Autonomous Car

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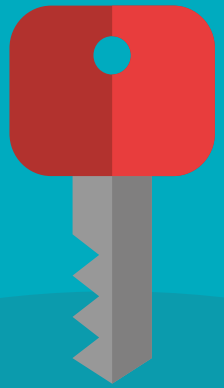
01

About Our Project



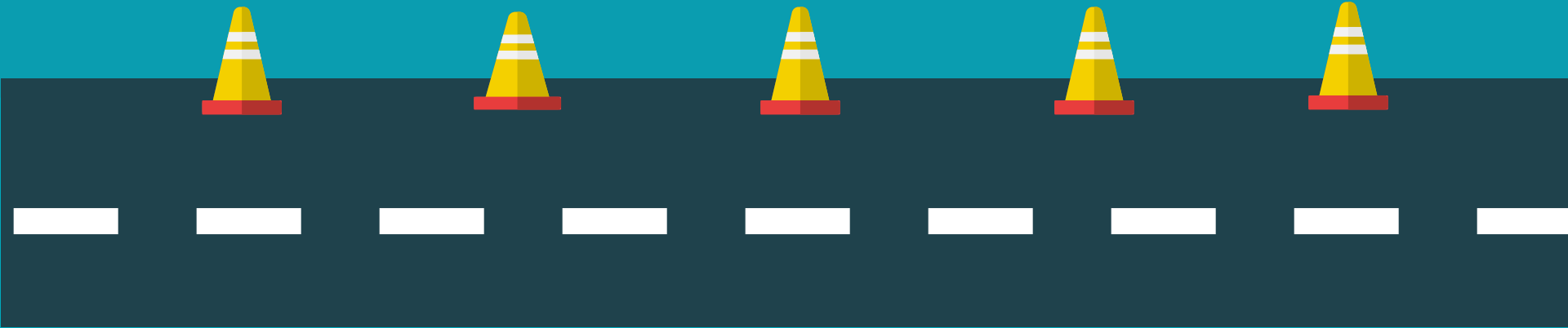
Initial Idea

UX/UI design for digital screens and human interfaces in the interior of self-driving cars.

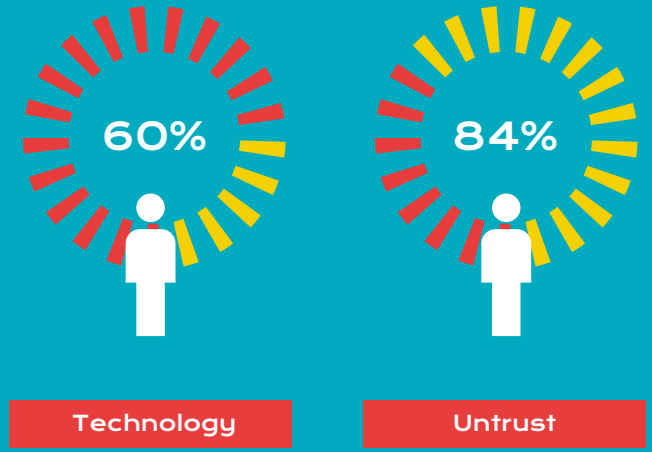
In this project, we want to explore what is an appropriate User Interface for autonomous cars. As the auto-driving system's research and development grow, we can definitely see the car industry's whole evolution in the coming future. However, are users preparing well to welcome the new technology? We hope to design a UI system that can facilitate users to trust autonomous cars.

Background

Level 1	Level 2	Level 3	Level 4	Level 5
Driver Assistant	Partial Automation	Conditional Automation	High Automation	Full Automation



Problem Definition



Among drivers who **DO NOT WANT SEMI-AUTONOMOUS FEATURES** on their next vehicle cite the following reasons:

- 84% trusting their driving skills more than the technology
- 60% feel the technology is too new and unproven
- 57% not wanting to pay extra for it
- 50% do not know enough about the technology
- 45% find it annoying

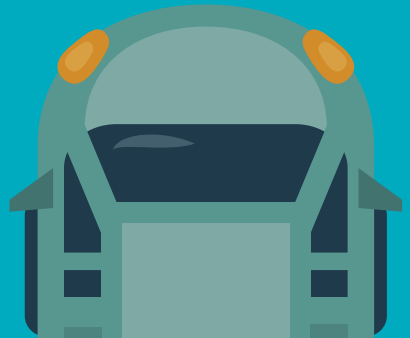
Competitive Analysis

Tesla Model 3

Tesla- Model 3 uses only one display/interactive screen for all its features. The screen display is divided into two sections.

Audi A8

Audi A8 is the first Level 3 autonomous car published to the market. They said when the speed is less than 60 km/hr, drivers don't need to control the steering wheel.

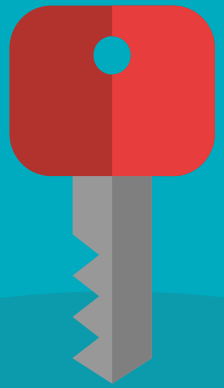


Waymo

Waymo aimed at creating transparency, freedom and consistency. It applies these three principles into its design.

02

User Research



User Interviews

User1

“I basically only use it on the highway. I really do not like it in the town.”
“The braking is too late. It also waits too long to change lanes.”
“To put the road path and speed on the main screen.”

20 years driving

User2

“I hope it could have stop sign detection.”
“The car is helpful for long drive but it not reliable when there is constructions.”
“I prefer one central screen in the car.”

8 years driving

User Interviews

User3

“I can charge it at home. If not, I will try to find a Supercharging station on the road.”
“I need to take control of the car sometimes it cannot work at night since the road is not clear.”

20 years driving

User4

“I am still learning how to drive it.”
“The lane change is very useful, but I rarely use the park assistant. ”
“Sometimes the pedestrians are still blocked by the pillar.”

2 years driving

User Interviews

User5

“The physical buttons are very efficient in the car. (turn signal of the left, multi-purpose buttons on the right)”
“I am still concerned about the safety. 1% mistake can let you die.”
“I expect fully-autonomous driving in the future”

20 years driving

User6

“I hope the screen could show all things the car is viewing. ”
“The audible UI is useful to let you know you are supposed to take the control.”
“I like the massive map for navigation.”

9 years driving

Highlights from Interviews

Situation Awareness

The car requires improvement on situation awareness like sign and obstacle detection.

Human Control

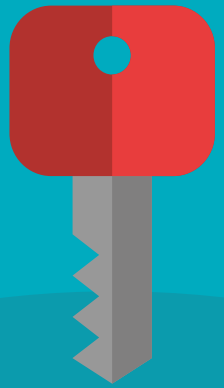
When the car makes mistakes, user want to take over control of the car in a safe way.

Windshield Display

Windshield screen to display important information directly in front of users.

03

Design & Testing



Information Architecture

Tier 1 Information

Speed
Distance
Time to reach destination
Direction
Battery
Weather
Driving Mode Indicator
3D Animation of the car
Alerts(Auto-braking, Auto Lane Changing, Auto Cruise Control, Collision Warning, Low Tire Pressure, Doors...)

Tier 2 Information

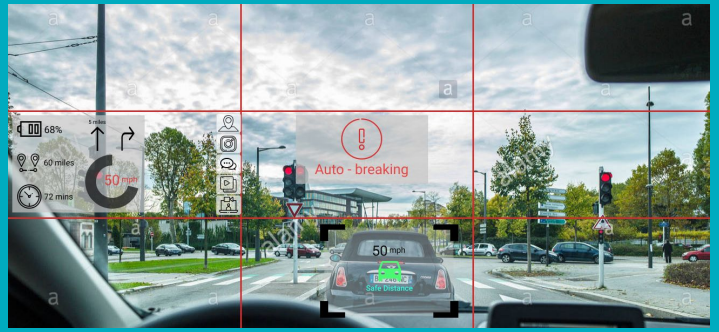
Navigation Map
Hardware Controls/Setting
Total miles the car has travelled
Screen Mode
Air Conditioner / Temperature
Tire Pressure
Fog Beams Indicator
Windshield Wiper
Hazard Warning Lights
Lights

