

An aerial, black and white photograph of a city intersection. The scene is dominated by a large, multi-lane crosswalk with white stripes. Several futuristic, pod-like vehicles are positioned at the corners of the intersection, appearing to be waiting or moving through the crosswalk. These vehicles have a rounded, boxy design with a dark upper section and a lighter lower section. In the background, there are cars and motorcycles on the roads, and some buildings and trees are visible. The overall atmosphere is one of a modern, high-tech urban environment.

# Time ++ Bus

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Not only for commuting

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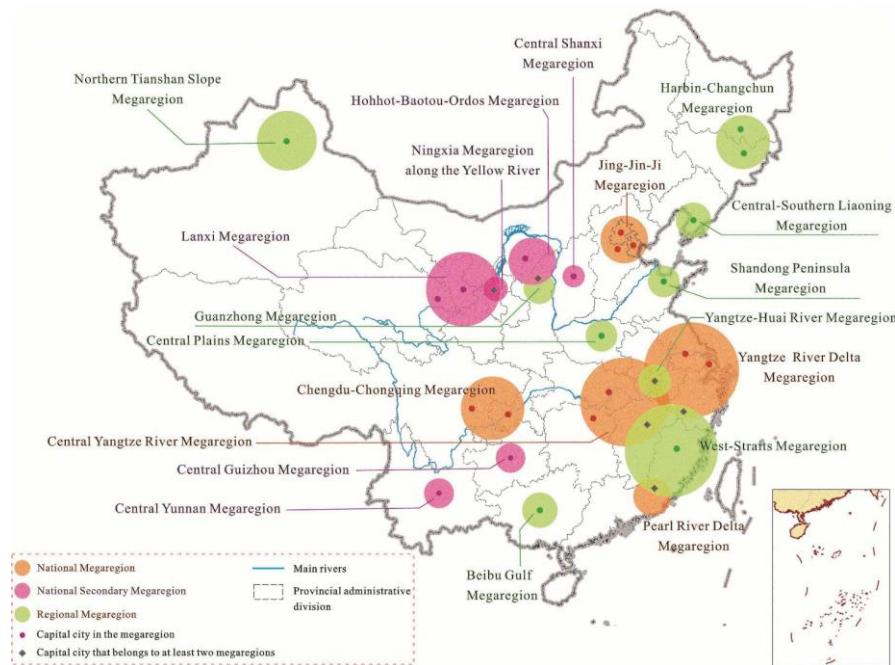
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## Description of the mobile activity



Picture : [http://www.sohu.com/a/130667518\\_692608](http://www.sohu.com/a/130667518_692608)

The development of urbanization in China generates several metropolitan areas, such as Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta. They have been formed under the accelerating development of Beijing, Shanghai, Guangzhou and Shenzhen, respectively. The resulting **separation of employment and residence** is intensifying and the demand for **inter-city transportation** is growing rapidly.

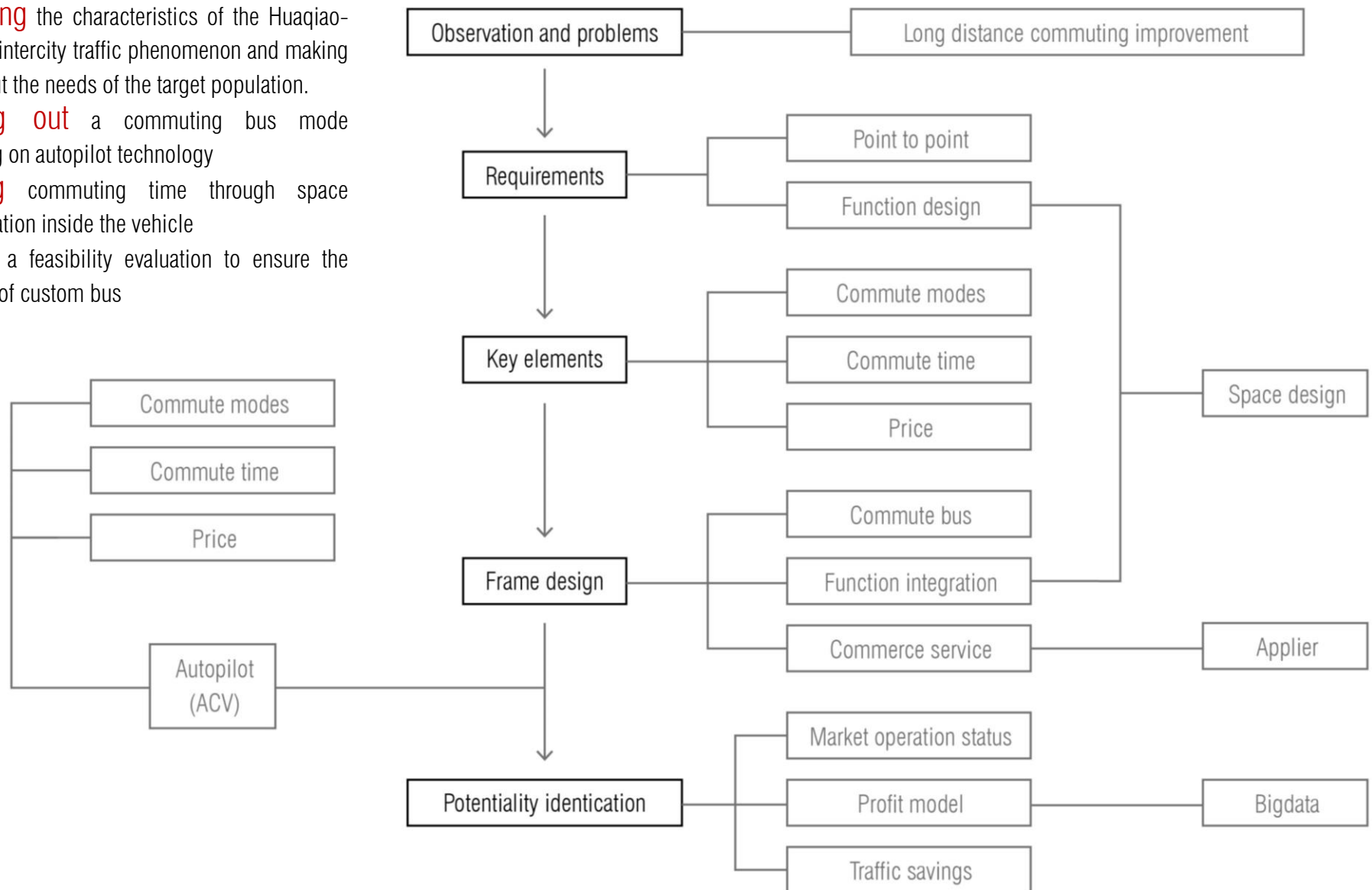


Picture : <https://www.zcool.com.cn/work/ZMzY40TgwNA==.html>

People surrounding Metropolitan areas are bearing long-distant commuting everyday. They usually spend **2-3 hours** from living places to workplaces, mainly depended on **subway**—an uncomfortable travel mode during morning and evening rush hour. Suffering from short sleeping time, the commuters choose to give up breakfast or leisure time, consuming their happiness to ensure a relatively rewarding income.

## Research Frame

- **Observing** the characteristics of the Huaqiao-Shanghai intercity traffic phenomenon and making clear about the needs of the target population.
- **Figuring out** a commuting bus mode depending on autopilot technology
- **Utilizing** commuting time through space transformation inside the vehicle
- **Making** a feasibility evaluation to ensure the operation of custom bus



## Methodology

### Online Questionnaire

Delivering online questionnaire to clarify requirements of commuters, including social property, travel modes, activities doing inside the bus and services expected operators to provide.

### Face-to-face Interview

Realizing the attitude of governments and enterprises and make clear the cost source and potential profit model.

### Data Analysis

Collecting back-stage data to give a basis of operation status and improve the service quality, at the same time, provide a report for directional advertisement.

### Market Design

Making sure of the feasibility of the project with exploring and cooperating with potential merchants.

### Institutional Arrangement

Fighting for allowance, getting a legal certificate, and guaranteeing the efficiency of the operation.



### 关于花桥——上海远距离通勤改善的问卷调查



## History of Customized Bus

### Problems:

- Difficult to make ends meet by commuting lines alone
- Driving time
- Road congestion
- Number of booking people



2013.07



2015



2016.05



2016.12



...

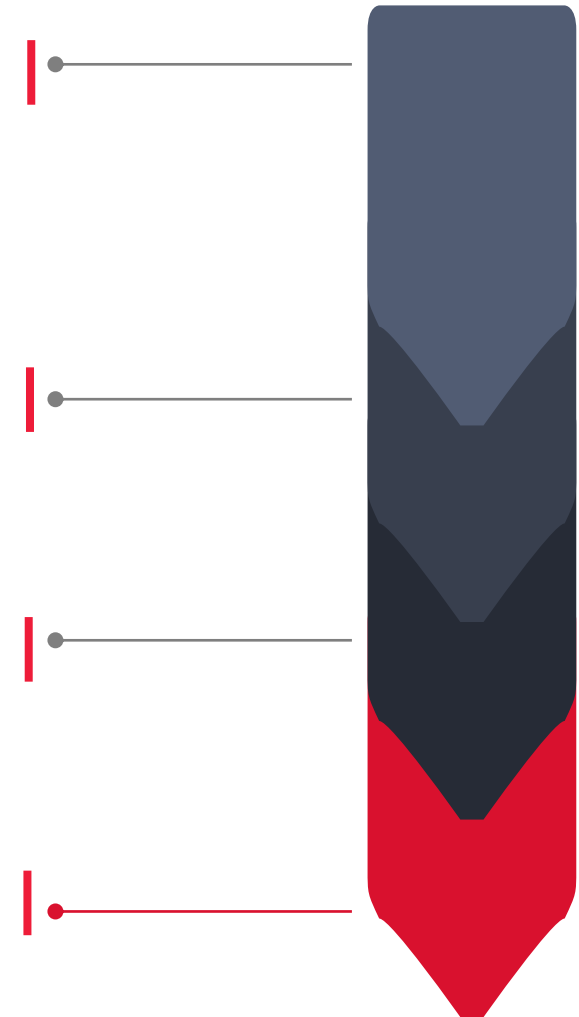
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Firstly appeared in United States, Singapore, some European countries

1974, DOT in the U.S. put forward "auxiliary bus"

