

Design Specifications for Auto X

Ride with Uber Autonomous cars

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Project Overview

Context and Background

The era of fully autonomous cars is coming soon. Industry leader, Elon Musk, estimates that fully autonomous vehicles may start appearing on the road with conventional cars as soon as 2025. As companies continue to invest resources into creating self-driving cars, they will eventually become the new standard for everyday people. As the industry starts to shift towards the trend of vehicle automation, new questions arise regarding the implications on other car-related segments, one of those being rideshare companies.

Uber and Lyft have already begun researching how they can potentially change their app models to accommodate autonomous cars, but there is still a lot of aspects that need to be considered. Waymo, a rideshare company working exclusively with autonomous vehicles, has already identified a number of issues with the standard rideshare workflow that need to have creative design solutions to meet the needs of their customers.

Project Summary

Our new phone interface aims to address several major complications that will occur within rideshare apps in the transition between the current workflow and a workflow with an autonomous car. Through in-app tools, people will have several options to help find their car, including a street view to give a point-of-view look from the car's perspective, a button to have the car give several light honks, and a tool to flash the car's headlights. Beyond helping to find the car, this interface will give people information regarding the number of trips the car has completed, a way to share their location with friends and family, and the ability to lock and unlock the car when needed.

Within the car, we've designed an interface that allows the customer to know exactly what the car is seeing. Our sensor view is a real-time screen that constantly updates with every object in proximity to the car. Combined with buttons that allow customers to change their destination, pull the car over, and get help during an emergency, this interface allows enough interaction to help people feel safe while still allowing them to enjoy their ride.

Design Question

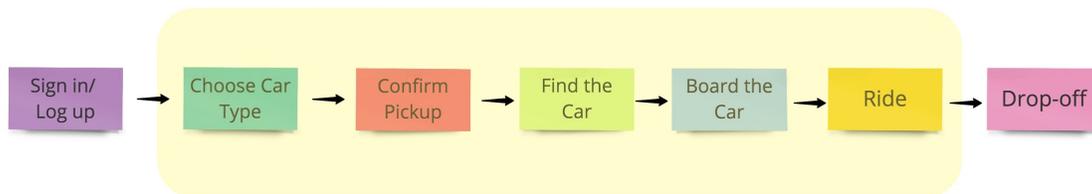
How might we improve the the pick-up and riding experience of passengers with autonomous ride sharing cabs?

Document Audience

Our intended audience for this document are designers and developers in Uber company. The interface we designed matches the look of the current Uber application, and this design specifications could provide research insights for designers who would design the interaction between riders and autonomous ridesharing cars. Also, this document specifies the design rationale information in order to further extend the system by addressing the currently out of scope functionalities. For developers, the document includes UI screens and annotations which specify how to turn the high-fidelity product into a working product.

Project Scope

The scope of this project is to design two separate interfaces to help customers interact with autonomous cars, one for their phone and one for the car's dashboard.



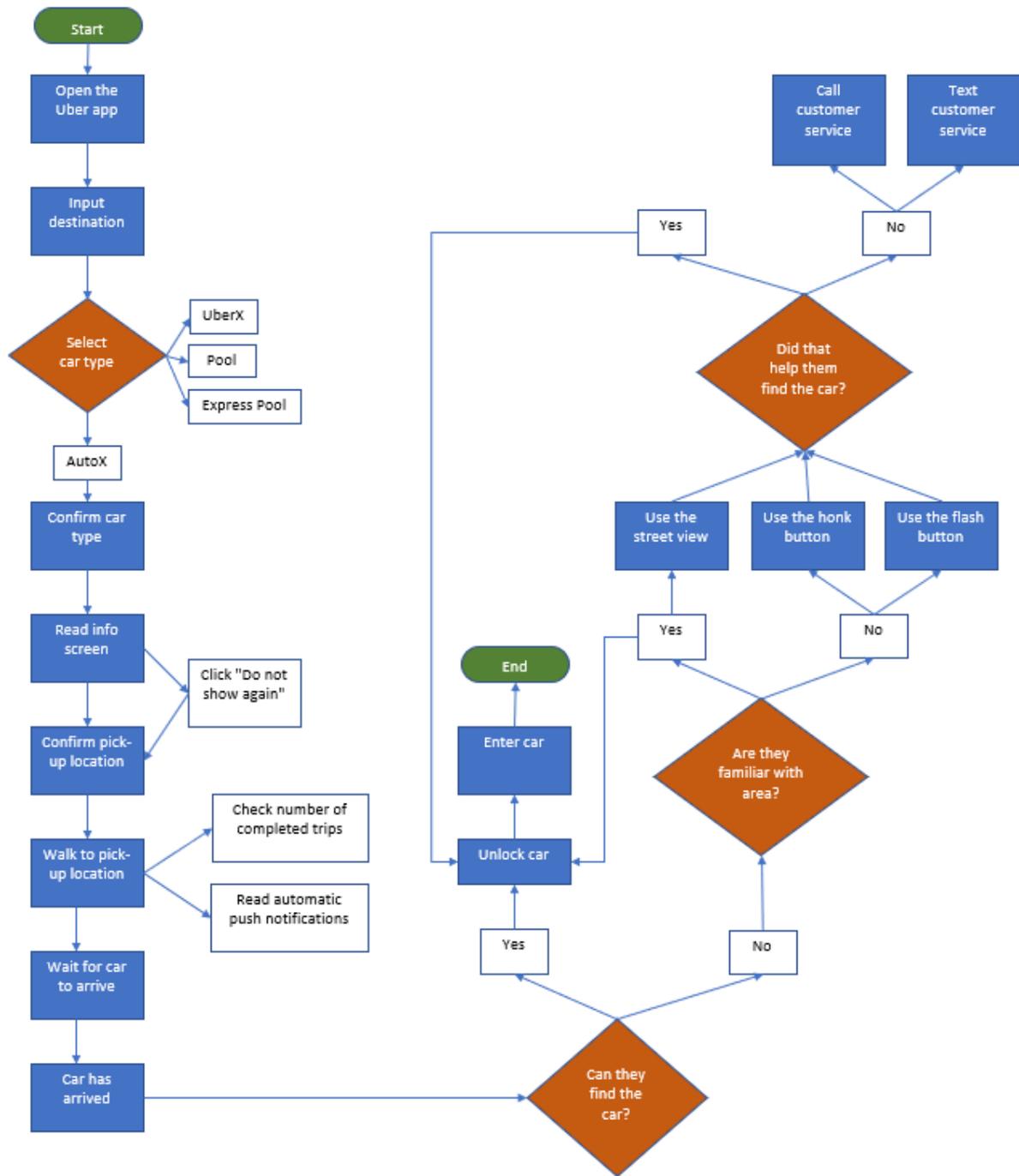
In Scope

- Visual integration with current Uber UI
- Selecting the car type
- Selecting and changing your pick-up location
- Basic instruction on pick-up process
- Push notifications sent to the passenger
- Tools to help find the car during pick-up
- Tools to contact customer service
- Basic car quality controls (music, seat adjustment, climate)

Out of Scope

- Registration Process
- Technical Feasibility
- Marketing Strategy
- Drop-off process

Process Flow



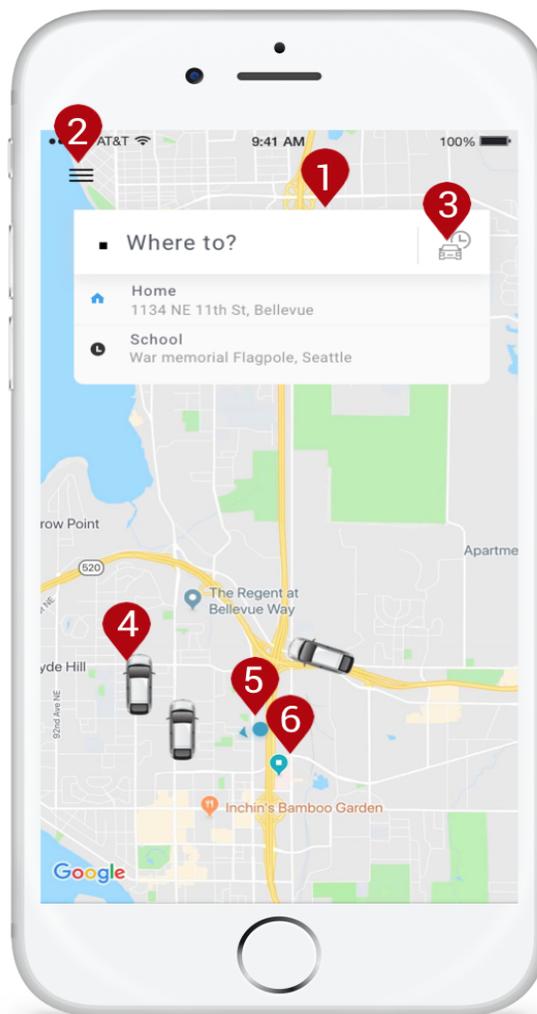
Design Requirements

Choice of Platform

We chose iOS system as our platform for this project, and the user interfaces are designed according to the guidelines of Uber's iOS mobile app.

