



Lumio × Didi

Optimized Design for Deaf and Mute Individuals

HCI Design

Product Design

Info Design

UX Design

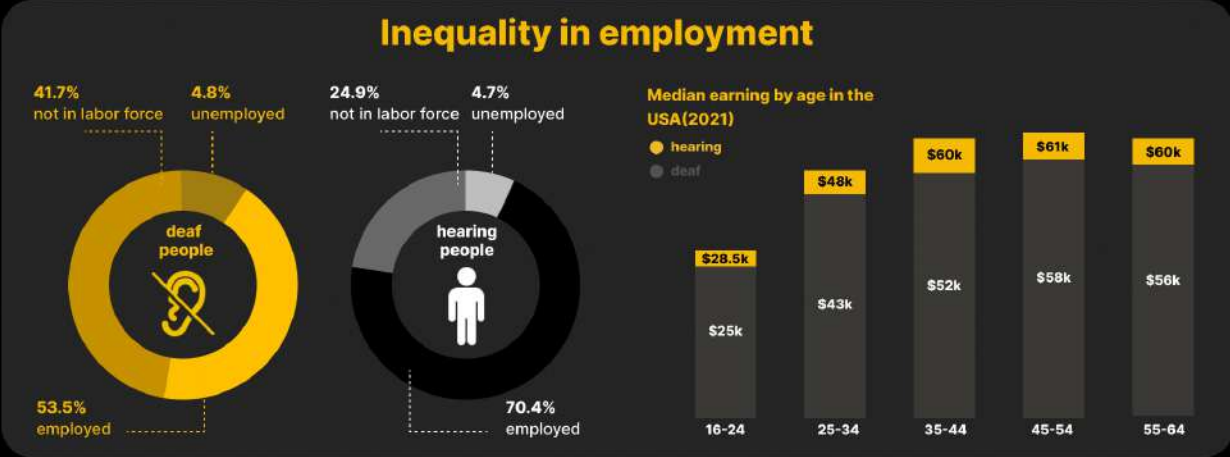
As the number of deaf-mute individuals in the ride-hailing industry grows, traditional voice communication methods are increasingly unable to meet the needs of both drivers and passengers, causing service challenges and frequent conflicts.

By analyzing existing platform processes and the needs of deaf-mute drivers and passengers, I identified key design points and created a user-friendly solution, optimizing the experience for both parties within the Didi platform.

" Inspiration

Based on my experience with a deaf-mute driver during a ride, I found significant communication challenges, especially when the GPS was inaccurate and we needed to discuss the pickup and drop-off points. We mostly communicated by typing, which was inconvenient. As it was my first time encountering a deaf-mute driver, I felt unsure about how to interact. I hope to develop my design based on this experience.

• Research Background

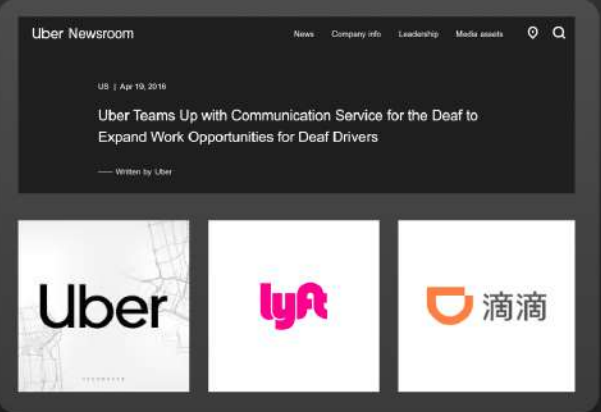


" Further Study

After understanding the current situation of the deaf-mute community, I will further focus my research on the group of deaf-mute drivers, especially those working as rideshare drivers.

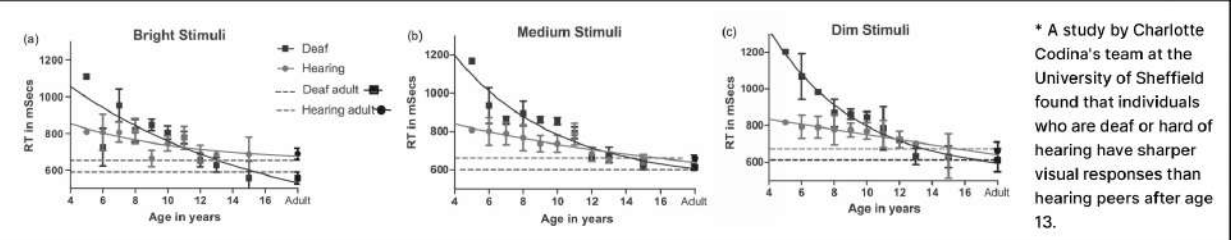
• Opportunities for Deaf Drivers

Several ride-hailing platforms, including Uber, Lyft and DiDi have introduced policies allowing the recruitment of deaf-mute individuals as drivers. They are committed to helping more people in the deaf-mute community find employment and achieve financial independence.

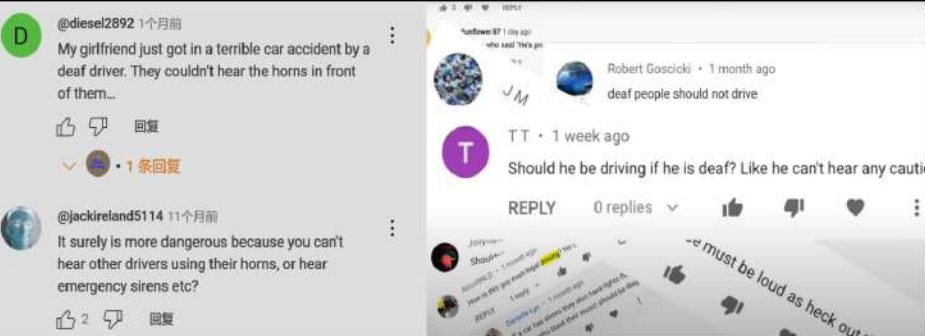


• Can Deaf People Drive ?

Despite not hearing road sounds, deaf individuals can drive safely. The process for obtaining a license is the same, but they must inform the DMV of their hearing impairment. The DMV may impose restrictions, such as requiring full-view mirrors or hearing aids. Besides, deaf drivers compensate for their hearing loss by enhancing their visual awareness.



• How Others See Deaf Drivers ?