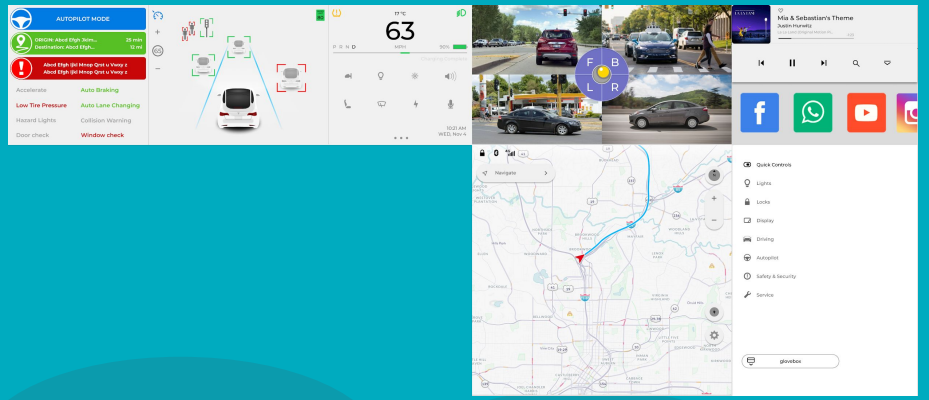
Other features

Entertainment
-Music / Social Media

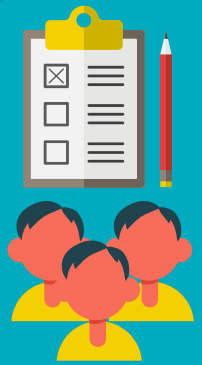
Screens for real-time camera view

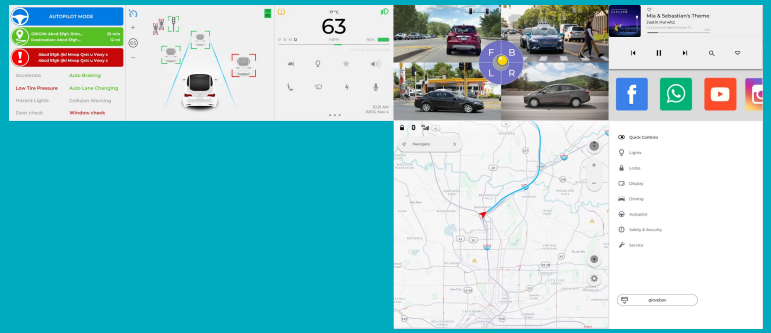
IA & Design Iteration 01

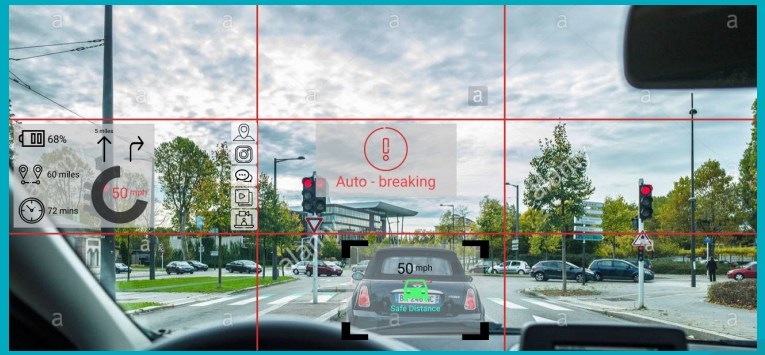




User Design Feedback





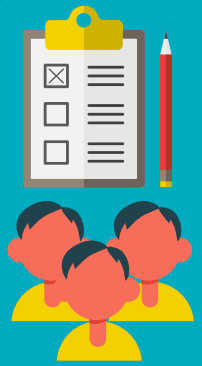


"I would like to see a better representation of the HUD instead of just the red area. How it will look, perspectives, shape, etc." UO1

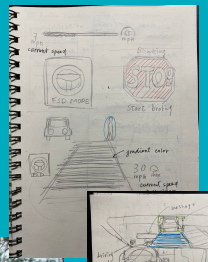
"I think the positions are well laid out. It shows me useful information such as safety warnings and about my driving trip at eye level." UO3

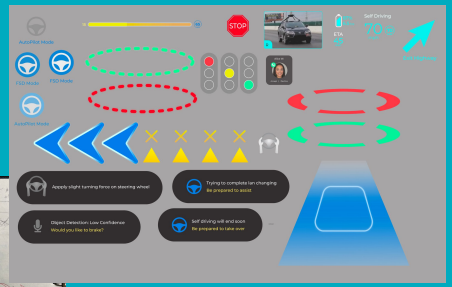
"I think the overall idea is fantastic but keep in mind too much information can be distracting. If anything, having options that can customize the amount of information would be an awesome option to have." UO1

