



cingg 

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MENG PRODUCT DESIGN ENGINEERING
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THE PROBLEM

1 in 5 Women

Unfortunately we live in a world where stories of women being attacked on the streets during daytime runs or walking home at night, is a far too frequent headline. In the year 2019 as many as **2213 rapes** were reported in Scotland and this number does not include the shocking number of attempted rapes.

1 in 5 women have been raped or sexually assaulted as an adult.



Personal alarms are bulky and often inaccessible at the bottom of your bag. They typically use a pull-pin mechanism which can easily catch on clothing or slip causing accidental activation and embarrassment for the user who will then refuse to carry the product.

These devices can also distract the user from their surroundings whilst they look for or try to activate the device risking being identified by an predator as vulnerable to attack.

THE SOLUTION



What:

CINGO is a personal safety device which includes a GPS tracker and panic alarm to give confidence to women at night, on dog walks and on runs.

Who:

For young women who feel unsafe walking going about their daily lives and feel most comfortable when loved ones can track their route home.

Where:

The product is designed to look like a watch so its inconspicuous design allows it to be worn in plain sight on the users wrist and not be recognisable for what it really is.

Why:

The horrific number of women who are attacked on the streets every year is shocking and women deserve to feel safe when walking alone at night and during the day. Existing products on the market are bulky, obvious as safety devices and are too easy to accidentally activate which creates users who own but do not carry a safety device for one of the just mentioned reasons.

How:

The GPS links to an app which the users loved ones can connect to and get updates of their journey home. The alarm has a two step process to prevent accidental activation and embarrassment.

RESEARCH

User Group

There is a wide range of users that could be considered for my project as the problem at hand is one widely known as affecting all ages of females with 5 million women experiencing rape since the age of 16 in England and Wales, however it was decided to focus on 18-35 year olds to refine the user group based on the focus group I had access to and who make up the majority of cases.

A survey was conducted to learn when users felt the most unsafe, what activities they are doing at this time and where they feel existing products do not meet their needs.



- Nights out
- Running
- Dog walking

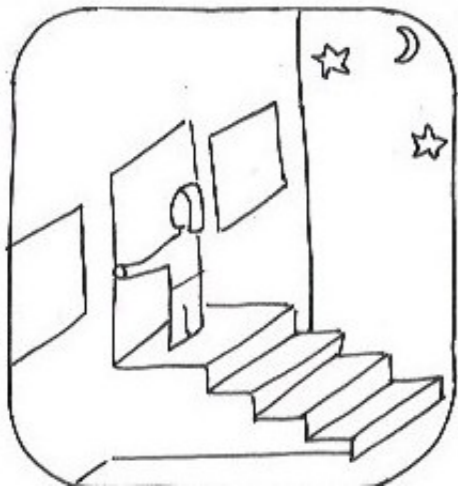
Between the hours of 8pm-5am are when they felt most unsafe. I also found that most attacks happen in the summer months due to increased outside activities so my product must be suitable for use with summer activities and clothing.

BRIEF

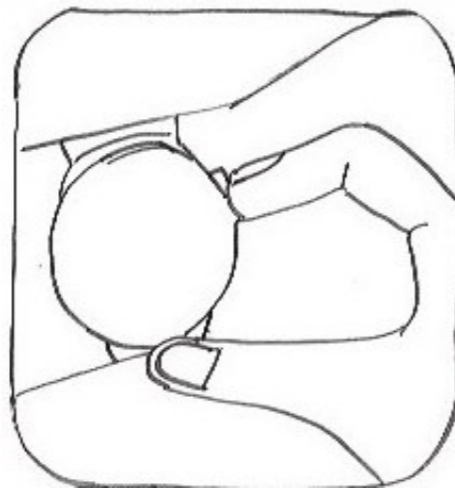
Design a system that gives young women and their families confidence when they are out and about.

Understanding the user journey of my product was a key point in my research to grasp the points of interaction and where my design would differ from existing products. The vital difference was the introduction of a 2-step process before alarm activation to prevent accidental activation.