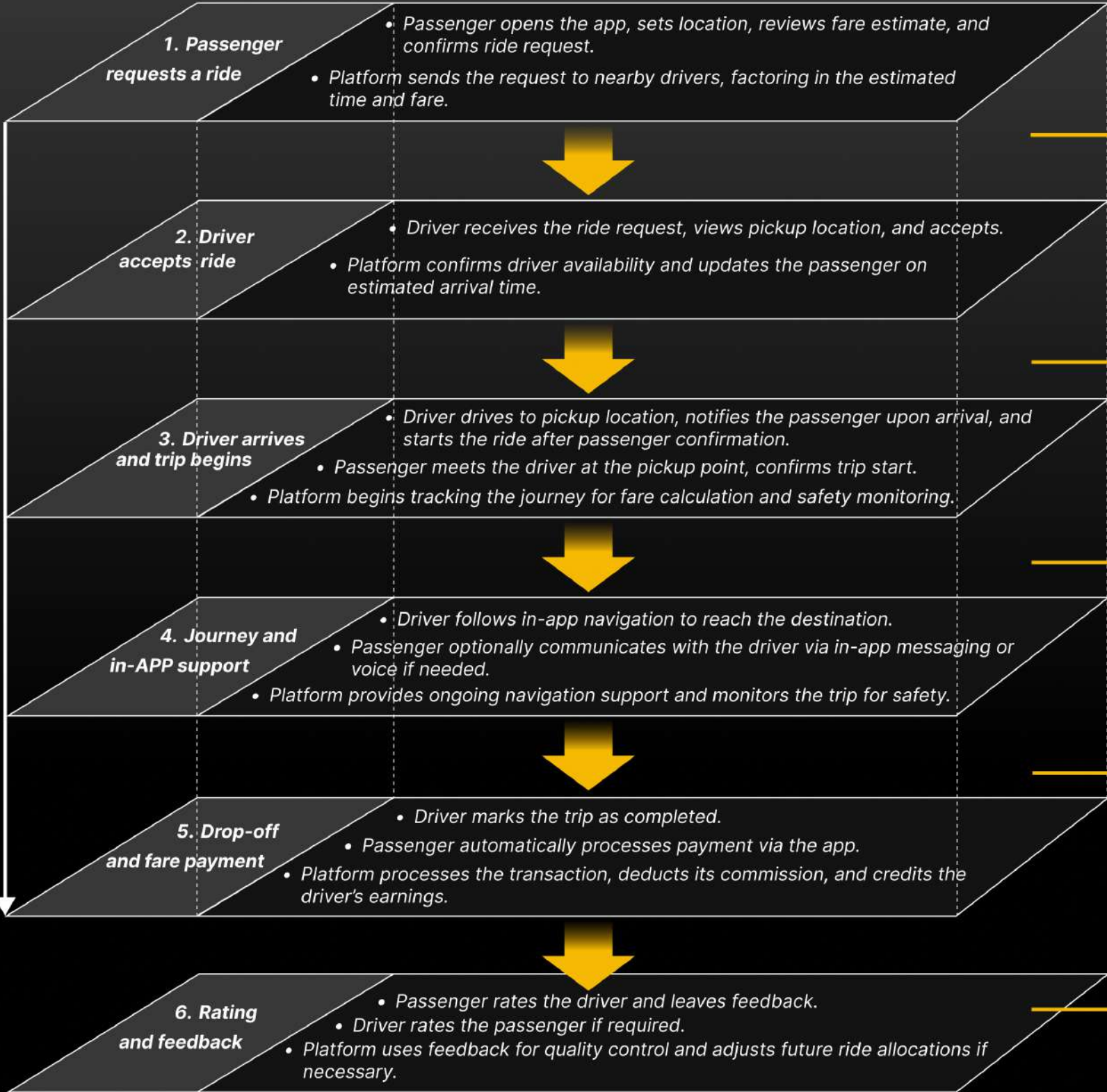


Many people question whether deaf individuals can drive and perceive them as potentially unsafe drivers.

" Case Study

By studying the operations of platforms like Uber, Lyft, and DiDi, I gained insights into the work conditions and challenges faced by deaf drivers. While some platforms offer special features for order acceptance and initial communication, these mainly address the early stages of the ride and overlook aspects like communication efficiency, navigation, and feedback systems for later stages.

• Operations and Processes Study



• Personalized Design

Flash Notification

Deaf drivers can enable a flash mode, where a white flash appears on the phone or device screen to notify them of a new order.

Text Message Notification

Before pickup, passengers receive a message informing them that the driver is deaf and may prefer text communication over phone calls.

• Problems

Passenger Communication Efficiency

Many passengers may not know how to communicate effectively with a deaf driver, especially if they are unfamiliar with sign language, making typed messages the primary but less convenient means of communication.

Maps and Navigation

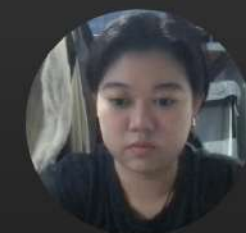
Current navigation systems are not deaf-friendly due to their reliance on audio directions, posing challenges for route guidance.

Feedback System

Rating systems on platforms like Uber may unfairly impact deaf drivers due to communication barriers, which can affect their future ride assignments.

" Focus Group

In order to better understand users' specific needs and explore potential issues between deaf-mute drivers and passengers, I reached out via social media and found two deaf-mute DiDi drivers, as well as passengers from various fields. To ensure fair communication, we have adopted typing as the method of interaction. Through online focus groups, I collected relevant interview data.



Yuting Pei
housewife



Passengers and drivers agree on needs like window ventilation and air conditioning, but preferences for speed and in-car environment vary among passengers.



Leyi Tan
student



Both sides agree that communication is inefficient, but differ on safety: passengers have concerns, while deaf drivers see this as biased.



Miaode Luo
deaf driver



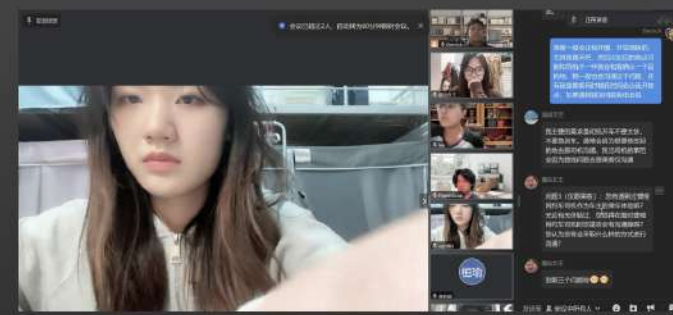
Jialu Li
nurse



Kebei Ye
coder



Wenqin Li
deaf driver



The process of on-line focus group



The specific needs of passengers show diversity

- When I'm in a car, I often pay attention to whether the **air** inside is circulating, as some vehicles are not very clean. If the **hygiene** is poor, I would prefer the driver to **open a window for ventilation**.
- I check whether the **air conditioning** is on, as some drivers try to save money by not using it in the summer, which can be uncomfortable.
- I enjoy **listening to music** on the road, so sometimes I ask the driver to play some. When I'm traveling in a new place, I hope the driver can **introduce local features** to me.
- Sometimes the **GPS location is inaccurate**, and I need to describe the location more specifically for the driver.
- I want the driver to reach the destination promptly within traffic rules, as **some drive too slowly** and need a reminder.

