DON BOSCO INSTITUTE OF TECHNOLOGY KURLA, MUMBAI

A PROJECT REPORT ON

"Smart Delivery Agent"

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DEPARTMENT OF INFORMATION TECHNOLOGY

(2019-2020)

CERTIFICATE

This is to certify that the project entitled **"Smart Delivery Agent"** is a bonafide work of **GANESH MASTUD (38), AFIF SHAIKH (62), PRABODH SHEWALKAR (65)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of "**TEIT"** in **"Internet of Things"**.

(GUIDE SIGNATURE) (HOD SIGNATURE)

Dissertation Approval Certificate

This project report entitled “Smart Delivery Agent” by Ganesh Mastud, Afif Shaikh and Prabodh Shewalkar is approved for the degree of Bachelor of Engineering in Information Technology.

Examiners

1.----------

Name: -

Date: -

Place: -

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Afif Shaikh – 62: _____

Prabodh Shewalkar – 65: _____

Date:

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Abstract

The library system is the most important aspect of any Educational Institute. To maintain and arrange the books in Library system efficiently we make the Effortless Book carrying Robot. Line follower is a intelligent robot which detects a visual line embedded on the floor and follows it. The path is predefined and can be either visible like a black line on a white surface with a high contrasted colour or the path can be a complex such as magnetic markers or laser guide markers. In order to detect these lines various sensors can be employed.

Generally, infrared Sensors are used to detect the line which the robot has to follow. The robot movement is automatic and can be used for long distance application. Line follower can be modified by giving obstacle detection capability to it. If any object is placed on the path then a normal line follower will try to push the obstacle and hence it gets damaged. By using ultrasonic sensor, the line follower can detect an obstacle and can stop till the obstacle is removed.

This type of robots can perform lot of tasks in industries, like material handling. These robots can be used as automated equipment carriers in industries replacing traditional conveyer belts. They also have domestic application and one of the interesting applications of this line follower robot is in health care management. As this smart line follower robot has obstacle detection capability it will not be damaged easily as it stops it motion till the obstacle is removed or till the path is changed. This ability of the robot increases it application especially in industries because obstacles are common in any workplace and if the robot is not able to detect the obstruction it will get damaged so this gives an added advantage wherever this intelligent line follower is used. In addition, the obstacle detection is used to achieve the smooth performance. This project can be used in Library System, Shopping malls, general stores etc.

Introduction

Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IoT is strongly established.

There are four main components used in IoT:

1. Low-power embedded systems –

Less battery consumption, high performance are the inverse factors play a significant role during the design of electronic systems.

2. Cloud computing –

Data collected through IoT devices is massive and this data has to be stored on a reliable storage server. This is where cloud computing comes into play. The data is processed and learned, giving more room for us to discover where things like electrical faults/errors are within the system

3. Availability of big data –

We know that IoT relies heavily on sensors, especially real-time. As these electronic devices spread throughout every field, their usage is going to trigger a massive flux of big data.

4. Networking connection –

In order to communicate, internet connectivity is a must where each physical object is represented by an IP address. However, there are only a limited number of addresses available according to the IP naming. Due to the growing number of devices, this naming system will not be feasible anymore. Therefore, researchers are looking for another alternative naming system to represent each physical object.

Characteristics of IoT:

- Massively scalable and efficient
- IP-based addressing will no longer be suitable in the upcoming future.
- An abundance of physical objects is present that does not use IP, so IoT is made possible.
- Devices typically consume less power. When not in use, they should be automatically programmed to sleep.
- A device that is connected to another device right now may not be connected in another instant of time

IoT Advantages:

The advantages of IoT span across every area of lifestyle and business. Here is a list of some of the advantages that IoT has to offer −

- Improved Customer Engagement − Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audiences.
- Technology Optimization − The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional and field data.
- Reduced Waste − IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.
- Enhanced Data Collection − Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyse our world. It allows an accurate picture of everything.

1.1 Problem Statement

In Big Universities Libraries Books are issued and returned daily in big numbers mainly during exam periods. Students issues the books by manually going to the shelf respected to its subject but when they return it, they give it back to librarian. Therefore, now to keep these books to its respected shelf is librarian's responsibility. The librarian either keep the books to the shelf every time a book is returned or keep it till the library is closed and arrange all the books in the shelf once. Carriers are required to carry these Books from librarian place to its respected cupboard/Shelf. The librarian has to push the carrier full of books.

1.2 Scope of the Project

This project is to automate the manual work of librarian using carts to follow a line instead of doing it manually. Not only libraries this project maybe useful in other sectors where carrying products within specific range is very hectic. Therefore, the main Goal of this project to carry the load from one specific point to another specific point. Minimizing the hassle of the person to carry the load. This project can be achieved in very low budget.

1.3 Current Scenario

Most of the libraries still has carriers which carry books from one cupboard/Shelf to another. The librarian has to push the carrier full of Books. The librarian does this thing regularly or someone else is appointed for this work. This project is to automate this manual work using carts to follow a line instead of doing it manually.

1.4 Need for the Proposed System:

The Purpose is simple a car which can carry the load which is usually carried by humans. This will decrease the time consumption. Increase the efficiency of the task.

