VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi-590 018

Project Report

on

"METAL, INFRARED & GAS DETECTION ROBOT USING IOT"

submitted in partial fulfillment of the requirements for the award of the Degree of

BACHELOR OF ENGINEERING

IN

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by

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Sir M. VISVESVARAYA INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi, Affiliated to VTU, Belagavi, ISO 9001:2008 Certified)

Off. International Airport Road, Krishnadevaraya Nagar, Bengaluru – 562157

2021– 2022

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CERTIFICATE

Certified that the project entitled ***"Metal, Infrared & Gas detection Robot using IOT"*** carried out by **Mr. Akash Kumar (1MV18EE008), Mr. Pushkar Kumar (1MV18EE072), Mr. Shivanshu Kumar (1MV18EE094), Mr. Vishwajeet Singh (1MV18EE110),** students of **SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY, Bengaluru** in partial fulfillment for the requirements for the award of the degree of **Bachelor of Engineering** in **Electrical & Electronics Engineering** of the **Visvesvaraya Technological University,** Belagavi during the year **2021-2022.** It is certified that all corrections/suggestions indicated have been incorporated in the report deposited in the department library. The project work report has been approved as it satisfies the academic requirements in respect of project work prescribed for the above-mentioned degree.

Signature of Guide	**Signature of HOD**	**Signature of Principal**
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Associate Professor	Professor & HOD	Principal
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INTERNAL VIVA

Name of Examiners	**Signature with Date**
1.	
2.	

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DECLARATION

We, **Mr. Akash Kumar (1MV18EE008), Mr. Pushkar Kumar (1MV18EE072), Mr. Shivanshu Kumar (1MV18EE094), Mr. Vishwajeet Singh (1MV18EE110)** hereby declare that the project work entitled **"Metal, Infrared & Gas detection Robot using IOT"** has been carried out by us under the guidance of **Dr. C.V. Mohan,** Associate Professor, Department of Electrical & Electronics Engineering in partial fulfilment for the award of **Bachelor of Engineering in Electrical & Electronics Engineering of the Visvesvaraya Technological University, Belagavi** during the year 2021-2022. The matter embodied in this project report has not been submitted to any other university or institute for the award of any other degree or diploma.

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ABSTRACT

The concept of IOT helps to connect all the devices to update themselves according to changes in surroundings and control electronic devices that is capable for performing programmed activities thereby replacing human work and providing highly accurate result, which motivated to develop an automatic mode for detecting the direction of the obstacles with the help of ultrasonic sensors, metal detector sensors and night vision cameras are placed under robot which are able to get data via GPS mode or WIFI mode with the help of IOT technology & helps us to find out exact location, any leakage of poisonous gas and unusual movements.

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CHAPTER 1

INTRODUCTION

The field of robotics includes many branches of engineering covering electronics, mechanical, digital logic, artificial intelligence, nanotechnology and bioengineering. A robot can perform various types of work depending on what type of robot is being referred to. Some of them are simple and some are quite complex. Robots are designed to do tasks that people may or may not be able to do for them. They are used to build cars, dismantle bombs, pack boxes, answer phones, mow yards and explore deep sea shipwrecks and many other things.

Internet of Things:

Internet of Things (IoT) In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as “the infrastructure of the information society”. IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

Wi-Fi technology:

The IEEE 802.11 (ISO/CEI 8802-11) is an international standard describing the characteristics of a wireless local network (WLAN). The name Wi-Fi (short for Wireless Fidelity) is originally the name given to the certification granted by the WECA (Wireless Ethernet Compatibility Alliance), the institution responsible for maintaining interoperability between devices under the 802.11 standard.

Wi-Fi allows us to create wireless local area networks at high speed. In practice, the Wi-Fi can connect laptops, desktops, PDAs or other devices (printers, game consoles) to a broadband connection (300 Mbps) over a radius of several meters indoors (usually between 20 and 50 meters). In an open environment, the range can reach over several hundred of meters in optimal conditions. ISPs are starting to equip areas with high concentrations of internet users (stations, airports, hotels, trains, etc.) with wireless internet access. These access areas are called "hotspots".

1.1 Literature Survey

Premkumar M. [1] proposed an Intelligent Unmanned Robot (IUR) using Zigbee saves human live and reduces manual error in defense side. Here the new system is proposed with the help of low power Zigbee wireless sensor network to trace out the intruders (unknown persons) and the robot will take the necessary action automatically. This is specially designed robotic system to save human life and protect the country from enemies.

Akash Ravindran, Akshay Premkumar [2] explained the study about military robot. Most of the military organization now takes the help of robots to carry out many risky tasks that cannot be done with the help of the soldier. These robots used in military application are usually employed with the integrated system, including video screens, sensors and cameras. A robot is basically an electro-mechanical machine which is guided by computer and electronic programming.
Many robots have been built for manufacturing application and can be found in factories around the world.

