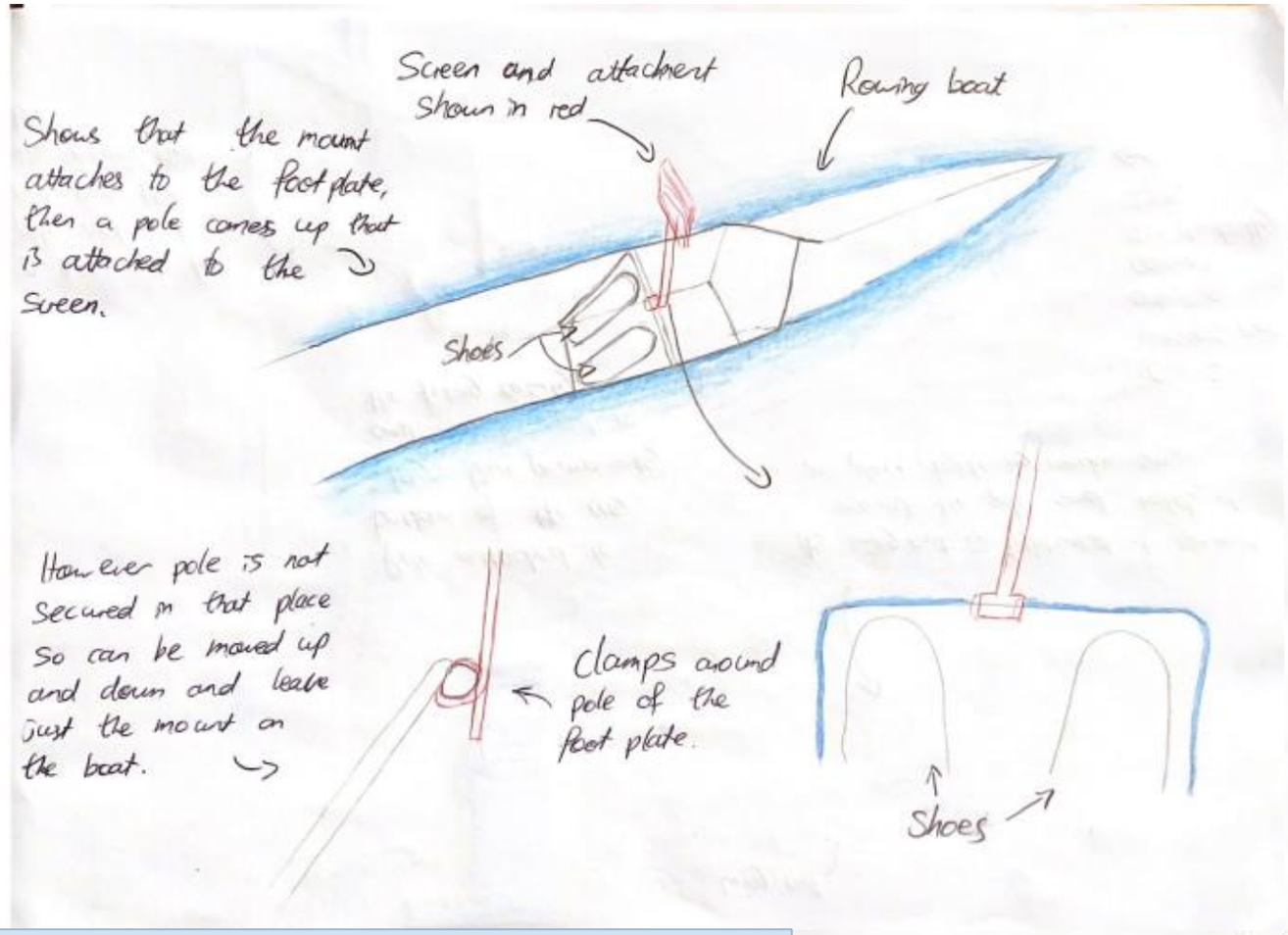
However I will still be using the Velcro straps to hold the phone in place.

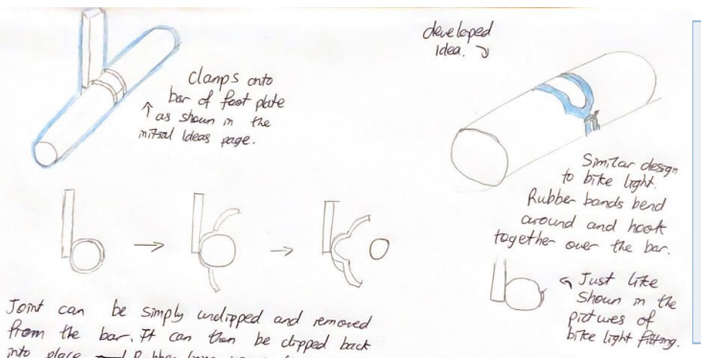
Camera attachment:

For the camera attachment I will simply look into buying a camera and it will come with an attachment to the boat. This will be simple and effective in doing the job of showing the picture. This will be done and tested at a later stage when I have more understanding of the type of camera and attachment I need.

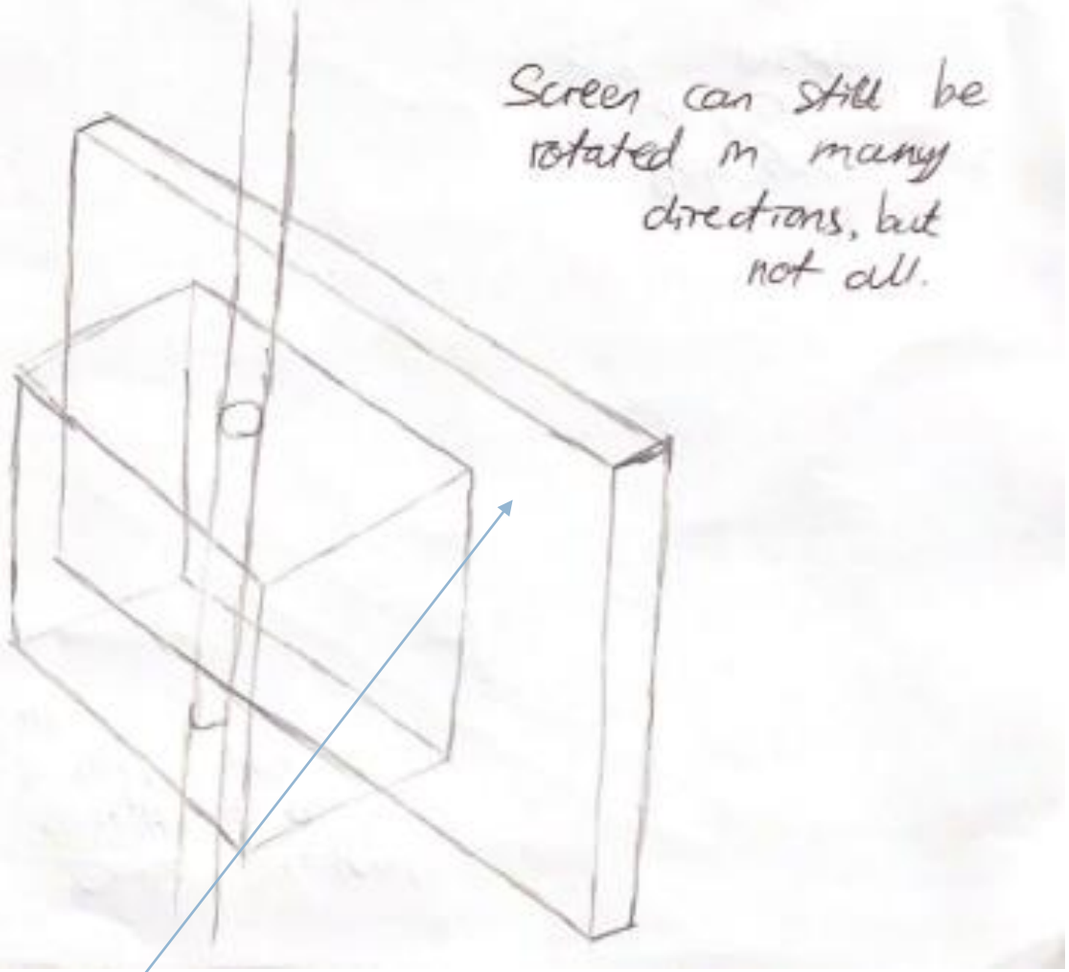
Next steps: On the next page I will look into the final design of the item to attach the screen to the boat.

Final design: Attachment method

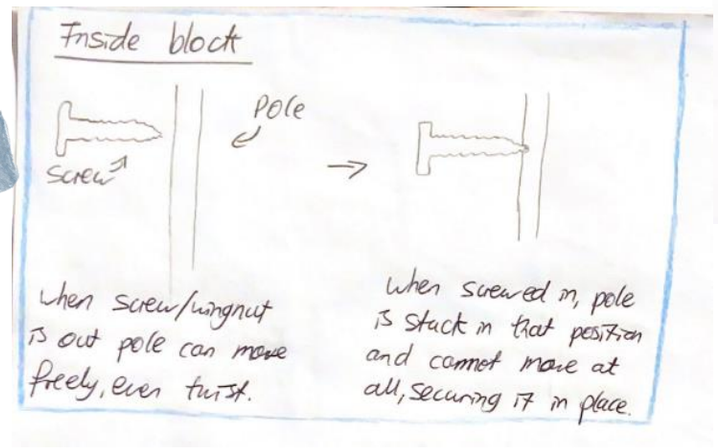




Pole will attach to the boat via the footplate mount, as shown in the sketch below. There will be a clamp mechanism that clamps to the bar of the footplate. This will be rubber so will grip even when wet.



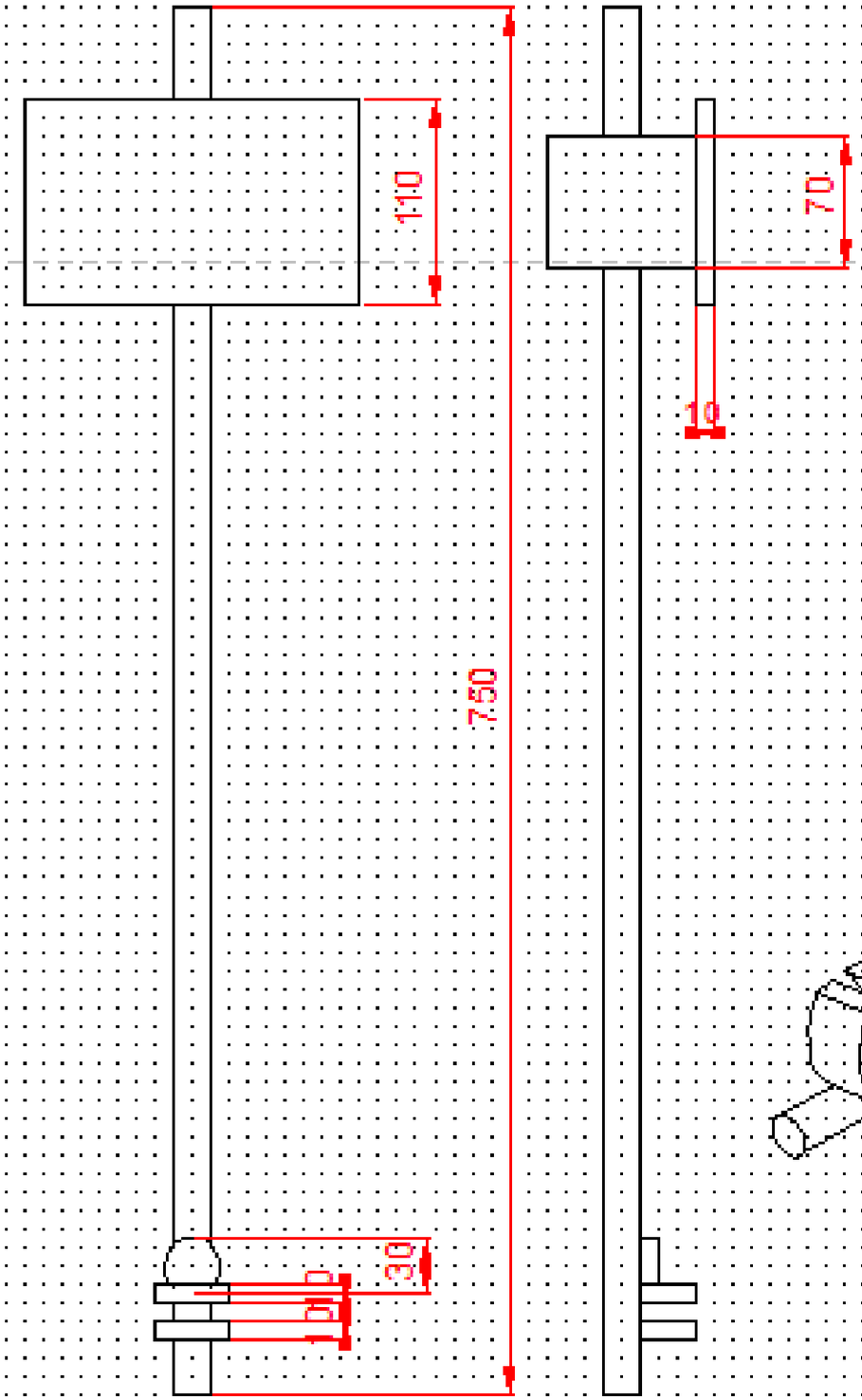
Main area will be the pole and holder for the box. The block of wood on the back will have a screw in it, as shown in the sketch below so it can be loosened and tightened in the place that the users desires. This increases inclusive design and cuts out the number of users that cannot use it.



