REPORT

Group 30

CRETOCE

COMPANY NAME:CRETOCE

Name	QM Student	BUPT Student Number
Jiaming Yue	161188841	2016213579
Xinyue Hao	161194749	2016213105
Wenxi Zhang	161189099	2016213604
Yingying Zhuang	161197832	2016213419
Zihan Jian	161188081	2016213499
Tao Yang	161197566	2016213391
Jiaxi Yang	161196190	2016213204
Yiyang Feng	161195698	2016213112
Peng Gao	161197049	2016213262
Gang Zhan	161193281	2016212971

Table1. Group Member information

Name	Task
Xinyue Hao	Write the arduino code and complete the test of the sensors. Draw the function flow charts. Write the user manual. Write the mode function design part of the report. Assist in appearance production.
Jiaxi Yang	Write the arduino code and complete the test of the sensors. Draw the circuit simulation diagrams. Write the user manual. Write the concept development and video design part of the report. Assist in appearance production.
Peng Gao	Make overall arrangements within the product group. Design the appearance of the car and complete the assembly of the car. Write the appearance design part of the report. Assist in hardware testing.
Gang Zhan	Complete circuit connection and car assembly. Write the arduino code and complete the testing of the hardware part. Write the system module of hardware product development, including motor drive part and Bluetooth remote control part of the report. Assist in appearance production.
Yingying Zhuang	Website back-end designing. Integrate website back-end and front-end. Database designing. Report writing about web designing.
Tao Yang	Website front-end designing and embellishing, and user manual writing.
Yiyang Feng	Website back-end designing and database designing.
Jiaming Yue	Writing the introduction and the summary part of the Final Report, formatting the document, and doing some translation work
Wenxi Zhang	Writing the group timeline of the final report and some translation work.
Zihan Jian	Advertise video taking and logo designing.

Table2. Group Member Task

Content

1 Introduction

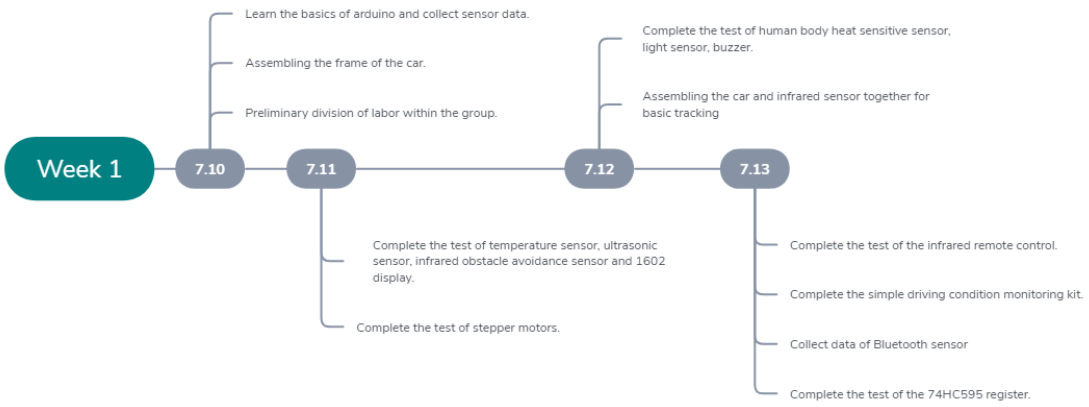
Perhaps we all had the idea at some point that" There is such a lot of world to see ". But when people come to a new place, they are full of fear because they are strangers. In order to alleviate people's worries, our company launched and promoted the entire project, and eventually developed robots that can follow people, automatically explore the environment, and measure temperature and humidity. This project is responsible for a series of product development, product design and product sales by ten students who come from the Internet of Things, Electronic Commerce and Telecommunications Engineering with Management of the International College. In just three months, we not only completed the prototype of smart car products, but also established a sales website, shooting promotional videos.

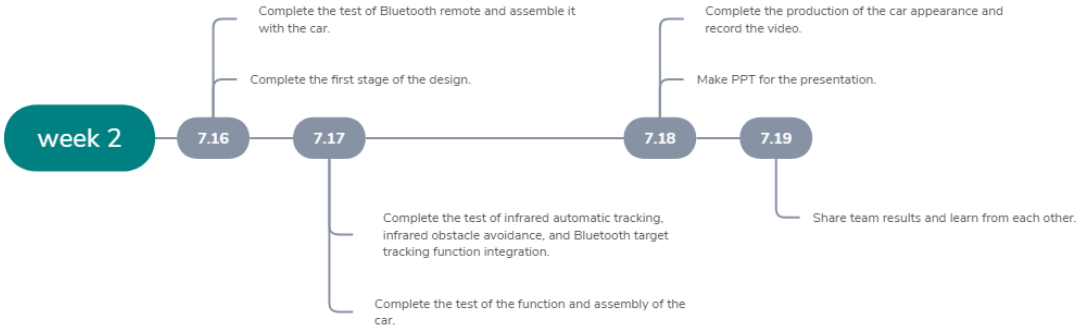
In the following sections, we will introduce the details of our project.

2 Product design

2.1 Electronic hardware design

2.1.1 Time table





2.1.2 Concept development

In order to better develop the concept of products, we use the Questionnaire Star Questionnaire website to conduct a questionnaire survey. In this questionnaire, we designed a series of questions to understand the needs of users and identify major users. The questionnaire we produced is as follows.

