ROBOTICAR: GAS DETECTOR AND MONITORING SYSTEM WITH TELEGRAM NOTIFICATION

Rommel G. Dones
College of Engineering
BS Computer Engineering
San Pablo City, Philippines
0318-0393@lspu.edu.ph

John Carlo Saraza
College of Engineering
BS Computer Engineering
San Pablo City, Philippines
0318-0388@lspu.edu.ph

Glenn Neil A. Villegas
College of Engineering
BS Computer Engineering
San Pablo City, Philippines
0318-0393@lspu.edu.ph

I. DESCRIPTION

Liquefied petroleum gas (LPG) has grown in popularity as a home cooking fuel. However, LPG leakage is a significant danger to both the user and others. Leakage of gas results in a variety of accidents, resulting in both material loss and human injury. The risk of explosion, fire, or suffocation is determined by the physical properties of the substance, such as toxicity, flammability, and so on. The number of fatalities caused by gas cylinder explosions has been increasing in recent years. The explosion occurred as a result of substandard cylinders, old valves, worn-out regulators, and a lack of awareness regarding gas cylinder handling. LPG or propane is a flammable mixture of hydrocarbon gases that is used as a fuel in a variety of applications such as homes, hostels, industries, automobiles, and vehicles due to its advantageous properties such as high calorific value, low smoke, low soot, and low environmental impact. Natural gas leakage is another widespread and serious issue. Due to their greater density than air, these gases do not disperse quickly. When inhaled, it can result in suffocation and explosion.

On the other hand, Gas Sensor MQ-2 is a flammable gas and smoke sensor that detects the concentration of combustible gas in the air. They are used in smoke and flammable gas detection equipment in the home, industry, and automobile. MQ-2 gas sensor utilizes SnO2 (an oxygen-deficient n-type semiconductor) as a gas sensing material due to its lower conductivity in clear air. In an atmosphere containing potentially flammable gases, the conductivity of the gas sensor increases in lockstep with the inflammable gas concentration. MQ-2 is highly sensitive to a variety of flammable gases, including natural gas, and is particularly sensitive to liquefied gas, propane, and hydrogen. In this project, the buzzer will beep when the harmful gas surrounding the sensor reaches a predetermined concentration.

The student developed ROBOTICAR: GAS DETECTOR AND MONITORING SYSTEM WITH TELEGRAM NOTIFICATION in response to the aforementioned problem and components. This roboticar is in close proximity to LPG tanks or other locations containing light materials that can cause an explosion or fire that shown in figure 1. Once the roboticar detects a gas leak, the buzzer will sound and the user will be notified via the telegram bot. Additionally, the user can view the gas content in the roboticar's immediate vicinity via the use of thingspeak.

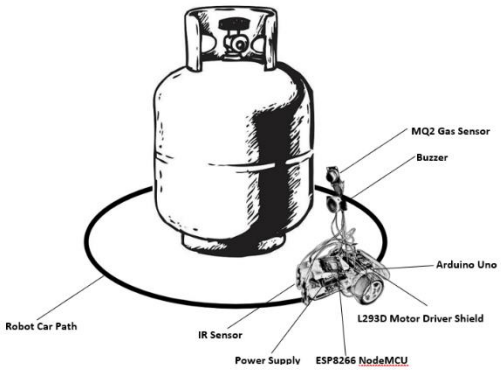

Figure 1. *perspective view*

II. OBJECTIVES

General Objective:

- To develop a robot car capable of detecting gas leaks and monitoring LPG tank.

Specific Objective:

- To utilize line follower robot and apply ESP8266 NodeMCU and MQ2 gas sensor for gas leakage detection.