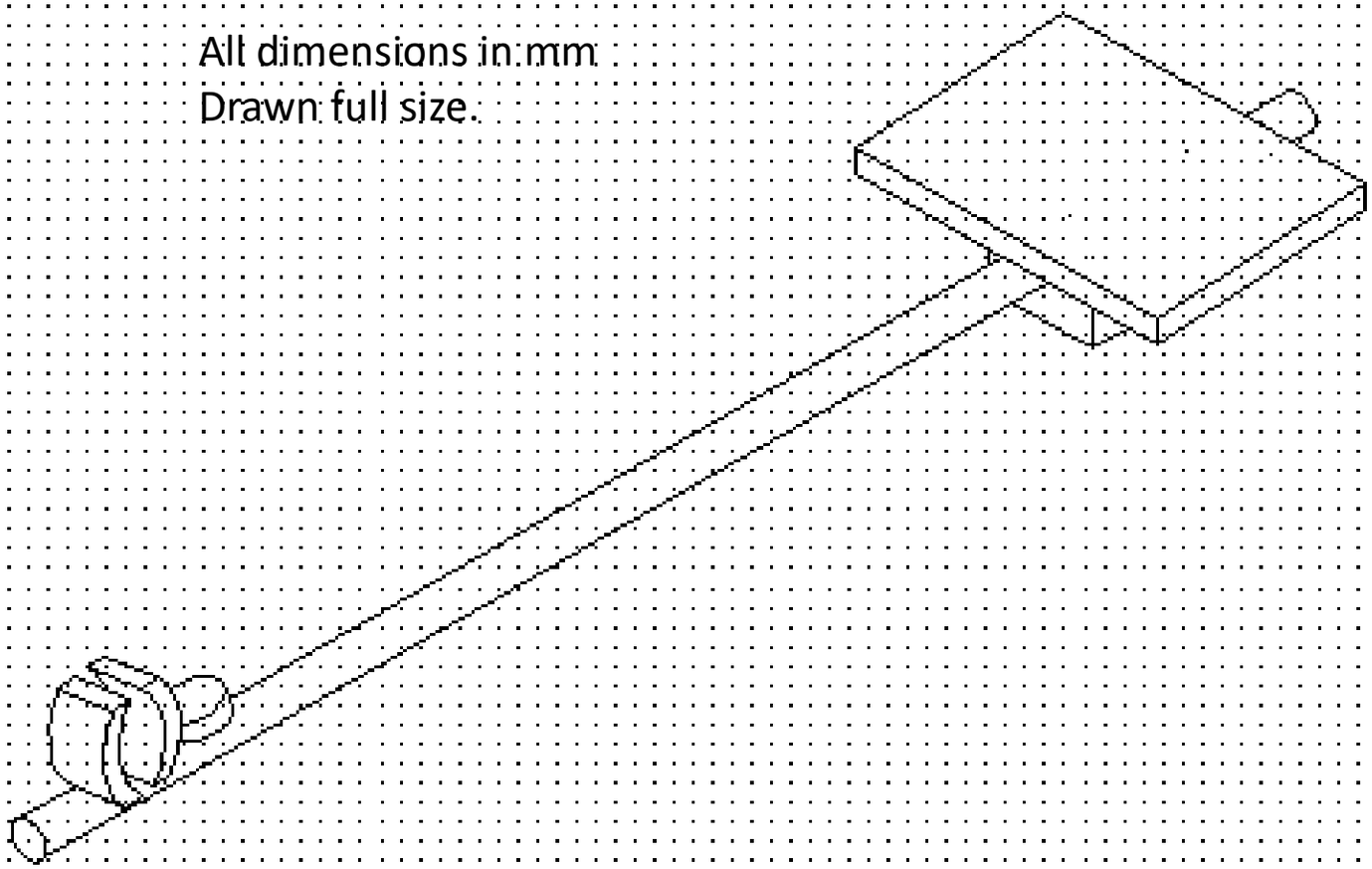
Screen will attach onto this panel of wood, this means that the device can be fully taken apart and reattached so its easier to store and transport.

Next steps: On the next page (after the technical specification) I will start the making process.

Technical specification



All dimensions in mm
Drawn full size.



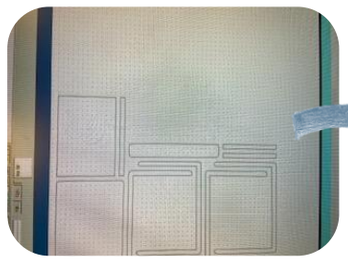
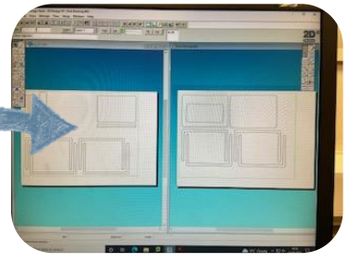
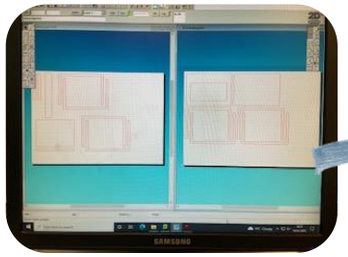
Plan of making

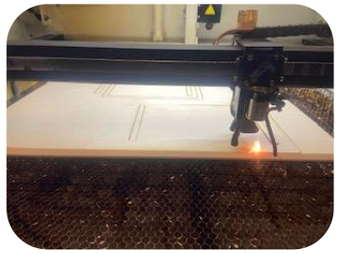
Steps	Materials and finishes	Machinery and techniques	Risk assessment and safety	Quality control check
1. Make the first prototype of the product, and assess parts that may need to be adjusted and improved.	I will use 3mm plywood for the frame, and a small amount of PVA glue for the adhesive. No finishes will be used because it's a prototype.	I will use the laser cutter to cut out the shape of the frame, then sand paper to sand down the edges so that they are smooth.	I will be sure to be supervised by an adult when using the laser cutter, and the workshop is suitable set out for safety.	I will be sure to make the items as neat as possible, however this is just a first prototype so I won't focus too much on perfection.
2. Making and testing 4 types of joints and deciding on a suitable joint.	I will use wood; manufactured boards like MDF and plywood and pine wood also. No finishes will be applied as they are only prototypes	I will use mostly hand tools like a chisel, tenon saw and sanding blocks. However I will also use a laser cutter to ensure accurate fit of some joints.	All machinery comes with a risk, and I will use PPE like safety goggles, an apron and gloves. A supervisor will also be present when I use the laser cutter.	To ensure each product is the same/even I will make a jig. I will also check that the steps are going as I desire at each step.
3. Focusing on 4 key parts of the design that the users said and testing the different variations of them.	This will use wood (MDF, plywood and 3mm dowels), plastic (2mm thick PVC) and polystyrene board. I won't use finishes because these are prototypes and finishes don't matter so much.	Machinery used will be a laser cutter, power drill, and a hand saw. The techniques that will be involved are countersinking, drilling and printing on the laser cutter.	I will be sure to use power machinery under supervision, and not put my hands near the path of the saws or drills.	The quality control will be assessed by me assuring the process was developing how I desire. If this process went into mass production, I would put procedures in place to ensure evenness.
4. Making prototype of pole mechanism and finding/fixing flaws.	I will use a cardboard tube, fixing to attach it to the boat and large nuts and bolts.	Machinery that will be used will be a power drill. Techniques involved will be sawing teeth and sanding.	I will use eye goggles when using the hand drill, and will wear an apron to protect my clothes from the shavings of metal and wood.	I will be pretty rough as it is a prototype and it is only a first try, but in future I will use a jig and template to ensure they are all equal.
5. Making final product, combining all of my techniques and creating my final product. This had several stages and took me the longest out of all of the processes.	I will use 3mm plywood (whereas if it was to be mass produced it would be acrylic but we do not have the equipment for that in the workshop), a block of pine wood, a panel of MDF, a PVC tube of 20mm diameter, a sheet of clear Perspex and a metal hinge. For the finishes I will cover the box in a black paint for colour and resistance to weathering.	I will use a laser cutting machine, a pillar drill, a hand power drill, handheld saws like a junior hacksaw, power glue and double sided tape. Some of the techniques I will use are drilling pilot holes for screws and brazing 2 metals together.	When using equipment like power tools and the brazing rig, I will be sure to be supervised by an adult and use suitable PPE. I also will use suitable protection on the equipment provided e.g. on the pilar drill I will make sure the cover is fully locked down so if the wood came out of place it didn't hit me.	When using the drills I would use a template or jig if it was being mass manufactured. The same would apply for the position of the hole and the screws. However the box does not necessarily need a template because the dowels keep the pieces in place, especially when the pieces are drying.

Making prototypes of the box

Prototype 1

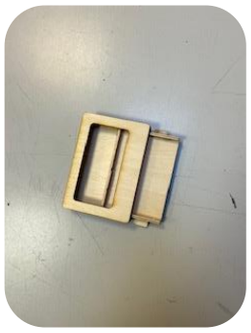
I started by making my first prototype to prove the function of the product, and the drawer, this is shown below. I made it a small size to reduce materials used.

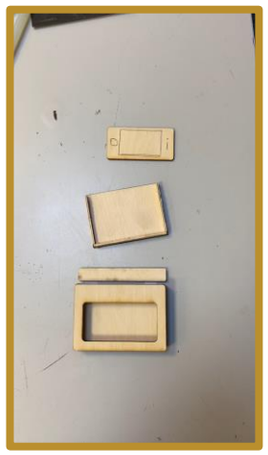



I started by making the 2D design from the practical drawing that I did. This mean that the net I created was full size. I then reduced the size by a factor of 4 so it was a quarter of the size. I turned the lines red and printed it on the laser cutter. This was a suitable size for the prototype and does not waste many materials. I ensured that it functioned as intended.

This process shows me using the laser cutter to print out the product. The pieces of the drawer are shown in the last picture. At this point I carried out a quality control check to ensure that the size of the pieces was the size that I intended, by measuring with a ruler.

The final stage was sanding the edges and putting it together using hot glue.



Video shows me taking the model phone, putting it in the drawer and putting the drawer in the box. Then closing the lid. For the hinge in this prototype I used a single piece of masking tape. Proving the prototype works

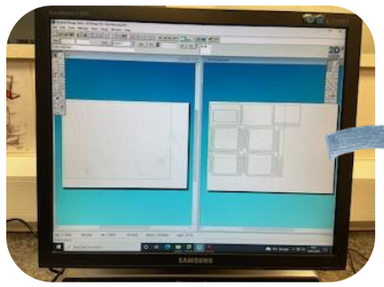


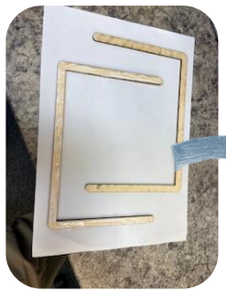

I started to glue the layers together using PVA, and wiping away the excess between the layers. I then stuck on the bottom and top panel. I tired to keep the layers as even as possible, so that they didn't dry unevenly. Then clamped them together and left them to dry for 24 hours.

Conclusion

These two prototypes were were reasonably successful, as they came out as I intended and functioned as I intended. However with the second the layers dried unevenly, this cannot happen in any more prototypes so I will look into making a jig. Features like the hinge, visor and plastic still need to be looked into further.

Prototype 2






For the second prototype I used the same 2D design page and measurements to print a similar item, but real size (4 times bigger than the previous prototype). This will allow me to test what need to be adjusted with issues that may have been hidden by the size of the previous prototype.





After this I started to build the drawer. This involved using hot glue to attach the walls to the base, and leaving it for 5 minutes between each to dry sufficiently. Once I had finished, I tested putting the model phone in the drawer, and then the drawer in the box. It was successful and the drawer was the correct size for the Phone.

Next steps: On the next page I will look into joints I could use.

Plan for making and prototyping

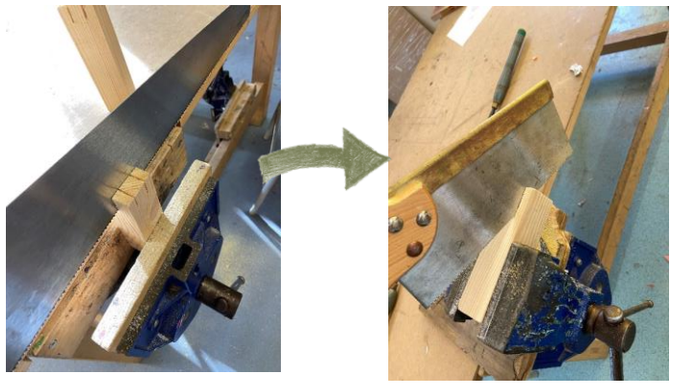
I plan to make multiple prototypes and principle proving prototypes. By doing this I can make my final product successfully and without failure as I will have done all of the testing previously. As shown in the next slides I look into the key parts of the design and test them each separately to make an informed decision on whether they are suitable for my product or not. This includes components like hinges, the waterproof covering, fixing and making a jig to ensure nothing is produced out of place/incorrectly.

Joints/fixing mechanisms I considered using

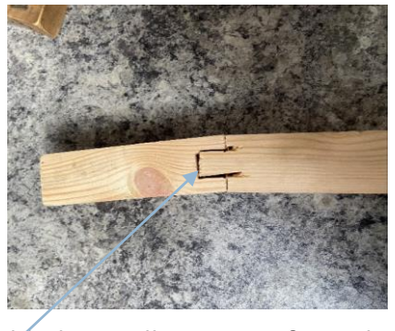
When I was in the process of making the models for my final prototype, I thought about how I could join the individual pieces together. Firstly I though of and assessed a range of joints as shown below; mortise and tenon, butt, finger and dowel joints. After destructive testing each of these, I decided on one suitable joint and chose it for my design and developments.

1. Mortise and tenon joint:

A mortise and tenon joint includes cutting a hole out of one piece of wood and a housing joint in the other, then fixing them together with glue. This would be used on the corners, if I printed 6 different planes and fixed them together at the corners. However, this would mean that I have to seal all the corners, which may become an issue and a greater area for failure of the seal. Shown below is me making a prototype and destructively testing it.



To make my joint I started with 2 identical wooden blocks. I then used a crosscut saw and a tenon saw to cut a cross into the end of each block. I removed inversing squares on each one (using a chisel and mallet) so that they fit together evenly. This process took me 20 minutes.



After fitting them together I added a small amount of wood glue and clamped together to dry for 24 hours. The picture to the left above showing the 2 joint pieces before being put together, and to the right above shows the final product. It was slightly out of place/wonky so if I chose this joint then I will make sure its accurate before repeating the process for the final prototype (quality control check).

The video shows my lightly hitting the completed joint with a hammer. I added wood glue before pressing together and leaving to dry for 24 hours. The joint proved relatively strong, but not outstandingly strong.

Example joint

The process took me 30 minutes to put together (ignoring the 24 hour dry time) , and was relatively simple.

Quality control

I was sure to make the pieces as even as possible, which failed because the final product was off centre, but if I use this I will use a go/no go system to make sure they are all uniform.

Conclusion

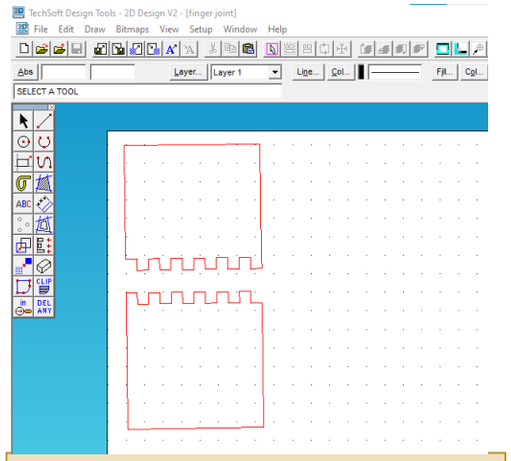
I realised that my sheets of material would be only 3mm thick, I deemed this not useful as the wood would not be thick enough to cut a square in and hold its shape and integrity.

2. Finger joint:

This seemed much more attractive as an idea because interlocking all of the parts together at the edges would look aesthetically pleasing. This would also involve adding wood glue or PVA glue to secure it and make it water tight, and even then it may not be watertight.

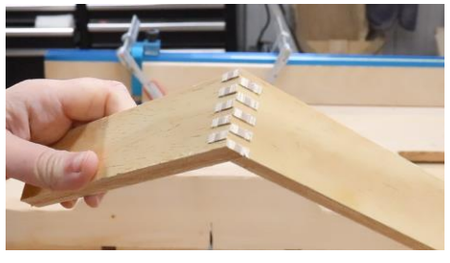
To make this joint I simply created 2 equal pieces of wood with alternating fingers of equal size and length. I used 2D design and a laser cutter to make sure its all accurate, as shown below in the photo. This took me 20 minutes to print and design.

I then used wood glue to stick the 2 interlocking pieces together and let it dry overnight. I then tested it destructively, showing that it does not have much structural integrity.



Destructive testing shows me pulling it apart totally with ease, showing it has minimal strength.

In total this design took 30 minutes to create



Example finger joint shown here for reference.

It did not take much force to snap into 2, this means it could easily break in a tough situation in the boat.

Conclusion

I will not use this joint in my final design, as it does not give much structural integrity and although it looks aesthetically pleasing, it will not work with the sides of my box because I'm only using 3mm plywood.