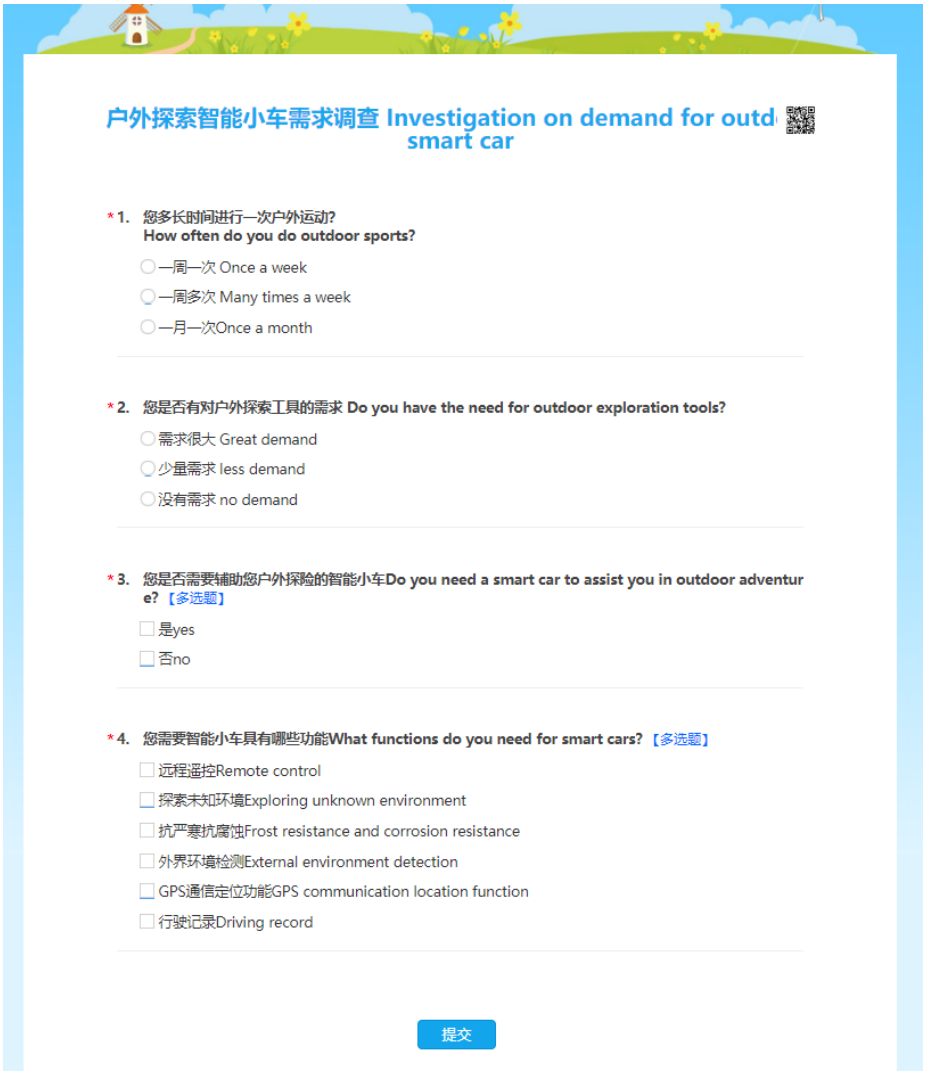


Fig1 Questionnaire

In order to increase the diversity of the survey population, we have written a questionnaire in both Chinese and English. The students from Beijing University of Posts and Telecommunications as well as overseas students have received the questionnaire. Moreover, the respondents included different age groups, occupations and family backgrounds. In this way, our questionnaire survey becomes very universal. From this survey, we learned that 42.86% of people do outdoor adventure many times a week.

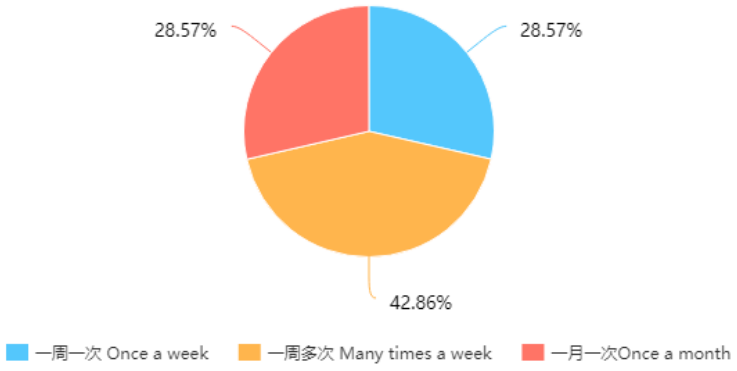


Fig2 How often do you do outdoor sports?

From Fig2 we realize that in the busy urban life, outdoor exploration, which can make people close to nature, has attracted a large number of people's attention, making outdoor exploration equipment in this field has hidden tremendous business opportunities.

So we did a further investigation, and from Fig3 we found that more than half of the people had a greater demand for outdoor exploration tools.

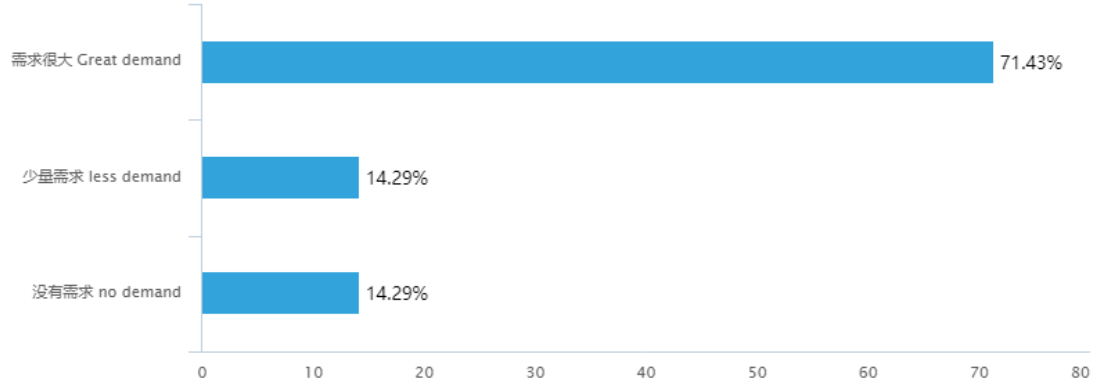


Fig3 Do you have the need for outdoor exploration tools?

From Fig4 we can see that the user's demand is mainly concentrated in the exploration of unknown environment, remote control, environmental monitoring and other aspects.

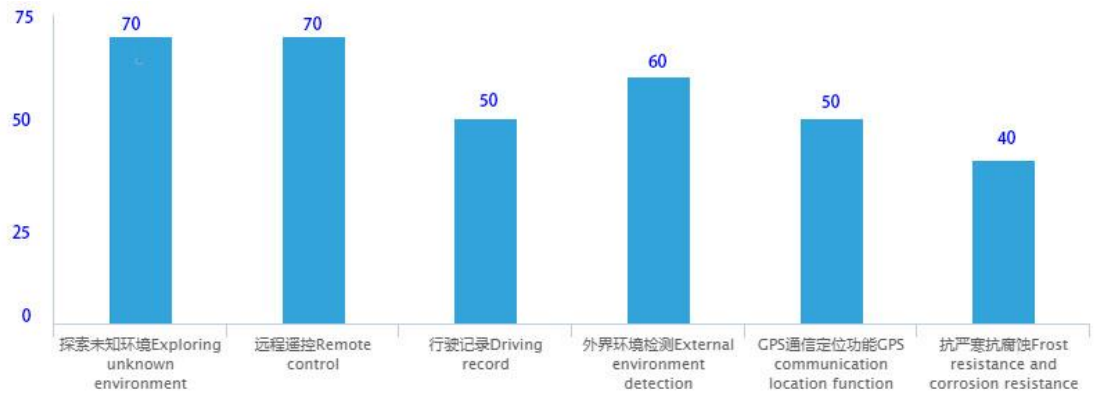


Fig4 What functions do you need for smart cars?