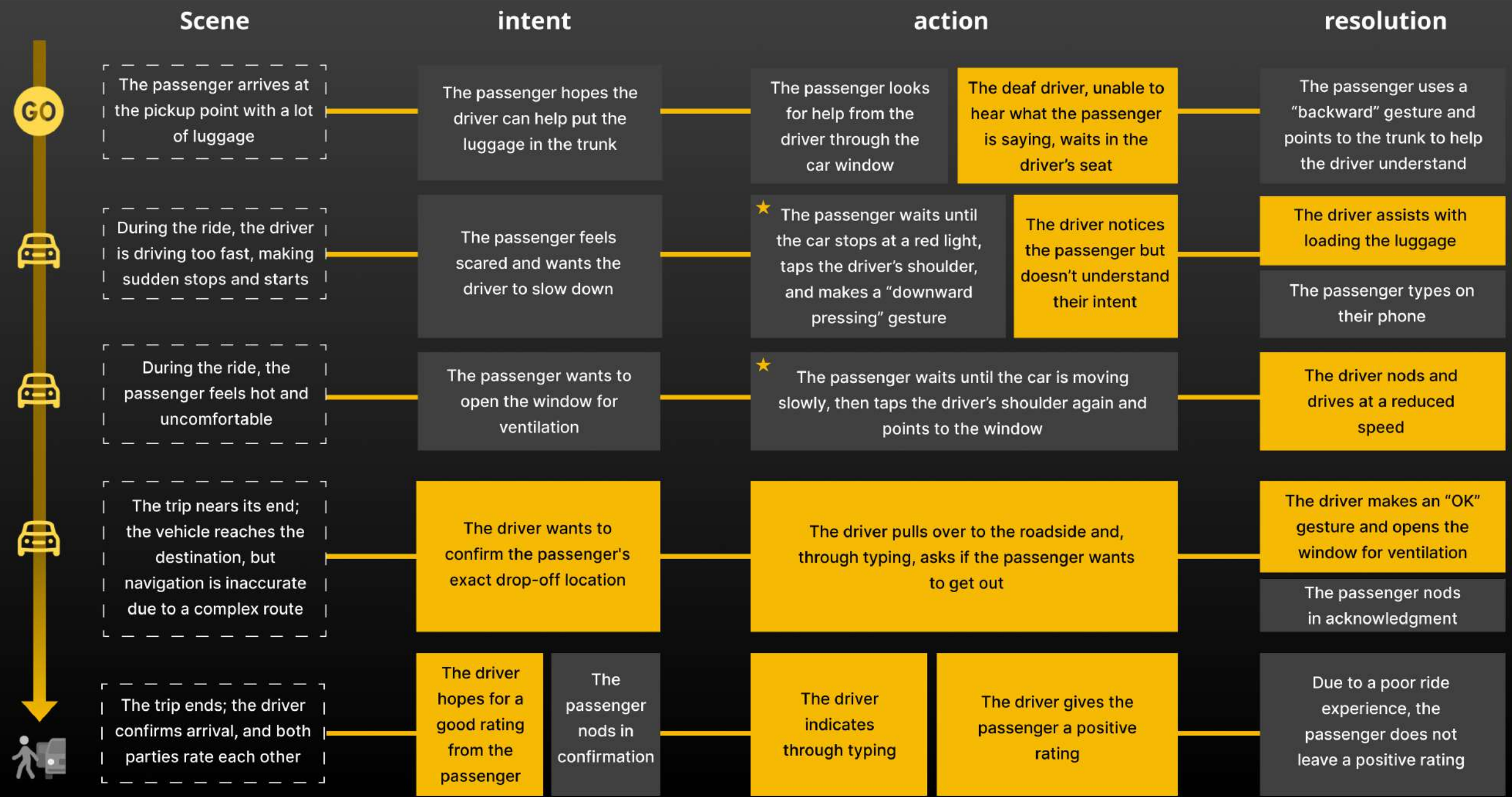
Passengers have safety concerns with deaf drivers, and communication is often inefficient

- I'm not entirely sure if deaf people can really drive, and it's **inconvenient to communicate by typing**.
- I don't know how to communicate with deaf drivers; I can only type, which delays responses, especially for urgent stops.
- I'm concerned when a driver suddenly turns the wheel, brakes hard, or speeds, as it makes me **feel unsafe**. I worry particularly with deaf drivers, as they can't hear their surroundings, and I fear they may not react quickly to road conditions.
- Some people might **leave poor ratings** for deaf drivers, but I try to be understanding since it's not easy for them to work.

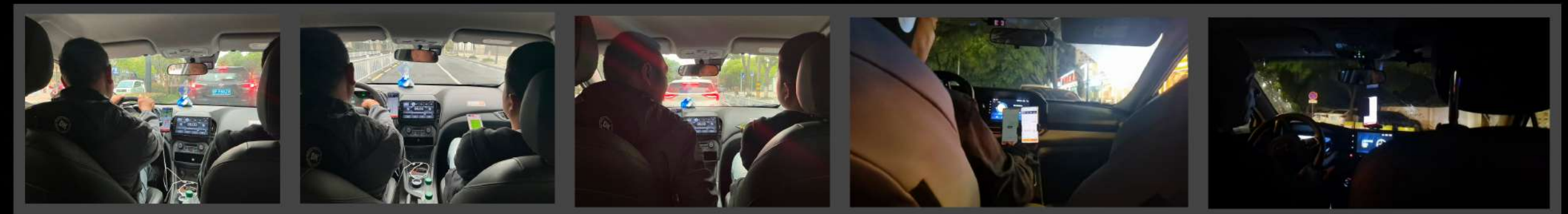
Deaf drivers feel that some passengers have biases, and communication is inefficient

- Communicating with passengers is often an issue, as they don't understand sign language, and I can only convey information through **basic body language or typing, which is inconvenient**.
- Some passengers leave me negative reviews, which **frustrates** me, but I've accepted it.
- I drive very safely. Deaf people rely on their vision more than others, so we tend to notice road conditions in advance and make judgments. Since I can't hear sounds, I **check my mirrors more frequently**. Besides, I believe my driving skills are above average.
- I understand some **basic gestures** from passengers, and I try to **read their lips** to guess what they want to express while they're speaking.

