

Autonomous Car

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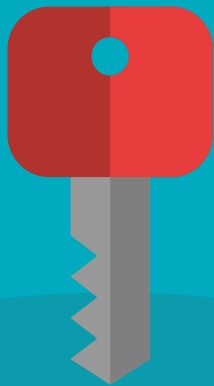
04

**Summary
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challenges

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



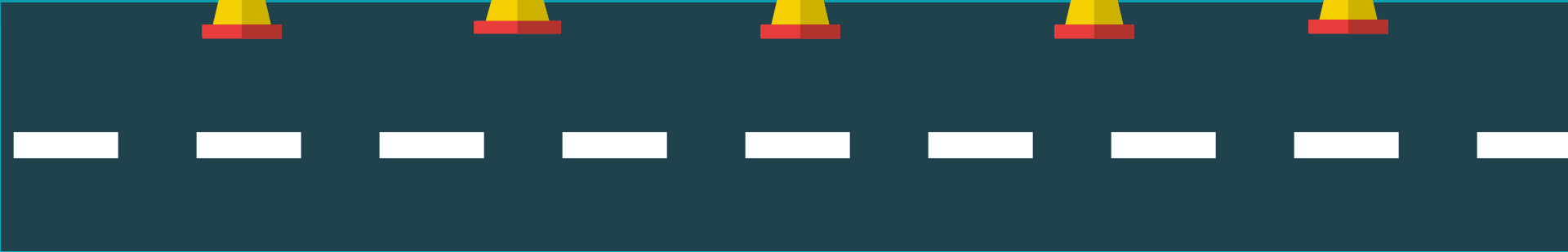
Driver
Assistant

Partial
Automation

Conditional
Automation

High
Automation

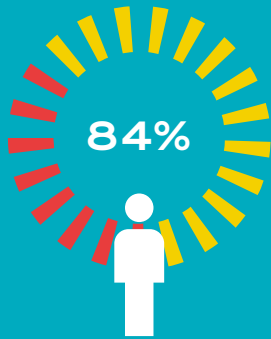
Full
Automation



Problem Definition

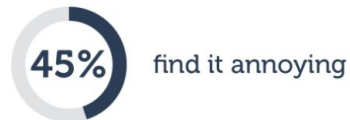
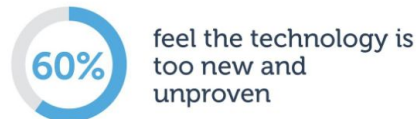


Technology



Untrust

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



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.



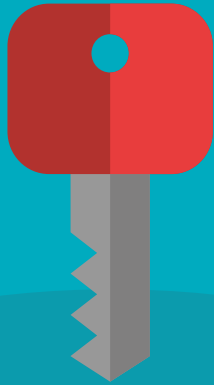
Waymo

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



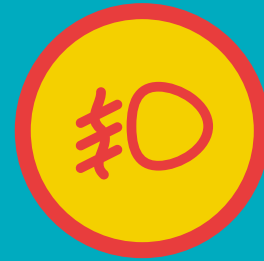
Situation Awareness

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.

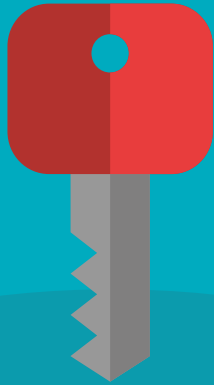


Windshield Display

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...)

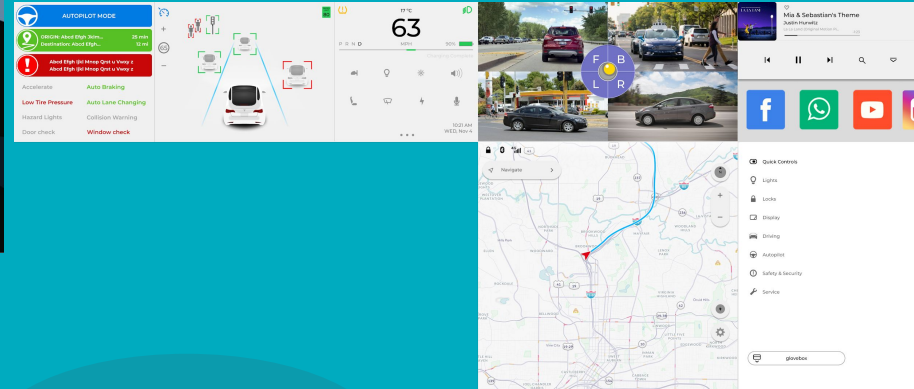
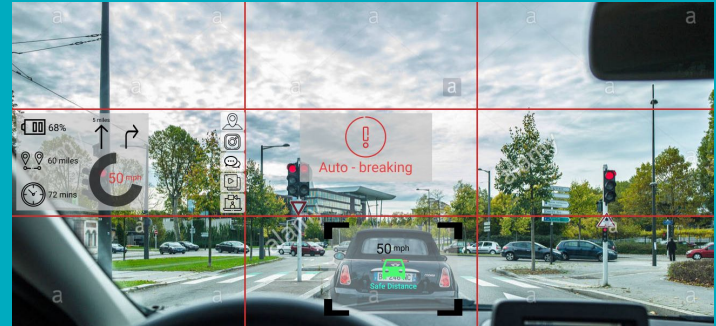
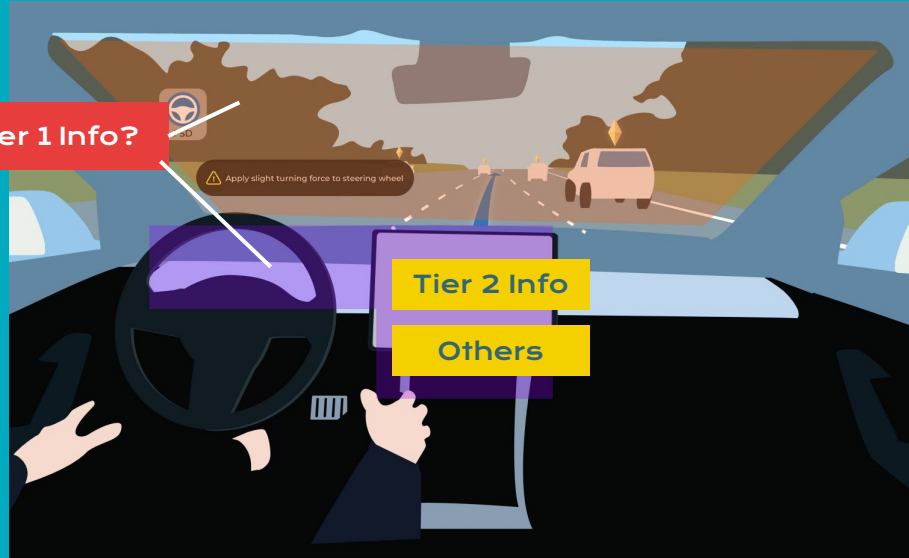
Tier 2 Information