III. MATERIALS

COMPONENT	SPECIFICATION	IMPLEMENTATION
Robot car chassis	Chassis Specification: Dimensions: 21.0cm x 15cm x 6.5 cm(L x W x H) approx.	A chassis of a robot will carry the DC motors, batteries, electronics, mounting supports, and

	Chassis thickness: 2.8 mm Carrying Capacity: 2-wheel drive Powered by: 4 x AA batteries (not included) DC motor specification: Rated Voltage: 3-6V DC. Gear Motor rotation speed: 125 RPM Load current: 190 mA (250 mA MAX). Maximum torque: 800 g. cm min. Wheel specification: Width: 30mm Diameter: 65mm Package Weight: 600g	more. All of these components and parts are added to the weight of the chassis itself, which will count towards the total carrying capacity of the electrical motors.
L293D motor driver	Wide Supply-Voltage Range: 4.5 V to 36 V Separate Input-Logic Supply Internal ESD Protection High-Noise-Immunity Inputs Output Current 600 mA Per Channel Peak Output Current 1.2 A Per Channel Output Clamp Diodes for Inductive Transient Suppression	L293D is a 16 pin IC for controlling DC motors. The IC operates between the voltage of 4.5V to 36V and supplies a current up to 600 mA. It consists of four high current half h-bridge circuit for driving the motor in both directions.

	Operation Temperature 0°C to 70°C. Automatic thermal shutdown is available	
ESP8266 NodeMCU	Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106 Operating Voltage: 3.3V Input Voltage: 7-12V Digital I/O Pins (DIO): 16 Analog Input Pins (ADC): 1 UARTs: 1 SPIs: 1 I2Cs: 1 Flash Memory: 4 MB SRAM: 64 KB Clock Speed: 80 MHz USB-TTL based on CP2102 is included onboard, Enabling Plug n Play PCB Antenna Small Sized module to fit smartly inside your IoT projects	NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.
Arduino Uno	Microcontroller: ATmega328p Operating Voltage: 5V Input Voltage (recommended): 7-12V Input Voltage (limits): 6-20V Digital I/O Pins: 14 pins	The Arduino Uno is an open-source microcontroller board that is based on the Microchip ATmega328P (for Arduino UNO R3) or Microchip ATmega4809 (for Arduino UNO WIFI R2) micro-

	(of which 6 are PWM output pins) Analog Input Pins: 6 DC Current per I/O Pin: 40 mA DC Current for 3.3V Pin: 50 mA Flash Memory: 32 KB (of which 0.5 KB is taken by bootloader) SRAM: 2 KB (ATmega328)	controller by Atmel and was the first USB powered board developed by Arduino.
IR sensor	Operating Voltage : 5V DC Digital Output : logic one (+3.5V DC) logic zero (0V DC) Digital output present Digital input values can be taken while programming	An IR Infrared Obstacle Avoidance Sensor Module is an electronic device, that emits in order to sense some aspects of the surroundings. An IR Infrared Obstacle Avoidance Sensor Module can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.
MQ2 Gas sensor	Operating Voltage is +5V Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane Analog output voltage: 0V to 5V Digital Output Voltage: 0V or 5V (TTL Logic) Preheat duration 20 seconds Can be used as a Digital or analog sensor The Sensitivity of Digital pin can be varied using the potentiometer	MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.
Buzzer	Alarm Diameter:29mm / 1.14 inch Alarm Height: 15mm / 0.59 inch 2 Mounting Holes distance: 40mm / 1.57 inch 2 Wires length: 105mm / 4.13 inch Rated Voltage: 12V Operating Voltage: 3-24V Rated Current(MAX): 20mA Min Sound Output at 10 cm: 95 DB Resonant Frequency: 3100+/-500 Operating Temperature: -20～	The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

