MICROCONTROLLER BASED AUTOMATIC DOOR OPENING AND LIQUID PETROLEUM GAS DETECTING SYSTEM

Sabal Phyu Thein[1], Wah Wah Myint [2] and Khin Mar Win [3]

Abstract

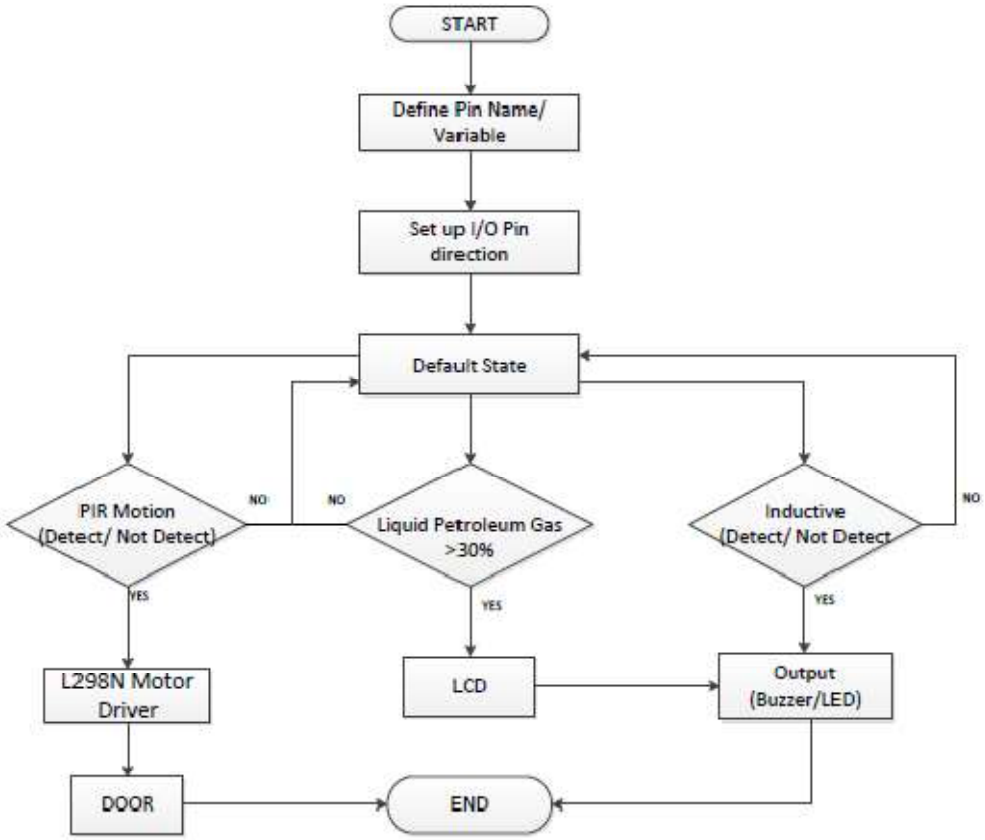
The purpose of the current research is to construct "Automatic Door Opening and Liquid Petroleum Gas Detecting System". The design is based on an Arduino Uno board, PIR (passive infrared) motion sensor, L298N motor driver, CD tray with 5V DC motor, Gas sensor MQ3, 0.96 I2C LCD driver and jumper wires. The PIR sensor is used to open and close the door automatically. The MQ3 sensor is used as liquid petroleum gas detecting system because it is suitable for detecting alcohol, benzine, CH4, hexane, LPG and CO. The Arduino UNO board is used to control all sensors' operation and gives an output. The controlled program is written in C programming language. The system can also be expanded with an inductive detector for metal detection purpose of security.

Keywords: Arduino UNO, PIR motion sensor, L298N motor driver, CD tray with 5V DC motor, Gas sensor MQ3, 0.96 I2C LCD driver, LCD, inductive detector

Introduction

The opening and closing of doors is always a tedious job, especially in places like shopping malls, hotels and theaters where a person is always required to open the door for visitors. In this research work, an Arduino Uno board connected with a PIR sensor is used to open and close the door automatically. Here, we used HC SR 501 passive infrared (PIR) sensor to detect the presence of humans near the surroundings of a door and then used the Atemega 328 microprocessor to control L298N motor drivers. If the PIR sensor detects a human, it gives a pulse or signal to a microcontroller and the gate will open by turning on the motor driver. The proposed design can be applied in many places such as industry, offices, Universities, shopping centers, airport and hospital etc. The liquid petroleum gas detection system is also constructed by using an Arduino Uno microcontroller interfacing with a gas sensor and an LCD module associate with a buzzer. The system can be expanded with an inductive detector for metal detection purpose of airport security. The block diagram of the proposed system is shown in Figure (1). It consists of power supply section, PIR sensor, MQ-3 gas sensor, inductive detector, gate entrance, LCD and alarm. The various units were designed and tested separately.

