



Dragon smart robot

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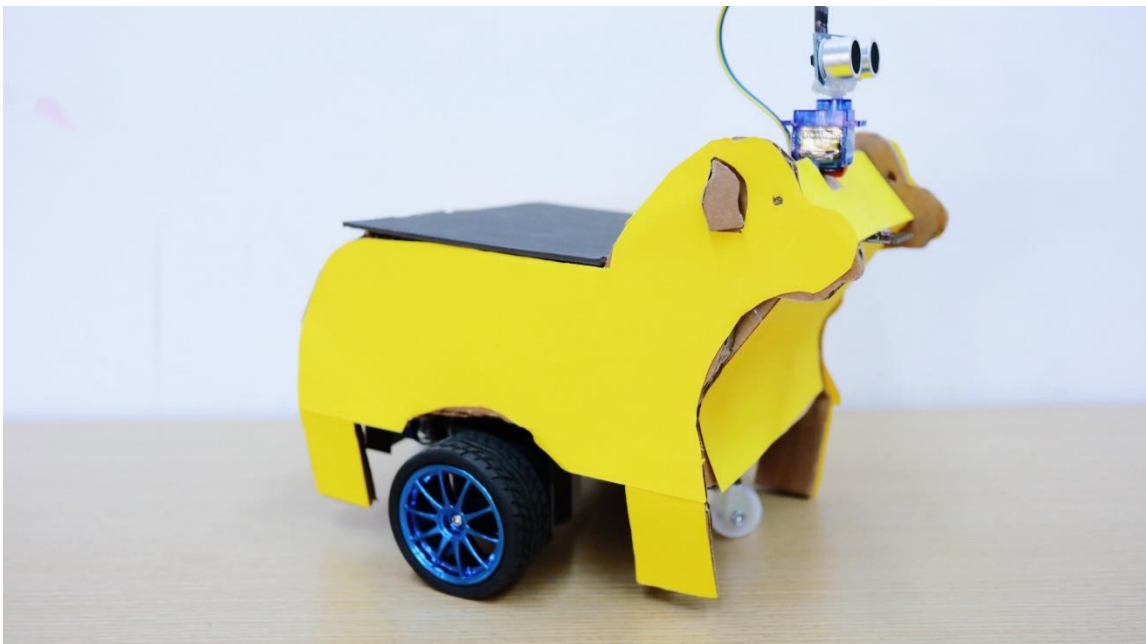
1 Introduction

Dragon, the smart guide dog from BetaGo, named after the horse of the heroine of game of thrones, which symbolizes eternal companionship. Based on Arduino board design, this guide dog can be directly controlled by mobile phone Bluetooth or voice, bringing great convenience to blind people.

Its appearance is a golden puppy shape, symbolizing light and loyalty, illuminating the way ahead for the blind.

It consists of stepping motor, Bluetooth sensor, ultrasonic sensor, voice control module and other basic components. Through Bluetooth and voice commands, the dogs can guide the blind, alert and avoid obstacles, and guard valuables. In addition, it also has a variety of humanized functions such as night travel alarm, downhill tips. With the company of Dragon, the blind can travel more safely.

Dragon adheres to the practical and humanized design concept, thinks of users in everything, and realizes good interaction between products and users through voice control. Dragon is the best companion for blind travel.



2 Product Design

2.1 Appearance design

Our product Dragon can automatically move not only according to voice commands from users, but also under the control of smart phones using blue tooth. It can also be switched into “auto mode”, in which it can avoid barriers within a certain distance and choose another correct way.

In order to attract our target sales population, we decide to design a lovely and appealing appearance for our product. We measure the size data of the basic car in all directions, and use the collected cardboard to wrap the device in it, which played the role of protecting the device while designing the appearance. Then we paste the ordinary cardboard with yellow and black cardboard. These two colors can make the dog look more eye-catching and remind passersby to take care of Dragon and blind people.

It is worth mentioning that Dragon adheres practical and green design concept. The materials that we use to build Dragon are all environmental protection material. We mainly use the cardboard collected from salvage station in the school to build it. And here is our sketch:

2.2 Hardware design

2.2.1 Power supply

Dragon's drive panel is powered by a 3.7-volt battery. There are two power supply methods for Arduino boards:

- Power supply by using charger, connect to USB interface of Arduino board.
- Power supply by a rechargeable battery, the battery box is placed in the rear of the car.

2.2.2 Hardware details

Device	Interface Type	Interface Number	Pin	Pin Name(In software)	Connect to arduino masters and slaves	Role	Function(In software)
L298N	Digital input	8	23456789	leftStepper(36, 2, 3, 4, 5) rightStepper(36, 6, 7, 8, 9)	Slaves	Drive	None
Infrared obstacle avoidance sensor	Digital input	1	A0	RLPin	Slaves	WatchDog	None
Infrared receiving module	Digital input	1	12	13	Slaves	Remote Control	None
Infrared remote control	None	0	None	None	None	Remote Control	None
HC05 bluetooth module	Digital input soft serial port	2	10,11	BT(10, 11)	Slaves	BT Remote Control	dealBT
Active buzzer module	PWM Output	1	5	BuzzPin	Master	Buzz Alarm	Buzz
DHT11 temperature and humidity sensor	Digital input	1	4	dhtPin	Master	Temperature and humidity voice broadcast	Temperature

Device	Interface Type	Interface Number	Pin	Pin Name(In software)	Connect to arduino masters and slaves	Role	Function(In software)
Inclination sensor	Digital input	2	6,7	leanPin1 , leanPin2	Master	Voice alerts are issued on both uphill and downhill slopes	Lean
Luminance sensor	Analog Input	1	A4	lightPin	Master	Voice alerts are issued when the brightness is too low	Light
Crash sensor	Digital input	1	13	punchPin	Master	A voice alert is issued when a collision occurs	Punch
Steering engine	PWM Output	2	10,A0	servoPin fakeServo Pin	Master	The ultrasonic sensor is bound to rotate to realize radar function	dealRadar
Ultrasonic transducer	Digital input and output	2	Input:11 Output: 12	trigPin echoPin	Master	Detect obstacle	dealDistance
M6 voice module	Digital input soft serial port	2	2,3	mySerial(2, 3)	Master	Make voice	None
8 mm led lamp	Digital input	1	A5	LEDPin	Master	Light alarm	None
Serial port communication	RX,TX	2	0,1	None	Master and Slave	Two arduino boards communicate through serial ports	None

2.2.3 Control

2.2.3.1 Bluetooth

We use the HC05 Bluetooth module to connect the Arduino board with the mobile phone to control the car. We use a software called SSP for Bluetooth control.



