HUSH

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EXECUTIVE SUMMARY

A product design opportunity was discovered after the horrible accident of the cricketing legend Andrew Symonds in Australia this May. The accident resulted in the death of Andrew Symonds. The reasons for his accident are not clear yet, other than the fact that the driver lost control of his vehicle with no apparent reason. There are so many causes of an accident. This led me to think: “How can the implementation of a product help increase the safety of the drivers and other passengers, without making the driver’s life more complicated?”

After carrying out more research into the causes of accidents, a conclusion was reached that Distractions while driving are the most common cause of accidents. With further research into distractions, I could find out that distractions could broadly be classified into 4 categories: Auditory, Visual, Cognitive and Bio-mechanical. As a next step, I got into touch with drivers from all around the world, to understand their problems, distractions they faced while driving, and how would they want these problems or distractions to be solved. From the feedback from the drivers, it was seen that there is an apparent connection between all the types of distractions, one can lead to another, thus taking accidents on the verge of high risk of fatality. The biggest cause of distractions was Cognitive and Visual distractions.

All this research lead to the refinement of the design opportunity: “Can the Visual and Cognitive distractions be avoided completely or reduced, in order to increase the safety of the drivers, other passengers and people traveling on the road without making the process to drive more complicated for the drivers?”

The next step after identifying the design opportunity, was to think about User Scenarios, generating User Personas, and to understand currently available products/solutions in the market. After having the user requirements and key insights, the next move was to create and design some ideas by quick ideation, mind maps, and futuristic fiction works. The feedback at this stage from the tutors, mentors, guides and classmates helped refined the decision-making process for the final product. The different backgrounds of everyone helped get different insights on the ideas.

With all the inputs from the ecosystem, finally decided that the product would be display device - improving on the current HUD technology and thus helping reduce visual and filter out cognitive distractions. After working on multiple mock-ups for various shape and design ideas, which were also tested in real life scenario to better understand the required dimensions, placement, retrofitting, and what shape suits the best. A final model and video prototype for the project was made to get a better grasp of its functioning and mechanism in context with the actual environment where it is to be used.

Towards the end, once again reached out to the classmates and drivers, took their feedback, which resulted in a sudden decision change, which was made between a transparent screen setup and a back-lit one. A back-lit display makes use of an OLED display making everything crispier and works with the help of cameras and sensors - LiDAR and IR sensors to help improve driver safety further by introducing death of field, distance sensor, and night vision. Since retrofitting the product was also a target, a button had to be introduced to help control the display, that would be connected with the mobile phones via Bluetooth technology.

Finally, the hinges were selected after the selection of the material, as the hinges need to be sturdy and be able to withhold the whole structure. The torque friction hinges were selected for this as they allowed the user to adjust the visor to their desire and better viewing angle. Feedback was also taken from the drivers for the final model and to also understand what all information is important to them and which information would they actually like to see as a requirement on the new HUD - called HUSH visor.

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Defining the problem

MOTIVATION

In May 2022, the world of cricketing lost one of the legends in car accident in Australia. Andrew Symonds was the sole person riding the vehicle and was involved in a single-vehicle accident. The actual reason why he lost control of his vehicle is still unknown, as the car left the roadway and rolled. There are multiple reasons for an accident, but in a single-vehicle accident, distractions are the main cause. People tried to revive him immediately after the accident, but he was unresponsive and died on the spot due to injuries. [1]

As per the National Highway Traffic Safety Administration (NHTSA), an estimated 3,142 people were killed, and an additional 424,000 people were injured in 2019, in car accidents that involved drivers who were distracted.[2]

“Driving a car is one of the riskiest activities any of us undertake despite decades of vehicle design improvements and traffic safety advancements”. This quote by the president of the National Safety Council and CEO Deborah Hersman represents the wholesome situation of how dangerous driving is, and we have not even taken account of distractions yet.

This made me realise that even with all the advancements in the automotive industry in the field of safety, there is still room for further improvements, as with the introduction of all the new technologies in the vehicle, it can and are causing more distractions.

BACKGROUND

As per the National Highway Traffic Safety Administration (NHTSA), 9 per cent of fatal crashes, 15 per cent of injury crashes, and 15 per cent of all police-reported motor vehicle traffic crashes in 2019 were reported as distraction-affected crashes.[2]

It is often the biggest misconception that ‘nothing will happen in a split second, I can text and drive, it is a familiar route’.

“In a split second, you could ruin your future, injure or kill others, and tear a hole in the heart of everyone who loves you.” – says Sharon Heit, a mother of texting while driving victim.