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

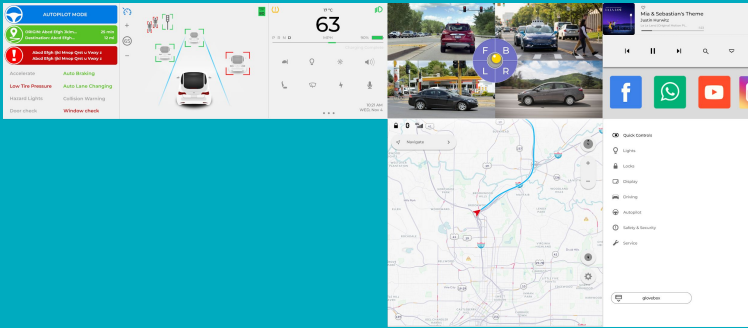
Other features

Entertainment
-Music / Social Media
Screens for real-time camera
view

IA & Design Iteration 01



User Design Feedback

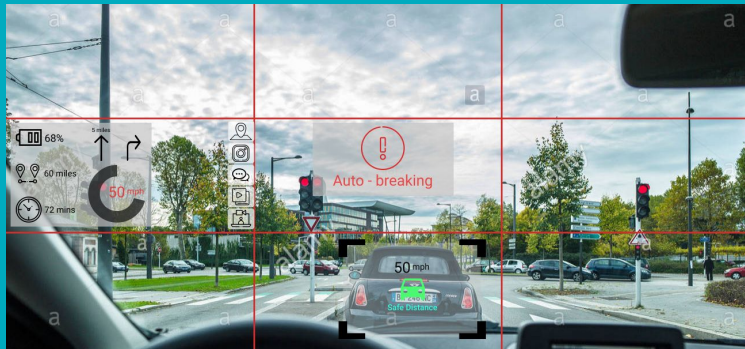


"I would like to see a better representation of the HUD instead of just the red area.

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."

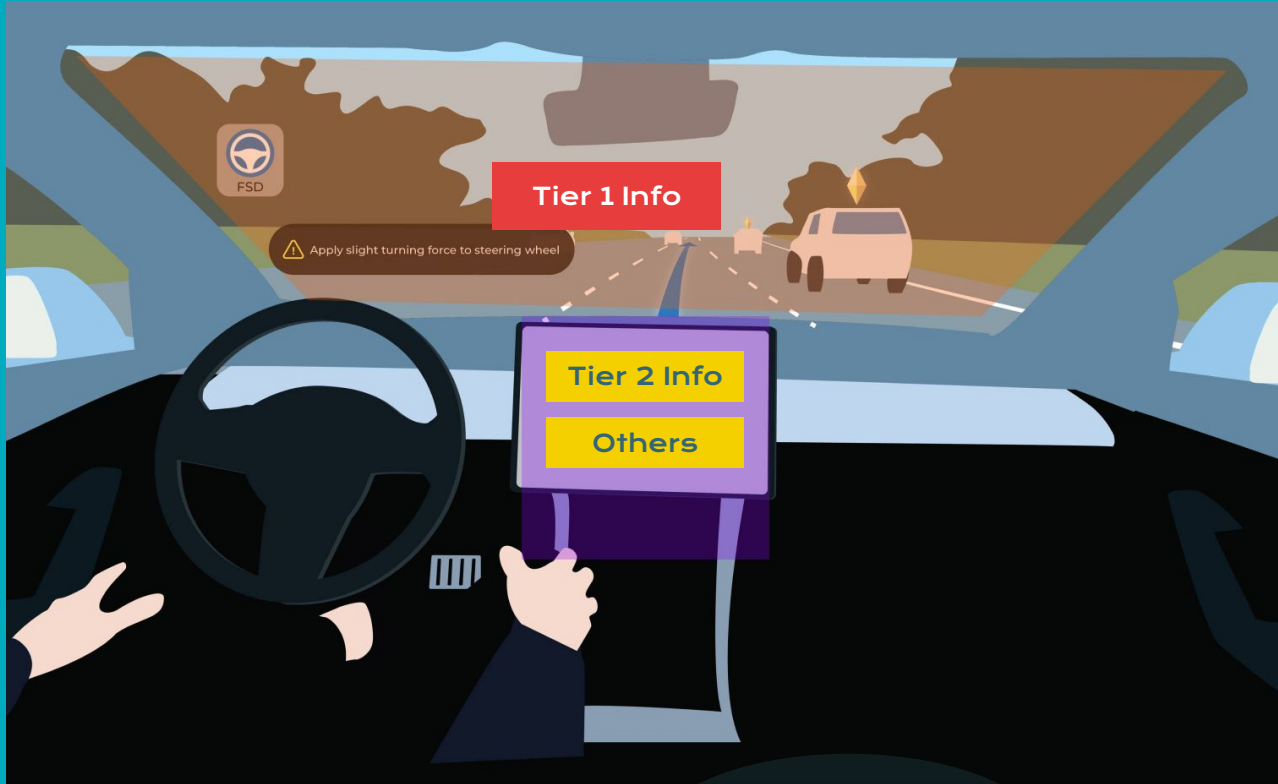
UO3



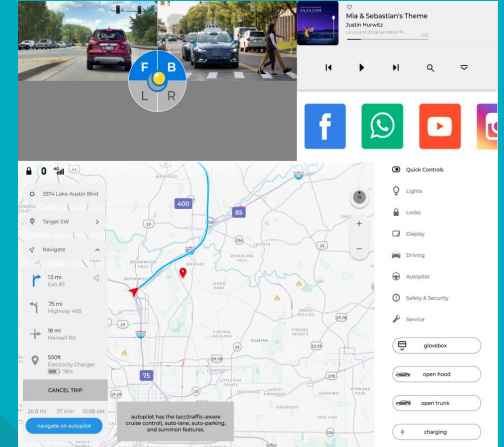
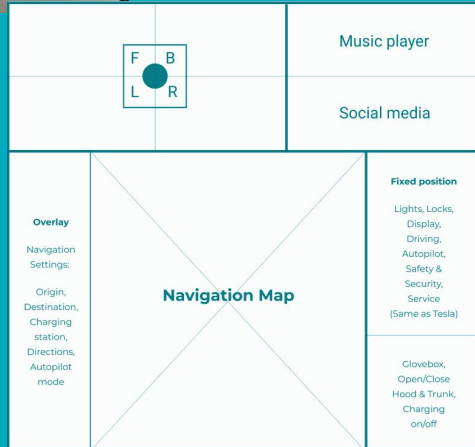
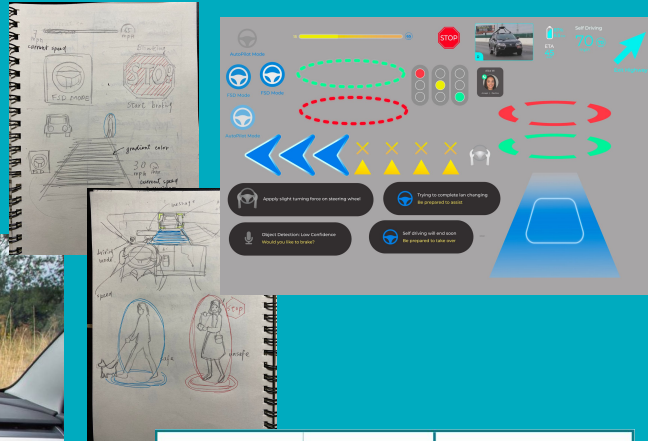
"I think the overall idea is fantastic but keep in mind too much information can be distracting. If anything, having options that can customize the amount of information would be an awesome option to have."

