

# Software Engineering Project Proposal

## Smart parking

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*URL (s) :*

<https://github.com/software-groupp/smart-parking>

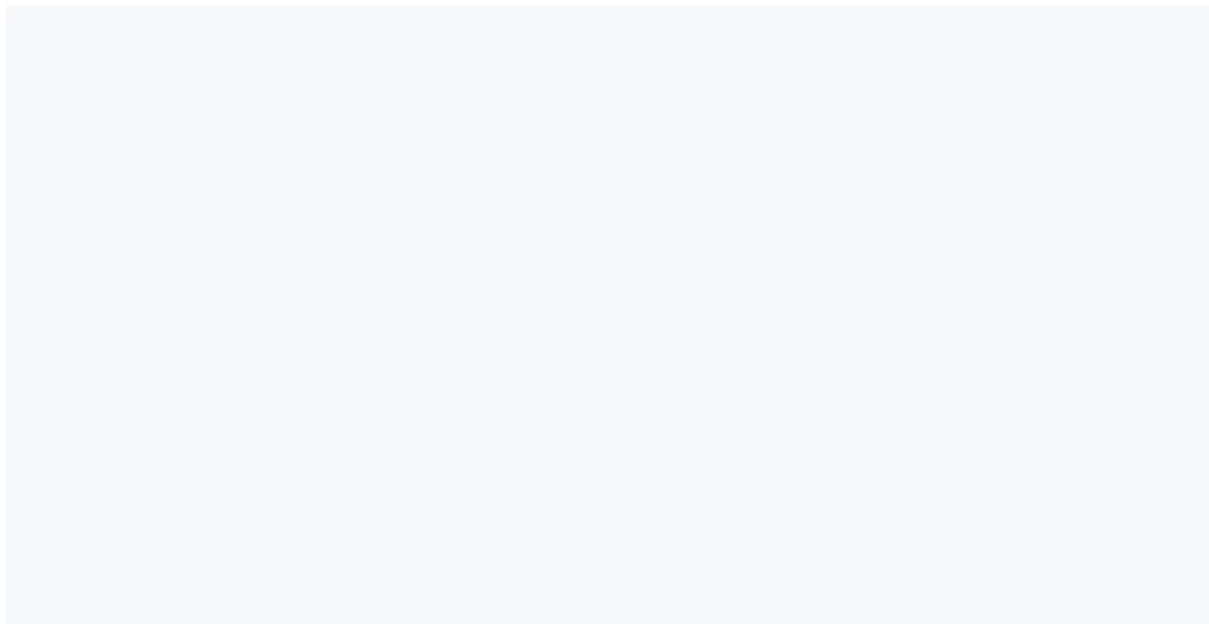
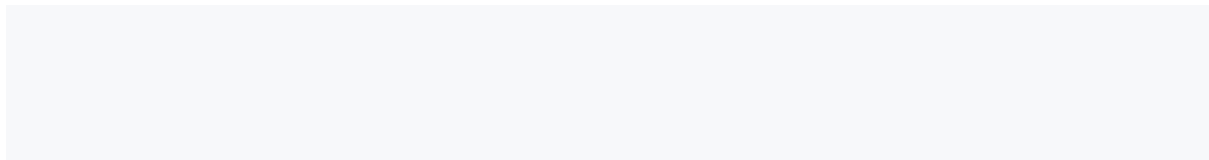
## **Project Management**

Thomas: Problem diagnosis, Proposed treatment, Plan of work , Problem Statement, Use Case4 :Camera sensor, Use Case5 :TimerUse Case, 6 :No Availability, User Interface Specification, User Effort Estimation, Overall arrangement of the project

Even: Problem diagnosis, Proposed treatment, Plan of work , System Requirements, Non-functional requirements, Use Case1 :Payment, Use Case2 :Parking , Use Case3:Going out, Traceability Matrix, Fully-Dressed Description

Alex: Problem diagnosis, Proposed treatment, Plan of work , User Interface Requirements, Use Case7 :Register, Use Case8 :Sensors, Use Case9 :ad-hoc, Stakeholders, Actors and Goals

Alan : Problem diagnosis , Proposed treatment , Plan of work , Project Management



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**Problem diagnosis:**

As we all know, due to the large population base in China, with the social progress, there will be more and more private cars on the roads, but the corresponding parking lots are small and messy. In fact, the biggest headache for car owners is not traffic, but parking - not only is there less space, but it takes great skill to park. Especially in places with heavy traffic, car owners do not know where there are free parking Spaces, so they are crowded together, resulting in traffic congestion in the parking lot. In addition, the existing parking garage/parking lot is too complex and requires a complete and impractical renovation to build a new parking lot, which requires too much time, manpower and material resources. Therefore, the idea is to make some small changes to the existing system to achieve the maximum effect. This small change will not cost much money, time or human resources.

**Proposed treatment:**

Domestic parking problems mainly lie in: 1) the parking lot is small and disorderly, it is difficult to find parking space. A parking lot should not only show the number of empty Spaces in the whole parking lot that the owner can see, but also tell the owner its specific location. In this way, car owners do not have to blindly look for a parking space and lead to traffic jams. 2) charging system. The parking lot adopts unmanned charging, automatic timing and offline charging. Our parking system has a corresponding APP support, which supports offline payment, thus saving time, so that the owner does not have to spend time waiting at the garage door when driving away the car.

**Plan of work:**

We need to install a sensor in each parking space to record whether there is a car or not. If there are several floors, a large enough screen will be set up at the entrance to show the remaining parking Spaces on each floor, and the owner can choose which floor to park on. At the entrance of each floor, a display is set up to show which row and position has a parking space. In addition, the number of lines and number of the parking lot should be obvious, so that when the owner enters the parking lot, he will know where there is a parking space, and the owner can drive the car to the designated location according to the corresponding sign. Here are four modules for building an intelligent parking lot:

**1) monitor system**

It is located at the entrance and exit of the parking lot. Its function is to record the entry and exit of the vehicle. The monitor will take pictures of the vehicle, identify the vehicle's license plate number and color, and record the entry time, so as to realize no parking access. This is much faster than the traditional card charges and manual charges. The information collected by the monitor is sent to the computer, which starts the timer and stops it when it

goes out through the exit monitor. So let's say a car goes in, goes out, and we have the amount of time it's going to stay here, so we can charge for it. ; Unlicensed car owners can enter by scanning the static qr code through WeChat. When leaving the field, they can scan the qr code to complete the payment and exit the gate.

## 2) display and sensor system

The display is located at the entrance to each parking lot, or at a prominent place in the parking lot. The sensor is located in each parking space, and the display can use the simplest led display, which only displays the number of vacant parking Spaces and their respective positions in the parking lot. The sensor needs to be numbered, which means that corresponding to each parking space, an infrared sensor is adopted, whose function is to sense whether there is a vehicle in its position and transmit the signal to the system. The system is analyzed and displayed on the monitor. Let's assume that any car entering the parking lot already knows where the space is, and when it drives away from its parking space, the display shows that the space is empty.

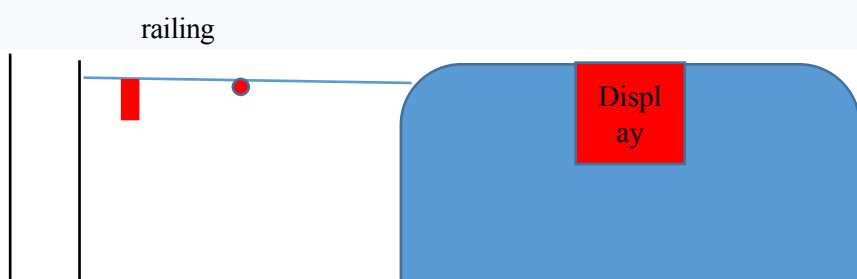
## 3) mobile app offline payment system

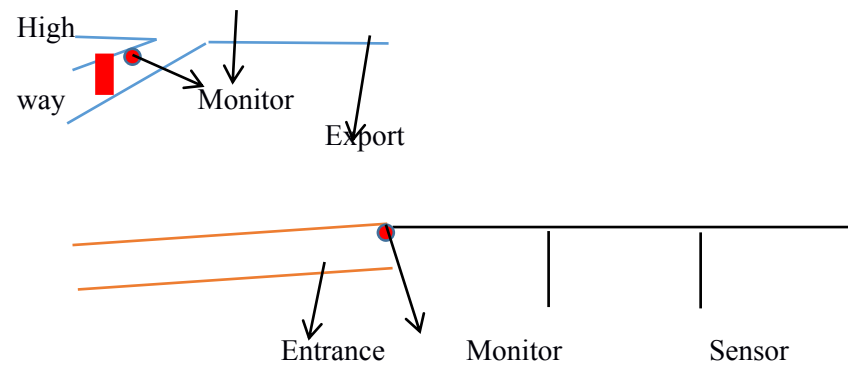
In order to reduce the time of waiting in line to pay the money, the car owner can pay the money on the handheld terminal (WeChat small program, app) a few minutes before getting on the car. The system will upload the information and stay time of each car and automatically calculate the amount. The car owner can check the corresponding timing system on the app to facilitate the driver to pay attention to the parking time and charging status at any time. Registration is not required on the app, and users can pay as long as they input their vehicle's license plate information. We assume that the forgiveness time is supported for half an hour, if the user paid at 14:30, then it can be out of the parking lot before 15:00.