Distractions affect everyone regardless of age or occupation. Driving has the worst place on a risk matrix due to vehicle collisions’ frequency and potential severity. Adding distraction to this mix makes driving the riskiest thing one does daily.

USER

The users are drivers aged 18 to approximately 75 years old. This is the average age range when people get their license and start driving and probably stop driving for majority of their time. These drivers can be men or women. According to NHTSA, people aged 15 to 25 years old form the most significant proportion of distracted drivers at the time of fatal accidents, thus making this group of prime focus. In driving everyone is equally at risk, no matter the job, wealth, or experience.[2]

PROBLEM

Initially the focus was to design a product that could help reduce cognitive distractions while driving the vehicle. Cognitive distractions are one of the most difficult to detect and confirm since it is related to conscious intellectual activity of the driver. With the help of some conversations with a few drivers, and tutors, changes were made to the project brief.

The biggest challenge brought into focus was that the drivers would require some incentive to wear devices like EEG or Goggles. These devices would make driving a more complicated activity.

There are a lot of visual distractions inside and outside of the vehicle. Outside distractions can be caused by people, hoardings and traffic signs. With the rise in technology there is an increase of distractions inside the vehicle, they can be caused by Infotainment Center, Navigation, other Passengers, Changing settings, and the biggest distraction of all - Mobile Phones.

Smarter the car, Trickier it is to drive with focus.

Designing a product for this problem, with a focus on how we could help reduce the distractions to the driver sitting behind the wheel. If distraction can be reduced even a bit, it can potentially save a lot of lives in the near future.

DESIGNING OPPORTUNITY

The opportunity here is to design a product that can collate all the information that are deemed necessary, and to display this information in the line-of-sight of the driver. This will not only encourage the driver to keep his focus on the road, but also avoid looking in multiple directions to look for information.

The product should be easy to use and understand. It should not cause any new distractions.

Refining the problem

Problem Scenario.

1

Driving a normal - not modified car.

2

Types of distractions: (A) Looking at HUD and (B) Speedometers.

3

(C) Infotainment Screen - Notifications and Alerts, (D) Temperature/ Climate Control

4

(E) Distractions outside the vehicle - Person or Thing, (F) Mobile Phones, and (G) Changing the vehicle settings

5

They may lead to fatal accidents. One of the biggest cause.

Environment of use

All drivers are prone to face distractions at some point of the driving journey. Visual distractions can be inside and outside the car/vehicle. The best approach to solve visual distractions would be from inside the vehicle, because you can then target both inside and outside distractions. The environment where this product can be used is inside the car, in-front of the driver and in his line of sight.

Focus/Attention should be on the Road up-ahead, the positioning of the product should be in a way that it does not cause any new distraction, and this product should do the job it was made for - Accident prevention by reducing distractions.

Key insights:

Increase Safety

Improve Visibility

Easy Usability

Ease of Access

Low Cost

User and specification

Persona

Mark Jason (21)

Mark is not exactly new to driving, but is still quite young. He was born and raised in Scotland. He prefers to travel to work and to his school via his own car. Mark is also passionate about driving and loves to take his car on long drives and journeys.

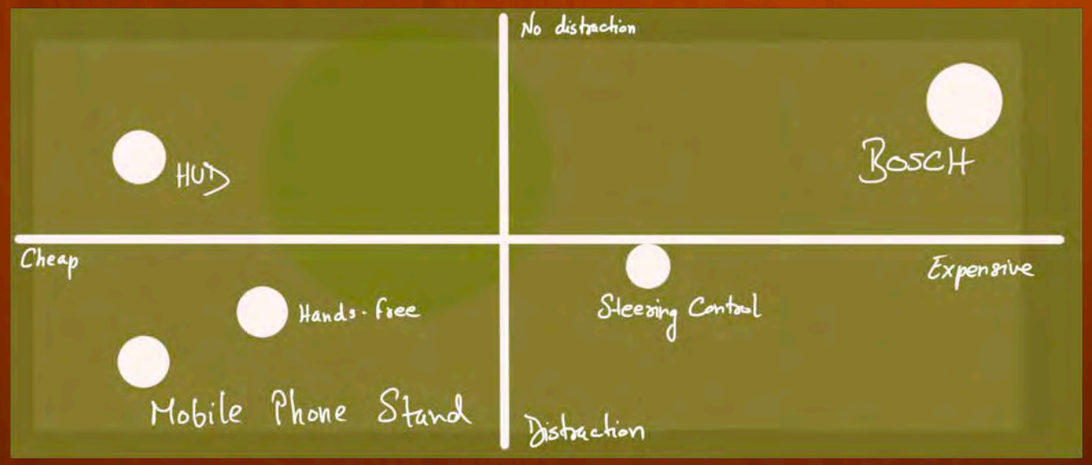
Mark has been involved in close shaves to accident when he was using his mobile phone while driving. Mark loves to listen to music, but likes to play them randomly as per his mood and therefore keeps changing them from the infotainment centre.