UO1

User Design Feedback



Design Iteration 02



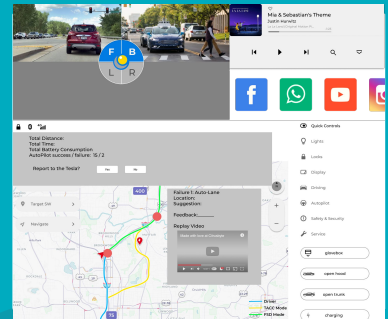
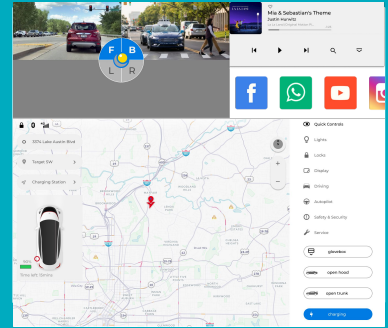
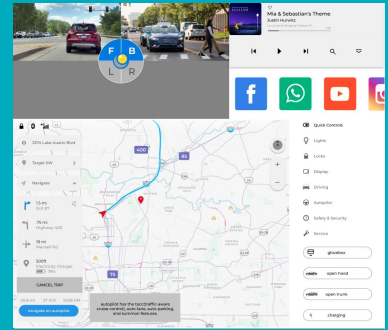
User Testing 01



Tasks



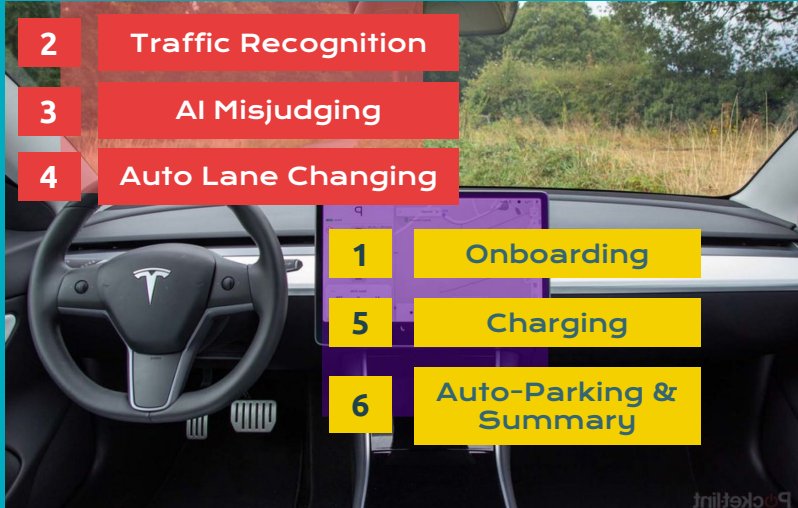
- 2 Traffic Recognition
- 3 AI Misjudging
- 4 Auto Lane Changing
- 1 Onboarding
- 5 Charging
- 6 Auto-Parking & Summary



User Testing 01 Result



Tasks



SUS



NPS



Usability Score



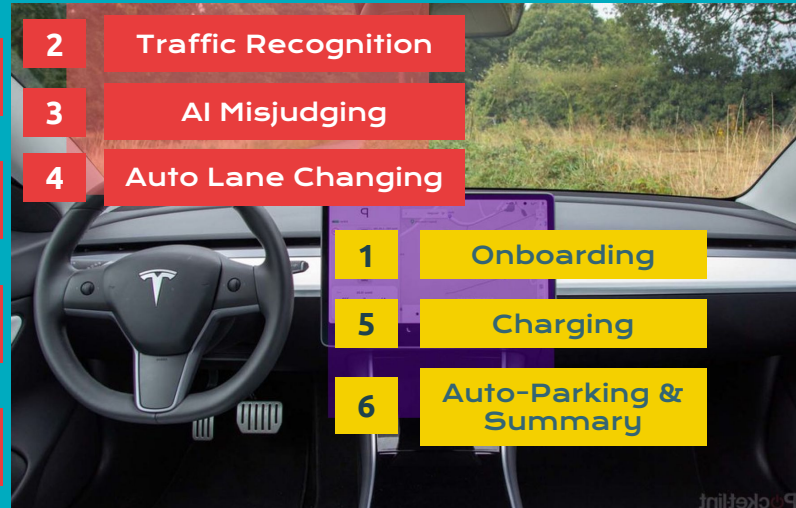
Safety Score



User Testing 01 Feedback



Tasks



2 Traffic Recognition

3 AI Misjudging

4 Auto Lane Changing

1 Onboarding

5 Charging

6 Auto-Parking & Summary

Autonomous car context, FSD not clear

Notifications are too scary to feel safe

Alerts too wordy to understand

Confused about interaction way

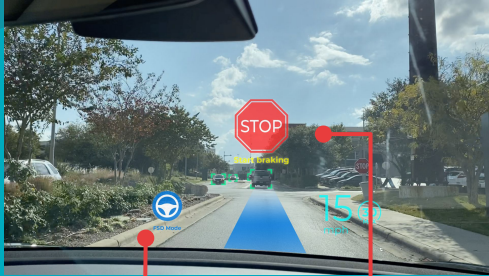
Confused about the scenarios

Confused about the camera

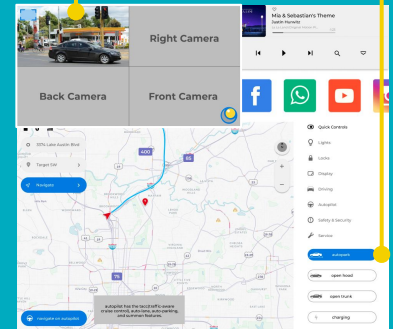
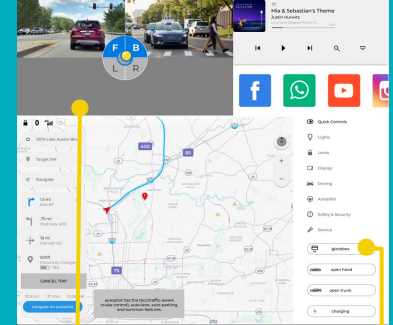
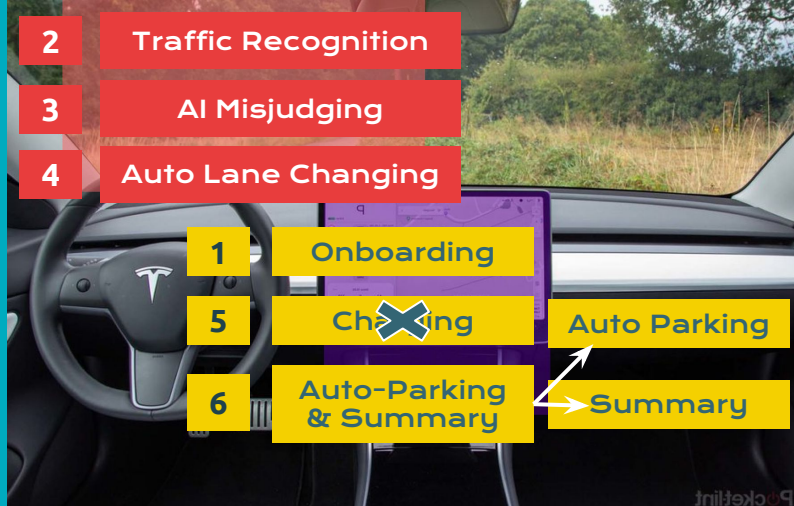
Why scenarios are safety issues