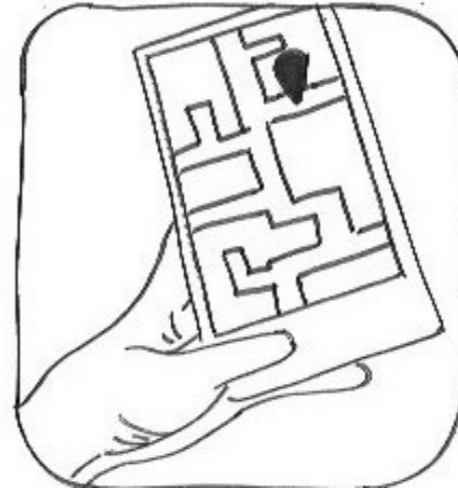
User Journey



User leaves their home at night



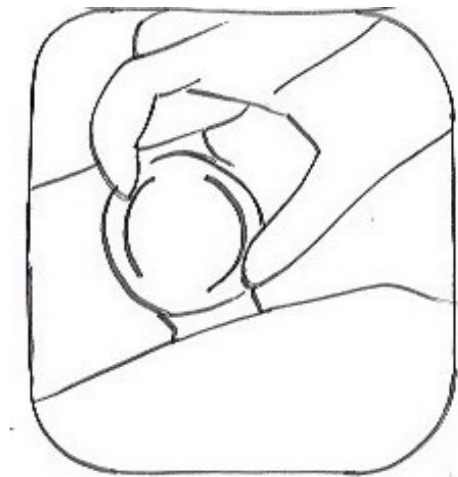
User activates GPS locator



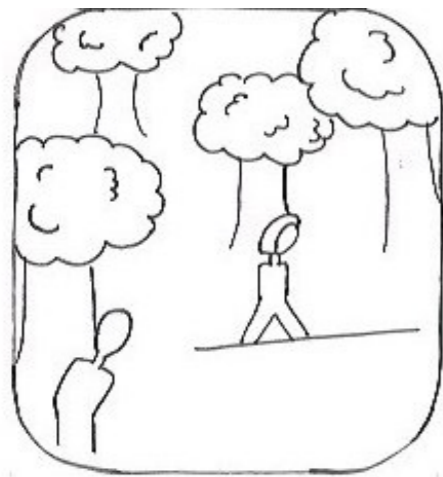
Loved ones can track their movements



User walks to destination



When feeling nervous they pre-set for alarm activation



User is being followed



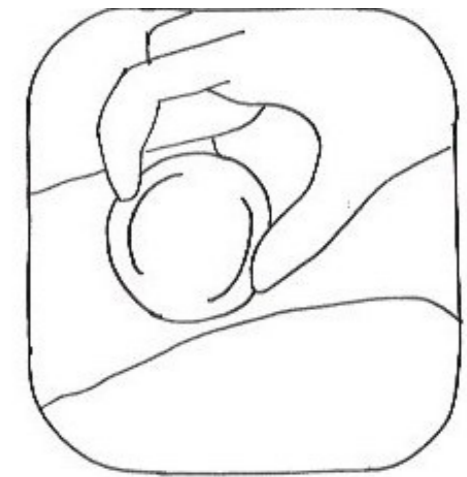
User is jumped by attacker



User activates alarm of device

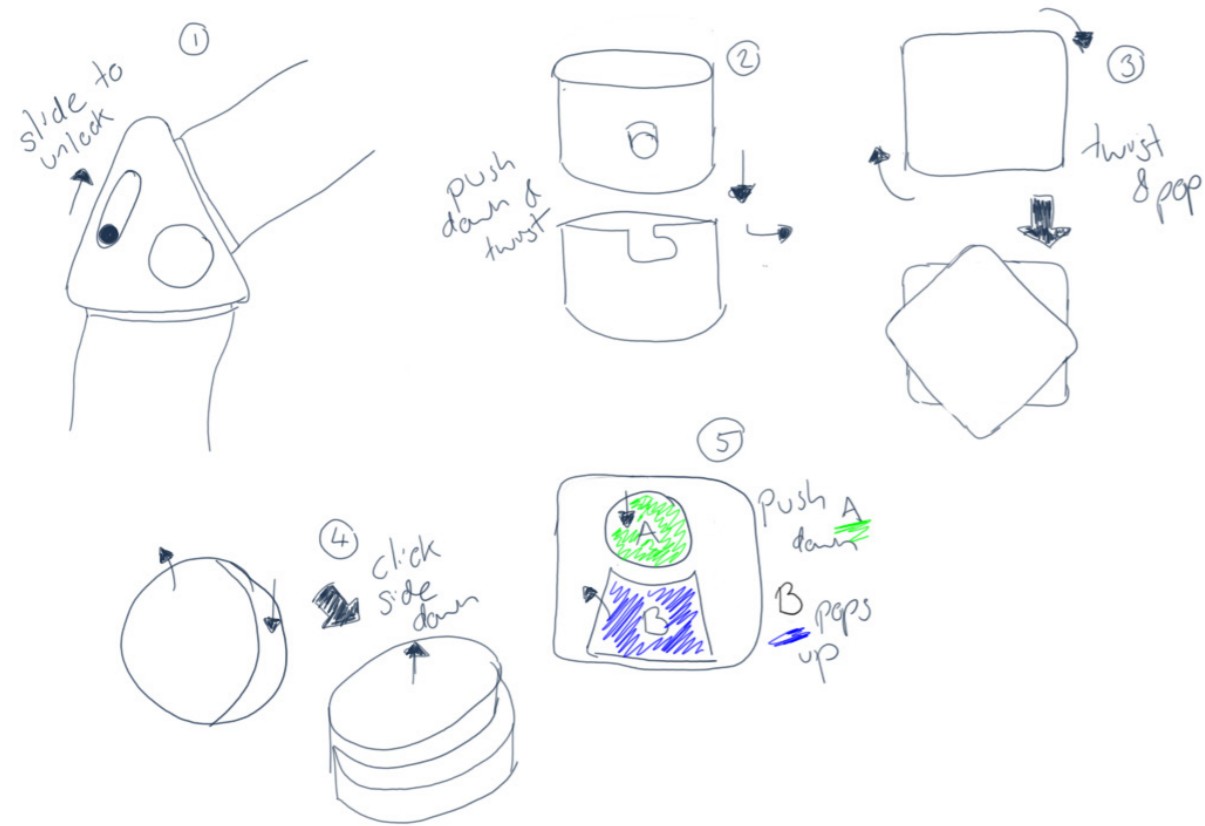


Alarm triggers and GPS alert is sent to loved ones

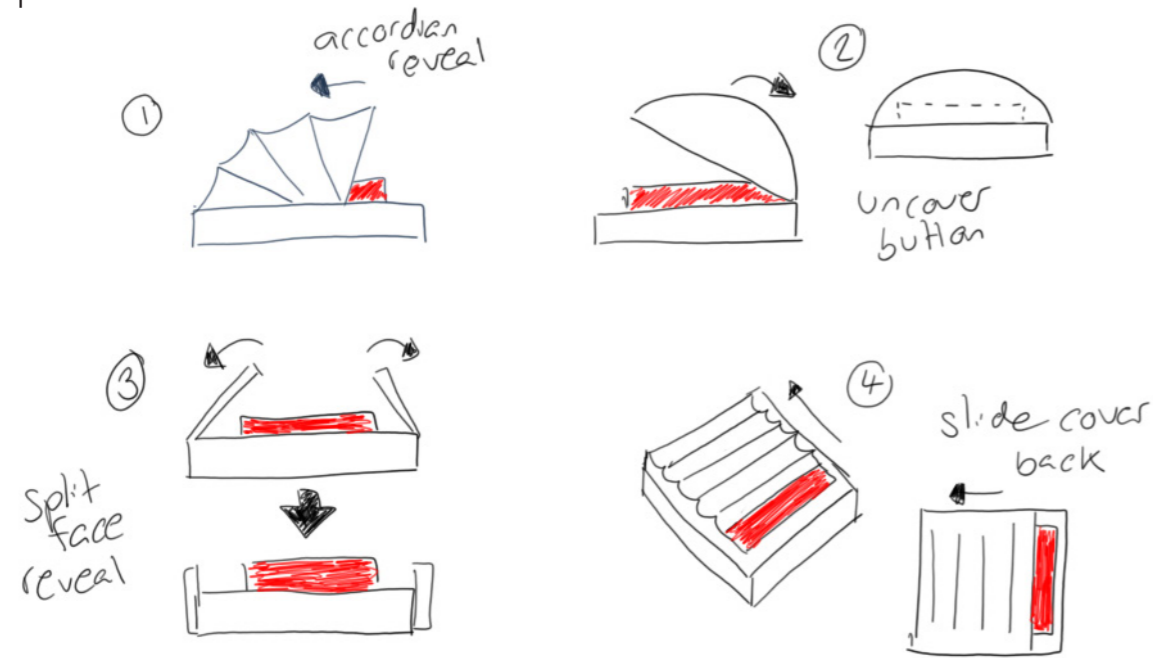


Attacker is scared off and device can be deactivated

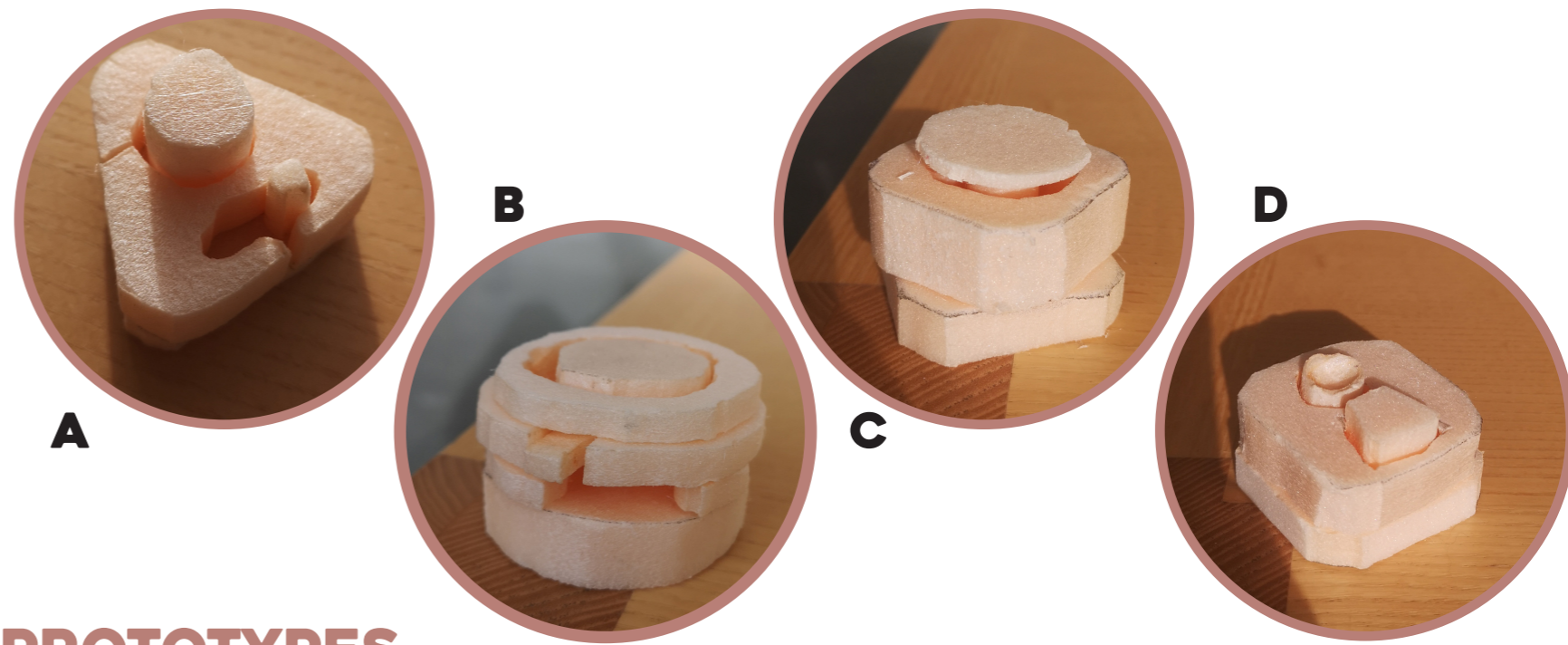
CONCEPT GENERATION



Different mechanisms for creating a two step process between the default mode and active alarm were explored. Each involved an action that the user had to carry out before the device could activate the alarm as 'accidental activation' was the key problem that my user group found with existing products.