## 4) detection system

We won't leave out the usual parking lot fence, it will show up at the final exit. The detection system consists of two monitors and two bars. Let's assume that after the vehicle comes out of the parking lot, it will pass a fork in the road, and there is a monitor at the intersection to collect the vehicle license plate number information to the computer. If the vehicle has paid money or comes out within half an hour after the payment, then the railing in front will be raised and it can go out. Otherwise, you will have to go to another intersection, manual charge.

View:





# **I. Customer Problem Statement**

## **a. Problem Statement**

As we all know that the biggest headache for motorists is not traffic jams, but parking. According to Sohu.com: Today, according to statistics, the number of cars owned by the company is 197 million. This shows that regardless of the size of the city, most areas, especially during peak traffic hours, it is difficult to find a parking space. The difficulty is that the parking garage/parking system is too complicated and the owner does not know where the space available at the time may be. Even knowing that many vehicles may pursue very limited, spacious parking spaces, causing serious traffic jams. Therefore, it is especially important to build a smart parking lot today in the rapid development of technology. Therefore, we have studied the most advanced parking strategies in intelligent parking systems in recent years and compared their performance. It is found that the management of existing parking systems and parking spaces generally has the following problems:

1) Timing problem: The owner is very confused about the timing system when parking. In our investigation, most parking lots do not have a system to provide the owner with a parking time. They can only pay according to the price quoted by the machine. In fact, they do not know about the parking time and charging system. Owners may be criticized for parking lots due to cost issues, which can cause problems for parking lot management. Therefore, it is critical for car owners to see their parking time directly.

2) The procedure is cumbersome: when the owner is in and out of the parking lot, it

is very complicated to park the line for charging. Especially in the late peak period, this problem is particularly obvious. Even in the most advanced parking lot, you still have to face the time when the parking lot is blocked by the railings and the charges are delayed. Therefore, it is imperative to solve the problem of excessive parking time and delay in parking efficiency. Moreover, setting up a manual toll booth requires unnecessary human and material resources, and this problem will no longer exist in the new system we are building.

3) Car parking is chaotic: the car is unreasonable and the parking space is difficult to find. This is the most important problem faced by car owners today. Due to the rapid increase in the number of domestic cars, the number, size and environment of parking lots have not improved. Parking is a skill that requires a high level of skill, and finding a parking space is another, more difficult thing: people often spend a lot of time trying to find a comfortable parking space. Therefore, many car owners are free to stop after driving the car into the parking lot, which causes the parking lot to be chaotic. There are obviously many parking spaces, but because there are too many vehicles in some areas, it is too messy to be blocked. Maximize the use of parking lot efficiency.

4) Mobile and parking lots: The market is blank, which is an urgent need for improvement. As early as 2012, mobile phone users replaced the computer with the overwhelming advantage of 500 million people, becoming China's largest network terminal. And until now, there is no good website, app or WeChat applet that makes the connection between the parking lot and the user. Owners still need to spend a lot



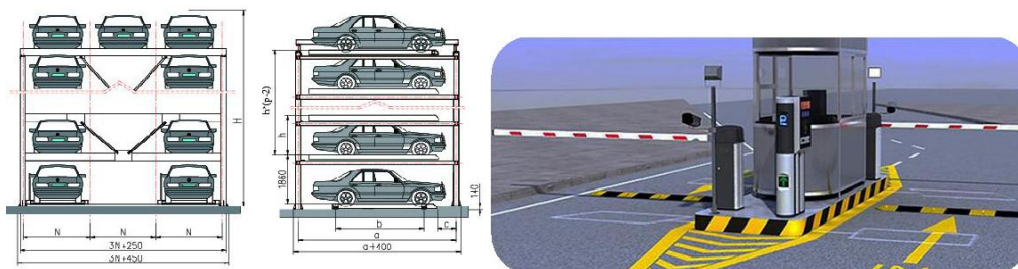
of manpower, and they need to move around to realize the management of the parking lot. Therefore, the driver needs a software to tell them the specific location of the parking space, observe the safety information and timing charges of their vehicles, and pay the fees on the handheld mobile terminal. And this operating system can not be too complicated, should save the cumbersome functions such as registration, focus on its practicality and functionality, simplify the payment system, and thus enhance the user experience.

5) The difficulty of the parking lot reconstruction is large: too many rules are bound, too many problems cannot be solved centrally. In all the current intelligent parking lot management systems, too many are forced to use a lot of manpower and material resources, and the investment risk is too large to be eliminated. The elevator garages mentioned in many reports are hierarchically partitioned into elevators. They seem to be very high-end. In fact, they need to build large-scale machinery and equipment, which consumes a lot of money, and the equipment maintenance and management in the later period are not It is considered in the column. Therefore, what we need is to make minor changes on the basis of the existing parking management system, without using too much manpower and material resources, so as to maximize the efficiency of parking lot management.

Therefore, we can know that in the current existing parking system, most of the systems are due to fuzzy timing management, cumbersome entry and exit procedures, poor management of parking lots, no connection with mobile terminals, and difficult parking garage reconstruction. And the program has been eliminated.

Domestic parking lots urgently need reforms and improve their current status.

Existing smart parking solution :



## b. Glossary of Terms

- |                             |                                |
|-----------------------------|--------------------------------|
| 1) SE: Software Engineering | 2)HLD: High Level Design       |
| 3) LLD: Low Level Design    | 4) OOD: Object Oriented Design |
| 5) RCA: Root Cause Analysis | 6) SD: System Design           |

## II.System Requirements

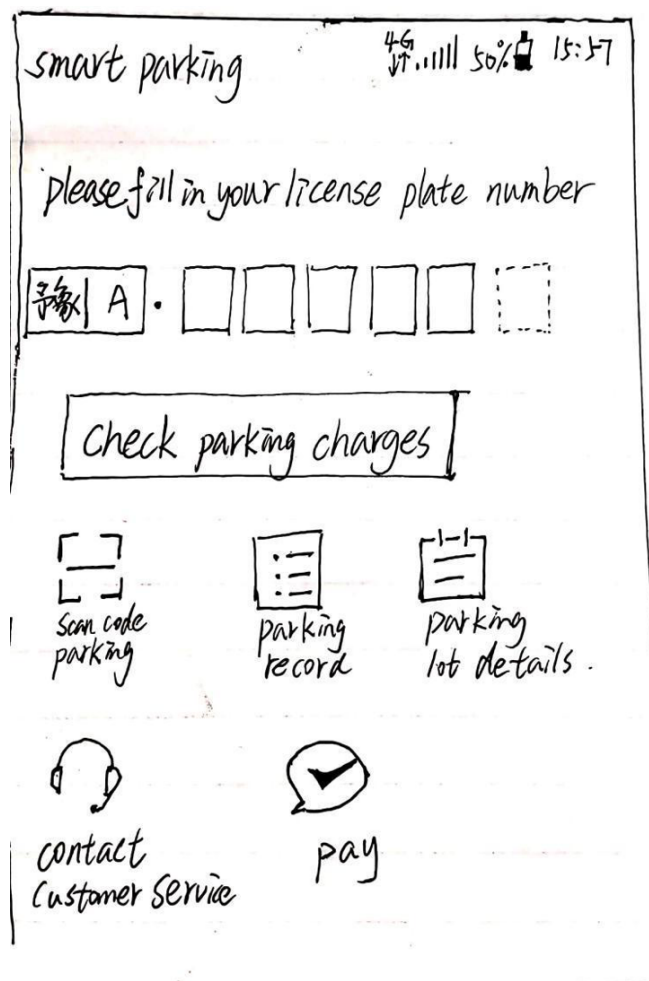
### a.Functional Requirements

Identifier	Priorit y	Requirement
REQ1	5	The system can provide online payment function on mobile app
REQ2	5	The system can display the specific position of the spare parking space on the monitor.
REQ3	4	The system can record license plate information.
REQ4	2	The system has the function of "fault tolerance".
REQ5	1	The system has manual checkout function.
REQ6	5	When the vehicle out, if the account can be out, if not out of the bill can not be out.