P. Hymavathi, T. Jyothy [3] proposed the surveillance alive human detection robot using Zigbee Technology. The wireless communication technologies are rapidly spreading to new areas, including automation, data acquisition, building control, monitoring systems and many more. Autonomous robotic system is an outstanding innovation of a modern technology. It has been able to provide significant support to mankind by accomplishing arduous tasks that are apparently infeasible for human beings to perform.

Dr. S. Bhargavi, S. Manjunath [4] proposed the design of an intelligent combat robot for war fields. It can silently enter into enemy area and send us all the information through its' tiny Camera eyes. This spy robot can be used in star hotels, shopping malls, jewellery show rooms, etc, where there can be threat from intruders or terrorists. Since human life is always precious, these robots are the replacement of fighters against terrorist in war areas.

Jean Schultz, Jill L. Drury, Holly A. Yanco [5] explained the evaluation of human-robot interaction awareness in search and rescue. In this paper we report on the analysis of critical incidents during a robot urban search and rescue competition where critical incidents are defined as a situation where the robot could potentially cause damage to itself, the victim, or the environment.

1.2 Objective

- The main motive behind multitasking wireless Robot is to reduce human losses in military operations or terrorist attacks.
- Robot acts as a virtual spy and can be sent into the strategic locations of military importance for observation and warfare purpose. Since it's very hard to detect it by a naked human eye, the Camouflage robot can be also used to test the various security systems developed in the market and act as a measure to evaluate its efficiency.
- The aim of the project is to design, manufacture and operate a robot via PC, used as remote-control device, a small mobile robot which can duplicate the colors where it moves on, hence being camouflaged to the outside world. To achieve these goals, we used a LED matrix (RGB) which can diffuse uniform colors. Initially, the robot can camouflage itself in red, green and blue color.

CHAPTER 2
SYSTEM REQUIREMENTS

Components required for this project are as follows:

2.1 Hardware requirement:

1. Arduino UNO
2. Colour sensor
3. PIR sensor
4. IR sensor
5. Metal sensor
6. Gas sensor
7. Camera
8. WI-FI module
9. Power supply system
10. Driver Circuit
11. DC Motor

2.1.1 Arduino UNO

The Arduino UNO 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove.

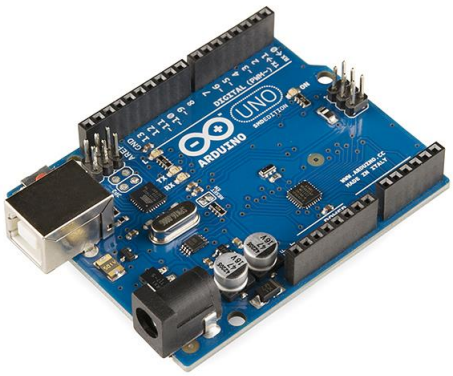

Fig 2.1.1 Arduino UNO 2560

2.1.2 Colour Sensor

The TCS230 senses color light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the color.

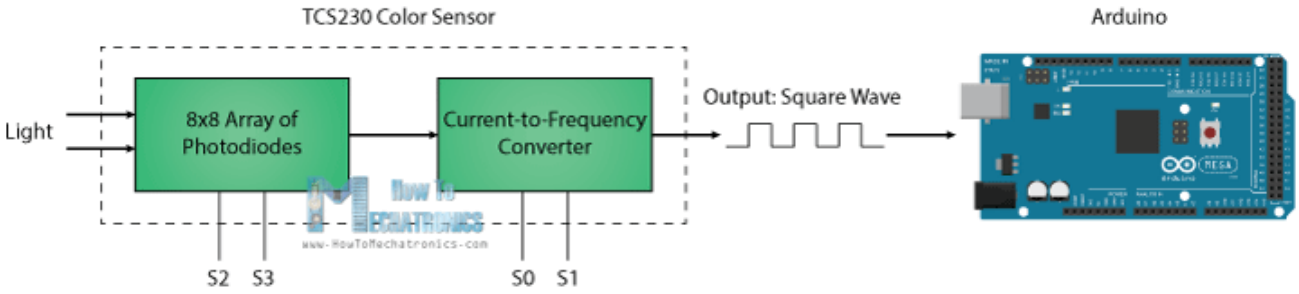

Fig. 2.1.2 TCS230 Colour Sensor

2.1.3 PIR Sensor

The PIR sensor used to detect the movement of human being within a certain range of the sensor is called as PIR sensor or passive infrared sensor (approximately have an average value of 10m, but 5m to 12m is the actual detection range of the sensor). Fundamentally, pyroelectric sensors that detect the levels of infrared radiation are used to make PIR sensors.