Key user requirements:
Easy Access, Can be used by anyone, Easy to understand the feedback, Improving confidence, Reducing Distractions, Should not cause any new distraction, No high cognitive effort, Increasing focus, Manage alerts and notifications, increasing safety and is effective.

Current ways to reduce distractions

Market research
Market research was done in order to look for opportunities in existing products, and to get some ideas about how the problem is being dealt with currently. Current existing products can found in MURAL. Head-Up Displays and stands for Mobile Phones are some of the examples of existing products.

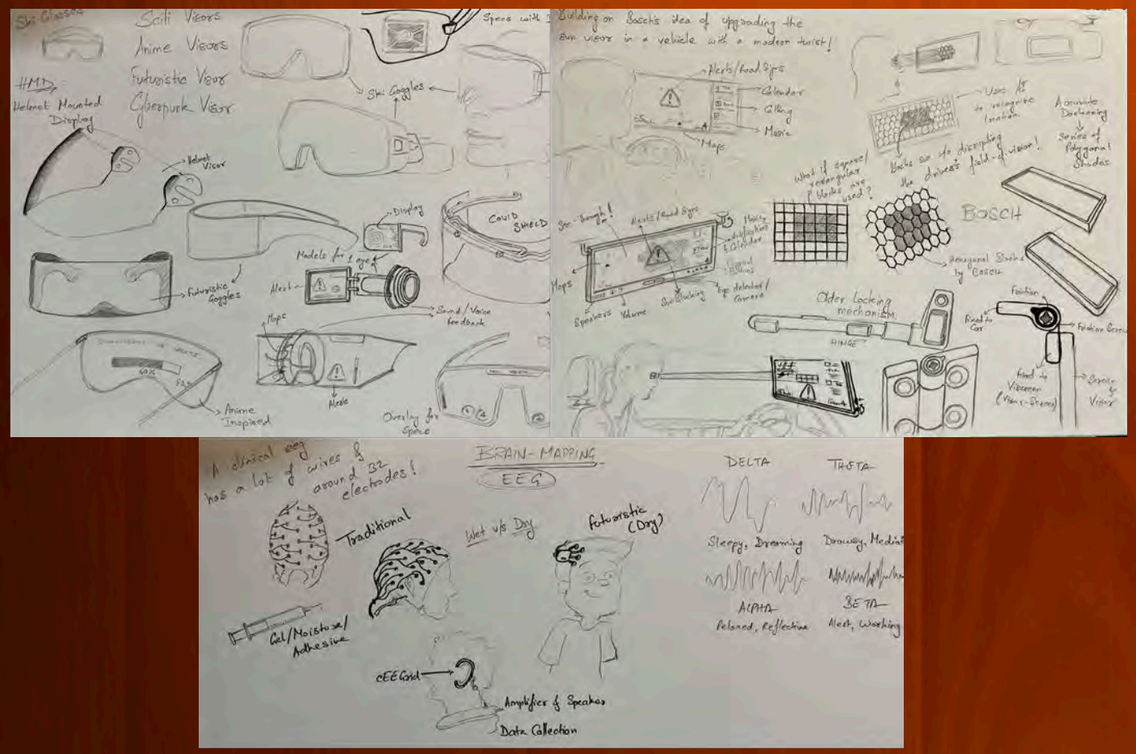
They also have been ordered on the basis of their own distraction compared to their prices. All of these have a tendency to cause further new distractions, like the HUD tends to attract drivers attention for which the driver has to look down on the dashboard where HUD sits and take their eyes away form road up-ahead The Hands-free technology might seem to be getting rid of visual distractions but causes cognitive load on the driver, thus leading to Cognitive Distractions.



Concept evaluation

Concept Generation

By using several techniques used for brainstorming like quick ideation and mind-mapping, several ideas were generated and can be found in detail as part of my Design Journal.



Feedback:

I really like the concept of using the EEG technology in a portable way inside the car and its use to understand and read the human brain and reactions to see the cognitive ability of the brain.