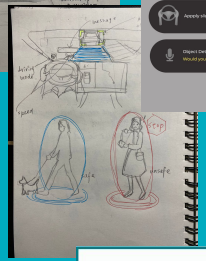
User Design Feedback

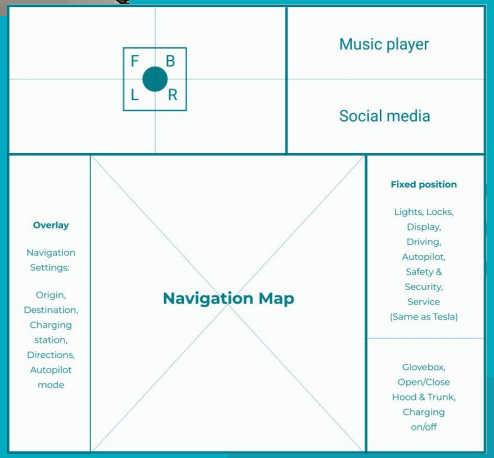


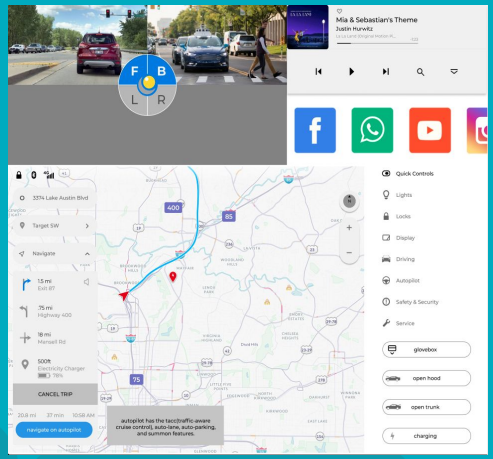
Design Iteration 02





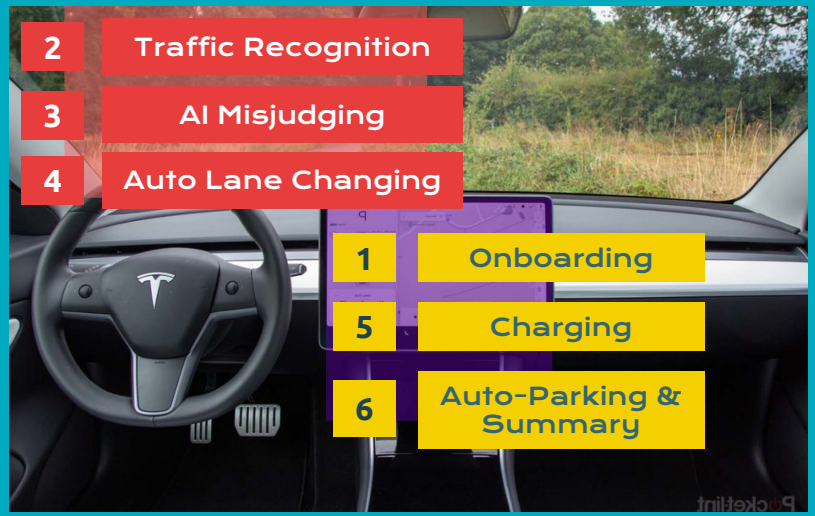






User Testing 01

Tasks



2 Traffic Recognition

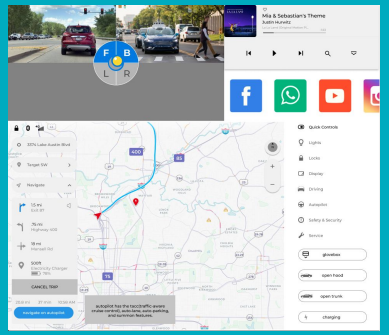
3 AI Misjudging

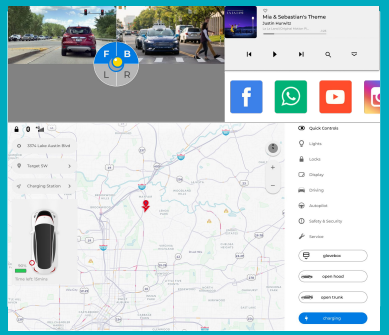
4 Auto Lane Changing

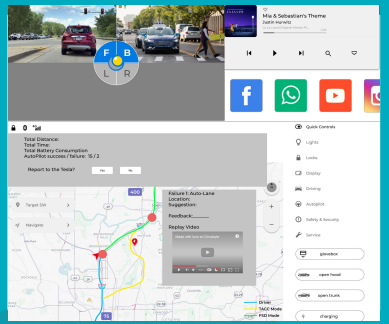
1 Onboarding

5 Charging

6 Auto-Parking & Summary

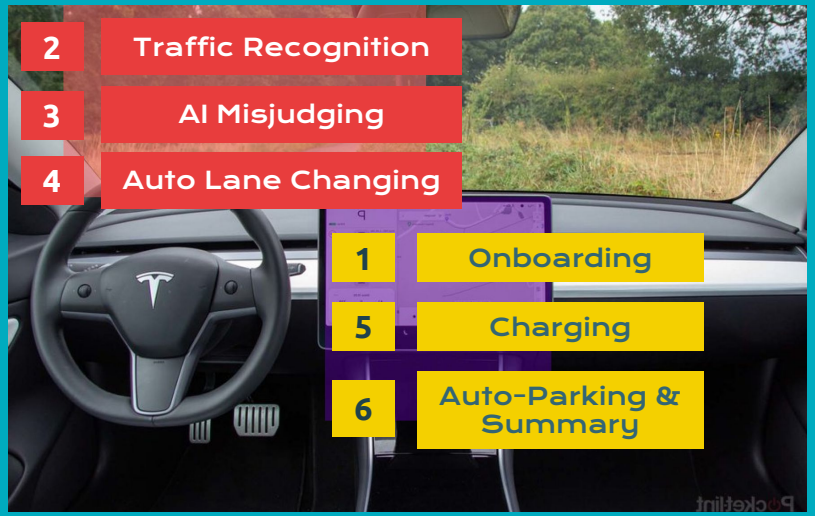






User Testing 01 Result

Tasks



SUS

NPS

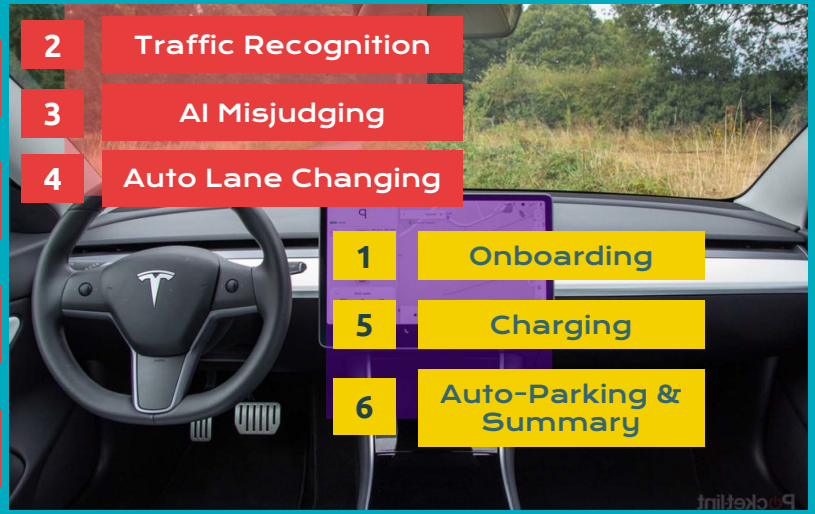
Usability Score

Safety Score

User Testing 01 Feedback

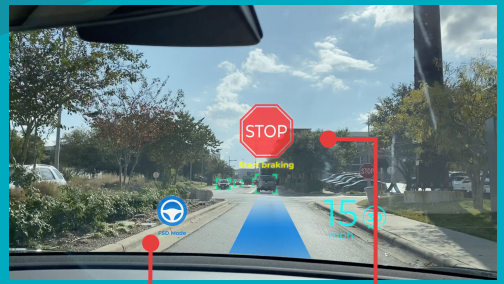
Tasks

- Autonomous car context, FSD not clear
- Notifications are too scary to feel safe
- Alerts too wordy to understand
- Confused about interaction way

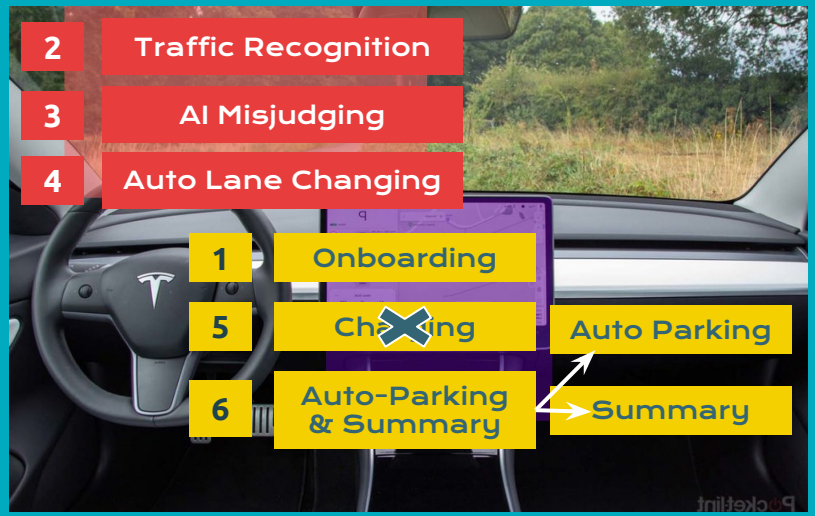


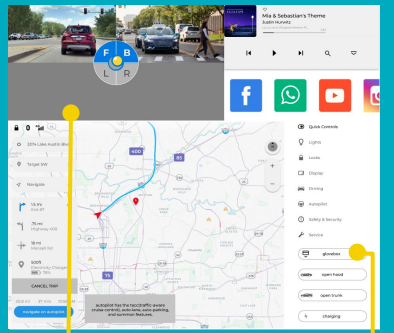
- Confused about the scenarios
- Confused about the camera
- Why scenarios are safety issues
- Confused about some buttons