Review of Literature

Sr. No	Paper Title	Author & Year of Publication	Methodologies, Advantages and Disadvantages	Hardware and Software requirements
01	A Line Follower Robot from design to Implementation: Technical issues and problems	Mahdi Rezaei On 17 May 2014	Generally, the line follower robot is one of the self-operating mobile machines that follows a line drawn on the floor. The path can be a visible black line on a white surface (reverse).	Sensors, ADC, Processor, Driver, Actuators (Motors and wheels), Chassis and body structure
02	Smart and Intelligent Line Follower Robot with Obstacle Detection	M. Sri Venkata Sai Surya, K. Bhogeshwar Reddy, K. Pavan Kalyan, S. Senthil Murugan On April 2018	The main aim of any robot is to reduce human effort. According to the purpose different types of robots are designed for practical applications. In any work environment proper monitoring is always needed for better results.	Arduino Nano,DC Motor(4 Qty) Tyre(4 Qty) L298N H-bridge Motor Driver ModuleUltrasonic Sensor IR Sensor Module (2 Qty) ArduinoDE
03	Vision-based detection technique for effective linetracking autonomus vehicle	Norhashim Mohd Arshad Noorfadzli Abdul Razak On 07 May 2012	An alternative means of implementing line detection technique to navigate autonomous mobile vehicles was investigated, specifically using vision sensor as the front-end detection device. A vision sensor has the advantages of much higher spatial and optical resolutions as compared to the conventional discrete photo-reflective sensors used in most line-following mobile vehicles.	Arduino Nano,DC Motor(4 Qty) Tyre(4 Qty) L298N H-bridge Motor Driver ModuleUltrasonic Sensor IR Sensor Module (2 Qty) ArduinoDE

Analysis and Design

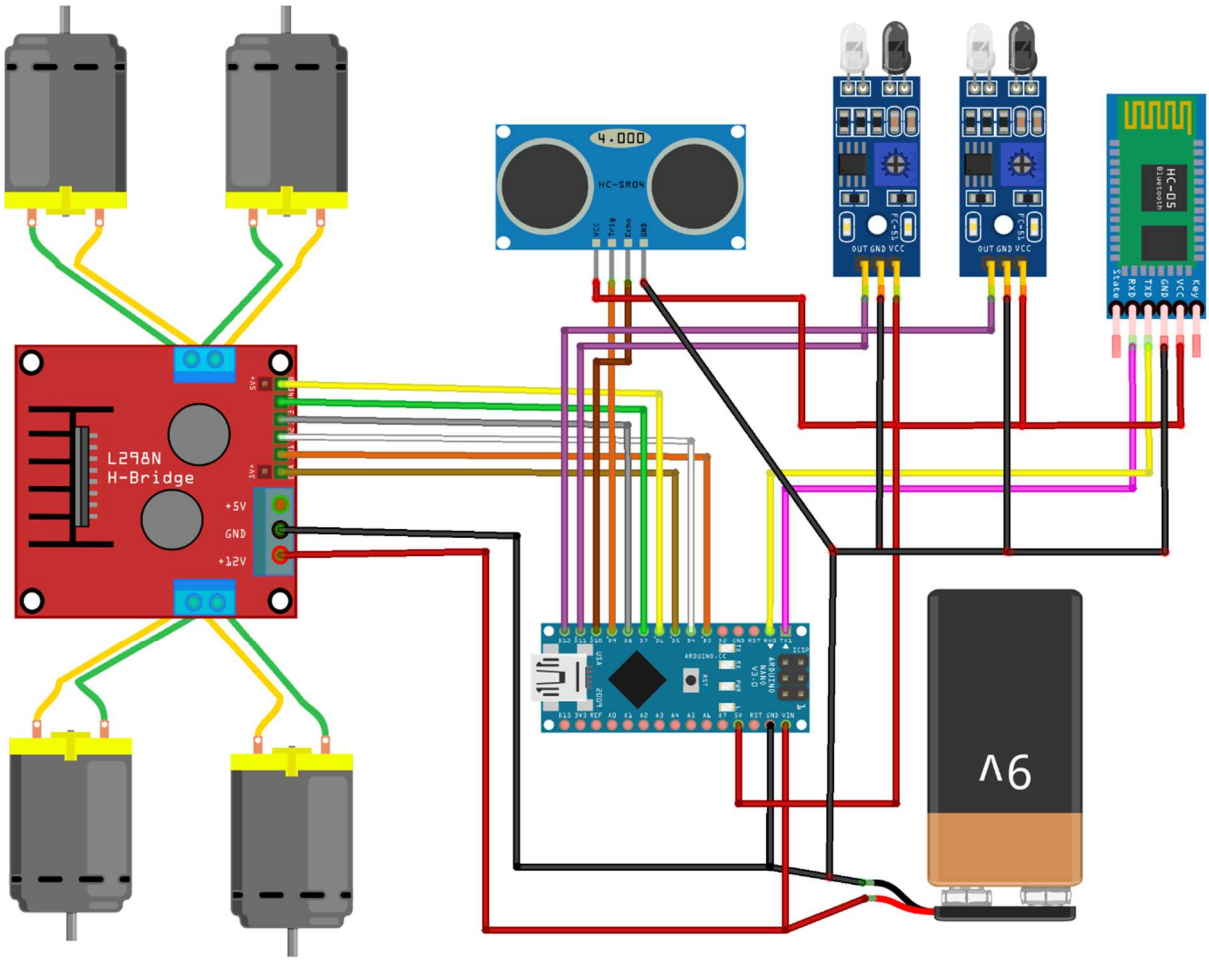


Fig 1. Circuit Diagram

Description:

Concept of working of line follower is related to light. We use here the behaviour of light at black and white surface. When light fall on a white surface it is almost full reflected and in case of black surface light is completely absorbed. This behaviour of light is used in building a line follower robot.