[1] Dr, Lecturer, Department of physics, Meiktila University
[2] Lecturer, Department of physics, Meiktila University
[3] Associate Professor, Department of Engineering Physics, Mandalay Technologiccal University



Methodology of the System

Design and Construction of the System

This circuit is based on Arduino Uno board with atmega328 microcontroller which is quite compact and it is connected with the PIR sensor, MQ3 gas sensor and inductive detector. There are automatic door opening and closing system using PIR sensor, liquid petroleum gas detecting system using MQ3gas sensor and metal detection system using inductive sensor performed in this constructed system. Each part of the system is controlled by the firmware program and it is written in C programming language. The photograph of the Arduino Uno, PIR sensor, MQ-3 gas sensor and inductive sensor are shown in Figure (2-5). The complete circuit diagram is shown in Figure (6).

Circuit Design and Connection between Arduino and Sensor Units

In this circuit diagram the output pin of PIR is connected with digital pin4 of arduino. A 5V pin of it is connected with VCC pin of sensors and GND pin is connected to GND pin of sensor. The digital output pin2 and pin3 of arduino are connected to input 1 and input 2 of L298N motor driver. Output 1 and 2 of motor driver are connected to 5V motor CD tray. For gas detection system, analog output pin Ao of MQ3 gas sensor is connected to analog pin A0 of arduino and digital pin D0 is connected to digital pin 8 of arduino. A 5V and GND pins of arduino are connected to VCC and GND pins of gas sensor. Analog output pin (A4, A5) of arduino are connected to SDA and SCL pins of I2C LCD driver. A LCD is used to indicate the detected gas percentage and a LED and a buzzer are used as the over gas percentage indicator. 5V and GND pins of arduino are connected to VCC and GND pins of LCD driver. Digital output

pins (9, 10) of arduino are connected to buzzer and LED. For inductor detection system, analog input pin A1 of arduino is connected to signal pin of inductive detector. A 5V and GND of arduino are connected to VCC and GND pins of inductive detector. The alarm unit used is buzzer which indicates when metals are detected. The flow diagram of microcontroller based automatic door opening and liquid petroleum gas detecting system is shown in figure (7).