The above sketches were a range of methods which covered the button and whilst interesting ideas they were dismissed as the user would struggle to carry these out underneath their jacket sleeve or whilst wearing gloves in winter, without looking at the device and hence becoming distracted to their surroundings.



PROTOTYPES

An initial prototype was made of each of the concepts to grasp immediate feedback from my focus group and evaluate how well they work as a mechanism. They were evaluated against the chosen criteria as shown below

CONCEPT	A	B	C	D
PREVENTION OF ACCIDENTAL ACTIVATION	2/5	2/5	5/5	4/5
ABILITY TO ACTIVATE WITHOUT LOOKING	5/5	4/5	4/5	5/5
UNDERSTANDABLE	5/5	3/5	4/5	5/5
FUNCTIONALITY	4/5	3/5	4/5	4/5
AESTHETIC	4/5	3/5	5/5	4/5
LONG LASTING	3/5	2/5	4/5	4/5
RATING	23/30	17/30	26/30	26/30

As the evaluation table shows, concepts C & D proved to be the most suitable against my chosen criteria and these were taken forward into development. However after several weeks of further research I began developing a system which incorporated elements of concept C and B.

DEVELOPMENT

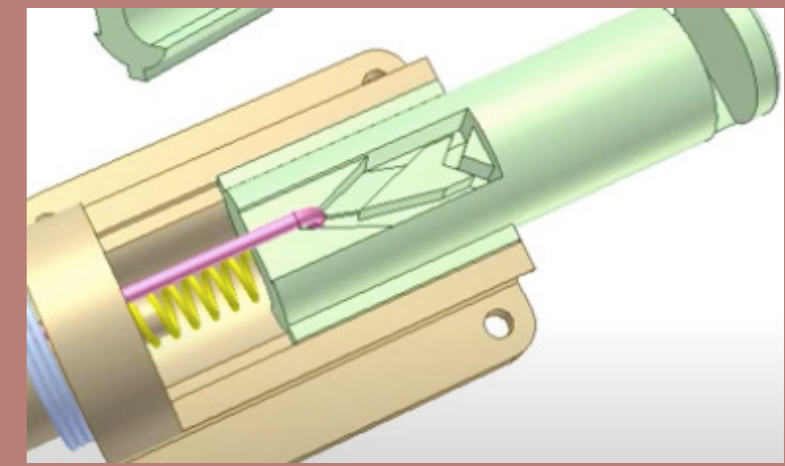
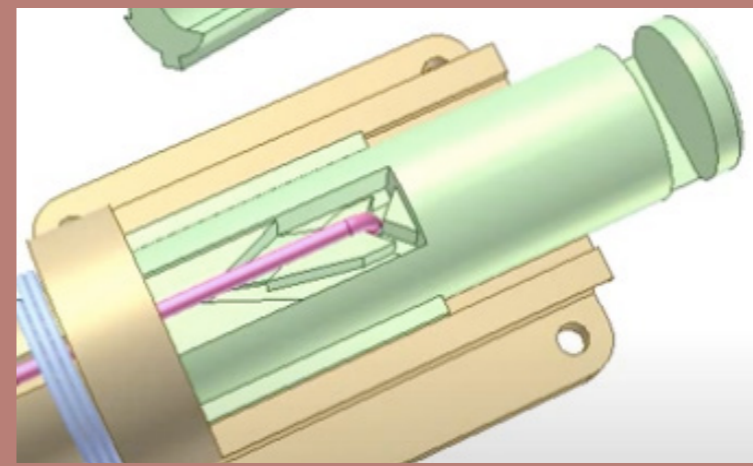
1 - ACTIVATE GPS