You can use Bluetooth to switch the car's three modes, and you can control the car's progress and stop, as well as its direction.

2.2.3.2 Natural Language Control

In addition, we use the M5 voice module to realize the control of Chinese voice on the car. When you wake up the car's voice module, you can use Chinese to control the car's progress and stop.

2.2.4 Voice Broadcast

2.2.4.1 Temperature and humidity

We use M5 voice module to realize voice control car and broadcast voice according to different events. M5 voice module and DHT11 temperature and humidity module cooperate, Dragon can broadcast the current temperature and humidity and make a blog report of the current temperature and humidity matters needing attention.

2.2.4.2 Uphill and downhill tips

The M5 voice module is combined with two tilt sensors. When entering the uphill or downhill area, Dragon will give voice prompts to help the blind people to have early warning of the uphill and downhill areas.

2.2.4.3 Night travel alert

The M5 voice module is combined with the brightness sensor. When the brightness is lower than a certain value, Dragon will conduct voice alarm to remind the current location of low brightness.

2.2.4.4 Collision warning

The M5 voice module works with the collision sensor. When the collision is triggered, Dragon will conduct voice alarm.

2.2.4.5 Obstruction warning while driving

The M5 voice module works with ultrasonic sensors and steering gear. In mode 1, when ultrasonic waves detect obstacles ahead, an alarm will be issued

2.2.4.6 Watchdog alert

M5 voice module and infrared sending and receiving module cooperate. In mode 3, voice broadcast will be conducted on the status of the guarded items.

2.3 Function design

2.3.1 Function Overview

[Automatic Obstacle Avoidance]: If a guide dog senses obstacles within 1 meter ahead, it can send out sound and light alarms and stop moving; after the obstacles are removed, it will stop alarming and continue to move according to the instructions.

[Automatic navigation]: In the mobile phone APP press the "automatic mode" button, "guide dog" can automatically drive: when encountering obstacles (within a meter) in the process of forward, through radar detection, automatically select the best path.

[Guard function]: the goods can be placed in front of the product, when the goods leave, the alarm will be issued to realize the guard function.

[Broadcasting temperature]: Real-time detection of current ambient temperature.

[Slope Tips]: When the product is in an uphill or downhill state, voice tips will be given.

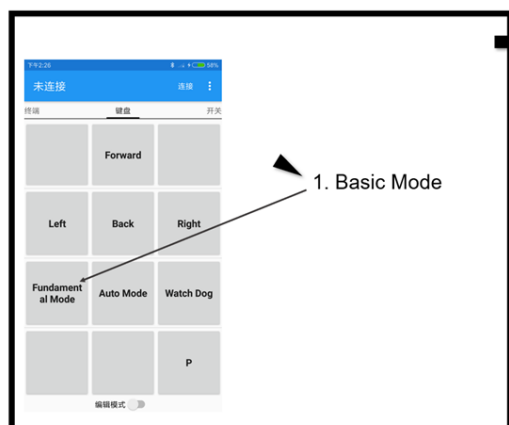
[Night travel alert]: When the product is in a low brightness environment, voice prompts will be given.

[Collision Alert]: When a product is hit, a voice prompt will be given.

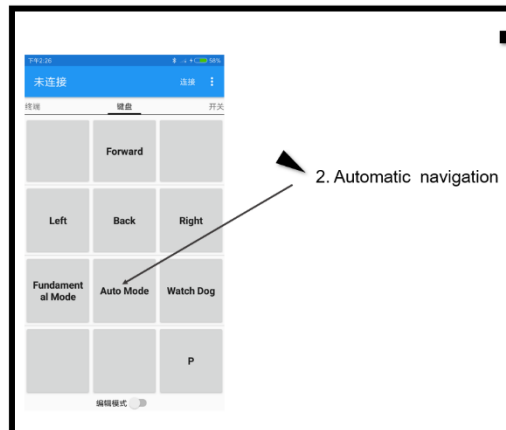
[Voice instruction]: This product can realize the function of voice instruction.

2.3.2 Control Board

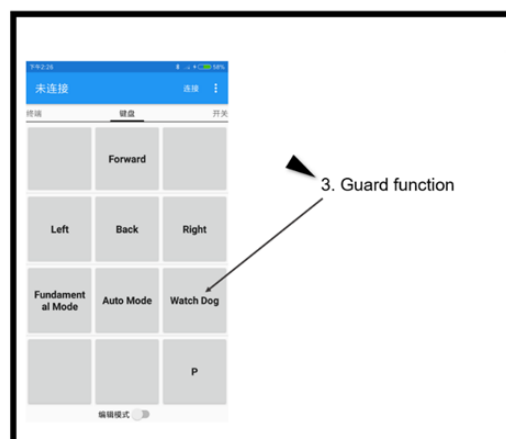
1. The function of automatic obstacle avoidance can be realized by pressing the button of "Basic Mode" in APP on the mobile terminal. At the same time, the intelligent guide dog can be operated by pressing the direction key in the mobile phone interface.