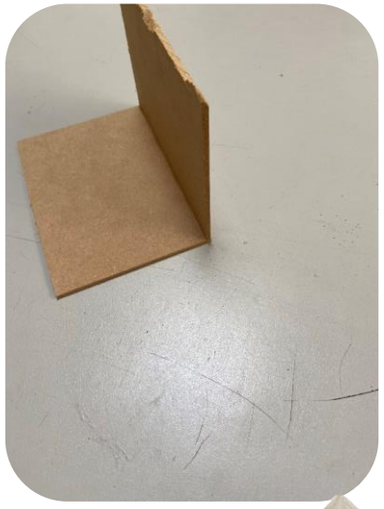
Quality control

For the finger joint I was sure to allow just enough space for the fingers to slot together tightly so that they didn't snap but also held in position. If I was to use this joint I would print it out on the laser cutter, therefore ensuring all of the fingers were the same width and size.

3. Butt joint:

This joint is renoundly simple and easy to make, however doesn't offer that much strength, this joint only took me 10 minutes in total, which is short in comparison. It involves simply sticking one edge to another. This would however mean that I would have to factor this into my designing process to make up for the loss and gain of material.

I started by simply sawing a piece of 4mm MDF into 2 bits. I then used wood glue to add one to the other, joining them at the end of each piece as shown in the picture. After leaving the glue to dry, I then destructively tested it and it showed poor strength and structural integrity.



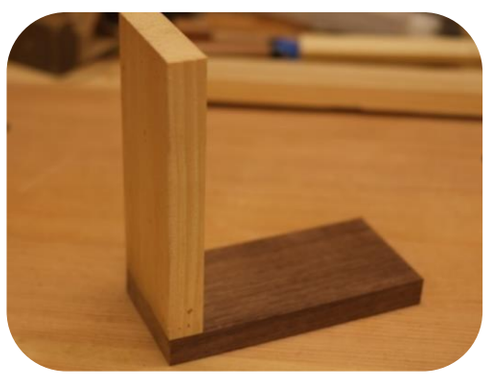
My final prototype.

The joint showed extremely poor strength, and as shown only required the smallest amount of force by the hammer to be destroyed. This technique is similar to the pendulum method where a hammer is swung and hits the object, testing its over all strength.

This process took me 20 minutes in total.

Quality control checks

When making this prototype I was sure to use a tri-square to mark out the line that I would cut with the tenon saw, this ensured it was a 90 degree and straight cut. Also when gluing the two pieces together I was sure to glue them at the degrees to not affect the strength of the joint once dried.



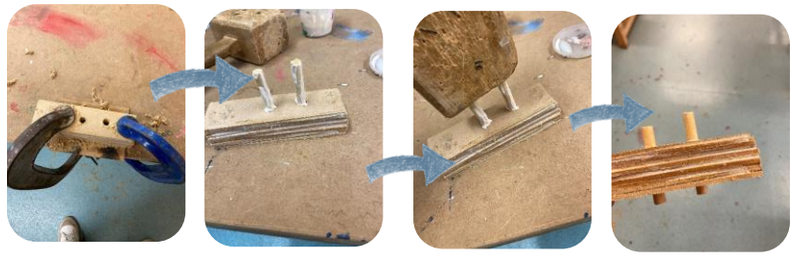
Conclusion

I will not be using this in the final product, as although It was quick, easy and didn't involve much work, it did not withstand suitable force for my use an the environment it will be used in. an example joint with thicker wood is shown to the left, but it still doesn't have much strength.

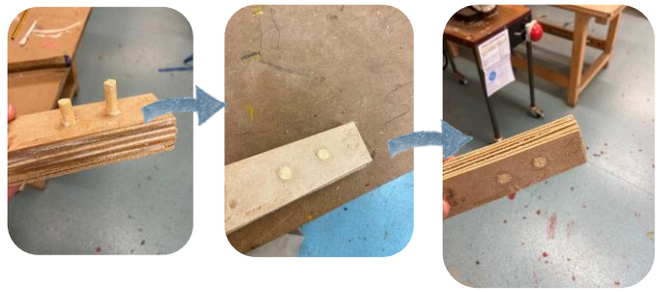
4. Dowel joint:

This joint takes slightly longer, but can be more effective and can look aesthetically pleasing when finished. It consists of drilling 4 or so holes of a set size. Then I can add a thin layer of glue and hammer a dowel piece (of equal size to the holes) into place. After it has dried, this makes it more secure and means the pieces cannot slide out of place. If I was to chose this I would use the laser cutter to cut a hole in the same place in each panel, then insert the dowel when all the glue is still wet so it dries all exactly in place. This will also keep the pieces all in place.

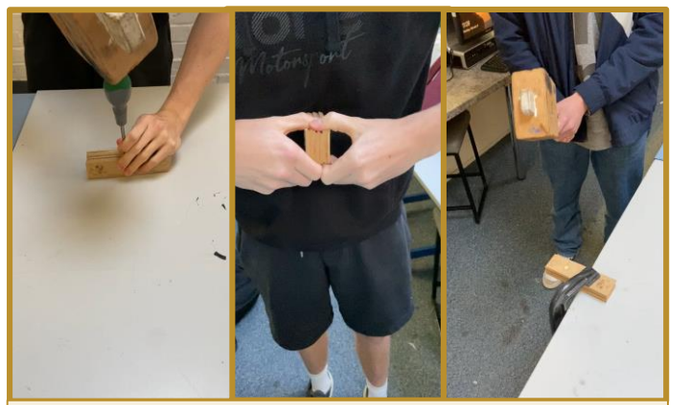
The first step involved getting roughly 8 equally sized pieced of 4mm MDF and gluing them together with wood glue. I then clamped the, and let them do dry for 24 hours.



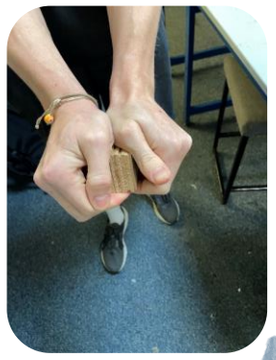
I then found some suitably sized dowels, 6mm in diameter and used a 6mm drill bit to drill 2 holes in the wood. I coated the dowels in glue and gently hammered them into the holes, making sure they go all the way through.



After leaving them to dry I used a junior hacksaw to take off the excess dowel, and then sanded down the wood for a final neat finish.



These 3 videos show the strength of the joint once dried. It withstood hard hitting from the hammer and only broke when prised apart by a chisel and hammer. This shows it can withstand a lot of force and can hold a phone securely.



Picture shows final product being tested for tensile strength.

Quality control check

When making this prototype I was sure to only use pieces of wood equal size and thickness, and the MDF means that there are no irregularities in the board. If I was to repeat this process I would cut out pieces and holes using the laser cutter for accuracy.

Total process took 2 hours excluding drying time of glue.

Conclusion

In conclusion I will use this joint because it is strong, and although it takes a long time to make it can withstand a lot of force and looks aesthetically pleasing when finished.

Final decision:

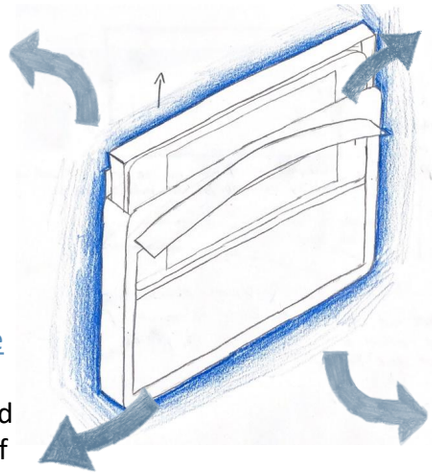
I have chosen to use the dowel joint, as it will work with my project and as I will print the final prototype in layers, I can put a dowel in each corner. I can add these identical holes on the 2D design software that I use, and therefore make them all the same size. The laser cutter I use is precise to +- 0.001mm. This should mean that there will not be much inaccuracy, and all the dowels should fit. I think this joint is suitable for my design because it can maintain the key sleek look and hold it together from force from the side which may otherwise break it. I test out the durability of the joint later on in the portfolio, and apply forces from a range of directions suddenly.

Areas I will focus on when making my final product

I will make sure to focus specifically on these areas when making the final product, as my end users said that these are some of their main concerns.

How the camera will attach to the back

Screen waterproofing- I will prototype and create a method that will ensure the screen is fully water tight and resistant to splashes.



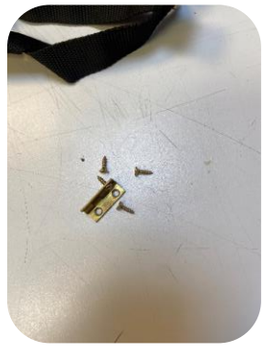
Hinge mechanism- when the top flap opens and closes I will attempt at using a hinge to keep it in place, this will involve waterproofing as well.

Ensuring the layers are all even- and in line will mean the product is more sleek and aesthetically pleasing. I plan to do this by using a jig and dowel joints to hold the pieces in place.

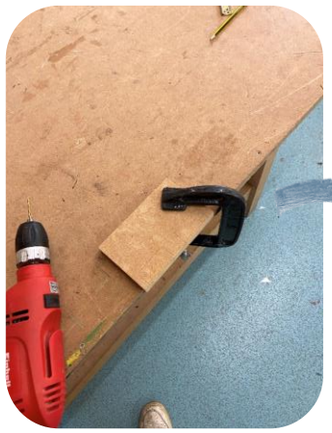
Securing the phone in the drawer- I will prototype some ides for this and find a way to secure phones of all sizes.

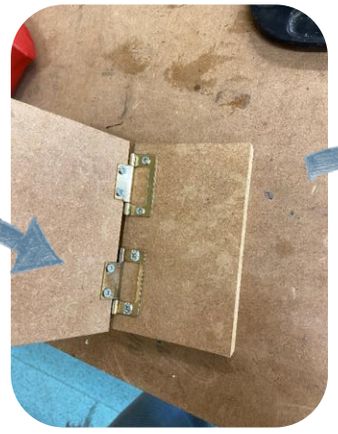
Testing and making the hinge mechanism

The hinge mechanism was the easiest to make and test, it took me 30 minutes in total and did not require much expertise or equipment. This came to my attention as a part which would need to be able to function repeatedly without breaking. A hinge would be a suitable component and they are readily available in standard sizes and cheap.



I started the process by collecting a box of small hinges, 8 3x12mm screws, 2 identical pieces of wood and a power drill. I clamped down the pieces of wood onto the table using a G-clamp, and marked out 4 holes where I would drill on both pieces of wood.

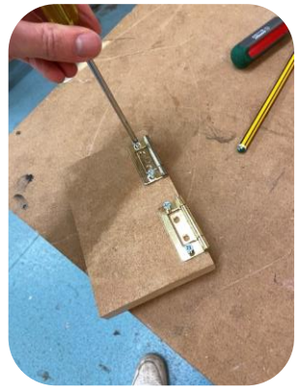




After marking out the holes to drill, I used a 2mm diameter drill bit to drill a 5mm into each block of wood, which allows the screw to enter without splintering the wood but also allows a good grip on the wood.

Once finishing, I realised that the hinge would never properly close because of the top of the screws protruding. I therefore used a countersink drill bit to allow a space for them. I used a 5mm countersink drill bit. This allowed it to close fully.

These photos show the hinge on a prototype of my product. I used glue gun to attach the hinge to the product as the wood was only 3mm, too thin and I could not use crews without splintering it.



Shows the countersink holes drilled to allow the joint to close fully.

Next steps: On the next page I will look into the screen waterproofing

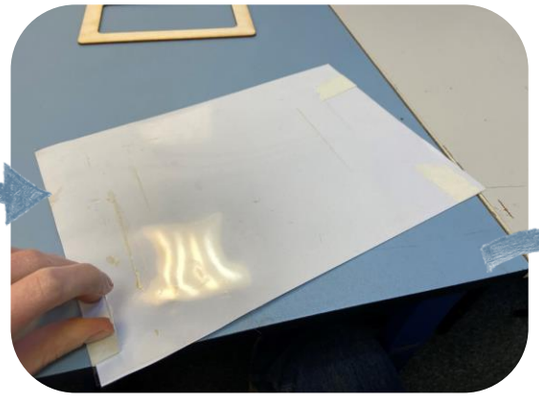
Screen waterproofing

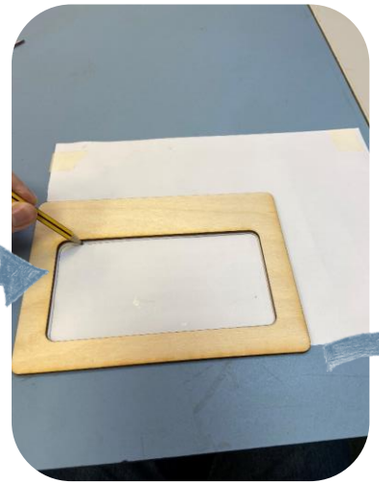
To make the screen waterproof, I started by finding a clear plastic that I could use to stick to the inside of the model. I used recyclable plastic to reduce the impact on the environment. I tested double sided sticky tape and figured that it would be strong enough to hold the screen on and waterproof it. I considered many methods as shown below.

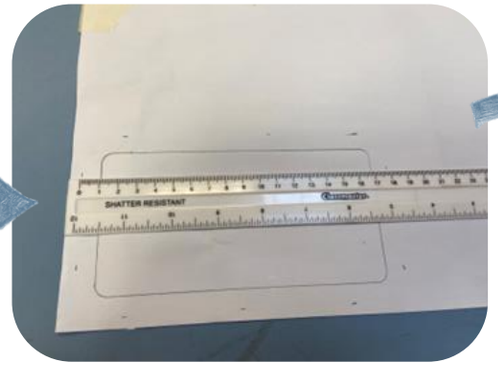
Environmental issues

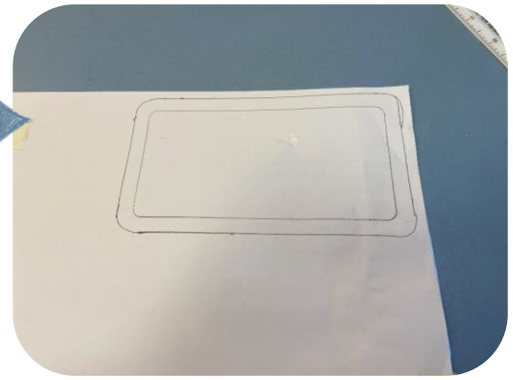
To ensure that my product stays as environmentally friendly as possible, I tried to reduce the amount of plastic I consumed and wasted in the process. For the screen I used recyclable plastic so that when it reaches the end of its life it does not go to landfill, I also have chosen to make it out of sustainably sourced wood not acrylic, to ensure that It can biodegrade as quickly as possible.

Making



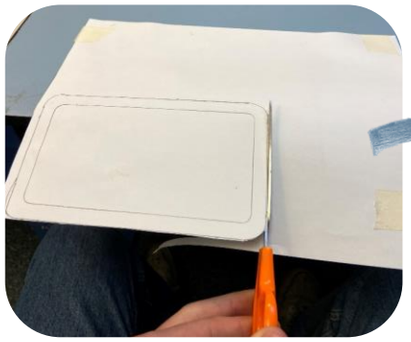






I first started by getting the A4 sheet of plastic film. By using masking tape to attach it to an A4 piece of paper, I could stencil out the shape on the paper then cut out both at once to get the desired shape.