Confused about some buttons

Design Iteration 03



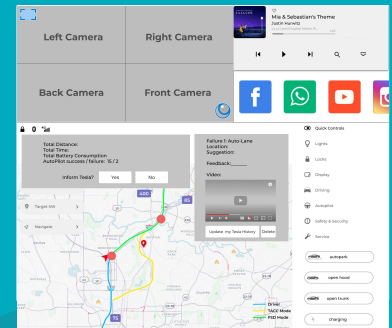
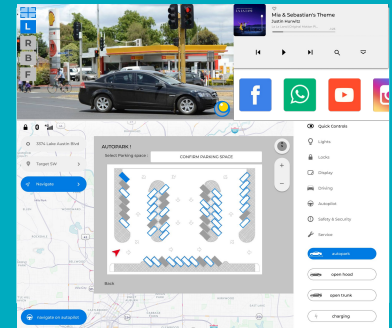
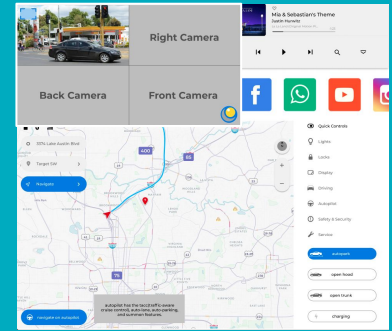
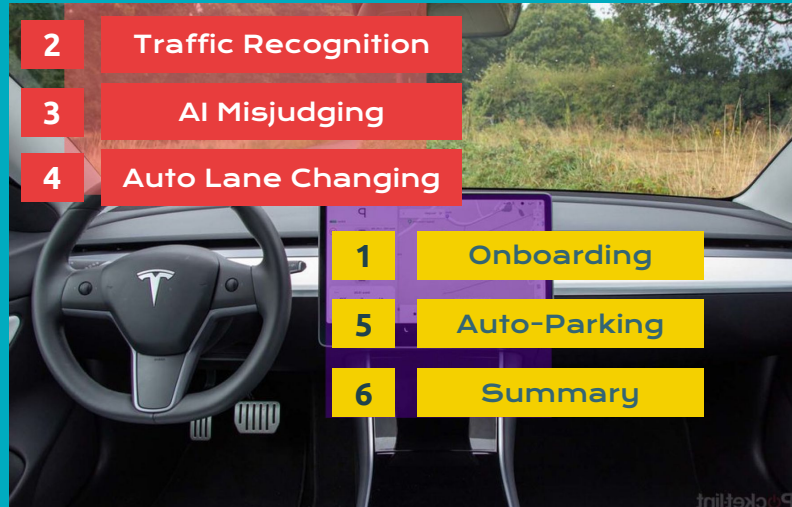
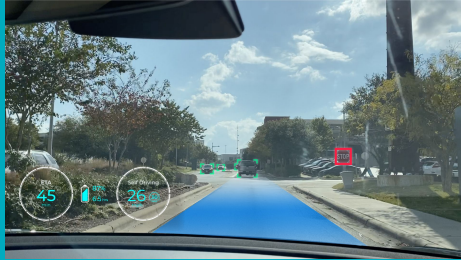
Tasks