2. Press the "automatic mode" button, the guide dog can realize the automatic navigation function.

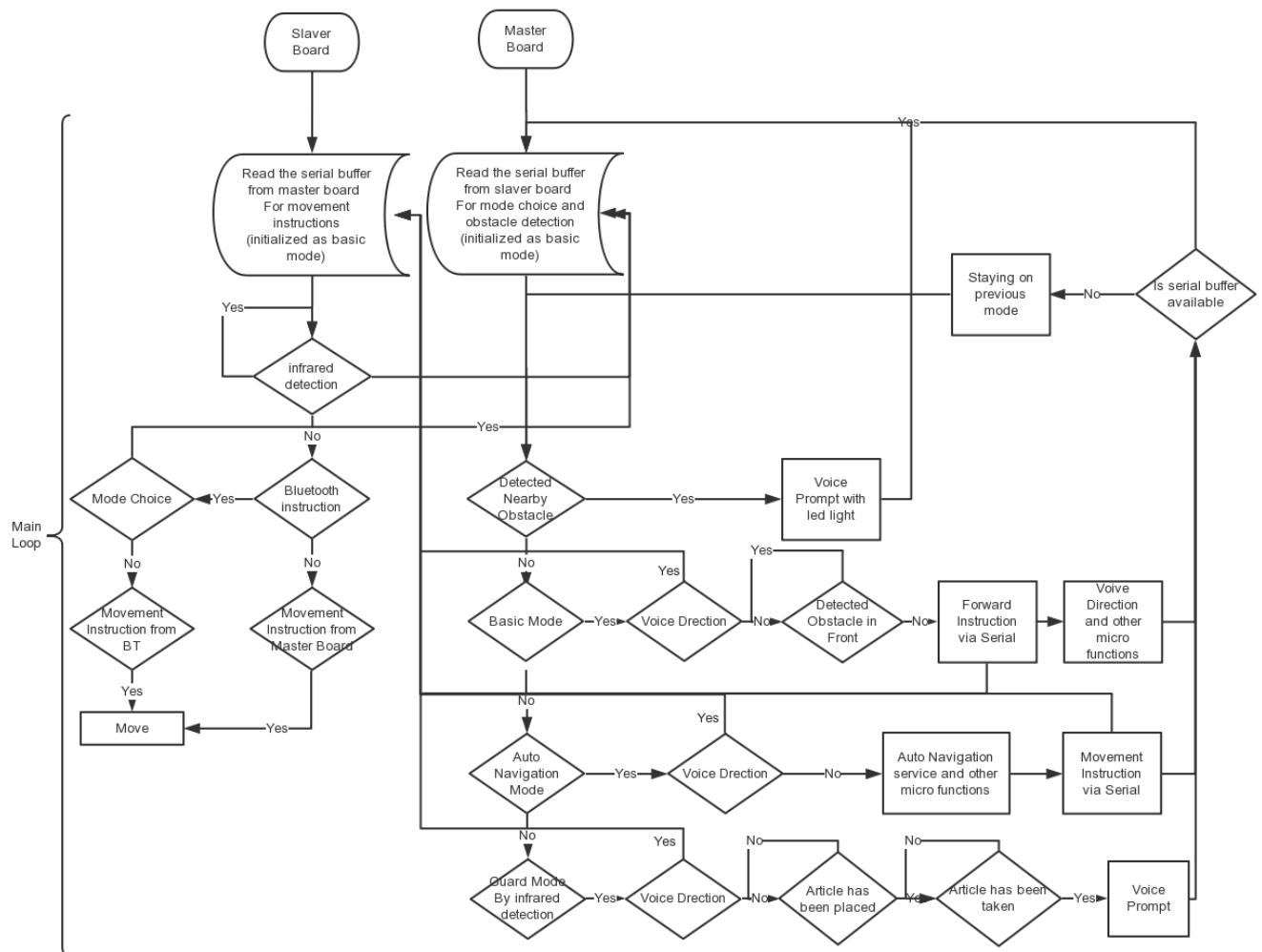


3. Press the "guard mode" button, and the intelligent guide dog will enter the guard mode to realize the guard function.



2.4 Software design

2.4.1 The general structure of the code



2.4.2 Details about the code

1. Master Board:

- Functions including:
 - 1) inclination detection
 - 2) collision detection
 - 3) luminance meter
 - 4) temperature meter
 - 5) ultrasonic ranging system
 - 6) voice recognition/prompt module
 - 7) LED warning light
 - 8) auto navigation

- Code:

a) initialization:

```
void setup()
{
  Serial.begin(4800);
  mySerial.begin(9600);
  pinMode(echoPin, INPUT);
  pinMode(trigPin, OUTPUT);
  pinMode(leanPin1, INPUT);
  pinMode(leanPin2, INPUT);
  pinMode(punchPin, INPUT);
  pinMode(LEDpin, OUTPUT);
  digitalWrite(lightPin, LOW);
  digitalWrite(LEDpin, LOW);
  myservo.attach(servoPin);
  myservo.write(90);
}
```

b) loop:

```
void loop() {
  preModeChar = modeChar;
  if(Serial.available()) modeChar = Serial.read();
  switch(modeChar) {
    case '0':
      digitalWrite(LEDpin, HIGH);
      if(mode0Int == 0) {
        voiceNoForward();
        delay(1500);
      }
      mode0Int = 1;
      modeChar = preModeChar;
      digitalWrite(LEDpin, LOW);
      break;
    case '1':
      while(!Serial.available()){
        if(dealRadar(90) > minDistance){
          Serial.write('C');
          Serial.flush();
          Serial.write('C');
          Serial.flush();
          voiceDeriction();
          lean();
          Punch();
          Light();
          mode1Int = 0;
        }
      }
      else{
        digitalWrite(LEDpin, HIGH);
        if(mode1Int == 0) {
          voiceNoForward();
          mode1Int = 1;
        }
      }
  }
}
```