2 - TWIST UPPER FACE

3 - HIT EXTRUDED BUTTON



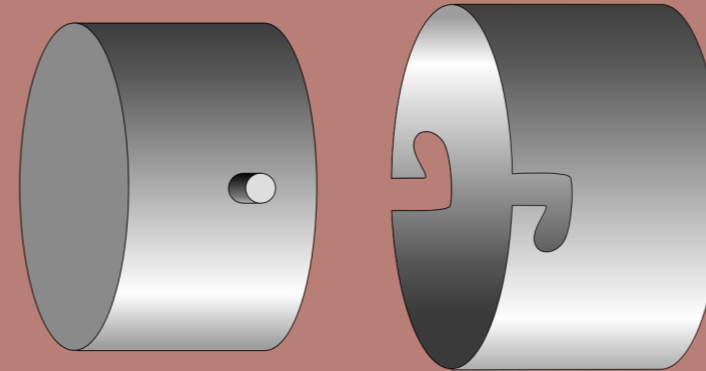
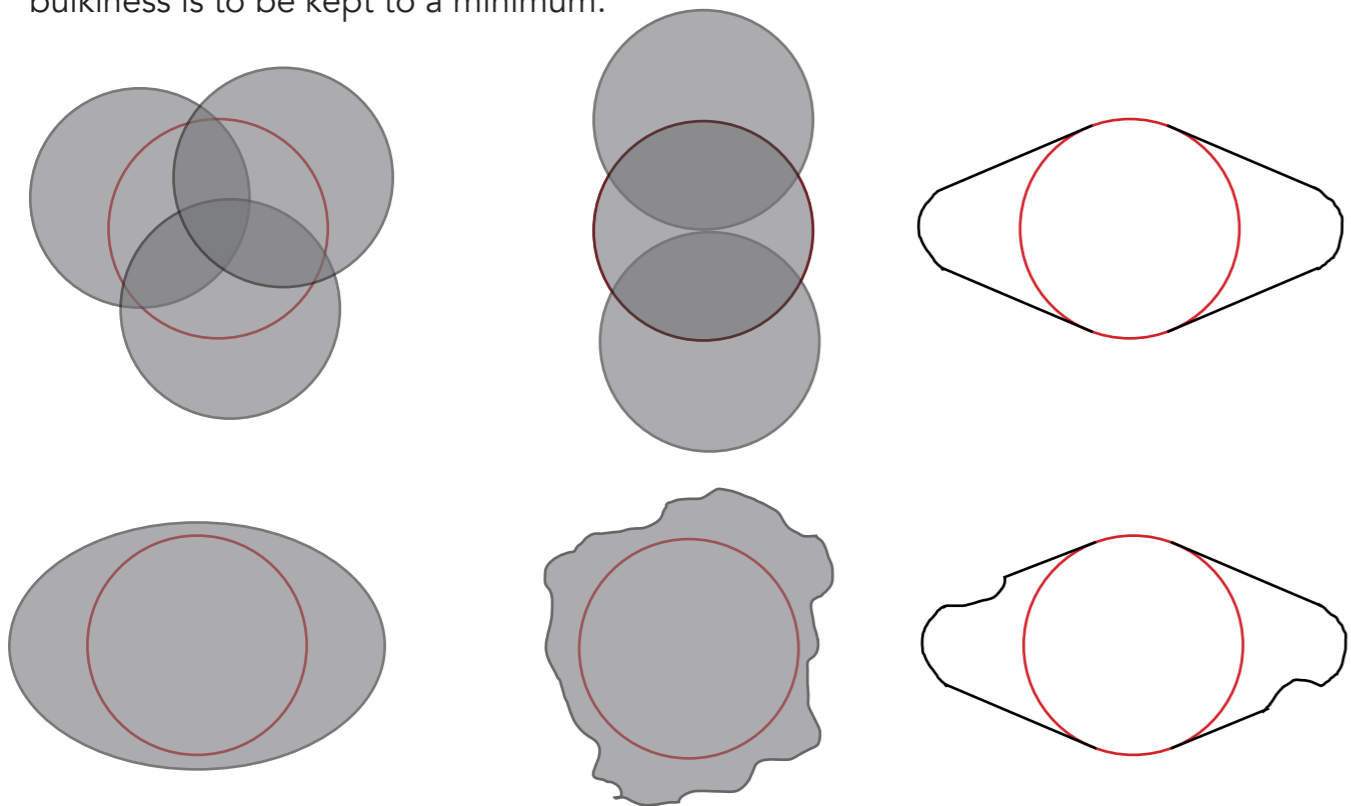
This concept followed the user twisting the upper face of the device to extrude out the inner button which automatically moves the device into prime activation stage. It was decided that I was overcomplicating the design so other formats were considered.



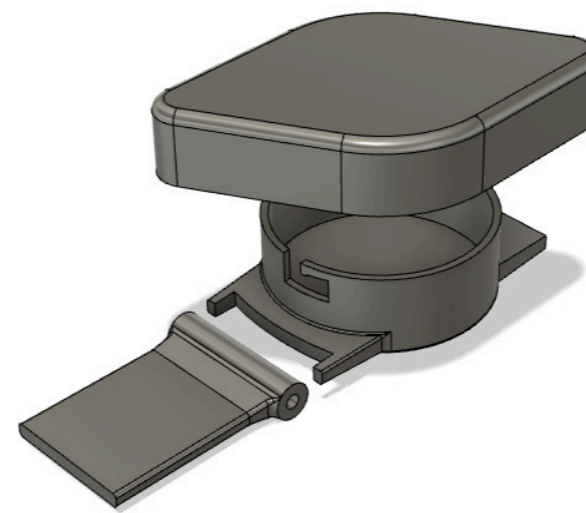
This concept involved a 'push-push' mechanism which would extrude the button out of the face of the device after a downwards push to the face. Whilst in theory this is a nice mechanism, the depth of my device would allow very limited movement in the button meaning that the force required to push the spring into a compressed state would be very minimal meaning it would likely accidentally extrude with accidental force so was written off as unsuitable.

FORM

It was calculated that all the electrical components would be able to fit within a circle of 24mm diameter (represented by the red circle). The design of the top must therefore be larger than this to allow the user to grip and twist the device and make it clear when it was in its activated state compared to its default. As this is to be worn on the users wrist, aesthetics also play a part in how well the device will be received by the target user so bulkiness is to be kept to a minimum.



The design was simplified to include a bayonet twist of the entire top face of the device which would make it easier for the user to push down and twist when resetting the device.