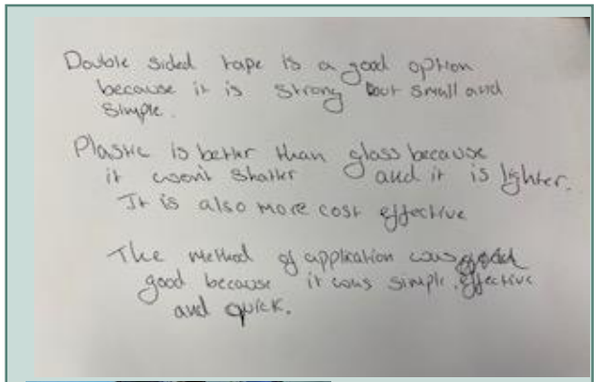
I used the outline of the front panel (which is sized to fit the average phone screen) using a pencil. I then used a ruler to measure a 1cm difference outside the line, space for the tape to go and so it has enough area to stick. Then drawing around the dots I plotted, I had a margin to put the tape in so it couldn't be seen in the screen when it was applied.



I then simply cut out the paper marking, and therefore had a plastic sheet of equal size. This also means that if I need to cut out another plastic screen, I have a template to use.

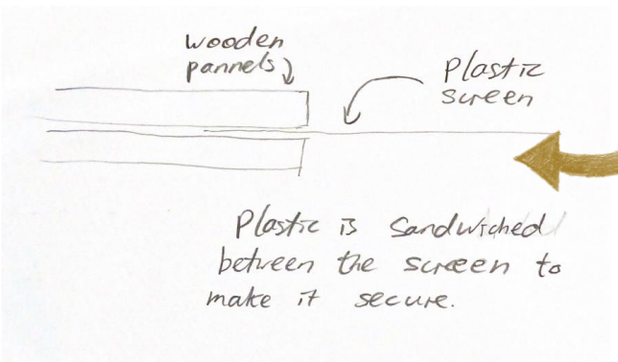
After cutting out the template, I applied double sided tape and stuck it onto the back of front panel. This meant I had a clean finish and it wouldn't get caught and rip off.

I then applied the front panel onto the rest of the body and left it to dry. The final product is shown here.



I asked one of my key users on their opinion to see if they liked or disliked the method and how secure it made it. What my user said is shown in the picture above. This shows that he supports my manufacturing decisions and material choices.

To ensure the double sided tape was secure, I attached it to a piece of wood to test. After firm application it was very secure and could withstand a reasonable amount of force. This shows that it is suitable for my product.



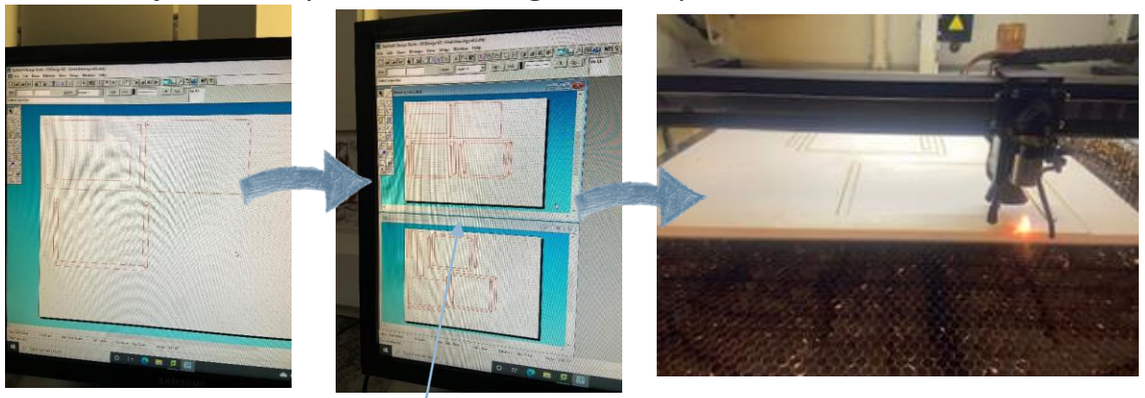
I considered using 2 panels of wood to sandwich the plastic, which would involve double the amount of tape and more wood glue to stick them together. As shown in the picture above. However I decided not to do this because it would put extra thickness onto the design and make it heavier, which may affect how it stands up.

Next steps: On the next page I will look into making a jig and dowels

Ensuring all the layers are in line

Making dowels

I made the dowel prototype to ensure that when I stack the layers on top of each other they are perfectly inline, which provides a cleaner look and more structural integrity when its been sanded. As shown to the right, when I made a mini prototype of the project and stuck them together, the glue I used acted as a lubricant. This means that it was very hard to get them all in line together and when I clamped it to dry it dried not straight. I therefore decided to make a jig for future models, and use the dowel joint to improve the strength of the product.



I started off by using 2D design to draw out then print the template for a prototype. I used tessellation as shown in the second picture to reduce the amount of waste that I created. I left the pieces in the laser cutter for an extra minute or so to remove all the gasses. I added 3mm holes at the same place on each piece so the dowel would fit through.

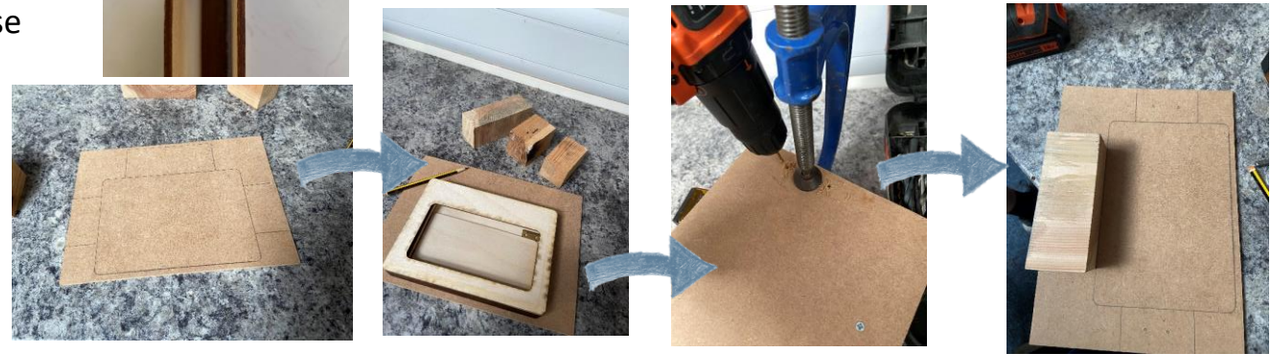
Once I had removed the pieces, I started to layer them up using the 4 dowels as guide points on where to put them. Adding a layer of glue in between each one and wiping the excess away. Once they had all been glued I clamped them together and left to dry overnight.

Once it had dried, I used a junior hack saw to take off the excess dowel parts, then roughly sanded to remove the majority of rough parts and glue. The rest will be removed when I sand properly before applying a finish.

Process took me 2 hours excluding dry time.

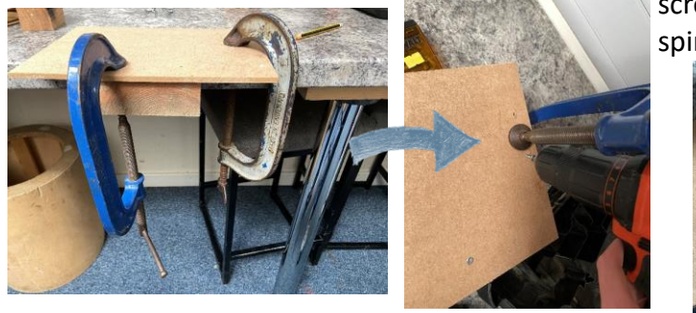
Making jig

After making my first prototype which dried in the incorrect form as shown to the left, I chose to make a jig for future prototypes and things which I may need to keep straight. This jig was relatively simple to make and took me 1.5 hours in total.



First I started by sketching around my full size prototype and 3 identical blocks which I would use for the jig.

I then clamped down one block at a time and used a hand drill to drill a 7mm pilot hole for screws that I would put in. Then used a Philips screwdriver to screw the screws in, I did 2 per block to prevent spinning.



I used G-clamps, one attaching the board to the work surface and the other attaching the block to the wood whilst I drilled it. As shown I repeated this for each block.

Once completed and checked, I used it to construct a second prototype, which tested the hinge, which is shown in another slide. It was successful in ensuring that all of the layers fitted evenly as shown in the picture, and the final product look neat and minimalist.

Quality control check

I was sure that all the blocks fitted inside their designated area, and that no nails were sticking out so that their was no risk of injury.

This process took me a total of 1.5 hours, due to the marking, drilling and screwing.

Making sure the phone stays in the drawer

This was seen as a challenge in my design. As phones come in different sizes I cannot provide size for each phone. Therefore I needed to figure out a way to ensure all phones fit without the consumer having to go out of their way. I decided to use the process of a standard sized drawer, and 2 pieces of polystyrene coming with the drawer, which can then be cut (using scissors or a knife) to the size of your phone. This means when you first get the item you have to trace the size of your phone and cut it out of the polystyrene. Then place the polystyrene in the drawer and the drawer fits exactly your size of phone. This also helps because it provides cushioning for the phone when its in the case, and means that when using a phone you don't have to remove the case.

I first got a sheet of polystyrene and marked out the size of the drawer onto it. Then using a Stanley knife I cut out the marking. I did this 2 times

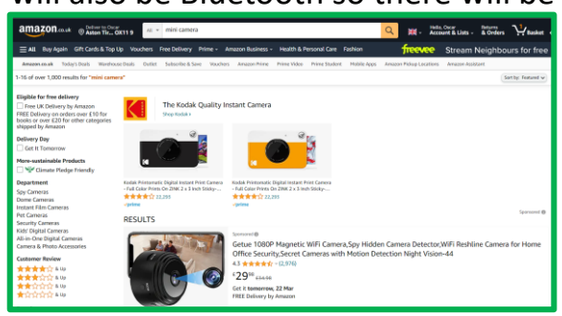
This process took me a total of 40 minutes.

I then used my phone as a template to cut out into the polystyrene at the exact size of my phone. This then allowed the phone to perfectly fit in the gap. The polystyrene then fitted into the drawer and this in turn holds the phone in place.

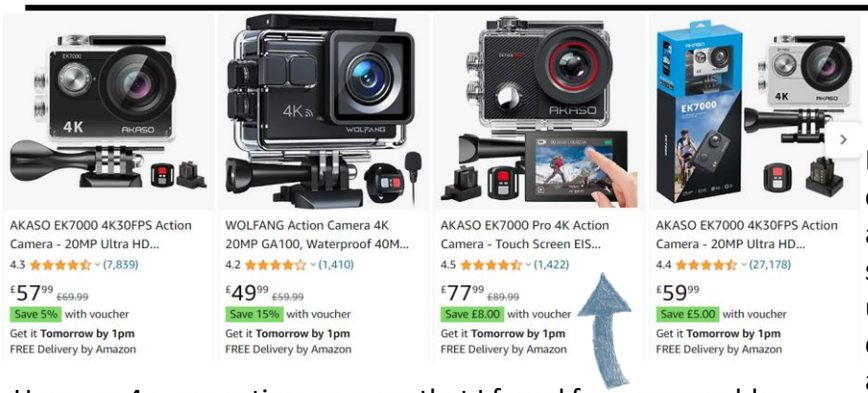
As shown this holds the phone perfectly in place and allows the full screen to be seen. This design allows for all types of phones to be used and it prevents the user having to take their phone case off to put it in the box. Each box will also come with 2 polystyrene panels in case there are 2 users or 2 phones being used.

Looking into camera to attach to the back

Here I look at the options for the camera and decide on a suitable one. This will not require much effort as the cameras come with a suction cup that I can use to stick to the boat. They will also be Bluetooth so there will be no wires involved.



When searching for small cameras, most of them were about £30, and varying quality. They all livestreamed and came with attachment mechanisms. When looking at more expensive options e.g. GoPros, they were £300-400 and much higher quality. As this product would need to last many hours at a time, the battery life would need to be long and it should still work even if the user forgot to charge it after one session.



AKASO EK7000 4K30FPS Action Camera - 20MP Ultra HD...
4.3 (7,839)
£57.99 £69.99
Save 5% with voucher
Get it Tomorrow by 1pm
FREE Delivery by Amazon

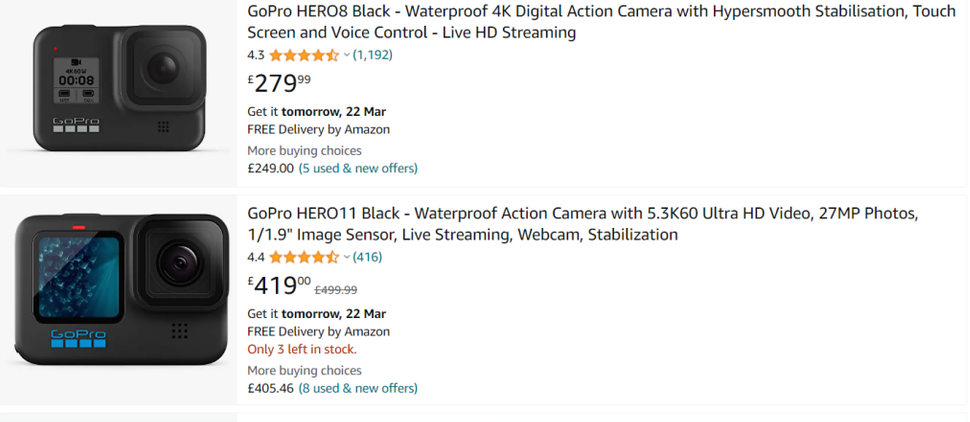
WOLFANG Action Camera 4K 20MP GA100, Waterproof 40M...
4.2 (1,410)
£49.99 £59.99
Save 15% with voucher
Get it Tomorrow by 1pm
FREE Delivery by Amazon

AKASO EK7000 Pro 4K Action Camera - Touch Screen EIS...
4.5 (1,422)
£77.99 £89.99
Save £8.00 with voucher
Get it Tomorrow by 1pm
FREE Delivery by Amazon

AKASO EK7000 4K30FPS Action Camera - 20MP Ultra HD...
4.4 (27,178)
£59.99
Save £5.00 with voucher
Get it Tomorrow by 1pm
FREE Delivery by Amazon

Here are 4 more action cameras that I found for a reasonable price on amazon. They also all had over 4 stars on 1000+ reviews. These were not go pros but would do the job, portray an image to a phone/screen. On top of this they are within my price range. These are looking more feasible than the GoPros due to price and quality.

I decided to buy the camera shown below, and ape-man, which streams to your phone using Bluetooth, and came with many attachments. One of these attachments was a suction cup which could be used on the boat. On the next page I will test it and show it works.



GoPro HERO8 Black - Waterproof 4K Digital Action Camera with Hypersmooth Stabilisation, Touch Screen and Voice Control - Live HD Streaming
4.3 (1,192)
£279.99
Get it tomorrow, 22 Mar
FREE Delivery by Amazon
More buying choices
£249.00 (5 used & new offers)

GoPro HERO11 Black - Waterproof Action Camera with 5.3K60 Ultra HD Video, 27MP Photos, 1/1.9" Image Sensor, Live Streaming, Webcam, Stabilization
4.4 (416)
£419.00 £499.99
Get it tomorrow, 22 Mar
FREE Delivery by Amazon
Only 3 left in stock.
More buying choices
£405.46 (8 used & new offers)

Testing the camera I bought

Here I test the camera I purchased and show it fully works.

I decided to buy the camera shown below, and ape-man, which streams to your phone using Bluetooth, and came with many attachments. One of these attachments was a suction cup which could be used on the boat, securely attaching it to the boat.