Fig. 2.1.3 HC SR-501 PIR Sensor

2.1.4 IR Sensor

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

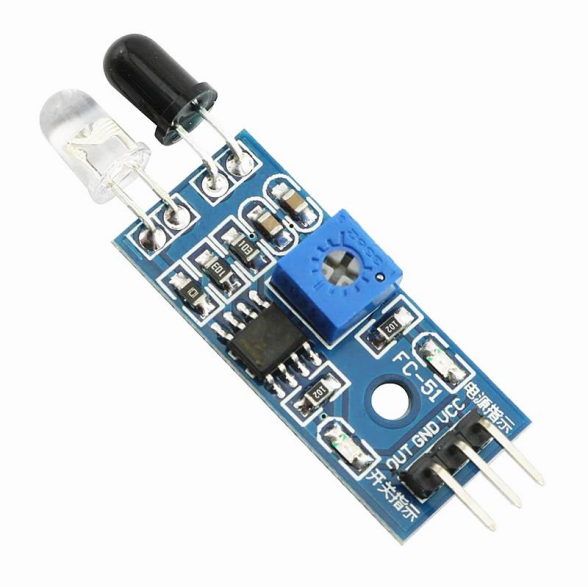

Fig. 2.1.4 IR Sensor

2.1.5 Metal Sensor

The metal detector is used to identify metallic devices such as bombs, guns for security purpose. To avoid any illegal or unauthorized entry of metallic objects, bombs, knives, guns within the luggage bags of the person carrying them in public places like theatres, shopping malls, parks, airports, hotels, railway stations.

Fig. 2.1.5 Metal Sensor

2.1.6 Gas Sensor

This module is made using Alcohol Gas Sensor MQ3. It is a low-cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs.

Fig.2.1.6 MQ3 Gas Sensor

2.1.7 Camera

This camera is a free video service product aiming at home users. Through "V380 Pro" video monitoring service, you can easily view live stream and replay of apartments, villas, stores, factories, working offices and so on through V380 Pro camera alarming service, you can receive any abnormal message of places you concern.

Fig. 2.1.7 V380 Pro Camera

2.1.8 Wi-Fi Module

Wi-Fi module is low-cost standalone wireless transceiver that can be used for endpoint IOT developments. ESP8266 Wi-Fi module enables internet connectivity to embedded applications. It uses TCP/UDP communication protocol to connect with server/client. To communicate with the ESP8266 Wi-Fi module, microcontroller needs to use set of AT commands. Microcontroller communicates with ESP8266-01 Wi-Fi module using UART having specified Baud rate.

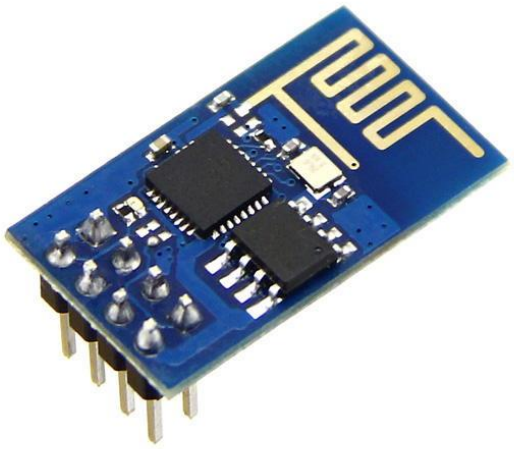

Fig. 2.1.8 ESP8266 Wi-Fi module

2.1.9 Power Supply System

The Arduino uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the Power connector.

Fig. 2.1.9 Battery (Power Supply System)

2.1.10 Driver Circuit

L293D Motor Driver Module is a medium power motor driver perfect for driving DC Motors and Stepper Motors. It uses the popular L293 motor driver IC. It can drive 4 DC motors on and off or drive 2 DC motors with directional and speed control. The driver greatly simplifies and increases the ease with which you may control motors, relays, etc from micro-controllers. It can drive motors up to 12V with a total DC current of up to 600mA.

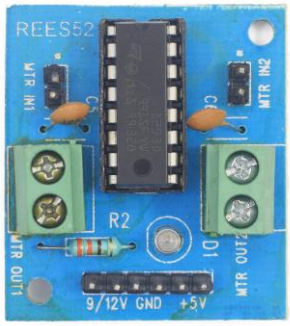

Fig. 2.1.10 L293D Motor Driver Circuit

2.1.11 DC Motor

An electric motor operated by DC (direct current) is known as a DC Motor (unlike an induction motor) that operates via an alternating current. A DC motor converts DC electrical energy into mechanical energy.