By incorporating the screen into the design this removed the restraint on the design and instead would allow the user to leave the house always wearing it especially in my targeted activities as it is disguised as a watch. With close communication with my focus group the design became the following:



The above design was taken forward after feedback from my focus group however there were still concerns over the bulk of the design when the user would also be wearing a watch on the other wrist. This led to an LCD screen being incorporated into the face of the device which would display the time.

PRODUCT OVERVIEW

DEFAULT MODE

DIGITAL WATCH FACE
- User can customise it using the app

GPS BUTTON
- Turns GPS location on/off

STANDARD 18MM STRAPS
- User can switch out the straps with different colours/materials to suit their activities



ACTIVATION MODE

RESET BUTTON
- User holds this as they push down and return the face to its default position to prevent the alarm going off whilst turning to reset

GRIPS
- Extruded grips allow the user to twist the face whilst wearing gloves in winter



FACE TWIST
- The user twists the face 50 degrees clockwise to move the device into Prime Activation Mode

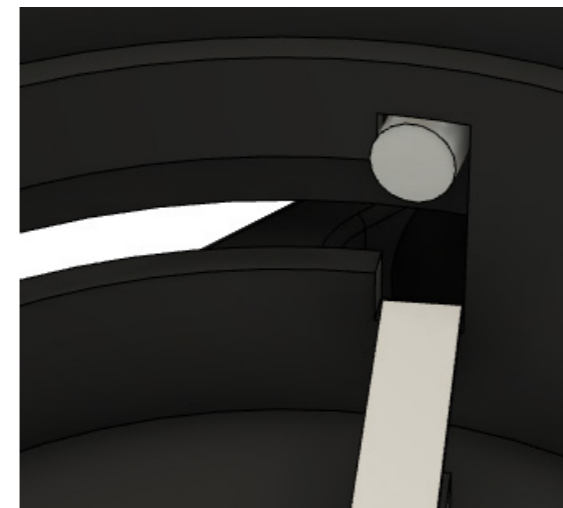
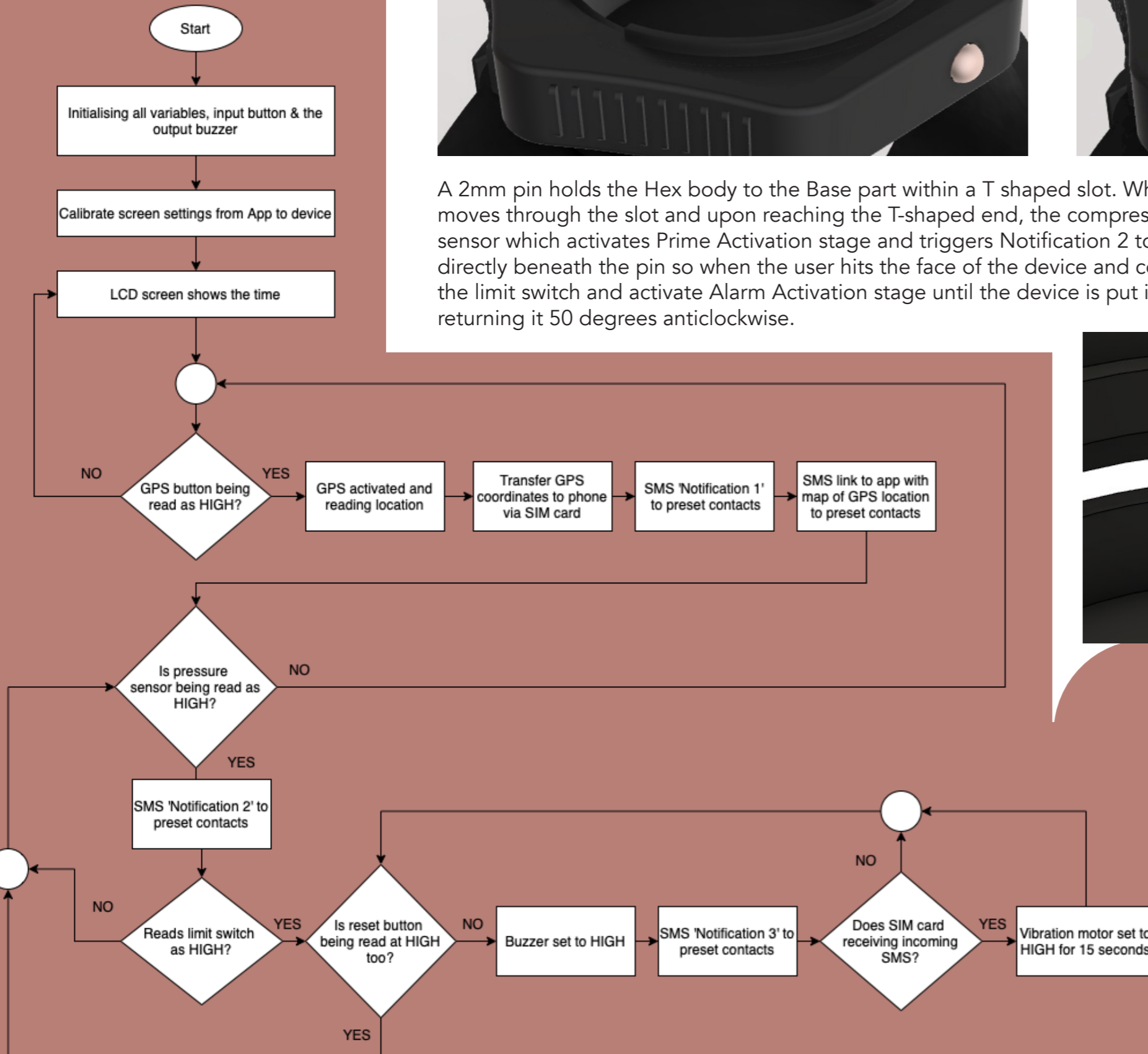
MECHANISM



This slot took many iterations to ensure that the user would not hit the limit switch whilst twisting and how to disable the alarm when they wished to return it to default position without activating it first.

A 2mm pin holds the Hex body to the Base part within a T shaped slot. When the hex body is twisted 50 degrees clockwise the pin moves through the slot and upon reaching the T-shaped end, the compressed spring pushes it up to the top. This hits a pressure sensor which activates Prime Activation stage and triggers Notification 2 to be sent. A limit switch sits at the bottom of the T directly beneath the pin so when the user hits the face of the device and compresses the spring by 3mm the pin will connect with the limit switch and activate Alarm Activation stage until the device is put into reset by holding down the reset button and returning it 50 degrees anticlockwise.

PROGRAMMING



By indenting the limit switch the spring would ensure the pin is always pressed to the top of the slot and avoid triggering the switch too early.