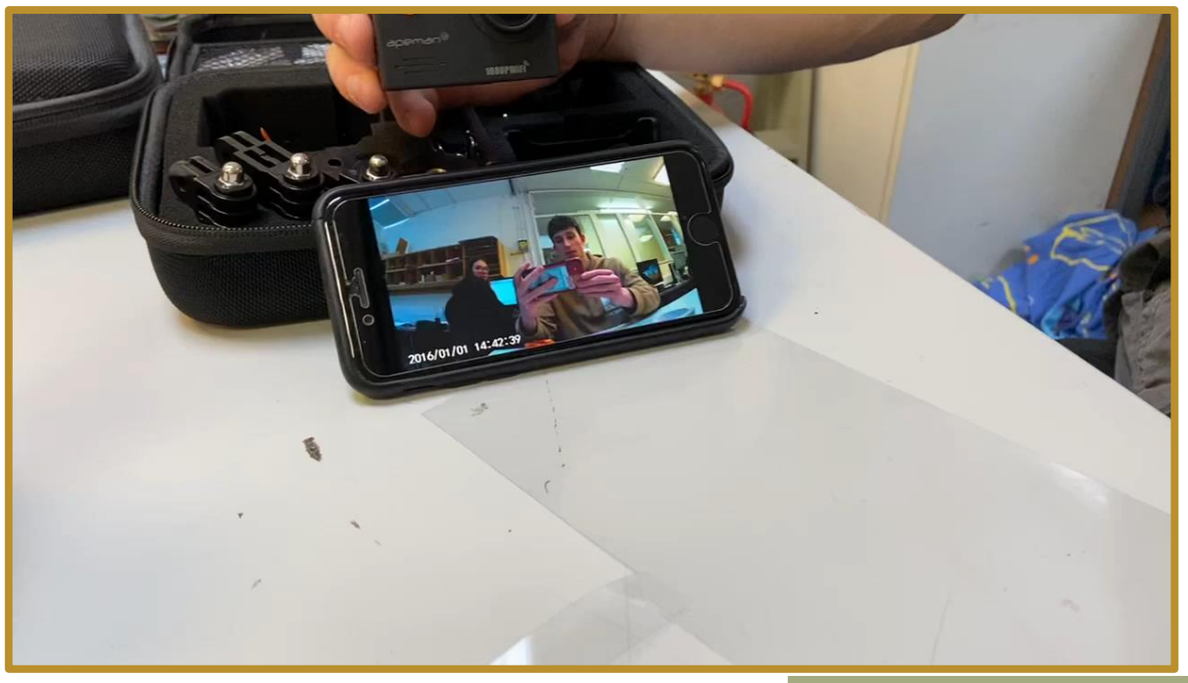
Pictures show the case being opened. This is an easy process and the case is very waterproof.

Pictures of the camera out of the case, and in the case in the suction cup.

All the equipment the camera came with.

The videos to the right show the camera in use. The first one shows the process of it streaming to a phone, as the camera is rotated around the room and the picture on the screen follows. Although this is slightly lagging behind, so there may be an issue in the boat, it should be ok as it is only roughly 1 second behind.

The second video shows the suction cup attaching the camera to the table, this shows it is very strong and can withstand a reasonable force. The suction cup also functions in the wet, and the boats surface is smooth and clean so it will stick well.



Next steps: On the next page I will look into the pole prototype design

Prototyping the pole mechanism

This involved getting a tube, a fixing mechanism, a holder for the phone box and a way to fix all the pieces together. This process was the most complex yet and will prove hard when competing my project. The process is shown below.

I started by getting a fixing mechanism and a tube. The fixing mechanism I took off an old trolley, but can be brought for a low price. I tested the function of the fixing mechanism, by tightening it onto the pole and twisting it to check how secure it was. I then went ahead and separated the mechanism from its axil, using a chisel and hammer, as shown in the last photo.

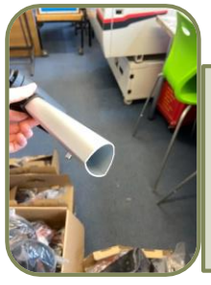
I got the fixing mechanism and outlined it on the pole, thinking that I could attach it by screwing the two parts together either side of the pole. I could out the hole using a Stanley knife, careful not to cut my hands. However once I had attached the parts together, I realised that there would not be enough space to tighten the 2 pieces together, and once they were tight they would not be secure.

I decided to try a new technique. I used a different part of the pole and got a large nut (6mm) and bolt. After drilling a hole with a 6mm drill bit, I could screw the nut in and fasten it securely.

The nut came too large, so I had to cut it down to size. I used a junior hacksaw to saw off a marked area of the it, so that it fitted inside the tube with enough space to screw on a bolt.

After cutting the nut, I screwed on the bolt and tightened it with the fixing mechanism in place. In my real object I will use 2 bolts for extra security.

This then proved effective in holding up the tube however when there was some weight on the tube it fell slightly and twisted. This needed to be fixed



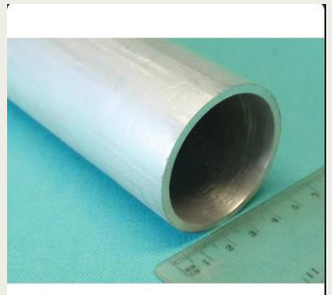
A potential tube I could use for the final product. Can be brought cheaply in shops or online. Thin aluminium pipe so is strong and resistant.

I realised that the issue with the pole mechanism was that when it tilted side to side it fell over and slipped. This was an issue because if it did this in the boat the phone may fall in. On the next page I will fix this issue by trying to prevent it from falling over and cutting teeth into the plastic.

Mini Clip Hose Clips Durable Mini Hose Clips Air Small Clamp Excellent

£5.06
eBay - topfashionlife
Free delivery

Secondary research shows that mini clamps (to the left) can be brought for very cheap, and are available in standard sizes for use. They are also secure and strong. The aluminium tubes (to the right) are more expensive but still strong and not too expensive. They can come in a range of sizes and are suitable for the job.

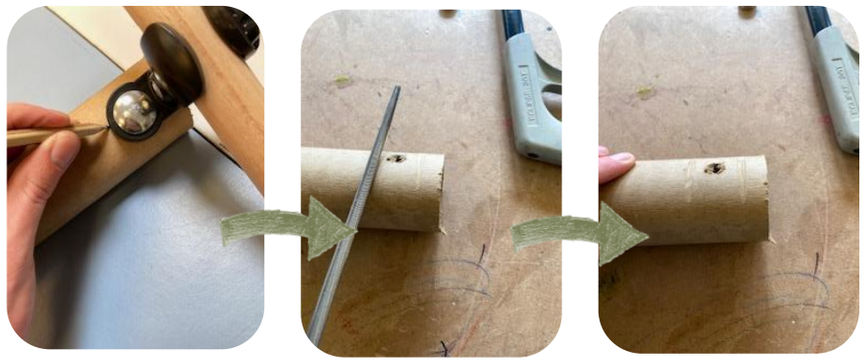


1.5M Gauge 2" X 16 1.63mm Thick Aluminium Pole

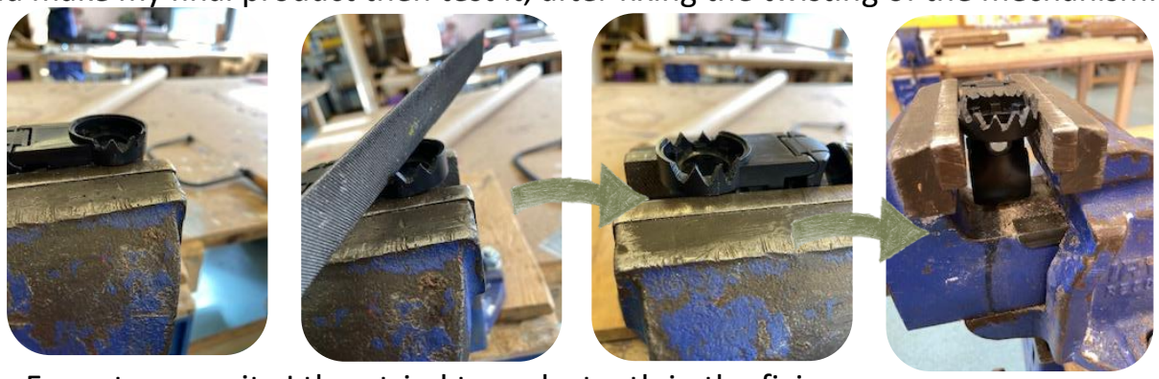
£18.00
ML&S Martin Lynch and Sons
£11.95 delivery

Pole prototype continued

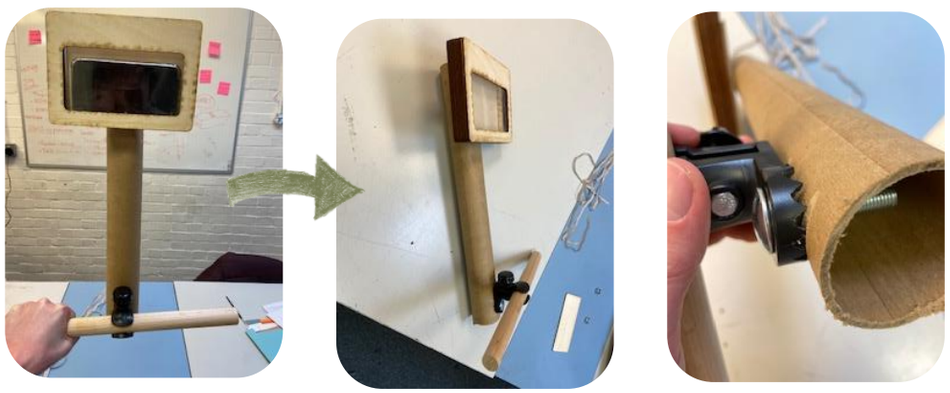
Here I combine all of the techniques I have used previously, and make my final product then test it, after fixing the twisting of the mechanism.



To try and prevent the spinning, I sanded down the areas where the fixing mechanism is in most contact, so that it would take more force to pull it out of position.



For extra security I then tried to make teeth in the fixing mechanism so that it would dig into the tube and not twist.



Once I had finished sawing the teeth, I reattached it to ensure that it was effective. It was strong enough to hold the phone even when twisting side to side, as shown in the video. However when I do it on the real object I will have to adjust the shape of the plastic because the teeth will not dig into a metal or plastic tube.

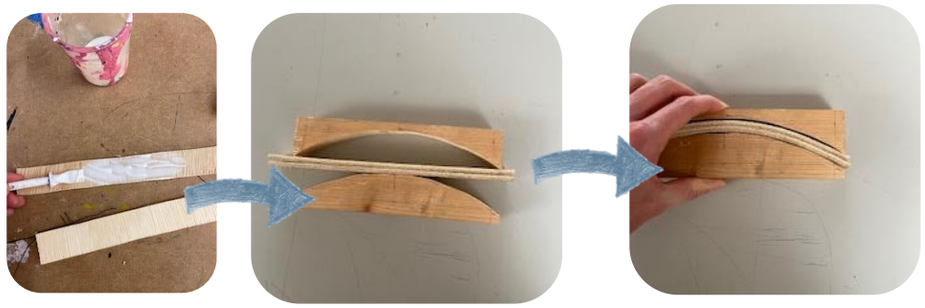
Video shows that the joint can be tilted side to side easily without the fixing device slipping on the tube. This shows its affective because the boat will tilt when the item is in use.

Visor prototype

This should be a simple design, as it will use flexi-ply and some wood glue. There may need to be 2 layers of flexi-ply for extra strength as well. I used a former and let it set clamped in the former overnight.

I started by getting a block of pine wood, and sketching out the exact dimensions of the visor from the working drawing. I then cut this out using a Hegner saw. This would act as my former, once this was done I marked out the area for the flexi-ply.

Once I had marked out 2 shapes, I cut them using the Hegner saw and wearing safety glasses.



I then used PVA glue to attach the 2 pieces of flexi-ply together, to ensure strength and integrity.

Once the pieces were together, I put them inside the former and clamped shut and left overnight.

To finish it off, I cut the edges with a Hegner saw and sanded them lightly, it is shown in place on a prototype of my model. The size fits perfectly as it bends just over the corners of the screen and shades it.

Next steps: On the next page I start to make the final prototype

Making final product

Here I combine all of the techniques I have used previously, and make my final product then test it.

Step 1: Pole fixing

I used the same fixing mechanism as in the prototype, but on real scale objects.



I first got some 6mm nuts and bolts, a 15mm plastic hollow tube and a 6mm drill bit. I drilled a hole directly through the tube with the 6mm drill bit, though both sides.


After adjusting the fixing mechanism to fit the size of the pole (I cut the curve of the pole into the base of the mechanism) I screwed the nut into the tube.


After adding 2 bolts for security, I added a mock footplate bar (which it will be attached to in the real situation) and it was secure and firm grip.

This process took me 2 hours.

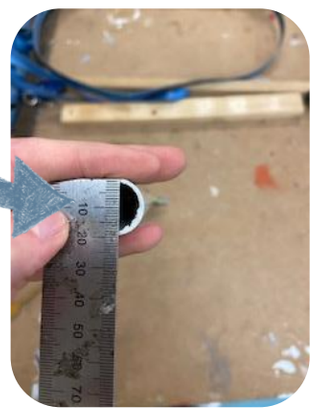
Step 2: phone holding mechanism

I used a block and panel just like in the prototype in the initial designs. Method is shown below



I started by getting a square length of pine wood, and marking out the section that I needed to cut in order for the pole to be able to poke through. I cut the square off using a Hegner saw as shown.


The part I was left with I then sanded, because this it would be handled many times so I was sure to remove any loose wood that may cause splinters.

I then drew a cross to find the centre, and measured the diameter of the tube. As it was 20mm, I chose a 25mm diameter drill bit so that it would have space to move around. Using a pillar drill, I cut out the hole, making sure to use no sudden movements that may break the wood. I also wore glasses and an apron for safety.

This process took me 1 hour.

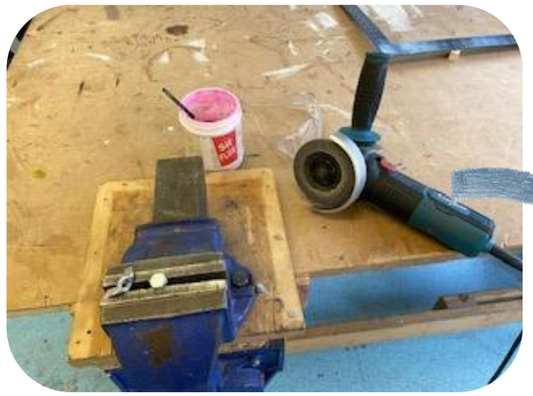


Quality control

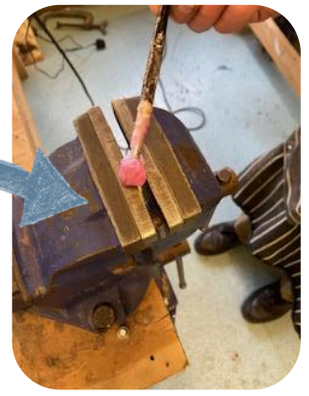
When making this I was sure to make everything as accurate as possible. E.g. using a tri square to get and exact right angle, and using a cross to get the exact centre of the wood. If I was to produce this on a large scale, e.g. batch or continuous production I would use jigs and CNC routers for extra precision.