c) several functions were made to optimize the code:

i. auto navigation:

```
void autoNavi() {
  if(dealRadar(90) > minDistance){
    Serial.write('F');
    Serial.flush();
    Serial.write('F');
    Serial.flush();
  }
  else{
    digitalWrite(LEDpin, HIGH);
    voiceNoForward();
    int i = 0;
    i = dealRadar(-1);
    delay(100);
    if(i < 6) {
      i = 6 - i;
      commondChar1 = 'R';
      commondChar2 = intToChar(i);
    }
  }
}
```

ii. ultrasonic ranging system:

inclination detection, collision detection, luminance meter, temperature meter, voice recognition/prompt module, etc.

```
int dealRadar(int setPos) {
  if(setPos != -1) {
    myservo.write(setPos);
    return dealDistance();
  }
  else{
    int pos;
    int i = 0, j = 0;
    int distance[13];
    int detectDis = 0;
    int bestPos = 0;
    myservo.write(0);
    delay(50);
    for(pos = 0; pos <= 180; pos += 15) {
      myservo.write(pos);
      delay(50);
      j = dealDistance();
      distance[i] = j;
      i++;
    }
  }
}
```

2.Slaver Board:

- functions including:

1)infrared detection

2)Bluetooth module

3)Stepper motor control module

- Code

a) initialization

```
void setup()
{
  Serial.begin(4800);
  BT.begin(9600);
  |
  char commondChar1 = '0';
  char commondChar2 = '0';
}
```

b) loop

```

void loop() {
  // Serial.println("loop");
  if(digitalRead(RLPin) == 0) {
    Serial.write('0');
  }
  else{
    if (BT.available()) dealBT();
    else {
      commondChar1 = '0';
      if(Serial.available()) {
        commondChar1 = Serial.read();
      }
    }
    switch(commondChar1) {
      case 'F':
        goForward(2);
        break;

      case 'L':
        delay(50);
        goLeft((charToInt(Serial.read()) * 15));
        break;

      case 'R':
        delay(50);
        goRight((charToInt(Serial.read()) * 15));
        break;

      case 'B':
        goBack(2);
    }
  }
}

```

c) several functions were made to optimize the code:

i. stepper motor control module

```

void goForward(int goLength) {
  // Serial.println("F");
  int goi = goLength * 9;
  for(int i = 0; i < goi; i++){
    leftStepper.step(-1);
    rightStepper.step(1);
    delay(goSpeed);
  }
}

void goBack(int goLength) {
  // Serial.println("B");
  int goi = goLength * 9;
  for(int i = 0; i < goi; i++){
    leftStepper.step(1);
    rightStepper.step(-1);
    delay(goSpeed);
  }
}

void goLeft(int degree) {
  // Serial.print("L");
  // Serial.println(degree);
  int goi = 143 * degree / 90;
  for(int i = 0; i < goi; i++){
    leftStepper.step(1);
    rightStepper.step(1);
    delay(goSpeed);
  }
}

```

ii. Bluetooth instruction module

```
void dealBT() {
  char c = 'C';
  char BTval = BT.read();
  if(BTval == 'F') {
    while(!BT.available()) {
      if(digitalRead(RLPin) != 0 && (c == 'C')) goForward(2);
      while(!Serial.available());
      c = Serial.read();
    }
    BTval = BT.read();
  }
  switch(BTval) {
    case 'L':
      goLeft(30);
      break;
    case 'R':
      goRight(30);
      break;
    case 'B':
      goBack(5);
      break;
    case '1':
      Serial.write('1');
      break;
    case '2':
      Serial.write('2');
      break;
  }
}
```

2.4.3 The advantage of the code

Code Advantage I

Aim: enable the car to go smooth

Solution: Two Arduino boards are working simultaneously to overcome the problem that one board deals too much things during one cycle, which may cause the stepper motors work off and on. Slaver board is mainly responsible for stepper motor control and get directions from Master board, while the latter deals with other tasks like navigation. The two board is communicating via serial. To ensure that the directions is on time, the serial buffer is adjusted to 2 from 128 by default to avoid outdated directions accumulated.

Code Advantage II

Aim: avoid the conflict between software serial and steering gear

Solution: Because the conflict comes from the C library of software serial and steering gear, the steering gear will move when there are data stream going through software serial and it is hard to solve the conflict from the source. A new solution was invented during the process. A fake pin is assigned to the steering gear when there is no need to turn it. When the car need to detect its surrounding, the real pin of steering gear will be assigned, witch enable the board to control it.

3 Website design

3.1 Appearance

Website is an important way for users to understand company culture and product information, so we browsed some shopping website which are famous for its appearance and learned the interface and layout to design our website.

The website serves our product completely, with the concise style to make our website more efficient. Our website is usable, intuitive and simple in hierarchy so that can help customers to have a deep understanding of our products and services.