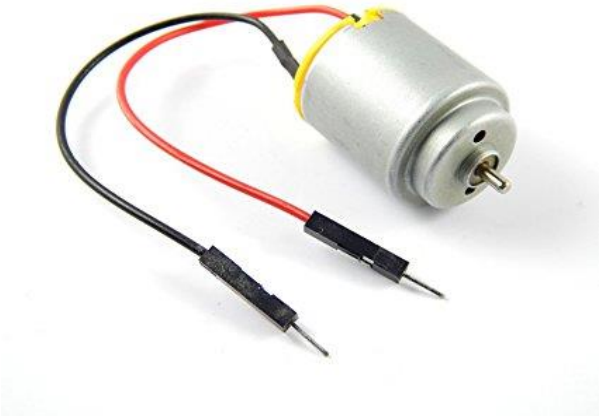

Fig. 2.1.11 DC Motor

2.2 Software requirement:

1. Arduino IDE
2. Blynk Application

2.2.1 Arduino IDE

Arduino IDE is the open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

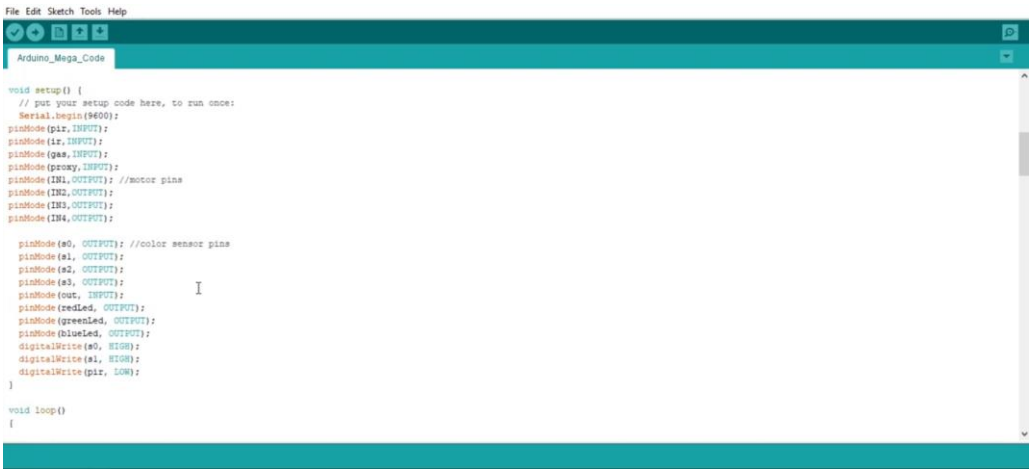

Fig. 2.2.1 Arduino IDE interface

2.2.2 Blynk Application

With Blynk, we can create smartphone applications that allow you to easily interact with microcontrollers or even full computers such as the Arduino. The main focus of the Blynk platform is to make it super-easy to develop the mobile phone application. As you will see in this course, developing a mobile app that can talk to your Arduino is as easy as dragging a widget and configuring a pin.

CHAPTER 3

METHODOLOGY

3.1 System Design

System design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development.

3.2 Architectural Design

System architecture is a conceptual model that defines the structure and behaviour of the system. It comprises of the system components and the relationships describing how they work together to implement the overall system.