Annotations for Screens and Interactions

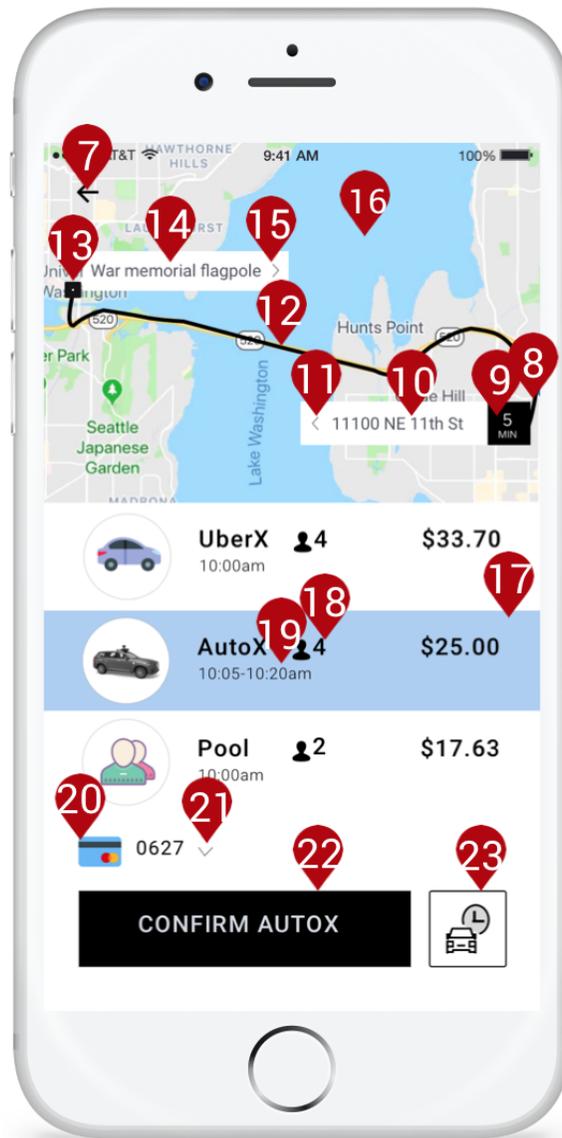
Mobile screen 1: Choose/Enter Destination



Reference	Element	Description	Interaction
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Number			
1	Address entry box	Riders can select/entry their destination	When clicked, transition to address page
2	Hamburger button	Rider's personal menu	When clicked, a personal menu would slide in from the left
3	Time setting button	Riders can book the car according to their schedule	When clicked, "Schedule a ride" menu would appear from the bottom
4	Car icons	Indicating the available cars nearby	N/A
5	Location icon	Indicating rider's current location	N/A
6	Pin	Indicating suggested pickup location	N/A

Mobile screen 2: Select car type and confirm



Reference Number	Element	Description	Interaction
7	Back button	N/A	When clicked, back to previous screen
8	Starting point icon	Indicating the pickup location/start of the trip	N/A
9	Waiting time	Indicating the estimated waiting time for the car to arrive	N/A

10	Pickup address text	Riders can view the address of pickup location	N/A
11	Change pickup location button	Riders can change their pickup location	When clicked, transition back to the address entry/selection screen
12	Path	The visualization of route for this trip	N/A
13	Destination icon	Indicating the destination location/end of the trip	N/A
14	Destination address text	Riders can view the address of destination	N/A
15	Change destination button	Riders can change their destination	When clicked, transition back to the address entry/selection screen
16	Map	Google map of the trip	Move/zoom in/zoom out to see more map details
17	Car type selection box of Auto X	Riders can view the icon of Uber's autonomous car, estimated arrival time, maximum passengers and price of AutoX	When clicked, Auto X would be selected and the text of confirmation button would change into "Confirm AutoX"
18	Numbers of Riders	Indicating the maximum number of riders for AutoX	N/A
19	Arrival time	Indicating estimated arrival time of the trip	N/A
20	Payment icon	Indicating current payment method and last four digit of card number, here it is a Master Card	N/A

		ending with 0627	
21	Payment button	Riders can view their current payment methods, add and change their method of payment	When clicked, transition to the screen of ride profile
22	Confirmation button	Riders can confirm riding with AutoX	When clicked, transition to pickup location confirmation screen or information screen(for new AutoX riders)
23	Time setting button	Riders can book the car according to their schedule	When clicked, "Schedule a ride" menu would appear from the bottom

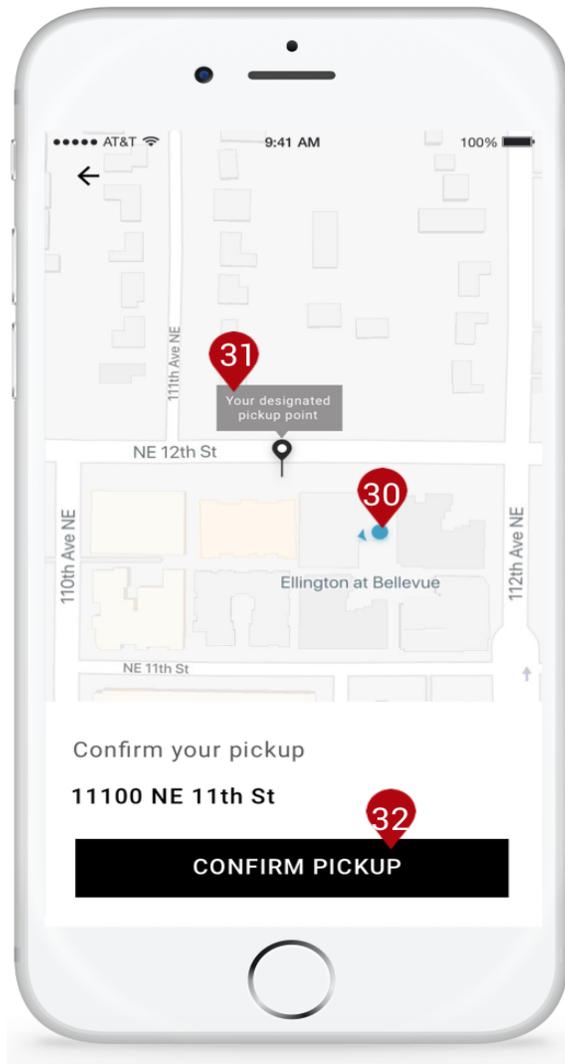
Mobile screen 3: Information screen for first-time AutoX riders



Reference Number	Element	Description	Interaction
24	Welcome text	Welcoming the riders who select AutoX for the first time	N/A
25	Pickup point address	Reminding the new riders to arrive at the pickup location before the car arrives	N/A