The above questionnaire survey has a great guiding significance for our company to define customer needs, determine target customers and improve concept development.

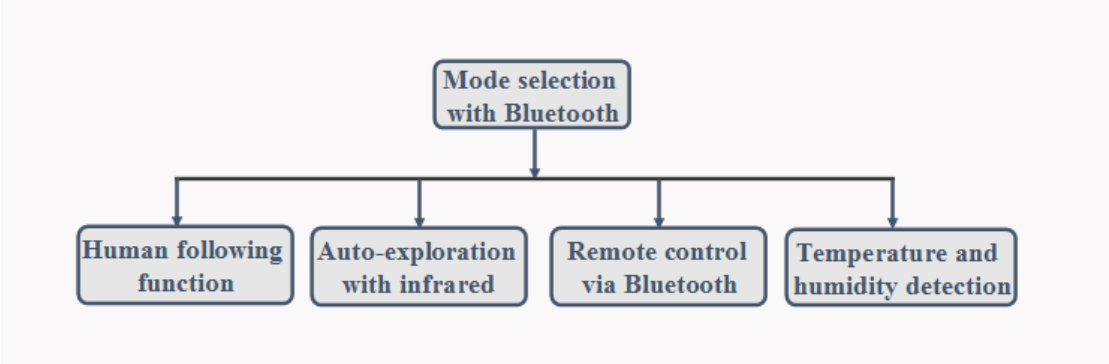
2.1.3 System design

2.1.3.1 Motor driving

This product uses two L298N drive modules to drive two stepper motors. In the production process, we first use a L298N drive module to drive the motor and drive the fan to rotate. Through this small experiment we determine the availability of the L298N drive module. Next, we will drive the module, stepper motor, Arduino and power. The connection is done. As shown in the figure

We wrote the related code on the arduino. By connecting the driving module, we have realized the related function like move forward and backward ,rotation in situ.

2.1.3.2 Mode function design



2.1.3.2.1 Human following function

According to customer needs, we found that people prefer the outdoor adventure car following the explorer automatically. So we combined the materials we have and the funding arrangements and finally got the following two solutions:

1. Achieving the automatic following function by using infrared obstacle avoidance sensor and infrared distance measuring sensor to detect the object.
2. Connect the mobile phone camera through Bluetooth, select the color of the object near the explorer's ankle different from the surrounding, and perform color recognition.

The following is the performance comparison of the two solutions:

Color recognition	Connect your phone via Bluetooth sensor and use the "track" application. The image captured by mobile phone camera will pass to the application. We only need to click the color module that needs to be tracked.	Not very stable. Different fixed intervals need to be designed for different mobile phones.	Low sensitivity. Due to the limitations of existing chip performance and the corresponding performance of the mobile application, there are several factors that affect the picture sensitivity.	Inconvenient. This feature requires customers to configure their own mobile phones and applications. Besides, customers need to operate them themselves.	Low .

Table3 performance comparison of the two solutions

The following is the relative advantages and disadvantages of the two solutions:

name	Advantages	Disadvantages
Infrared sensor	High sensitivity. Easy to operate. Not easy to damage. Good user experience. Low cost	The detection may be terminated due to the presence of other objects so that the cart position needs to be re-adjusted.
Color	In the outdoor adventure	The realization of the function

recognition	environment, The color that rarely appears outside the user is used as the basis for recognition so that the accuracy is high.	depends on the mobile phone, and the customer needs to configure the corresponding mobile phone or camera device. Besides, a good recognition experience requires a good configuration.

Table4.relative advantages and disadvantages of the two solutions

By comparing the performance of the above two functions and the relative advantages and disadvantages, we found that in the same tracking function, color recognition requires the customer to additionally configure a mobile phone or camera device, which is not convenient for the customer. Besides, due to the different equipment of the customer's mobile phone or camera, it is difficult for us to provide satisfactory after-sales service to customers. What's more, infrared sensor has high sensitivity and low cost. So all in all, the development team finally selected the infrared sensor as the automatically following function settings.

2.1.3.2.2 Infrared obstacle avoidance function:

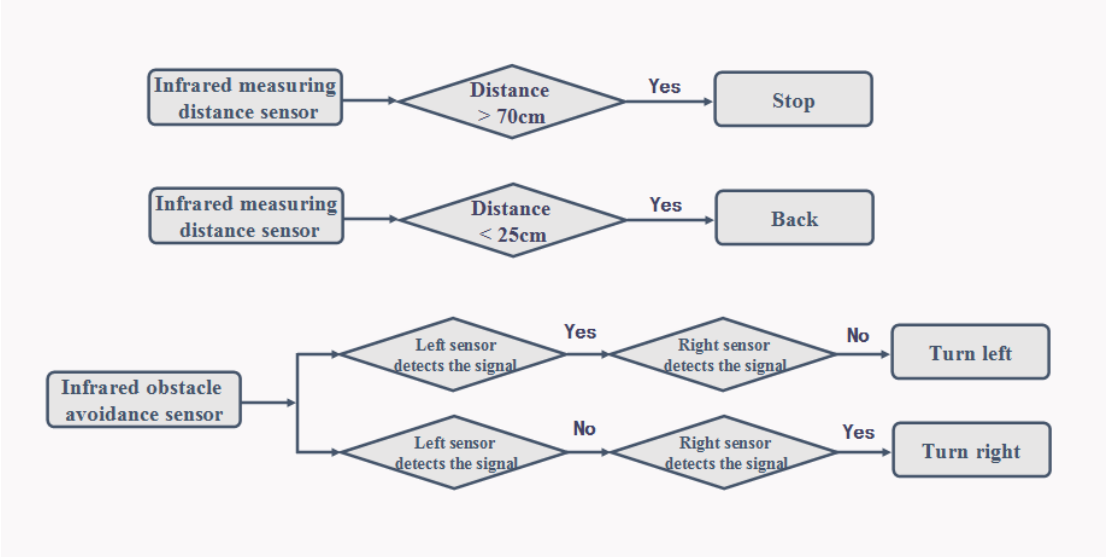


Fig6 How Infrared obstacle avoidance function works

In order to reduce the fear and confusion of customers in the unknown area during outdoor adventures, let customers better understand the environment and images in front of them, and provide explorers with a safer and more realistic adventure process, The development team selected the infrared obstacle avoidance sensor and the infrared measuring distance sensor to launch the infrared obstacle avoidance automatic detection environment function.

