Future Engineers

I Love Shina

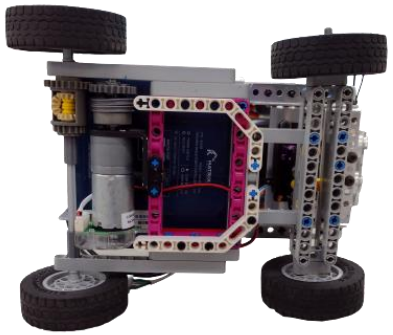
Vehicle design Concept

Vehicle

In order to have better steering so we design the Ackerman steering in vehicle. And use the servo motor to control the steering. We download Differential at the mover motor.

Vehicle View

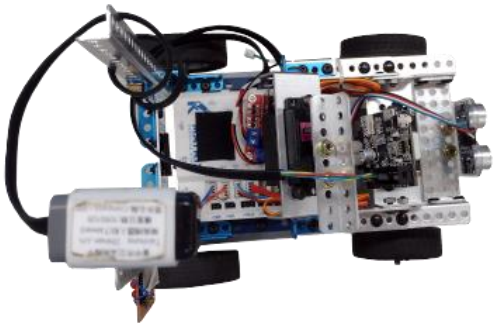
Pictures of Car Body



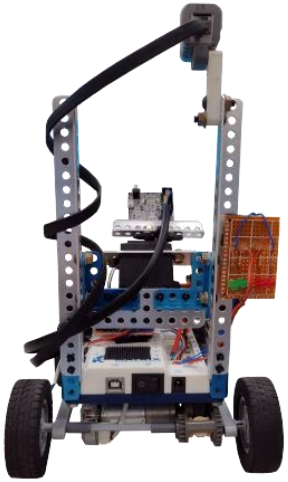
Bottom

Front

Left



Top

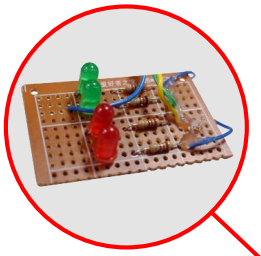


Rear

Right

Vehicle Component

Component



LED Mode

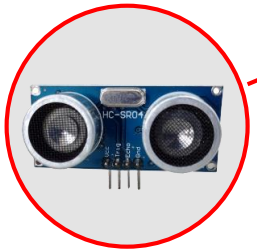
Compass Sensor

Pixy2 Camera

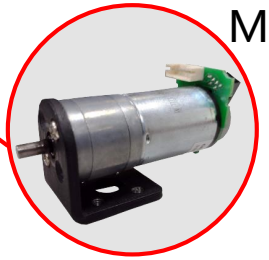
Servo Motor

Motor Driver Module

Matrix Mini controller



Uitrasound Sensor



Move Motor

Matrix Mini controller

Controller introduction:

- There is 18 I/O on Matrix MINI, which can be used to connect motors and sensors.
- I/O includes: 2 DC motor ports, 4 RC motor ports, 4 digital and 3 analog input/output ports, 2 RGB LED lights, 3 buttons and 4 I2C ports.
- Matrix MINI can be programmed in Arduino IDE or Scratch.

Compass Sensor

Function：

- The compass sensor can detect the earth’s magnetic field. detect it at a rate of 100 times one second, and return a value between 0 and 359 to indicate the angle of north.

Application：

- Detect the vehicle’s magnetic field azimuth value to control the vehicle to avoid deviating from the lane.

Pixy2 Camera

Function：

- Pixy2 is small in size and light in weight. You only need to use the app to learn to recognize objects.
- Pixy2 completes object recognition at a speed of 60 frames per second, allowing the machine to react faster.

Application：

- Pixy2 is used to identify the position and size of the red and green obstacles on the field to dodge the block obstacles.

Motor Driver Module

Function：

- The Motor Driver Module controls the rotation direction and speed of the motor through the direction of the input. current.

Application：

- Control the forward, reverse and rotation speed of the Move Motor.

Uitrasound Sensor

Function：

- The HC-SR04 ultrasonic sensor is a non-contact sensor. This sensor uses the ultrasonic principle to achieve the effect of measuring distance. The effective range of detection is 2 cm to 400 cm, and the accuracy can reach 3mm.

Application：

- Detect the distance between the fence and the vehicle to know whether the vehicle needs to turn.