" Scenario Mapping



• Part of Picture Records



Persona



Catherine
teacher & passenger
23 years old, with 7 years
ride-hailing platforms using experience

Aspiration
"I hope to have a pleasant ride experience; I need a clean and safe environment."

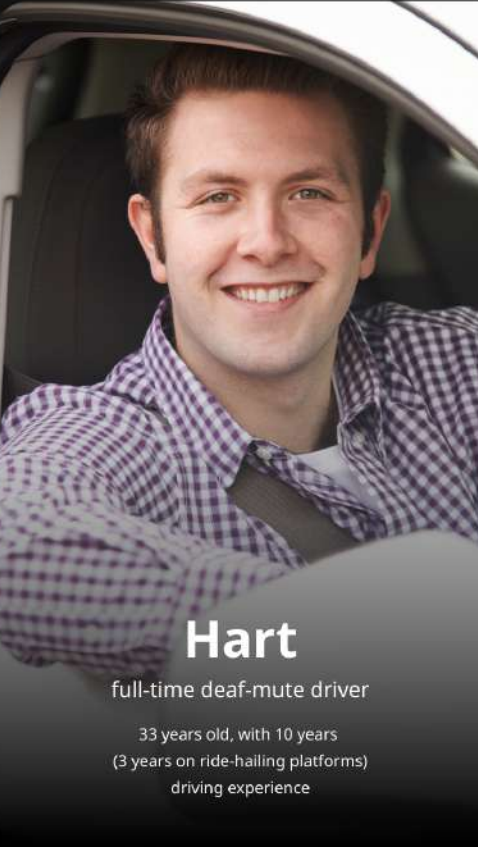
Mindset
"As a consumer, I have the right to enjoy quality ride services. I will treat all drivers equally, regardless of whether they are deaf or not."

- Needs**
- Cleanliness and tidiness
 - Driving speed
 - In-car temperature
 - Boredom
 - Reasonable fare
 - Safety concerns
 - Change destination

- Pain points**
- Susceptibility to motion sickness
 - Lack of safety due to driver's high speed
 - Inaccurate navigation
 - Communication barriers
 - Poor in-car hygiene



- Design opportunities**
1. Improve the communication mechanism between passengers and drivers
 2. Enhance passengers' sense of safety



Hart
full-time deaf-mute driver
33 years old, with 10 years
(3 years on ride-hailing platforms)
driving experience

Aspiration
"I hope to complete my work more easily and be respected, rather than feeling frustrated and helpless due to communication issues."

Mindset
"As a driver, I take pride in my work. Passengers should treat me with respect and provide objective feedback. I also hope to improve the quality of my service."

- Needs**
- Sense of achievement in work
 - Income support
 - Respect
 - Objective evaluation Mechanism
 - Platform assistance
 - Companionship

- Pain points**
- Low passenger ratings
 - Platform lacks special protections
 - Inaccurate navigation
 - Communication barriers
 - Lack of due respect



- Design opportunities**
1. Improve the communication mechanism between passengers and drivers
 2. Provide deaf drivers with companionship and respect
 3. Refine the platform's rating system

Conception



Enhance passenger's sense of safety

How to design ?
2. Improve driver-passenger communication mechanism



3. Increase driver's sense of fairness and respect



Three main design points

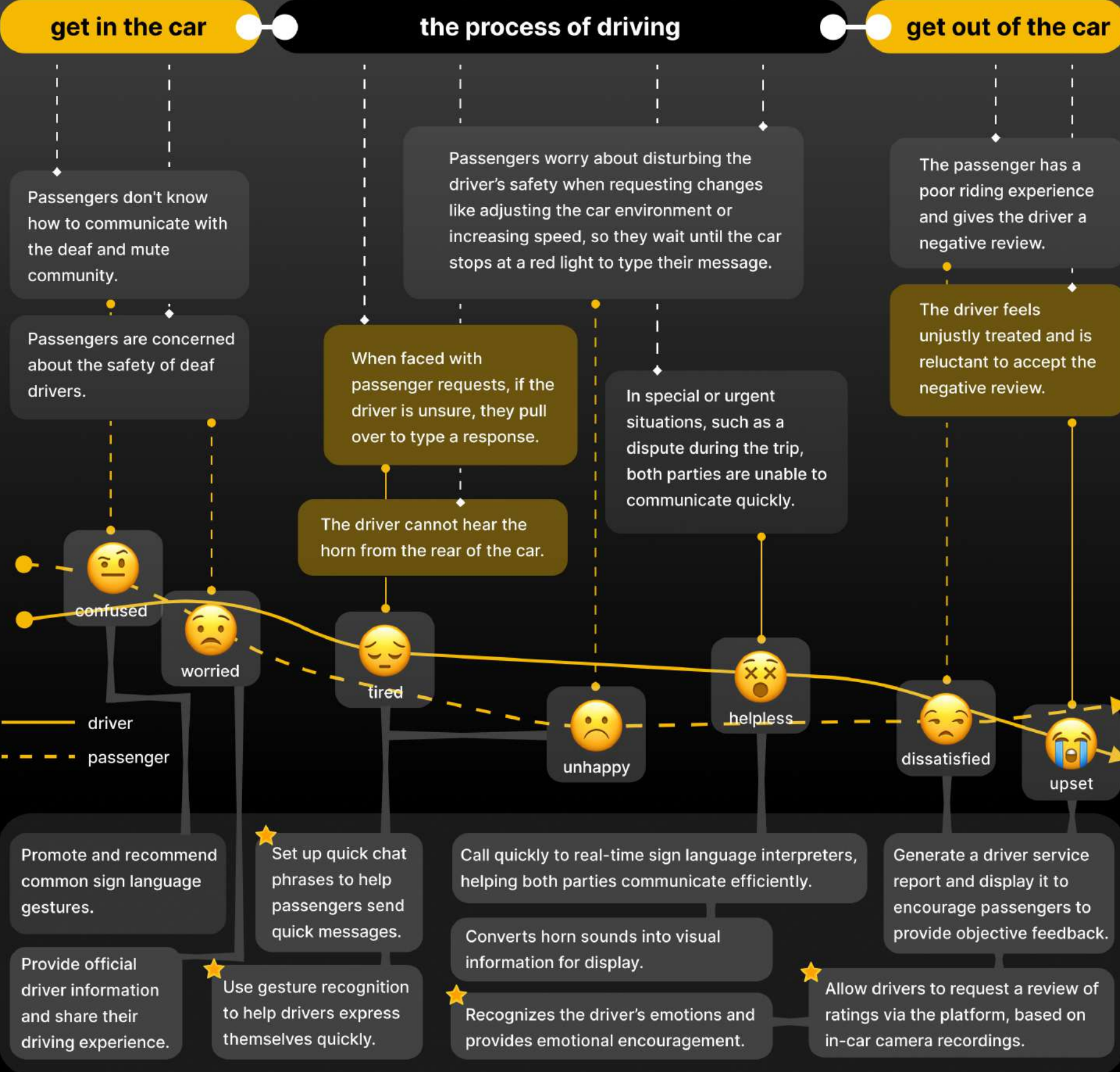
- Provide real-time trip information and objective driving condition analysis
- Convert auditory signals to visual cues for hearing compensation
- Show key qualifications and accolades to demonstrate professionalism and safety