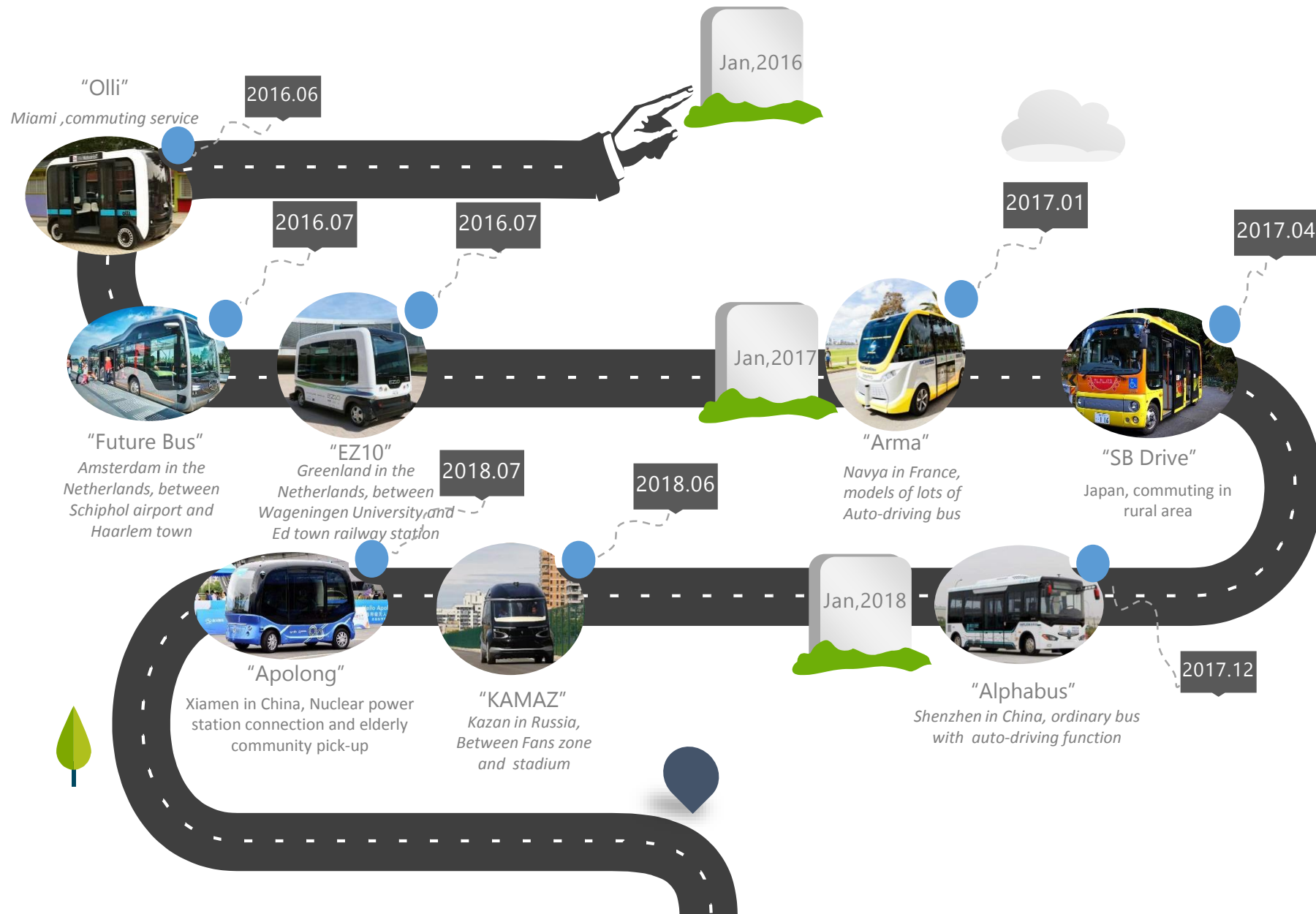
2013, Qingdao took the lead in operating two customized bus routes.

Tianjin (in March 2014) and Shenzhen (in March 2014), appeared, now more than 30 cities.





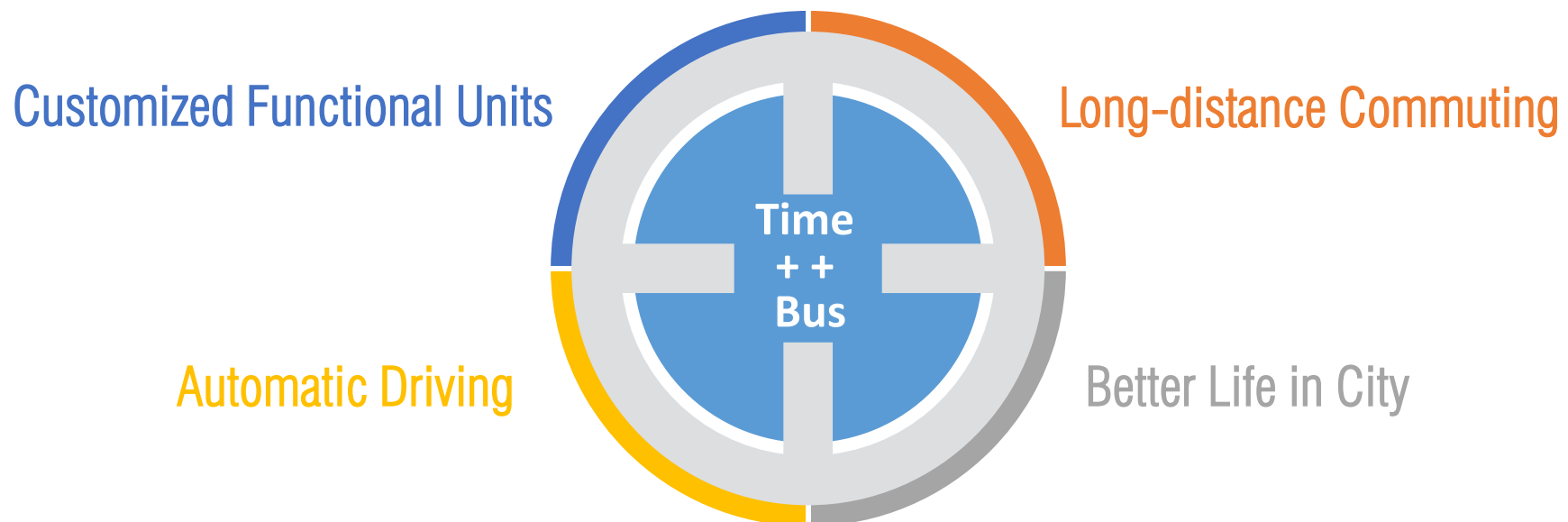
# History of Auto-driving Bus



## Research Direction

Based on the reality of long-distance commuting in Shanghai, through the research on the development of customized public transportation and the history of automatic driving development, we found that the introduction of autonomous driving technology into customized public transportation will be a new trend in the development of public transportation in the future.

Therefore, our research direction has been established. Combined the characteristics of customized bus multi-function service with the advantages of stable, high-speed and safety of automatic driving technology, we form a new urban commuter commuting mode called “Time++ Bus”: “customized functional units + automatic driving to solve the existing long-distance commuting problem”. It is not only for commuting, but also for better living conditions in city.





## Specificity for the project



China's actual condition

private space + public space

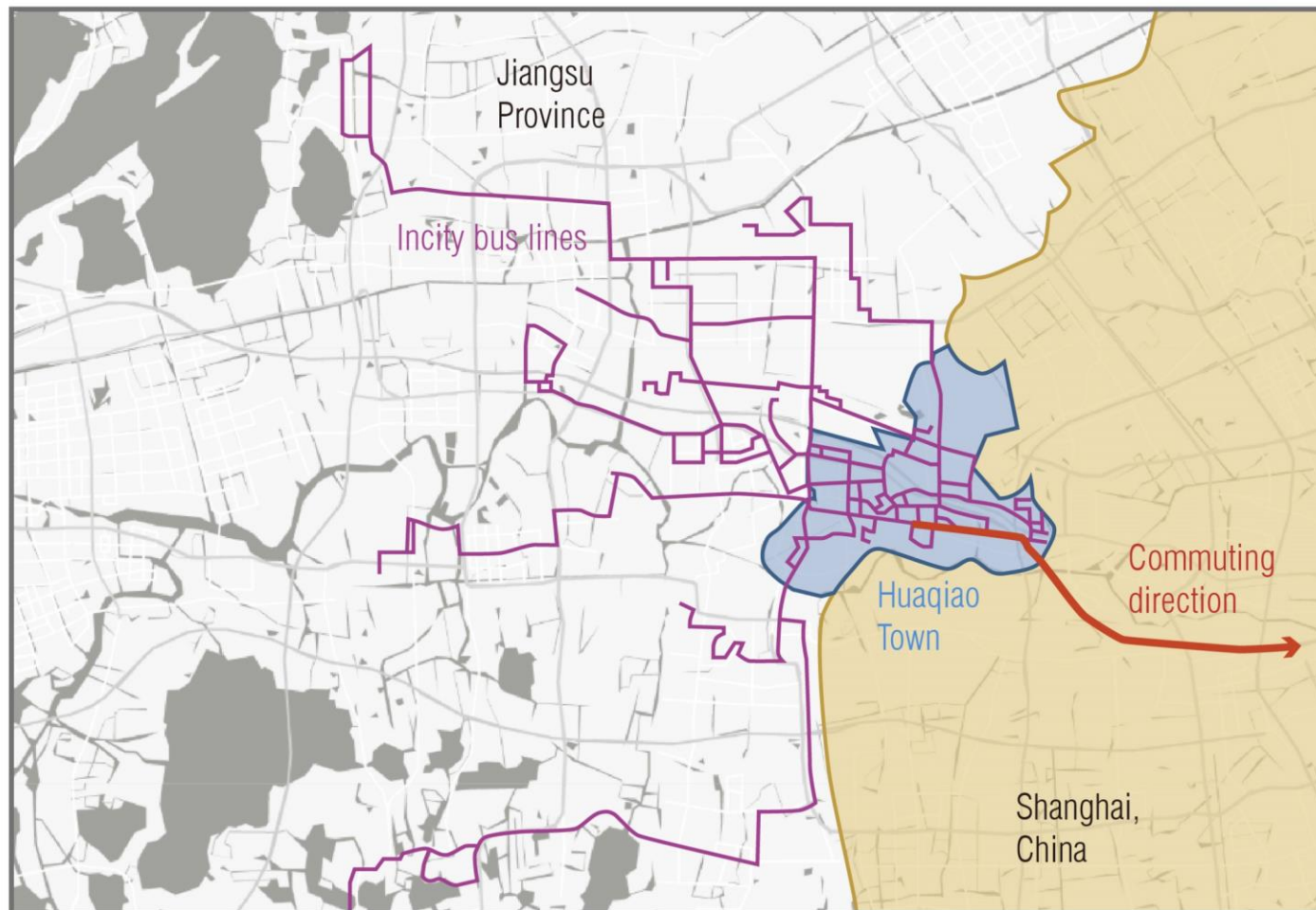
Autonomous bus

logistics systems

mobile payment



## Research background



With the expansion of the metropolitan area, more and more young people choose to live around the metropolis and go to work in the city center. After the construction of Shanghai metro line 11 in 2013, Huaqiao town has been integrated into the Shanghai subway network. It takes only 12 minutes to get to Anting by subway from Huaqiao to Anting, and only one hour to Xujiahui in Shanghai. Most of the young people here work in the six districts including Pudong, Jiading, Putuo, Changning, Xuhui and Jing'an. The monotonous long-distance commuting and lack of leisure time have led to a decline in the quality of life of residents here.



## Project Survey: Huaqiao-Shanghai intercity traffic



Name of the interviewer:

Zhenyu Gu

Position:

Property manager of the community  
Responsible for bus operation since  
2017

Time of the interview:

2018.09.24

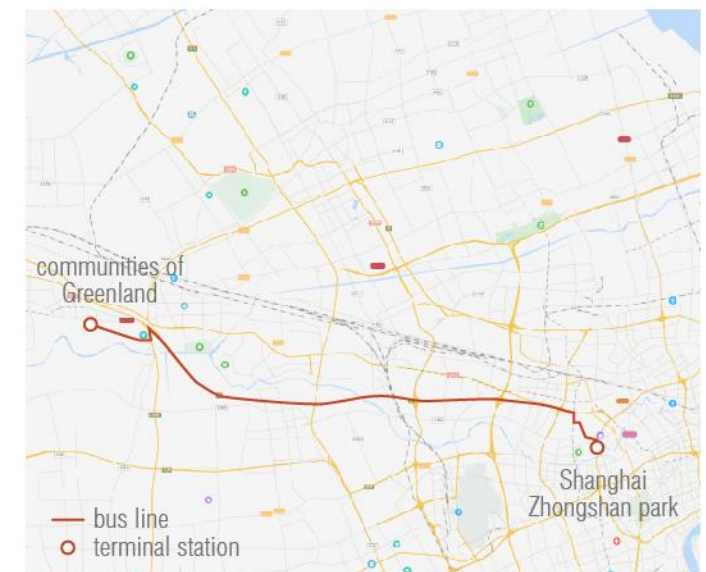
### History:

Since 2008, Greenland real estate company has built a large number of residential buildings in Huaqiao town. In order to attract people who work in Shanghai to buy, it launched a supporting shuttle service, owners can take the Huaqiao-Shanghai intercity bus at a low price. Huaqiao is forced to become a “sleeping city” and became the habitat of Shanghai commuter.