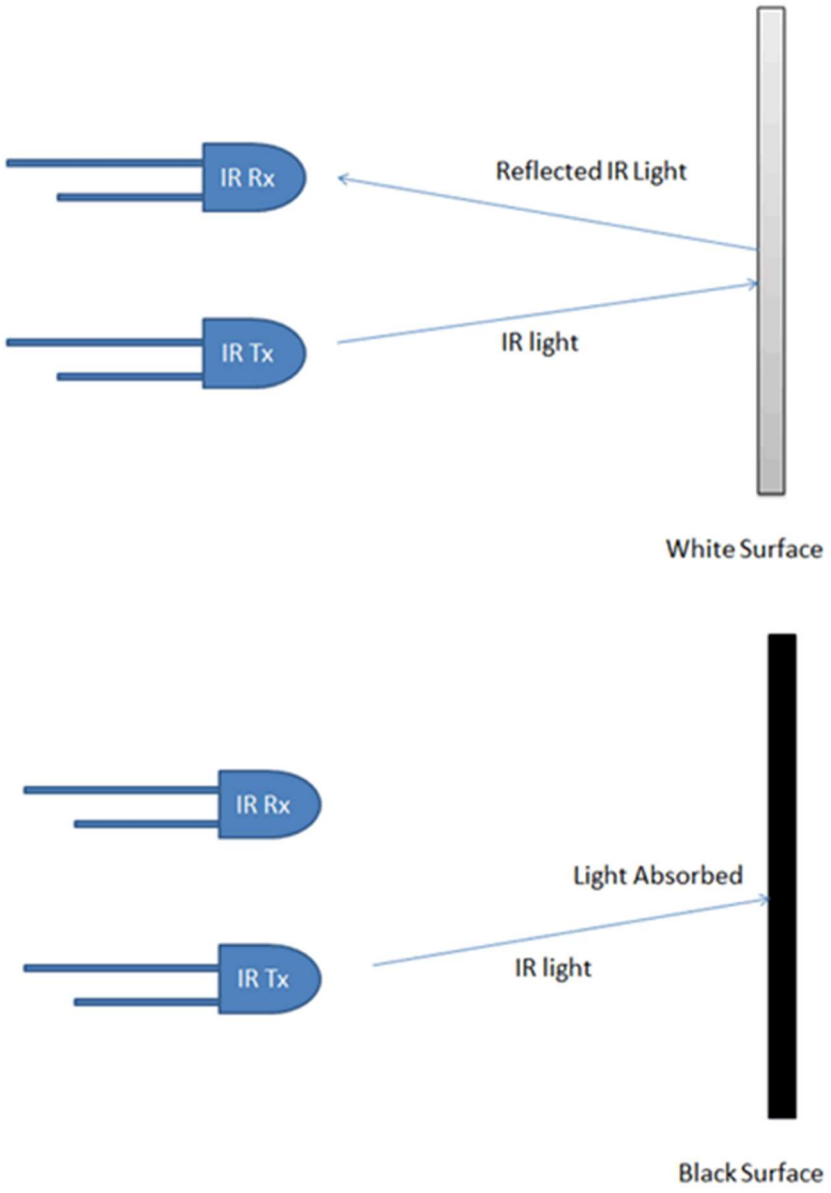


Fig 2. Working of IR Sensor

In this Arduino based line follower robot we have used IR Transmitters and IR receivers also called photo diodes. They are used for sending and receiving light. IR transmits infrared lights. When infrared rays fall on white surface, it's reflected back and catches by photodiodes which generates some voltage changes. When IR light falls on a black surface, light is absorbed by the black surface and no rays are reflected back, thus photo diode does not receive any light or rays. Here in this Arduino line follower robot when sensor senses white surface then Arduino gets 1(High) as input and when senses black line Arduino gets 0(Low) as input.

Circuit Explanation:

The whole *Arduino line follower robot* can be divided into 3 sections: sensor section, control section and driver section.

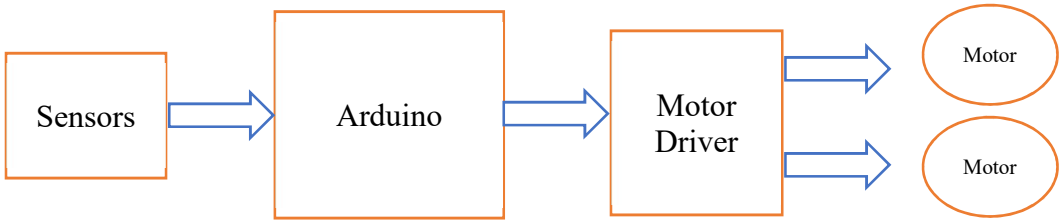


Fig 3. Block Diagram

Sensor section:

This section contains IR Sensor, Ultrasonic Sensor and Bluetooth Sensor. IR sensors are used to sense the line and provide a change in voltage at comparator's second terminal and Ultrasonic Sensor is used to detect the obstacles and Bluetooth sensor will notify the user about the obstacle (detected or not).