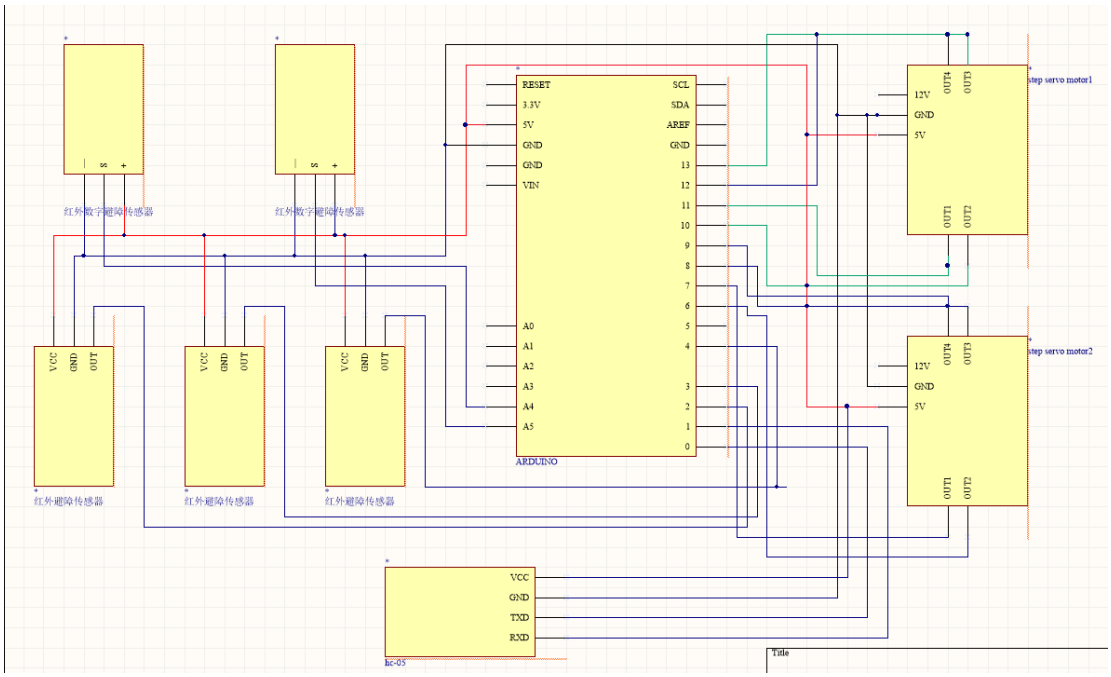


Fig7 the connecting scheme of the circuit

2.1.3.2.3 Bluetooth remote control car module

After adding the Bluetooth module, we try to use Bluetooth to control the car forward, backward, left, right. The implementation flow of this function is shown in the figure

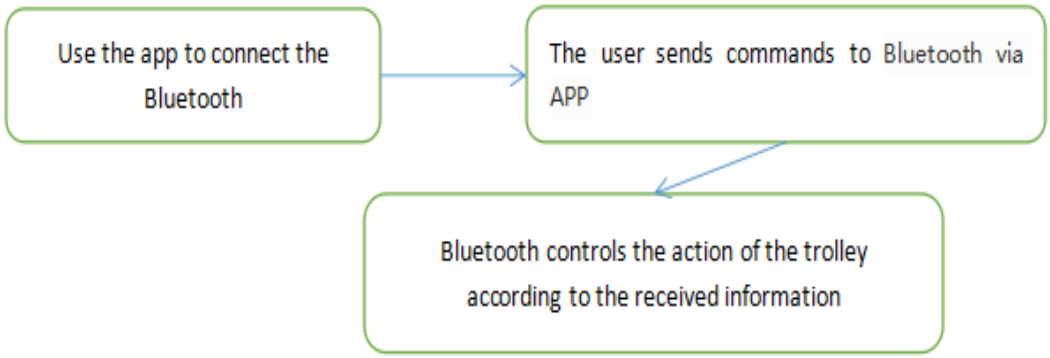


Fig8 the flow of user's instruction

In the test of Bluetooth control car movement, We found that sending instructions to Bluetooth via the app message window on the phone greatly affected the user's experience. So we proposed an improved scheme. We set the interface of the instructions sending as keyboard manipulation, which makes it easier and faster for users to manipulate it.

Fig9 remote control interface

2.1.3.2.4 Auxiliary module

Temperature and humidity data collection: The environmental factors around the car will be sent to the explorer's mobile phone through the temperature and humidity sensor and the Bluetooth module.

Night driving module: After the brightness reaches the condition, the light will be turned on to reach the explorer's observation of the car.

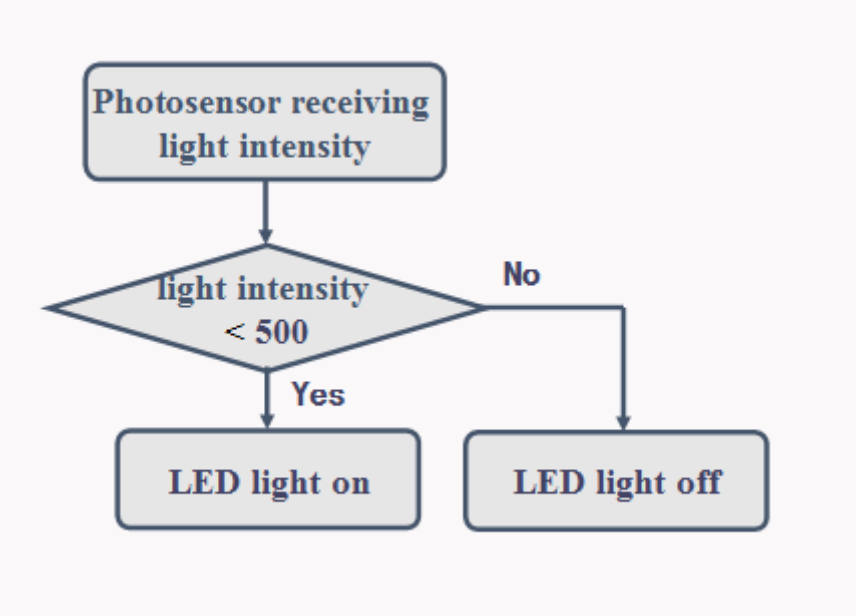


Fig10 how auxiliary module works

Driving record module: Record the running time of the car, send the distance of the target from the car to the mobile phone through the Bluetooth module.

2.1.4 Detail design

Idea: In the first stage, according to the characteristics of simplicity, we designed a dining car model, the appearance of the car is simple but without loss of characteristics. The car designed has plenty of room for sensor placement our group decide. According to the group discussion, we decided to design a “Jungle expeditions” car. So, our product implements the idea which is called “Explore the unknown” serving the outdoor adventure enthusiasts. It can better enrich explorers' adventure experience. In a word, we decided to use the camouflage design.