According to the 2008 plan, the bus runs between communities of Greenland in Huaqiao and Shanghai Zhongshan park. There are six stations in Huaqiao, including the bus terminal, Xiaoxianfang station, Jingcai station, E-mart station, Qihangshe station, U-time station, all of them close to the gates of communities. The selection of Zhongshan park as the terminal is considered to transfer, passengers can conveniently choose subway line 2, line 3 or line 4 to go to other places.



Bus stations in Huaqiao



Bus line of Huaqiao-Shanghai intercity traffic

## Management and Operation

### Q The vehicle scheduling?

A We will not make scheduling on a daily basis. Buses are set out according to the timetable. There are 46 trains per day on weekdays and 21 trains on weekends.

Scheduling behavior requires a lot of manpower and material resources to obtain passenger needs and provide feedback, which is not realistic at the present stage, but we adjust the schedule each year according to the previous year. The adjustment is based on two aspects. On the one hand, there are the statistics of the card swiping, which can show the travel situation in each period. On the other hand, the vehicular attendant can get the needs of passengers while they maintaining order.

Huaqiao-Zhongshan park (weekdays)			
1	6:10	24	11:00
2	6:20	25	12:00
3	6:30	26	13:00
4	6:40(E-Mart)	27	13:40
5	6:40	28	14:20
6	6:50	29	15:00
7	7:00(E-Mart)	30	15:30
8	7:00	31	15:50
9	7:10	32	16:20
10	7:20(E-Mart)	33	16:50
11	7:20	34	17:10
12	7:30	35	17:20
13	7:40	36	17:40
14	7:50	37	17:50
15	8:00(E-Mart)	38	18:30
16	8:00	39	18:50
17	8:20	40	19:10
18	8:40	41	19:30
19	9:00	42	19:50
20	9:20	43	20:10
21	9:40	44	20:30
22	10:00	45	20:50
23	10:40		

### Q The latest adjustment?

A In view of the high demand during the morning peak, we increased the number of vehicles between 6:10-8:00.

At the same time, four vehicles are started at the fourth station(the E-Mart station)to make sure passengers waiting at the next few stops can get on the bus.

In addition, we have adjusted the price, increasing the ticket price from 4 yuan to 10 yuan

### Q Problems and Expectations?

A The main problem is the high vacancy rate. For example, there are many people going to Shanghai in the morning, but few people are on the bus back to Huaqiao. In order to solve this problem, I have considered two solutions:

1. Under the premise of satisfying the needs of the owners of this community, others can pay to ride by scanning the code.

2. Cooperate with the logistics enterprise, when the number of passengers is small, we can use the vehicle to transport the goods and excavate the remaining value.

However, both plans are complicated to implement and we are concerned that residents are opposed.





## Characteristics of passengers and the Vehicle

### Q Demand statistics?

A The total number of people in the communities is about 120,000. Only owners of first-hand houses can take this bus, and this category comprises approximately 24,000 persons.

The number of monthly trips is about 50,000, while the number of daily is about 1,200 on weekends and about 2,500 on weekdays, mainly in the morning and evening peak period.

### Q Behavior of passengers?

A Most passengers rest on the bus. No one can eat or talk loudly on the bus.



### Q Other modes of commuting?

A If residents can't take our bus, most office workers living in Greenland will choose two ways to get to Shanghai:

1. public bus-subway

Take a nearby bus to Huaqiao station on line 11, and then transfer to another subway to their work places. The average price is around 10 yuan.

2. car-pooling

The residents with cars can gather other people through WeChat group of the community, sharing expenses equally. A car can take up to five people, and the average cost per person is 20 to 30 yuan.



### Q The price of a ticket and the profitability

A It has been losing money every year since it started in 2008.

At present price of 10 yuan per person:

#### Expenditure:

the cost of car rental, 1400 yuan per bus per day

highway tolls, 50 yuan per bus per day

#### Income:

$10(\text{price}) \times 45(\text{seats}) \times 80\%(\text{seat occupancy rate}) \times 3 = 1080 \text{ yuan}$

Total:  $1080 - 1400 - 50 = -370 \text{ yuan}$

Monthly loss of 18 buses:

$370 \times 18 \times 30 \approx 200,000 \text{ yuan}$

If the price goes up to 15 yuan per person:

Income:

$15 \times 45 \times 80\% \times 3 = 1620 \text{ yuan}$

Total:  $1620 - 1400 - 50 = 170 \text{ yuan}$

Monthly profit of 18 buses:

$170 \times 18 \times 30 \approx 90,000 \text{ yuan}$

Recently I heard that car rental fees will increase, which means we will have more losses.

## The Users



**Personal information:**

enterprise manager

**Why to Shanghai:**

work, leisure

**frequency:**

10 times a month

**Behavior:**

play video games

**Comments:**

Compared with subway and high-speed rail, buses are more cost-effective and convenient, and I do not pay much attention to price.

**Expectations:**

wifi



**Personal information:**

Retired

**Why to Shanghai:**

shopping, leisure

**Behavior:**

read ebook

**Comments:**

When I'm not in a hurry, I would choose this bus. If I need to arrive on time, I would take the subway.

**Expectations:**

Provide hot water and fast food;  
Small bus for 6-8 people, less than 50 yuan.

**Why to Shanghai:**

work(ince 2013)

**Time:**

1.7:00am

2.after work

**Behavior:**

sleep,play video games  
(Talking loudly and eating smelly food are not allowed on the bus).

**Comments:**

Everyone has a seat, which is more comfortable than the subway, but the waiting time is longer.

**Expectations:**

It's pretty good now



**Why to Shanghai:**

work(Since 6 months ago)

**Time:**

1.7:10am,I will buy break-fast when I get to zhongshan park.After adjusting the schedule, the number of vehicles increased, basically all can take the bus

**Behavior:**

sleep

**Comments:**

Make sure you have a seat and you can sleep well.

**Expectations:**

more comfortable ways to sleep.



**Why to Shanghai:**

work(since 2010)

**Time:**

1.7:00am

2.5:20pm

**Behavior:**

sleep,play video games

**Comments:**

I don't drive car to work, because it's not convenient to park .The reason why I don't choose the subway is that it takes longer and there are no seats as usual.

**Expectations:**

Improve the environment and serve breakfast



# Questionnaire Survey

## Objective

To understand the basic information of Huaqiao local residents, their commuting situation, willingness to demand, and understanding of customized public transportation.