Control Section:

The Arduino nano board is used to control the robot.

Driver section:

Driver section consists motor driver and two DC motors. Motor driver is used for driving motors because Arduino does not supply enough voltage and current to motor. So, we added a motor driver circuit to get enough voltage and current for motor. Arduino sends commands to this motor driver and then it drive motors.

Working:

Working of line follower is very interesting. Line follower robot senses black line by using sensor and then sends the signal to Arduino. Then Arduino drives the motor according to sensors' output.

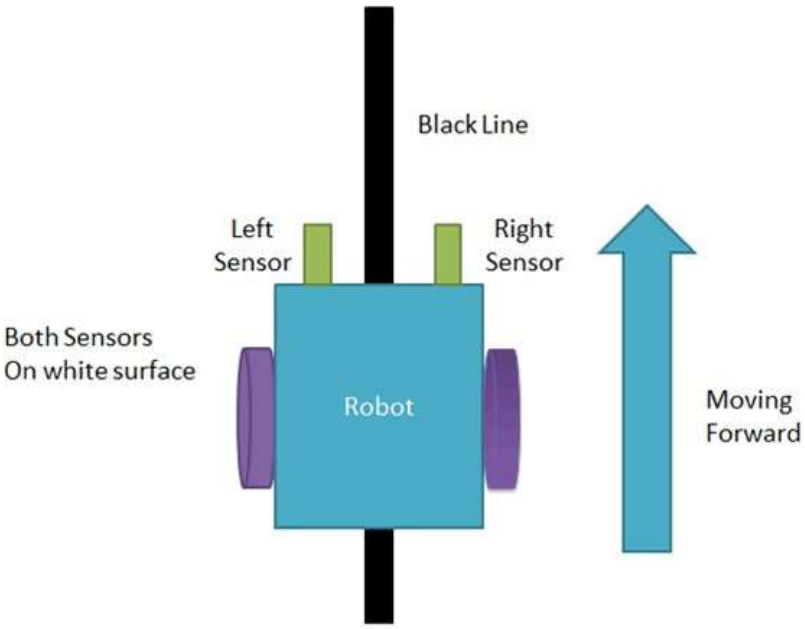


Fig 4. Working of Car

If left sensor comes on black line then robot turn left side.

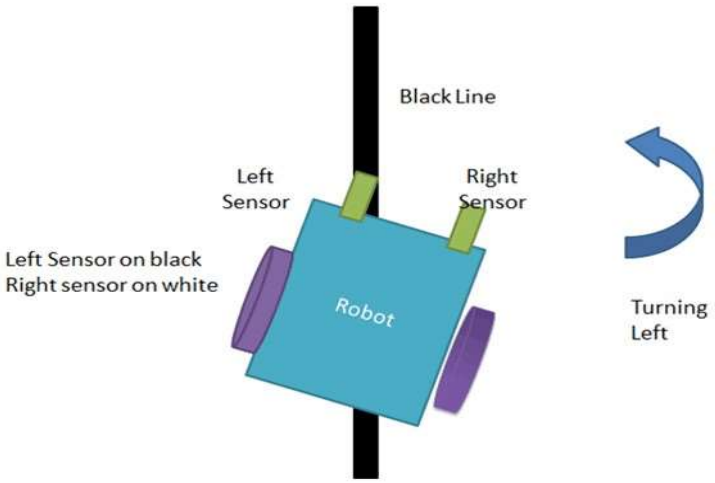


Fig 4.1 Car turning left

If right sensor sense black line then robot turn right side until both sensors comes at white surface. When white surface comes robot starts moving on forward again.

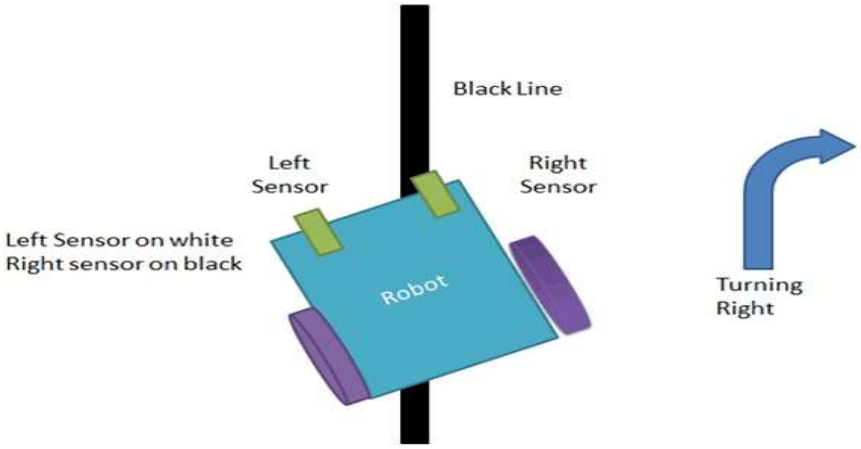


Fig 4.2 Car turning right

Hardware and Software requirements

Arduino Nano

DC Motor (4 Qty)

Tyre (4 Qty)

L298N H-bridge Motor Driver Module

Ultrasonic Sensor Model hc-SR04

IR Sensor Module fc-51 (2 Qty)