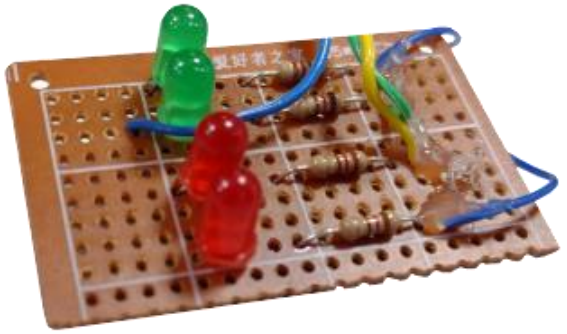
LED Mode

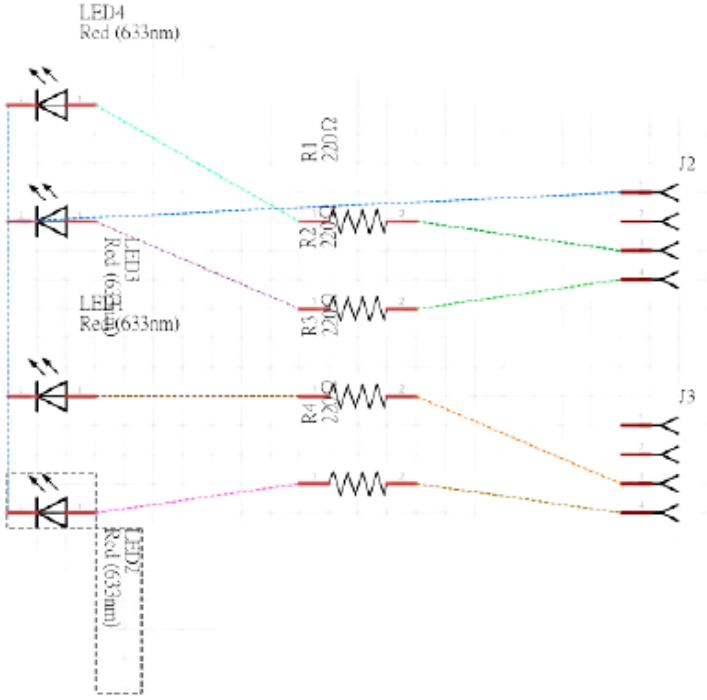
Function：

- It is made of light-emitting diodes, resistors and dot matrix boards.
- Use Matrix MINI controller digital pin output to control the LED light on and off.

Application：

- Since the Pixy2 image recognition module cannot display the image recognition results in real time, a self-made LED light module is used to indicate the results of the Pixy2 image recognition with lights.





Move Motor

Specification：

- No-load speed: 126 rpm/m
- Reduction ratio: 1:34
- Voltage: 3~12V

Application：

- Drive the rear wheels of the car to control the forward and backward of the vehicle.

Servo Motor

Specification：

- The rotation angle can be controlled to 180°, the error is ±3°
- The maximum torque is 11kg/cm (6v), the fastest rotation speed is 0.16 seconds/60 degrees (6.0v)
- Working voltage is between 4.8V-7.2V

Application：

- Control the rotation of Pixy2 image recognition module.
- Control the Ackerman steering mechanism to make the vehicle turn.