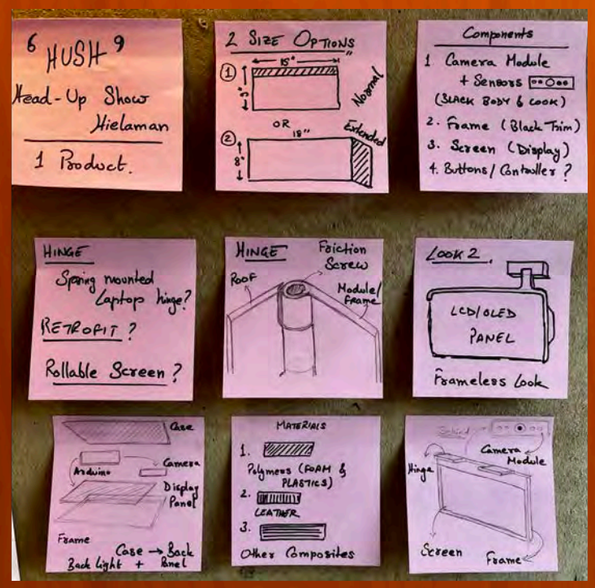
Feedback:

The transparent modern HUD has potential. The idea is really good that it is inbuilt in the car, and provides all the required information in the line of sight of the driver. Are you sure this won't cause any new distraction?

Concept Evaluation

The ideas were shown during the numerous tutorials and discussed with tutors, along with taking in a general feedback from the people - who form the user group.

Out of the various ideations developed, the screen or display visor, that would replace the current sun visors in the car, was the most exciting concept and received many positive reviews. This would be installed inside the car, thus getting an edge over other concepts which were wearable devices that required an incentive to be worn by the driver whenever he wants to drive his/her car.



These concepts were also shown to the PDE classmates in order to get their point of views which was more focussed on design and technical approaches to the solving the distractions. They asked questions on the technology and what form the designed product would have along with features, and safety. They helped choose the most interesting concept.

The concepts have been chosen with user requirements and some of the early key insights in mind as well:

- Reducing distractions.
- Should not cause any new distraction.
- No high cognitive effort.
- Increased focus.
- Increasing safety.
- Is effective.
- Manages alerts and notifications.
- Easy Access
- Easy to understand Feedback

The important feedback that I got from my tutors and fellow classmates:

a) Technologies like smart glasses and EEG require contact with skin or to be worn on the body. This will on complicate a simple process like driving. The question they asked, "Why should I wear it before driving?" and "What about short trips?"

b) Look into minimising the frame width and size, if possible look to go for 'frame-less', 'transparent' displays. This will help merge the display with the rest of the windscreen without causing any obstruction in the driver's line-of-sight.

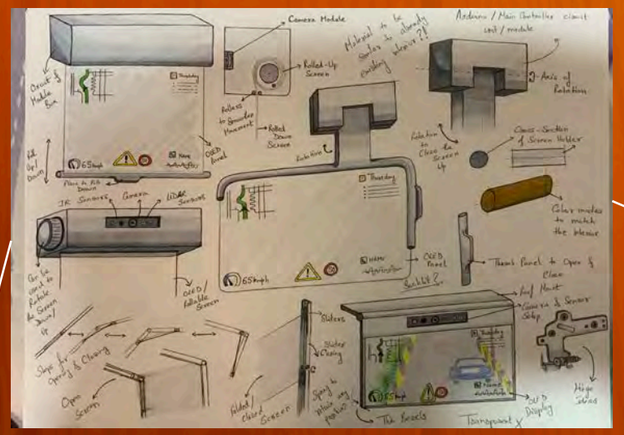
c) **This was probably one of the most important feedbacks of all: "What happens at night time, especially when there is car coming head-on (opposite direction) with its headlights (maybe even high-beam) turned on?"**

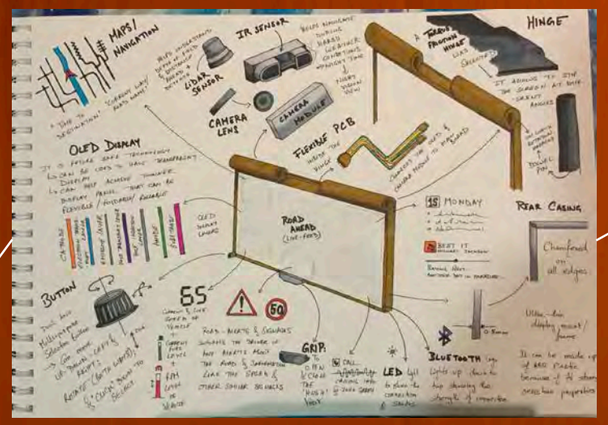
Prototyping

Testing different forms and shapes to understand the sizing.