## b.Non-functional requirements

Identifier	Priorit y	Requirement
NFR1	5 F	The system will not be vulnerable to hackers to lose money.
NFR2	4 U	The system is very simple to use and can be understood at a glance.
NFR3	4 R	Only two minutes of downtime is allowed in 24 hours a day
NFR4	5 P	The system can be used by 100 people at the same time.It won't crash.
NFR5	3 S	The system can be applied to a variety of parking garage, easy maintenance.

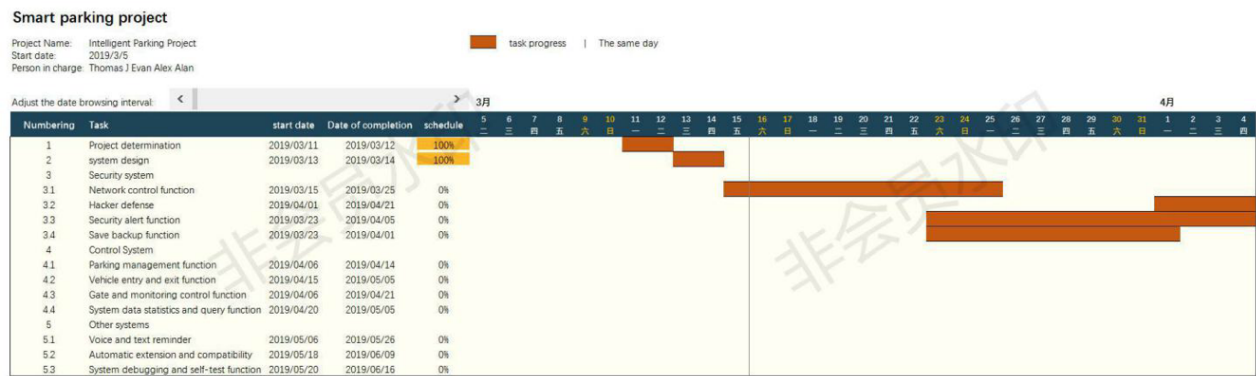
## c.User Interface Requirements



The user interface has a function button :

1. Add position
2. Enter the license plate number
3. Check parking charges
4. Scan code parking
5. Parking record
6. Parking lot details
7. Contact customer service
8. Pay
9. Personal center

Project Management



References

References from:

[http://www.itdlc.com/programview/558.html?bd\\_vid=7574043182115787937](http://www.itdlc.com/programview/558.html?bd_vid=7574043182115787937)

References from: [http://www.sohu.com/a/240932817\\_775892](http://www.sohu.com/a/240932817_775892)

III.Functional Requirements Specification

a. Stakeholders

This system is mainly used for the transformation of the existing parking garage, to help the garage owners to improve efficiency and reduce manpower recruitment, and to improve the utilization rate of the garage space.The system is very simple and convenient for people to use it.Below is a list of possible stakeholders in the system

- Customers: ad-hoc and walk-ins
- Parking Garage Owners

- Business Enterpris

b. Actors and Goals

Actors	Goals	USe Cases
License-Plate Reader	Read the license plate and pass it to the system	UC-4
display	Empty position	UC-2 UC-6 UC-9
System	Verify the vehicle information and store it in the database	UC-1 UC-2 UC-3
Customer	To enter the garage	UC-2 UC-3 UC-7
Clock	Start recording the stop time and transmit it to the system in real time	UC-5 UC-1

Customer	To leave the garage by car	UC-3
System	computational costs	UC-1
Customer	Pay	UC-1
handrail	permit through	UC-3

## c. Use Cases

### 1.Casual Description

Use Case1 :Payment

Users pay money on their phones

Use Case2 :Parking

The user stops the car in an empty space

Use Case3:Going out

The user pays and drives out within the allotted time

Use Case4 :Camera sensor

The user's license plate number is read

Use Case5 :Timer

Timing starts when the user's license plate number information is read

Use Case6 :No Availability

Users can observe the parking information on the display

Use Case7 :Register

Users can query the vehicle time information on their mobile phones

Use Case8 :Sensors

Sensors can sense parking information

Use Case9 :ad-hoc

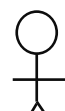
The user can select an empty seat with a target

### 2.Use Case Diagram

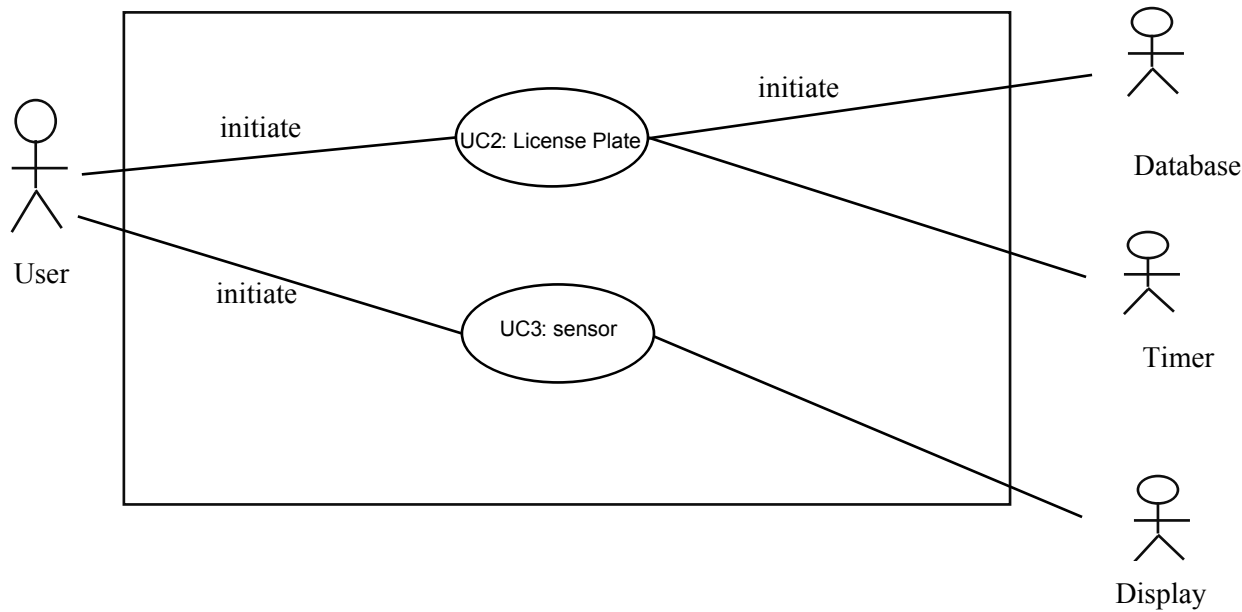
Use Case Diagram:Payment

UC1: Inquiry license plate  
UC2: License Plate Recognition  
UC3: sensor  
UC4: Verify license plate information