User Testing 02



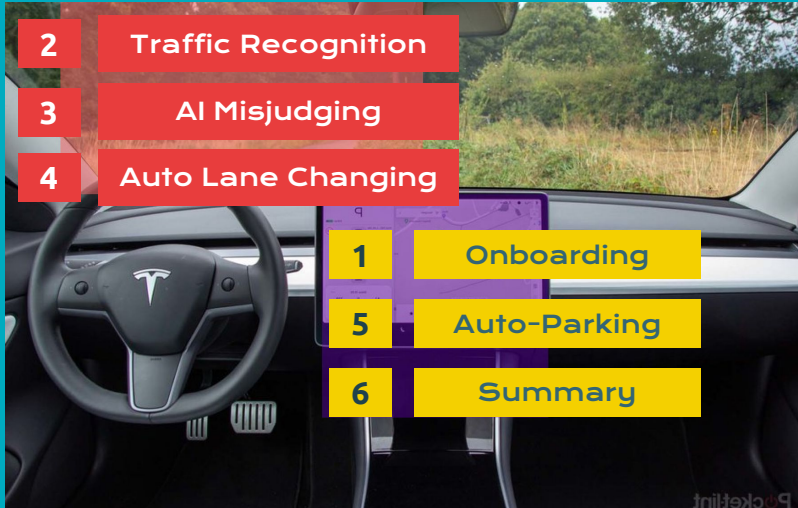
Tasks



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

2

Traffic Recognition

3

AI Misjudging

4

Auto Lane Changing

1

Onboarding

5

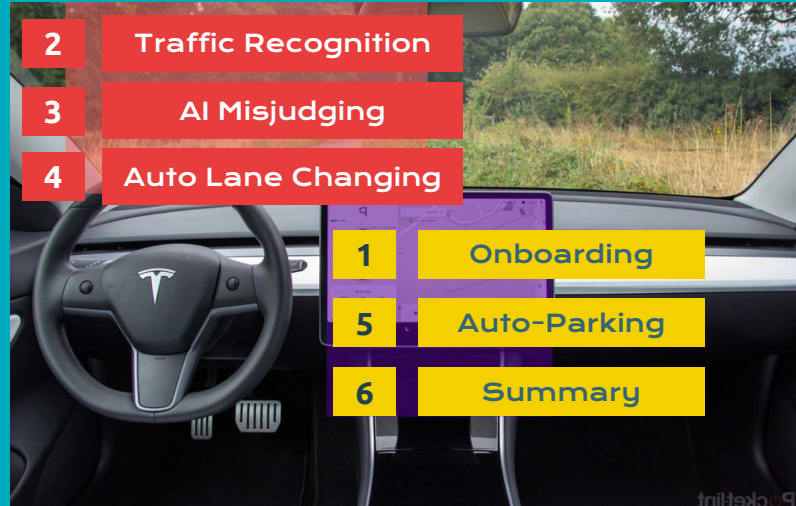
Auto-Parking

6

Summary

Scenarios details

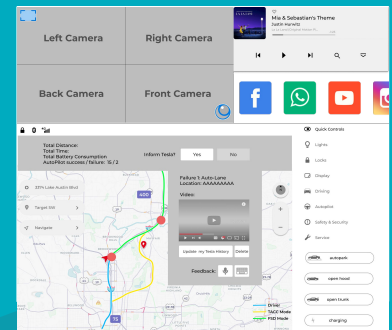
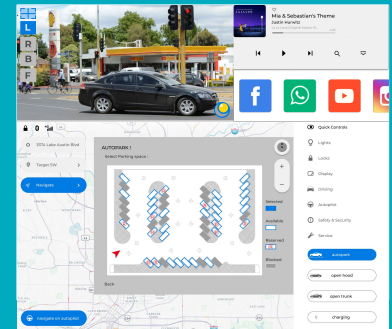
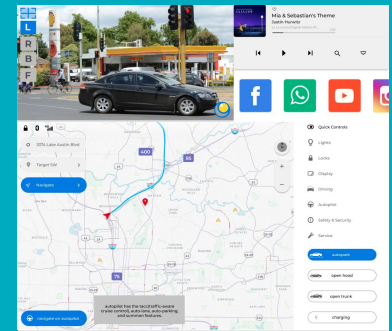
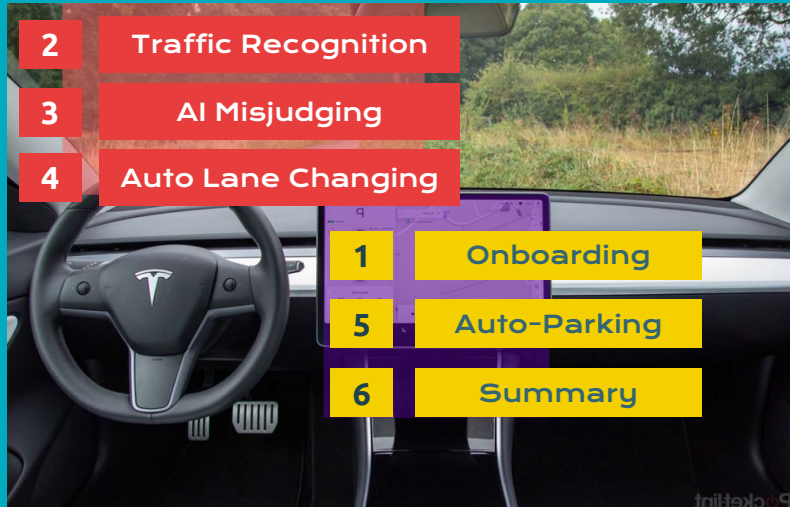
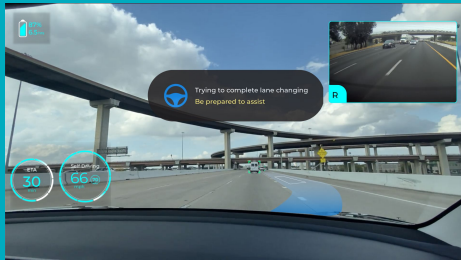
Feedback Input



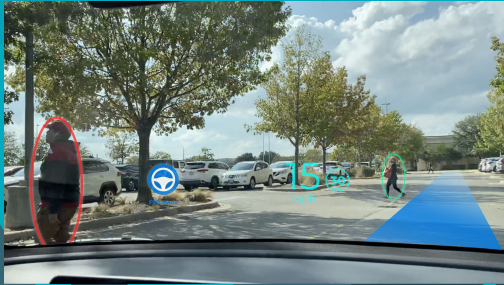
Final Design



Tasks



Task 2 Iteration_ Traffic Recognition



Alert System

FSD Mode

Battery Position

Task 3 Iteration_ AI Misjudging

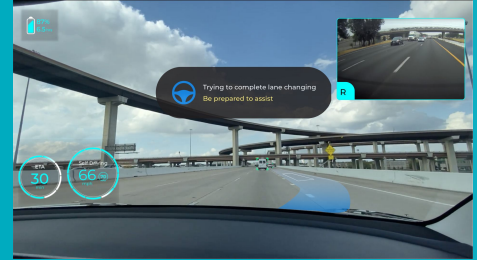


Interaction way

Reaction Time

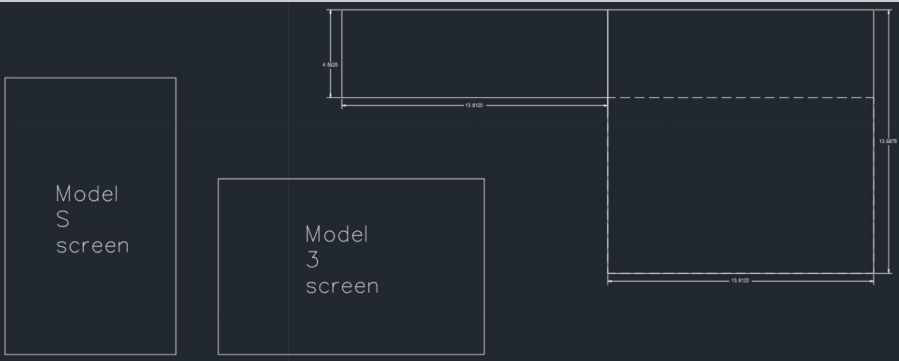
Task 4 Iteration - Auto Lane Changing

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"

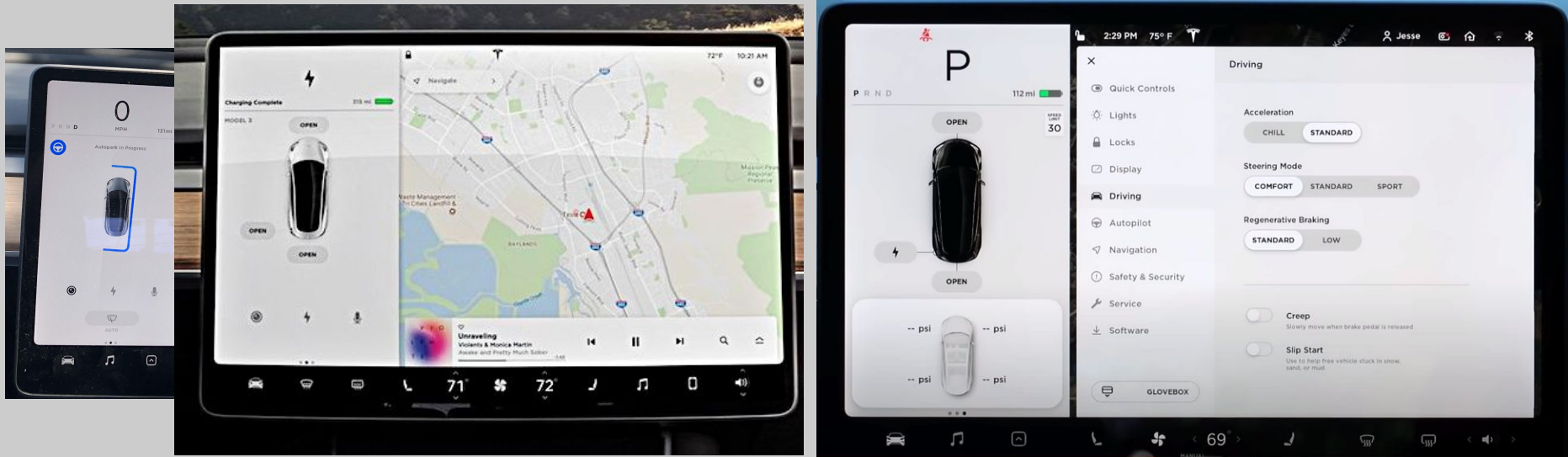
Longest horizontal length 13.812"

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.