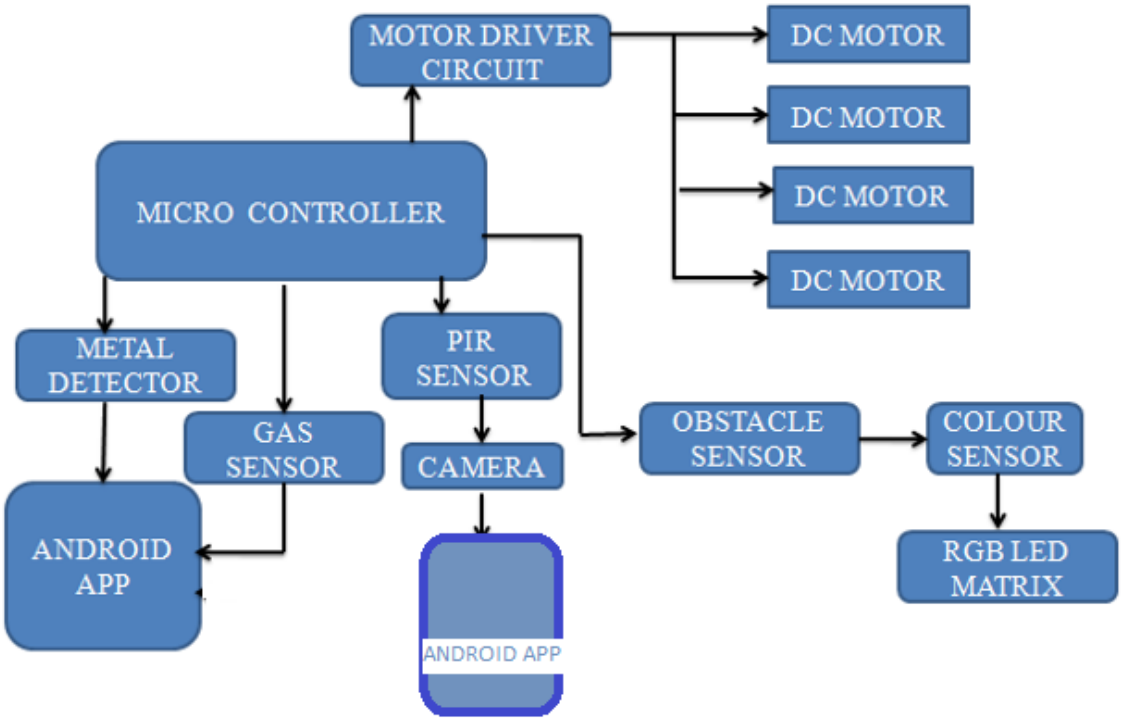

Fig 3.2 Architectural Design

3.3 Use Case Diagrams

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

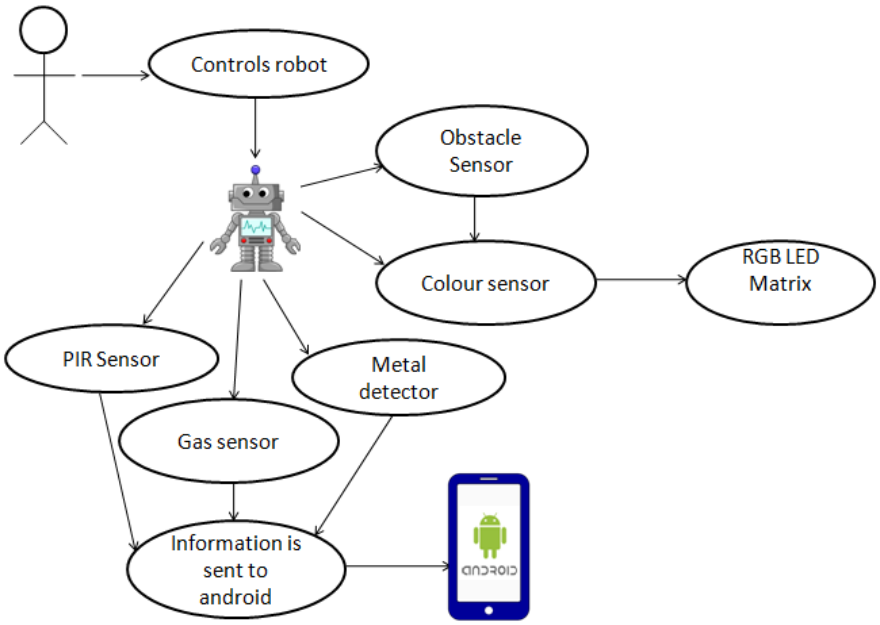

Fig. 3.3 Use Case Diagram

While a use case itself might drill into a lot of detail about every possibility, a use-case diagram can help provide a higher-level view of the system. It has been said before that "Use case diagrams are the blueprints for your system". They provide the simplified and graphical representation of what the system must actually do.

3.4 System Implementation

System Implementation uses the structure created during architectural design and the results of system analysis to construct system elements that meet the stakeholder requirements and system requirements developed in the early life cycle phases. These system elements are then integrated to form intermediate aggregates and finally the complete system-of-interest (SoI). Implementation is the process that actually yields the lowest-level system elements in the system hierarchy (system breakdown structure). System elements are made, bought, or reused. Production involves the hardware fabrication processes of forming, removing, joining, and finishing, the software realization processes of coding and testing, or the operational procedures development processes for operators' roles.