Testing best positions inside the car.

Testing the final concept and changing the concept from Transparent display to Backlit OLED panel.

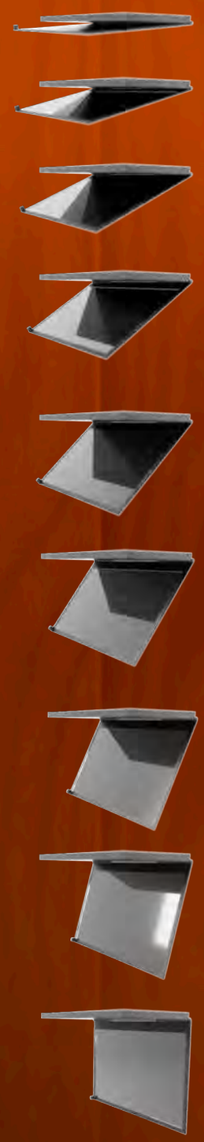




Concept Decision

Finalising Product Shape

Testing the final concrpt using CAD



CAD renders and models showing the products from different angles as well as showing the opening and closing on the Hinge.

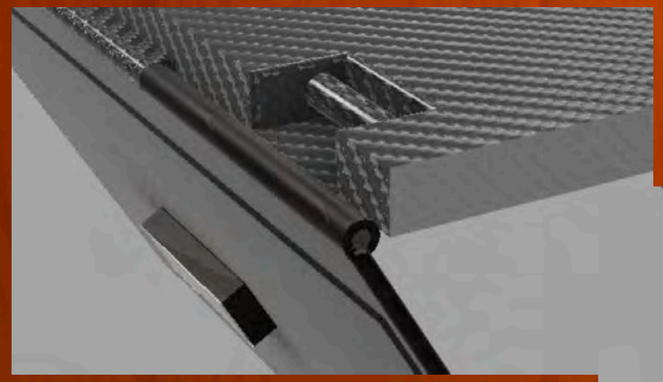
FInal prototype and design

The decision was made to take up the rectangular shape and to keep the frame border - but as thin as possible so as to make the product - HUSH retrofit-table, with the edges being rounded off to provide a smooth feel and operation. The material choice was made according to the material inside the car's interior, so as to make the part fit into the car's environment.

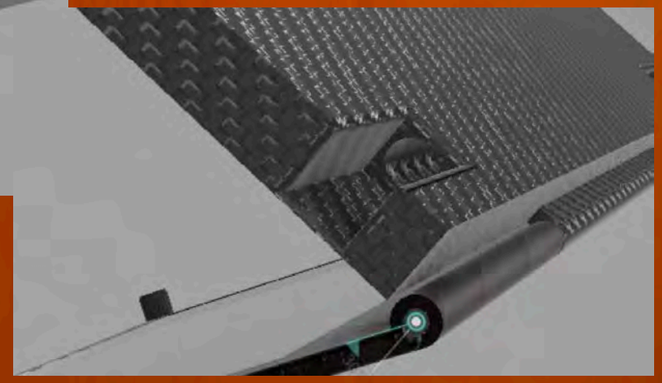
The product before the final prototype - that shared the same dimensions but only had a transparent scree was tested by the user in the car's environment, but with out the working technology.

The product fits into the driver's field of vision without obstructing anything else, and also helps improve the visibility.

The button the product was made with respect to anthropometric data and sizes.



Retrofit-table product: Part of the product that can be used to retrofit the product in current models of the passenger vehicles.



Demonstration in context

A person driving the car like any other day.

Adjusting Climate Control

Looking down at Speedometer

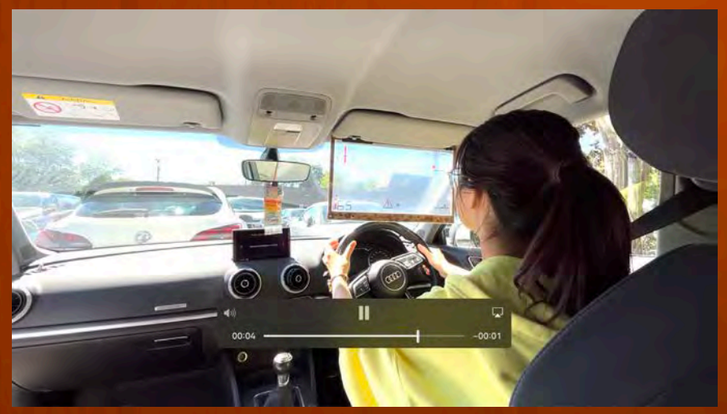
Busy in phone, not looking at a psser-bu