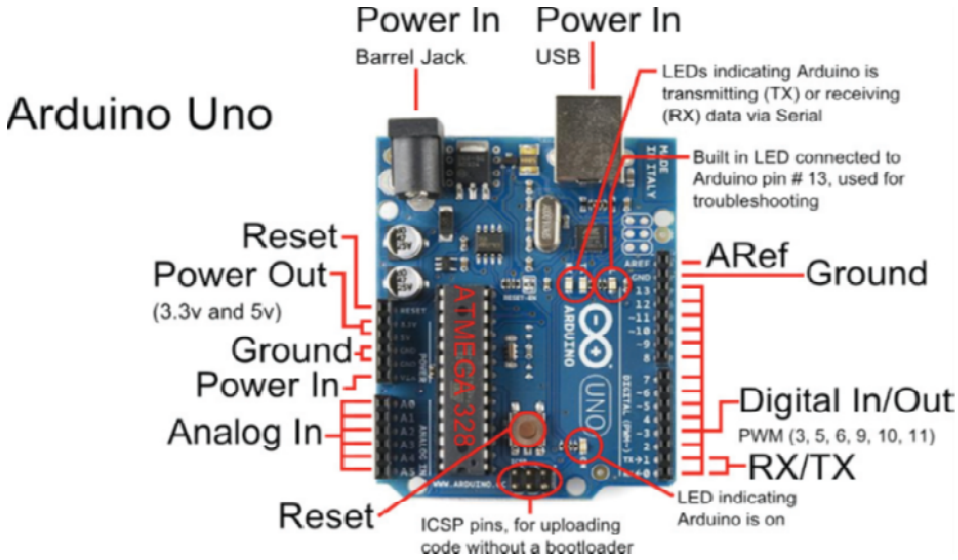


Figure 2 The pin configurations of arduino uno board

Figure 3 The photograph of PIR sensor

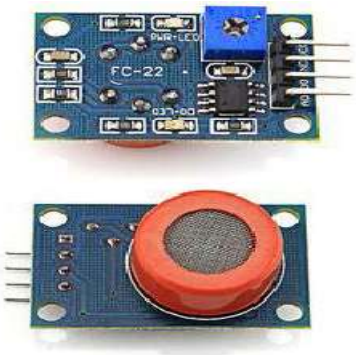


Figure 4 The photograph of MQ3 gas sensor

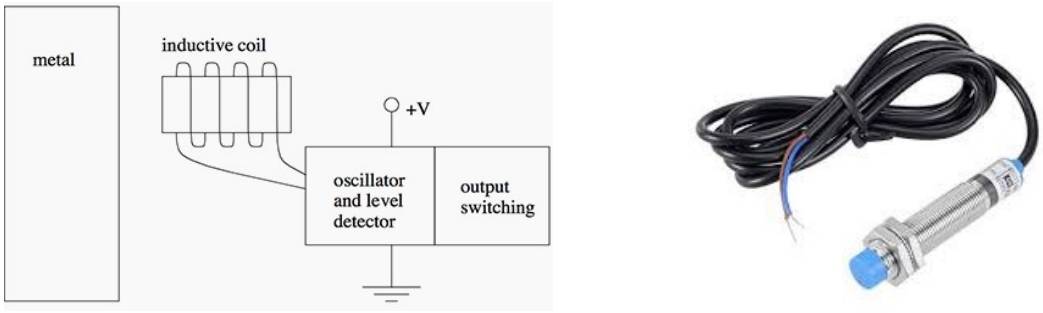


Figure 5 The photograph of inductive detector

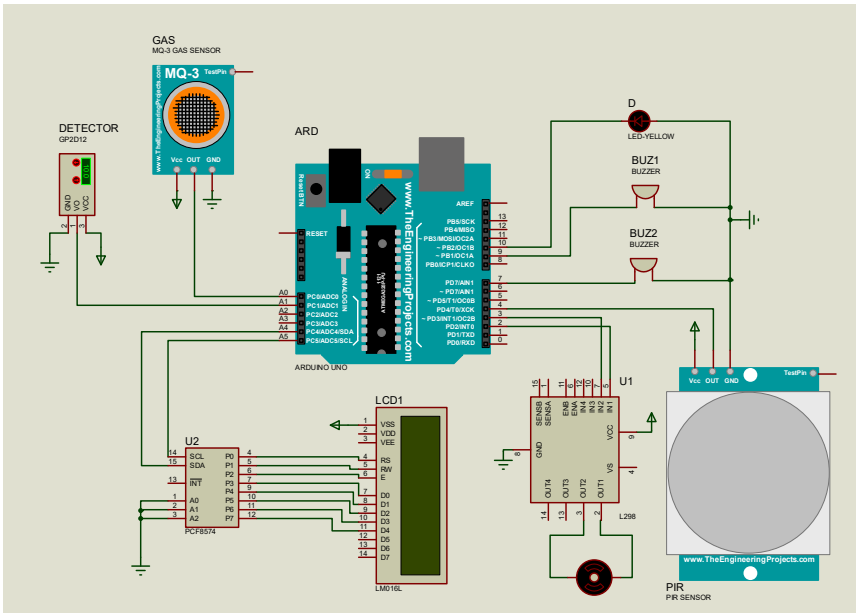


Figure 6 The circuit diagram of Microcontroller Based Automatic Door Opening and Liquid Petroleum Gas detecting system