CHAPTER 4

CIRCUIT DIAGRAM AND PROGRAM

4.1 Circuit Diagram of working module

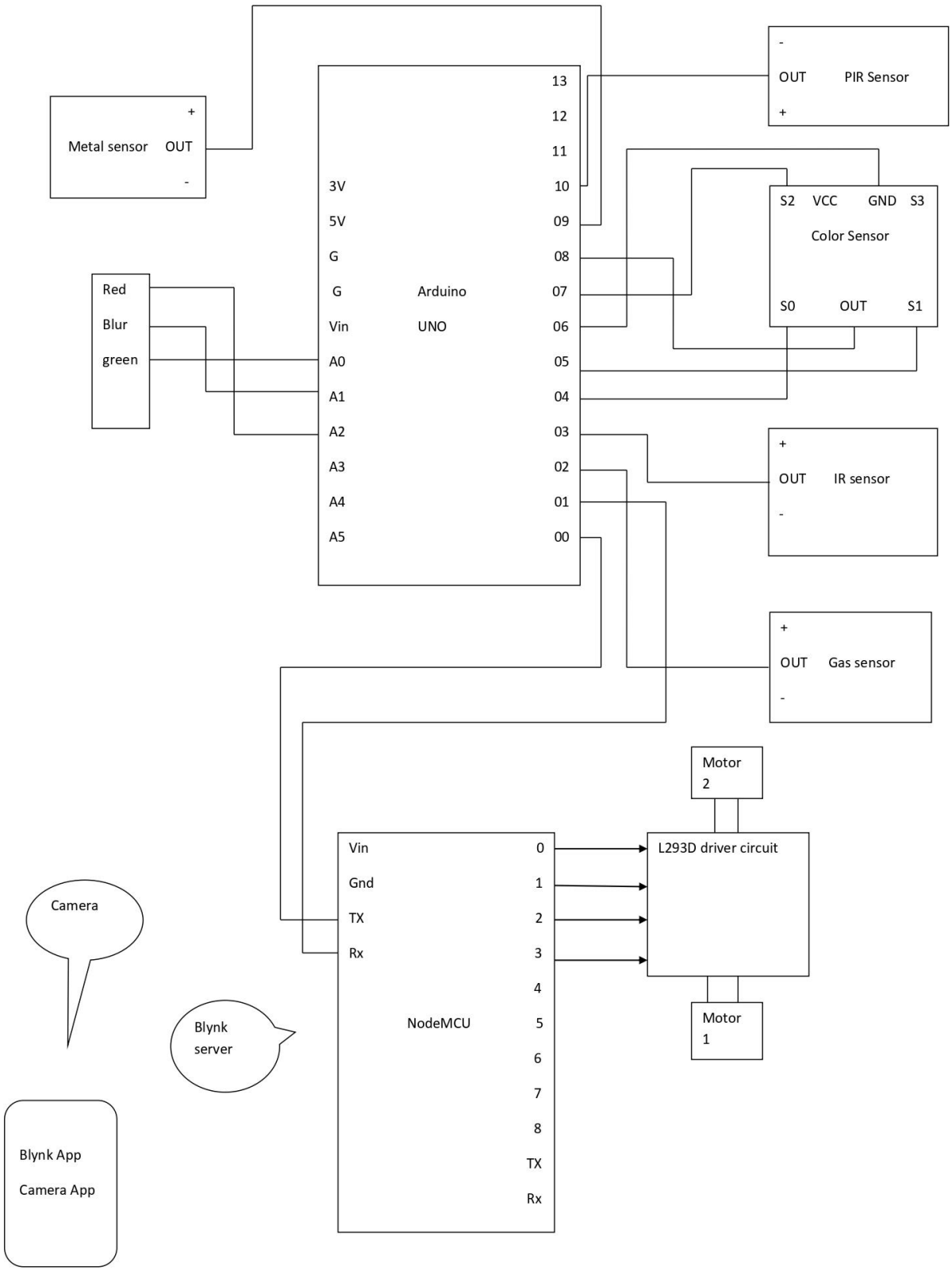

Fig. 4.1 Circuit Diagram

4.2 Program

4.2.1 Arduino UNO Program

```
#define  IR digitalRead(ir)
#define  PIR digitalRead(pir)
#define  GAS digitalRead(gas)
#define  PROX digitalRead(proximity)

int ir = 2;
int gas = 3;
int pir=4;
int proximity=5;
int IN1=9;
int IN2=10;
int IN3=11;
int IN4=12;
int state;
int state1;
int state2;
int state3;
int pinstate1;
int rPin1=6;
int c1,c2,c3,c4;

const int s0 = 22;
const int s1 = 23;
const int s2 = 24;
const int s3 = 25;
const int out = 26;

// LED pins connected to Arduino
int redLed = 28;
int greenLed = 29;
int blueLed = 27;
int red;
```

```
int green;
int blue;
void setup(){
c1=c2=c3=c4=0;
  Serial.begin(9600);
   pinMode(ir,INPUT);
   pinMode(gas,INPUT);
   pinMode(pir,INPUT);
   pinMode(proximity,INPUT);
   pinMode(IN1,OUTPUT);
   pinMode(IN2,OUTPUT);
   pinMode(IN3,OUTPUT);
   pinMode(IN4,OUTPUT);
   pinMode(s0, OUTPUT);
  pinMode(s1, OUTPUT);
  pinMode(s2, OUTPUT);
  pinMode(s3, OUTPUT);
  pinMode(out, INPUT);
  pinMode(redLed, OUTPUT);
  pinMode(greenLed, OUTPUT);
  pinMode(blueLed, OUTPUT);
  digitalWrite(s0, HIGH);
  digitalWrite(s1, HIGH);
   delay(6000);
}
void loop(){
 //serialEvent();
 if((IR==1)){
  if(c1==0){
  c1=1;
  Serial.print('a');
  delay(1000);
   }
 }
 else{
```

```
 if(c1==1)
 {
   c1=0;
 Serial.print('b');
 }
}
if((PIR==1)){
 if(c2==0){
 c2=1;
 Serial.print('c');
 delay(1000);
 }
}
else{
 if(c2==1){
   c2=0;
 Serial.print('d');
 }
}
if((GAS==1)){
 if(c3==0){
 c3=1;
 Serial.print('e');
 delay(1000);
 }
}
else{
 if(c3==1){
   c3=0;
 Serial.print('f');
 }
}
if((PROX==1)){
 if(c4==0){
 c4=1;
```

```
 Serial.print('g');
 delay(1000);
 }
}
else{
 if(c4==1){
   c4=0;
 Serial.print('h');
 }
}
 if (red < blue && red < green && red < 100){
  Serial.println(" - (Red Color)");
  digitalWrite(redLed, HIGH); // Turn RED LED ON
  digitalWrite(greenLed, LOW);
  digitalWrite(blueLed, LOW);
 }
 else if (blue < red && blue < green && blue<200)   {
  Serial.println(" - (Blue Color)");
  digitalWrite(redLed, LOW);
  digitalWrite(greenLed, LOW);
  digitalWrite(blueLed, HIGH); // Turn BLUE LED ON
 }
 else if (green < red && green < blue && green < 200)  {
  Serial.println(" - (Green Color)");
  digitalWrite(redLed, LOW);
  digitalWrite(greenLed, HIGH); // Turn GREEN LED ON
  digitalWrite(blueLed, LOW);
 }
 else{
// Serial.println();
 }
 delay(300);
 digitalWrite(redLed, LOW);
 digitalWrite(greenLed, LOW);
 digitalWrite(blueLed, LOW);
```

```
}
  void serialEvent() {
  while (Serial.available()>0) {
    // get the new byte:
    char inbyte = (char)Serial.read();
    switch(inbyte){
      case 'F':
          Serial.print("F");
          digitalWrite(IN1,HIGH);
          digitalWrite(IN3,HIGH);
          digitalWrite(IN2,LOW);
          digitalWrite(IN4,LOW);
          break;
      case 'B':
          Serial.print("B");
          digitalWrite(IN2,HIGH);
          digitalWrite(IN4,HIGH);
          digitalWrite(IN1,LOW);
          digitalWrite(IN3,LOW);
          break;
      case 'L':
          Serial.print("L");
          digitalWrite(IN1,HIGH);
          digitalWrite(IN4,HIGH);
          digitalWrite(IN3,LOW);
          digitalWrite(IN2,LOW);
          break;
      case 'R':
          Serial.print("R");
          digitalWrite(IN2,HIGH);
          digitalWrite(IN3,HIGH);
          digitalWrite(IN1,LOW);
          digitalWrite(IN4,LOW);
          break;
      default:
```

```
        Serial.print("S");
        digitalWrite(IN2,LOW);
        digitalWrite(IN3,LOW);
        digitalWrite(IN1,LOW);
        digitalWrite(IN4,LOW);
        break;
    }
  }
}
void color()  {
  digitalWrite(s2, LOW);
  digitalWrite(s3, LOW);
  //count OUT, pRed, RED
  red = pulseIn(out, digitalRead(out) == HIGH ? LOW : HIGH);
  digitalWrite(s3, HIGH);
  //count OUT, pBLUE, BLUE
  blue = pulseIn(out, digitalRead(out) == HIGH ? LOW : HIGH);
  digitalWrite(s2, HIGH);
  //count OUT, pGreen, GREEN
  green = pulseIn(out, digitalRead(out) == HIGH ? LOW : HIGH);
}
```