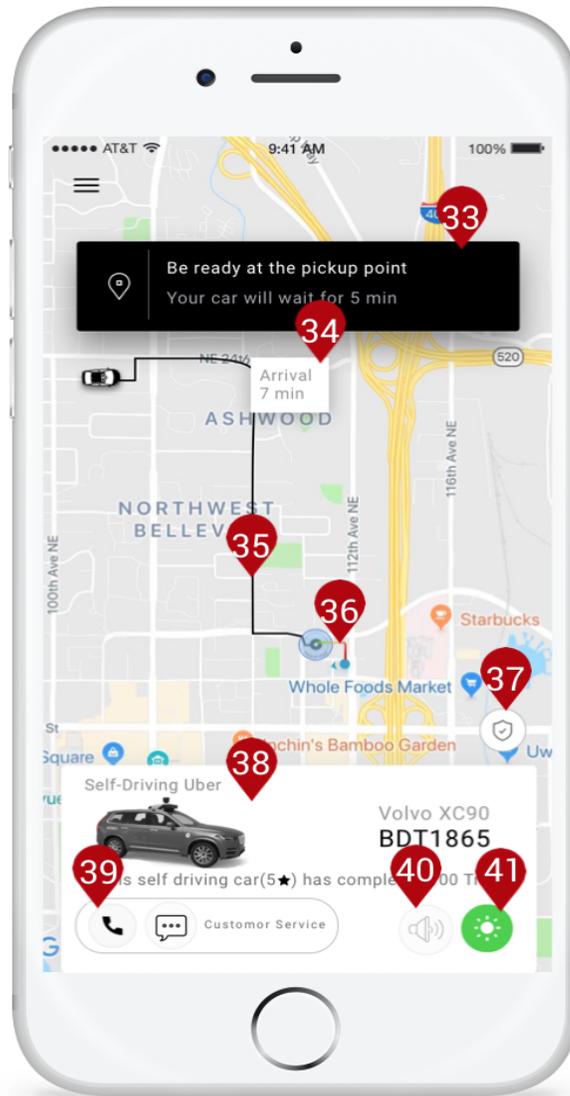
26	Pin	Indication the pickup location	N/A
27	Confirmation button	Riders can press this button after reading all info on this page	When clicked, transition to pickup location confirmation screen
28	Cancellation button	Riders can regret and cancel the trip, or reselect other types	When clicked, transition to car types selection screen
29	Selection button	Riders can skip this screen in their future trips with AutoX	When selected, this screen will never appear to this rider again

Mobile screen 4: Confirm pickup



Reference Number	Element	Description	Interaction
30	Location icon	Indicating current location of the rider	N/A
31	Pick-up point pin	Indicating location of the pickup point, riders can move the pin to change the pickup point	When moved, the pickup address below would be automatically changed
32	Confirmation button	Riders can confirm pickup if the location is correct	When clicked, transition to trip info screen

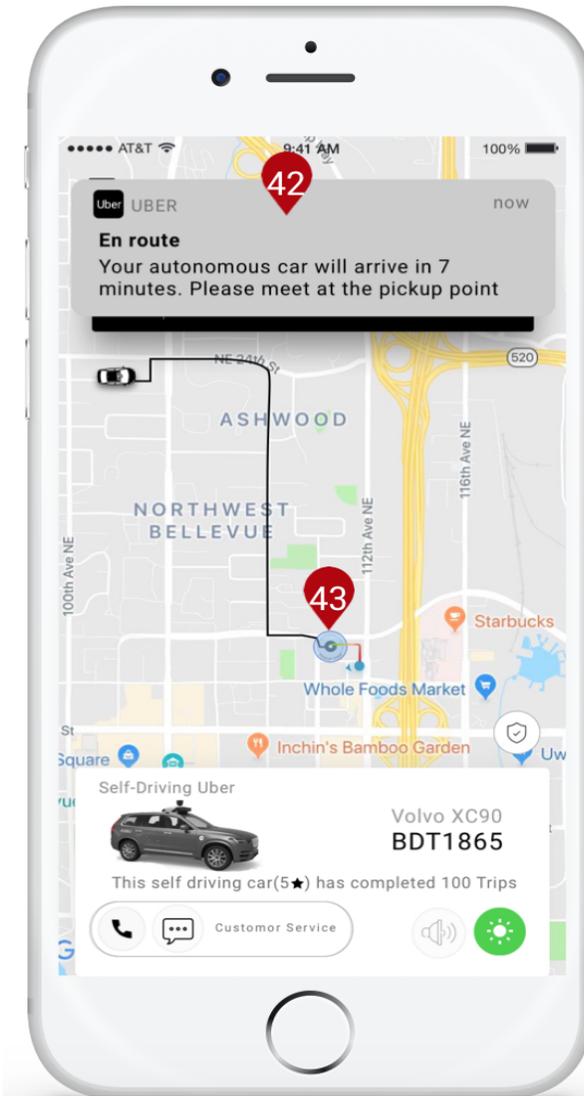
Mobile screen 5: Wait for the car-the car is coming now



Reference Number	Element	Description	Interaction
33	Status box	Reminding riders to move to the pickup spot	N/A
34	Time box	Riders would know how long they need to wait for the car	N/A
35	Path	Visualization of the route which the car is taking from their current location	N/A

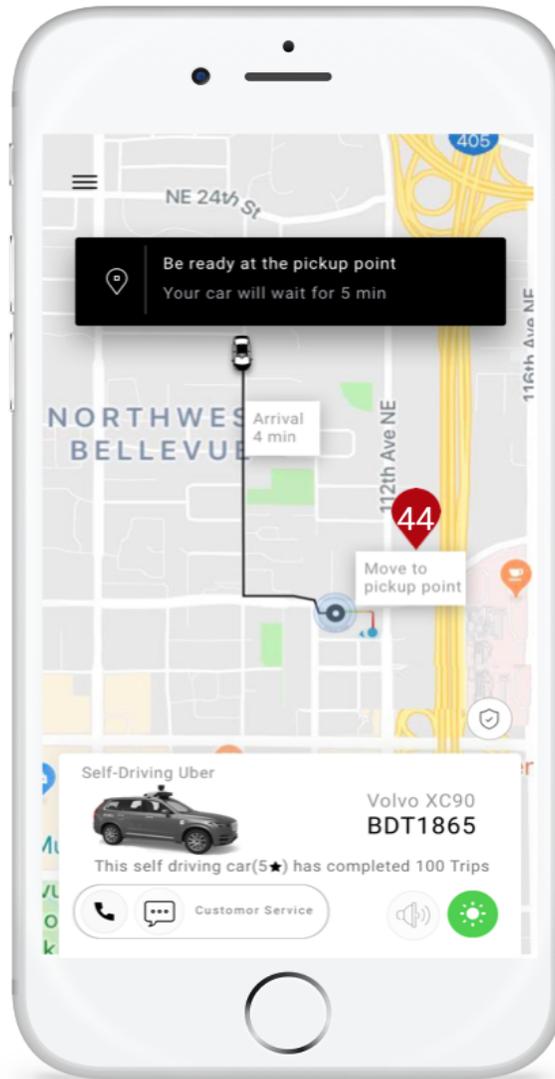
		to the pickup point	
36	Navigation line	Red color gradient UI will guide the user to move to the pick up point	N/A
37	Safety Toolkit Button	Riders can share the ride with others or call 911 for assistance in case of emergency	When clicked, the safety toolkit menu would appear from the bottom of the screen
38	Car info box	Riders can view the general information of the coming car, including car type, car plate number, picture, rating and how many successful trips it has completed	N/A
39	Customer service button	Riders can call or text the local customer service team if they have problems/concerns	When clicked, transition to customer services contact screen
40	Horn button	Riders can press this button to make honking sound of the car, so it would be easier for them to locate the car (function as the car key). Disabled before the car arrives	Nothing would happen when the button is disabled. When clicked at the time of car arrival, the car would make the honking sound
41	Light button	Riders can press this button to change the light color on the fore window of the car. It is helpful especially at night when it's dark outside	When clicked, a color selection menu will appear from the bottom of the screen

Mobile screen 6: Wait for the car with notification(s)