## Mode

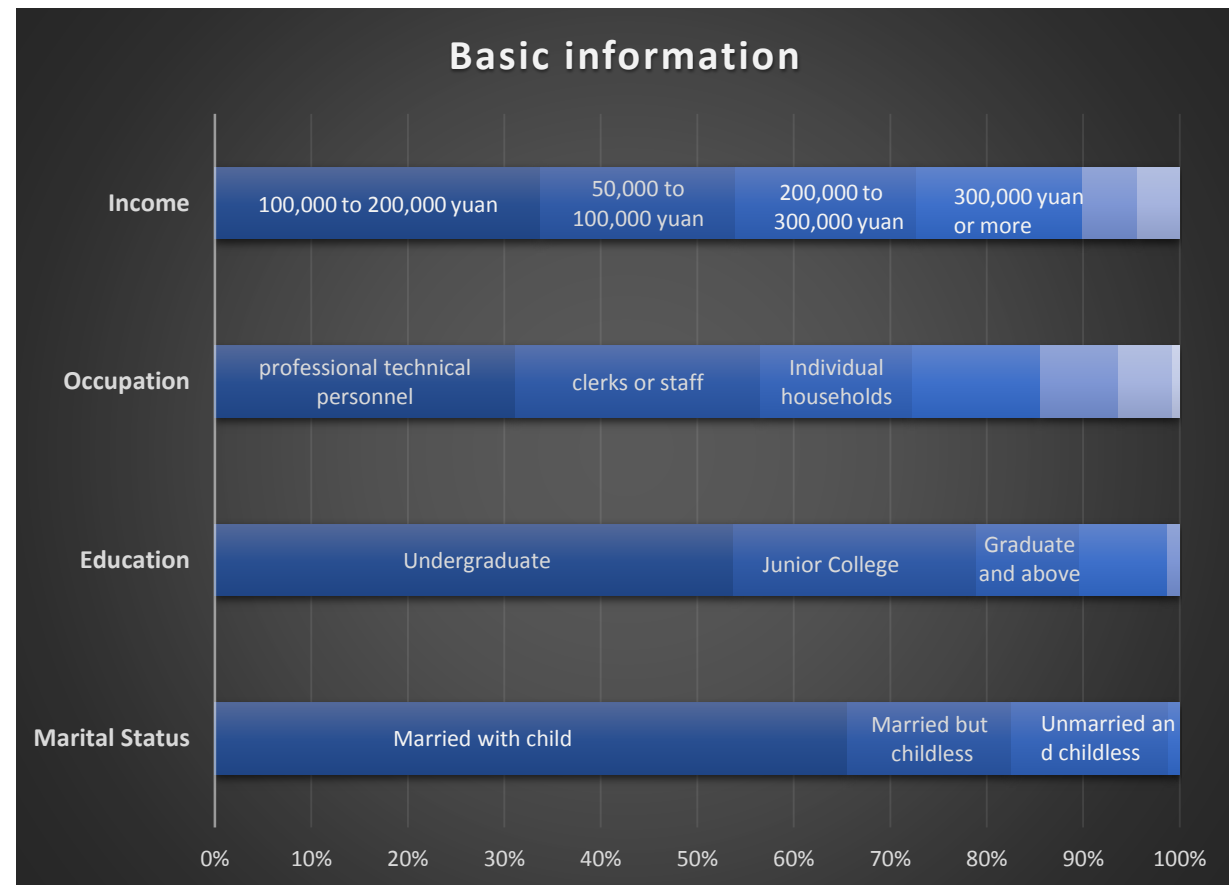
Community Owner WeChat Group

Effective questionnaire amount

674

## Statistical Results

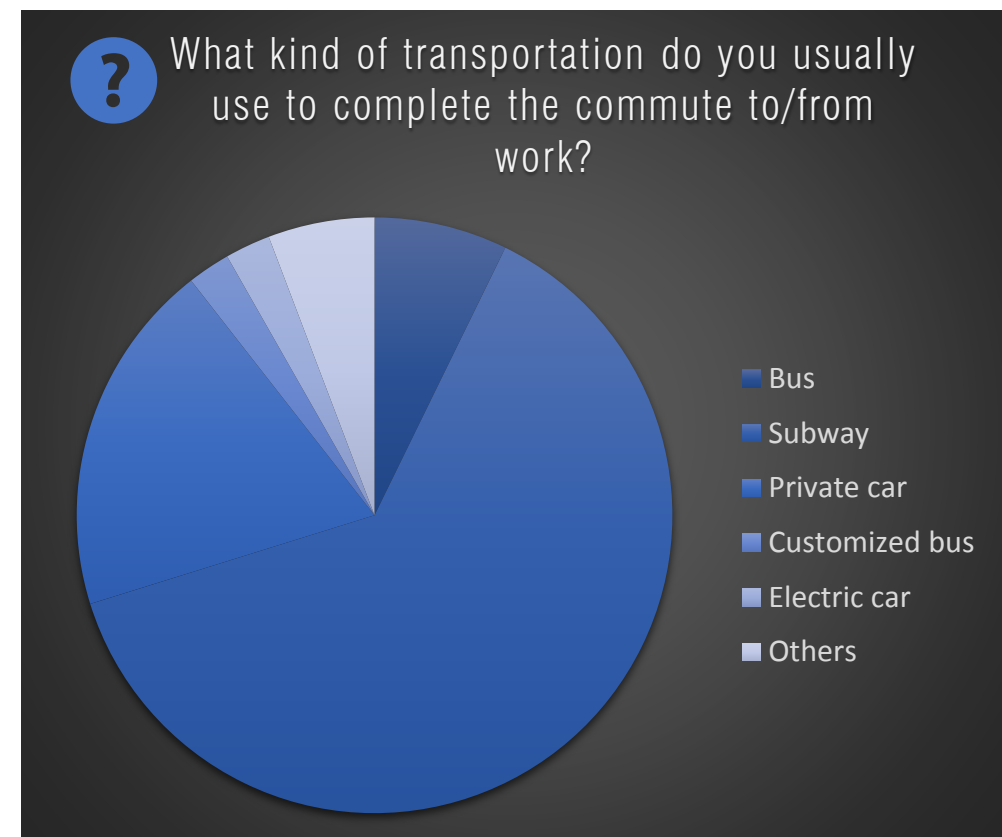
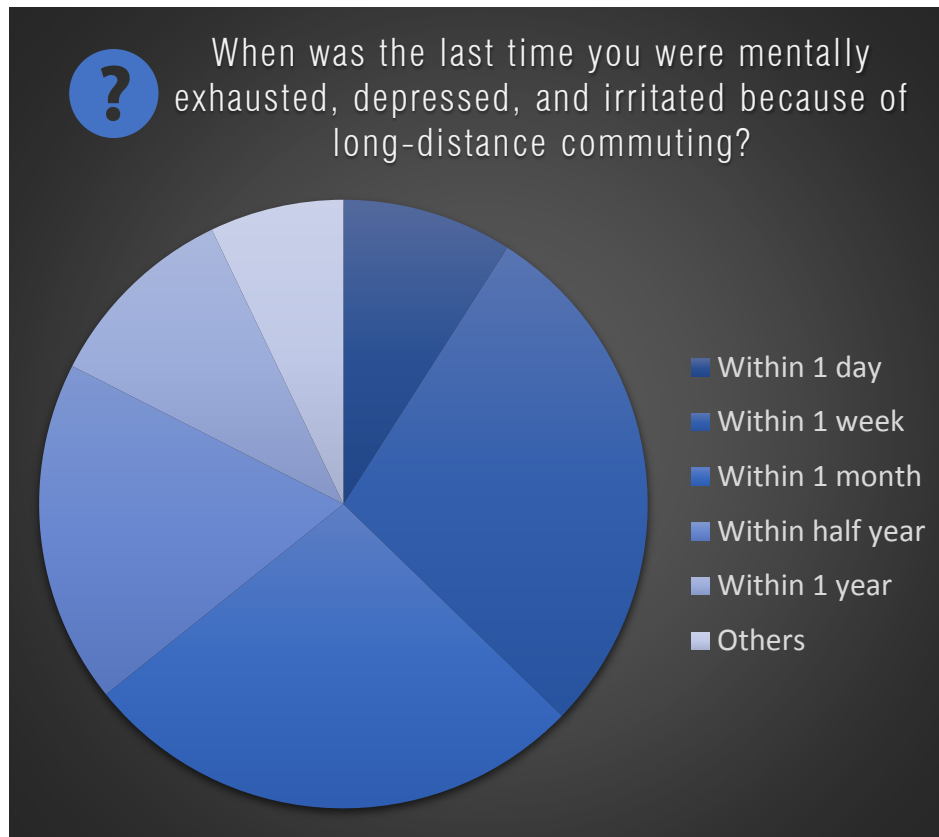
**Basic information** Huaqiao residents are mostly married (82.53%) and highly educated (84.48% undergraduate and above). The occupational category is mainly professional technical personnel (31.14%) and clerks or staff (25.43%). The per capita annual income of families is mostly distributed between 50,000 and 100,000 (20.23%) or between 100,000 and 200,000 (33.77%).





## Statistical Results

**Daily commute** Residents private choose subway (62.95%), cars (19.25%) or buses (7.24%) to travel in the long-distance. During long distance commuting, there are negative emotions such as physical and mental exhaustion, depression, and irritability.





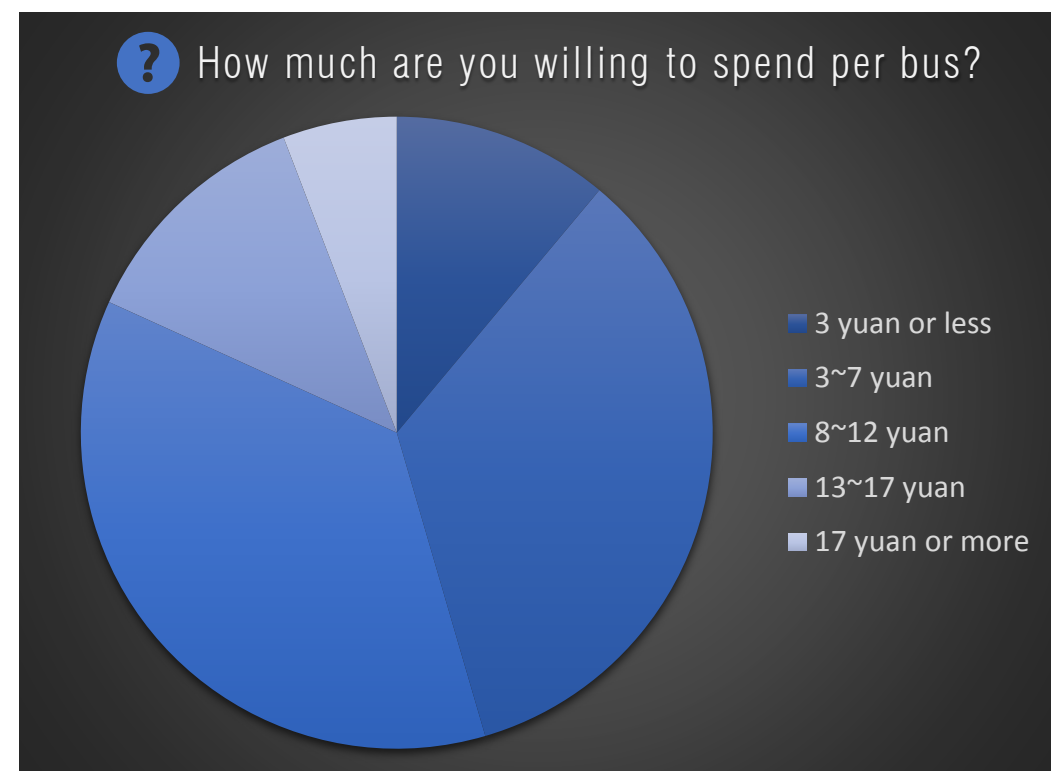
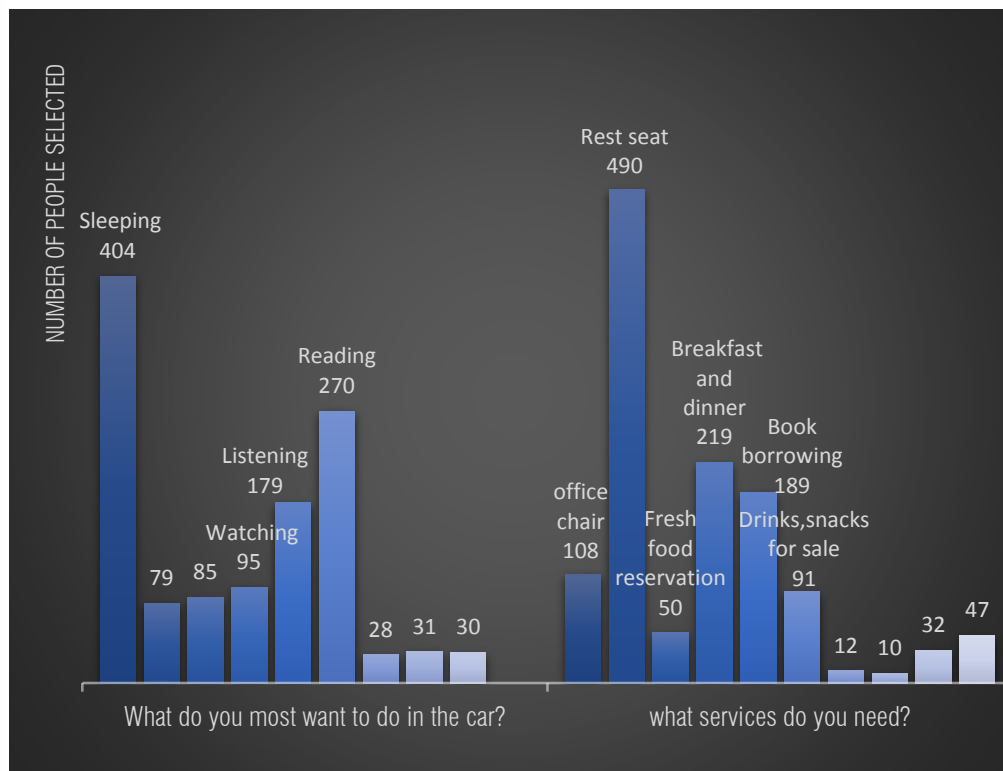
## Statistical Results

### Demand

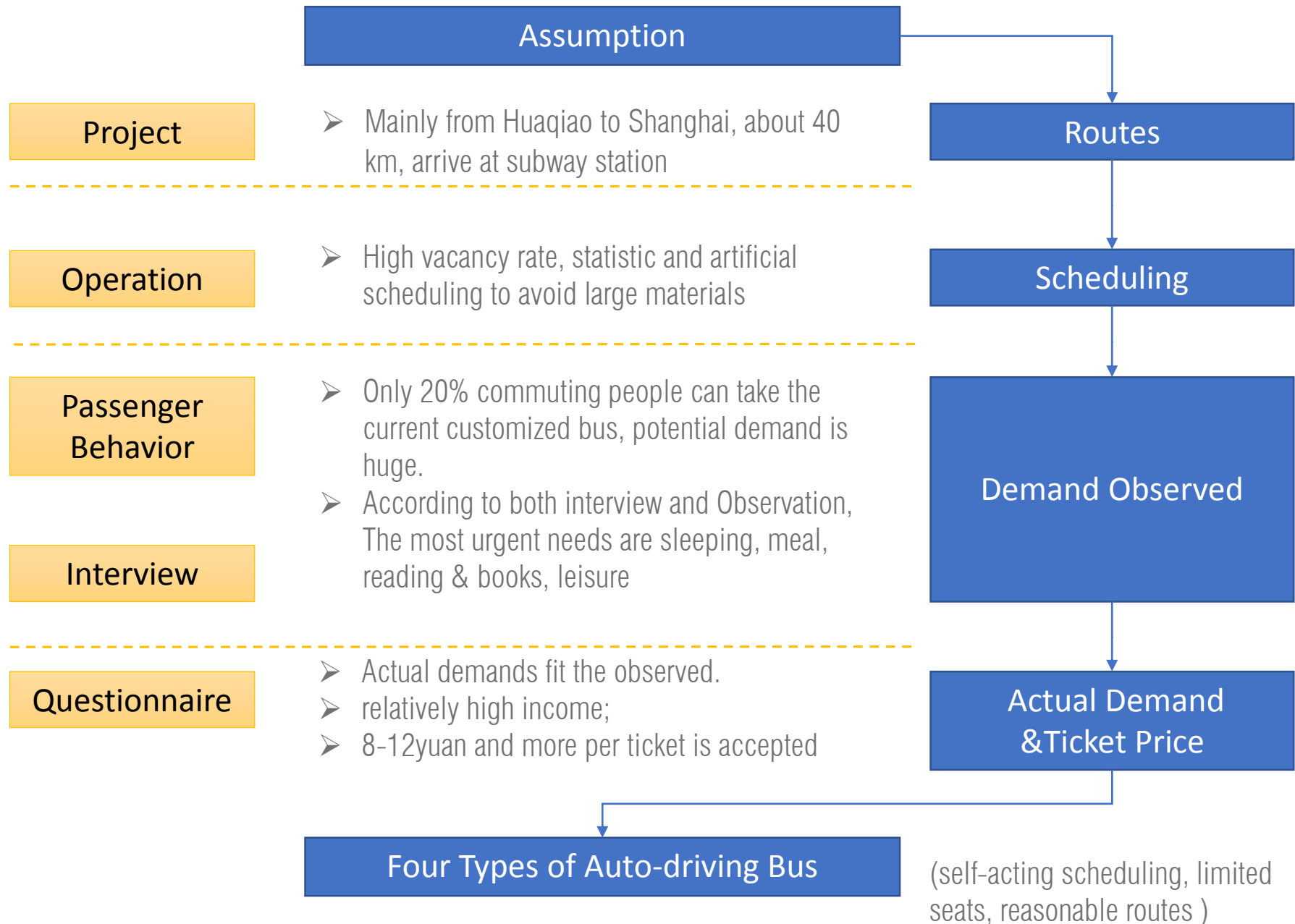
Residents are generally willing to sleep (59.32%), reading (39.65%) and leisure (13.95%) while the running of the vehicle. In addition, passengers hope that commuter vehicles can provide special office seats (15.91%), fresh food reservations (7.36%), breakfast and dinner (32.25%) and beverages, snacks sales (13.4%) and other services in the future.