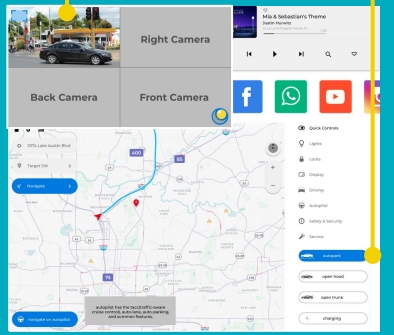
Design Iteration 03



Tasks

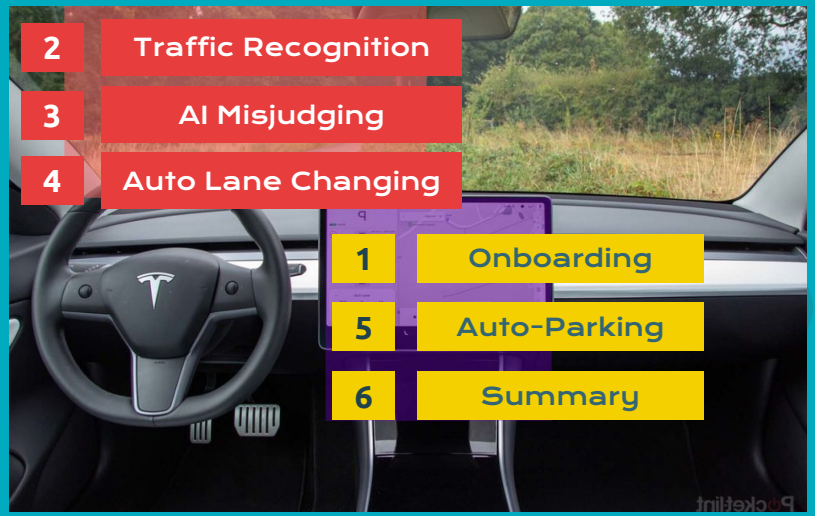


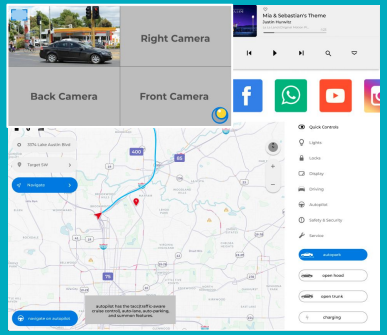


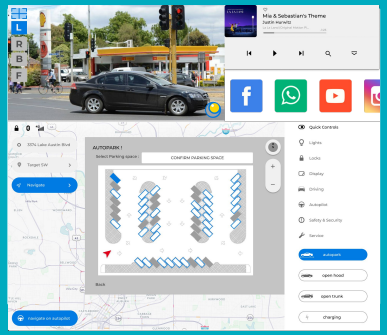


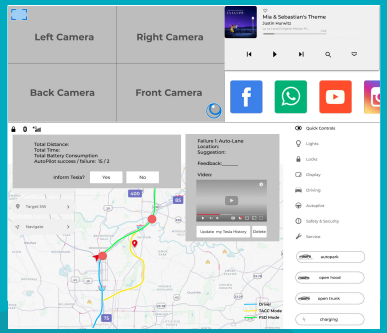
User Testing 02

Tasks



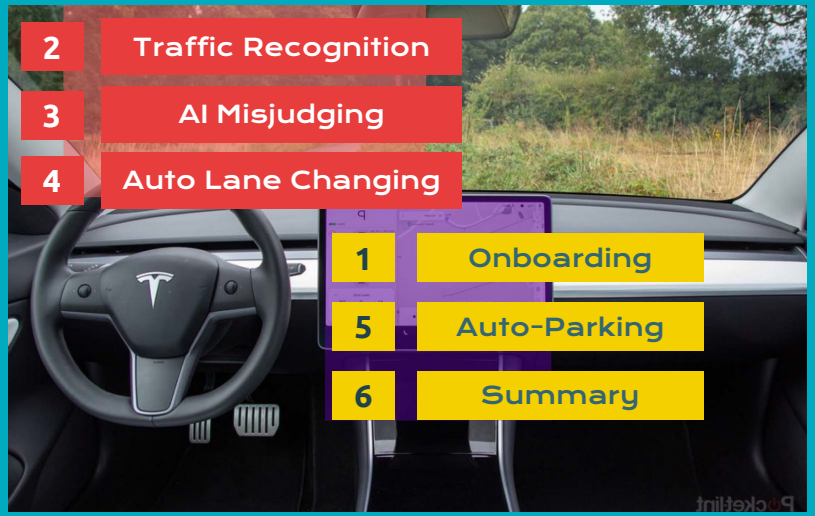


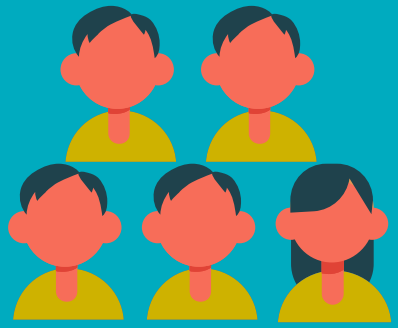




User Testing 02 Result

Tasks

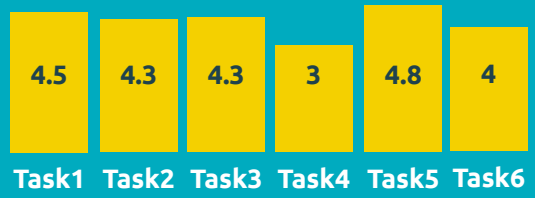




SUS

NPS

Usability Score



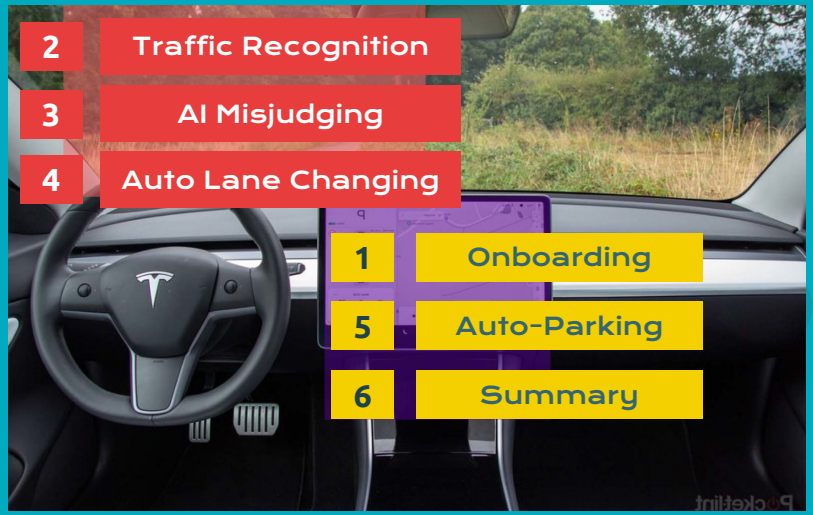
Safety Score

Trust Score

User Testing 02 Feedback

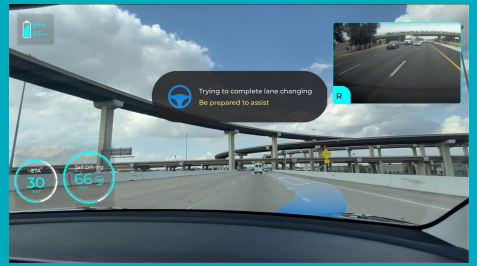
Tasks

- Battery position
- Interaction Way
- Reaction Time Issue

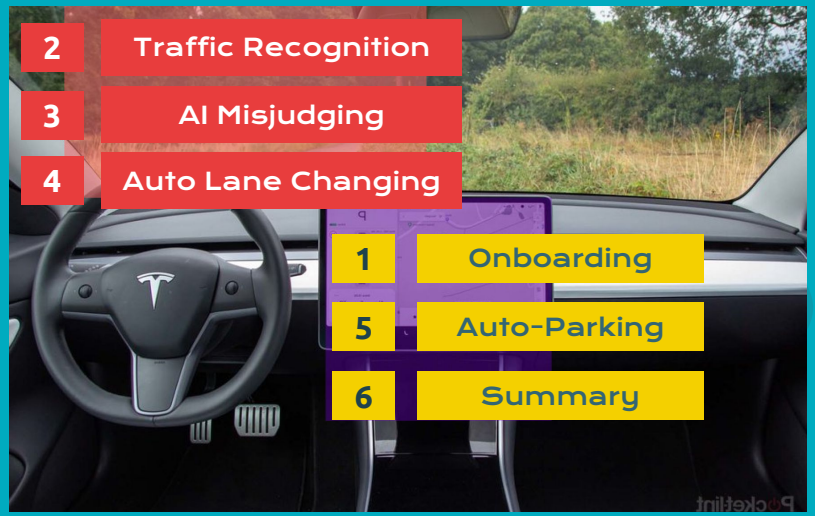


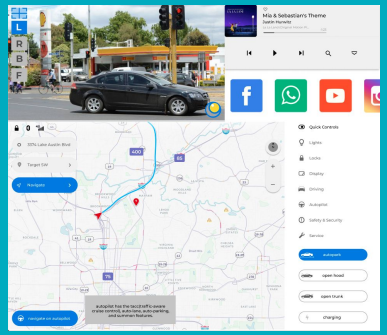
- Scenarios details
- Feedback Input

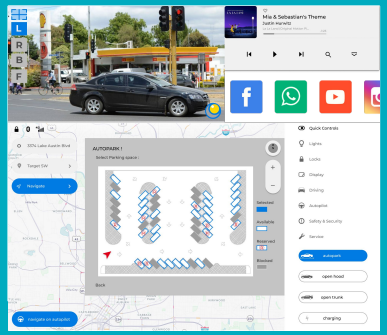
Final Design

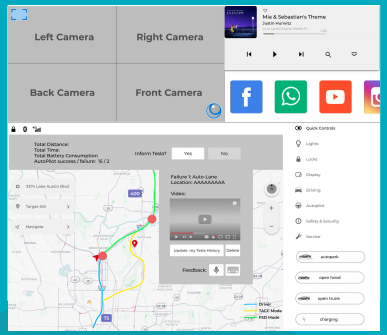


Tasks









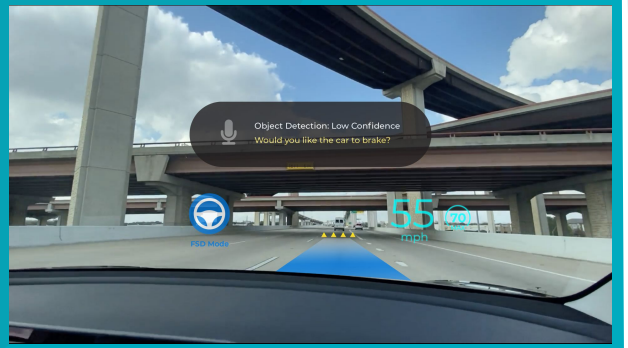
Task 2 Iteration_ Traffic Recognition

Alert System

FSD Mode

Battery Position

Task 3 Iteration_ AI Misjudging

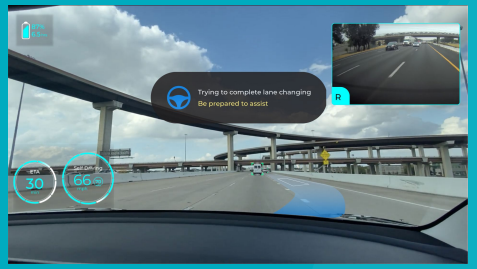


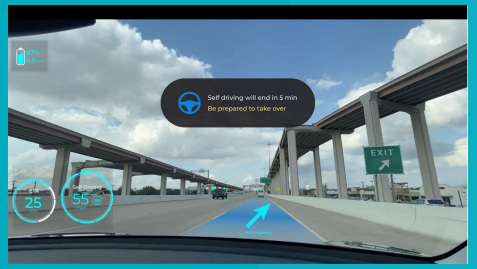
Interaction way

Reaction Time

Task 4 Iteration_ Auto Lane Changing

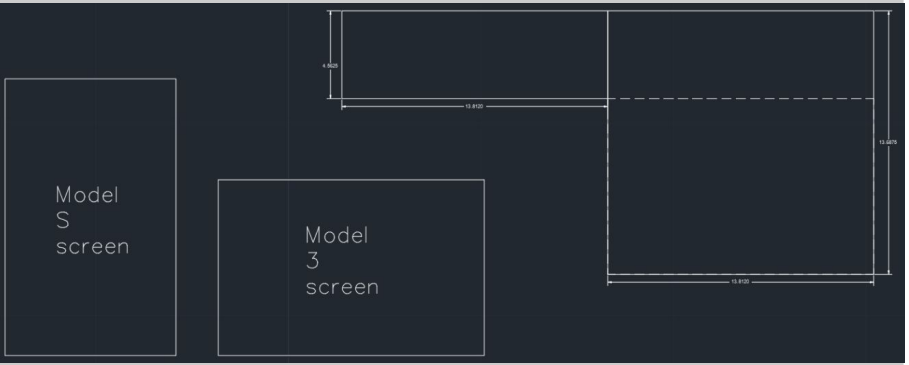
Scenario Simulation





Notification comprehension

Design Conceptualization - Control Panel



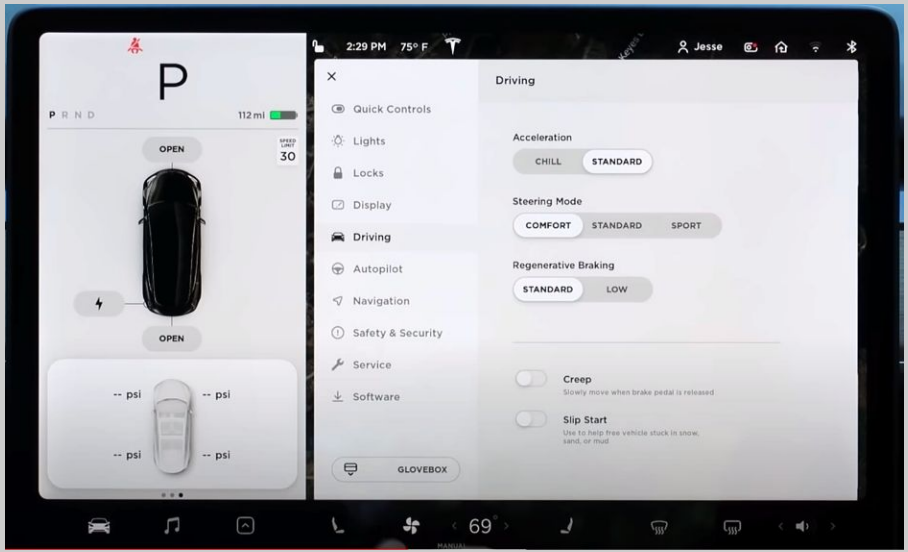
Screen Profile

Model S
Overall diagonal length 17"
Longest vertical length 14.375”
Longest horizontal length 8.875”
Dashboard- diagonal length 12.3”

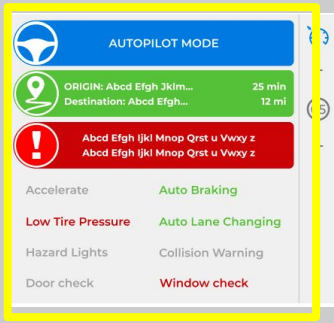
Model 3
Overall diagonal length 15"
Longest horizontal length 13.812"
Longest vertical length 9.125"