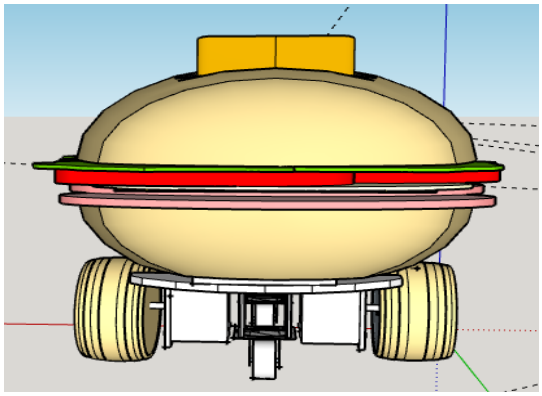


Fig 11-1 Front view of the first model

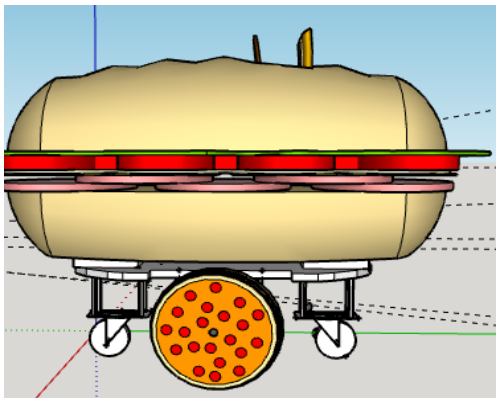


Fig 11- 2 Side view of the first model

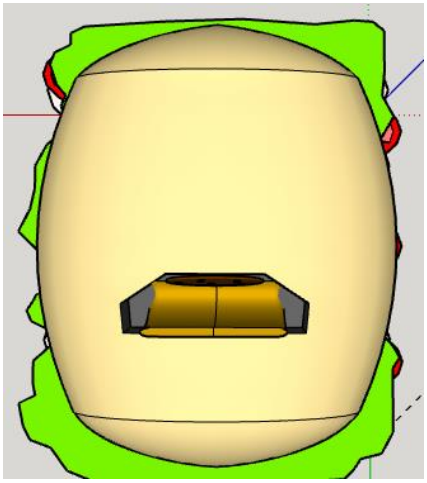


Fig 11- 3 Top view of the first model

In the second stage, we have no obvious characteristics of the dining car model because there is no car. There's a lot of room for sensors, but the posts are a bit cluttered, so we're going to change the look of the car to make a model of an Optimus Prime-like car so that we can better allocate the location of the sensors. So we plan to put sensors

in the position of the headlights. So we decided to use the Optimus model.

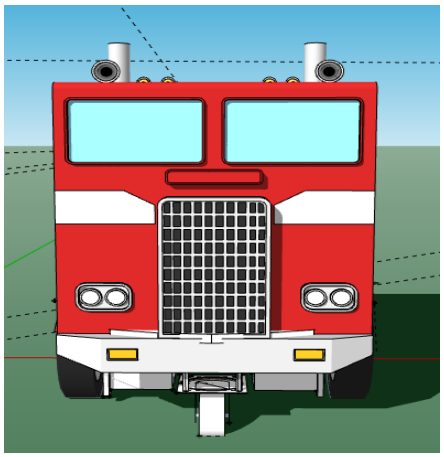


Fig 12- 1 Front view of the second model

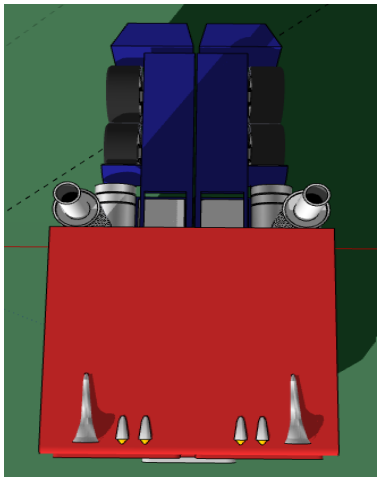


Fig 12- 2 Side view of the second

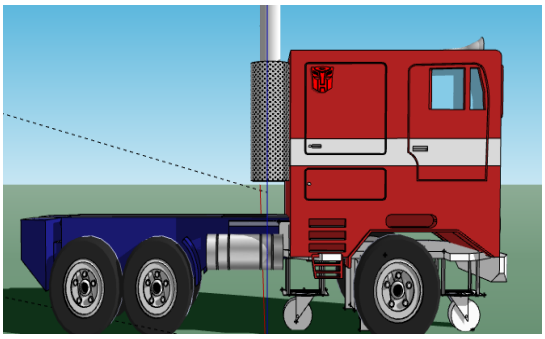


Fig 12- 3 Top view of the second model

In the final phase, in order to better fit our theme of "exploring the unknown," we decided to design the appearance of the car as camouflage, which is more conducive to car sales.

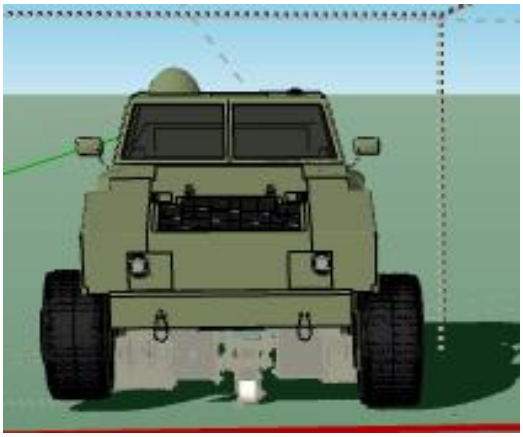


Fig 13-1 Front view of the third model

Fig 13- 2 Side view of the third model

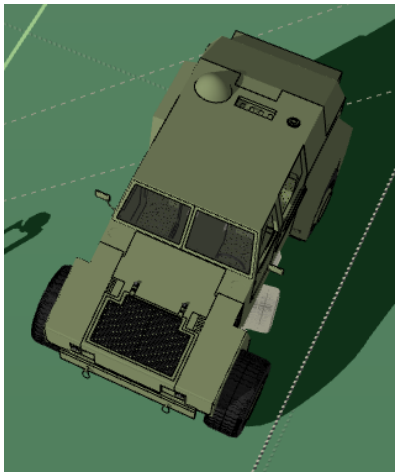


Fig 13- 3 Top view of the third model

The design is from the customer's point of view, with the main goal of customer friendliness. When designing the exterior, the development team used the hinge to design the trunk of the car to be freely open and close. The battery is placed in the trunk so that it is easy and convenient for customers to replace the battery. The driving record display of the trolley is placed above the trunk so that the customer can clearly observe the working time of the trolley and the tracking distance from the target. Besides, the windshield of the car can be used for the customer to install the camera device. This can protect the camera in the car from being damaged by branches or some other things. What's more, the overall color of the car is a camouflage system so that it can better protect itself from being attacked by wild animals when it is running outdoors. Last but not the least, the warning light is placed at the top of the car, which allows the customer to accurately determine the position of the car in the case where the field of view is not good.