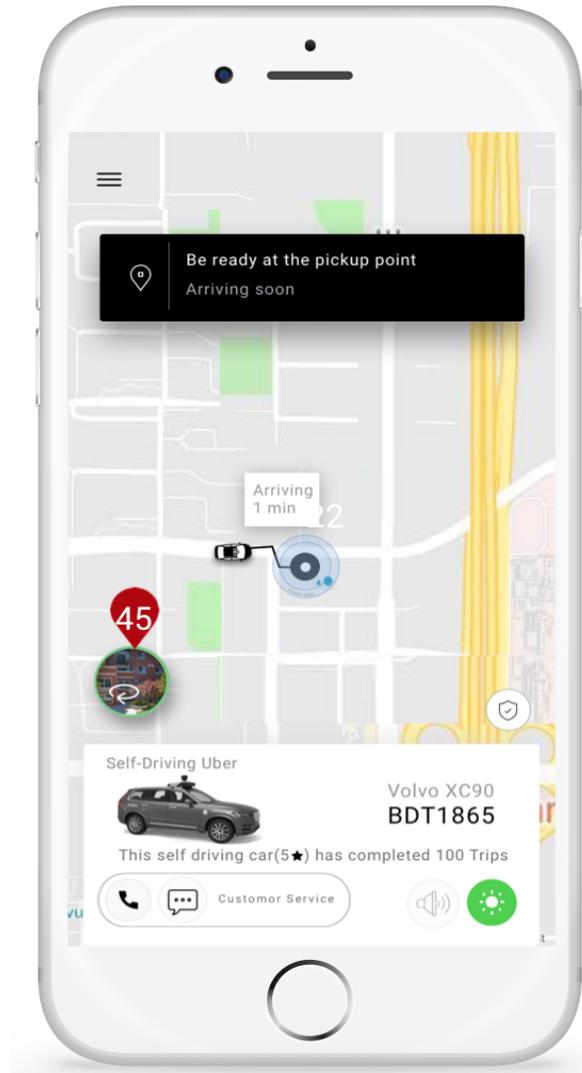
Reference Number	Element	Description	Interaction
42	Drop-down notification	Informing the passenger about the current status of the car, the notification appears when the car starts, when the car is 2 min away and 1 min away	N/A
43	Pickup zone	Indicating that customer should wait for the car in this zone	N/A

Mobile screen 7: Wait for the car - the car is on its way



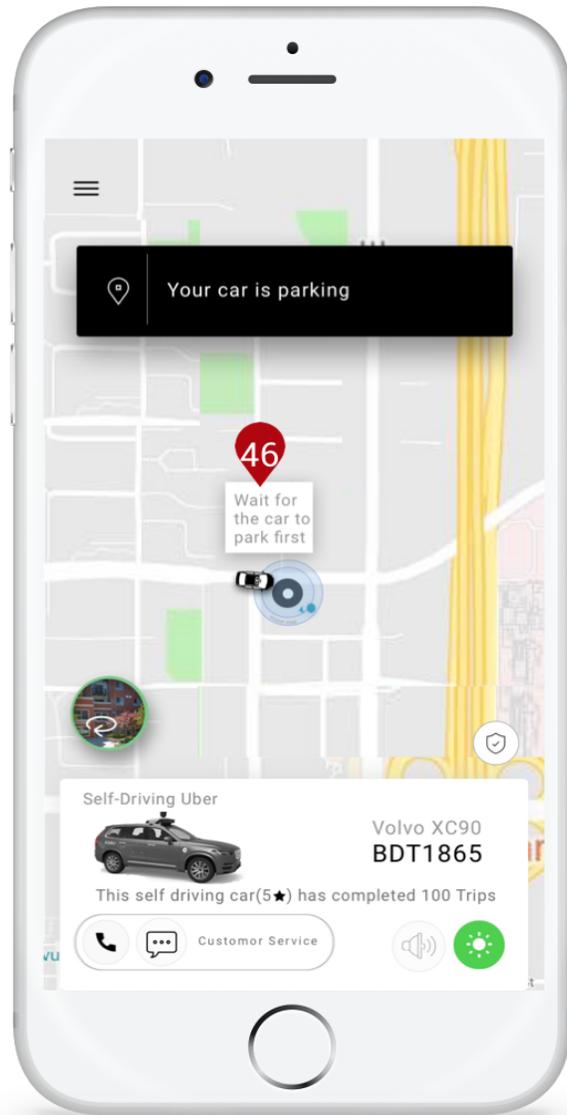
Reference Number	Element	Description	Interaction
44	Notification box	Notifying the riders to move to the pickup point	N/A

Mobile screen 8: Wait for the car - the car is arriving soon



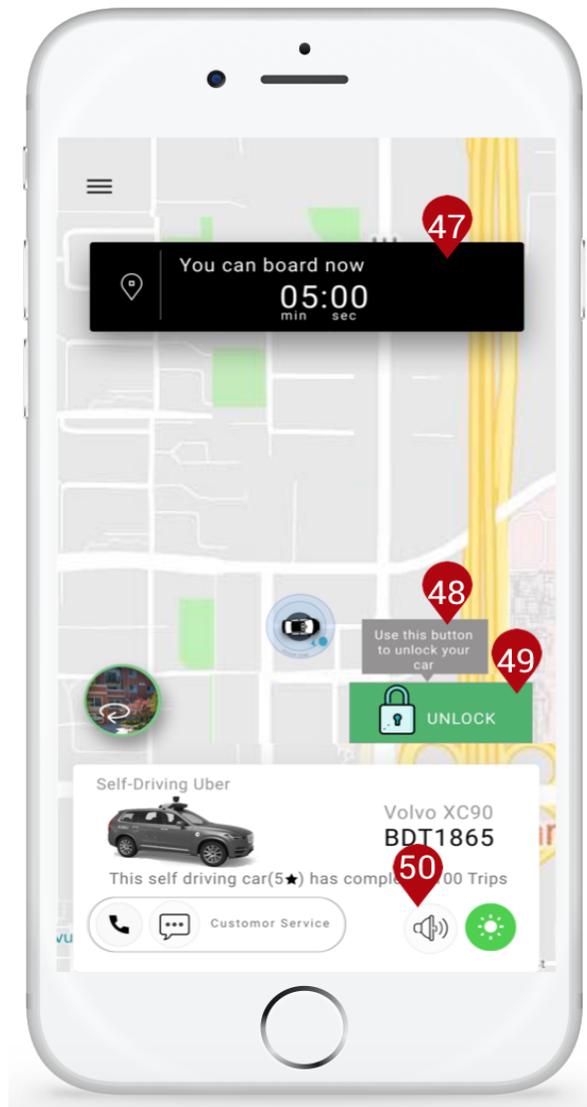
Reference Number	Element	Description	Interaction
45	Street View button	Showing the real time street view of the car, riders could see the surroundings of the car to better locate it	When clicked, transition to street view screen

Mobile screen 9: The car is parking



Reference Number	Element	Description	Interaction
46	Notification box	Notifying the rider to wait for the car to park itself first	N/A