Step 3: Creating the wingnut to tighten the tube to the block

I used equipment and techniques like an angle grinder and brazing. This has allowed me to create a wingnut to tighten the pole and phone holder together. If I was to manufacture this on a large scale I would have brought the wingnuts on a large scale to reduce production times.



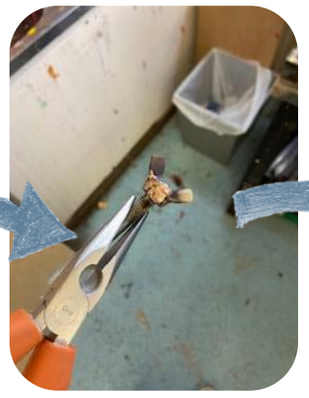




I started by getting a wingnut and a 8mm bolt. My plan was to braze them together to create 1 object. I used the angle grinder to smoothen out the surfaces of the bolt and wingnut that would be stuck together. I used goggles, an apron and gloves to prevent sparks burning my hands.

After this I placed flux on the bolt, this prevents oxidising and allows the 2 metals to braze together. Once the flux was applied I added the wingnut on top and started to heat it up, with first a cold flame, then a hot flame when applying the brass. The brass melted on joining the 2 pieces of metal together.






After the objects were brazed together, I allowed to cool for a few minutes, before holding with plyers and running under a cool tap.

As the bolt was too long to work suitably, I cut it in half with a junior hacksaw until it was a suitable length. The last photo shows the size in comparison to the block.

This process took me 1 and a half hours.

Quality control and safety

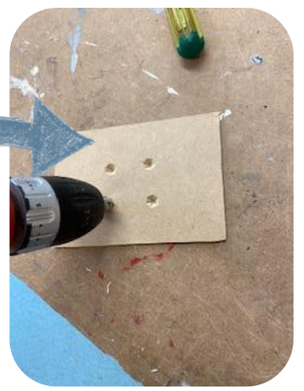
When using the brazing equipment, I was sure to use the blacked out goggles to prevent my eyes from strain, and an apron. To control the quality, I used plyers to hold the wingnut in place when brazing and ensured it stayed in the right place.

Step 4: Making the phone holder which attaches to the pole

This was a relatively simple task, and only took me 20 minutes.

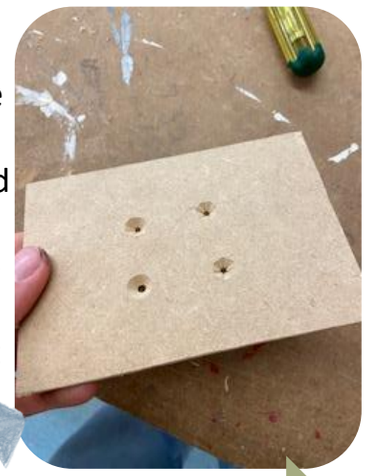

I started by getting a small panel of 8cm by 12cm MDF board, at 4mm thick. Then I use the block to draw an outline.



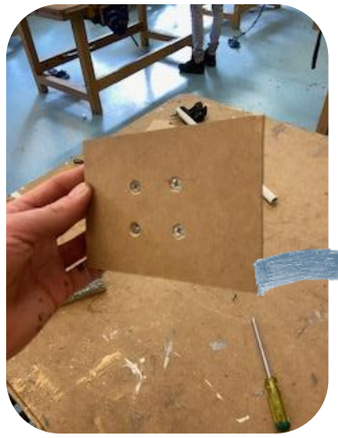
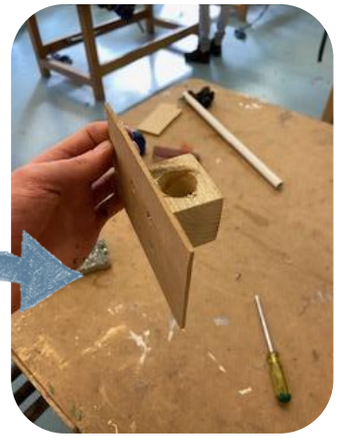



I then marked out the holes to drill and used a 2mm drill bit, as I had 3mm screws. I used a hand power drill as shown in the picture and wore goggles when using it.

As the screen would have to stick to this surface, it would have to be smooth and flush. Therefore I used a countersink drill bit to allow space for the screws to properly be put in and leave a flat surface.



Next steps: On the next pages I continue to make my final product.


This mechanism allows the screen to be attached securely to the footplate of the boat. This means it can be taken off and attached back on at any point. Also providing a secure mount.

I then simply screwed the 3mm screws in using a Philips screwdriver. The final pole product is shown in the last photo.

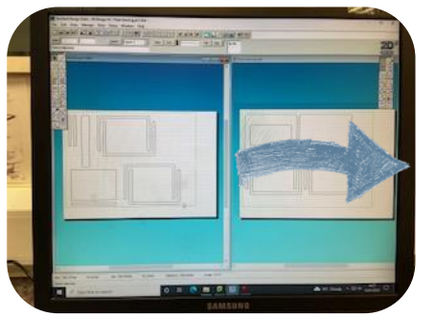
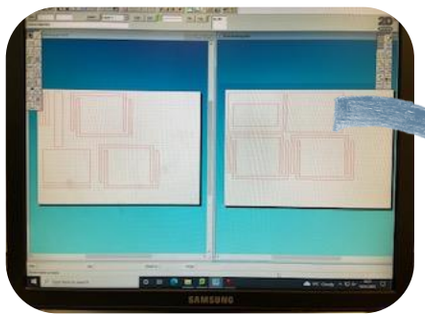
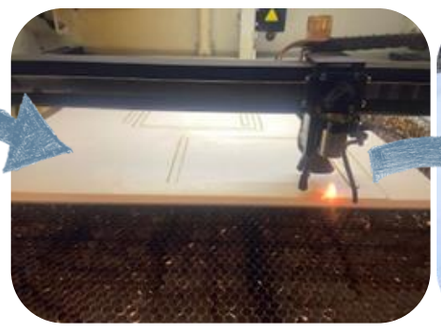
This process took me 20 minutes.

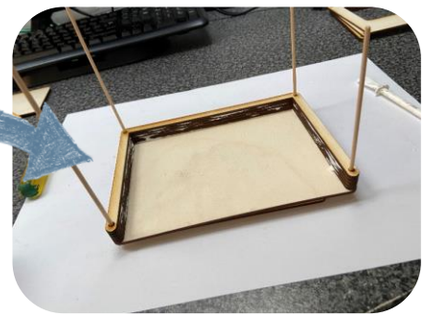
Quality control and safety

The power equipment used in this process was a pillar drill and a hand drill. For both of these I used goggles and was under supervision so if anything went wrong there was a responsible adult to help. If this product was to be mass manufactured, I would definitely use jigs and templates to reduce error. As well as that I would buy in as many parts as possible to reduce manufacturing time, e.g. the wingnut.

Step 5: Making box

For this process I will use the dowel joint, that I decided earlier on, and I will sand and apply with a finish. If this product was to be made in a batch I would use injection moulding and polypropylene. However because this was just a prototype and we do not have the equipment for that in school, I had to use plywood which I cut on the laser cutter.




I first started with drawing the designs for the product on 2D design. I turned the lines red to give the laser cutter the demand to cut through. I used 3mm plywood.

After the laser cutter had cut them. I let the harmful chemicals be extracted from the machine before opening the door. I then started to glue the pieces together using the 3mm dowels as guidelines to ensure all the pieces are all in line, this also added more strength.

This process took me 2 hours.


Once it had dried I cut the dowels off using a junior hack saw. Although this left rough edges which I sanded.

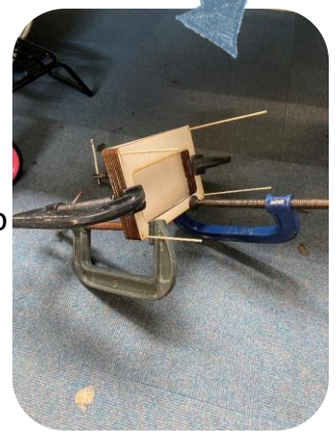
Step 6: Applying finish to box and sanding




I used an electric sander and sand paper to smoothen the edges for a sleeker look and ready to apply paint.

As shown it makes a large difference, because the laser cutter leaves burn marks and it takes them away.

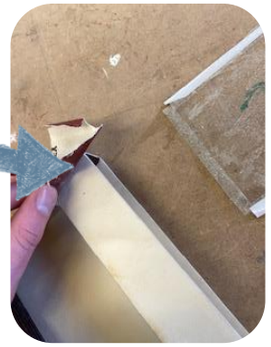
I then left it to dry for 24 hours, clamped in place. I left the dowels in so it would dry in place.



Next steps: On the next pages I continue to make my final product.

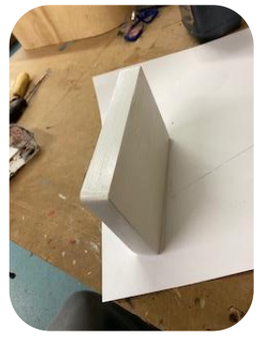

After the box was fully sanded, it looked sleek and minimalist, but bare. I will next apply paint to make it more aesthetically pleasing.

This process took me I hour and 20 minutes.

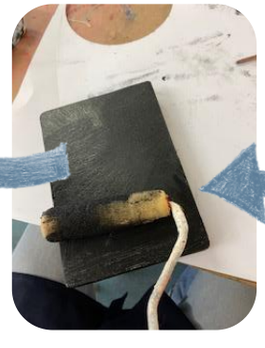
I used sand paper to take off the excess rough areas that the machine sander couldn't reach.


I then started on the painting. I first used a primer. As shown in the photo I used a brush, tray and roller.

After 1 coat of primer had been applied to the box and visor, I left for 4 hours to dry.


I then started on my first coat of black acrylic paint. I will do two coat of this in total. I applied the initial paint by brush, then used a roller to go over the paint. This gave It an even coating and no brush marks.




As shown using the roller gives a nicer finish. I did the same process with the visor. I applied the second coat in the same way and left it to dry by a radiator for 24 hours.

I then did the same for the top panel, adding a coat of primer then 2 coats of black acrylic paint.

Step 7: Assemble all parts of the box

This is the final process of my design, where I combine all of the separate parts and it comes together. I will then evaluate my product.



Once the visor and box were fully painted and dried, I marked out where the visor should go on the box with a pencil. As the visor was made to a certain measurement I was sure to set it equal in the centre. I then applied a layer of PVA glue and left to dry for 24 hours.

7.a: The visor

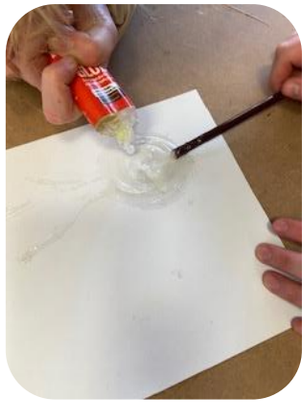
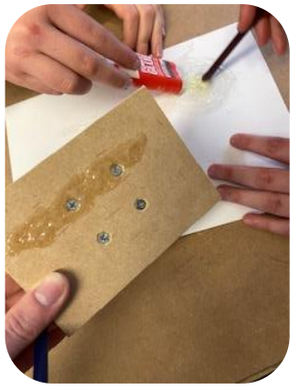


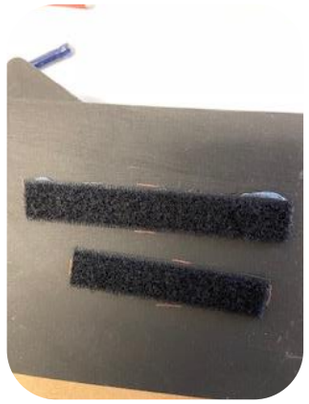
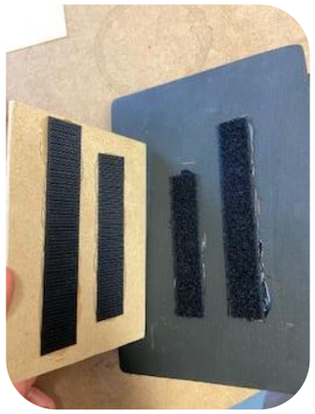
I then focused on sticking the box to the mount. My initial idea was Velcro straps, so I cut suitable lengths to go on the mount. They came with adhesive back. However when I stuck them on, they easily pealed off so I devised another way of applying them. As shown in the last picture I used a power glue.

7.b: Velcro attachment

This is the power glue I used, it works by mixing the 2 components and letting them dry.

Next steps: On the next pages I continue to make my final product then present it


These pictures show me mixing the glue and applying it each surface (I marked out where I want the straps to be with a pencil)

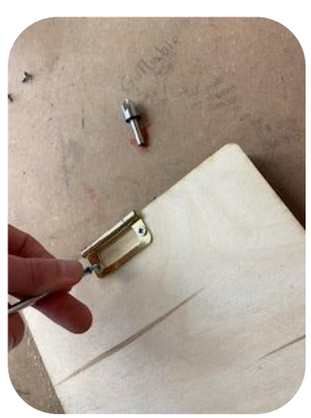
After that I left it for 24 hours to dry, then tested it. This proved effective and there was enough surface area to hold the screen.

Quality control and safety

The glue was corrosive, so I was sure not to get it on my hands, and if it got on them I washed it thoroughly straight away. If this was to be mass produced I would have a quality control station to ensure that the Velcro strap positioning mirrors that of on the other surface. So that when sticking them together they fit securely.

7.c: Hinge mechanism



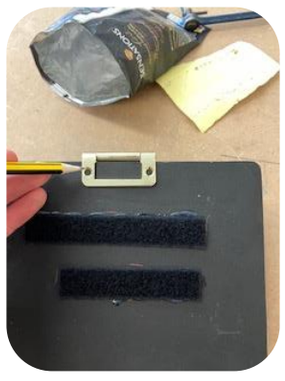



I then went onto create the hinge mechanism for the top flap. I collected some 3.5 x 12mm screws.

I sketched out the outline of the hinge, then got some 2.5mm drill bits and drilled the holes that I sketched. By getting drill bits just smaller than the screws it allows the screw to fasten into the wood and not crack it.

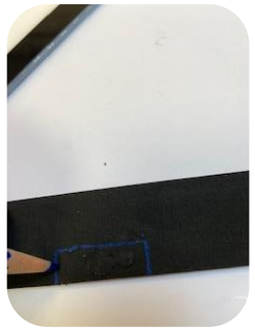
I then screwed it in using a screw driver and repeated the process for the top.

Video shows the hinge functioning correctly and flapping up and down. Only issue is the screws came out of the wood and are sharp so could be dangerous, for this reason I will not be using this method for the hinge.

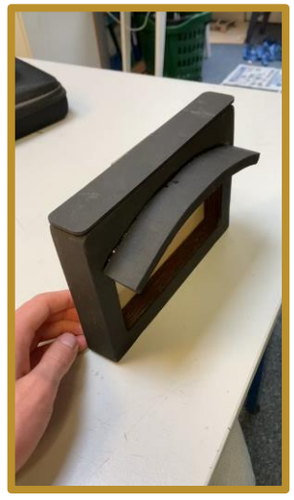



Using the new technique (which I tested on a hinge as shown to the right of the second photo), I outlined where the glue would need to go on the box.