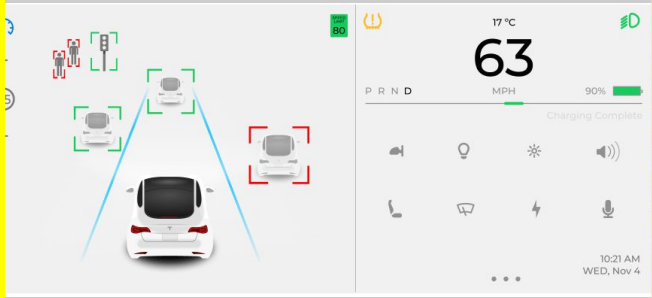
Some reviews after first round of interviews:

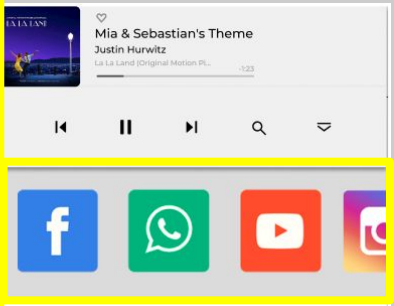
- ➔ The saliency of the icon- 'indicator of autopilot mode' is very low.
- ➔ Positions of all the cars around, through video images instead of the animated images - Syncing the cameras with screen may help
- ➔ Prior information eg: switching lanes, breakdown is needed
- ➔ Avoid readable information/ alerts
- ➔ Alerts like audio tones/ haptic- vibrations/ color indication eg: users' peripheral vision can see some red blinking light for traffic alerts at turns.
- ➔ Navigation map gets hidden behind the settings menu.

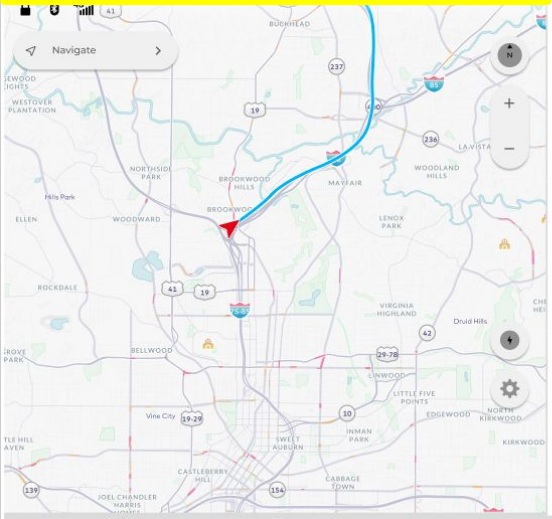


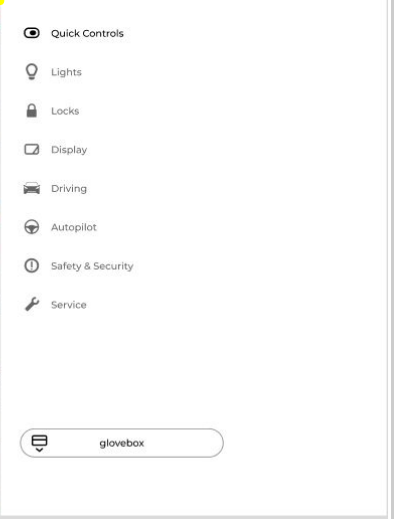
Based on our Test Drive and User Interviews, the interactive screen (Dashboard & Control Panel) was designed using the basic UI elements of Tesla models 3 & S.











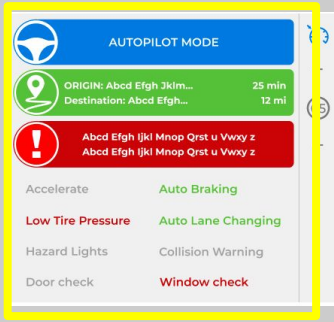
Major Additions:

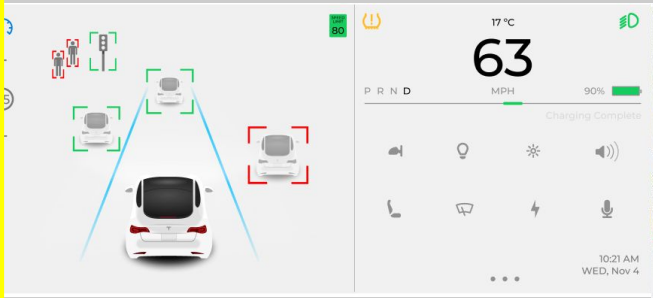
- ➔ Camera screens (Front, Right, Left, Back)
- ➔ Notification section for Autopilot indicator, Trip information, Warnings
- ➔ Colored indicators for pedestrians, cars, traffic signals
- ➔ Social media accessible directly from the main screen

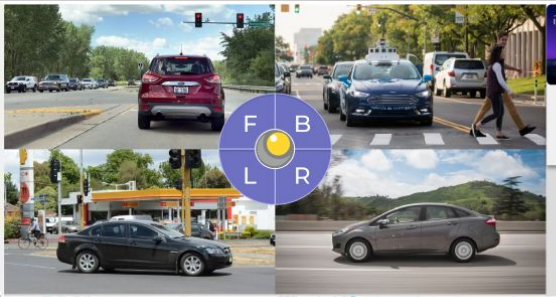
Rearranged Sections:

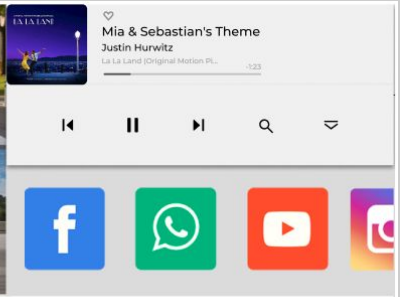
- ➔ Basic interactive controls along with 3D route animation shifted to Dashboard
- ➔ Settings menu shifted to the right (Fixed position- all the settings options are readily available)

> I would remove the safety warning prompt. I think it might become distracting in some situation where attention needs to be focused on the road.