Bluetooth Module hc-05

Arduino IDE

MIT APP Inventor

Arduino Nano:

To create devices which can interact with environment using sensors and actuators the Arduino project was started in 2003 aiming to provide an easy way for professionals. Most of the Arduino boards consist of an Atmel 8-bit AVR microcontroller with varying amounts of flash memory, pins and other features. Arduino boards are programmed via Universal Serial Bus, implemented using USB to Serial adapter chips such as FTDI FT232. A program for Arduino can be written in any programming language with compilers that produce binary machine code for the target processor. The Arduino provides the integrated development environment (IDE), which is a cross platform application written in programming language JAVA

Fig 5. Arduino Nano Board

IR Sensor

The Infrared (IR) sensors consist of Infrared (IR) LED and Infrared (IR) photodiodes. The IR LED is called photo emitter and IR photodiode is called receiver. The IR light emitted by the LED strikes the surface and gets reflected back to the photodiode. Then the photodiode gives an output voltage which is proportional to the reflectance of the surface which will be high for a light surface and low for dark surface. Light colour objects reflect more IR light and dark coloured objects reflect less IR light.

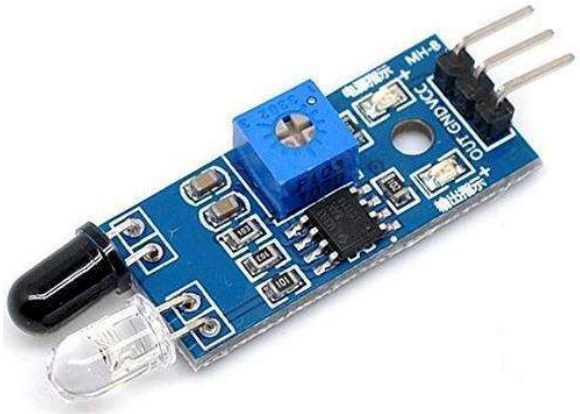


Fig 5.1 Infrared Sensor

Ultrasonic Sensor

Ultrasonic sensor is a device which can measure the distance to an object by using sound waves. It will measure the distance by sending out a sound wave at a particular frequency and listening that wave when it bounces back. Ultrasonic sensor will not be able to detect some objects because the reflected sound wave may deviate from its path and will not be received by the ultrasonic sensor and so the sensor cannot detect the obstacle. And also, if the obstacle is too small then the sound wave will not be able to bounce back. Accuracy of the ultrasonic sensor also depends on the temperature and humidity of the area where it is being used but this factor can be neglected.

Fig 5.2 Ultrasonic Sensor

Motor Driver

Motor driver acts like a current amplifier. Motor driver is used for controlling the current in the motor. The motor driver will provide high current to the motor when low current is received in the circuit. A high value of current is needed to drive these motors. The IC L293D will be able to control two dc motors simultaneously. The motor can be rotated in both forward and reverse direction. The motor driver controls the motors when the robot needs to turn left or right. It completely controls the movement of dc motors

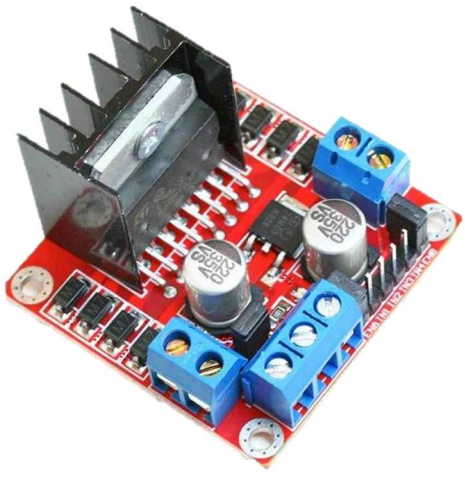


Fig 5.3 Driver Module

Bluetooth Module

Bluetooth module is a PCBA board which integrated Bluetooth functions. Bluetooth module can be used in short-distance wireless communication, which can be divided into the Bluetooth module and Bluetooth voice module according to its usage.

Bluetooth module is a basic circuit set of chips which integrated Bluetooth functions and which can be used in wireless network transmission. Generally, the Bluetooth module can be divided into the following types: data transmission module, remote control module, etc. Usually, modules are the semi-finished products, which are processed on the basis of chips to make the next application easier.

Fig 5.4 Bluetooth Module

Motors and Wheels

Two dc motors have been used in this line follower robot which obstacle detection. A castor wheel is used in the front of the robot which makes the movement of robot easy in every direction. The two dc motors are controlled by the motor drive and accordingly the signal the motors will work. The whole system is controlled by Arduino, at which the commands are given about the path and obstacles so it controls the whole robot according to the program given to it.