- Educate about the deaf community and teach common communication methods
- Offer preset quick commands to help passengers express information quickly
- Use simple gestures to help drivers communicate effectively

- Empower drivers to request arbitration, with the platform verifying the objectivity of negative reviews
- Promote awareness of the deaf community, encouraging passengers to show care and warmth
- Provide companionship, motivation, and encouragement to deaf drivers

To optimize convenience and cost, I plan to integrate these features into an external product and system to support passengers and drivers.

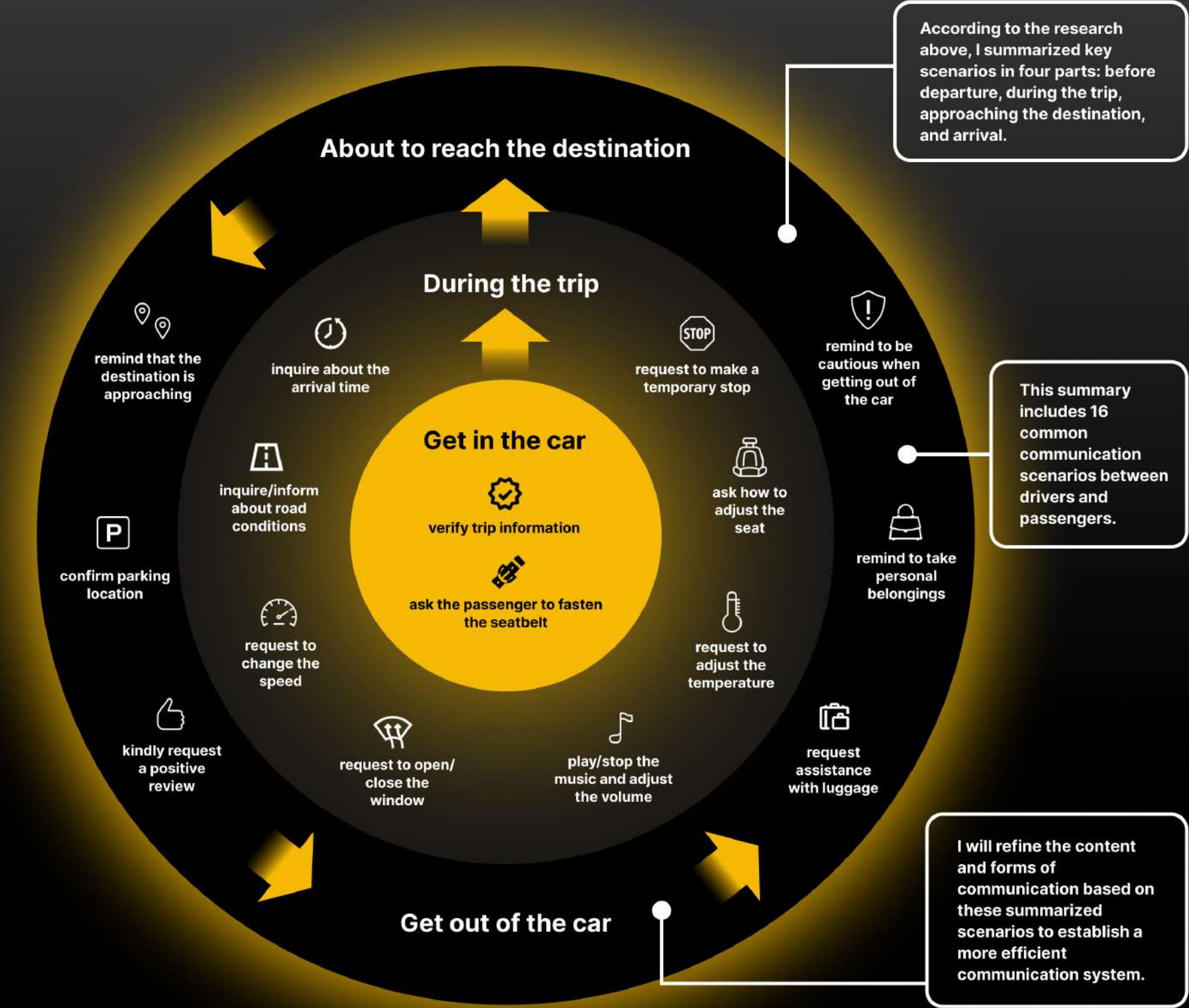
User Journey



" Language System

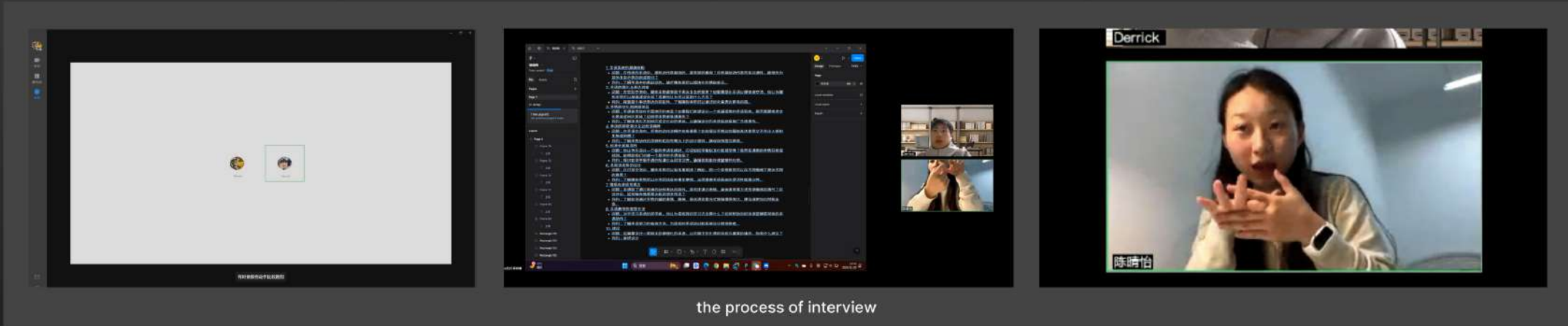
To improve the communication system between deaf-mute drivers and passengers, I believe it is crucial to create an entirely new language system that minimizes the communication cost between the driver and passenger, enabling smooth and efficient interaction for both parties.