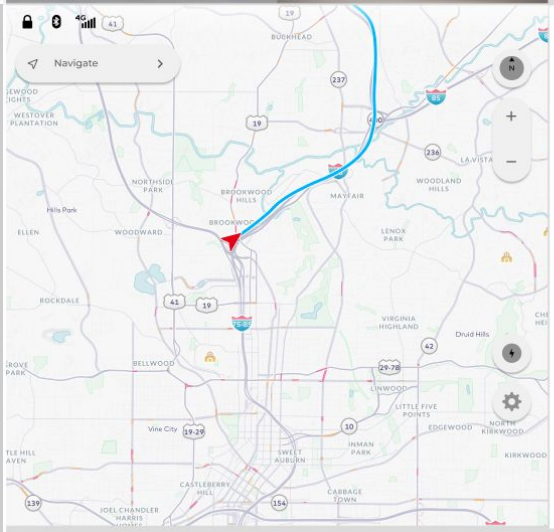


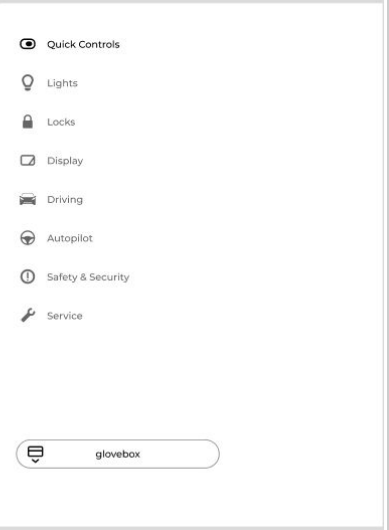






> I think the overall idea is fantastic but keep in mind too much information can be distracting. It's like having many pop up ads on your computer screen while shopping for clothes or on Amazon. If anything, having options that can customize the amount of information would be an awesome option to have.





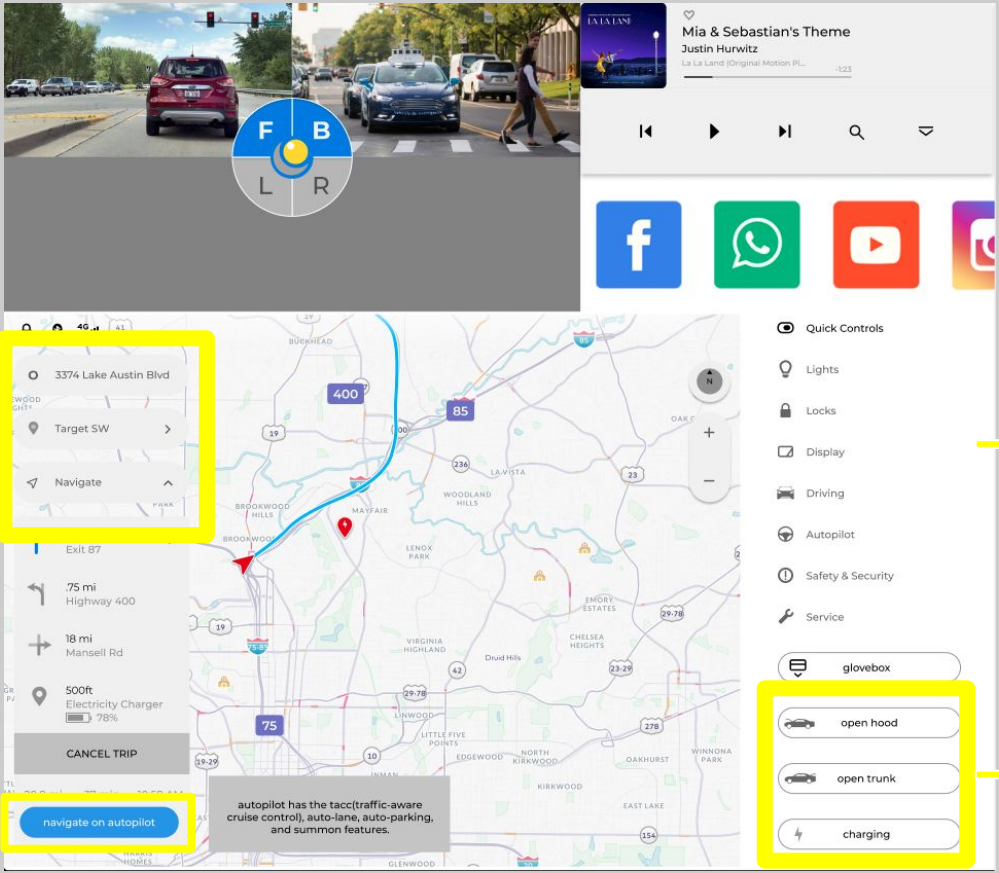
➔ Through online Google survey, it reflected that the prototype screen (Dashboard + Control Panel) presented a lot of information for the driver, and could provide distraction, hence increasing the safety concerns

Control Panel (First Iteration)

-Navigation

Basic trip information (origin & destination visible to the driver always)

Navigate dropdown menu lists ‘Autopilot’ mode and provides extra information



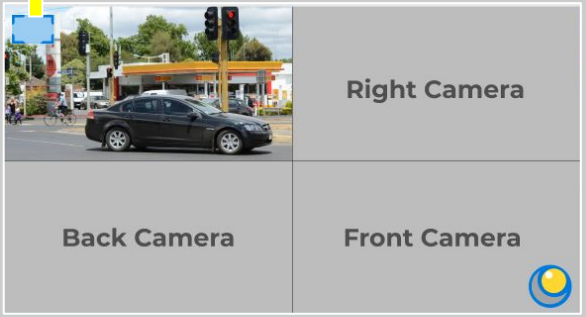
Settings menu narrowed down to maximize navigation map view

Additional options added for frequently used features

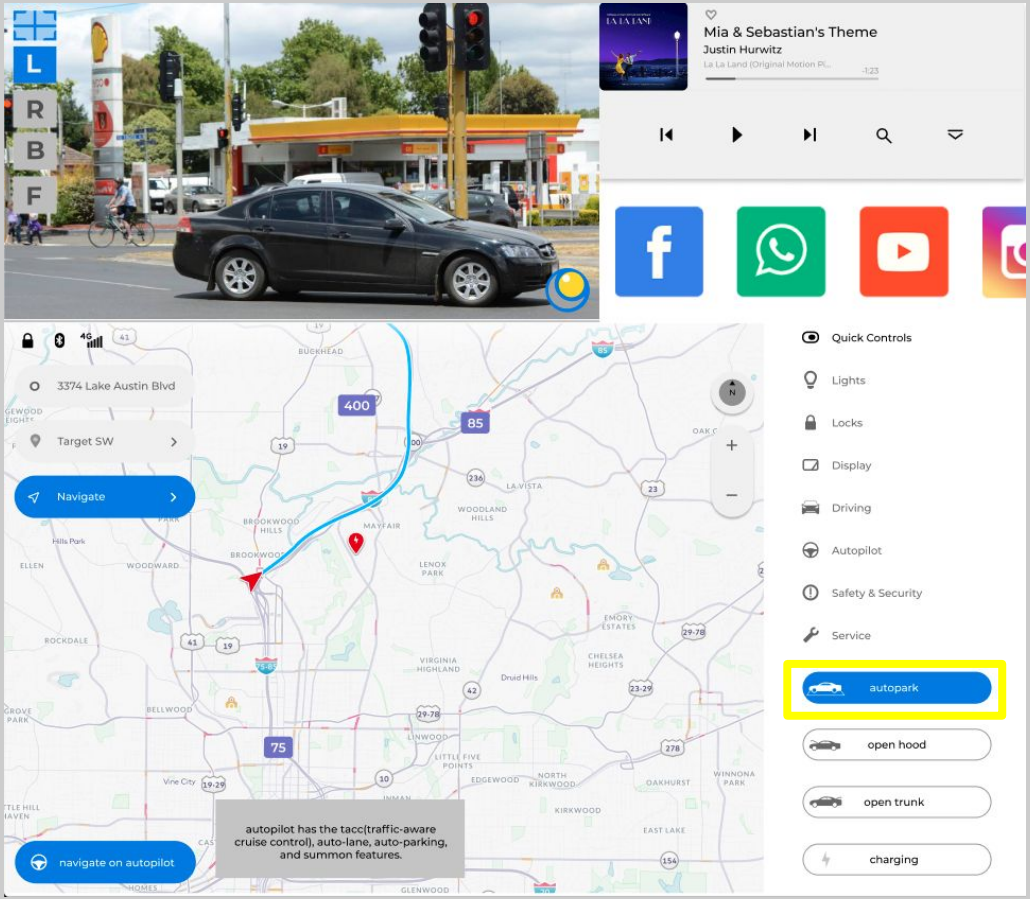
Control Panel (Second Iteration)

-Navigation

The four camera screens were labelled and provided with the expandable view option

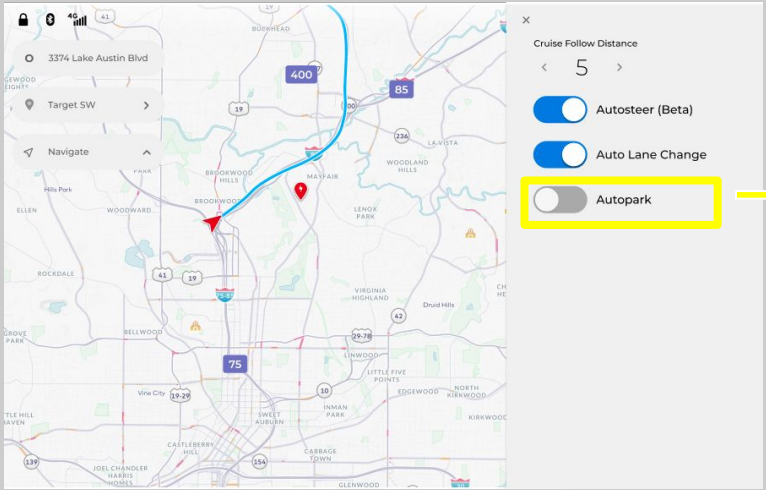


➔ The ‘glovebox’ button was changed to ‘autopark’ and was linked to the ‘navigate on autopilot’ option