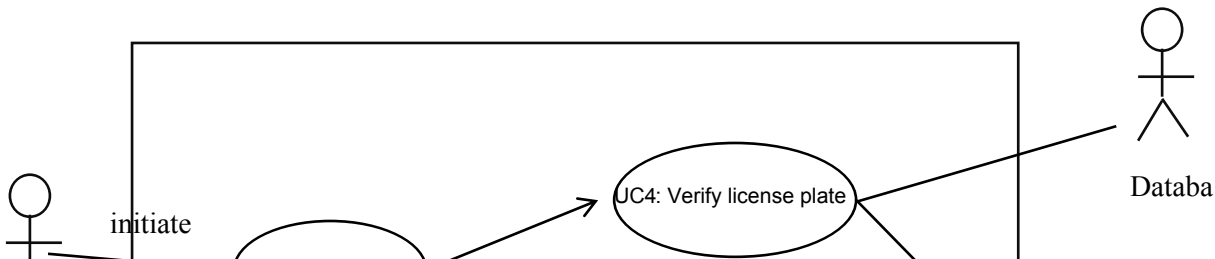
participate



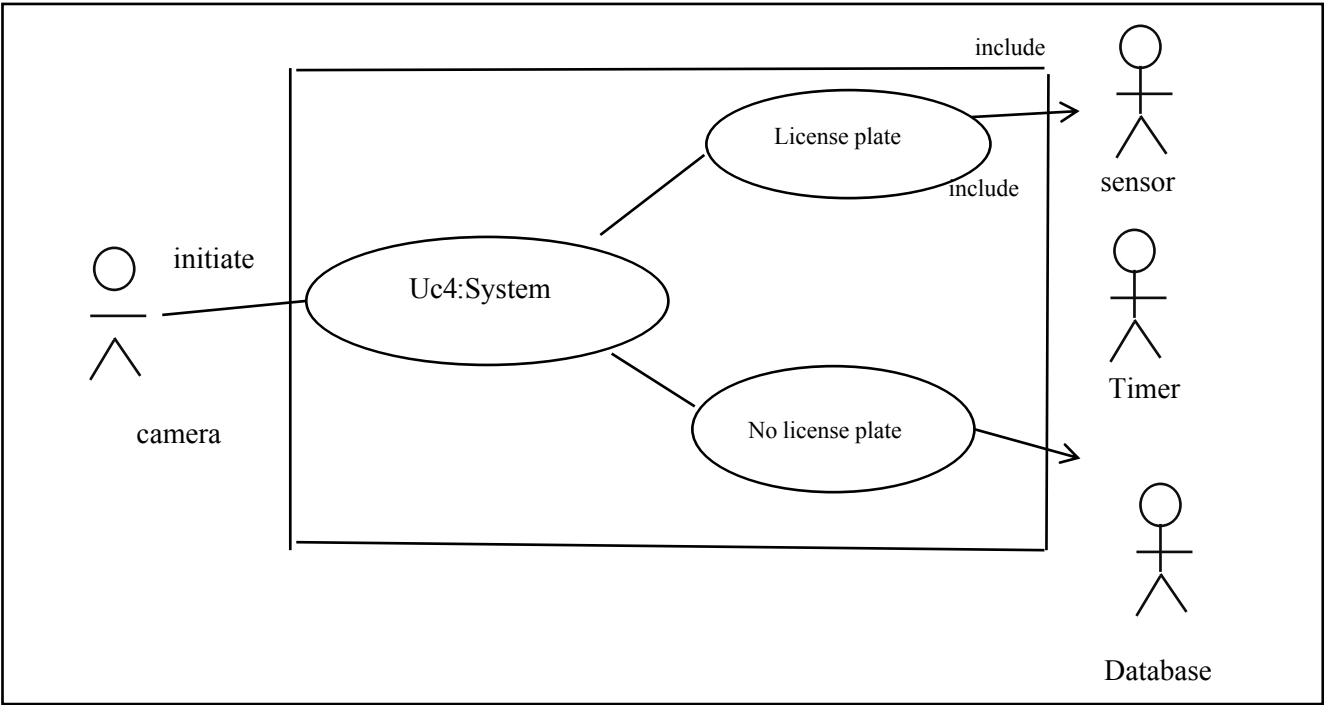
Use Case Diagram: Parking warehousing / picking up the car