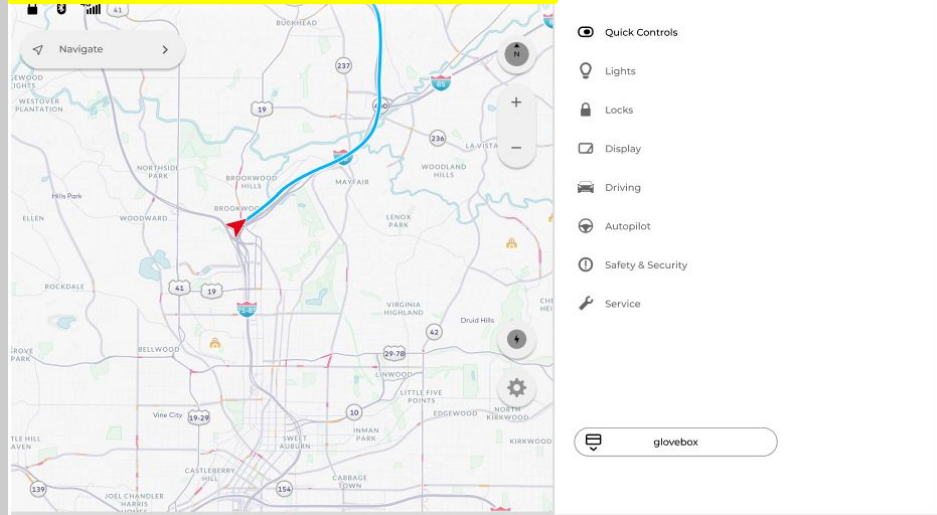


Major Additions:

- 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.

”



AUTOPILOT MODE

ORIGIN: Abcd Efgh 3klm... 25 min
Destination: Abcd Efgh... 12 mi

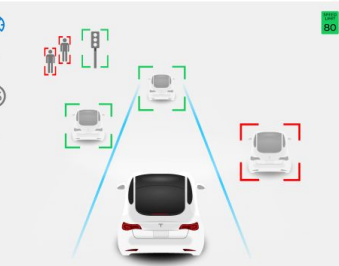
Abcd Efgh Ijkl Mnop Qrst u Vwxy z
Abcd Efgh Ijkl Mnop Qrst u Vwxy z

Accelerate Auto Braking

Low Tire Pressure Auto Lane Changing

Hazard Lights Collision Warning

Door check Window check



17 °C

63
MPH

PRND 90% Changing Complete

Accelerator, Lights, Fan, Horn, Phone, Wipers, Power Windows, Microphone

10:21 AM
WED, Nov 4



Mia & Sebastian's Theme
Justin Hurwitz
La La Land (Original Motion Pic...)

Navigation controls: Play, Pause, Next, Search, Volume

Social media icons: Facebook, WhatsApp, YouTube, Instagram

“

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

Navigation screen showing a map with a blue route and various controls.

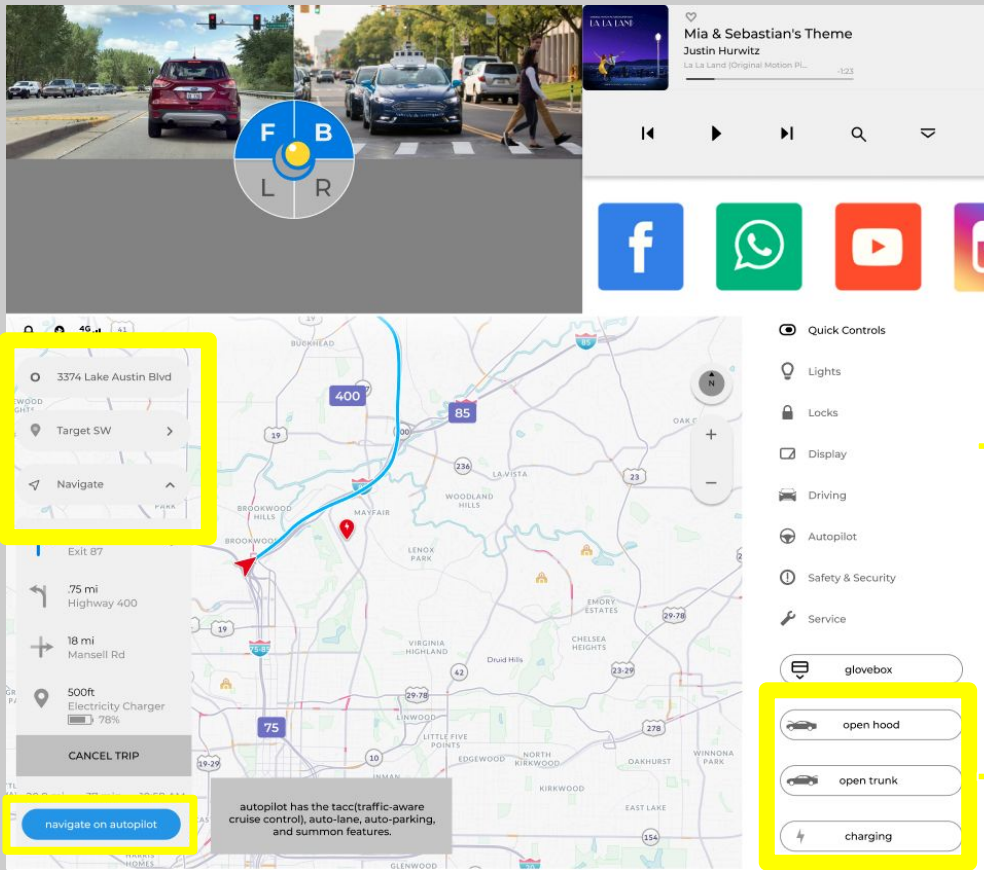
Quick Controls:

- Lights
- Locks
- Display
- Driving
- Autopilot
- Safety & Security
- Service

glovebox

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

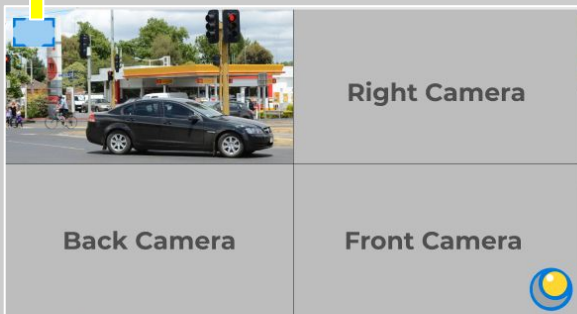
Settings menu
narrowed down
to maximize
navigation map
view

Additional
options added
for frequently
used features

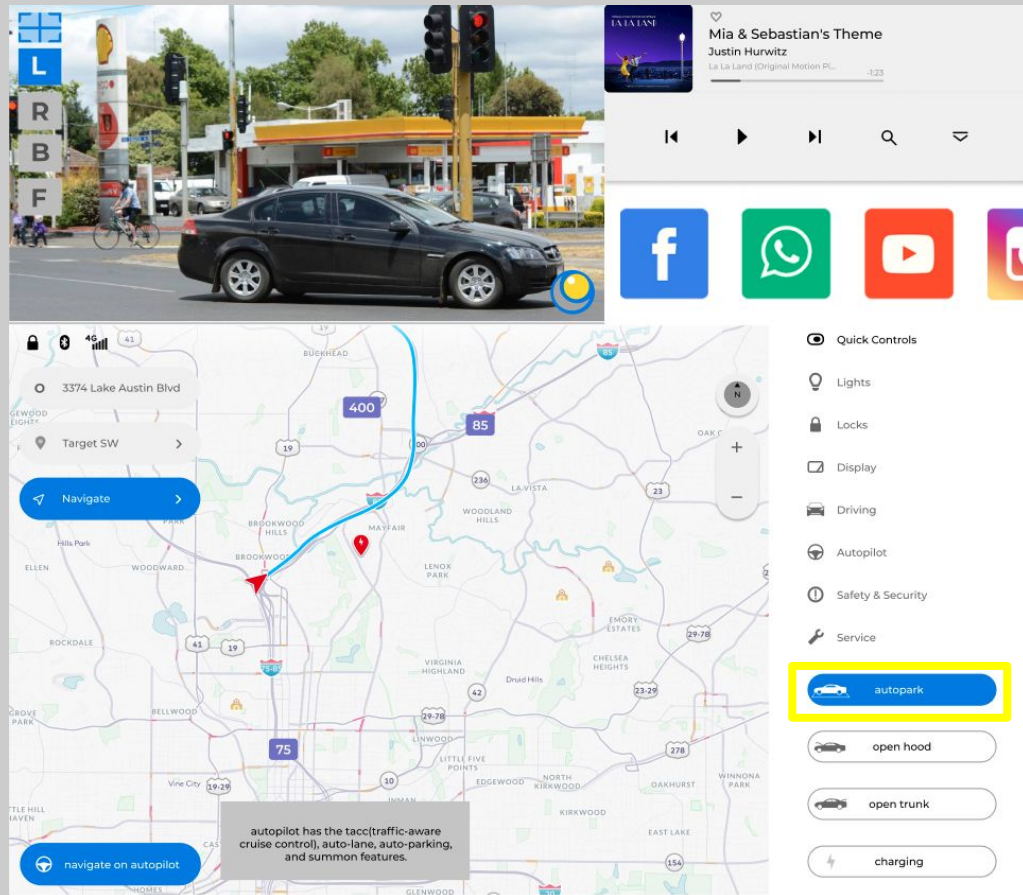
Control Panel (Second Iteration)

-Navigation

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

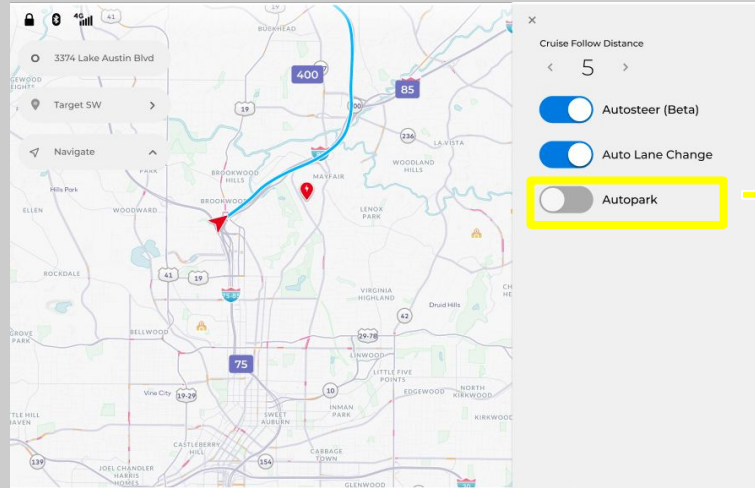
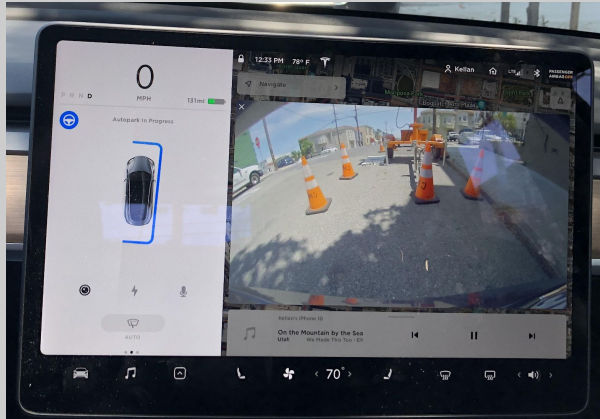


→ The 'glovebox' button was changed to 'autopark' and was linked to the 'navigate on autopilot' option



Control Panel (First Iteration)

-Autoparking

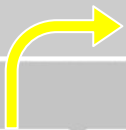


The 'Autopark' option was added on the homepage and included in the 'Autopilot' settings option

→ How Tesla does it

Control Panel (Second Iteration)

-Autoparking



AUTOPARK !