Control Panel (First Iteration)

-Autoparking

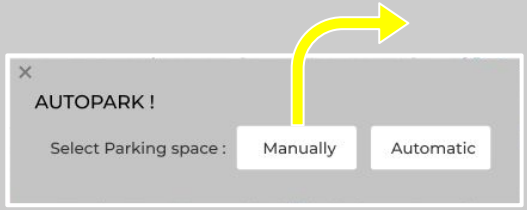


The ‘Autopark’ option was added on the homepage and included in the ‘Autopilot’ settings option

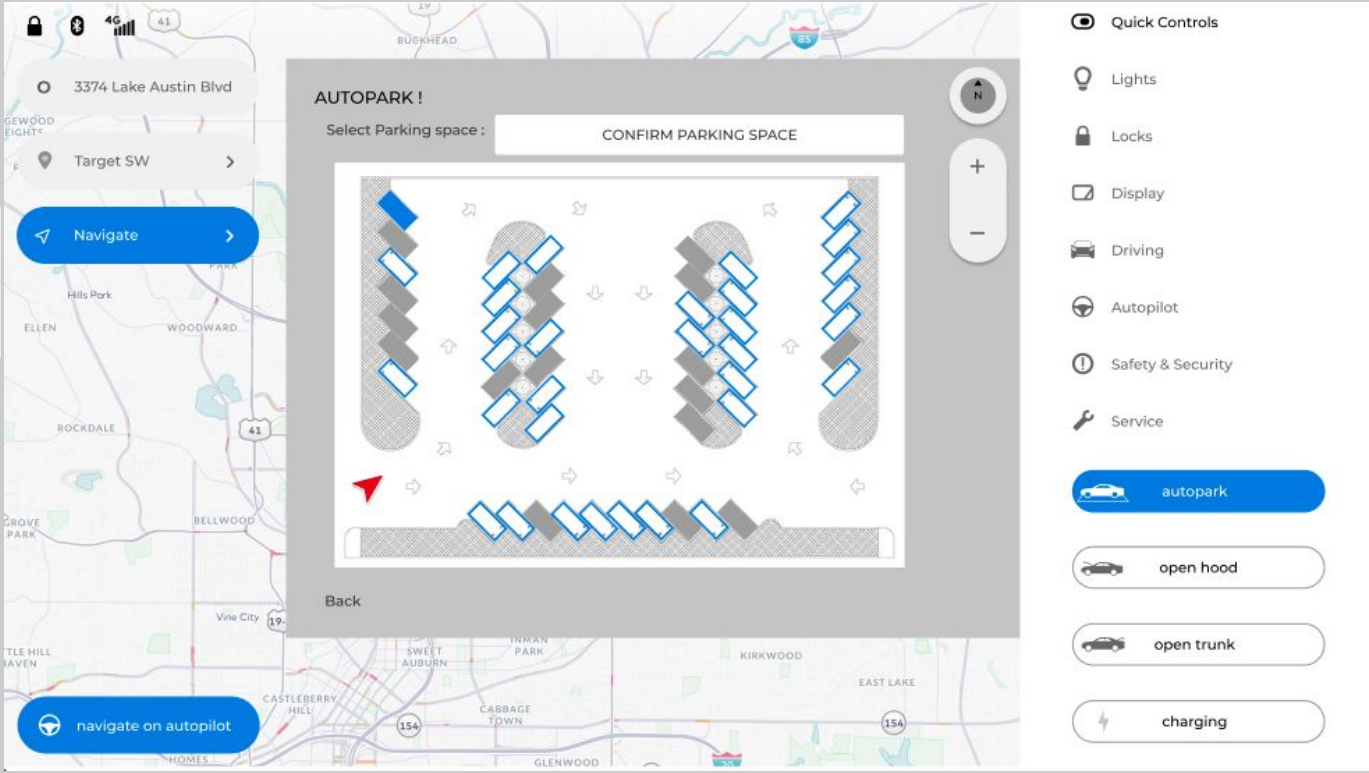
➔ How Tesla does it

Control Panel (Second Iteration)

-Autoparking



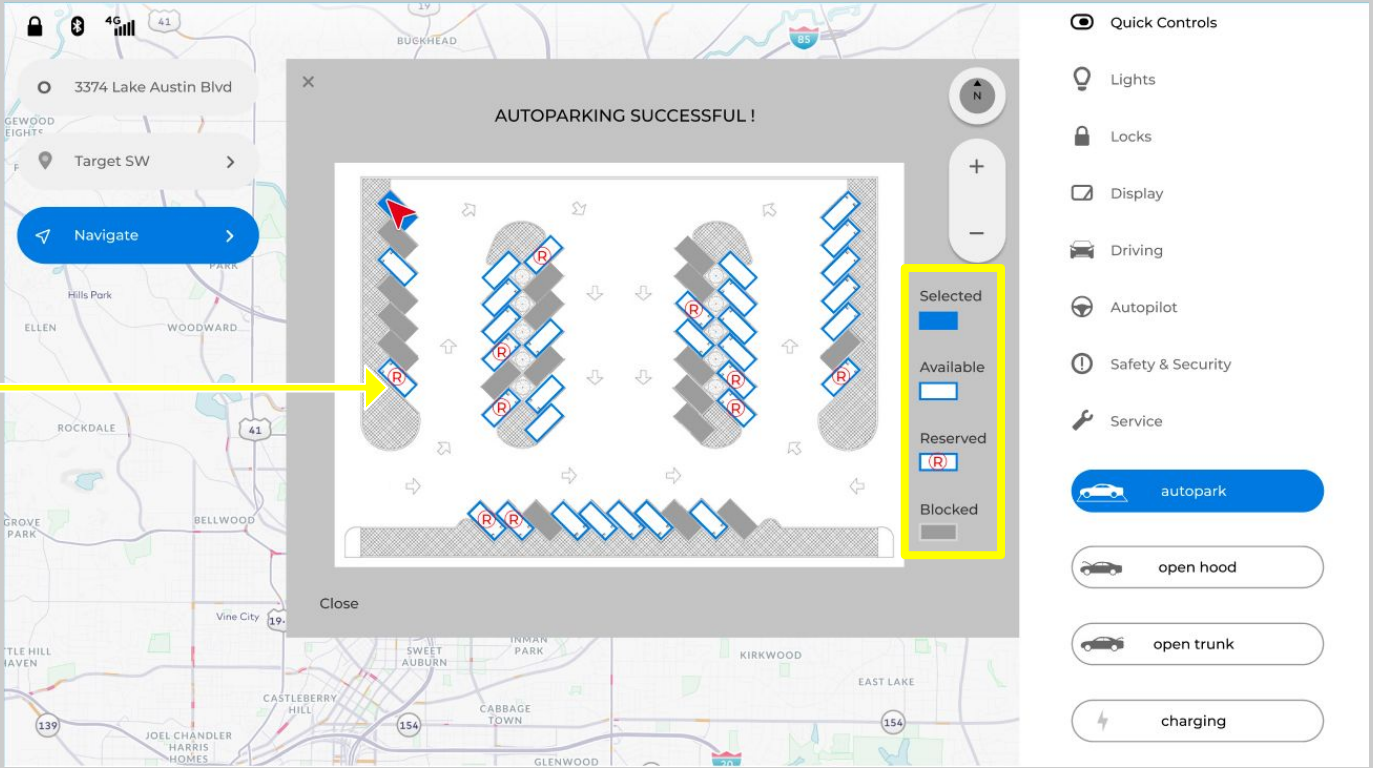
An option to choose the parking space - manually, was provided along with the map of the parking lot. This would work with real-time AI technology where the map would get update regularly.