2.2 Website design

2.2.1 Website design process

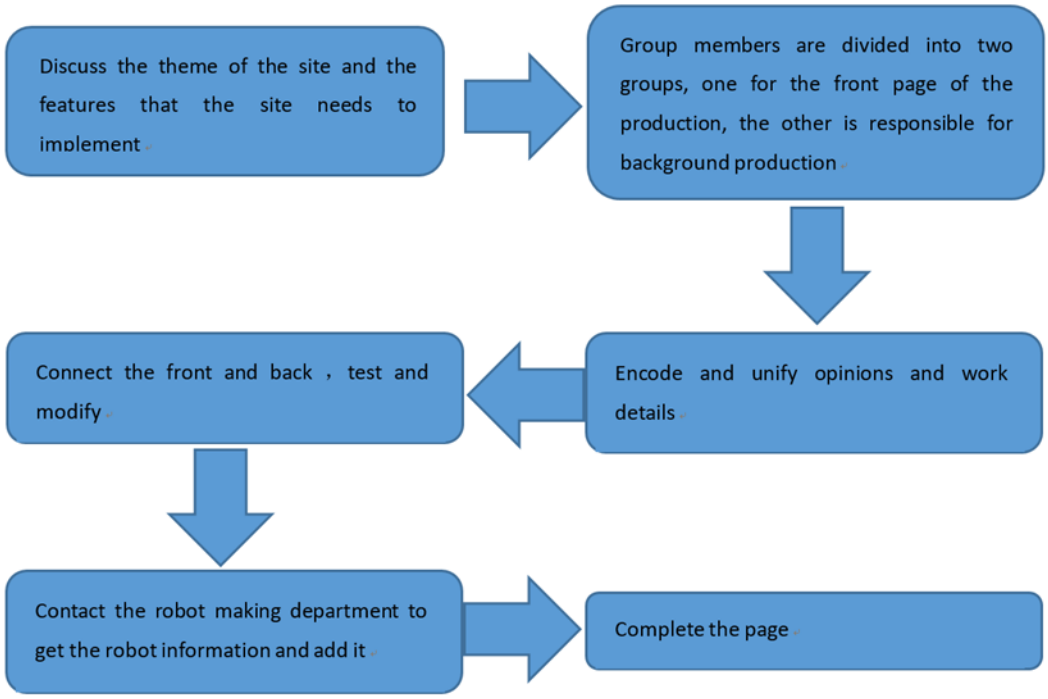


Fig14. Website Development Process

2.2.2 Design objective

Our web pages are mainly used to promote companies, provide products' buying channels and provide channel to contact us. Through the website, users can get on our company's introduction and the company's latest product information. Also, users can leave message and contact us from our website. At the same time, users can log in to buy our company's products online, which is convenient for users to buy products, functioning as our sales strategy.

2.2.3 Functional module design

1. Login and Register:
   Users can register in our web and also can login in to buy our products. They can also modify their password if they forget their information.

2. Display:
The display module is mainly divided into display company's information and display products. We show the company's trademark and the company's latest product information. In addition, we show the basic information and price of the product. You can click on "view more" to learn more about the product. And we can search product information by inputting the product name. Otherwise, we provide navigation and button which users can turn to any another page.

3. Purchase:
Users who have login in can purchase products by adding products to a shopping cart, generating orders and inputting the information of recipients. In addition, users who have login in can check their cart.

4. Feedback:
The module provides users with the gap to write down feedback of purchase or products which will facilitate our company's product improvement and web improvement.

2.2.4 Web design

1. Theme:
Our company is committed to providing intelligent products relating outdoor adventure. So our web pages are used in dark blue which is not only to show the company's sense of technology and cutting-edge, but also to highlight our professionalism. At the same time, we advocate the use of science and technology to change life and we try to make the robot more humane. Thus, our publicity picture uses anthropomorphic robot, to leave a better impression to users.

2. Home page:
You will see our company's promotional pictures, company logo and company introduction on the homepage. At the same time, you can see the navigation bar to help you to go to the next page.

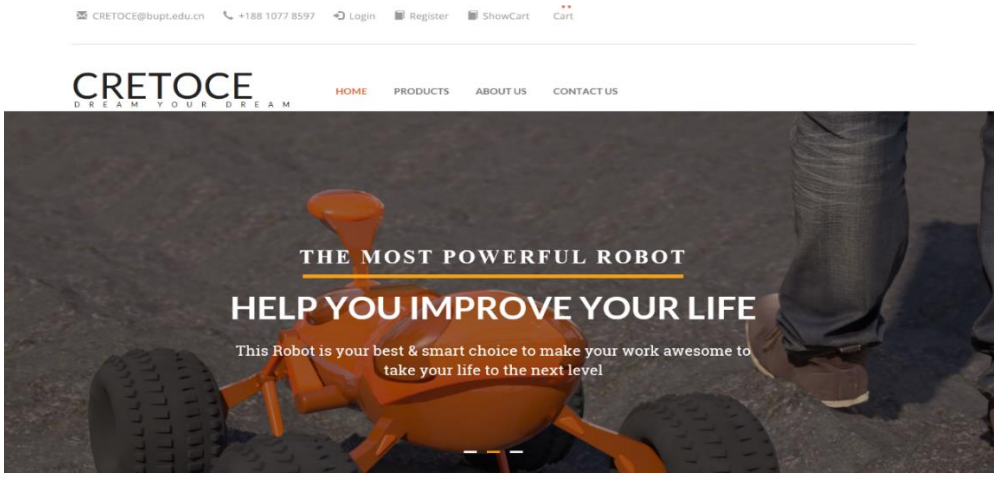


Fig15. Home Page

3. User registration page:

When the user enters the registration page, they need to enter the user name, password and email. To ensure the accuracy of setting the password, our page requires a duplicate password. We through the user name to identify whether the user has been registered. If user has registered, then the page jump directly to the error interface. if not, it will jump to registered successfully page and turn to the home page after 5 seconds.