Fig 5.5 Motor & Wheel

Implementation of Mini Project

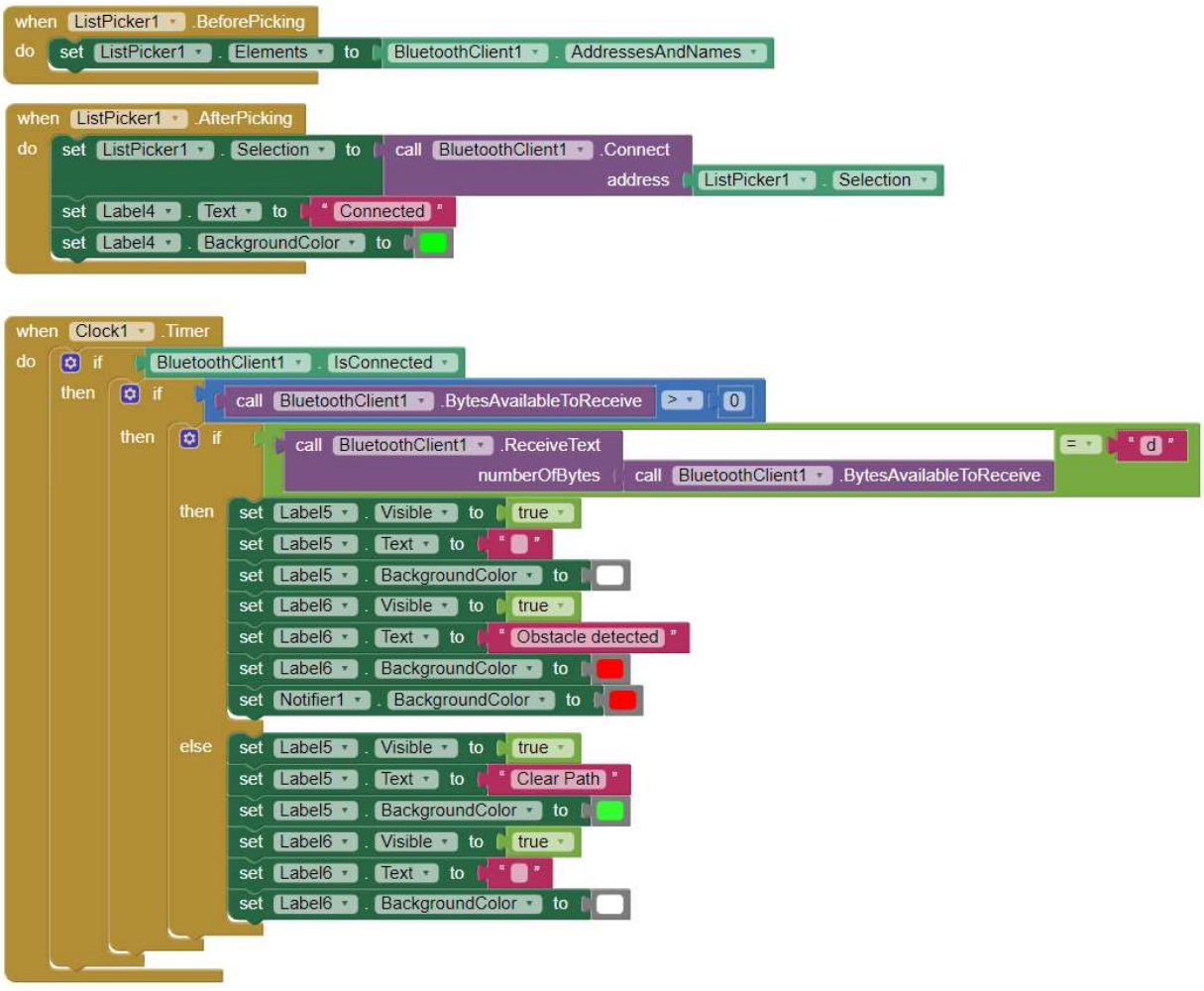
Arduino Code

```
int trigPin = 9;
int echoPin = 10;
// connect motor controller pins to Arduino digital pins
// motor one
int enA = 5;
int in1 = 3;
int in2 = 4;
// motor two
int enB = 6;
int in3 = 8;
int in4 = 7;
// Ir Sensors
int left_ir_val;
int right_ir_val;
const int left_ir = 12;
const int right_ir = 11;

void setup()
{
  Serial.begin(9600);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  // set all the motor control pins to outputs
  pinMode(enA, OUTPUT);
  pinMode(enB, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
}
void forward()
{
  // turn on motor A
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);
  // set speed to 200 out of possible range 0~255
  analogWrite(enA, 200);
  // turn on motor B
  digitalWrite(in3, LOW);
  digitalWrite(in4, HIGH);
//// set speed to 200 out of possible range 0~255
  analogWrite(enB,200);
}
void right()
{
  // turn on motor A
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);
  // set speed to 200 out of possible range 0~255
```

```
  analogWrite(enA, 255);
  // turn on motor B
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
  // set speed to 200 out of possible range 0~255
  analogWrite(enB,255);
  delay(2000);
}
void left()
{
  // turn on motor A
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  // set speed to 200 out of possible range 0~255
  analogWrite(enA, 255);
  // turn on motor B
  digitalWrite(in3, LOW);
  digitalWrite(in4, HIGH);
  // set speed to 200 out of possible range 0~255
  analogWrite(enB,255);
}
void stops()
{
  // now turn off motors
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
  analogWrite(enA, 0);
  analogWrite(enB,0);
}
void loop() {
  long duration, distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance =(duration/2)/29.1;
  delay(10);
  left_ir_val = digitalRead(left_ir);
  right_ir_val = digitalRead(right_ir);

  if((distance<=80))
  {
    stops();
    Serial.print("d"); //sent to app
    delay(350);
  }
  else if(right_ir_val == HIGH && left_ir_val == LOW)
  {
    //left
    left();
    Serial.print("n");
```