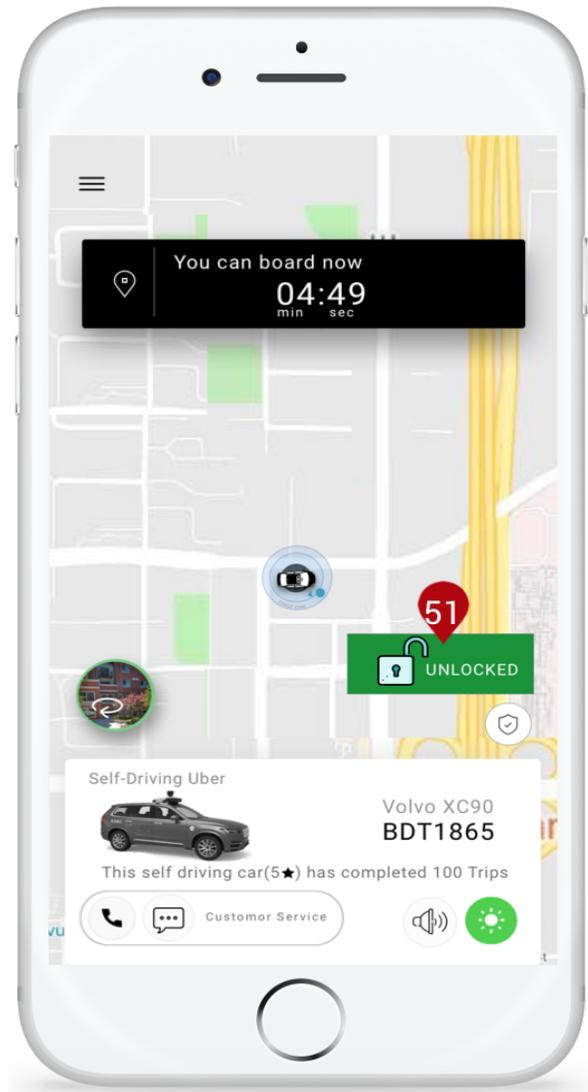
Mobile screen 10: Unlock and board the car



Reference Number	Element	Description	Interaction
47	Timer	Counting down for 5 minutes, informing the riders they will have 5 mins to board the car	N/A
48	Notification box	Notify the riders to use unlock button to unlock the car	N/A
49	Unlock button	Riders can unlock the car by themselves by pressing this button	When clicked, the button would change into

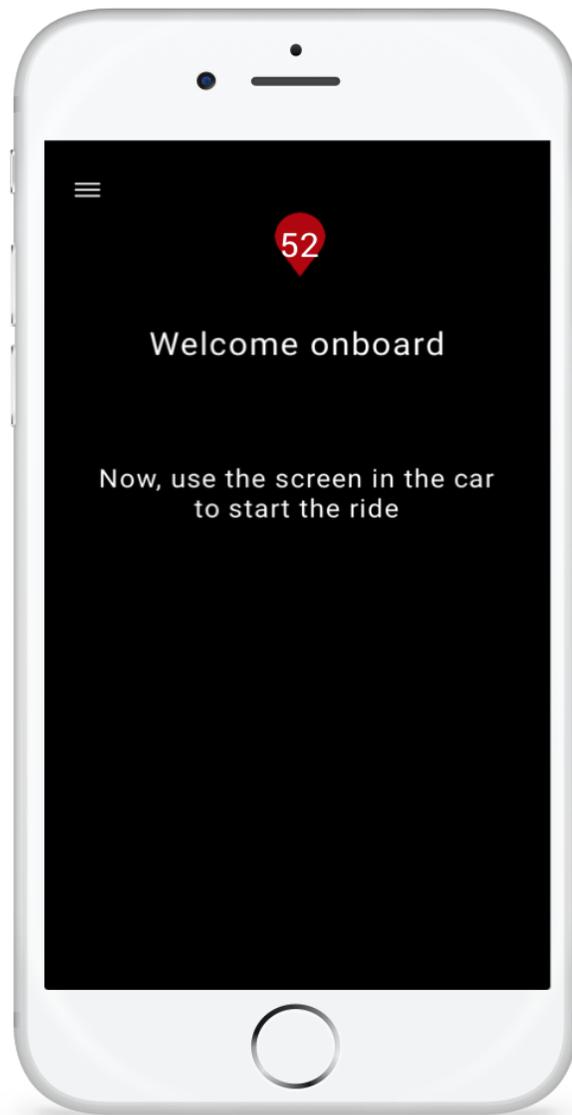
			“unlocked” status and the car door will be opened
50	Horn button	Riders can press this button to make the car have the honking sound so it would be easier to locate the car. Since the car has already arrived, this button is enabled.	When clicked, the car would make the honking sound.

Mobile screen 11: The car is unlocked, board the car



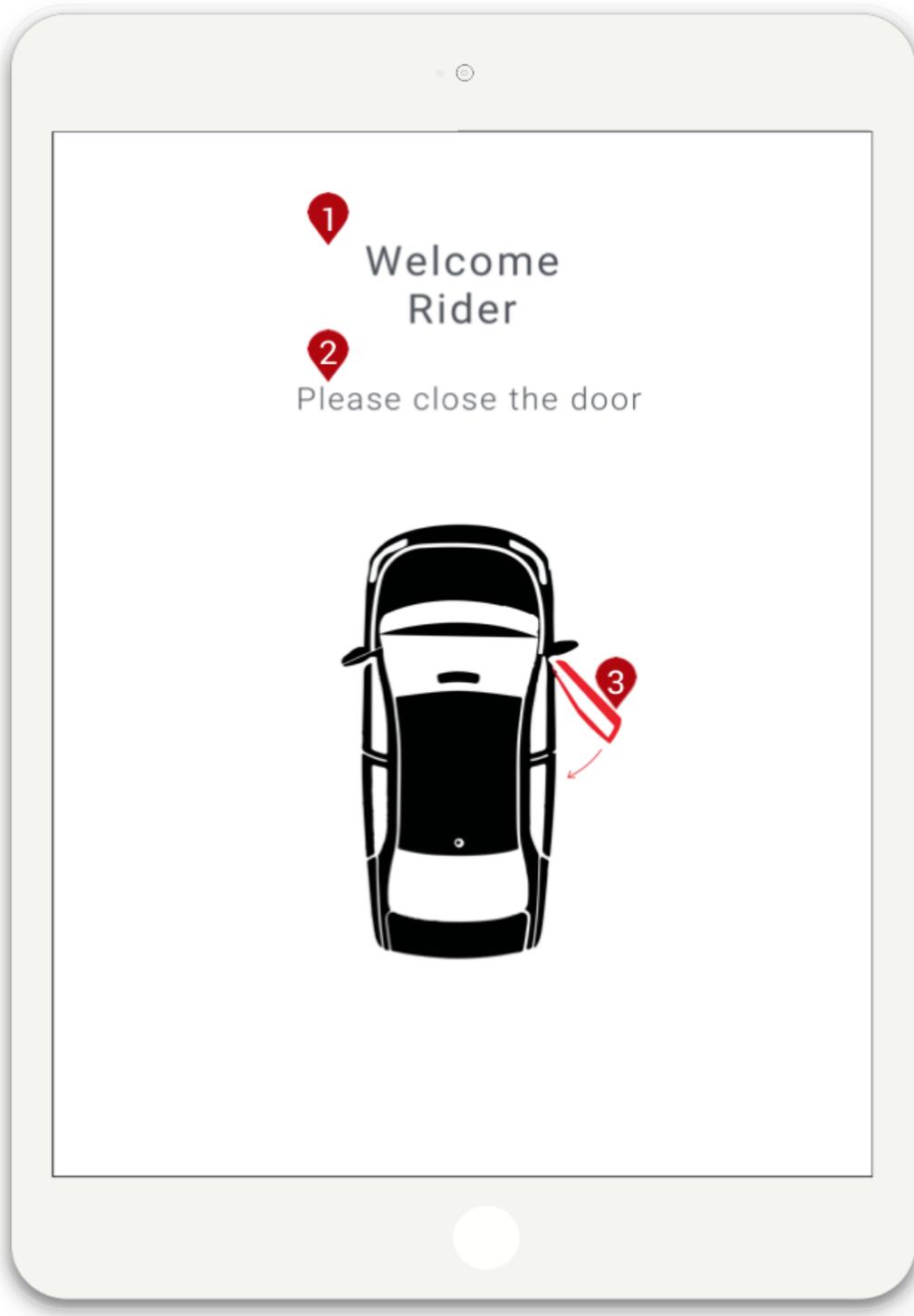
Reference Number	Element	Description	Interaction
51	Unlocked button	Indicating the car has already been unlocked	N/A

Mobile screen 12: Notify the riders to use car dashboard to start the ride



Reference Number	Element	Description	Interaction
52	Notification screen	Informing the riders to use the car dashboard to start the ride	N/A