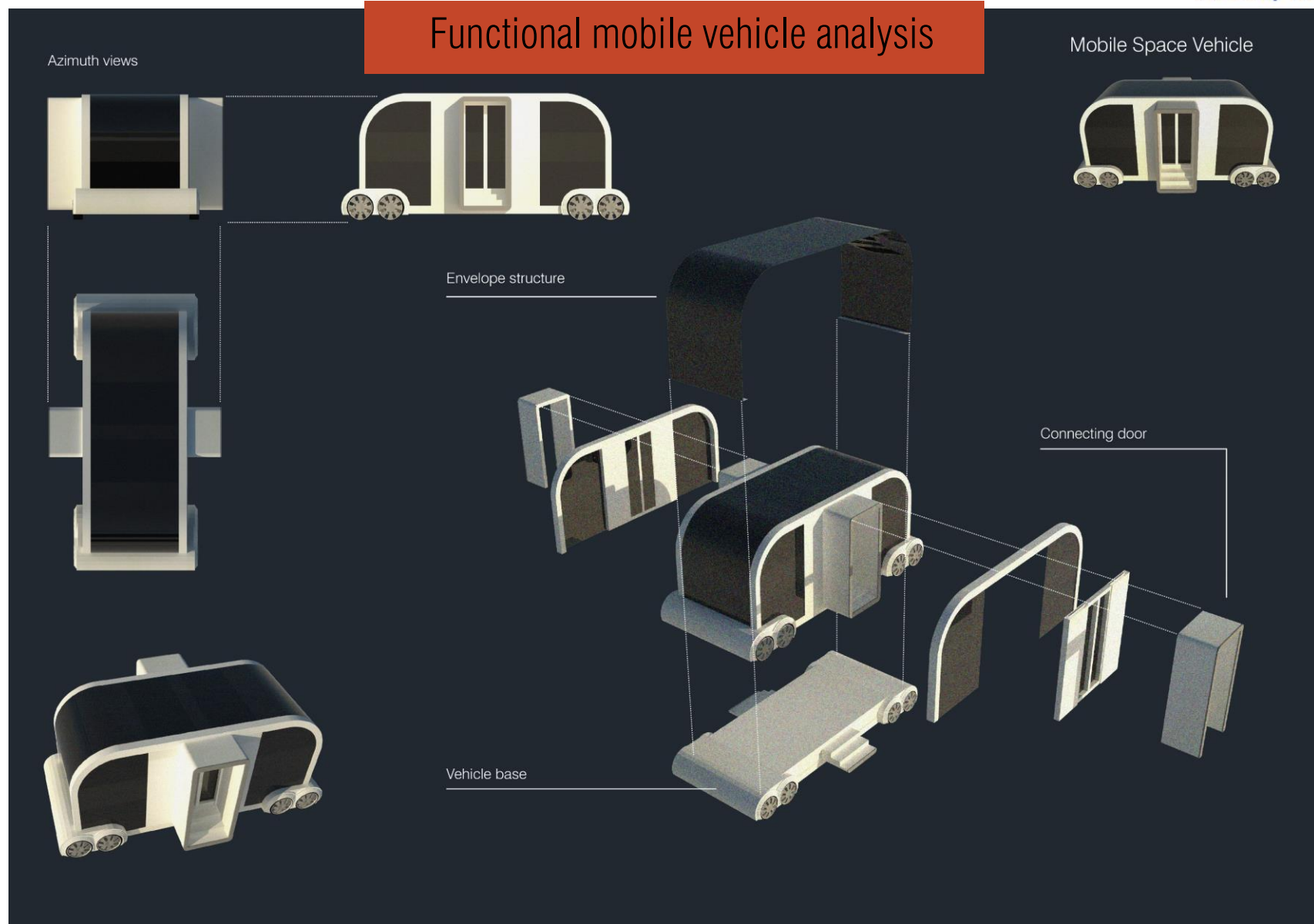
### Payable fees

3 to 7 yuan (34.4%) and 8 to 12 yuan (36.3%) per trip.



## Survey & Questionnaire Conclusion



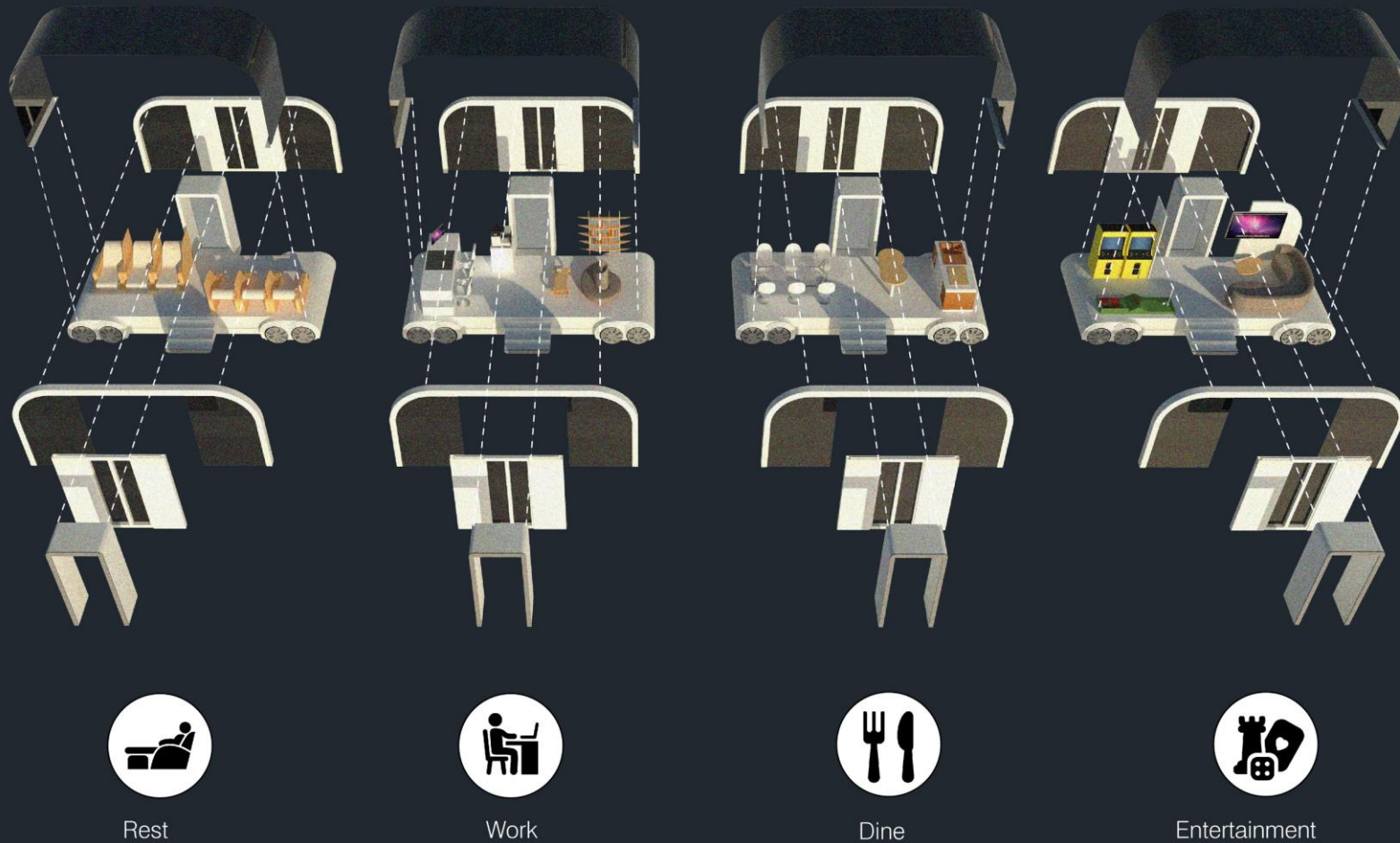


Based on the survey results and comprehensive analysis, we designed a vehicle that meets people's travel needs.

## Functional mobile vehicle analysis

Four types of vehicles

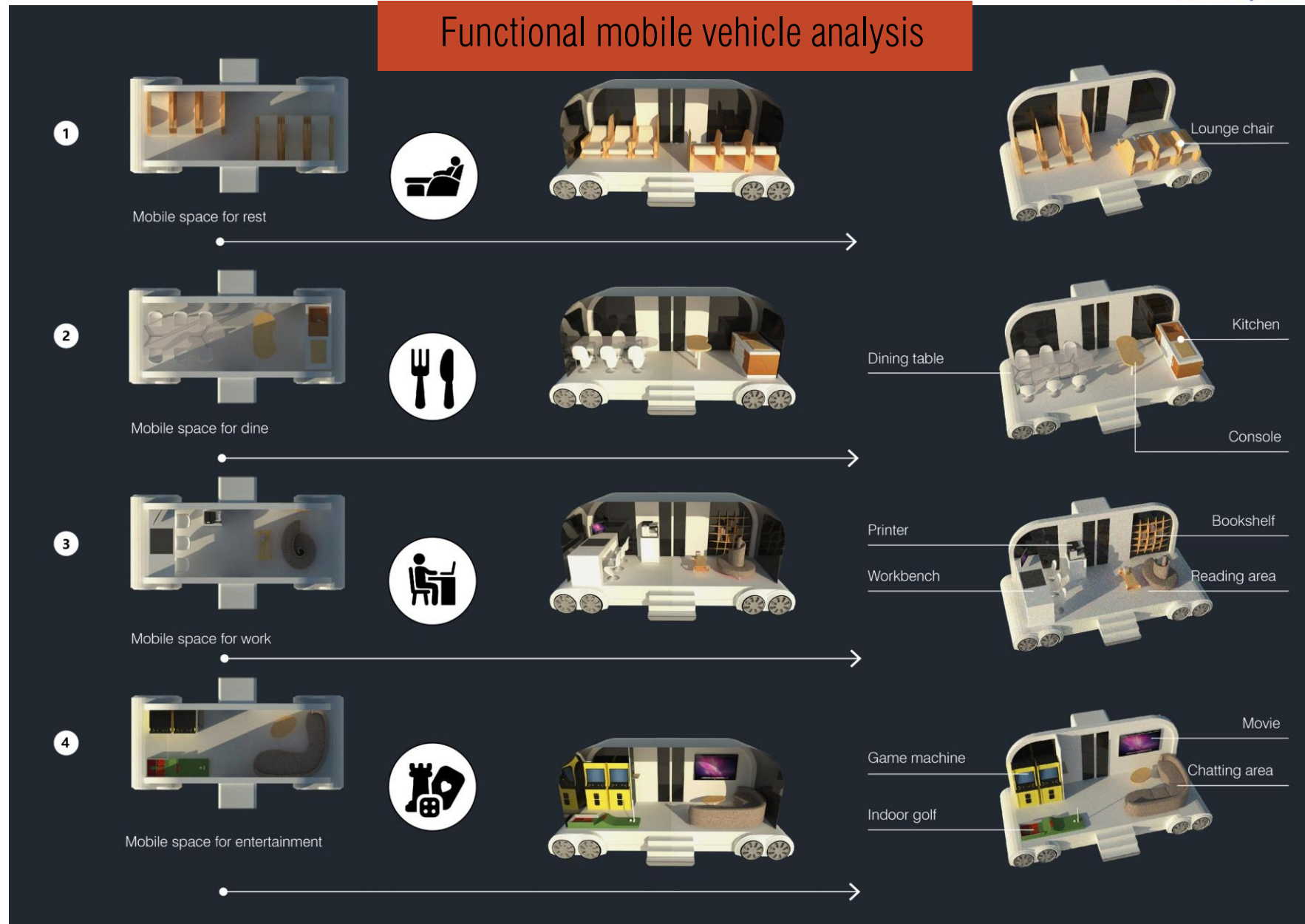
According to the questionnaire, people are more inclined to have four aspects in the car activities, namely rest, catering, work and entertainment.