Busy on phone, whole driving

HUD messing up

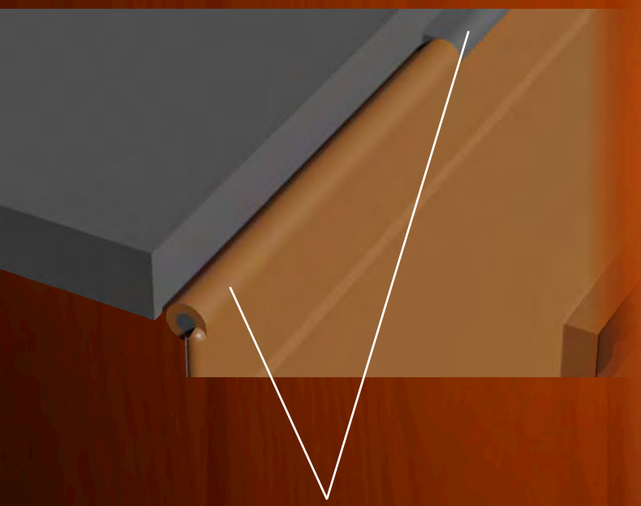
Looking at Infotainment scree

Making use of HUSH get rid of distractions



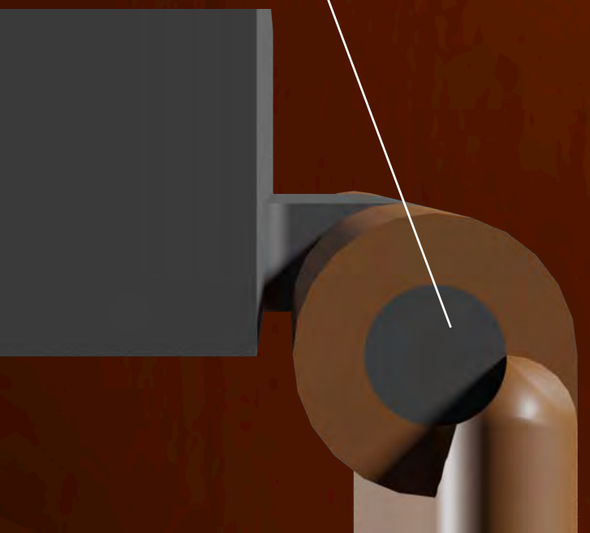
HUSH making life easier for the driver.