• Communication Scenarios Summary



• Sign Language Reference

To build an efficient communication system, I have decided to explore breakthroughs in the sign language commonly used by the deaf-mute community. To this end, I interviewed two sign language teachers to explore the structure of sign language, the expressive habits of the deaf-mute community, and other related aspects.



• New Language Design

Inspired by modular programming and building block games, I came up with the idea of breaking sentences into components and combining modules to convey meaning in the new language.

I will approach sign language design by breaking down scenarios into two parts: universal modules and action modules. Universal modules are essential for constructing complex sentences, as they form the foundation of most structures. Action modules represent the objects or actions specific to each scenario.

part of universal modules

tone	people	increase-decrease
agree, deny, doubt	I, you, he/she	increase, decrease

part of action modules

in specific scenario	direction	time	number	on-off
help, positive review, stop, buckle up, air conditioner, music, speed, car window	forward, backward, left, right	just now, now, future	number 0, number 1, number 2, number 3, number 8, number 9	on, off

conclusion

- 1.universality**
Sign language is regional, with variations in different areas, so a universal form may not fit all contexts. The language design must also consider its universality.
- 2.safety**
Some sign language expressions require both hands, but for safety, one hand must remain on the steering wheel. A one-handed sign language system is needed.
- 3.mnemonic**
Many sign language gestures are based on actions or objects they represent, so the design can focus on aligning gestures with these actions.
- 4.learner-friendly**
The new sign language should be tailored to ride-hailing scenarios, with common phrases expressed through single gestures to reduce the driver's learning curve.

example

1 "Please fasten your seatbelt now." = "now" + "you" + "buckle up"

2 "Should I set the air conditioner to 23°C?" = "should I" + "set air conditioner" + "23°C"

3 "I'll try to reach the destination faster." = "will" + "I" + "speed" + "increase"

Tech Analysis

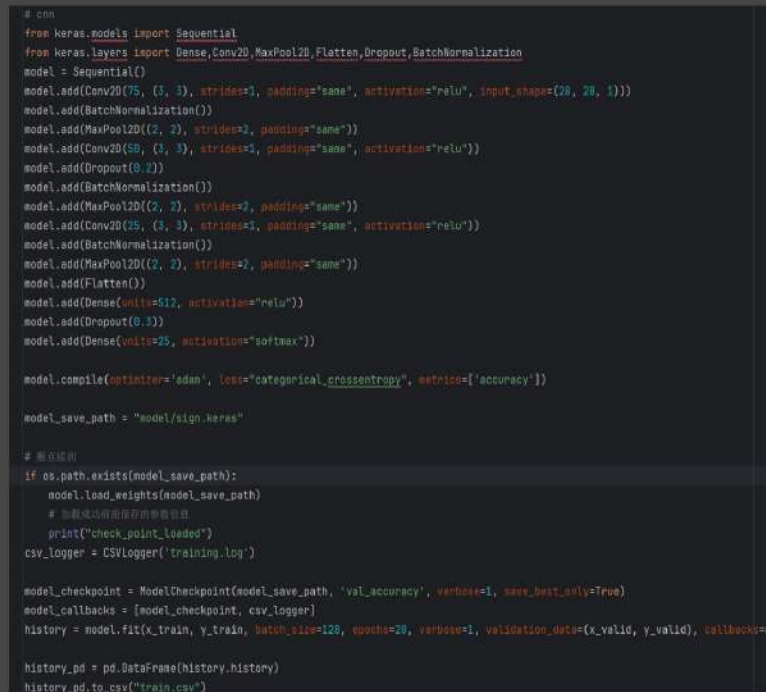
To achieve the three main functions of driver sign language communication, intelligent product companionship, and auditory compensation, I have focused on developing three key systems: gesture recognition, emotion recognition, and sound detection.

- **Gesture Recognition**

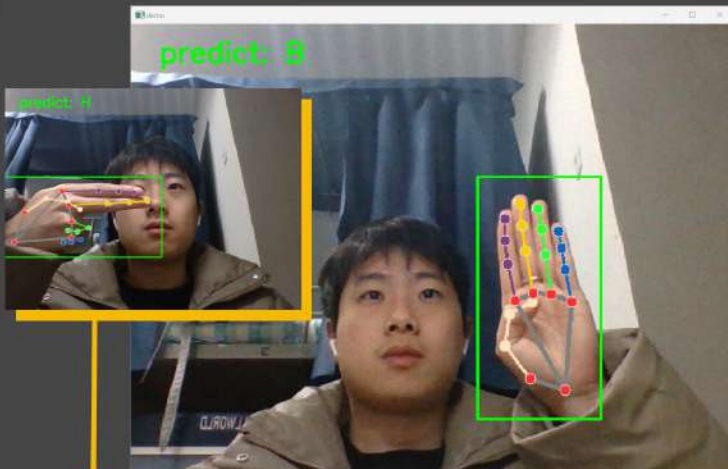


use the "sign language MNIST" dataset

capture hand coordinates and detect them



build a neural network for training

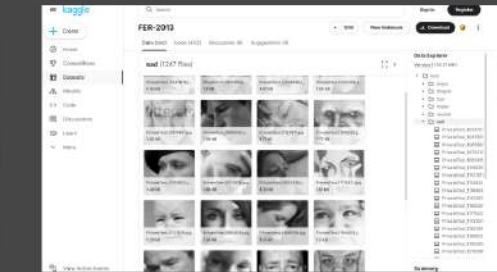


test gesture recognition accuracy

Required improvements

Unclear or non-standard gestures may cause misrecognition or delays, with vibrations, lighting, and subtle gesture differences affecting accuracy.