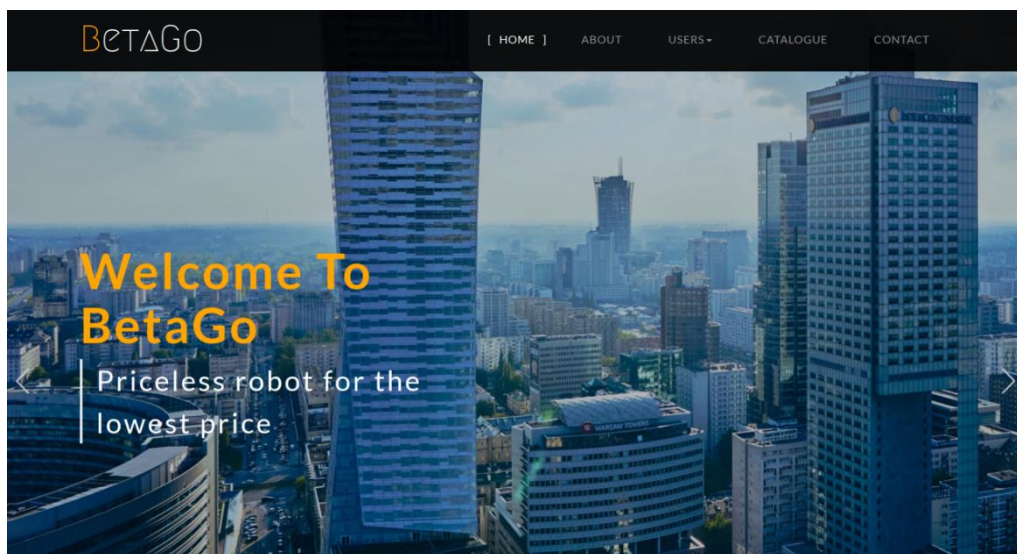
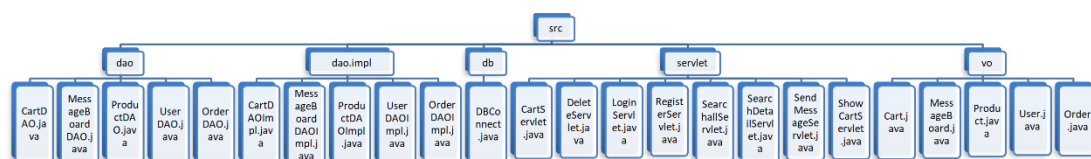


Figure 1 Index page

3.2 Function

Our website attaches great importance to the practicability and intuition of the website and the functions of this website satisfy most users' needs. Users can register, sign in, manage their information, browse products, contact us, add, minus or delete products in shopping cart in our website. Users who are not logged in can also browse the product, when they want to buy something, the website will prompt the user to log in.

3.3 The general structure of the code



3.4 Details about the website

Product display

Users can see the basic information of the product including price and name on this page. When the user wants to learn more about or purchase a product, click on the product image.

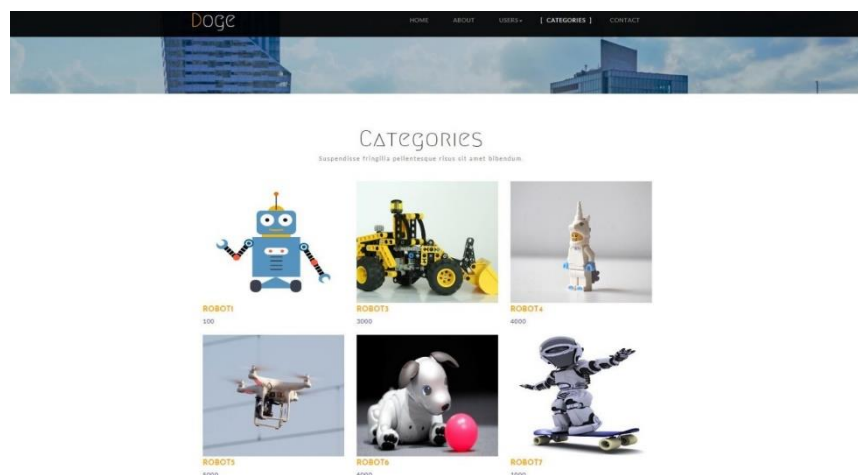


Figure 2 Product page

Add robot to cart

Users can increase or decrease the number of robot dogs and then add them to the shopping cart.

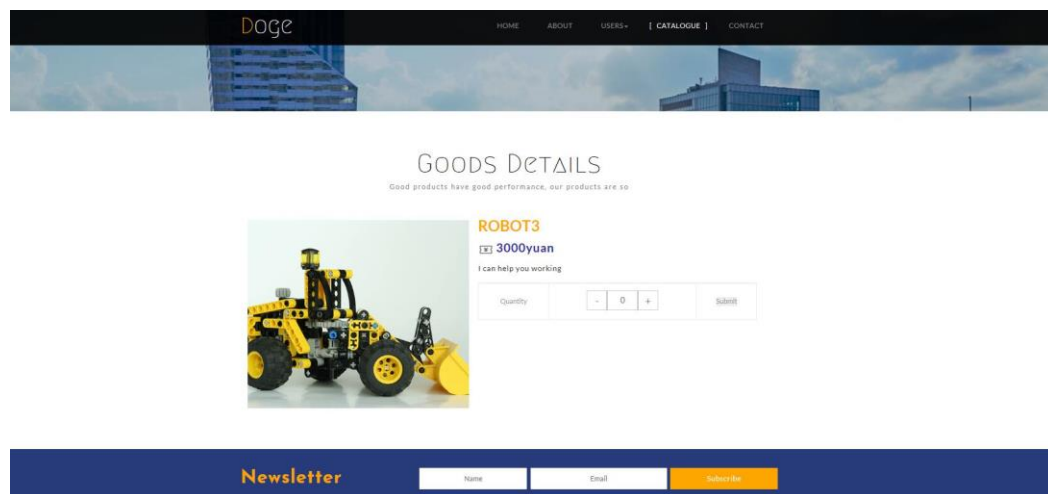


Figure 3 Cart page

View shopping cart

Customers can browse their shopping cart and cut it down, and at the bottom of the page are two buttons to continue shopping and proceed to checkout.