4.2.2 Node-MCU Program

```
#define BLYNK_PRINT Serial
#include<ESP8266WiFi.h>
#include<BlynkSimpleEsp8266.h>
#include<SimpleTimer.h>

char auth[]="6840c4008b364eb48d26f1b7c16a676b";
char ssid[]="bharath";
char pass[]="bharathn";
int c1,c2,c3,c4,c5;
void setup(){
  c1=c2=c3=c4=0;
```

```
  Serial.begin(9600);
  Blynk.begin(auth,ssid,pass);
  pinMode(D0,INPUT);
  pinMode(D1,INPUT);
  pinMode(D2,INPUT);
  pinMode(D4,INPUT);
}
void loop(){
  Blynk.run();
if((digitalRead(D0)==0)&&(digitalRead(D2)==0)&&(c5==0)&&(digitalRead(D1)==0)&&(digital
Read(D3)==0){
    Serial.print("S");
    c1=0;
    c2=0;
    c3=0;
    c4=0;
    c5=1;
    }
  else if((digitalRead(D0)==1)&&(digitalRead(D2)==1)&&(c1==0)){
    Serial.print("F");
    c1=1;
    c2=0;
    c3=0;
    c4=0;
    c5=0;
  }
 else if((digitalRead(D1)==1)&&(digitalRead(D4)==1)&&(c2==0)){
    Serial.print("B");
    c1=0;
    c2=1;
    c3=0;
    c4=0;
    c5=0;
  }
 else if((digitalRead(D0)==1)&&(digitalRead(D4)==1)&&(c3==0)){
```

```
    Serial.print("L");
    c1=0;
    c2=0;
    c3=1;
    c4=0;
    c5=0;
  }
 else if((digitalRead(D1)==1)&&(digitalRead(D2)==1)&&(c4==0)){
    Serial.print("R");
    c1=0;
    c2=0;
    c3=0;
    c4=1;
    c5=0;
  }
if(Serial.available()>0){
    char data=Serial.read();
    switch (data){
      case 'a':
        Blynk.virtualWrite(V0,"HIGH");
        break;
      case 'b':
        Blynk.virtualWrite(V0,"LOW");
        break;
      case 'c':
         Blynk.virtualWrite(V1,"HIGH");
        break;
      case 'd':
         Blynk.virtualWrite(V1,"LOW");
        break;
        case 'e':
         Blynk.virtualWrite(V2,"HIGH");
        break;
      case 'f':
        Blynk.virtualWrite(V2,"LOW");
```

```
      break;
    case 'g':
      Blynk.virtualWrite(V3,"HIGH");
      break;
    case 'h':
       Blynk.virtualWrite(V3,"LOW");
      break;
   }
  }
}
```

CHAPTER 5

RESULTS

Robots are rapidly growing and emerges to be the best option for a variety of automation applications. Robots will continue to evolve with adapting technology improvements in hardware, communications, and software.