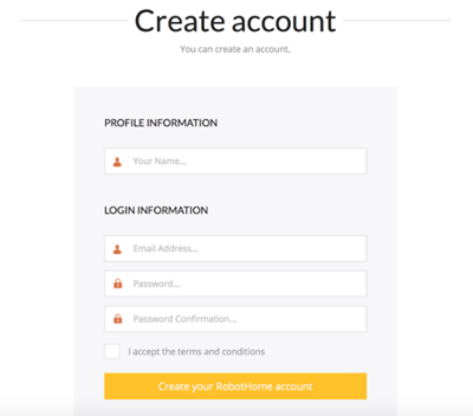


Fig16. Register Page

4. User login page:

Login page requires the user to enter the registered user name and password. If success, it will jump to login successfully page and turn to the home page after 5 seconds. If the user forgets the password, they can also modify it if they input wright information.

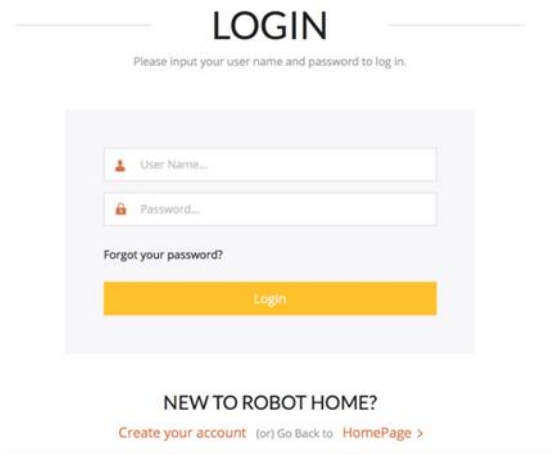


Fig17. Login Page

5. Product page:

The product page shows the basic information of the product, including the picture, name, price, type and basic introduction, enabling users to have a clear understanding of the product. Users can click “quick view” button to learn more detailed product information which will help them understand more product features, easy to choose. If the user is willing to buy, just click to “add to cart” and input the quantity.

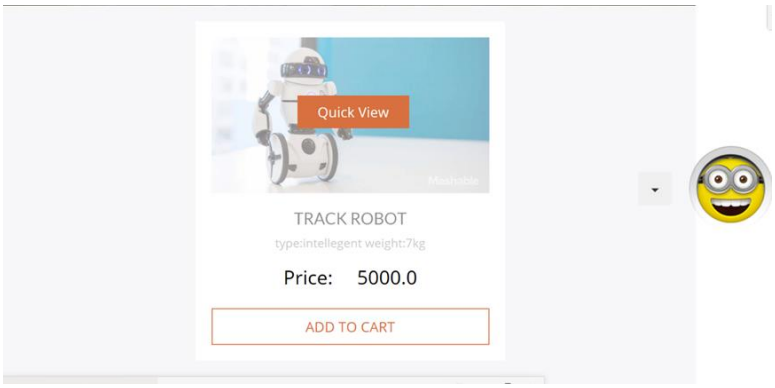


Fig18. Product Display Page

6. Shopping Cart page:

The shopping cart page shows all the product information and price that the user has not purchased. The user can choose to determine the product to be purchased and delete product which they don't want to purchase from cart. Click "generate order" can purchase the products in the cart.

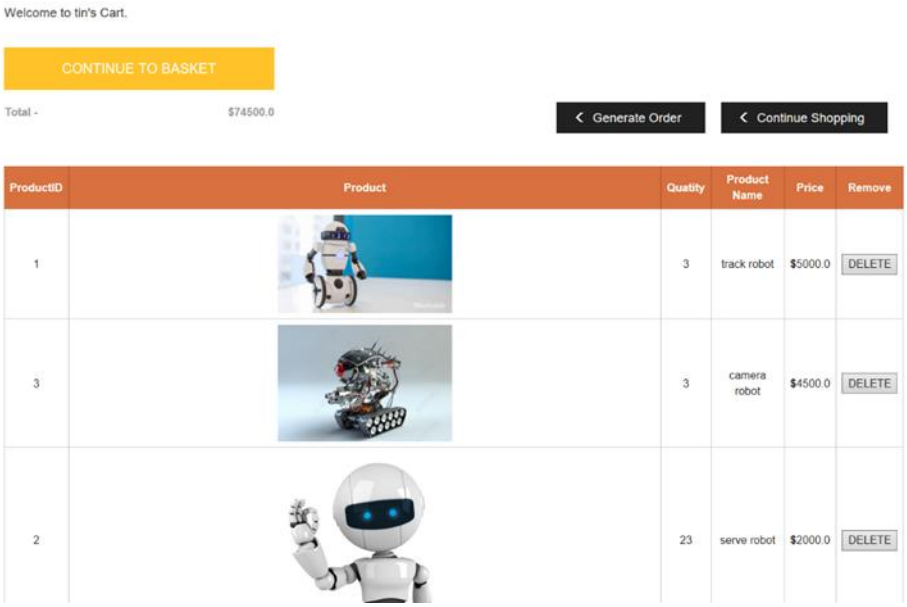


Fig19. Cart Page

7. Order page:

Users should input the information of recipients, including recipient's name, address, phone number and zip code. Click"Pay Now", users can purchase products successfully.

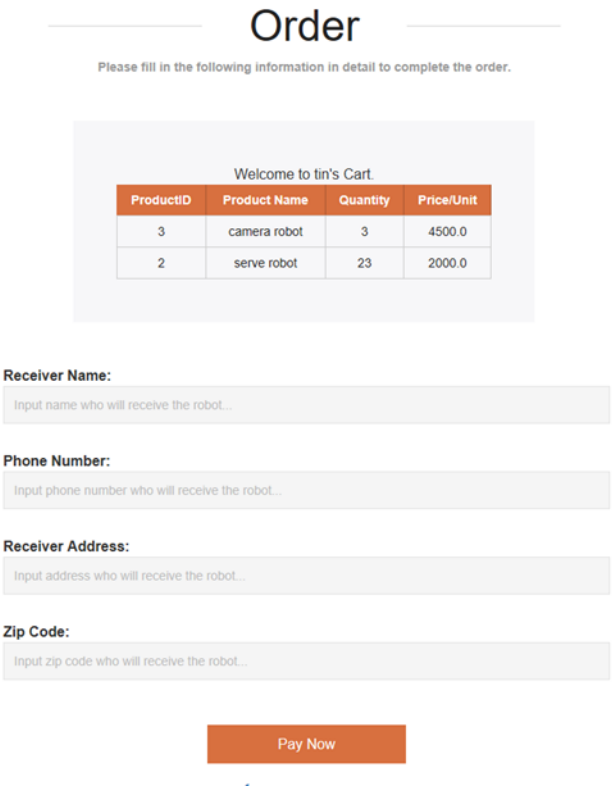


Fig20. Order Page

8. Error page:

When the user performs the wrong operation, or does not meet the required operation, the page will jump to the warning page and help them jump to other correct pages.