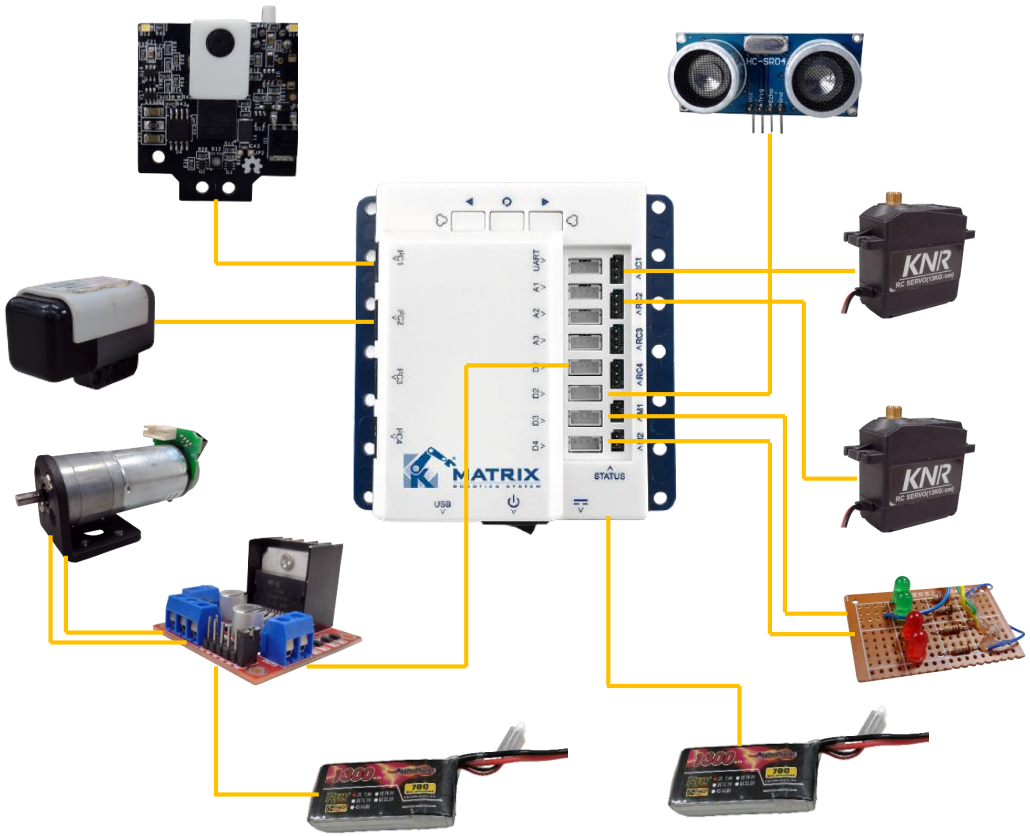
Lithium Battery

Specification：

- Maximum current: 45.5A
- Maximum current: 45.5A
- Rated voltage: 11.1V
- application：
- Supply motor and motherboard power

Vehicle Components Introduction

Component Configuration



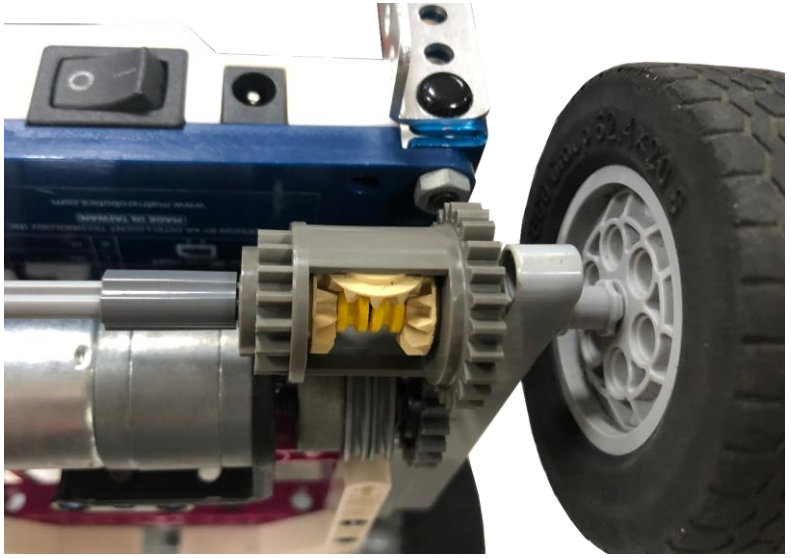
Component	Controller on Matrix Mini
Pixy2 Camera	I2C Port1
Compass Sensor	I2C Port2
Uitrasound Sensor	D2
Motor Driver Module	D1
Servo Motor	RC1
Servo Motor	RC2
LED Model	D3、D5