- **Emotion Recognition**



use the "FER-2013" dataset

```
perform data training
```

detect faces and recognize expressions



test emotion recognition accuracy

- **Sound Detection**



use the "sign language MNIST" dataset

model training and evaluation

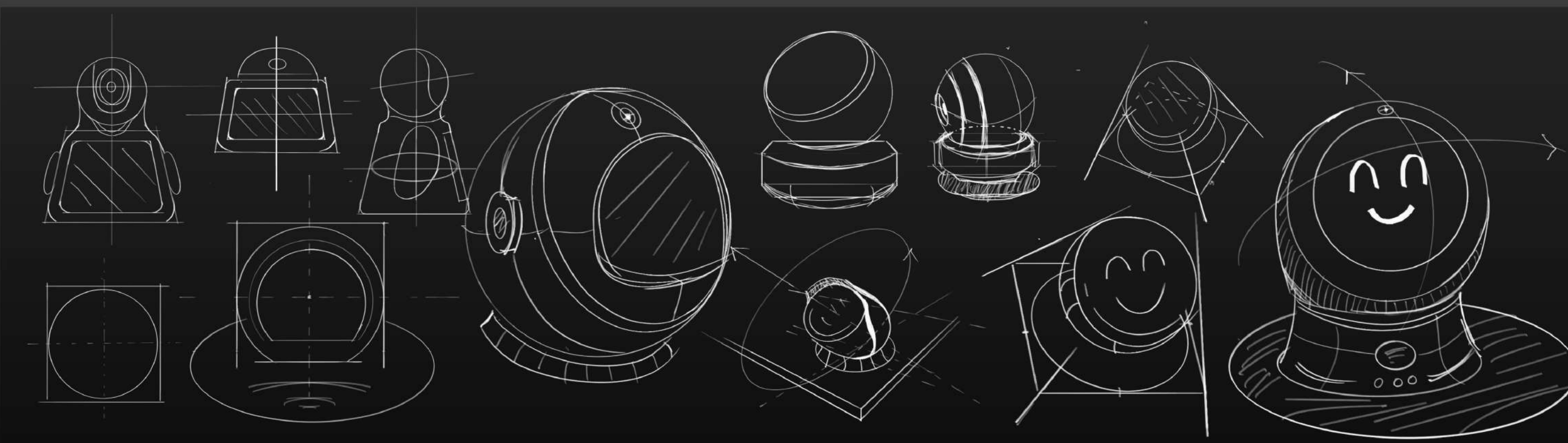
sound recognition

Required improvements

Due to traffic noise, car horn recognition can be affected by other sounds, requiring more robust audio hardware support.