Based on the data collected, we screened out four of the most popular features and then designed four vehicles with independent functions.

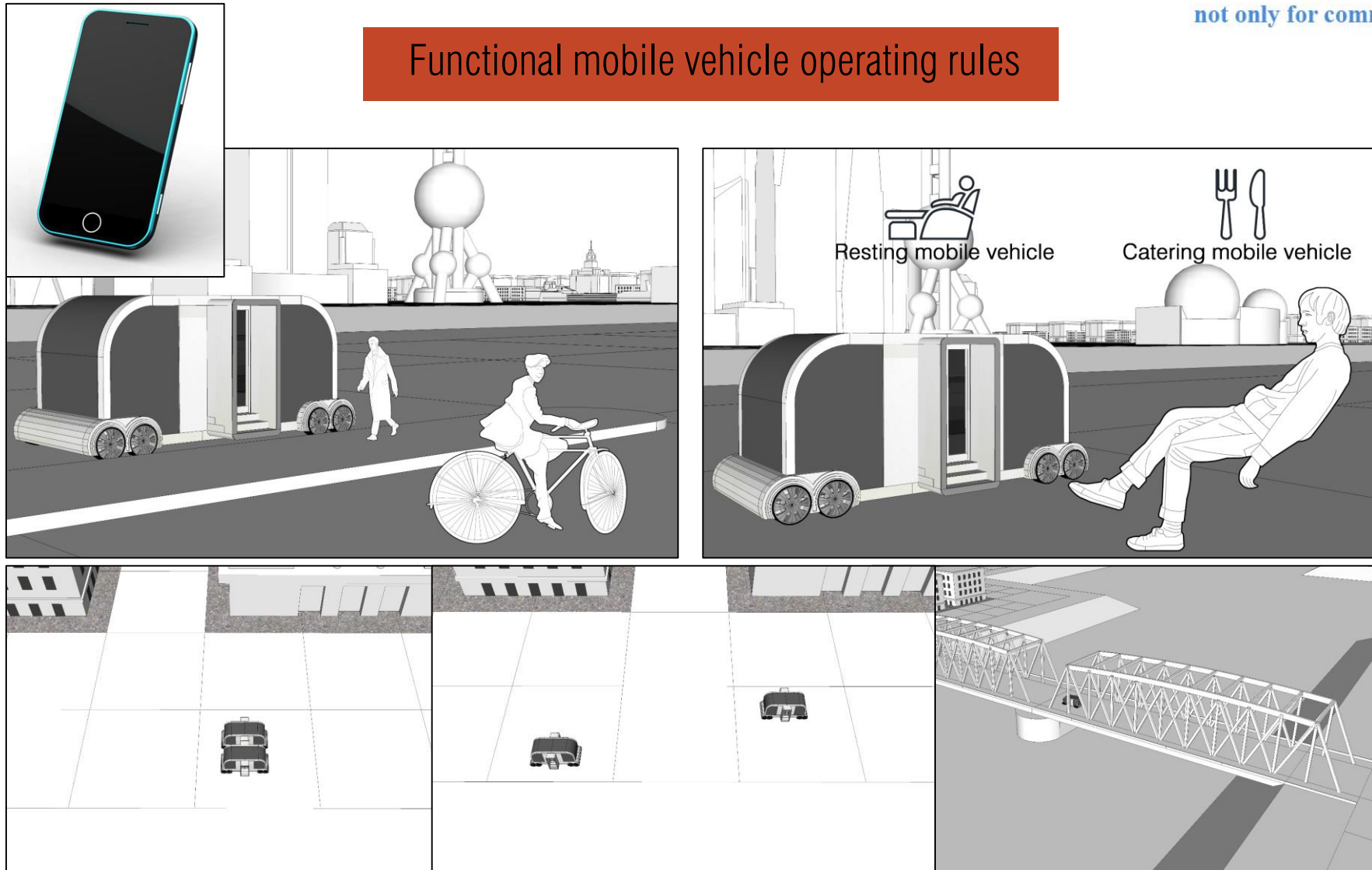


## Functional mobile vehicle analysis



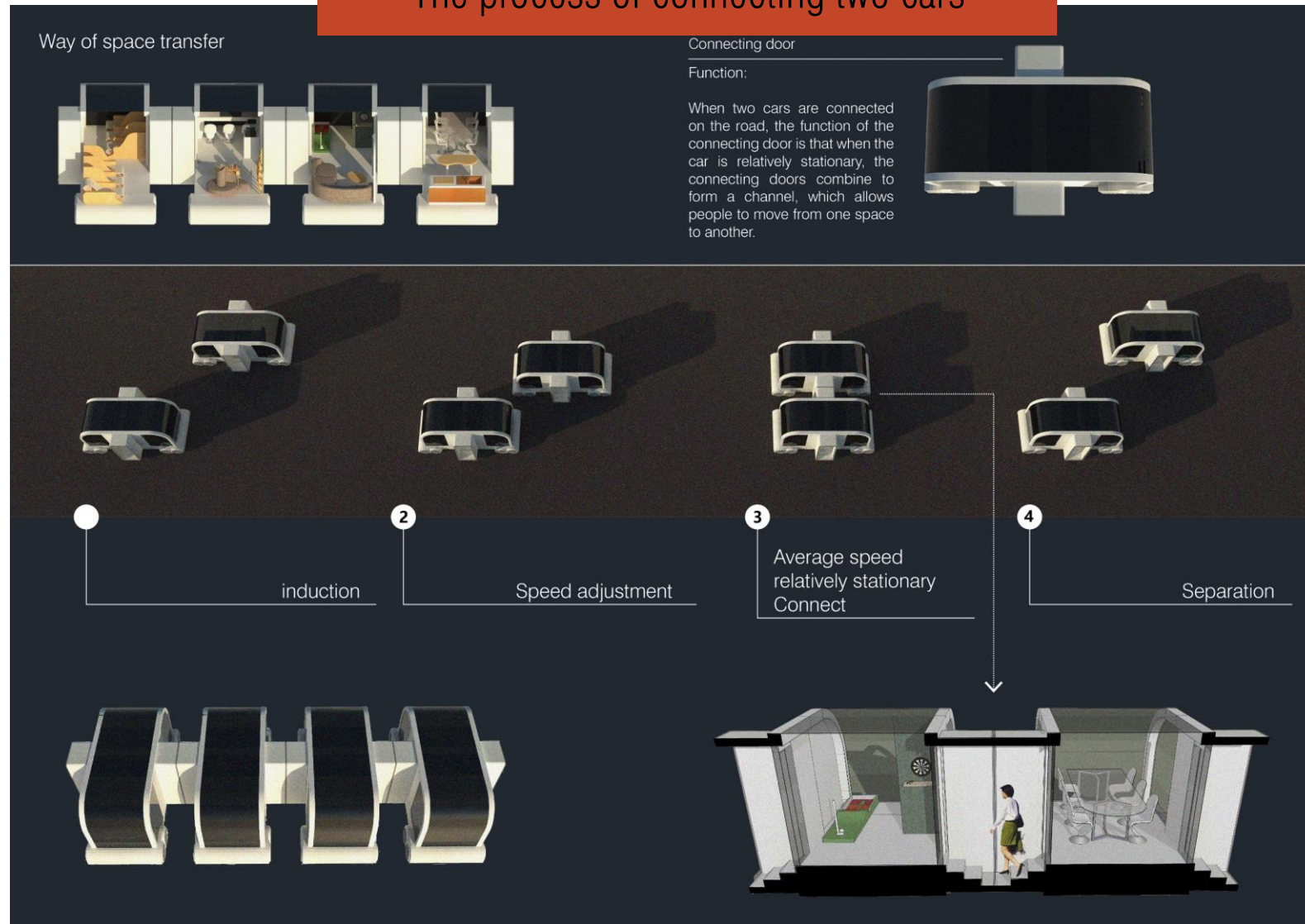
This type of vehicle can accommodate up to six people at the same time. In addition, the vehicle interior equipment is designed with humanity in mind, and is dedicated to providing users with the most comfortable service.

## Functional mobile vehicle operating rules



Before taking the vehicle, the user uses the mobile phone's dedicated APP to make a reservation for the vehicle, determining the time of travel and the functions and duration of use on the way. When the passenger wants to enter the next functional space, the data system notifies the corresponding function of the vehicle to connect with it, thereby realizing the passenger from one space to another.

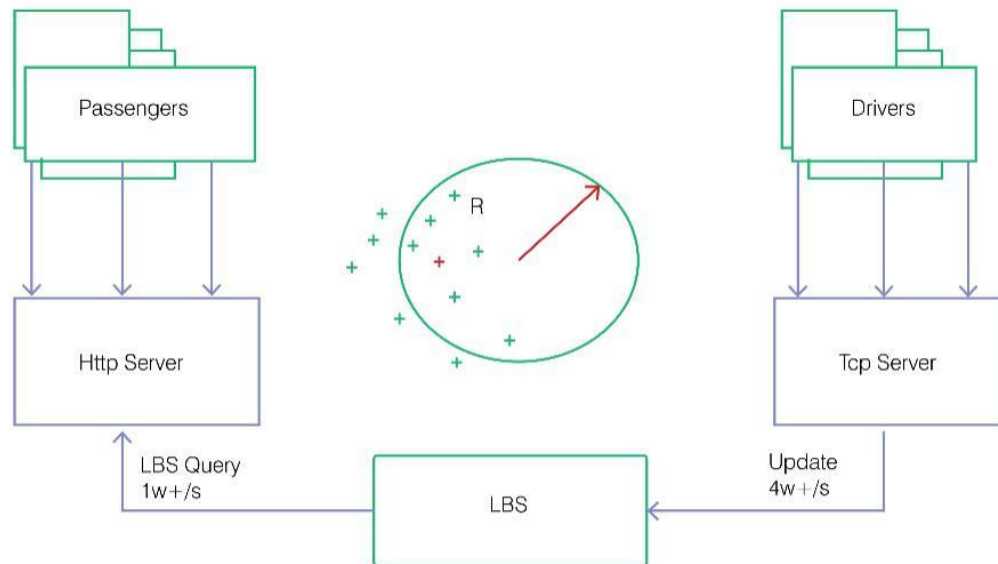
## The process of connecting two cars



First, the two cars each adjust the speed. When the two cars move side by side, the speed is adjusted to be the same. Then, slowly approaching, a passage is formed by the connection of the two doors, thereby realizing the passengers to pass through the relatively static space.

## Technical Support —— 1. Online APP Booking Technology

### The Operating Principle of The App Reservation System



Push the order to the driver through the long connection service; The driver takes the order and begins service.