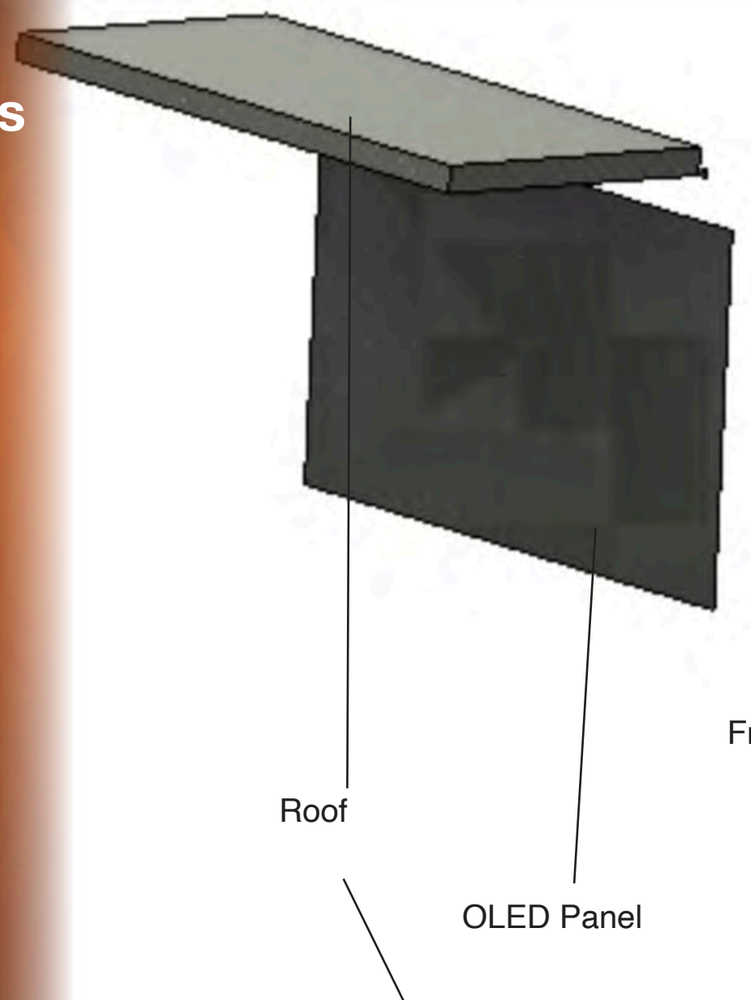
Technical Specifications

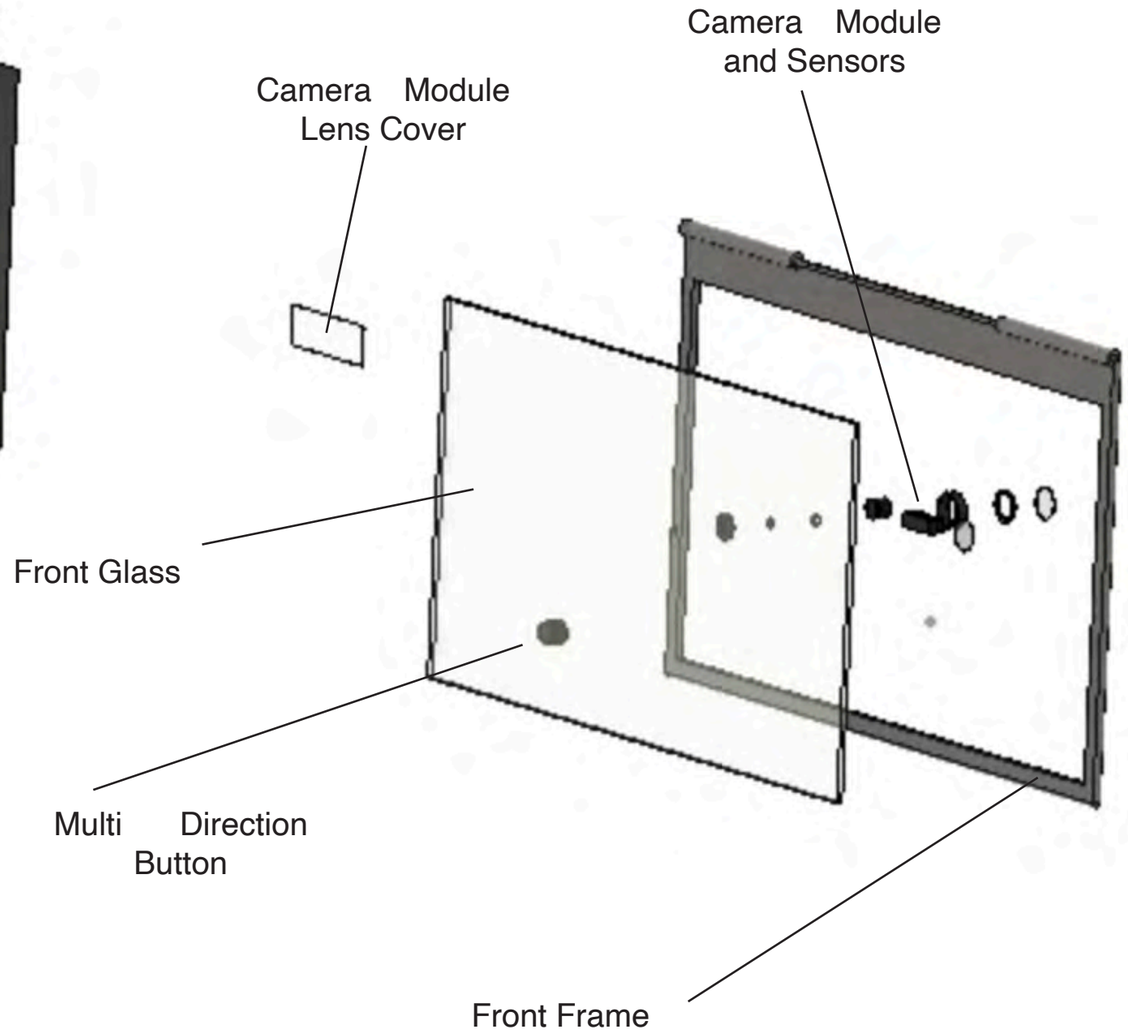


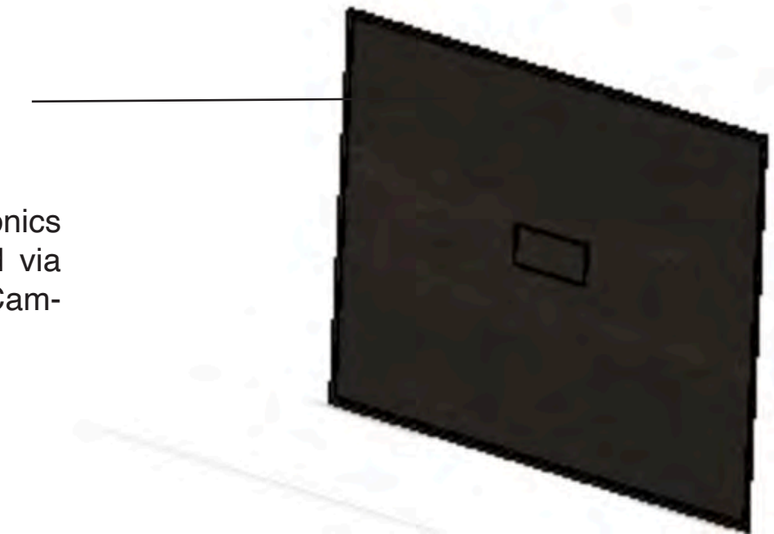
Torque Friction Hinges are used in between the Roof and the main display panel.
The roof holds all the important main boards and is connected via flexible PCB through the Hinge.

These hinges allow for control over the positioning of the display as desired by the user









The roof is where all the electronics will go, which will be connected via Flexible PCB to the Display and Camera modules

Final Product

A RENDERED IMAGE OF ALL THE DIFFERENT MATERIALS USED

HUSH BEING USED INSIDE THE CAR

MULTI DIRECTION BUTTON TO NAVIGATE IN CASE OF RETROFITTING

IR SENSOR

CAMERA MODULE

LiDAR SENSOR

Reflection

I am really very proud of this project and the final product. It took me deep into the designing process and at the same time taught me how to be confident and true to the approach and thinking. This learning would remain with me and ensure that I do follow the same right from the start of any project.

The project also taught me how to interact with my user group and gain feedback from them to better understand and learn more about their requirements and needs. The final delivered product, I believe that it can bring about a change in the automobile industry and bring about a change in the way people drive and help increase safety and reduce distractions while driving.

I feel that my love for cars is what brought me to this project, along with the designer's passion to help people and help solve their problems - that I learned during my time at GSA. I wanted to work on something related to cars and also help solve a problem.

This project also pushed me to my limits and helped me adventure new areas and fields related to being a designer and an engineer.

I would love to take this opportunity to thank Craig Whittet, Stuart Bailey, Jonathan Barnes, and Dr Alessandro Casaburi, for helping me out thought out the projects' journey, giving important feedbacks, and tips to make my project progress further.