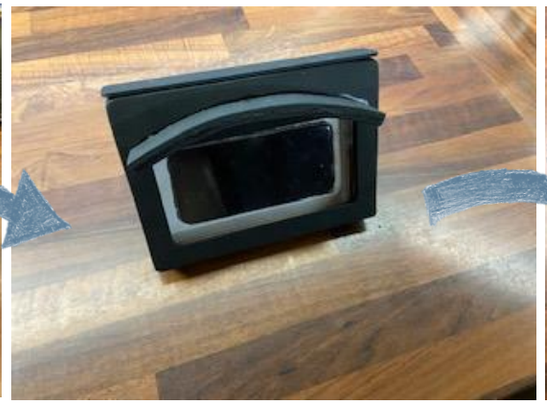

I then squirted out the glue and mixed the two components, then applied a reasonably thick layer to the box. This was thick enough to hold the lightweight hinge in place and I left it to dry for 24 hours.




For the lid I used the same technique. I let the glue dry on the box before attaching the lid. I then marked out where it would go, applied glue and clamped the lid in place using 2 G-clamps.
The video shoes the joint functioning when dried. The positive of this mechanism is that the path of the drawer is not interrupted, because the hinge is on the outside.

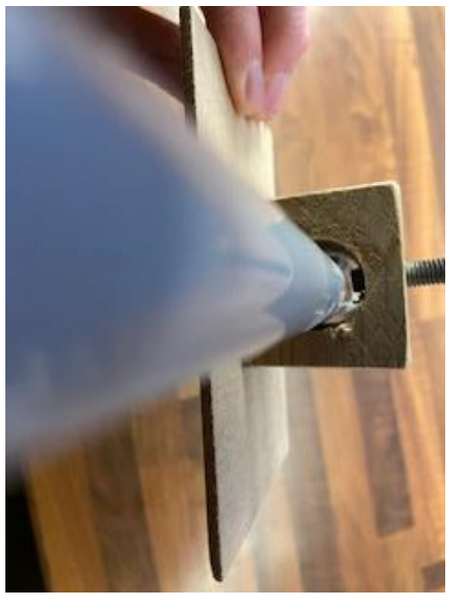


Final prototype










in the next section I will evaluate my product in the real environment of use.

Making: Feasibility study

Here I will assess the feasibility of making my product, transporting it and how it will affect the market.

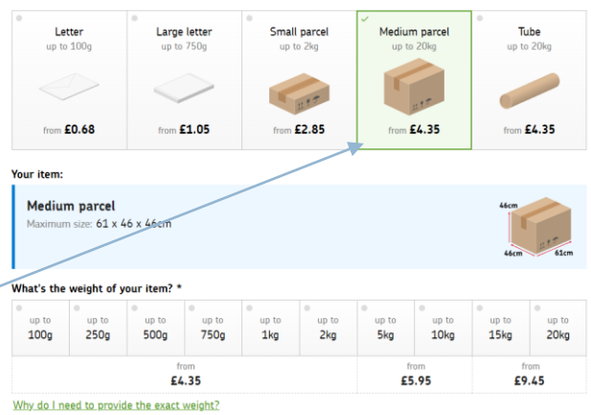
Who?	What?	When?	Why?	Where?	How?
Manufacturer.	Working drawing, materials and finishes.	I would use Just In Time (JIT) production to reduce waste and prevent spending on storage.	My bespoke prototype is not a clear representative of the market/product.	How feasible it would be on an industrial scale.	I would send the working drawing and materials and finishes to the manufacturer and they would make it.
Delivery driver/delivery company.	Package size, weight and cost.	Delivery date and I should include a few extra days in case of delay.	If this was to be viable on the market it would need a delivery system.	They would be the intermediate player, taking the product to the end user.	A fee of a shipment for a certain amount of items.
Marketers	Specifics, environment of use, intended audience and price.	On product launches and key times in the products lifecycle.	The product needs to be marketable in order to succeed.	Online rowing kit websites e.g. Godfrey sports kit. Also in rowing kit shops.	I will analyse similar products and see how they have been marketed.
End user: Jasper Tidmarsh	I would want a product that works effectively.		I can see behind me when rowing or sweeping.	On the river or on a rowing lake.	By using the item.
Fellow product design student and potential end user: Bethany Bright	I would want it to be innovative, not something I've seen before.		It would stop the glare on my phone and make it easier to see what's behind me	On the river when rowing.	I will attach it to the footplate and the camera to the back.

Now I have finished making my final prototype I will start to evaluate it and carry out feasibility tests and see how the product will act in the market. This will include views and opinions from key stake holders. However, as this is a rowing product, I have to test it on the river in a rowing boat. As the river is currently on red boards at the moment (it's too high and fast to rowon) So I will simulate rowing in other ways as shown later on. I will also try to get on the river and test it at some point.

Here I talk to my friend studying business at a university degree course level, Finbar. He introduced me to a way to measure how successful the product might be in the market.

Finbar explained to me that my product would fit into the diversification box. This is because it is a new product, therefore can be on of diversification, and product development. It is also a reasonably new market because I have only found one product of similar nature. This means it fits into the diversification box.
He then went onto explain that this means it may sell very well, as its entering a new market as a new idea.

When looking at postage of the item, it would fit into a medium parcel, and its not over 2kg so it would be £4.35 per item.



This shows that my product is viable to be posted on mass by the royal mail, a trusted mail company.

A table to show all of the wants and needs of my stakeholders and how feasible my product would be in the market.

Finbar showing me the table.

My evaluation will consist of getting opinions and feedback from other rowers and users. This will include them testing it as well as myself. I will also do a feasibility test to see how feasible it is to bring it to market.

Physical testing of product

First I attach it onto a boat on land, in a stable controlled environment this will show that it initially works as a designed. I will later test it on a rowing machine as well. As the river are currently on red boards (the river is too high and fast to row on safely) I cannot test it on the river, however the stream may die down in the future where I will hopefully test it.

Here is the boat I will be using, a simple single sculling boat. The position of the screen mount is shown by the red circle, and the camera position is shown by the green circle. This means I will not hit either component at any point in the stroke.

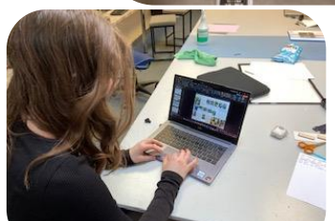
These photos show the product being attached to my phone step by step. The process took me 5 minutes in total and was easy. The phone is securely attached. However to make the suction cup firmly attached I needed to dip it in water before attaching it to the boat. This made the stick much stronger.

This picture shows the phone box being fully attached to the boat. When I test the product on the water I will also test how it affects the balance of the boat, because that was a worry for my users.

As shown the camera attaches to the inside sheltered bit of the boat. This means it wont affect wind resistance. Also if it falls over it will stay inside the boat, not fall in the river and be lost.

This is a rowing machine which I have at home, This is the same action as rowing just in a stable controlled environment. I mimiced a boat by putting the camera behind me and the screen in front of me. This gave me my first experience of using the product in a real situation. It worked well.

Pictures show the camera stuck onto a box (mimicking the position in the boat) and the screen in front of me face. Its positioned correctly so that I don't hit it with my hands or face when I come to front stops.



Videos shows me rowing on the machine, with the camera and screen in place. They also show the screen is recording live, as an object is waved past the camera and it comes up on the screen. This shows that my product idea works in a stable controlled environment.

Stakeholder opinion:
You have done a very thorough evaluation of your product which clearly shows how it would function on the boat. It makes it very easy for you whilst rowing and has prime on the boat.

Testing in intended environment

Here I test the prototype in the intended environment and assess the pros and cons.



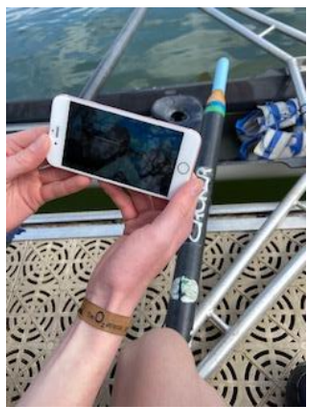




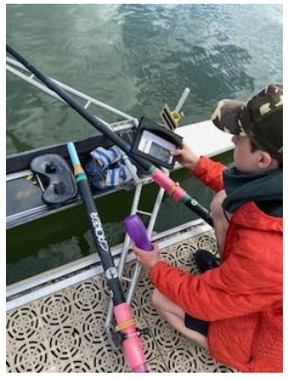

I started by attaching the screen mount to the footplate, this took roughly 2 minutes and was relatively simple. One of my users who was watching me in the process brought up the issue that if the footplate had different sized poles it may not attach. I will take this into consideration as an improvement for the iterative design process and modify it.

I then added the camera on, I was sure to make surfaces wet before application to make sure they stick effectively. This was also done inside the boat so if it falls out it will not fall in the river, it will be in the boat. This took me a minute at most.

Once this process was done on the land, I moved it onto the water and then attached and paired the phone. The photos above show the product fully set up on the tressels on land.



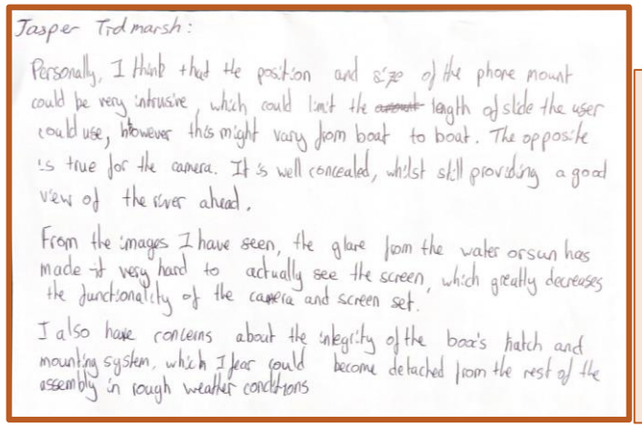




I then paired the phone to the camera on the landing stage, then put it in the box and attached the box to the mechanism. I then adjusted it to my eye height when I was in the boat. This took 2 minutes.

The fact that it only took 5 minutes to set up shows that it is easy and quick. This was one of the concerns from my users when investigating their opinions. It also will not take too much technical expertise as it connects to a phone via a single app.

The videos show me using the design whilst rowing. As shown the product projects an image of what is behind me so I don't need to turn and look over my shoulder. This was effective however didn't fully cut out the glare of light off the water. This was one of the main concerns of many of the users like Jasper Tidmarsh and Harry James. This will be an improvement in the iterative design process.

I could only test this product for a short amount of time due to strength of the river not allowing extended outings in a single. Therefore to fully test I would do an outing which lasted more than an hour (which is the length of a normal outing). This means this test was not significant enough to fully gauge the effectiveness of the product so I cannot come to a full valid conclusion.



Jasper Tidmarsh:

Personally, I think that the position and size of the phone mount could be very intrusive, which could limit the ~~amount~~ length of slide the user could use, however this might vary from boat to boat. The opposite is true for the camera. It is well concealed, whilst still providing a good view of the river ahead.

From the images I have seen, the glare from the water or sun has made it very hard to actually see the screen, which greatly decreases the functionality of the camera and screen set.

I also have concerns about the integrity of the boat's hatch and mounting system, which I fear could become detached from the rest of the assembly in rough weather conditions

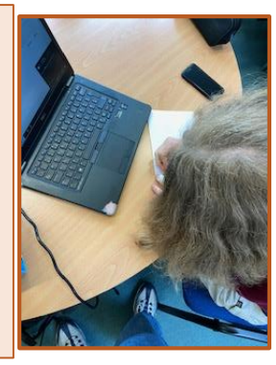
The photos above show one of the rowers (Dylan peters) who watched me set up and came up with suggestions of improvements. His opinion on the idea: 'I think the initial idea is good but the screen needs to be a bit larger to see properly where your going. Also it is a bit unsteady and needs some extra support. Also if you have very long arms you may punch it when you come forward.

In response to this feedback I will make sure that the pole is fully secure and stays upright at all times.

One of my main other users Jasper Tidmarsh watched me test the item and gave his response on how it worked. It is shown to the left.

<u>My analysis of Jaspers response:</u>

The glare from the sun is a major issue and prevented the use of the screen. Also that fact that it was slightly wobbly and may not always stay upright when in rough and choppy conditions. However the position of the camera works nicely and doesn't get in the way.



Risk assessment

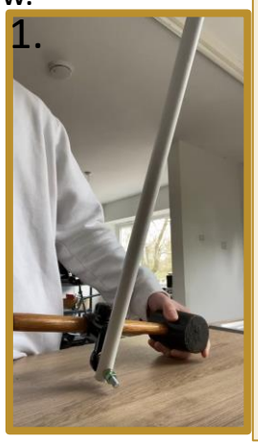
Hazard	Likelihood (1-5)	Severity (1-5)	Overall risk level (1-10)	Precautions to reduce risk
Falling into the river from the bank.	4, could easily happen	3, cold may be an issue	7, moderate risk	Ensure I am standing on a solid surface and am careful where to stand. Also anyone on a support launch should wear a life jacket.
Phone falling into water out of box.	4, could easily happen	5, a lost phone is a big loss	9, high risk	Try and not jog the boat too much. Ensure the phone is securely in and maybe attach string to box to ensure it doesn't float away if it falls in.
Capsizing whilst rowing.	2, I am an experienced rower so its unlikely	3, would mean the phone might fall out and I may get cold shock	5, low risk	Stay concentrated on the boat level at all times and don't get too distracted by the screen. Also keep an eye out for other river users.
Risk of support boat loosing power/sinking	1, low risk because they are well designed	5, would mean high cost of lost equipment and oil spillage could affect wildlife	6, very unlikely but would be very bad if it happened	Ensure boat has full fuel tank, and it fully functioning before taking it out.
Risk of catching crab (blade coming out of control when moving) and injuring oneself.	3, could happen especially in strong current to most experienced rowers	3, mostly no lasting damage, but if dealt with incorrectly could end up in lasting damage like broken arm.	6, could happen and could have lasting effects, but overall low level of risk.	Ensure my rowing technique is up to standard, and focus on rowing correctly. I can look at screen but should not pay full attention to it.
Risk of phone losing power whilst rowing.	4, could easily happen especially on a long outing.	1, would only mean product cannot be used, and user would have to revert to original way of steering.	5, high chance but very low severity.	Bring a charging pack with you on the boat. I have also looked into using solar panels to charge so it could be an apartment. However connecting the phone to power may be an issue due to it being in a watertight box.

Destructive testing

Here I mimicked the footplate mount by using the handle of a hammer, this also allowed me to move it freely and wobble it to test its stability, this will be how it may wobble in the boat. The videos are shown below.

This is the setup I used for the testing. By using a hammer handle it allows me to control the shaking and movement.

1.



The first video shows the pole being tested for strength and integrity. It does bend a considerable amount on its mount, which will need to be adjusted before being used again. If this was to be mass produced I would also properly secure it.

2.

The second video shows the whole object being shaken like it may in the boat. It does eventually fall down and twist around. This shows the screw is not quite strong enough to hold it up. As an improvement I may add holes in the pole for the screw to screw into for extra security.

The last video shows the phone box being shaken on its Velcro attachment. This shows that the Velcro is perfectly effective in holding the phone up and is not effected by water.

3.

Evaluation in relation to other existing products

I chose to evaluate my product in comparison to 4 main products which I assessed in the investigation into context: Trieye, the phone holder for a bike, mirror on cap and tail camera/light. By evaluating this it will allow me to come to a conclusion on how good my product is in comparison to others, this will also mean I can predict how well it will do in the market, and how the sales may compare to the sales of the other products. I also aim to make my product as marketable as possible, this may include using certain parts for other designs to make mine better, e.g. the pouches from the bike phone holder on my design. This may increase the number of people who want to buy the product, and therefore the popularity and success of it.

Although my product is more expensive. It offers more.

This was one of the cheaper products I evaluated, at roughly £3 per piece.