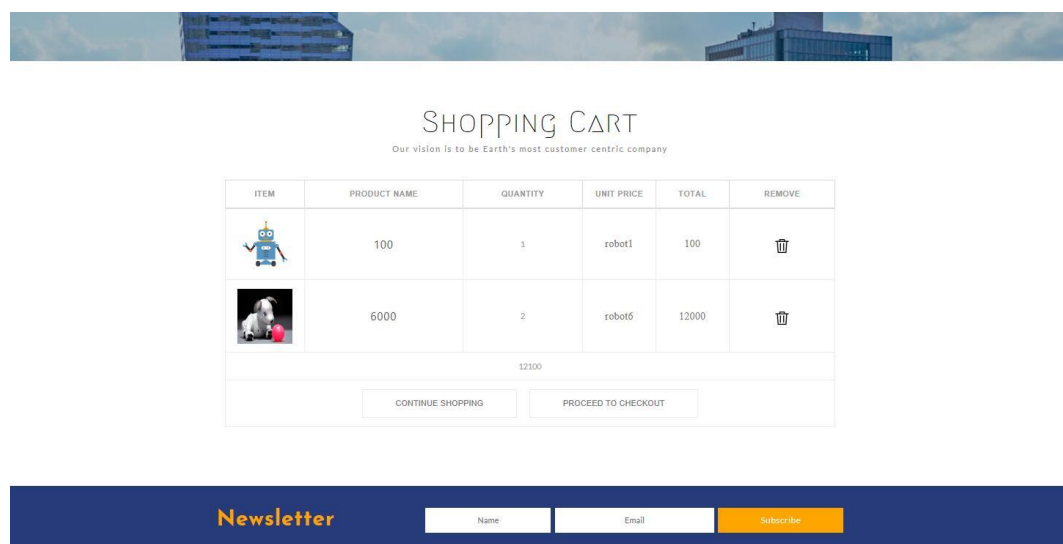


Figure 4 Viewing Cart page

Submit Order

When the user submits, the website will display the successful submission information.

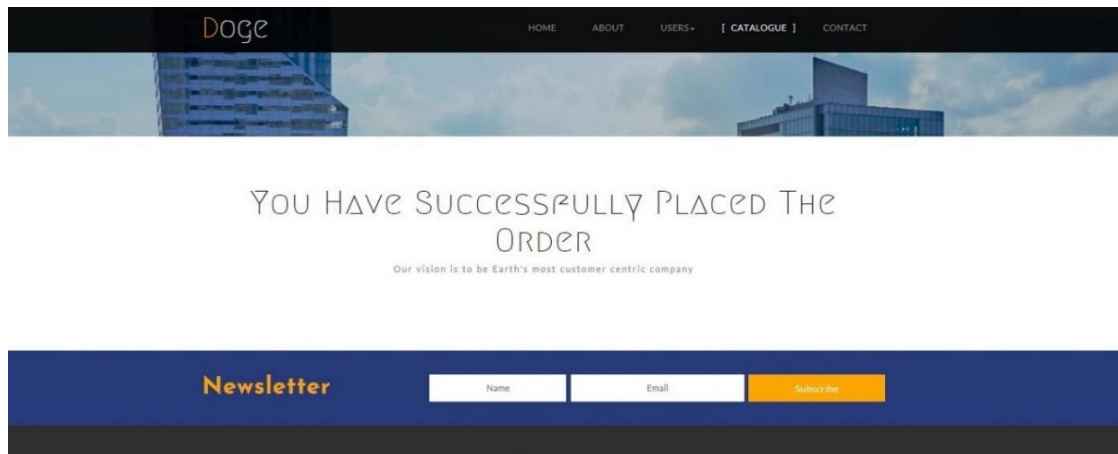


Figure 5 Order page

Contact us

When users encounter problem that cannot be solved by themselves, they can communicate with the staff to solve by feedback module. Users need to enter a name and email when leaving a message so that managers can easily contact them. The user's message will be stored in the database.

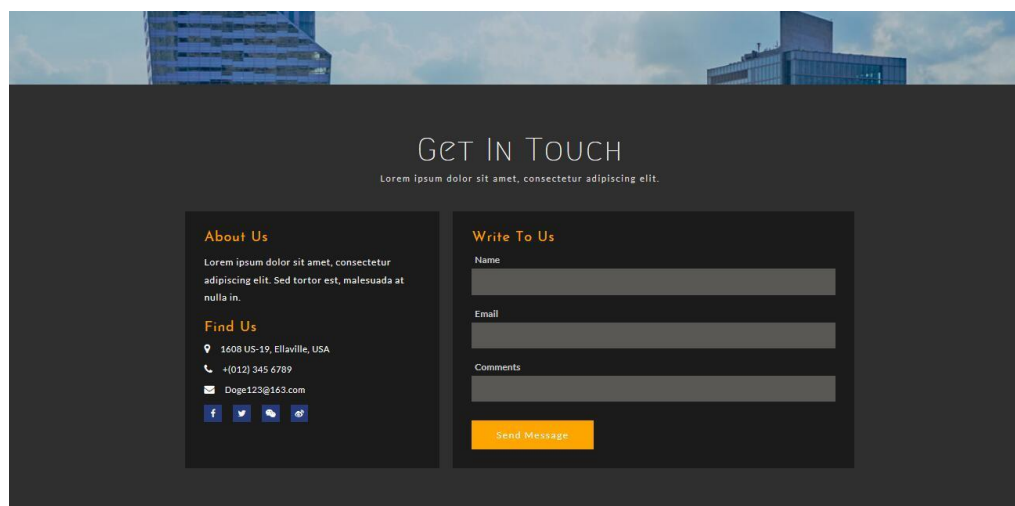
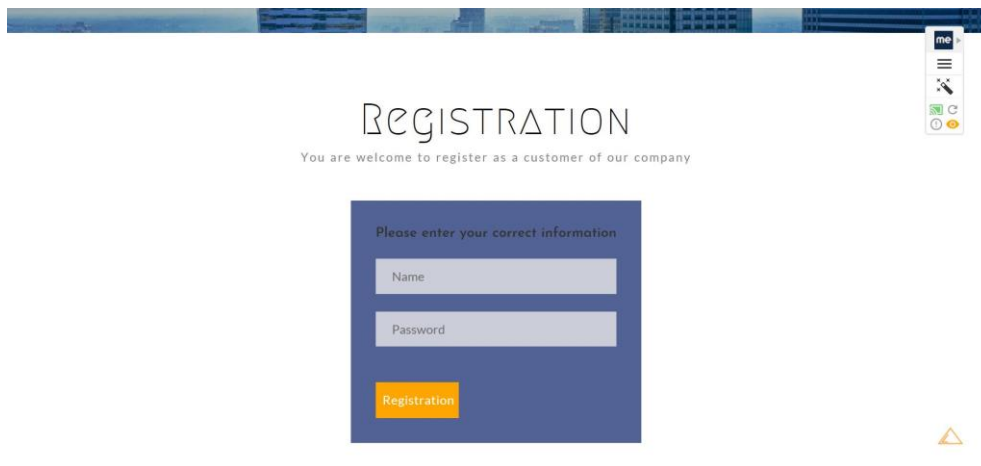