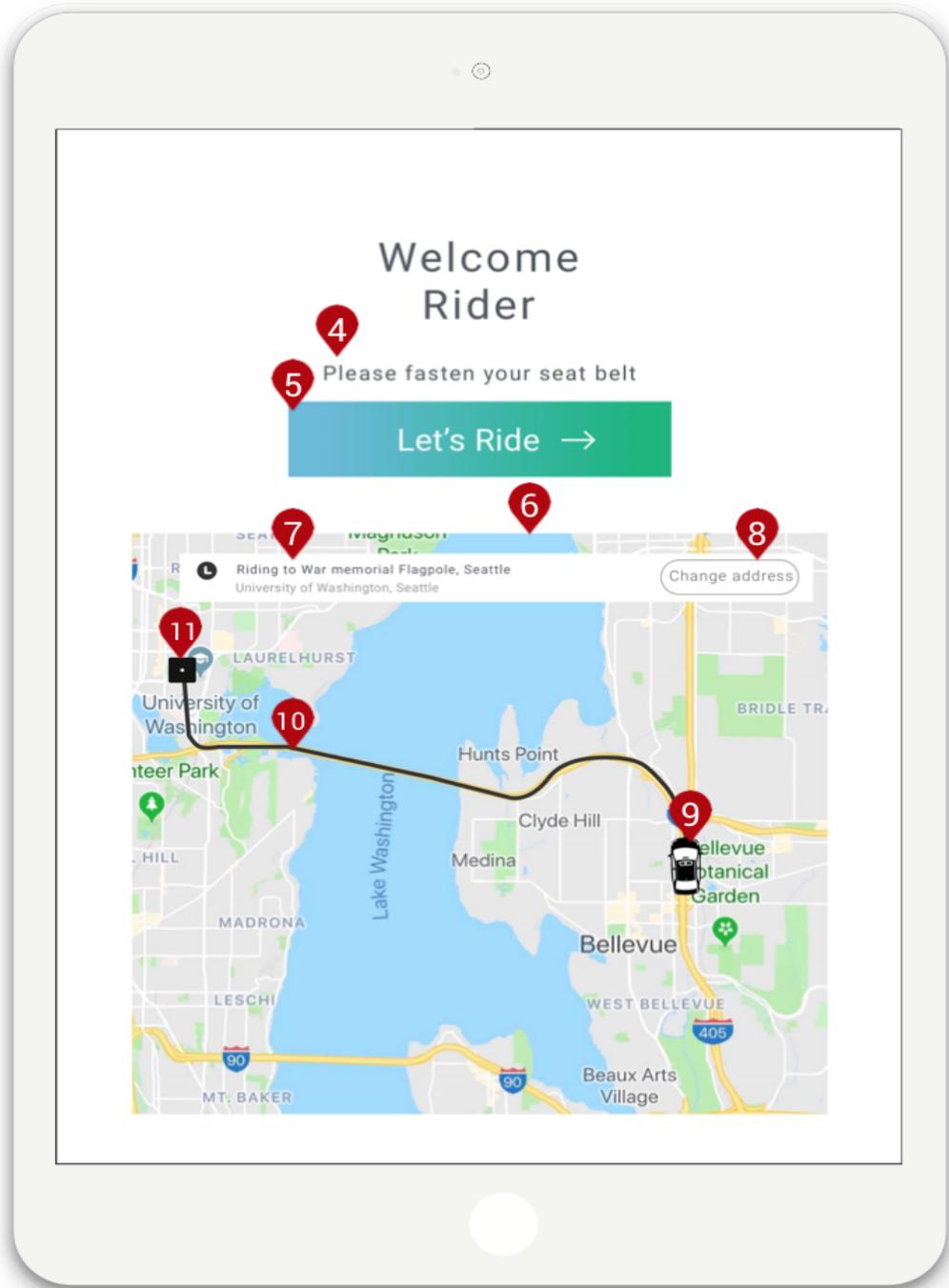
Car dashboard 1: Welcome the rider



Reference Number	Element	Description	Interaction
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1	Introductory text	Welcome the rider onboard	N/A
2	Reminding text	Reminding the rider to close the door	N/A
3	Animation of closing the car door	Reminding the rider to close the door	N/A

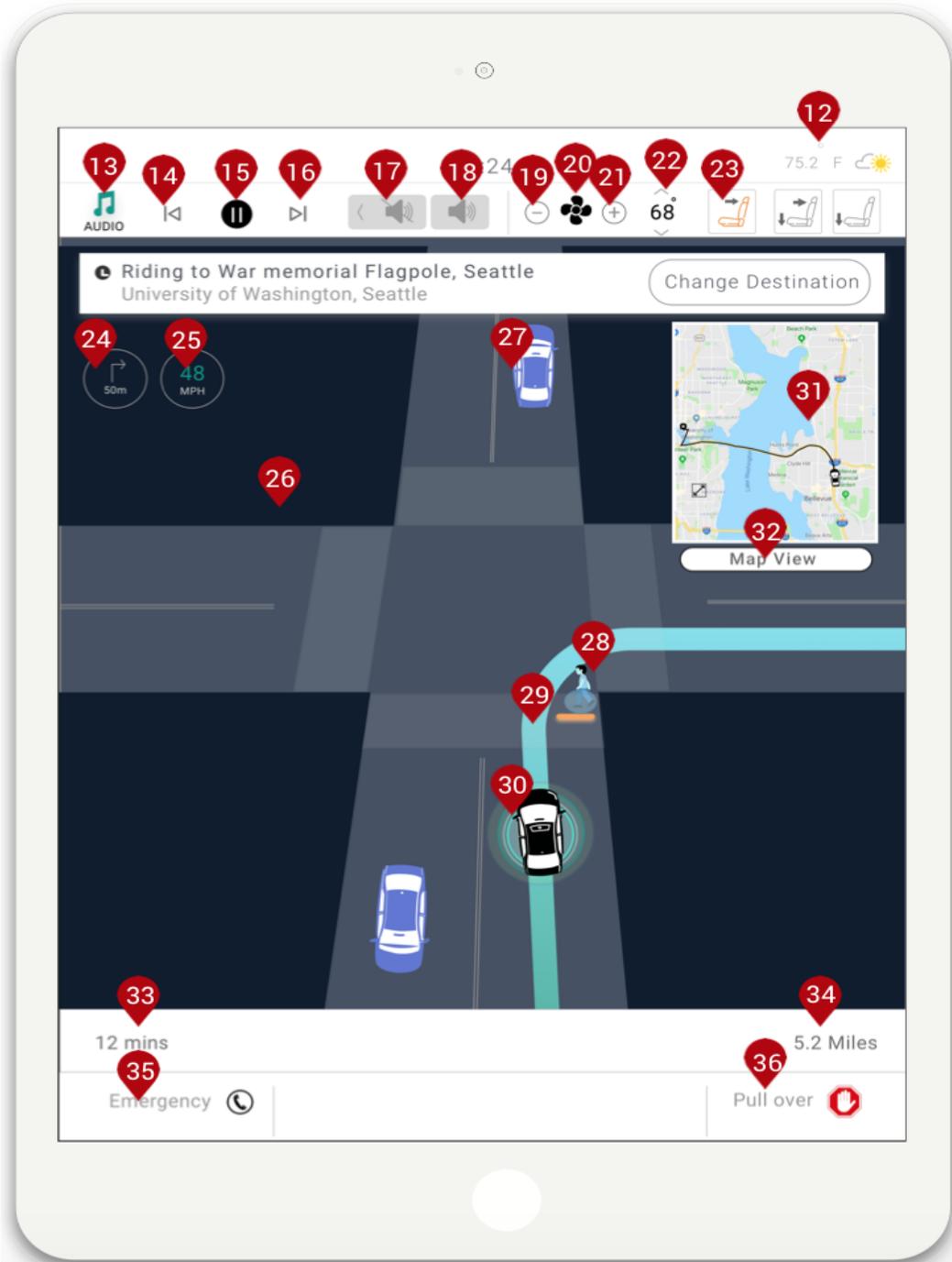
Car dashboard 2: Start the ride



Reference Number	Element	Description	Interaction
4	Reminding text	Reminding the rider to close the door	N/A