Future Work

If this project is to be carried on further, the next step would be to research more in technical aspects of the project and develop a more detailed design for the same. Critical components could be chosen in more real-life detail and not just for the sake of prototyping. An extensive DfMA, force analysis, and electrical analysis for the product could be performed. For future this project can take the shape of the initial idea of a transparent display with more advanced technologies. The future of this project could also lead to in-built screens for driving which would then replace existing windshield.

The continuation of this project would require a team effort, with resources being pooled together to cover all the different logistic aspects of the project like casing, electrical, mechanical, and policy design. A full scale, working model or prototype will be possible to made and it can help understand the working and possibility.

The HUSH product dips carefully into the future of driving experience and how it might feel like to be a part of the future. Taking up the big shape in the distant future, this product could lead to an overhaul of driving experience by introducing a method where you could just tap on the big screen – display setup – and interact with the world outside, thus sitting perfectly well with the future of vehicles – AI driven, smart cars and other vehicles.

This may not change anything, but might just become the push that is needed for change sometimes.

References

[1] The Independent. (2022). Former Australia all-rounder Andrew Symonds dies in Queensland car crash. [online] Available at: https://www.independent.co.uk/sport/cricket/andrew-symonds-dead-car-crash-australia-b2079360.html [Accessed 15 Aug. 2022].

[2] NHTSA 2019 - Distracted Driving, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813111

Please do refer to my Technical report and Mural for referring to other references which have been leveraged during the execution of this project.