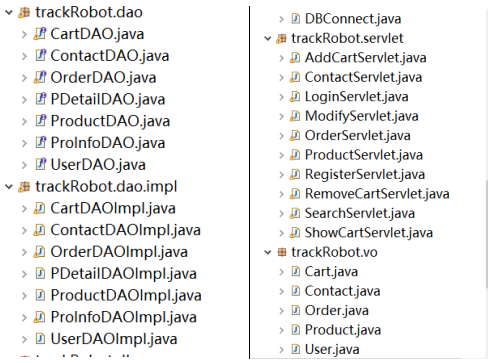


Fig21.Background program

2.2.5 Database design

We use MySQL to manage data and we have following four tables:

1. The user information table(userinfo):

This table is used to store user information, the main information contains three columns:

Username - the user's name

Password - the user's password
Email - the email of the user

2, The product information table(productinfo):
This form is used to store product information. The main information contains five columns:
proID-product ID
proNname - product name
proImg- product image
proPrice- product price
proDetail- product detail introduction
proNum- product number

3. Shopping cart table(cart):
This form is used to record the contents of the user to join the shopping cart, including two columns:
username - the user's name
proID- the ID of product
amount- the quantity that users want to buy
cartID- the ID of cart

4, Purchase order form(orderlist):
The table is used to record the user purchase records, the main information includes eight columns:
username - the user's name
num -number of users to purchase the product
proID - The ID of the product purchased by the user
orderNum - the user's order number
name- the name of recipient
address- the address of recipient
code- the zip code of recipient
phone- the phone number of recipient

5. Feedback information(contact)
The table is used to record the feedback information that users leave on the page, and the main information includes four columns:
name- the name of the user
email- the email of the user
subject- the subject of the feedback information
message- the detail message of the feedback

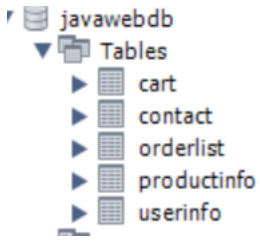


Fig22.Database Design

3 Video design

3.1 General idea

Our product aims at people who enjoy outdoor adventure and the joy of manipulating a robot. For example, for people who want to having adventures with their friends, our robot can provide them with basic function of exploring unknown environment, gathering signal of environment temperature and humidity. People can use these information which is returned to their phones to auxiliary exploring.
Since our idea is that" everybody can be an adventurer" so our advertisement aims to design something that" catches your eye" while encouraging people to explore the nature. So we decide to use Flash mob to make that advertising video.

3.2 Script

We briefly introduce these two functions: human following function and infrared obstacle avoidance function. A group of teenagers are exploring in the jungle and the would like to penetrate the heart of the jungle, but cannot probe the environment in the heart of the jungle. Inspiration comes from their minds, they use our robot to explore the unknown world. In the video it shows the users the appearance, functions, designs and any other highlights of our product.

3.3 video shooting

In order to achieve the best visual effect, we use professional equipment to shoot some pictures and short videos.

4 Staff position

After defining the company's project, we divided our products into two parts: hardware car and a websites to promote and sell.
The company consists of three parts: technical department, marketing department and

Administration Department.

Technical Department	Technical Department Manager	Jiaxi Yang
	Product Engineering Engineer	Xinyue Hao
	Design Engineer	Peng Gao
	Test Engineer	Gang Zhan
Marketing Department	Soft Engineer	Yiyang Feng
	Marketing Manager	Yingying Zhuang
	Web Design Engineer	Tao Yang
Administration Department	Advertising planning supervisor	Zihan Jian
	Finance Director	Jiaming Yue
	Public Relations Manager	Wenxi Zhang

Table5.Staff position

5 Management planning

Group meeting time and time management

Time	Main contents
July 9th	First group meeting, deciding objectives and responsibility.
July 12rd	Customer's need clarified, system level design began.
July 15th	Began detailed design, and website creation.
July 19th	Before going home the group held a meeting to identify the current progress and what needed to do in the summer vacation.
July 25th	First prototype had been built.
August 15th	Website layout design and final product appearance design.
August 19th	Online meeting for prototype testing and refinement.
September 5th	Meeting for document writing and final product.
September 13rd	Meeting for document writing and final product.

Table6.Time of group meeting

Planning time axis:

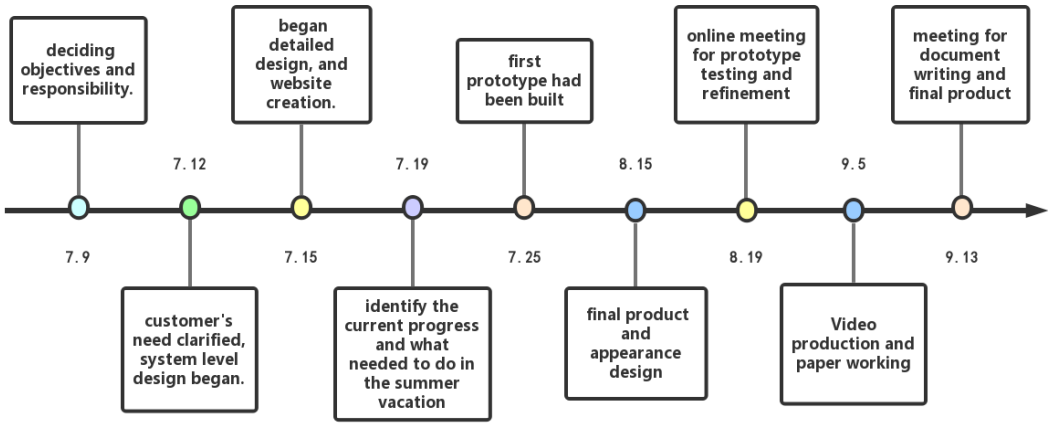


Fig23.Group plan

6 Conclusion

Each stage of the project is well organized. Everyone has learned a lot in this project. We all began from the learning of the most basic technology , and finally, the product achieved the desired effect, which is inseparable from our patience, learning ability, innovation ability, teamwork and so on.

Our car has the functions of human tracking, automatic exploration, Bluetooth control, temperature and humidity detection. It satisfies the needs of people to explore the unknown area of the car portability, interactive friendliness and accurate grasp of the environmental properties of the unknown area, which can meet the needs of consumers. In addition, our website has aesthetics, practicality and stability, so that consumers can have a better shopping experience.

The successful completion of the product gives us comfort and pride. We hope that our products can be more perfect in practical application, and can better realize our concept: sweep away the unknown, move forward bravely.