5	Starting button	Riders can start the ride by pressing this button	When clicked, transition to the riding screen
6	Map	Google map or Uber map of the trip	N/A
7	Destination	Riders can view the address of their destination	N/A
8	Changing address button	Riders can change their destination during the ride	When clicked, transition back to the address entry/selection screen
9	Car icon	Showing the current location of the car	N/A
10	Path	Visualization of the route of the trip	N/A
11	Destination icon	Showing the location of destination on the map	N/A

Car dashboard 3: In the middle of the ride

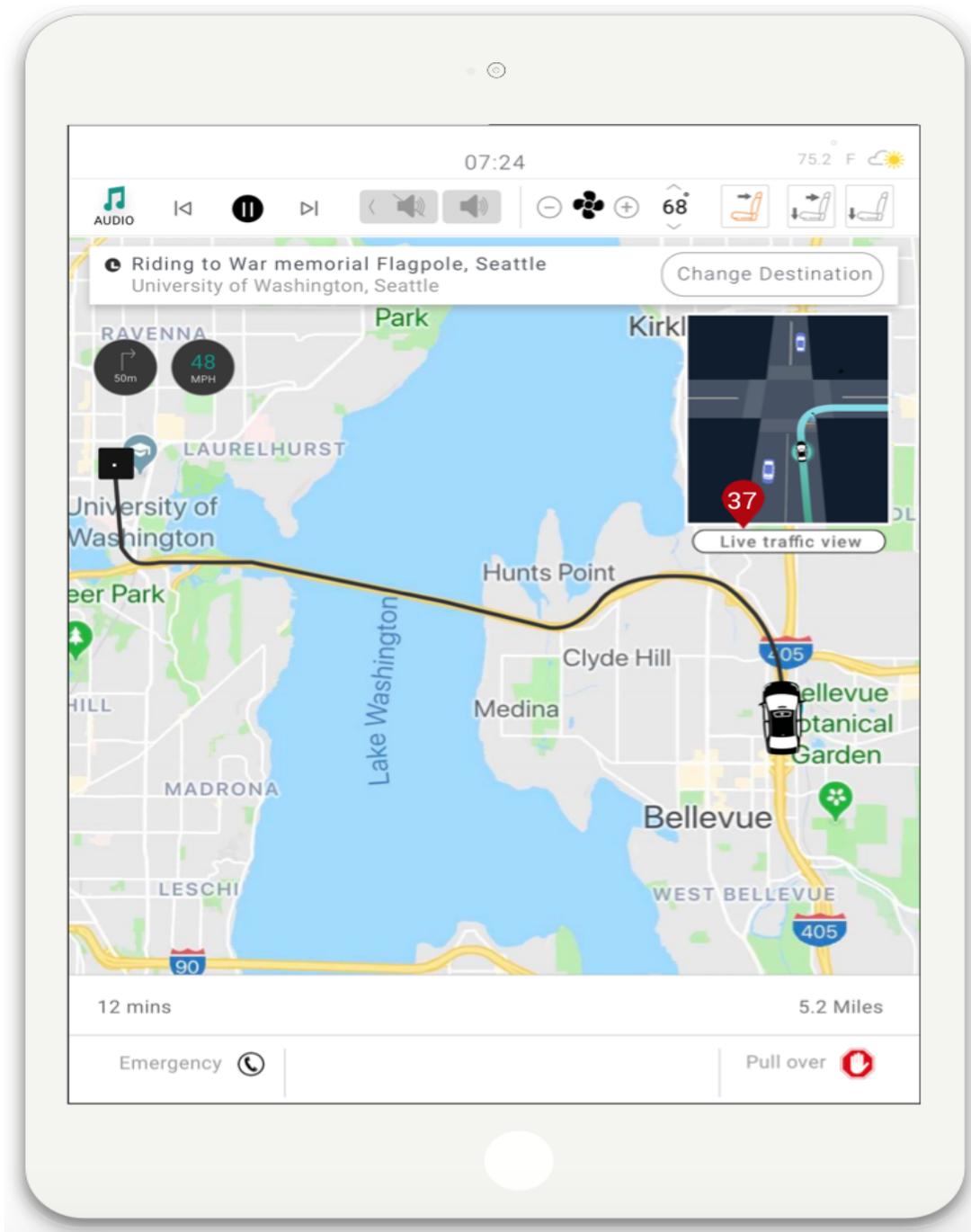


Reference Number	Element	Description	Interaction
12	Weather info	Showing the current temperature and weather	N/A

13	Audio icon	N/A	N/A
14	Back button	N/A	When clicked, go back to previous music
15	Stop button	N/A	When clicked, the music would stop
16	Next button	N/A	When clicked, go to next music
17	Silent mood button	Riders can choose/unchoose silent mood	Click to select/unselect silent mood
18	Volume button	Riders can set the volume of the audio	Click to move the volume up or down
19	Slow down button	N/A	Click to slow the fan down
20	Fan icon	N/A	N/A
21	Speed up button	N/A	Click to speed the fan up
22	Temperature adjustment button	Riders can adjust the temperature inside the car	Click to change the temperature inside the car
23	Seat adjustment button	Riders can adjust their seats using the car dashboard	Click to adjust the seat
24	Navigation circle	Showing direction and navigation	N/A
25	Speed circle	Showing current speed of the car	N/A
26	Map	Live traffic view, colors encode surroundings in real time	N/A
27	Car icon	Indicating there is a car in this location, encoded in purple color	N/A

		here	
28	People icon	Indicating there is a person in this location, encoded in green color here	N/A
29	Path	Visualization of the route the car is taking right now	N/A
30	Car icon	Indicating current location and movement of the autonomous car	N/A
31	Map	Normal map view of the trip, including car location, route and destination	N/A
32	Toggle button	Riders can swap between different views on the main dashboard	Click to switch to the map view
33	Explanatory text	Remaining minutes of the trip	N/A
34	Explanatory text	Remaining miles of the trip	N/A
35	Emergency button	Riders could press this button in case of emergency such as car accidents	Press to call customer service or 911
36	Pull-over button	Riders could press this button if they want to stop the trip and leave in the middle of the trip	Press to pull over

Car dashboard 4: In the middle of the ride



Reference Number	Element	Description	Interaction
37	Toggle button	Riders can swap between different views on the main dashboard	Press to switch to live traffic view

Design Rationale

Research on the problems and interaction with users informed our design decisions through the entire development of the product. Below we describe 4 major design decisions and the design rationales behind them.

Mobile App + Car Dashboards

As soon as we settled on that we want to incorporate our autonomous experience into Uber, we decided to have a mobile app functionality. We used many data and resources from Uber to have the valid reasons to install the app because it was convenient and efficient. However, we struggled to finalize the design for car dashboards to be also incorporated while the passengers are in the car. The reasons that we want to have the standard and default car dashboards to be installed are that first we do not want the users to mess around with the car dashboards themselves, therefore we want to have us to better help and communicate the users. Secondly, we could better use the car dashboards to advertise and market any products to earn profit.

There are two car dashboards installed in the car. One in the front and one in the back. Users are able to sit anywhere in the car to be able to interact with the car dashboard. If there is a group of people, (please note that we are only designing for one passenger or a group of passenger riding together, not Uberpool), the interactive dashboard should be the one that is been interacted the first, and the other one is for display purpose only.

Locating the Car

The reason that we value the ease of locating the car is that during the research, locating the car is our most significant problems to solve. With the survey sent out about the current Uber experience, most of people indicated that they would call the driver in person to find where he/she is. While for autonomous cars, users are not able to phone the driver, we designed three other approaches to let the users to locate the car.

After the autonomous car is safely parked, there is a 3D street view function for users to tab on. It gives users the option to view in the street view where the car is located at. Besides the

actual map, we want to aware users where the car is located at in real scenarios. This feature could benefit users who struggle with the maps and navigations.