The user can edit each notification in the app to their own wording. The following are examples for each of the Notifications:

Notification 1 - I've just left and am on my way home now :)

Notification 2 - I am feeling a bit uneasy so I am just being cautious and putting my device into Prime Activation Mode

Notification 3 - HELP! A situation is occurring and I need

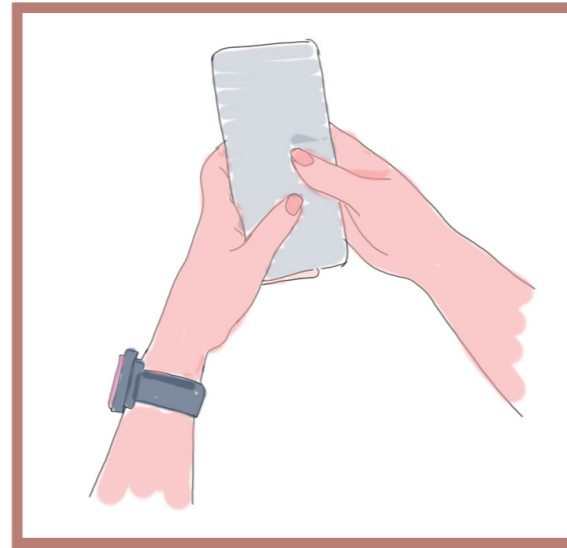
USER INTERACTION

1.



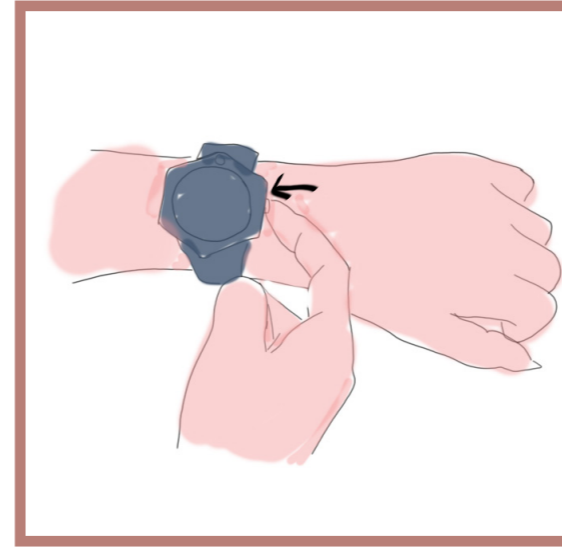
User removes CINGO device from the wireless charging dish and wraps it on their wrist

2.



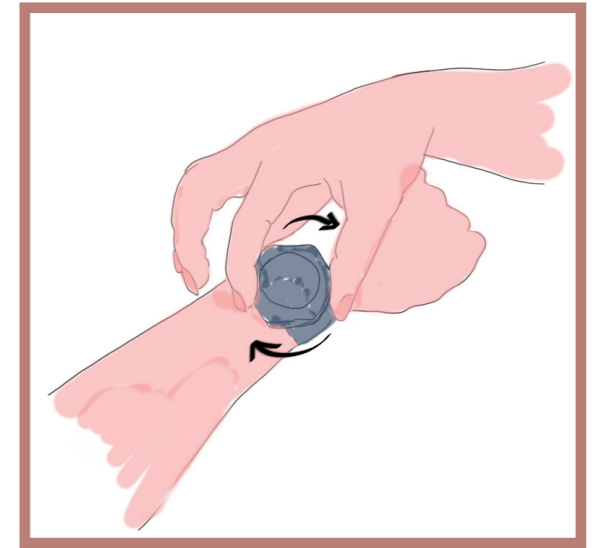
User uses the app to set their alarm to audible or silent and edit the notifications

3.



User presses the GPS button to turn the GPS location ON

4.

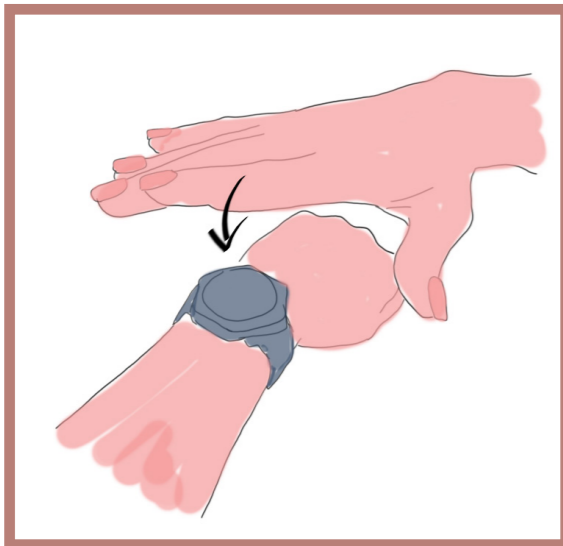


User twists the Hex body clockwise by 50 degrees which expands the face into Prime Alarm mode.

USER GETS ATTACKED

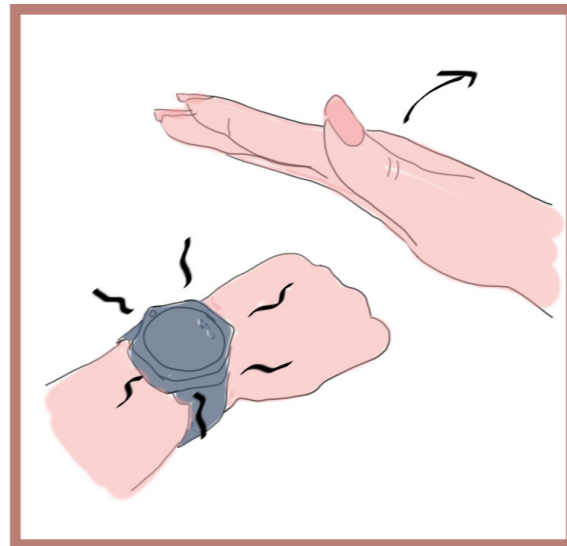
USER REACHES DESTINATION SAFELY

5A.



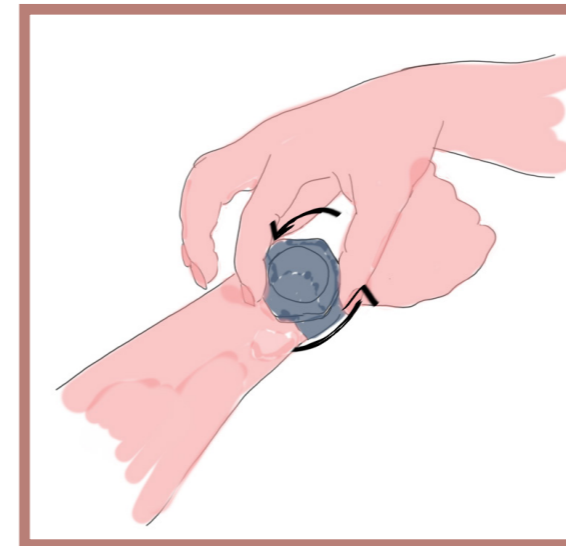
User hits the face to activate the alarm

6A.