Figure 6 contact us page

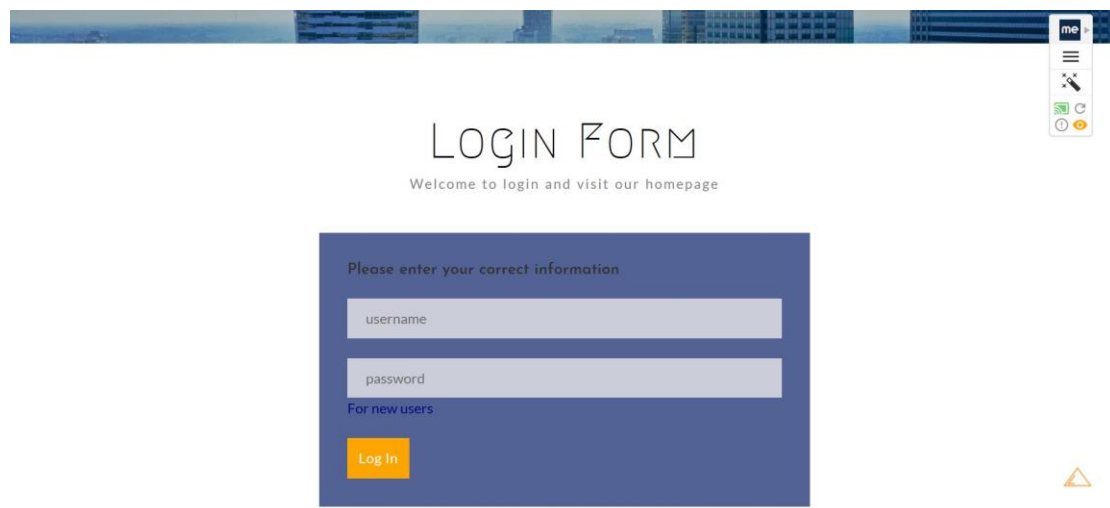
Register



The screenshot shows a web page titled "REGISTRATION" with a subtitle "You are welcome to register as a customer of our company". The main content is a registration form with a blue header "Please enter your correct information". It contains two input fields: "Name" and "Password". Below these fields is an orange button labeled "Registration". The page has a dark blue header with a cityscape image and a sidebar on the right with a "me" profile icon and a menu. A small orange triangle icon is visible in the bottom right corner of the form area.

Figure 6 register page

Log in



The screenshot shows a web page titled "LOGIN FORM" with a subtitle "Welcome to login and visit our homepage". The main content is a login form with a blue header "Please enter your correct information". It contains two input fields: "username" and "password". Below these fields is an orange button labeled "Log In". There is a link "For new users" below the password field. The page has a dark blue header with a cityscape image and a sidebar on the right with a "me" profile icon and a menu. A small orange triangle icon is visible in the bottom right corner of the form area.

Figure 7 log in page

3.5 Design principles

Login&Register	<ul style="list-style-type: none"> Record the user's personal information
Product Display	<ul style="list-style-type: none"> Display basic products. Every user can make personal choice.
Shopping Cart	<ul style="list-style-type: none"> Users can add products to their cart and then check it. Finally they can choose some products in cart to pay.
Order	<ul style="list-style-type: none"> When users decided to pay some products, the corresponding orders will be generated and deposited into the database.
Contact	<ul style="list-style-type: none"> Users can leave some message, and then they can communicate with the staff to solve by contact module.

3.6 Database

userinfo	(username, password)
product	(pid, name, price, SRC, detail)
cart	(pid, username, price, name, SRC)
order	(pid, username, num, price, SRC, name)
messageboard	(username, message, email)

Table 1 Database table

4 Video Design

4.1 General idea

Our product “Dragon” is specially aimed at blind people or people who have difficulty in walking and need some external device help. First and foremost, Dragon are popular for its ability to move according to voice commands from users, in this way, it can sense the way and provide useful help for blind people. Besides moving according to voice commands, Dragon can also be switched into “Auto mode”, in which Dragon will automatically avoid what is in its way, and choose another correct way to go on. Users can follow the route which Dragon choose conveniently without thinking of other things. What’s more, in “watch dog” mode, users can put their belongings in front of Dragon, if the things are moved away, Dragon will give voice cues, users can get benefit from this mode when they can’t take their belongings all the time. Further more, users can use blue tooth to control Dragon on their smart phone remotely, and Dragon has some additional functions: such as “real-time temperature prompt”, “signs for uphill and downhill roads”, and “indication about changes in night brightness”.