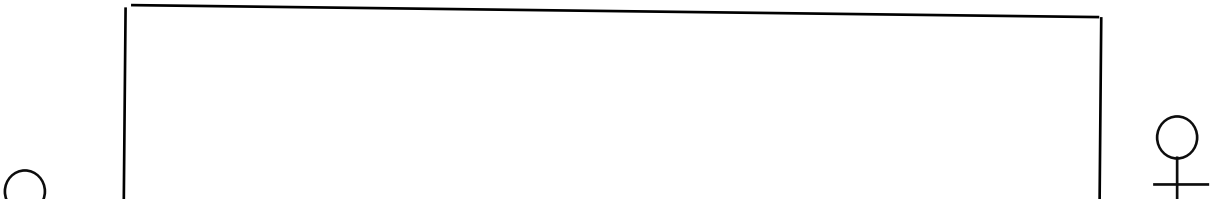
Use Case Diagram: Going



Use Case Diagram:Camera sensor

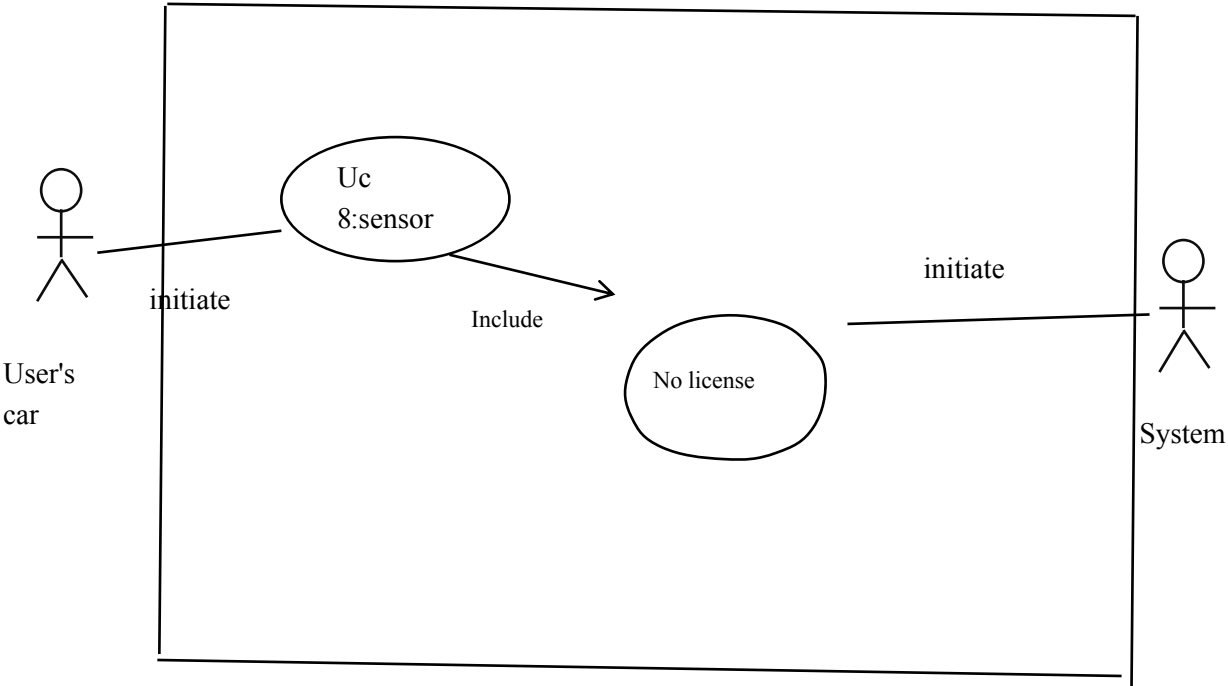


Use Case

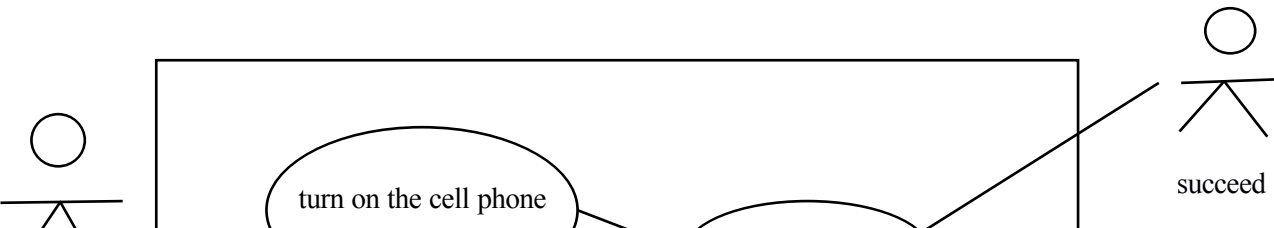


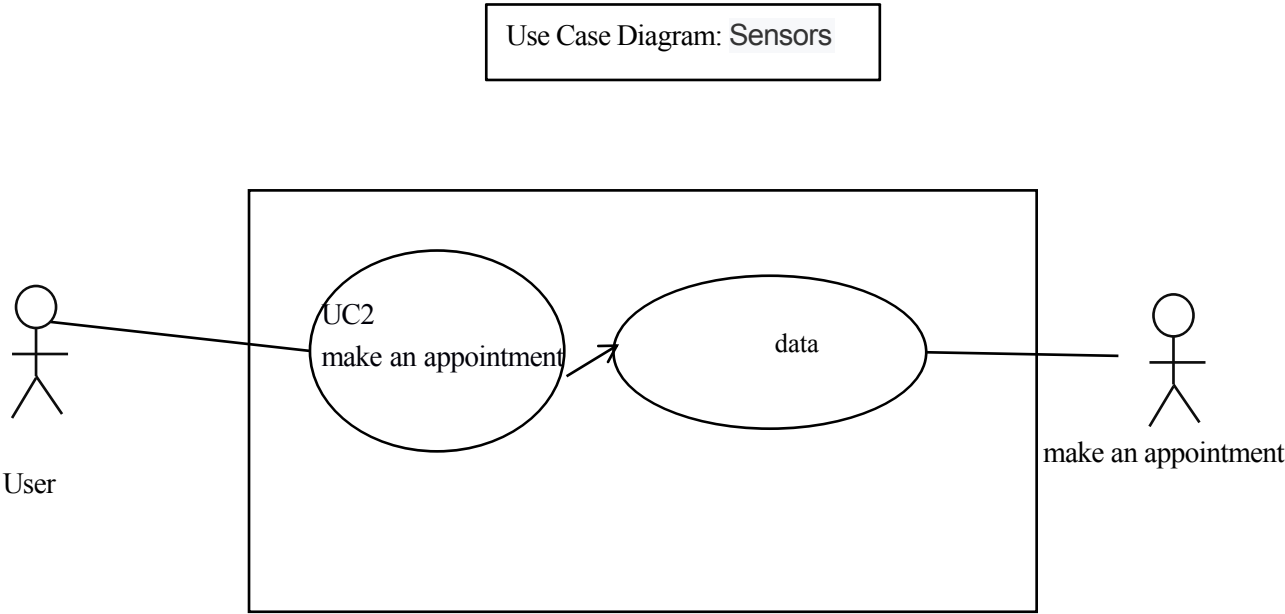


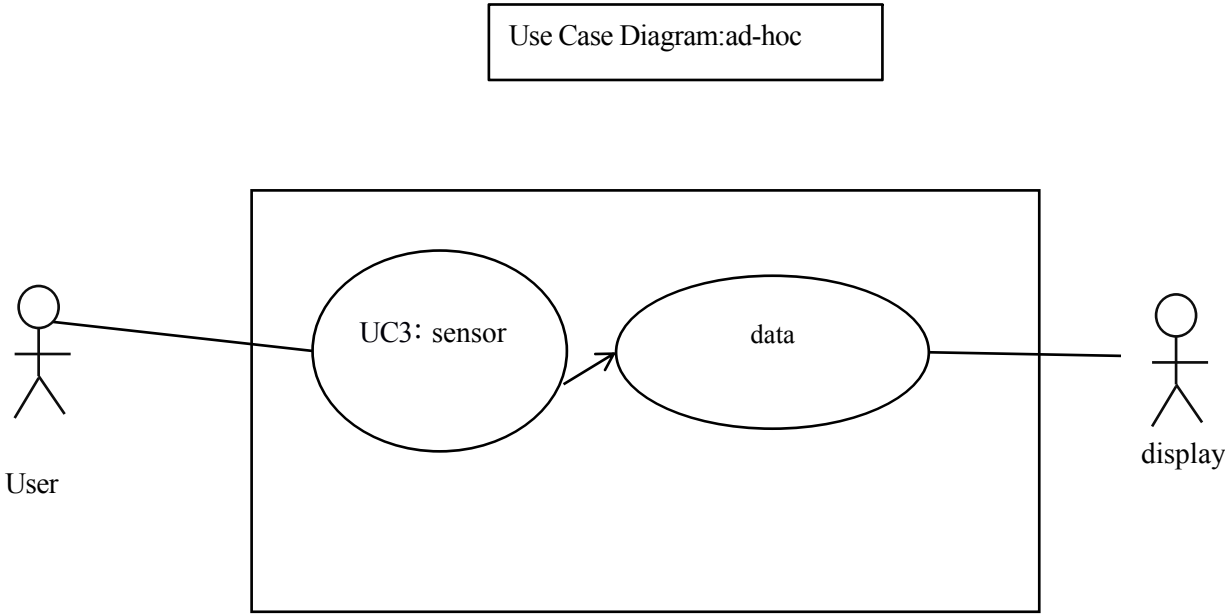
Use Case Diagram:No



Use Case Diagram:Register







3.Traceability Matrix

Req't	PW	UC1	UC2	UC3	UC4
REQ1	5		X	X	

REQ2	5	X			X
REQ3	4		X	X	X
REQ4	2	X		X	
REQ5	1	X		X	X
REQ6	5			X	
Max PW		5	5	5	5
Total PW		14	13	5	12

- REQ1 The system can provide online payment function on mobile app
- REQ2 The system can display the specific position of the spare parking space on the monitor.
- REQ3 The system can record license plate information.
- REQ4 The system has the function of "fault tolerance".
- REQ5 The system has manual checkout function.
- REQ6 When the vehicle out, if the account can be out, if not out of the bill can not be out.

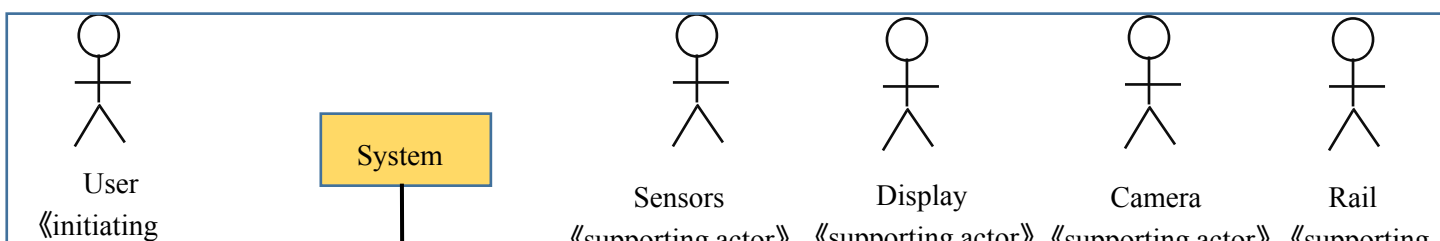
- UC1: 查询车牌
- UC2: 车牌识别
- UC3: 感应器
- UC4: 验证车牌信息

#### 4.Fully-Dressed Description

Use Case UC-2:	permit through	
Related Requirem'ts	REQ1, REQ3, REQ4, and REQ5 stated	
Initiating Actor	Any user	
Actor's Goal	Drive out onto the road	
Participating Actors	The database The timer Display	
Preconditions	·The bill has been paid and the vehicle is parked in the parking space. ·Go out within thirty minutes of closing the bill.	
Postconditio	The timer starts when the checkout is completed.	
Flow of Events for Main Success Scenario:		
	1	The user drove the car out of the parking space
	2	The sensor receives the signal, sends it to the system, and the system sends it to the display (this position is empty).
	3	The user goes past the monitor at the door
	4	The monitor sends the license plate information to the system, and the system detects whether the payment is made or whether the payment exceeds 30 minutes.All right, the system is signaling the railing.
	5	Railing raised, user out.