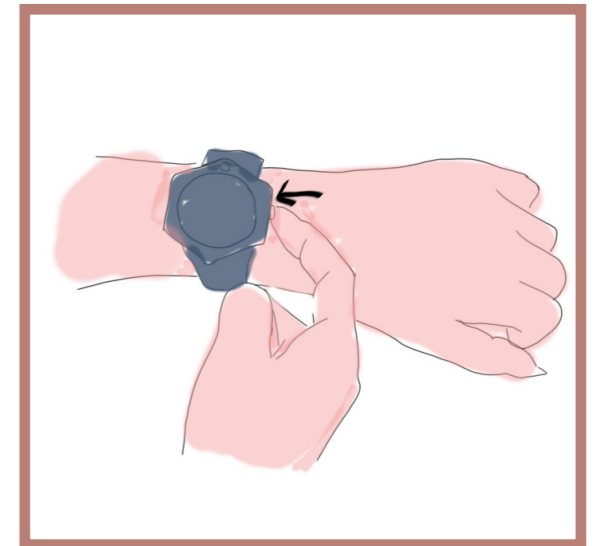
The alarm starts going off giving the user a chance to run

5B.
7A.



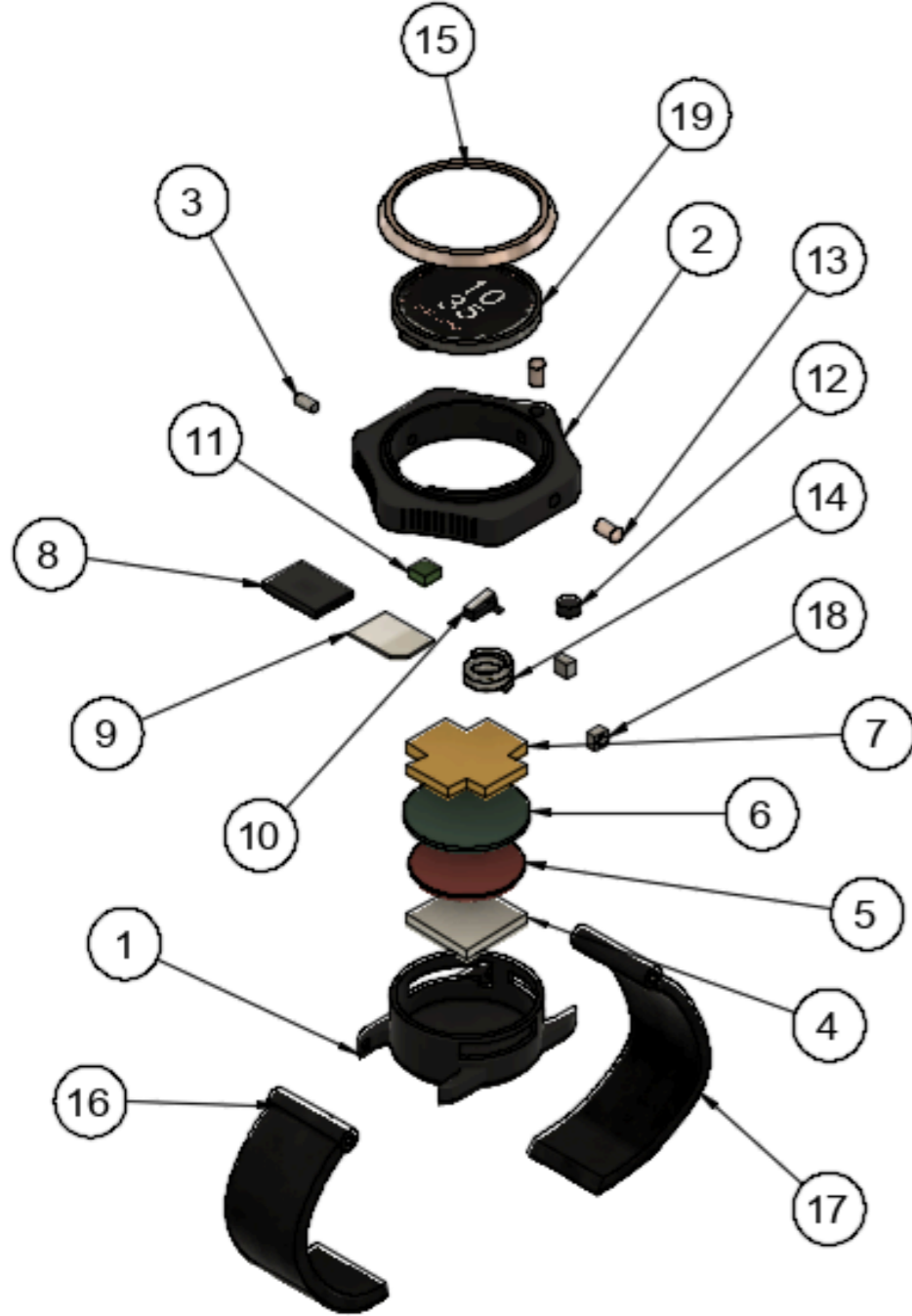
User holds down the reset button on the front face whilst twisting the face 50 degrees anticlockwise

6B.
8A.



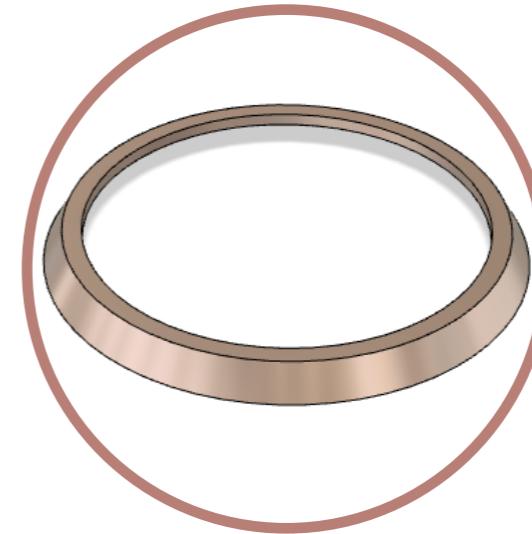
User presses the GPS button for a second time to turn the GPS location OFF