**3.Bus-taking:** the minibus will arrive at the designated place to pick up the passengers who need to take, and then deliver them to the designated point according to the reserved route.

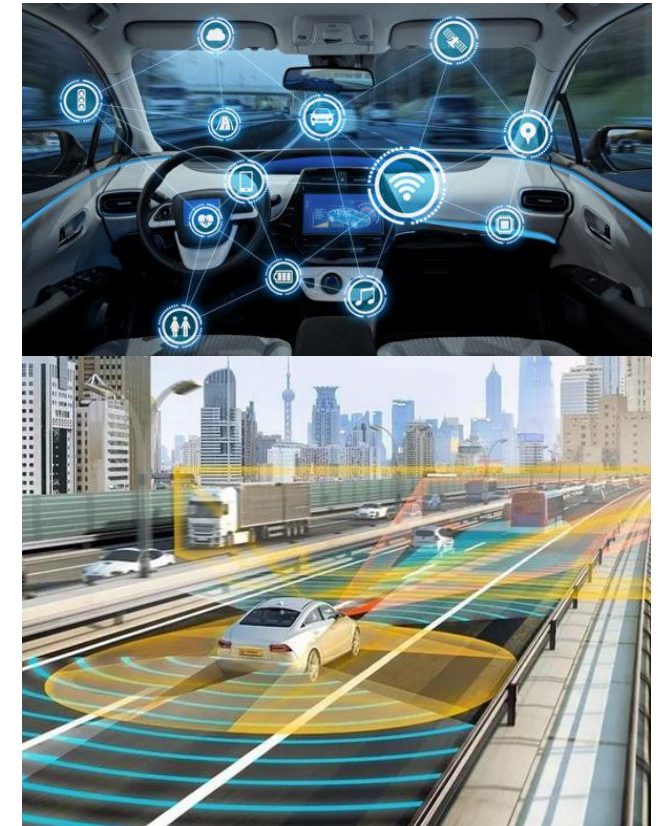
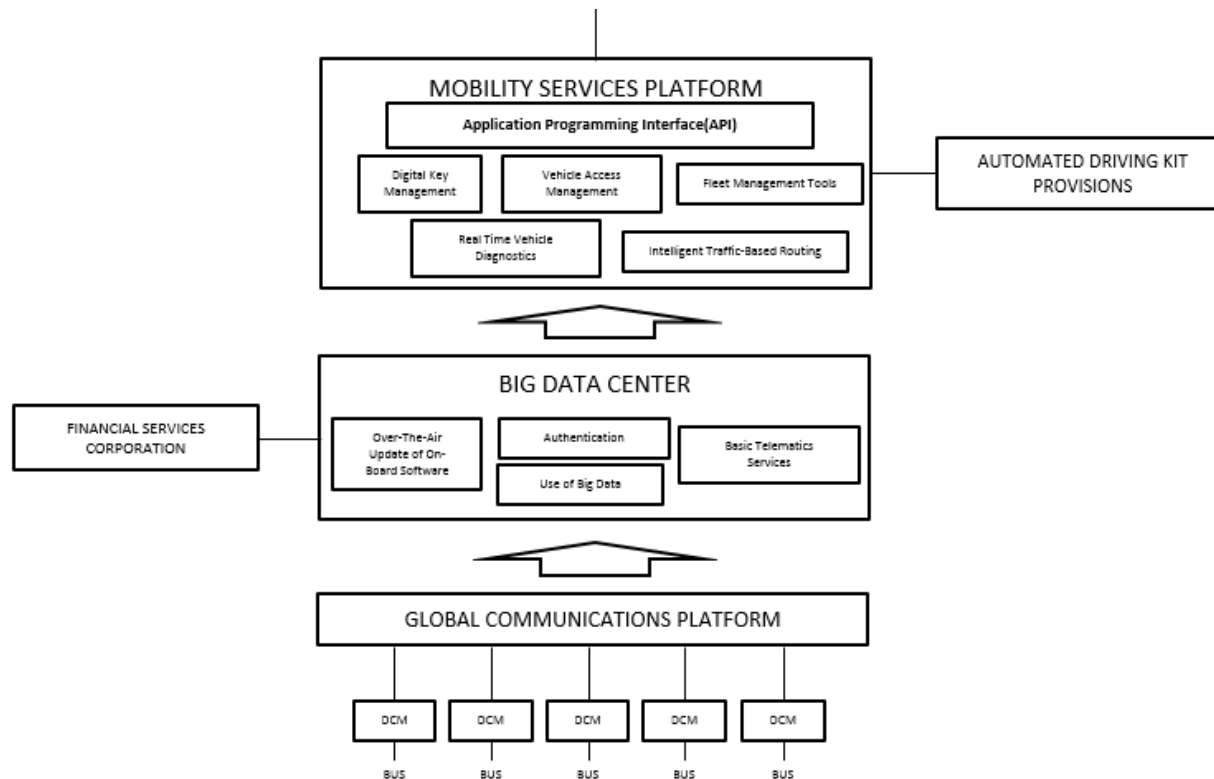
**4. Return:** when the minibus is finished, it will judge whether it needs to be charged according to the electric quantity, and then it will arrive at the nearest charging pile for charging and give a prompt on the display screen.



1. **Registration:** users log in the website and fill in their information as required
2. **Appointment:** members can make appointments on the APP according to their own needs, such as the model, region and use time, etc. The Internet can automatically search for the nearest minibus according to the members' needs to complete the appointment. The system is based on the basic LBS service. The driver will report the longitude and latitude every few seconds and store them in MongoDB. When the passenger issues the order, the nearby driver is selected through the MongoDB ring.

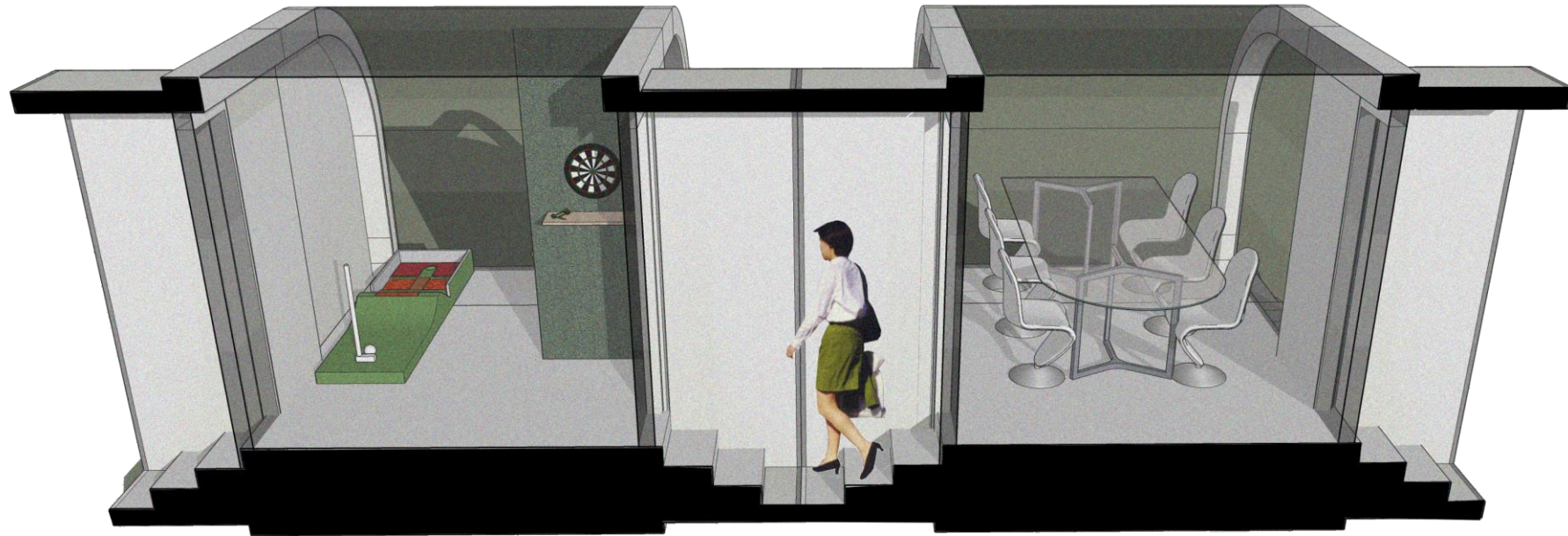


## Technical Support —— 2. Self-driving Technical Support



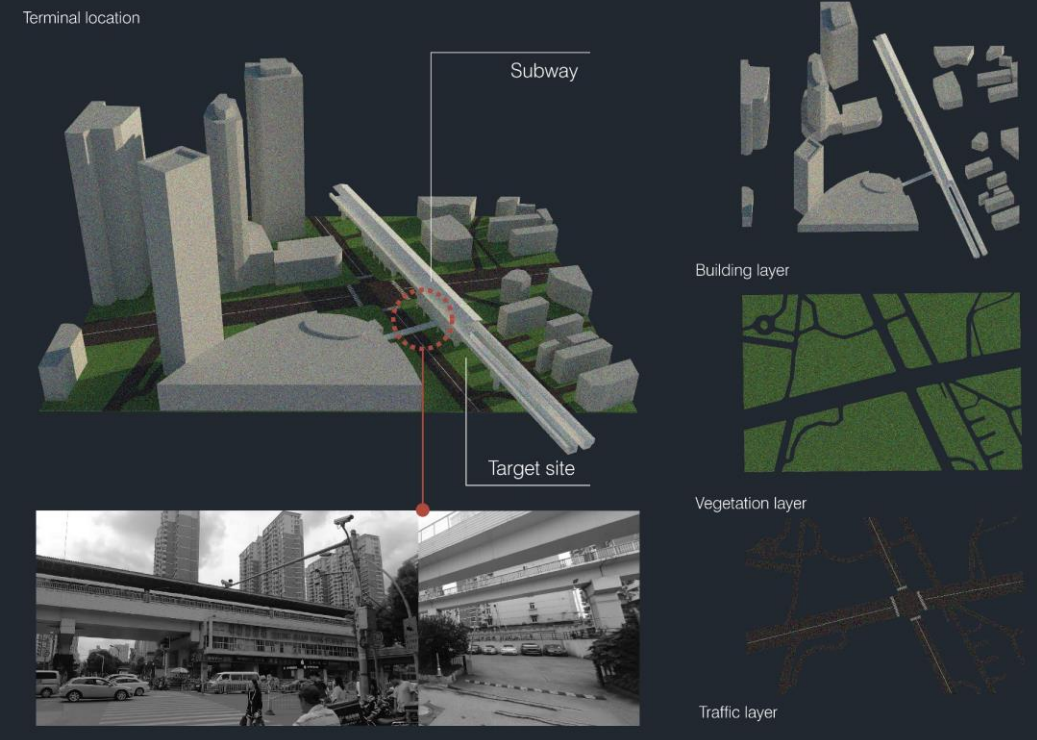
Driverless cars through digital Communication modules (Data Communication Module) will all vehicles built up a global Communication platform, and use the platform to build large Data center, Data collected by including regularly updates on software radio transmission of information, identification information, basic telecommunications services, and other large Data use. The data is then standardized into subsystems for different purposes, such as electronic key management system, vehicle access management system, order management tool, real-time vehicle diagnosis system, and intelligent traffic navigation system. By connecting to subsystem standardized apis, mobile retailers can conduct unguarded business.

## Technical Support —— 3. Car Hinge Technical Support



The vehicle uses a similar principle to space docking. Taking the ground as a reference, when the vehicle travels at a certain speed, the two vehicles remain relatively still, and they will automatically dock with another vehicle through the mechanical hinge device on the door, and finally link up through the door frame. The whole process can be divided into four stages: long distance guidance, short distance guidance, final approach and docking. The door frame is attached with a rubber device, and the two are tightly adsorbed together to ensure the tightness of the joint.