Control Panel (Third Iteration)

-Autoparking

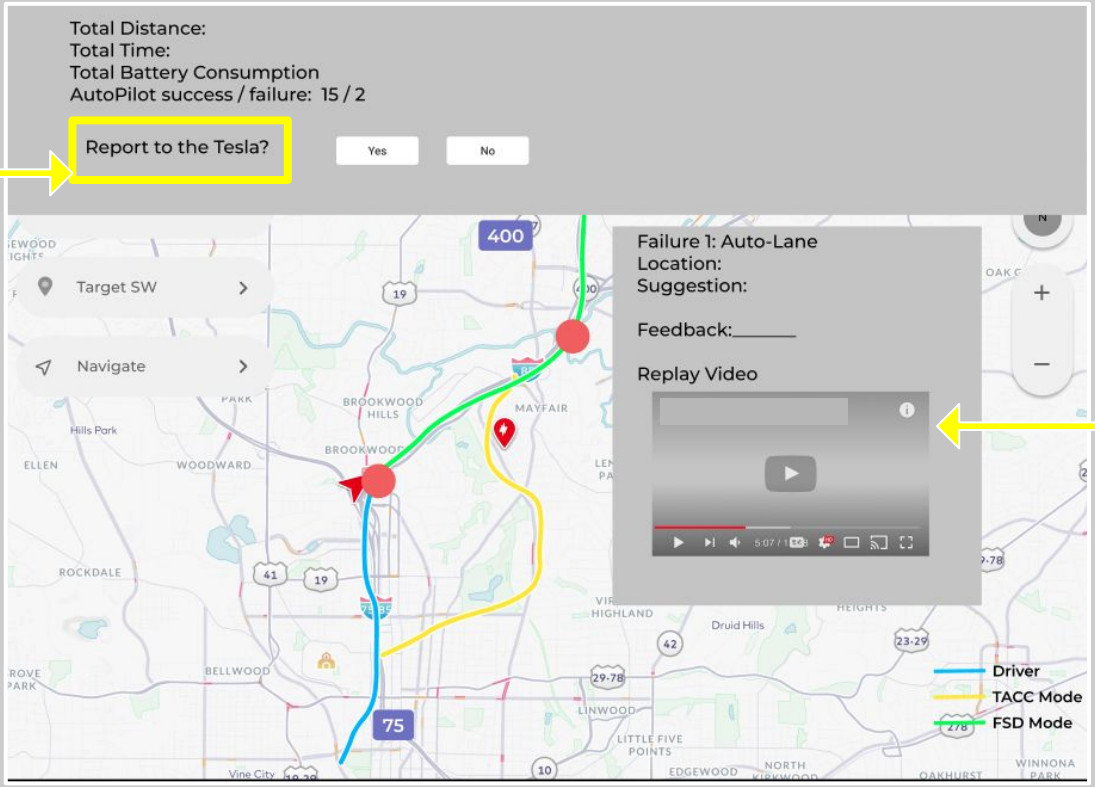
Reserved Parking spots were added along with the legend for the availability information



Control Panel (First Iteration)

-Trip Summary

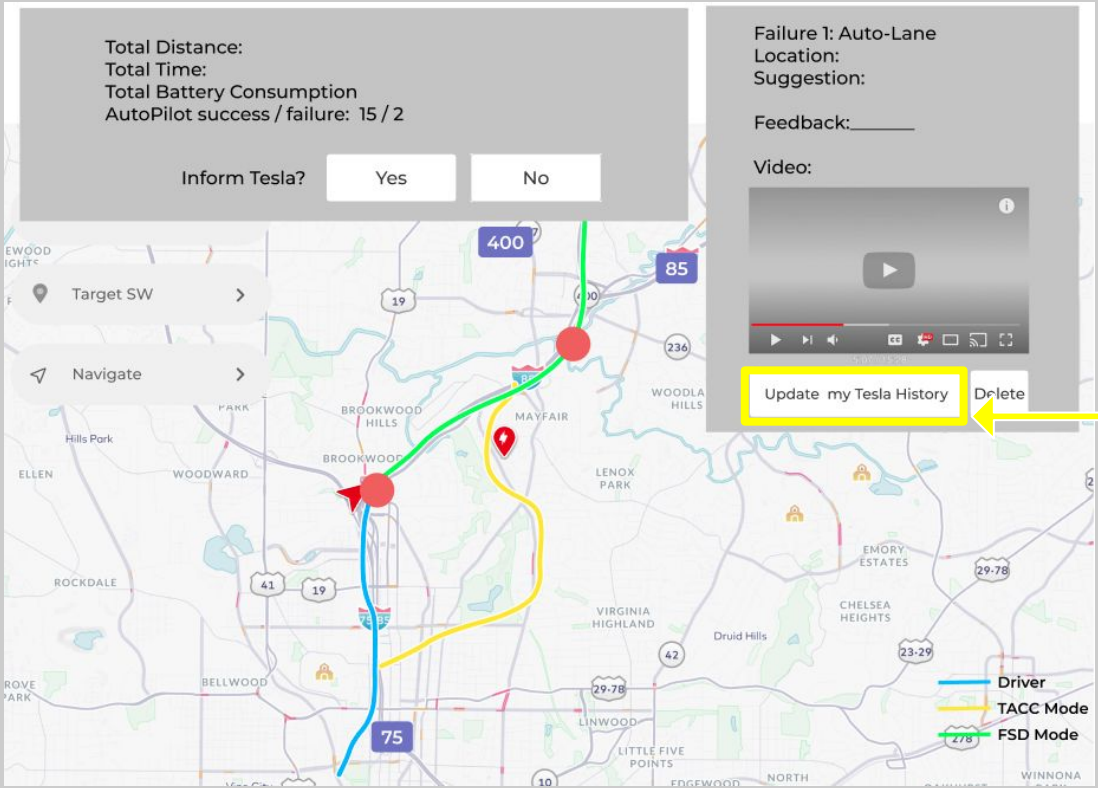
To increase user reliability, the trips can end with a summary showing the failure details along with an option to update the company with an error report/ feedback



The recorded camera videos can be viewed after the trip.

Control Panel (Second Iteration)

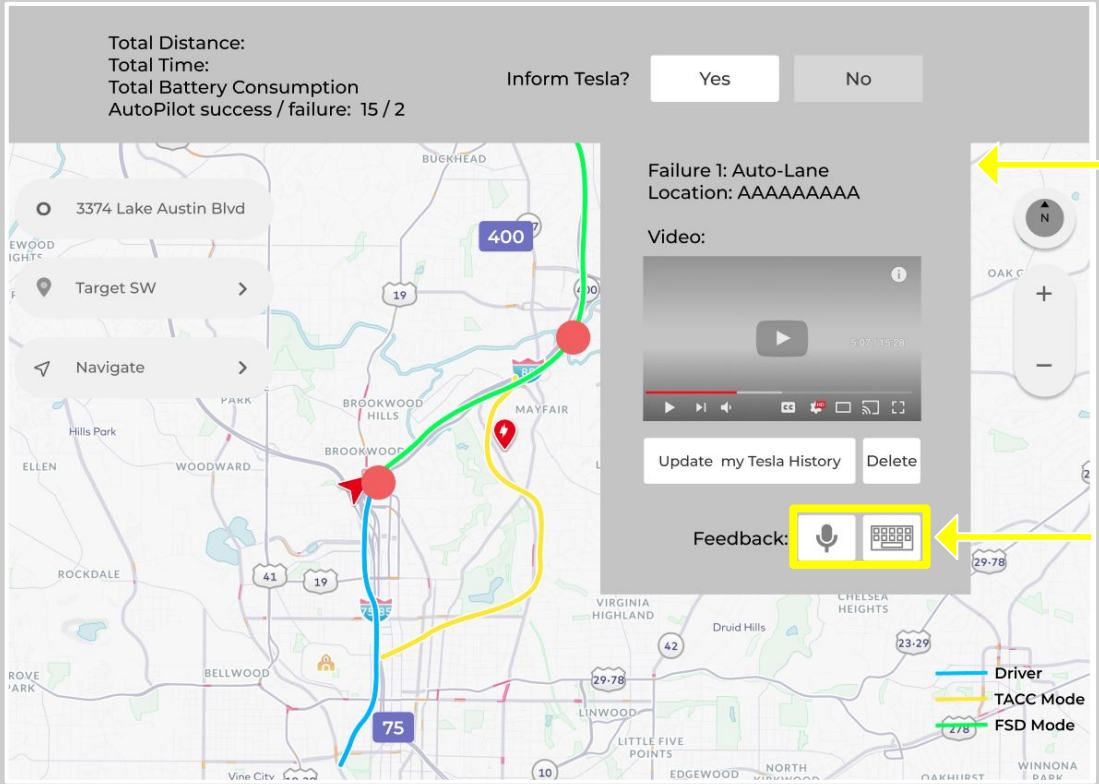
-Trip Summary



The recorded camera videos can be uploaded in the trip-history of online account, for future reference.

Control Panel (Third Iteration)

-Trip Summary



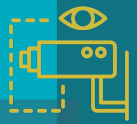
These options would pop-up, and be linked to 'Yes' button only

Provide feedback through voice recording/text format as per user convenience

Lessons Learnt

USER GAP

Fans and normal people will give totally different opinions and visions!!!



TECHNICAL ISSUE

Autonomous cars still faced lots of AI/Computer Vision issues can't solve and hard to rely on

FACILITATE WITH AR

AR windshield display system may be a good solution to bridge the gap for normal people

Challenges

ENVIRONMENT

Car environments are hard to use Figma to demonstrate

INTERACTION WAY

Voice command and some buttons on the steer wheel also hard to simulate

SCENARIO & REACTION TIME

Safety scenarios for autonomous cars are hard to determine by static prototypes

Future Plan

1 VR Simulation

Building car VR simulation system

2 Optimizing scenarios

Giving different info with reasonable reaction time

3 Personal Info Setting

Displaying info based on personal habit

Resources

Intel Survey
https://newsroom.intel.com/news/latest-intel-study-finds-people-expect-self-driving-cars-common-50-years/#gs.hftplr
AAA Insurance Survey
https://www.wesa.fm/post/aaa-survey-finds-many-dont-trust-driverless-cars-technology#stream/0

Thank you!