CINGO DEVICE ASSEMBLY



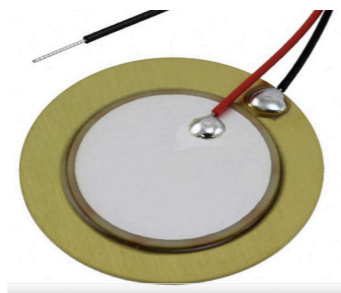
Parts List			
Item	Qty	Part Number	Material
1	1	Base Body	ABS Plastic
2	1	Hex Body	ABS Plastic
3	1	Pin	Steel
4	1	Lipo Battery	Discrete Component
5	1	Piezoelectric buzzer	Copper
6	1	Wireless charging coil	Steel
7	1	PCB	FR4
8	1	Sim slot	Discrete Component
9	1	Sim card	FR4
10	1	Limit switch	Discrete Component
11	1	Nano Spider GPS	Discrete Component
12	1	Vibration motor	Discrete Component
13	2	Button	Silicon Nitride
14	1	Spring	Steel
15	1	Screen rim	Aluminum
16	1	Long strap	Rubber
17	1	Short strap	Rubber
18	2	Push button	Discrete Component
19	1	LCD screen	Glass

The majority of the components are pre-made source-able elements which can then be assembled with the body parts. The only fabricated parts are the Hex Body, Base body and Screen Rim. Both the Hex and Base bodies are to be 3D printed out of ABS plastic as injection moulding was not suitable due to the nature of the slots in the bodies. The Screen rim is made from Stainless steel and will be fabricated through a process of die casting.



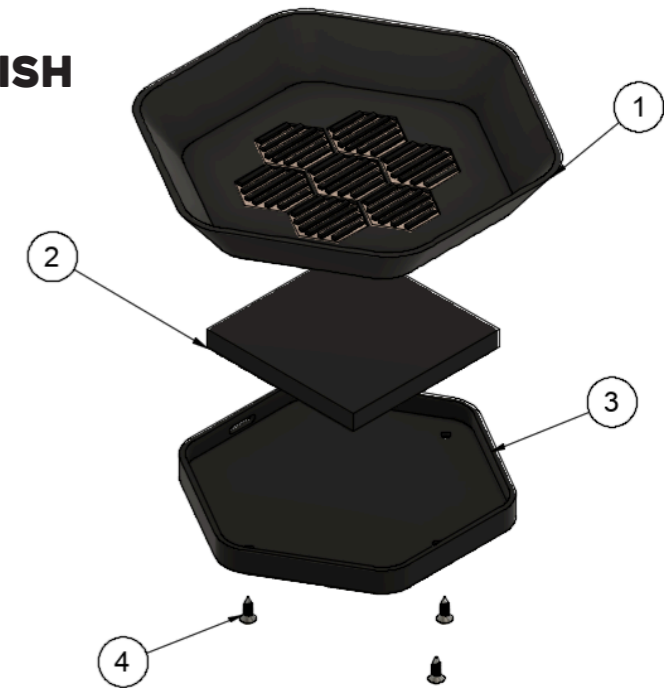
Other key components of the design are the GPS which is a ORG4400 Nano Spider Chipset which has an update rate of 5Hz, a -163dBm sensitivity and measures just 4.1x4.1x2.1mm in size.

A piezoelectric buzzer measuring 20mm in diameter was selected as the sound element. This buzzer is used to create the panic alarm by running a voltage across it which distorts the shape to create sound.

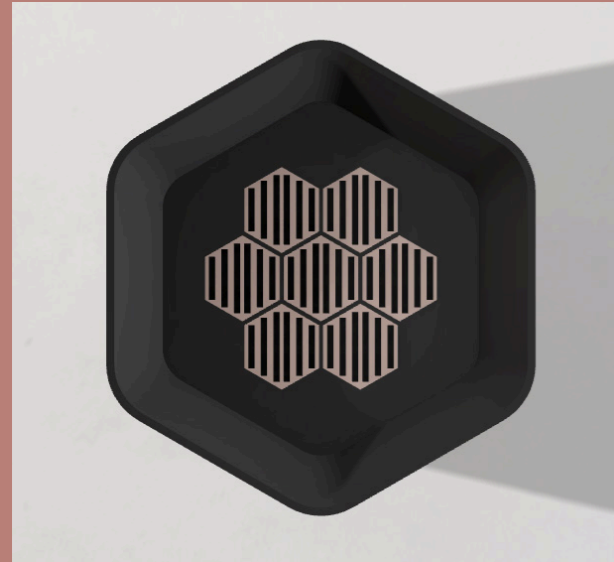


WIRELESS CHARGING DISH ASSEMBLY

Parts List			
Item	Qty	Part Number	Material
1	1	Charging Dish	ABS Plastic
2	1	Wireless charging transmitter	Discrete Component
3	1	Charging Dish base	ABS Plastic
4	3	95844A610_18-8 Stainless Steel Phillips Flat Head Screws for Metal	Steel



DESIGN DETAILS



CHARGING

Due to the limited space within the device it was decided that the battery would be charged wirelessly. As such a charging dish was designed that would allow the user to keep the device on their dressing table alongside their other accessories.

With silicon grips on the bottom to prevent the screen scratching, the user can leave it charging overnight and easily grab it when needed.

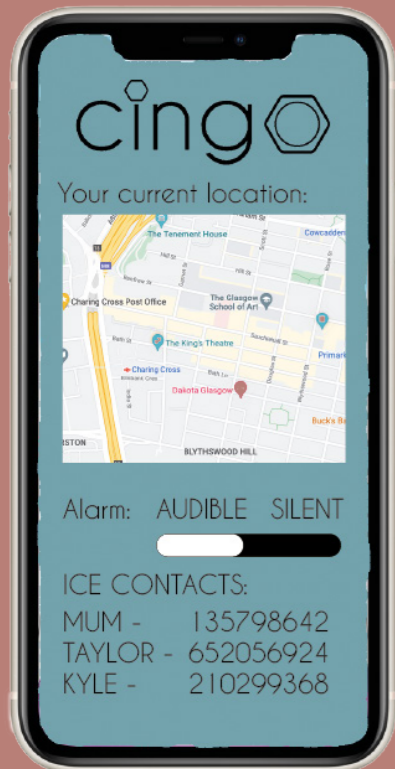
CUSTOMISABILITY

The Hex and Base bodies are available in two colours, white and black. The base is designed to fit standard 18mm watch straps which allows the user to swap the straps out depending on activity, occasion or style.



USER INTERFACE

Cingo is paired with an app which the user uses to set the device to their preferences. These preferences are settings such as whether the alarm is audible or silent, who is contacted by the notifications and by the emergency alert, and what each notification says. By allowing for this customisability the user is in full control of how they use the device whether it is just for comfort or for worried family members.



HUMAN FACTORS

On 4 of the 6 faces are small extruded grips positioned on either side of the centerline. This helps provide grip to the users fingers during twisting especially for winter months when they might be wearing gloves.