Vehicle Technical Documents

Structure Introduction

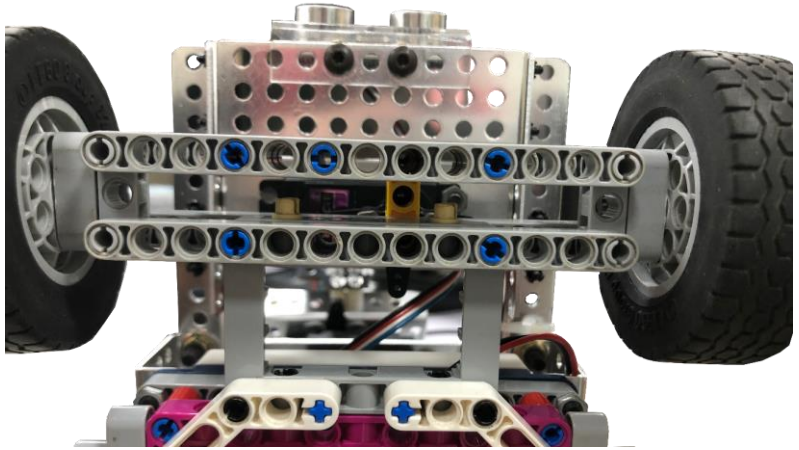
Differential

- In order to solve the problem that the path taken by the outer wheels is larger than the path taken by the inner wheels when turning, we install a differential.



Steering Mechanism

- In order to have better steering, we design the steering rudder as Ackerman steering structure, and use the servo motor to control the steering of the steering rudder.



Vehicle Technical Documents

Programming

Abstract of Robot Rogramming

Programming language

Function：

- Arduino IDE is a hardware platform, Write the program and burn the program into the Matrix MINI.

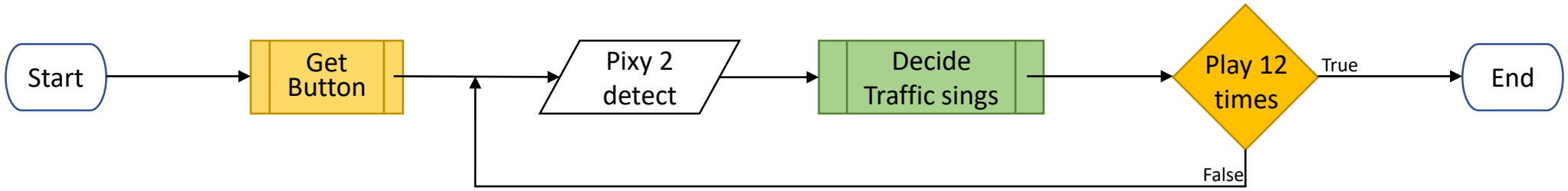
Application ：

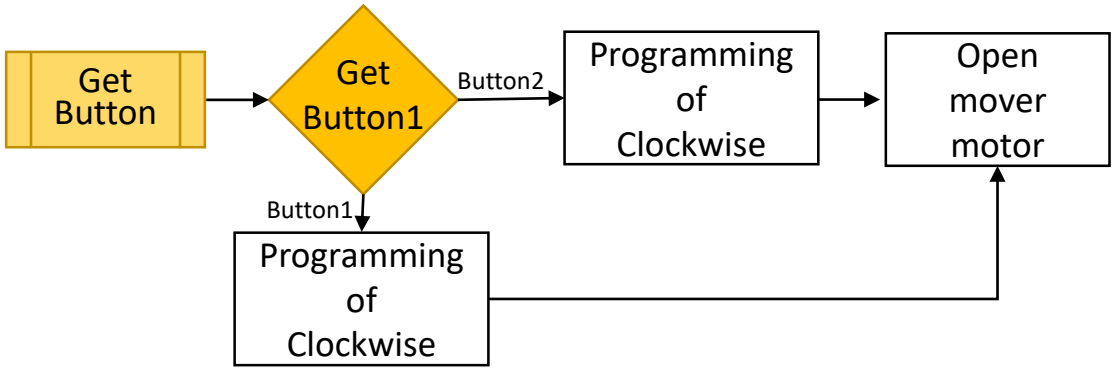
- Write the program and burn the program into the Matrix MINI.

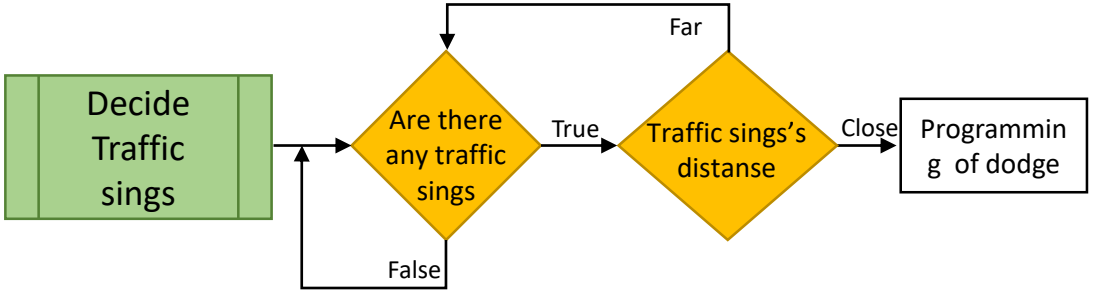
ARDUINO IDE

Abstract of Robot Programming

Flowchart







Abstract of Robot Programming

Programming Introduction

Block_Switch_Logic :