Select Parking space :

- Quick Controls
- Lights
- Locks
- Display
- Driving
- Autopilot
- Safety & Security
- Service

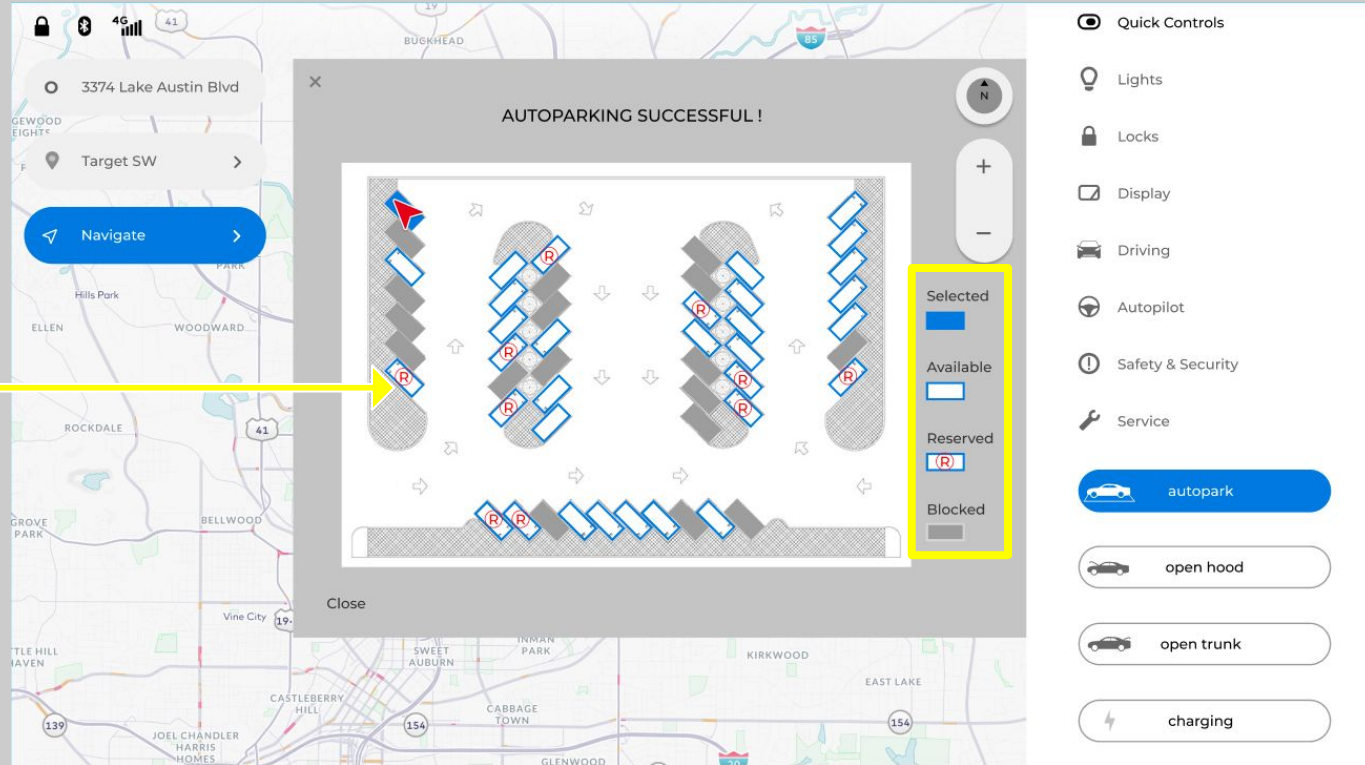
-
-
-
-

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 screenshot displays a trip summary interface. At the top, a grey panel contains the following text: "Total Distance:", "Total Time:", "Total Battery Consumption", and "AutoPilot success / failure: 15 / 2". Below this is a yellow-bordered box with the text "Report to the Tesla?" and two buttons labeled "Yes" and "No".

The main area features a map with a route highlighted in three colors: blue for "Driver", yellow for "TACC Mode", and green for "FSD Mode". A red location pin is placed on the map. A white overlay box titled "Failure 1: Auto-Lane" is positioned over the map, containing the text "Location:", "Suggestion:", and "Feedback: _____". Below this is a "Replay Video" section with a video player interface showing a play button and a progress bar at 5:07 / 11:30.

At the bottom right, a legend identifies the driving modes: "Driver" (blue line), "TACC Mode" (yellow line), and "FSD Mode" (green line).

The recorded camera videos can be viewed after the trip.

Control Panel (Second Iteration)

-Trip Summary

Total Distance:
Total Time:
Total Battery Consumption
AutoPilot success / failure: 15 / 2

Inform Tesla?

Failure 1: Auto-Lane
Location:
Suggestion:

Feedback: _____

Video:

Map Legend:
Driver (Blue line)
TACC Mode (Yellow line)
FSD Mode (Green line)

The screenshot displays a navigation control panel. At the top, it shows trip summary statistics: Total Distance, Total Time, Total Battery Consumption, and AutoPilot success/failure (15/2). Below this is an 'Inform Tesla?' section with 'Yes' and 'No' buttons. A map in the center shows a route with three driving modes: Driver (blue), TACC Mode (yellow), and FSD Mode (green). A red location pin is placed on the TACC Mode segment. To the right, a 'Failure 1: Auto-Lane' section includes fields for Location, Suggestion, and Feedback. Below that is a video player with a play button and a progress bar. A yellow box highlights the 'Update my Tesla History' button, with a yellow arrow pointing to it from the right.

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

Control Panel (Third Iteration)

-Trip Summary

Total Distance:
Total Time:
Total Battery Consumption
AutoPilot success / failure: 15 / 2

Inform Tesla?

Failure 1: Auto-Lane
Location: AAAAAAAAAA

Video:
[Video Player]

Feedback:

Legend:
Driver
TACC Mode
FSD Mode

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

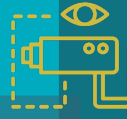
Provide feedback through voice recording/text format as per user convenience

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



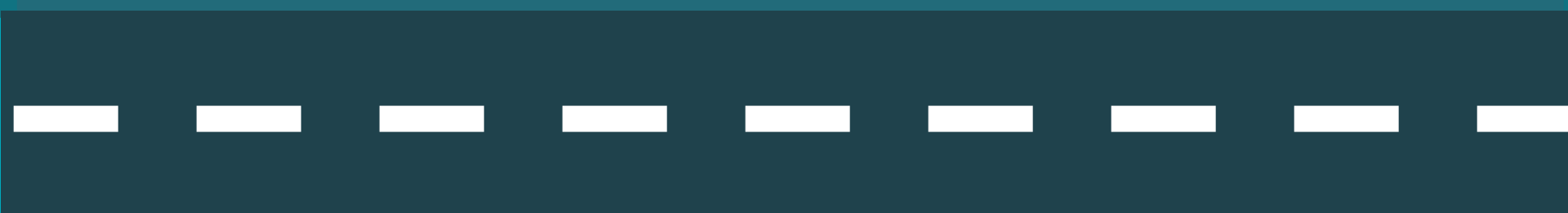
INTERACTION WAY

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

The background features a stylized landscape with a yellow sky and blue ground. A dark blue road with white dashed lines winds from the bottom right towards the top center. Three red circles of increasing size are placed along the road, each connected by a white line to a red text box on the left. The text boxes contain numbered steps and descriptions of the 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

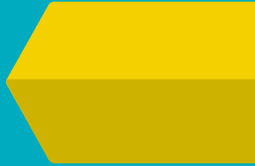
Resources

Intel Survey

<https://newsroom.intel.com/news/latest-intel-study-finds-people-expect-self-driving-cars-common-50-years/#gs.hfp1r>

AAA Insurance Survey

<https://www.wesa.fm/post/aaa-survey-finds-many-dont-trust-driverless-cars-technology#stream/0>



A graphic of a yellow sign with a white center and dark blue text that says "Thank you!". The sign has a grey border and four dark blue dots in the corners. The background is teal with geometric shapes.

Thank you!