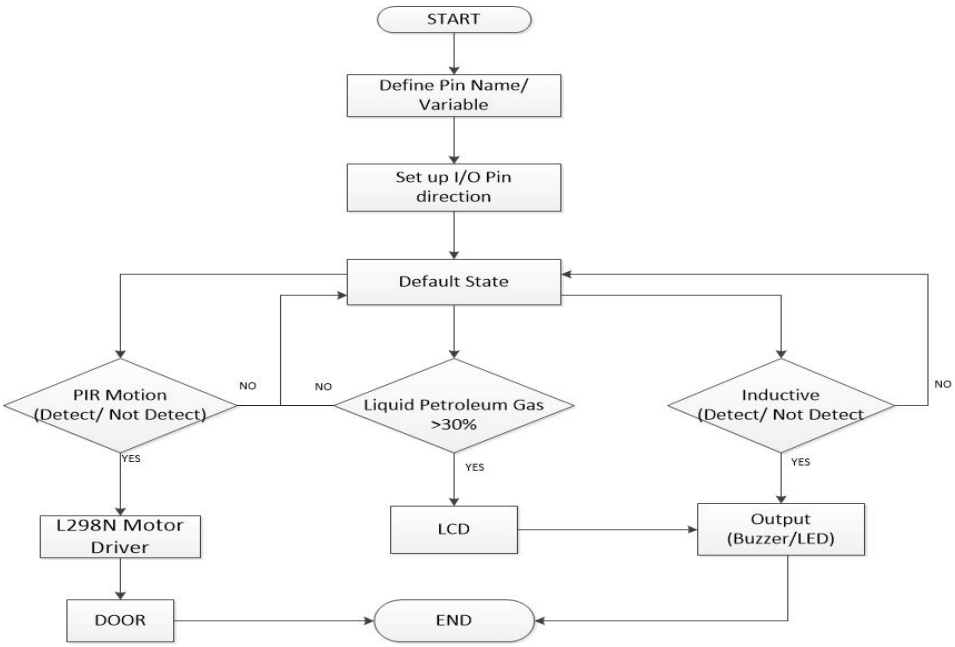


Figure 7 The flow diagram of microcontroller based automatic door opening and liquid petroleum gas detecting system

Discussion

This research proposes a system of automatic opening and closing of door by sensing anybody movement near the door. This is achieved with help of a PIR (Passive Infrared) sensor. Alive body generally emits infrared energy which is sensed by the PIR sensor from a considerable distance. This sensing signal is fed to a microcontroller to operate a door motor through motor driver IC. When a body approaches within the operating range of the sensor, it sends a logical command to open the door. The door automatically closes with a fixed time delay. The hardware demonstration of automatic door opening is shown in Figure (8). The detected analog voltage values of MQ3 gas sensor are read by the microcontroller. The Arduino Uno board is 10-bit device that changes an analog voltage on a pin to a digital number. The system will link input voltages from 0 to 5 V with decimal values from zero to 1023 to generate 5Vs for every 1024 units. The system will process the analog signal and convert it to digital value of 0 or 1. Also, the analog values from the gas sensor will be scaled to percentage. If the percentage is greater than 30, the alarm and the orange LED indicator will be ON. The sensor value only reflects the approximated trend of gas concentration in a permissible error range it does not represent the exact gas concentration .The detection of certain components in the air usually requires a more precise and costly instruments, which cannot be done with a single gas sensor. The gas sensor module is useful for gas leakage detection in home and industry. The hardware demonstration of liquid petroleum gas detecting system is shown in Figure (9).The inductive sensor can determine when a metal have been brought nearby. The hardware demonstration of inductor detecting is shown in Figure (10). The compiled sketch program is shown in Figure (11).

Conclusion

Also this research will aim to develop automatic door opening and liquid petroleum gas detecting system. The system proposes a system of automatic opening and closing of door by sensing anybody arriving near the door. This is achieved with help of a PIR motion sensor. The proposed design can be applied in many places such as industry, offices, Universities, shopping centers, airport and hospital etc. For the detecting system MQ3 gas sensor and inductive sensor are used. These sensors will detect fuel gas any metals and so these detection systems can be used in airport, classrooms and meeting rooms' security.