My product relates to this because it has the same function. In my opinion it is better because doesn't make you seasick.

This product takes less time to make (as there o less) and is less sophisticated, can be used by anyone without fault.

Mirror on cap

This is the go to piece of simple equipment for a rower, although its not that popular.

However both designs offer a solution to the problem

Conclusion

This product is a good cheap alternative to my product, and does still work. Although it does make you seasick. I believe I can withstand this competitor (as this it the most similar product out of all the ones I asses), because its simple, cheap, flimsy and doesn't effectively give you a full view behind you, whereas mine gives a full view.

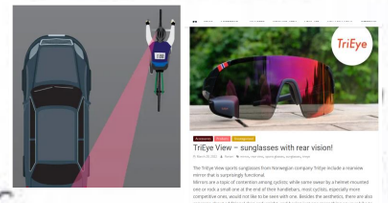
Although you could argue that it may fog up the mirror, I believe because my product is better because by the state of the user.

This product is also easier to store.

I believe my product is more innovative.

This product is cheaper than mine, at about £25. However are optimal in the sun as the glasses are polarised.

Tri eye



Much more innovative product. Well designed.

This product comprises of glasses with a camera to the side so you can see behind you.

Conclusion

I believe this is the most innovative out of all of the products I assess, because of how minimalist is it, built into a normal pair of sunglasses. This is very similar to the mirror on cap design, and Is better in my opinion despite being more expensive, however I believe I can compete with it because it doesn't give you a full view behind you and could fog up with sweat.

This product is much more expensive, at £ likely. This may make it less popular.

This product is very similar to the second half of my product (the camera). However it also has a tail light on it.

This is also a more sleek design. But this is something I can improve on, a more sleek design.

Tail camera

This product is unique, and designed initially for a bike, however has the same initiative as mine. It's also at a high standard.

The camera is high quality, but as the screen isn't very big a high quality camera is not needed and will only cost more.

Conclusion

This product is a very close resemblance to the second half of my product. This is an expensive but high quality product and long lasting. The light may also be useful for visibility. I believe I can withstand and overtake this competitor because they do not offer a phone holder, and it is expensive. My product can also attract a larger audience, because the user can use any phone they want and still use the same size box.

In my opinion this is a good product and works effectively. The flexible screen also allows you to control the phone, which you cannot do on mine.

I could add this as an adaptation/development point to mine.

This can also be bought on many sites like amazon.

This is a similar price to my product

Phone holder

This product costs about £20, and comes with a good amount of storage space.

I could improve this on mine as I could add storage for a power pack or lead.

I think this is a good design, which I could look at for inspiration. However it is already popular in the market it might make it harder for my product to reach success. Although this is only one

Conclusion

This is a good idea because it also has storage pouches for a power pack or power cable. However this is designed for bikes, so cannot be attached to a rowing boat without extra work being done. This is why I can beat this product in the market. It is also only the phone holder, and does not offer a camera system.

Questionnaire and answers from stakeholders

I asked 8 of my potential users (4 of them rowers) about my product in order to gauge a their opinions

The 8 questions I asked

1) Would you use my product?
2) Do you think it looks nice?
3) Do you think it would be practical in a boat on the water?
4) What are your least favourite parts?
5) What are your favourite parts?
6) What would you change if you had the chance?
7) Is there any part that you think is useless?
8) Can you see this product being popular amongst rowers?

Emily brown

1. Would you use my product? Yes
2. Do you think its aesthetically pleasing? Yeah, it could be uglier.
3. Do you think it would be practical in the boat? Yeah, but I thought its not needed.
4. What are your least favourite parts? It looks really big.
5. What are your favourite parts? The visor looks nice
6. What would you change if you had the chance? I dont know probably not.
7. Is there any part that you think is useless? No, its great.
8. Can you see this being useful and popular amongst rowers? So popular and useful.

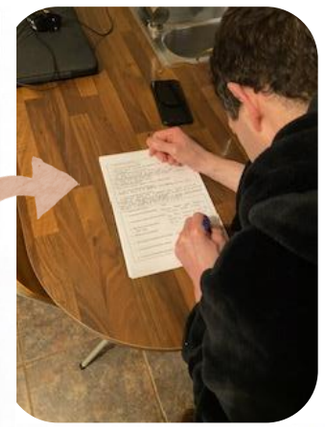
Bethany Bright

1. Would you use my product? No
2. Do you think its aesthetically pleasing? Yes, very sleek design
3. Do you think it would be practical in the boat? Yes
4. What are your least favourite parts? The texture of the paint
5. What are your favourite parts? The hinges and the visor - practical parts
6. What would you change if you had the chance? some sort of waterproofing - potentially a cover which comes out of the top of the pole
7. Is there any part that you think is useless? No
8. Can you see this being useful and popular amongst rowers? it depends on how big of an issue rowers have looking backwards and how much the product can withstand

This is the photo that I showed them, of the item with the camera attached to the boat. Their answers are shown on the sheets.

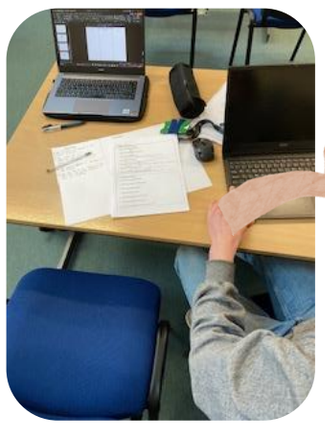
1. Would you use my product? Yes
2. Do you think its aesthetically pleasing? It's OK but would be better if it had rounded corners.
3. Do you think it would be practical in the boat? As long as it stays in place, yes. It is out of the way of the rower and at eye level, so well designed. Also the height can be adjusted
4. What are your least favourite parts? It may get splashed from the sides. protection at the sides would help.
5. What are your favourite parts? The sun visor looks very practical
6. What would you change if you had the chance? Make sure it is fitted securely on the pole
7. Is there any part that you think is useless? It doesn't look like it needs the full vertical height of the box, so I would reduce the size of it.
8. Can you see this being useful and popular amongst rowers? Yes, with a few adjustments, I think individual rowers would find this very useful.

1. Would you use my product? Yes. Marcus
2. Do you think its aesthetically pleasing? Camera looks good. Display screen looks bulky.
3. Do you think it would be practical in the boat? Yes. The shading over the display screen is a nice touch.
4. What are your least favourite parts? See #2.
5. What are your favourite parts? Adjustable display screen.
6. What would you change if you had the chance? slightly smaller screen?
7. Is there any part that you think is useless? No.
8. Can you see this being useful and popular amongst rowers? Yes, definitely.



Finbar Wilson

1. Would you use my product? No
2. Do you think its aesthetically pleasing? yes
3. Do you think it would be practical in the boat? yes
4. What are your least favourite parts? how it is attached to the boat, while stick
5. What are your favourite parts? Sleekness, dark(not too eyecatching) you don't have to focus on it
6. What would you change if you had the chance? Maybe have it attached at a slanted angle, cause thats cool
7. Is there any part that you think is useless? NO, maybe the sunblocker on darker days,
8. Can you see this being useful and popular amongst rowers? yes, not seeing is an issue



Rueben

1. Would you use my product? Yes
2. Do you think its aesthetically pleasing? Yes
3. Do you think it would be practical in the boat? Yes
4. What are your least favourite parts? It could fall off
5. What are your favourite parts? It has a sleek design and is not overwhelming
6. What would you change if you had the chance? Type of camera
7. Is there any part that you think is useless? Not really
8. Can you see this being useful and popular amongst rowers? Yes

1. Would you use my product? Yes
2. Do you think its aesthetically pleasing? Not too ugly, ~~not~~ ok aesthetics
3. Do you think it would be practical in the boat? For steering & awareness, yes
4. What are your least favourite parts? I am worried that you might hit your hands on the screen/that might upset in some rigging instances
5. What are your favourite parts? the balance The screen
6. What would you change if you had the chance? move the screen
7. Is there any part that you think is useless? ~~Oscar's face~~ The sun visor probably isn't as useful as originally thought, the sun will reflect from the water below
8. Can you see this being useful and popular amongst rowers? Yes Winners.

1. Would you use my product? If I was rowing Yes
2. Do you think its aesthetically pleasing? Yeah its not too invasive.
3. Do you think it would be practical in the boat? Yes I do.
4. What are your least favourite parts? Nothing, I love it all
5. What are your favourite parts? Its very practical
6. What would you change if you had the chance? Make pole shorter, its too long.
7. Is there any part that you think is useless? B.T of pole at the top.
8. Can you see this being useful and popular amongst rowers? I hope so.

Answer analysis

From the majority of these stakeholders, I have decided that the overall answer to using the product is yes, as 6/8 answered yes. As well as that the majority 7/8 said yes it looks nice. However on the third question there were mixed answers, as most said yes but many said only if needed or if it was secured properly, which shows that my product could be a nuisance if designed incorrectly. The answers for questions 4 and 5 outline the pros and cons of the product, they were how bulky it is, if It will stay on and if that length of pole is required. The pros included a sleek design and visor. When the stakeholders got the chance to change things they outlined the size of it and its secureness. The last 2 questions involve people saying that the visor is useless due to sun being reflected off the water and the pole being unnecessarily long.

On the next page I will asses strengths, weaknesses and improvements.

Strengths, weaknesses and improvements

Strengths

- It functions as intended in the given enviroment.
- It worked well and effectively when testing on the rowing machine.

- The visor is effective in blocking out the sunlight.
- The box has an even coating of black paint. this also provides resistance to wear and weathering.
- It can move up and down on its pole, to adjust the height, to head height of the user.
- Its angle in relation to the user can be adjusted, so if you are sweeping (rowing with one blade only) you can still see it.
- The camera is attached inside the boat so if it does fall off for any reason it should just fall inside the boat and not into the river. I could also attachch a string to it.
- The camera can attach anywhere to any surface, not dependant on boat

Weaknesses

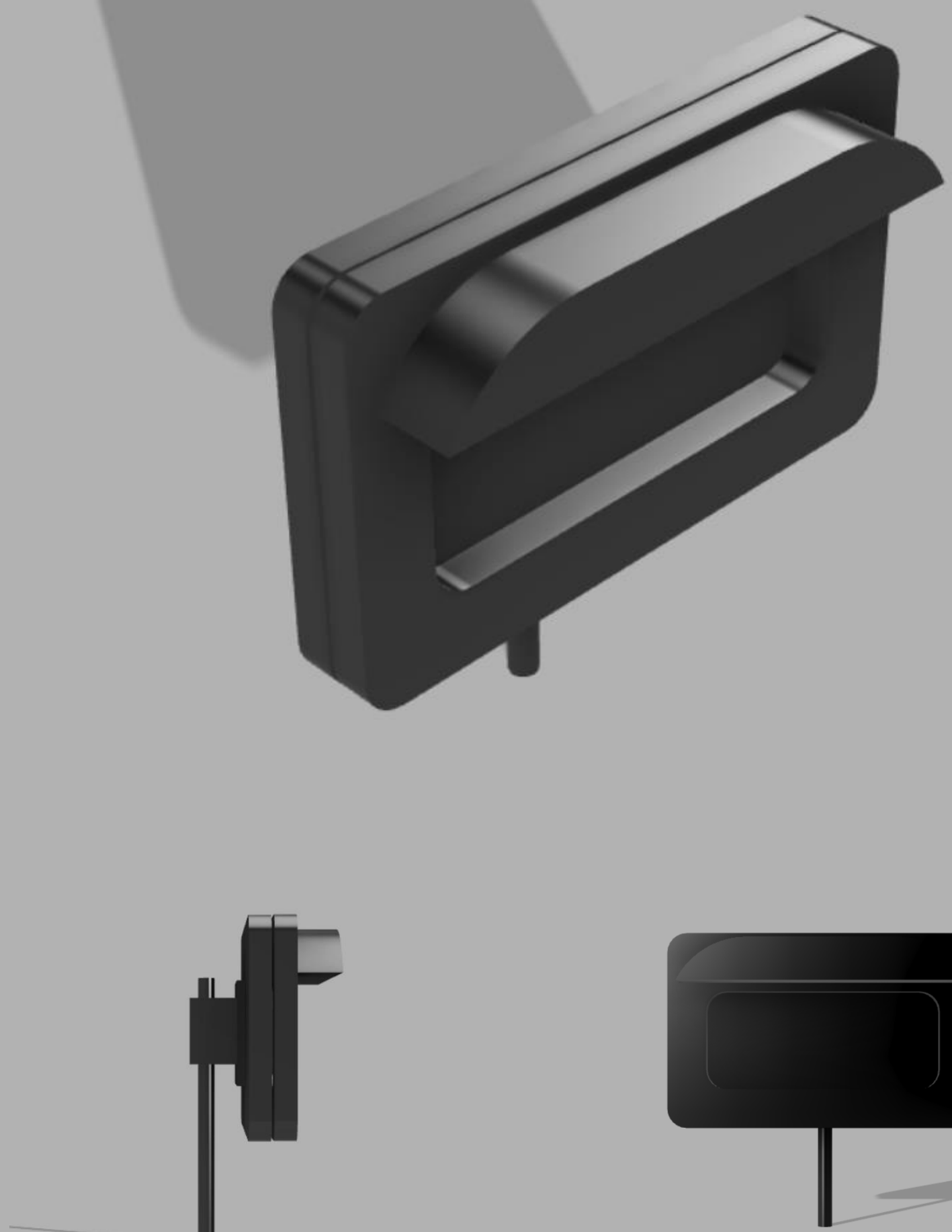
- It is slightly wobbly on the water. It is fine in a controlled enviroment but when the boat rocks its unsteady.
- It can only go ~~side to side~~ up and down, not up ~~and down~~ side to side on its pole. This means it can only adjust height not full position. This may be an issue.
- The visor may only protect the screen from glare at one point in the stroke. As you are constantly moving throughout the stroke different positions may affect you.
- If ~~you~~ the attachment pole gets wet it may become more slippery. This means the screen may rotate if it becomes loose and fall down.
- If the boat and suction cup are particularly dry they may not be that strong. Then the camera may fall off.
- The sun visor will not protect me from light that is reflected off the water or other boats, only light directly above me.
- I didn't have time to secure the flap closed. So if one capsizes then they may loose their phone.
- Both attachments may not be secure enough for a capsize, and may become loose
- Design only allows phone to fit to some types of boats with a circular flatplate

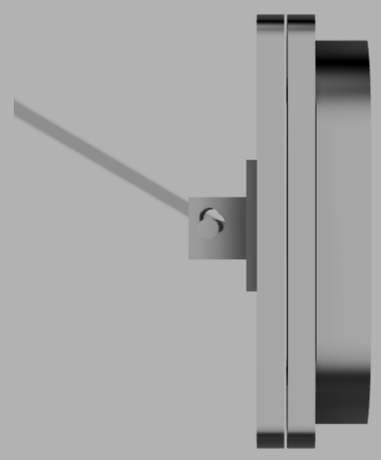
Improvements

- Make attachment of screen stronger to ensure it can go in all types of boats.
- Make mechanism that allows all angles of the screen to be covered for all users. Inclusive design.
- Make larger visor to prevent glare or use glare proof glass. Larger visor will make it look uglier and heavier.

- Add attachment to pole for extra security
- Use strong suction cup with pump action to make camera more secure.
- Add extra strong plastic film to the box instead of normal plastic sheet. I will not use glass because if it shatters it could be very dangerous.
- Add security mechanism to flap so phone stays in in case of capsize.
- Add mechanism which is not affected by water.

Final prototype





Rowing screen and camera device