4.2 Video shooting

In order to better display the functions of our products and obtain the best effect of shooting vision, we decide to use the professional camera which has excellent performance in video capturing. As for video editing, we use Adobe Premiere this application. It can better edit video fragments without damaging video picture quality, and realize scene conversion, subtitles adding and other functions.

5 Planning and management

5.1 Planning for hardware design

Preliminary preparation

July 1st

Knowledge: familiar with the required components, define our mission and learn the basic operation of Arduino.

Operation: finish the assembly of the basic components of the car.

July 2nd

Knowledge:

Try to use some sensors and Arduino to realize some basic functions.

Operation: Ultrasonic ranging, measuring the temperature and humidity in the environment.

Other creative idea proportion:

In addition to some basic functions like making noises based on the distance from the obstacle and moving according to the control from users, we have also devised some new ideas: our product can receive user's voice controls, guard over users' belongings and send out a night alarm.

Basic operations

July 3rd

Operation: Install Bluetooth module, and learn how to make Dragon move.

Complete: Staged acceptance and make the Dragon to carry out basic movement.

July 4th -7th

Knowledge: after finishing the basic requirements like making noises based on the distance from the obstacles and so on, we propose a new idea about how to make Dragon move based on the voice commands from the users.

Operation: realize speech recognizing function using speech module and serial communication between two UNO boards.

Complete: purchase other materials which are helpful to our Dragon development.

We divide functions we want to achieve into four parts: fundamental mode, auto mode, "watch dog" mode and speech recognition mode. And we tried to finish these codes respectively first.

July 7th-8th

Knowledge: We decided to use the cardboard to design the appearance of the Dragon, improve the function of Dragon, and design the interface of mobile phone blue tooth control.

Operation: Use Photoshop and CAD to simulate the appearance of the car and draw the front and side view. Achieve Bluetooth control car code and integrate all of the code, and debug.

Complete: Purchase materials, improve the car assembly, realize all the function we proposed before, handmade appearance.

July 8th- 9th

Operation&Complete:

Complete the video shooting of Dragon's appearance and function introduction, so as to better market our products. Meanwhile, make PowerPoint for acceptance.

5.2 Planning for website

Preliminary preparation

July 1st

Knowledge: Understand task requirements, know what we do, and prepare to learn relevant knowledge. Learn HTML basic tags, CSS selector, box model. Learn how to use MyEclipse basic operation and connection with database.

Operation: Complete the login function.

Basic task

July 2th

Operation: Complete the functions of registration.

Part of design: Complete design of index.

July 3th

Operation: Complete the functions of viewing the items.

Part of design: Complete design of login and register.

July 4th

Operation: Complete the functions of add items to the shopping cart and choose the number of the products.

Part of design: Complete interface design of products.

July 5th

Operation: Complete the functions of viewing the shopping cart

Part of design: Complete design of shopping cart.21 Year 2 Short Semester 201

July 6th

Operation: Complete the functions of placing the orders.

Part of design: Complete design of order.21

Later
period

July 7th-July 8th

Integrated the website, add some corresponding web pages and debug.

July 9th

Check.

6 Minutes of group meeting

In order to make the work more efficient, we usually work together in the circuit experiment center and hold regular meetings. The meeting can not only further improve the functional quality of the car, but also enhance the relationship between team members

Minutes of the first group meeting

Date/time: 30th June, 2019, 4:00pm

Location: library

Present: All of the members

Chairman: Maokun Peng

Proceedings:

1. Every member gave a brief introduction of themselves.(including professional expertise, time arrangement, experience)
2. We reviewed the meeting contents in the morning and specified the product and time.
3. Analyzed the market and functions of the similar products.
4. Everyone gave opinions about the functions and appearance. Then we evaluated and determined the functions that we were going to realize and several possibilities of the appearance.
5. The group was divided into three parts according to the major, professional expertise as well as experience from seniors.(Group Telecom and Group e-commerce and group IOT)
7. Determines the approximate timeline.

Minutes of the first sub-group telecom meeting

Date/time: 2th July, 2019, 8:00pm

Location: Classroom

Present: All of the members of sub-group telecom

Chairman: Maokun Peng

Proceedings:

1. Identified the technical tasks and find out what knowledge is required.
2. Discussed the details of the functions of product.
3. Made a time plan about the phases of development.

Minutes of the second group meeting

Date/time: 9th July, 2019, 8:00am

Location: library

Present: All of the members

Chairman: Maokun Peng

Proceedings:

1. Sub-group telecom displayed the prototype in the group.

2. Sub-group telecom shared the process of development, the difficulties as well as solutions and some other experience.
3. Others came up with some deficiencies, ideas, suggestions and somewhere they can improvements.
4. Sub-group e-commerce asked more detail information which they need for the website.

Minutes of the second sub-group telecom meeting

Date/time: 10th July, 2019, 10:00a.m

Location: classroom

Present: All of the members of sub-group telecom

Chairman: Maokun Peng

Proceedings:

Integration all the functions.

Discuss the appearance of the dog.

Make circuit connections and fix device positions.

Preliminary tests.

Minutes of the third group meeting

Date/time: 10th September, 2019, 8:00p.m

Location: Maan Coffee

Present: All of the members

Chairman: Maokun Peng

Proceedings:

Final test.

Carry out the division of labor of report and user manual.

Discuss the final demo flow and set a deadline.

7 Acknowledgement

Many people have offered us valuable help during this short semester, including our teachers, our partners, and our classmates.

Firstly, we would like to express our sincere appreciation and gratitude to our teachers. It is their helpful advice that provides us with inspiration of new ideas.

Secondly, we are extremely grateful for our partners for our cooperation. In this way, we can enjoy a meaningful short semester and make breakthrough together.

Besides, we also want to give thanks to your patience for reading this report.

Finally, if you have any questions or advice, please you contact us at 1527032003@qq.com.

We highly value your comments, which will help us improve our product. Please do not hesitate to contact us!