Figure 8 Hardware demonstration of automatic door opening

Figure 9 Hardware demonstration of liquid petroleum gas detecting system

Figure 10 Hardware demonstration of inductor detecting metal

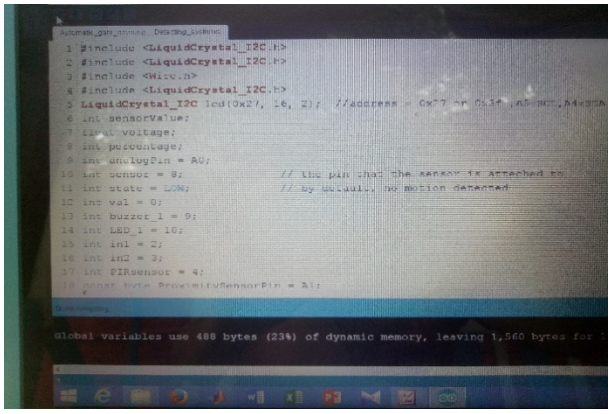


Figure 11 The photograph of compiled sketch program

Appendix

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);  //address = 0x27 or 0x3f ,A5=SCL,A4=SDA
int sensorValue;
float voltage;
int percentage;
int analogPin = A0;
int sensor = 8;              // the pin that the sensor is attached to
int state = LOW;             // by default, no motion detected
int val = 0;
int buzzer_1 = 9;
int LED_1 = 10;
int in1 = 2;
int in2 = 3;
int PIRsensor = 4;
const byte ProximitySensorPin = A1;
const byte Buzzer_2 = 6;
const byte LED_2 = 7;
long duration;
int distance;
void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  Serial.println("LPG Tester");
  // initialize the LCD
  Wire.begin();
  lcd.begin();
  lcd.setCursor(0, 0);
  lcd.print("LPG Tester");
  pinMode(sensor, INPUT);    // initialize sensor as an input
  pinMode(buzzer_1, OUTPUT);
  pinMode(LED_1, OUTPUT);
  delay(100);
  pinMode(in1, OUTPUT);
    pinMode(in2, OUTPUT);
    pinMode(PIRsensor, INPUT);
   Serial.begin(9600);
  pinMode(ProximitySensorPin, INPUT_PULLUP);
  pinMode(Buzzer_2, OUTPUT);
 pinMode(LED_2, OUTPUT);
}
void loop() {
```

```
  {
  //---------------------------------------------
   sensorValue = analogRead(A0);  // read the input on analog pin 0:
  percentage = map(sensorValue, 200, 1023, 0, 100); //
  if (percentage <0) percentage =0;
  lcd.clear();
  lcd.print(percentage);
  lcd.print("% LPG  ");
  digitalWrite(buzzer_1,LOW);
  digitalWrite(LED_1,LOW);
  lcd.setCursor(0, 1);
  lcd.print(sensorValue);
  lcd.print(" adc");
  Serial.print(sensorValue);
  Serial.print("Adc ");
  Serial.print(percentage, 1);
  Serial.println("%");
if (percentage >30)
 {
  digitalWrite(buzzer_1,HIGH);
  digitalWrite(LED_1,HIGH);
  delay(1000);
}
else
{
 digitalWrite(buzzer_1,LOW);
digitalWrite(LED_1,LOW);
}
delay(100);
  }
{
if(digitalRead(PIRsensor)==HIGH)
  {
       digitalWrite(in1,HIGH);
       digitalWrite(in2,LOW);
       delay(2000);
       digitalWrite(in1,LOW);
       digitalWrite(in2,LOW);
       delay(2000);
       digitalWrite(in1,LOW);
       digitalWrite(in2,HIGH);
       delay(5000);
}
```

```
    else
{
 digitalWrite(in1,LOW);
 digitalWrite(in2,LOW);
}
delay(100);
if(digitalRead(ProximitySensorPin))
 {
  Serial.print("Object detected!");
 digitalWrite(Buzzer_2, HIGH);
 digitalWrite(LED_2,HIGH);
 delay(1000);
 }
else{
 digitalWrite(Buzzer_2, LOW);
 digitalWrite(LED_2,LOW);
}
delay(100);
}
}
}
```

Acknowledgement

The authors would like to acknowledge Professor Dr Khin Khin Win, Head of Department of Physics, University of Yangon, for her kind permission to carry out this work. The authors also thank to Professor Dr Hla Hla Than, Head of Department of Physics, Meiktila University and Professor Dr Daw Hla Win, Department of Physics, Meiktila University , for their kind permission to carry out this work.

References

Arduino-Arduino Board BT. (n.d.). Retrieved January 14, 2018, from http://www.arduino.cc

Muhammad, W.(2017) "Human Sensed Automatic Door Opening and Closing System using PIR Sensor in Green PAK™."PDF-(487KB).

Altaf, S.V., S. Abhinay, E. Ansari, M.D. Kaunain, & R. Anwer (2017) "Alcohol Detection and Mortor Locking System." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*."* 6(2): pp.989-993.

Winncy Y. Du. (2014) "Resisitive, Capacitive, Inductive and Magnetic Sensor Technologies." CRC Press, ISBN 1439812446, Chapter 4 Inductive Sensors.

Kousikan M, Sundaraj M. (2014) "Automatic Drunken Drive Prevention System". International Journal of Students Research in Technology and Management. 2(2): 75-77.