Judging traffic signs and dodge

```
void Block_Switch_Logic(int Block_Count) {
  Mini.I2C1.PIXYcam.getblock(0, 1);
  if (Block_Count == 0) {
    Serial.println("ZERO");
    Far_Block_Code = 0;
    Close_Block_Code = 0;
  } else if (Block_Count == 1) {
    Serial.println("ONE");
    long Block_Size = Mini.I2C1.PIXYcam.block.width * Mini.I2C1.PIXYcam.block.height;
    long Block_X =  Mini.I2C1.PIXYcam.block.x;
    Serial.println("Block_Size"); Serial.println(Block_Size);
    Serial.print("Block_X"); Serial.println(Block_X);
    if (Block_Size >  Pixy2_Block_Size) {
      Far_Block_Code = 0;
      Close_Block_Code = Mini.I2C1.PIXYcam.block.signature;
    } else {
      if ((Block_X < Shun_Block_X && Spin_Direction == 0) || (Block_X > inverse_Block_X && Spin_Direction == 1)) {
        Far_Block_Code = 0;
        Close_Block_Code = Mini.I2C1.PIXYcam.block.signature;
      } else {
        Far_Block_Code = Mini.I2C1.PIXYcam.block.signature * 3;
        Close_Block_Code = 0;
      }
    }
  } else if (Block_Count == 2) {
    Serial.println("TWO");

    Mini.I2C1.PIXYcam.getblock(0, 1);
    Close_Block_Code = Mini.I2C1.PIXYcam.block.signature;
    Mini.I2C1.PIXYcam.getblock(0, 2);
    Far_Block_Code = Mini.I2C1.PIXYcam.block.signature * 3;
  }
}
```

Block_Switch_Logic will determine the distance, quantity, coordinates, area and color detected by the Pixy2 image sensor. When the traffic sign approaches, the direction of the dodge action will be executed according to the color. If there is no traffic sign or the traffic sign is far away from the organization, the dodge action will not be executed.

Abstract of Robot Programming

Programming Introduction

Start_Decide:

Detect vehicle direction

```
void Start_Decide() {
  US_Last_Error = Mini.D2.US.get();
  while (Mini.BTN1.get() == 0 && Mini.BTN2.get() == 0) {
    Mini.I2C1.PIXYcam.getblock(0, 1);
    Serial.print("US2:"); Serial.println(US_Filter());
    Serial.print("Compass:"); Serial.println(Mini.I2C2.HTcompass.getHeading());
    Serial.print("Blcok_Count:"); Serial.println(Mini.I2C1.PIXYcam.getCountofBlock());
    Serial.print("Size:"); Serial.println(Mini.I2C1.PIXYcam.block.width * Mini.I2C1.PIXYcam.block.height);
    Serial.print("X:"); Serial.println(Mini.I2C1.PIXYcam.block.x);
    Serial.println("==================================");
    delay(100);
  }
  Serial.println("============================");
  if (Mini.BTN1.get() == 1) {
    Spin_Direction = 0;
    Mini.RC2.set(pixy2_Servo - 5);
    Serial.println("順時針");
  } else {
    Spin_Direction = 1;
    Mini.RC2.set(pixy2_Servo + 8);
    Serial.println("逆時針");
  }
  for (int i = 0; i < 4; i++) {
    Start_Area = i;
    if (abs(Compass_Heading(Compass[Spin_Direction][i])) < 20) {
      break;
    }
  }
  Serial.print("第"); Serial.print(Start_Area); Serial.println("開始區");
  delay(300);
  int Power = map(power, 0, 100 , 0, 255);
  digitalWrite(IN1PIN, HIGH);
  analogWrite(EN1PIN, Power);
}
```

Start_Decide is used to detect the button you press to determine the direction of the vehicle. When you press button 1, it will move clockwise, and button 2 will move counterclockwise. When the program starts, it will detect the value of the electronic compass to know where it starts.