This robotic vehicle with different sub modules can widely be used as surveillance robot for security purpose and emergency rescue operations where human cannot footpace and user will be able to alert prior to intruder in his premises.

The future of human world will be more secure if the modifications are achieved in the Robotic World. The main advantage of this robot is that the user will be able to get notified about the situation of the area before any human interference and it also helps to sense the different parameters from its surrounding where the user can control the movement of robot by getting live video of surrounding as feedback.

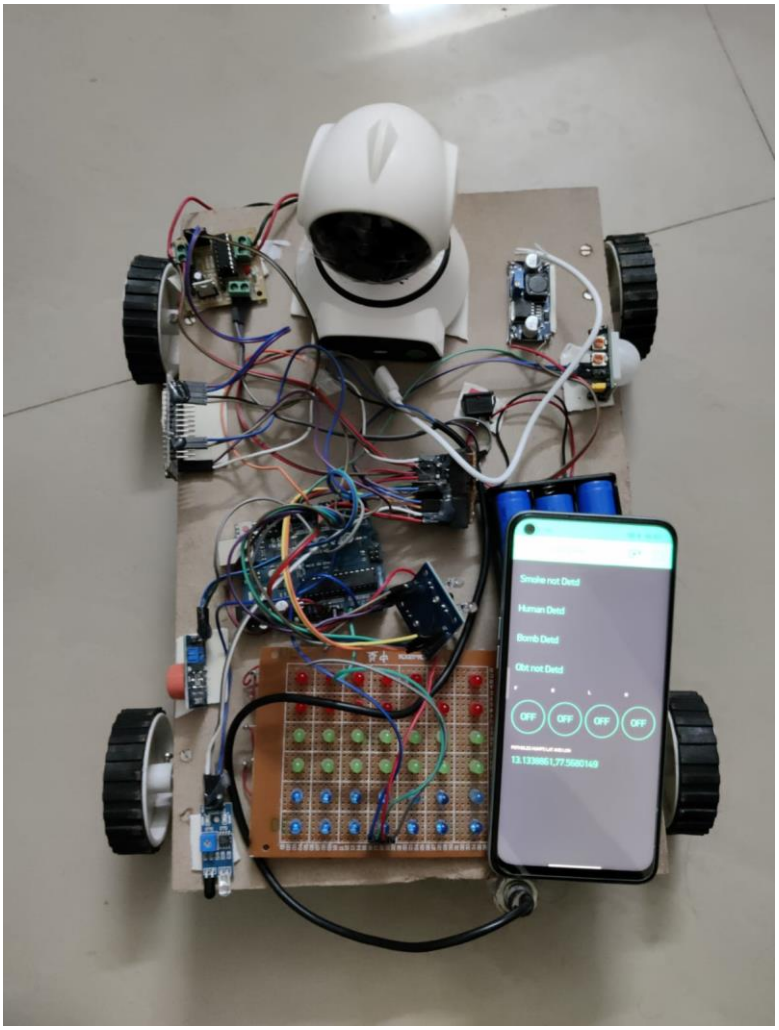

Fig. 5.1 Robot

CONCLUSION

The main motive of the **"Metal, Infrared and Gas Detection Robot"** is to detect the metal present in the ground, harmful gases in the surrounding and will be able to identify any heat from any living being as well as providing us clear view via night vision cameras.

The future of human world will be more secure if the modifications are achieved in the Robotic World. The main advantage of this robot is that the user will be able to get notified about the situation of the area before any human interference and it also helps to sense the different parameters from its surrounding where the user can control the movement of robot by getting live video of surrounding as feedback. This robotic vehicle with different sub modules can widely be used as surveillance robot for security purpose and emergency rescue operations where human cannot footpace and user will be able to alert prior to intruder in his premises.

FUTURE SCOPE

Our future aim is to focus on artificial intelligence, and an effort that could improve other security function. This robot can be modified by using number of sensors for multiple function. As the technology proliferates rapidly, IOT dimension to world of Information, communication. Currently, the use of Internet in our daily life and it would lead to development which machines, RFID tags, Sensors and Thing communicate with each other through Internet of Things (IOT). IOT is emerging technology has certain challenges providing unique address to each thing, so access over has ubiquities the internet.

And for powering up the robot we can also use several renewable energy sources like solar, green hydrogen and other methods.

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