#### d. System Sequence Diagrams

### Use case: Going out

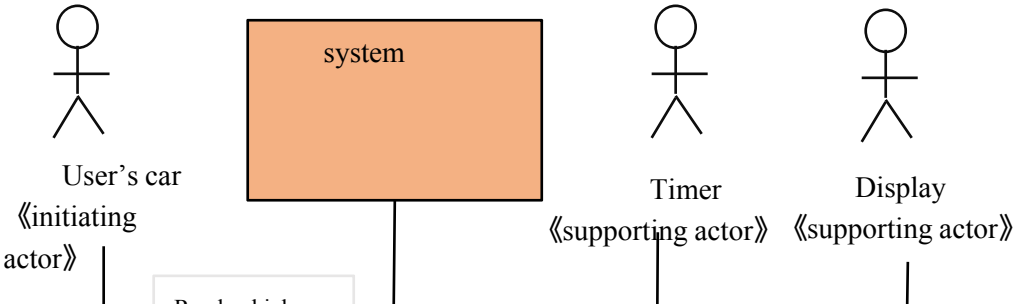


Use case:Payment

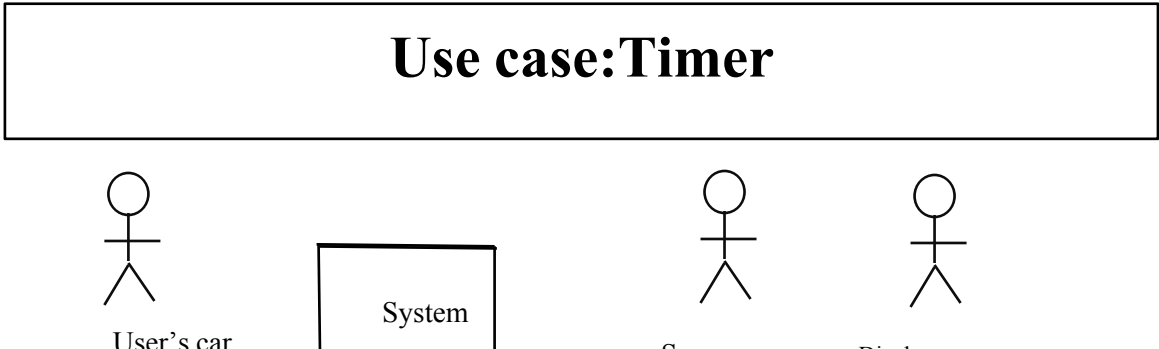


**Use case: Parking**

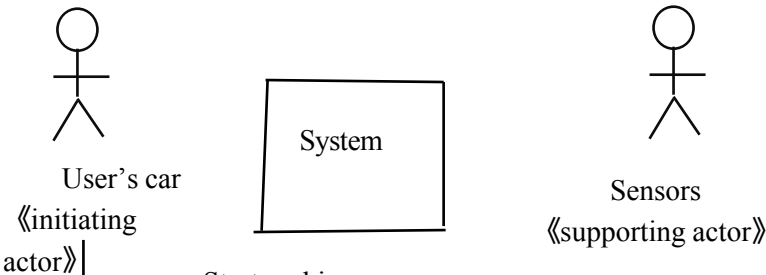
Use case:Camera sensor



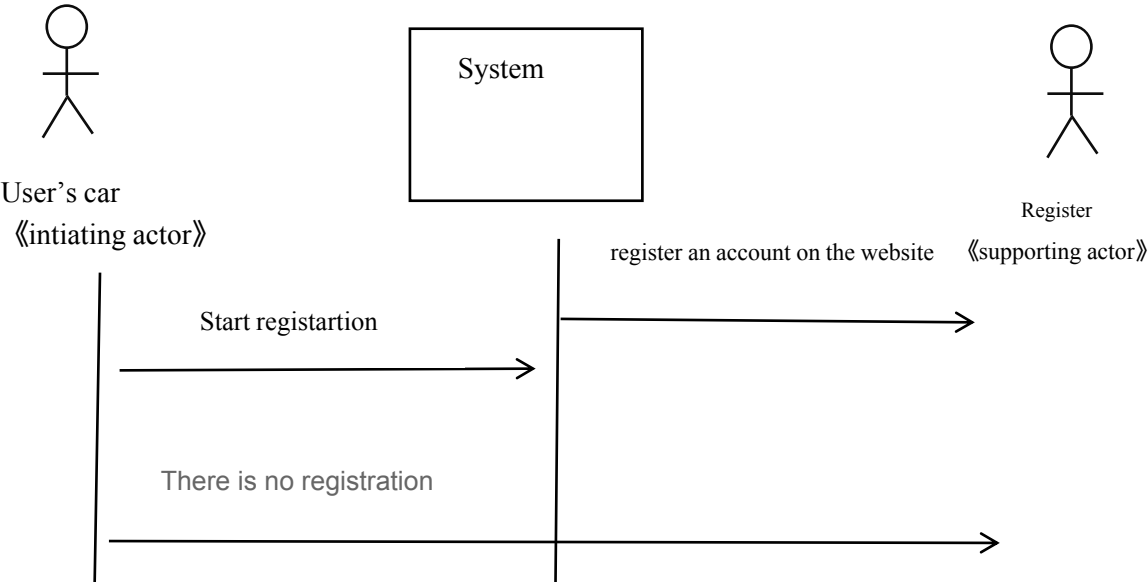




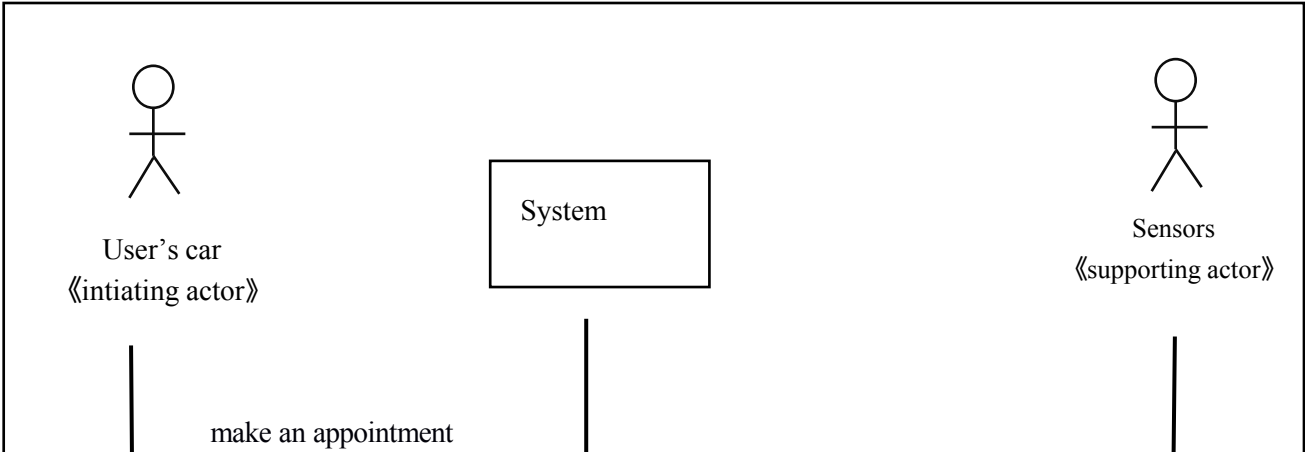
Use case:No Availability



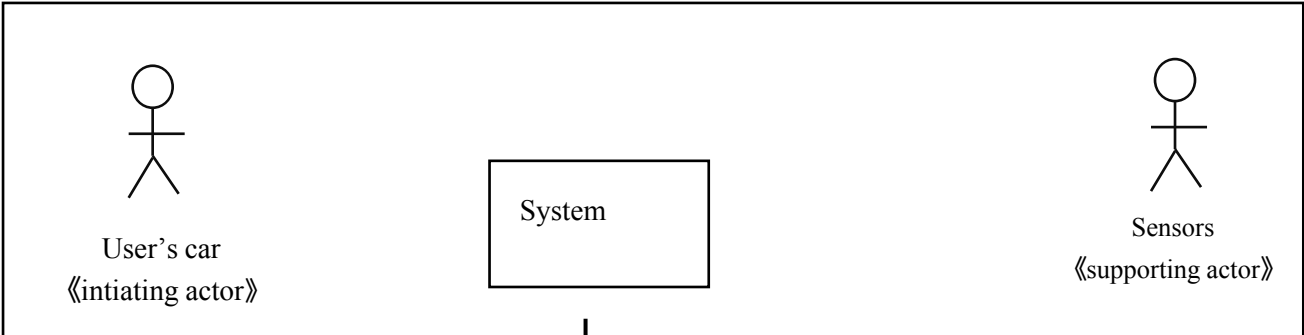