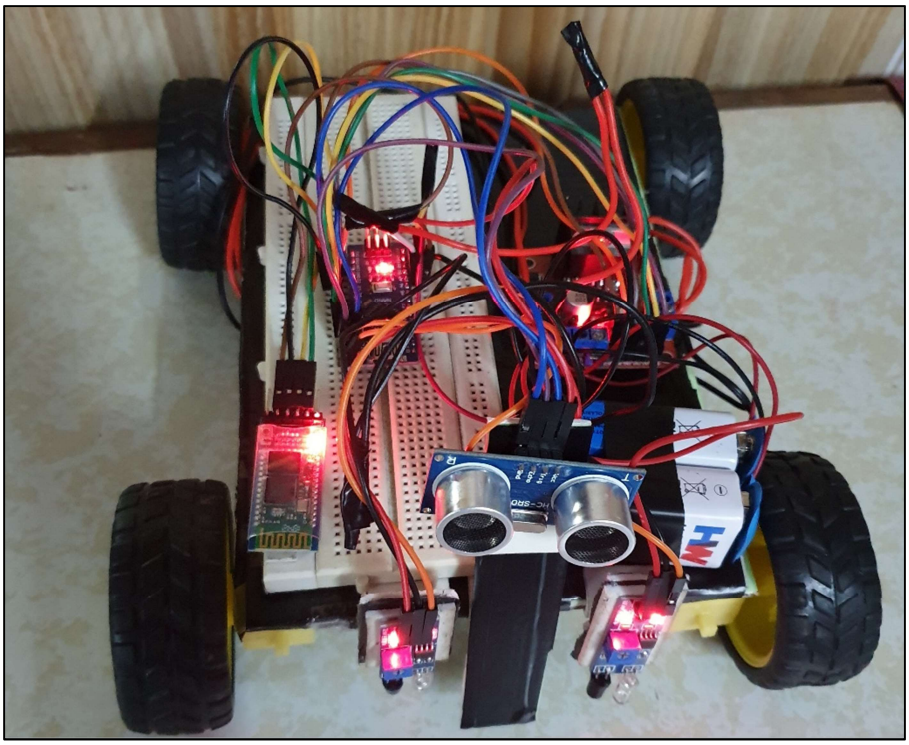
```
  }
  else if(right_ir_val == LOW && left_ir_val == HIGH)
  {
   //right
   right();
   Serial.print("n");
   delay(10);
  }
  else if(right_ir_val == LOW && left_ir_val == LOW)
  {
   forward();
   Serial.print("n");
   delay(10);
  }
  else if(right_ir_val == HIGH && left_ir_val == HIGH)
  {
   stops();
   Serial.print("n");
   delay(10);
  }
}
```