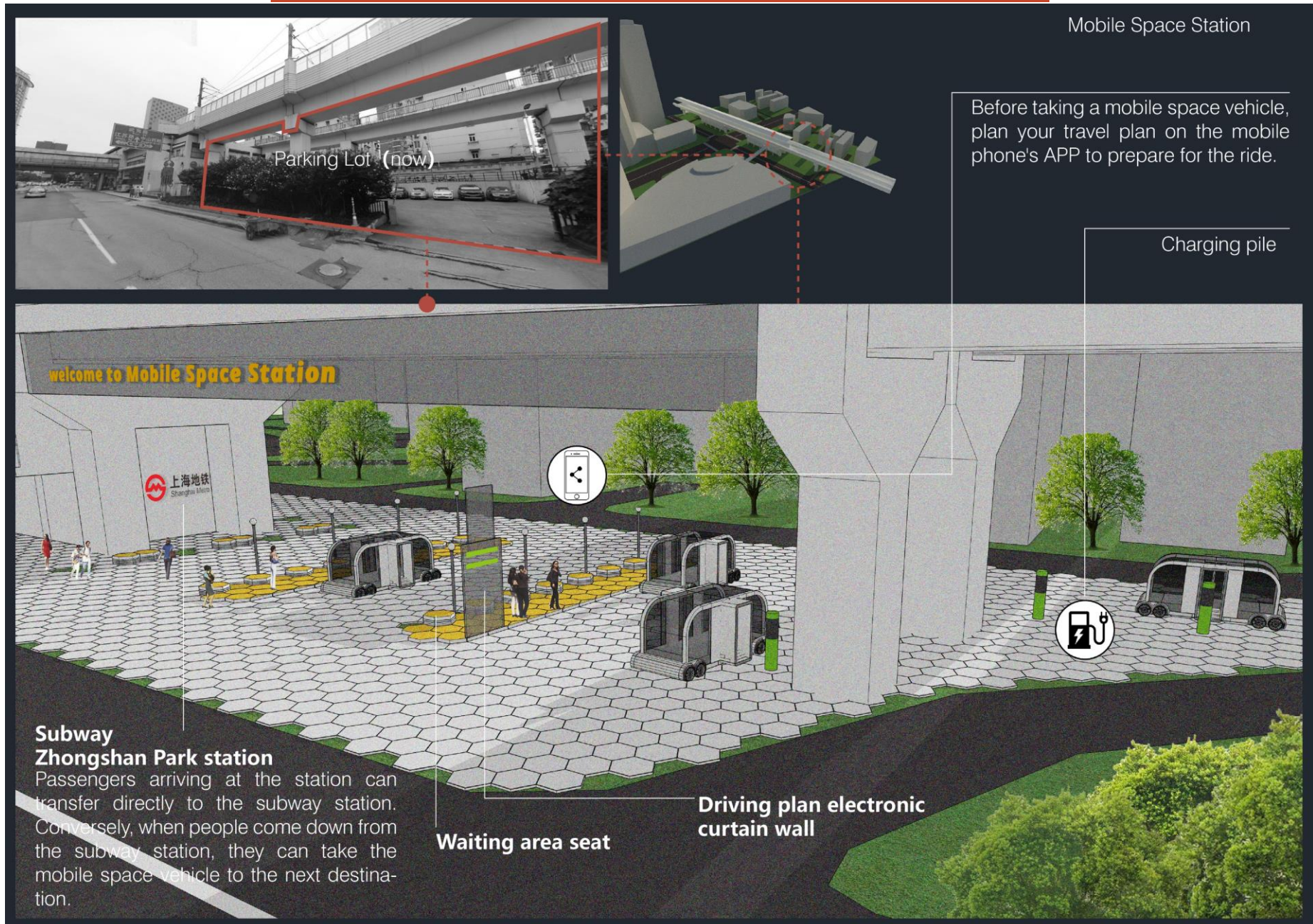




Through field research, we found that there is a parking lot under the Zhongshan Park Station. In fact, this land is unnecessary as a parking space, so we designed a place under the bridge to be a station for functional mobile vehicles. Another reason is that when passengers get off at the station, they can take the subway directly at Zhongshan Park Station, or people from the subway station can take the car directly to the next destination.



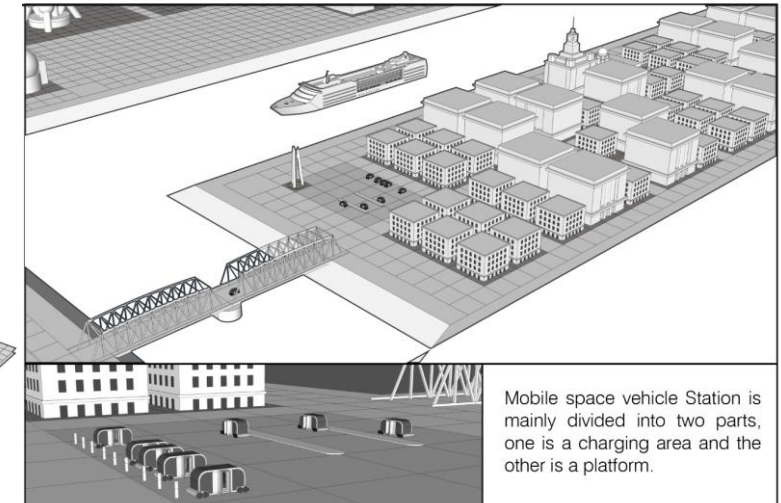
## Community change —— Design of dedicated stations



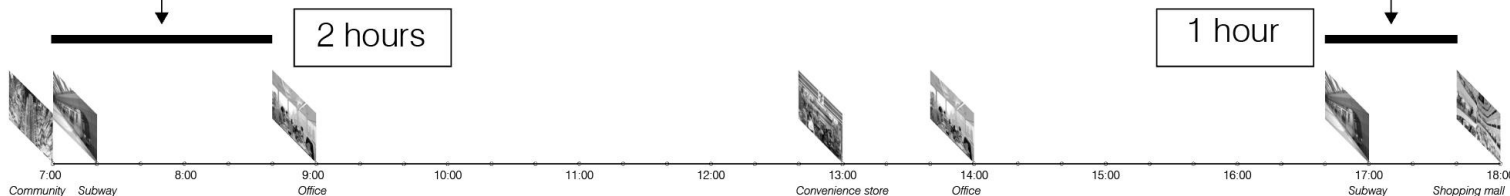
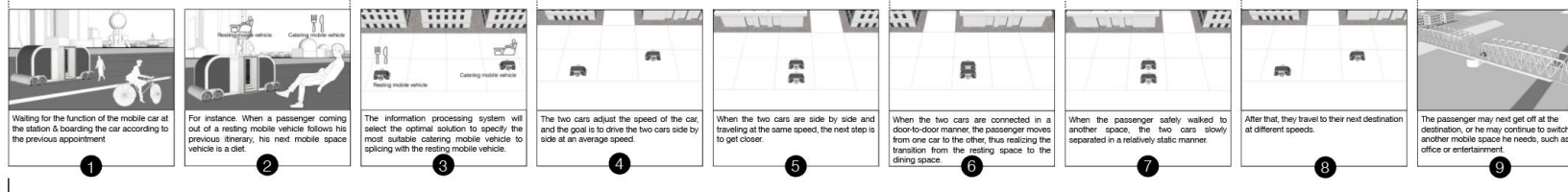
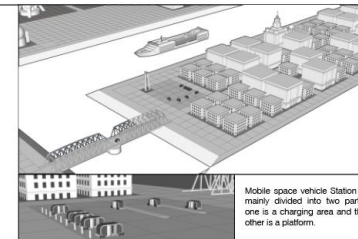


# Simulation scene in Shanghai

## Mobile space vehicle station



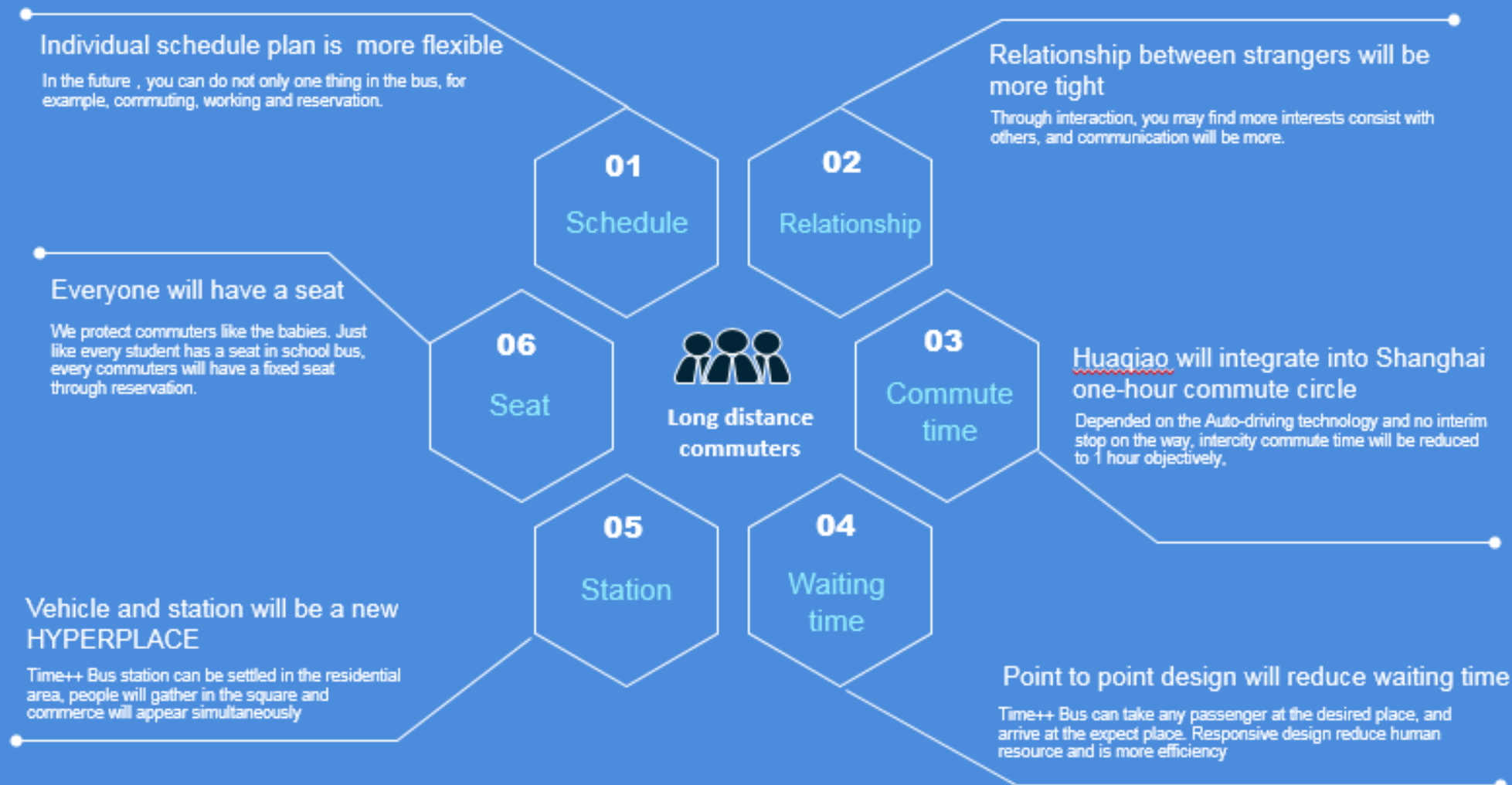
Mobile space vehicle station



The usual day. However, if there is such a car, the man can use three hours to do a lot of things.

This is a scene of such a vehicle running in a big city. Here we give an example. A company employee spends about three hours a day on commute, but if the car appears, he can use this precious 3 hours to do a lot of meaningful things.

### Six Benefits of Time++ Bus



# Thanks!

——Time + + Bus: not only for commuting

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