In AutoX , we also support honk and light functions. At the bottom of the mobile app interface, users are able to tab on the honk icon to let the car make sound and tab on the light icon to let the car flash. These are the existing functions in the current automobile systems to let the drivers easily locate their parked car. We designed to incorporate these functions as they are already familiar with the users and they are quick and easy ways to locate the car.

There is also additional support from the customer support. For any non-emergency situations, for example, locating the car, if users want to speak with real people for help, they could either tab on the phone icon to speak with them or type in the message box to chat with customer service.

Lock and Unlock

On the mobile application, as the car is parked, there is a unlock button for users to unlock the autonomous car to get in. We had many considerations in to the boarding experience. We brainstormed of scanning QR code, automatically unlocked as the users approach to the car and so on. Finally we settled down on the unlock button because it is safe for users to interact on their phone to control it. Second, it is a clear experience flow for users to get on board. After users tab on unlock button, then the system will show the count down message on top to let the users know that they have 5 minutes to board. Also the unlock button will now be unlocked for reference.

After the users get into the car, the system will inform the users to gently close the door and the car will automatically lock itself and have the lock sound to ensure the users that they are ready to go.

Safety

Safety is another important issue we considered during the project. There are two main reasons for it. The first is to consider the safety of autonomous car technology itself. Second is to consider how safe users feel during the entire ride.

Considering the safety issue that users care the most, we added the real-time car information system on the car dashboards. In the interface, users are able to see the real-time traffic next to the autonomous cars, for example, the system could indicate and then detect on the interface that there is a car next to us or there are passengers crossing over. The reason we added this is that we want to ensure the users that the autonomous cars understand and is taking actions based on the surroundings. It is safe to ride with autonomous cars and they can take you to the destination safely.

In terms of emergencies that regarding to the users, we added the safety toolkit on the mobile application to let users share their location with family members and friends or call 911 if there is any emergency. On the car dashboards, we also have an emergency button and a pull over button on the bottom to give users options to do in case of emergencies.

Future Considerations

During the research, one of the most significant problems that we found from the users was the troublesome of finding and locating the cars. It is already painful sometimes for users to find the car, not to say the automatic cars with no drivers. Therefore, besides all of the supportive features to locate the cars we have right now, we want to explore in the future if Augmented Reality (AR) could help people navigate to the cars. The new AR technology will need more research and usability sessions to review the new designs.

We also want to consider the interactions between the autonomous car and the riders while they are on board. Since there is no drivers to communicate with in person. We also want to consider and explore Voice Interaction, for example chatbot, to support and bring in harmonization and delights to the users.

For every product that we design for, we want to incorporate inclusive design. Due to the limited time of this project, we did not put our effort into consideration of inclusive design for all users for both mobile app and car dashboards. Therefore, in the future we want to solve the accessibility issues for users.

Picking up experience is only one part of the AutoX. In the future, we want to also explore the ways in all of other experiences, such as drop-off experience to ensure the riders to actually get off the car and do not stay in the car after the ride.

Since Uber is a profitable company, we, as a UX team have to collaborate with the marketing and product managers to explore the best way to advertise and market our product while not decreasing user experience.

Appendix

Persona

Primary Persona

"I want to get home safe and fast after late night parties with my friends."



Name Mark Johnson
Age 27
Profession UX Researcher
Location Redmond, Washington
Technical background -Have sufficient research background on autonomous cars.
-Proficient with phones softwares

Biography
Mark is a UX researcher working at Microsoft. Mark loves to go to bars after work every Friday. He wants to enjoy the time with his friends and have fun. Therefore, he has to call for an Uber after hanging out with friends. However, sometimes he has troubles finding the cars in the late night. Navigating through phones by calling and texting the driver late at night does not work very well for Mark. Therefore Mark is in need for a more convenient approach of locating the driver.

Scenario
After a good time with friends at night in a bar, Mark calls an Uber to get home. As usual, he gets onto the Uber car and greets the driver. When Mark almost gets home, he asks the driver to stop at a Safeway which is close to his home because he just realized that he wants to get decorations for Halloween. He likes the flexibility to be able to change the drop point when possible.

Pain points
Having trouble finding the drivers through phones at night
Drivers detoured without notifying him

Goals
Getting home safe late at night
Getting picked up with no hassle
Being able to adjust the address if necessary

Reasons for riding with autonomous car
He feels safer when riding with semi-autonomous cars and thinks the ride sharing experience could be better with autonomous cars.

Concerns with autonomous car
He is worried that he can't change the drop off address, while there is no driver.

Secondary Persona

" Ride-sharing is so convenient that I don't have to waste time on bus while I don't drive."



Name Vivian Lam
Age 22
Profession Student
Location Issaquah, Washington
Technical background Quite tech-savvy;
Avid user of emerging technology

Biography
Vivian is a graduate student of University of Washington and lives in Issaquah, WA. Her schedule is very full and doesn't want to waste time on waiting for a bus. She also doesn't like to drive as her sense of direction is poor and it is not easy for parking sometimes. As it rains quite a lot in Seattle, it is more comfortable to use ridesharing apps to call a car instead of walking in the rain to bus station.

Scenarios
Calls an Uber to go to school in the late afternoon and don't want to be late for class. She uses ride-sharing taxi during rainy weather as well

Pain Points
Have trouble finding the car often, especially at night
The driver arrives at the wrong pickup location
Not very patient to call or text the driver to describe the location

Goals
Arrive at the destination as fast as possible
Arrive home and school safely

Reasons for riding with autonomous car
Don't want to drive, but want to have the first-hand fresh experience riding with the driverless car

Concerns with autonomous car
Needs more evidence that the car is safe for ride

Tertiary Persona

" I want to go to the airport based on my own time schedule, I don't want to wait for a bus or find a taxi on the street "



Name Samuel Walters
Age 35
Profession Software Engineer
Location Seattle
Technical background Early technology adopter
Expert in algorithms and machine learning
Tech-Savvy

Biography

Samuel is a Software Engineer at Microsoft. His home is close to a lot of stores, restaurants, and is only 5 minutes away from his office, so he's never felt the need to own a car. However, he has team members in Chicago and New York, and needs to meet them every two months. For this long-distance travel, he usually calls an Uber to the airport because the company will reimburse the fees. He finds the convenience of having a car to himself, particularly having space for his luggage, is much better than struggling with public transportation.

Reasons for riding with autonomous car

He knows it will eventually be safer than riding with a human driver.

Concerns with autonomous car

He thinks he would feel helpless during an emergency situation.

Scenario

Samuel is very excited but also a bit apprehensive to order his first driver-less Uber. From a technical standpoint he knows they are supposed to be safe, but this break from tradition is still leaving him a bit nervous. He wants to feel like he has some amount of control in the car, even though he knows he probably won't need to intervene.

Pain points

The actual waiting time is longer than the time shown on the app.

The driver takes a bad route (heavy traffic).

The driver will park on the opposite side of the street, making it difficult to get his luggage in the car.

Goals

Arrive at the airport two hours before the departure time.

To have a smooth pick-up experience with the driver.

Interactive Prototype

Link to the mobile app interactive prototype:

<https://projects.invisionapp.com/share/3WPA5PZA957?fbclid=IwAR2r6m2-mTrdaorAx4llcTWe9bVslXa2sXsz9YC9-iqL3jd9ckZedjLD5Cc#/screens/333385292>

Link to the car dashboard interactive prototype:

https://projects.invisionapp.com/share/DJPA5R7SX2K?fbclid=IwAR3FTE91qsLNNqxj6p_Y9hEC-40_6p2uhgAY1AT0o9S65YtEnjzRUMrmp7s#/screens/333106393

Project Documents

<https://drive.google.com/drive/u/0/folders/1iNtJLPIWNEHqUI3mh3iCDR8dxJPjZt9P>

Usability Test Documents

<https://drive.google.com/drive/u/0/folders/1M8MZL56VPbDqvJe3b3nj3v8VUFsMwhOx>