Product Design

- Sketch



- **Modeling**

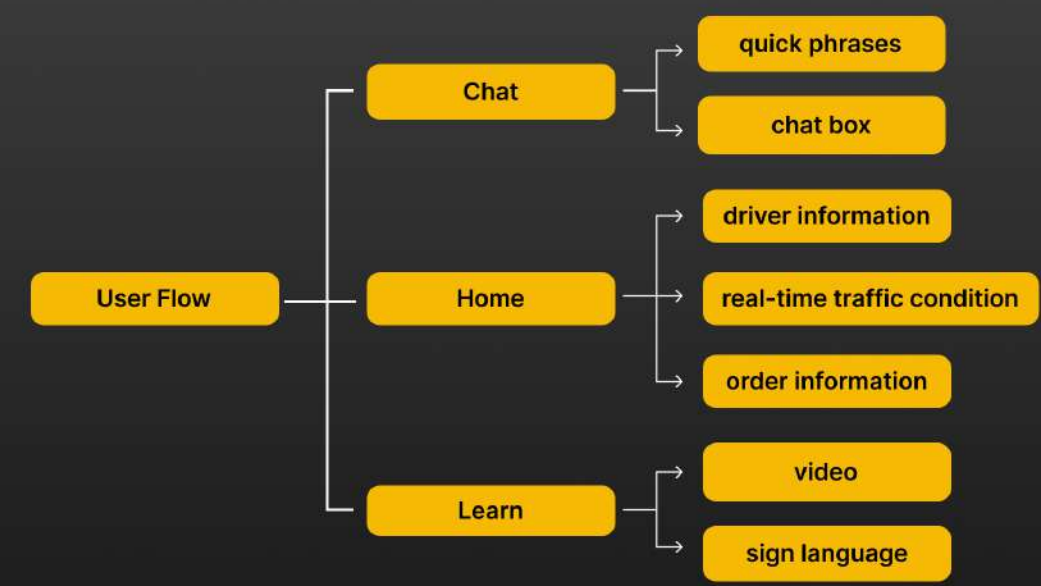


- **Rendering**

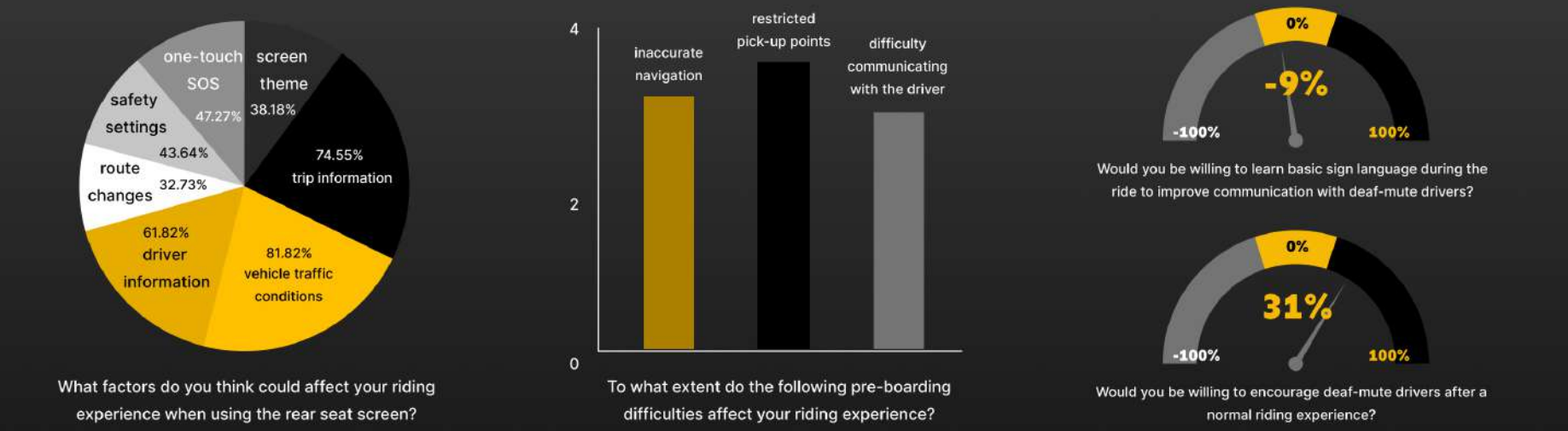


UI Design

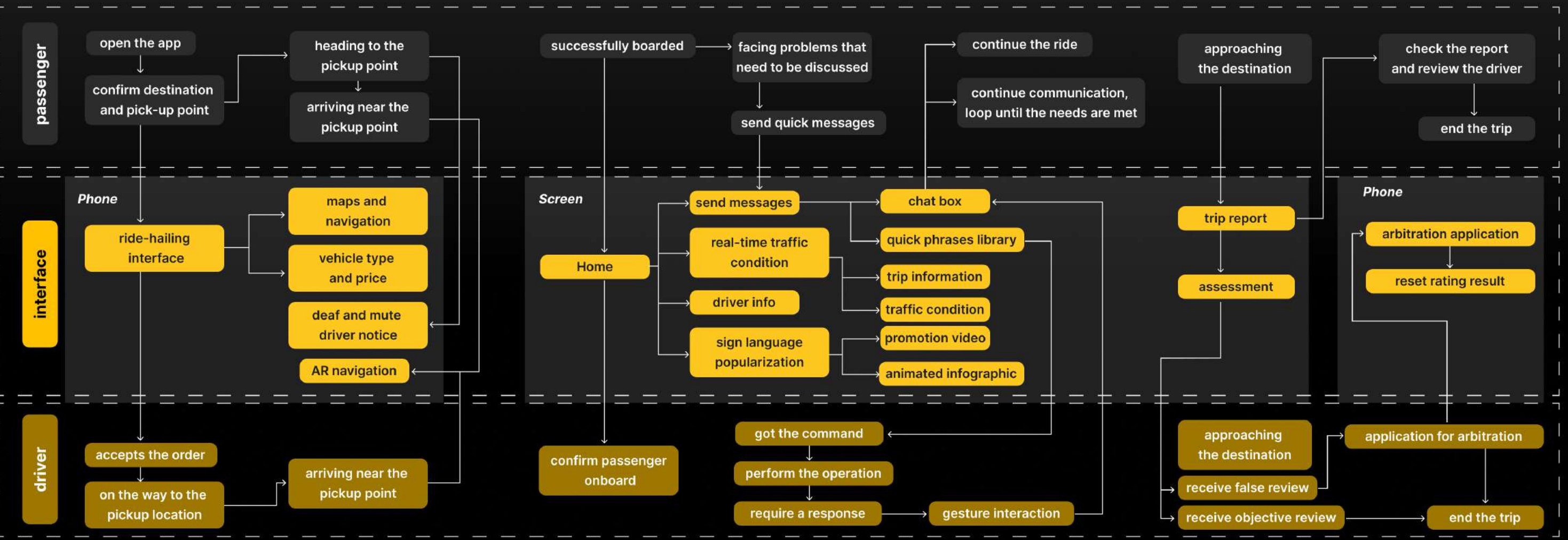
User Flow



To improve the passenger experience, I conducted a survey and found that passengers often face difficulties before boarding, such as inaccurate pick-up points. Based on this, I redesigned the pre-boarding scenario and made adjustments to the rear seat screen design based on passenger needs.



New User Flow



Wireframe Flow

Didi is a leading ride-hailing platform in China. I aim to integrate my design into the platform to address user experience issues between deaf-mute drivers and passengers.

after getting out of the car (driver)

apply for arbitration

update review

before getting in the car (passenger)

confirm destination

select car type

matching

deaf driver notification

AR navigation

the process of driving

home page

deaf insight

quick chat

trip overview

assessment

Final Design



Product Interface

Companion Mode

When the system detects the driver is feeling down, this mode will express companionship through visual cues.



Warning Mode

When a car behind honks, this mode shows a yellow alert to notify the driver, using visual cues to compensate for hearing.



Emergency Mode

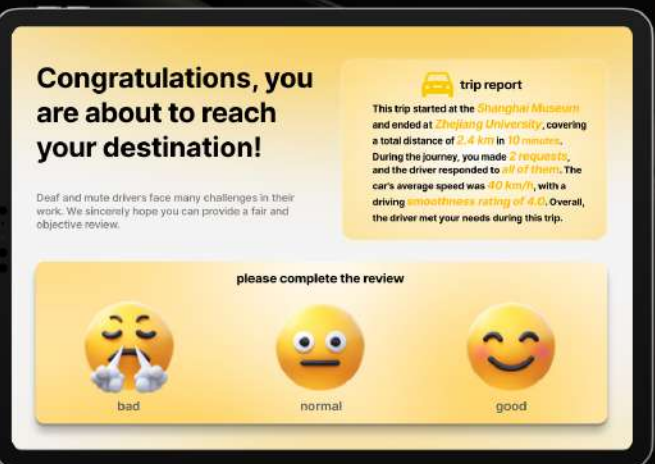
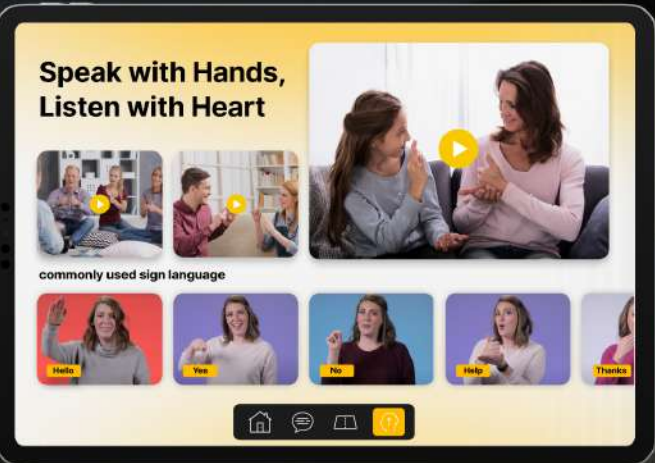
When the driver faces an emergency requiring complex translation, they can press a button to call a translation center for real-time video assistance.

Communication Mode

This mode helps the driver view messages from the passenger and quickly respond for smooth communication.



Rear Seat Screen Interface

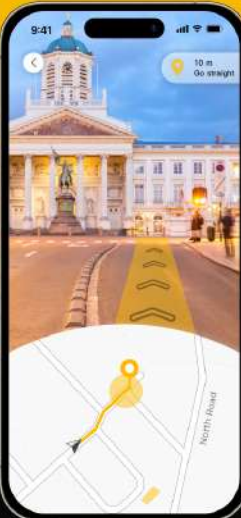


Ride-hailing Interface



Deaf Driver Notification

Once the driver accepts the ride, the passenger will receive information about the deaf-mute driver and be informed to communicate via text.



AR Navigation

When passengers have difficulty finding the pickup point, AR navigation provides visual guidance to help both the passenger and driver meet quickly.

Arbitration For Assessment

If the driver believes that the evaluation they received does not reflect the objective facts, they can submit an arbitration request to the platform. The platform will review the in-car product video playback to make an official judgment and provide a final evaluation, ensuring the rights of deaf-mute drivers.