Use case:Register



Use case:Sensors



**Use case:ad-hoc**

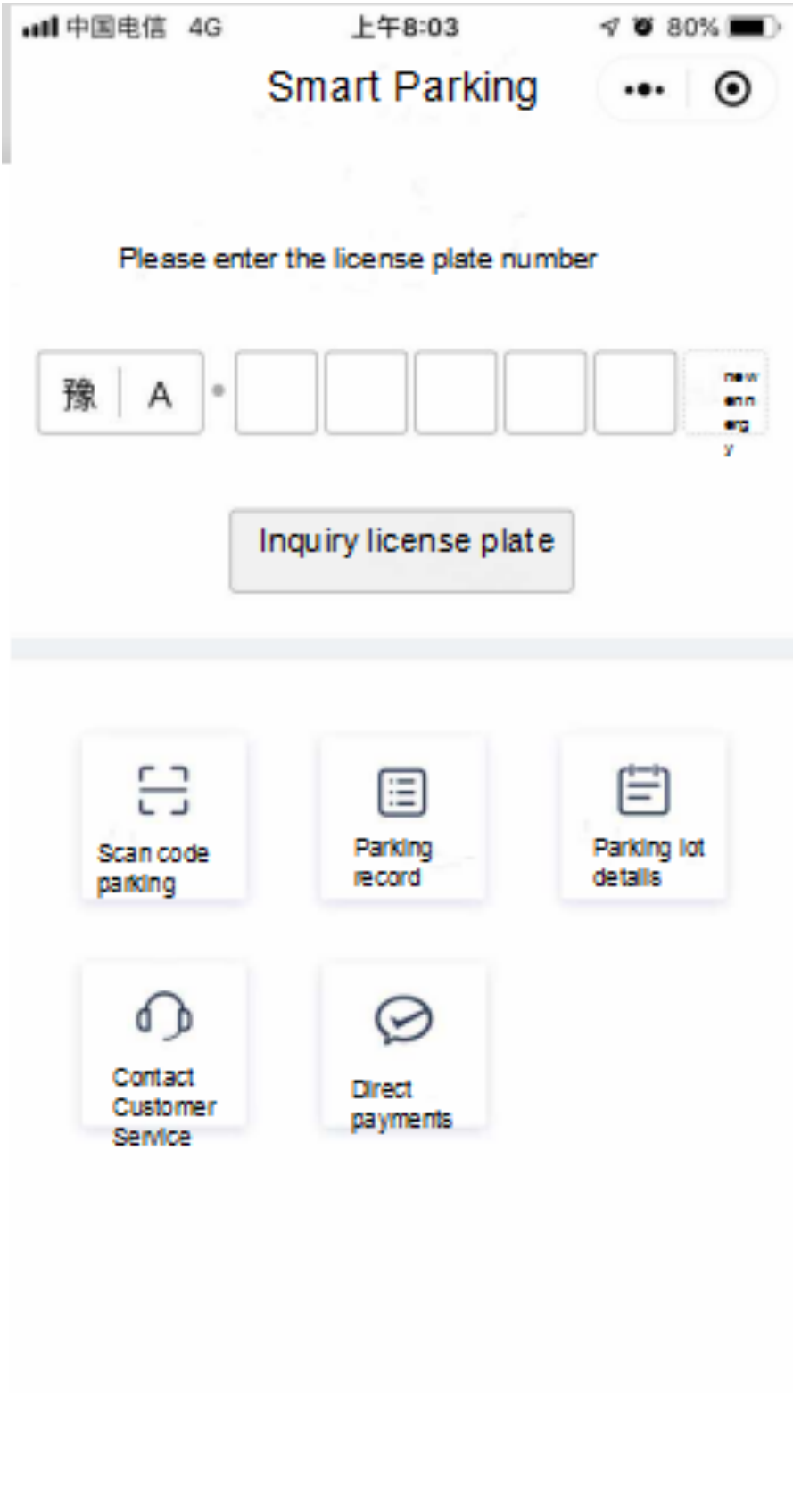


## **IV. User Interface Specification**

### **a. Preliminary Design**

- I .Open the applet





III. Enter license plate information





IV.Payment

中国电信

4G

上午8:57

67%

Charge statistics

parking lot:

Software engineering team

Parking time:

one and a half hours

Time slot:

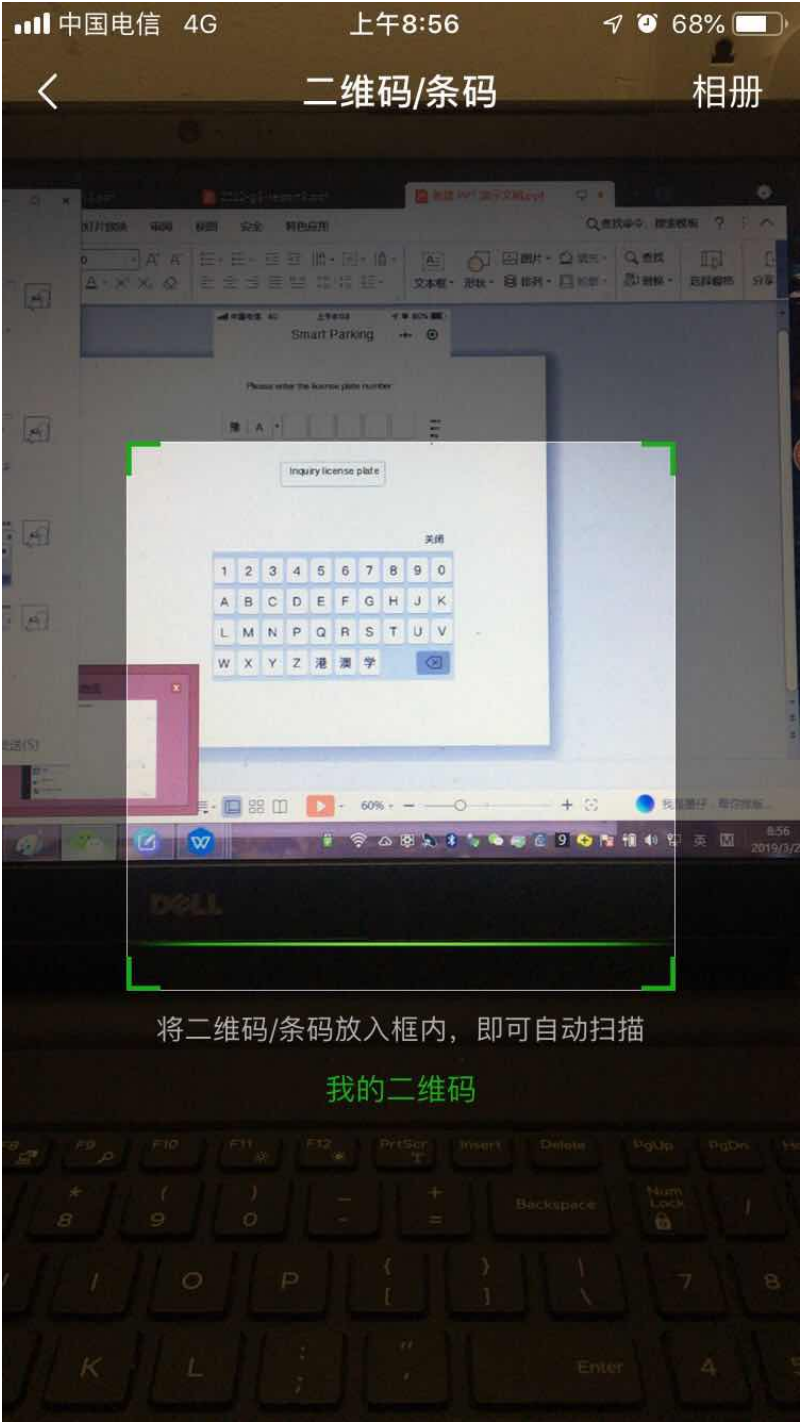
3: 00PM-4:30PM

4 \$

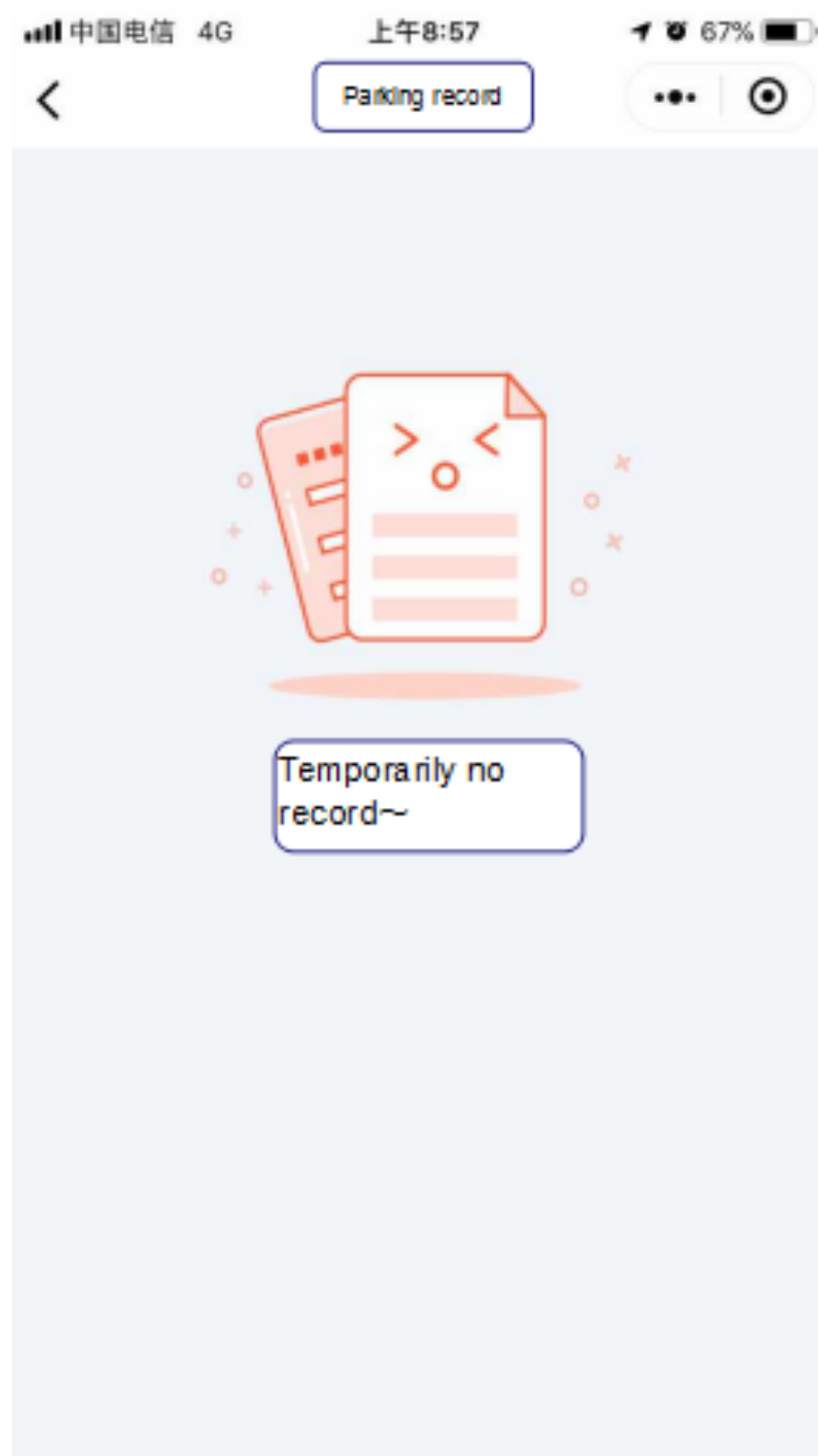
微信支付

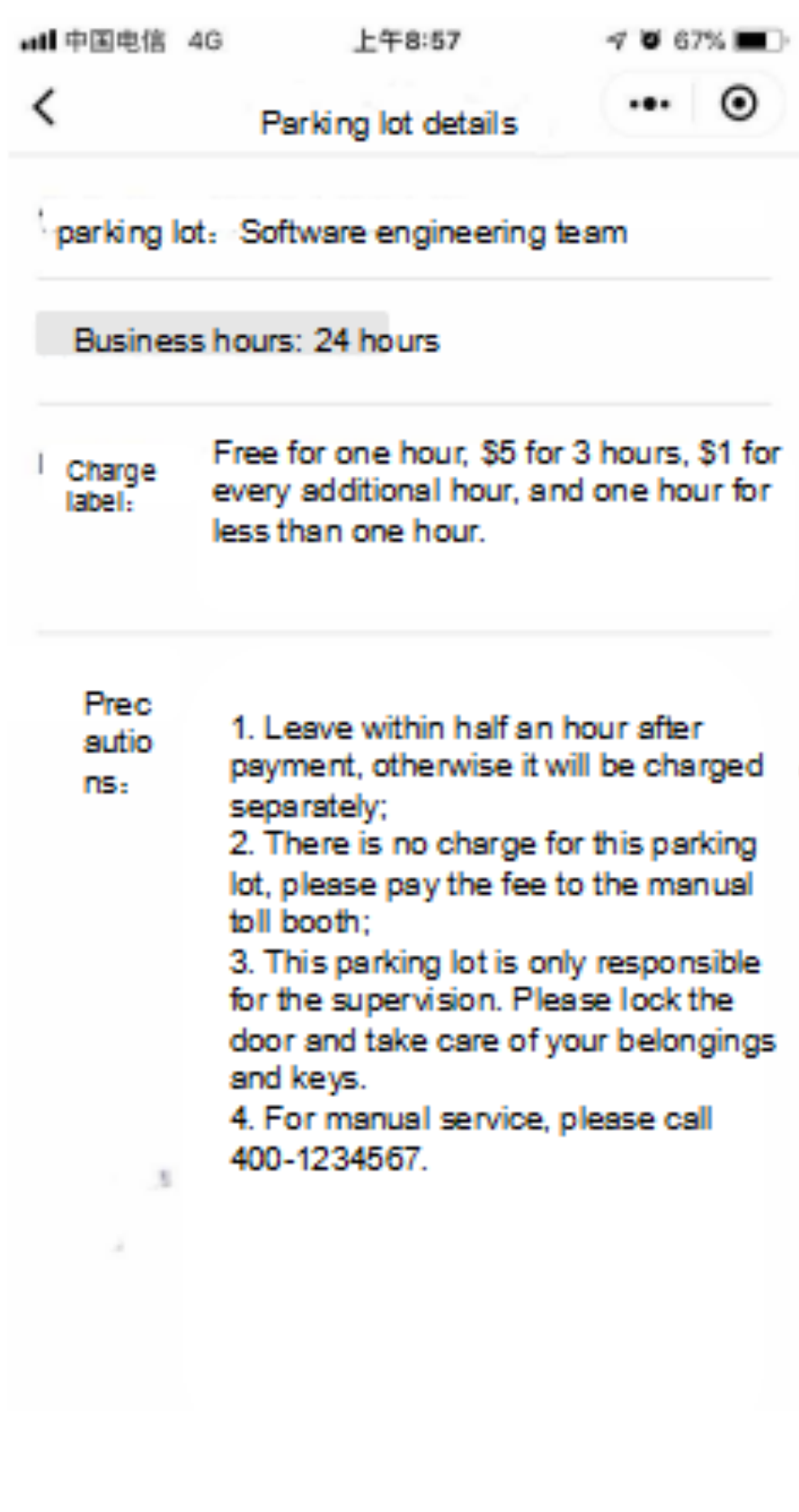
支付宝支付

确认支付



VI.Parking Record







b. User Effort Estimation

Open the small program smart garage on WeChat, then you want to enter the "Payment"

"Online customer service" "Query" required user effort:

1.payment: Press the button three times in total as follows:

a. Click on the inquiry to pay;

b. Click to pay;

c. Choose a payment method.

2. Online customer service: Press the button three times in total as follows:

a. Click for more details;

b. Click on the manual customer service;

c. dial or cancel.

3.Query: Press the button three times in total as follows:

a. Click to enter the query page;

b. Click on the query duration;

c. Click on the inquiry fee.