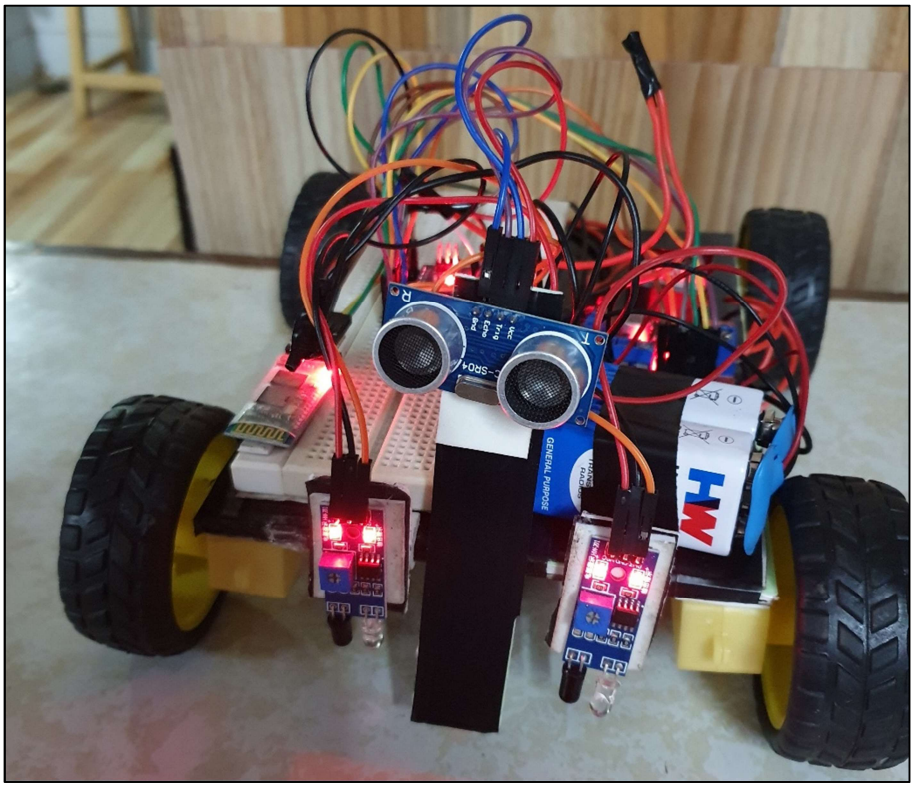
//Android App Code in MIT App Inventor



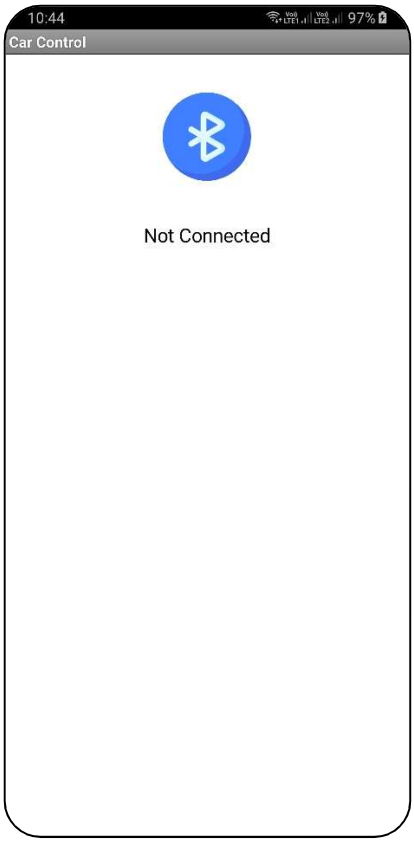
Results and Discussion

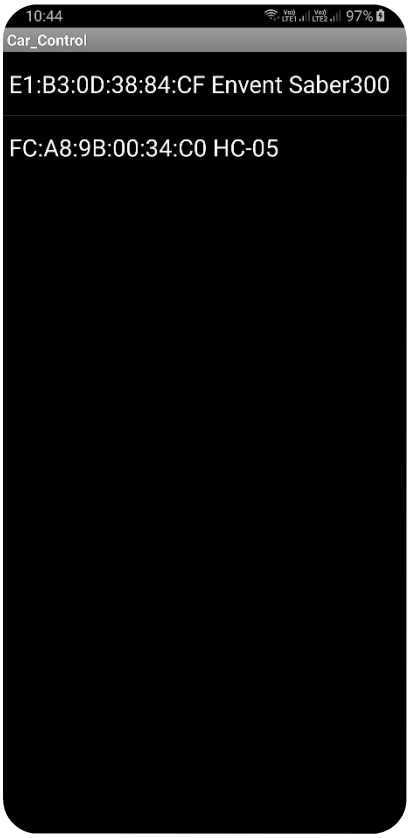
Snapshots of Output and hardware

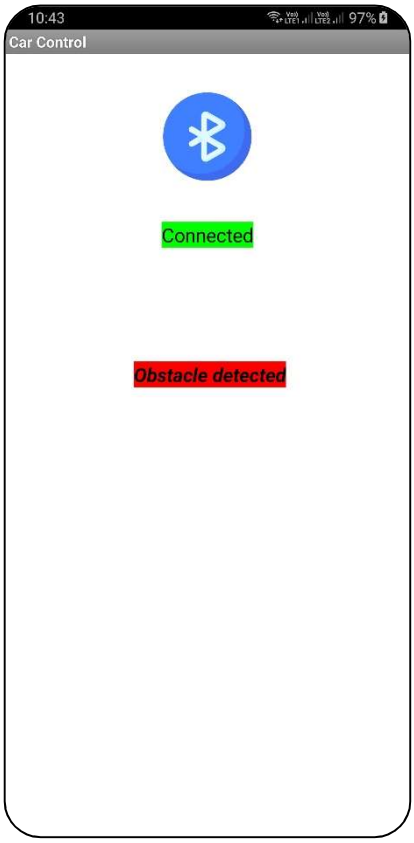


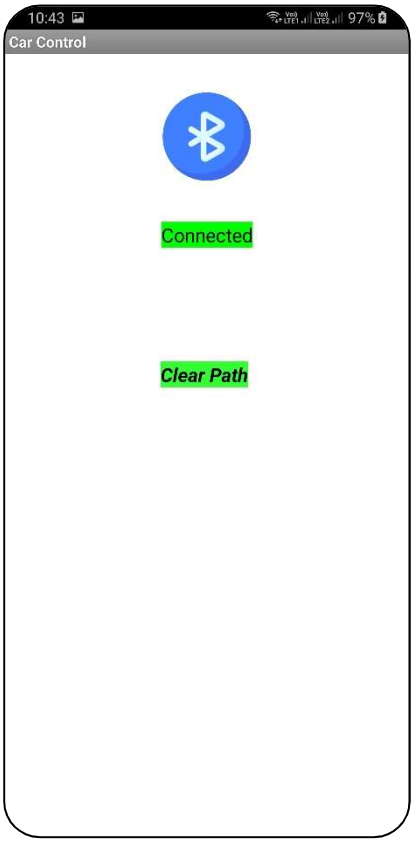


Car Control App









Conclusion

In its current form this car is enough capable. It can follow any curve and cycle. We must build a robot that has light weight and high speed. Therefore, we used two high speed motors and high sensitivity sensors circuit.

The body weight and wheels radius have effects on speed, too. The weight of the prototype design robot is lighter but to carry heavy loads a metal chassis is recommended.

References

[1] Mahdi Rezaei "A Line Follower Robot from design to Implementation, Technical issues and Problems"

[2] P. Heyrati, A. Aghagani, "Science of Robot Disgn and Build Robot", Azarakhsh Publication, 2008.

[3] A. Kahe, "AVR Microcontroller", Nas Publication, 2007