	+80Degrees Celsius Intermittent Sound	

IV. CIRCUIT DIAGRAM

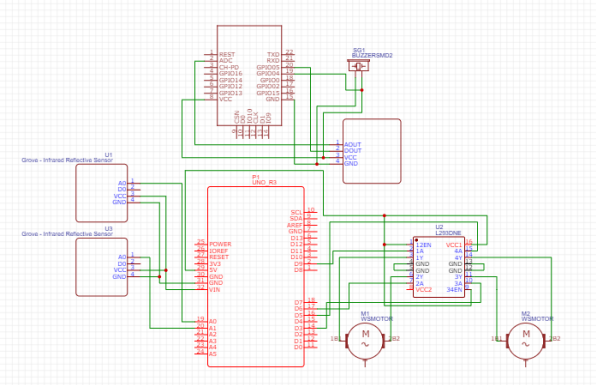

Figure 2. *circuit diagram of the system*

V. CODE

```
#include "ThingSpeak.h"
#include <ESP8266WiFi.h>
#include <UniversalTelegramBot.h>
#include <AFMotor.h>
#define lefts A0
#define rights A1

//---------- Enter you Wi-Fi Details---------//
char ssid[] = "SBG6700AC-87708";//Enter your WIFI SSIS
char pass[] = "686e8cc4b2";//Enter your WIFI password
//-----------------------------------------//
#define BOTtoken "14aF2AD2a:1f224FGJ51fbBsXAD355dX1fqioQXr XgXXqq126"


int pinValue = 0;
int buzzer = D5;
int smoke = A0;
int sensorThres = 400;
AF_DCMotor motor1(1, MOTOR12_1KHZ);
AF_DCMotor motor2(2, MOTOR12_1KHZ);
AF_DCMotor motor3(3, MOTOR34_1KHZ);
AF_DCMotor motor4(4, MOTOR34_1KHZ);

WiFiClient  client;
UniversalTelegramBot bot(BOTtoken, client);
int botRequestDelay = 500;
unsigned long lastTimeBotRan;
unsigned long myChannelField = 1657054; // Channel ID
const int ChannelField = 1; // Which channel to write data
const char * myWriteAPIKey = "GWZJ76GJW7Q8VU2V"; // Your write API Key

void handleNewMessages(int numNewMessages) {
  Serial.println("handleNewMessages");
  Serial.println(String(numNewMessages));

  for (int i=0; i<numNewMessages; i++) {
    String chat_id = String(bot.messages[i].chat_id);
    String text = bot.messages[i].text;

    String from_name = bot.messages[i].from_name;
    if (from_name == "") from_name = "Guest";

    if (text == "/GAS") {
      D1Status = 1;
      bot.sendMessage(chat_id, "GAS LEAKAGE DETECTED", "");
    }


void setup()
{
  Serial.begin(9600);
   pinMode(buzzer, OUTPUT);
  pinMode(smoke, INPUT);
  motor1.setSpeed(100);
  motor2.setSpeed(100);
  motor3.setSpeed(100);
  motor4.setSpeed(100);
  //Declaring PIN input types
  pinMode(lefts,INPUT);
  pinMode(rights,INPUT);
  WiFi.mode(WIFI_STA);
  ThingSpeak.begin(client);
}
void loop()
{
  if (WiFi.status() != WL_CONNECTED)
  {
    Serial.print("Attempting to connect to SSID: ");
    Serial.println(ssid);
    while (WiFi.status() != WL_CONNECTED)
    {
      WiFi.begin(ssid, pass);
      Serial.print(".");
      delay(5000);
    }
    Serial.println("\nConnected.");
  }
  int analogSensor = analogRead(smoke);
  Serial.print("Pin A0: ");
  Serial.println(analogSensor);
  // Checks if it has reached the threshold value
```

```
  Serial.println(analogRead(lefts));
  Serial.println(analogRead(rights));
  //line detected by both
  if(analogRead(lefts)<=350                    &&
analogRead(rights)<=350){
    //Forward
    motor1.run(FORWARD);
    motor2.run(FORWARD);
    motor3.run(FORWARD);
    motor4.run(FORWARD);
  }
  //line detected by left sensor
  else          if(analogRead(lefts)<=350          &&
!analogRead(rights)<=350){
    //turn left
    motor1.run(FORWARD);
    motor2.run(FORWARD);
    motor3.run(BACKWARD);
    motor4.run(BACKWARD);

  }
  //line detected by right sensor
  else          if(!analogRead(lefts)<=350         &&
analogRead(rights)<=350){
    //turn right
    motor1.run(BACKWARD);
    motor2.run(BACKWARD);
    motor3.run(FORWARD);
    motor4.run(FORWARD);

  }
  //line detected by none
  else          if(!analogRead(lefts)<=350         &&
!analogRead(rights)<=350){
    //stop
    motor1.run(RELEASE);
    motor2.run(RELEASE);
    motor3.run(RELEASE);
    motor4.run(RELEASE);

  }
  if (analogSensor > sensorThres)
  {
    tone(buzzer, 1000, 2000);

  }
  else
  {
    noTone(buzzer);
  }
  delay(100);
  ThingSpeak.writeField(myChannelField,
ChannelField, analogSensor, myWriteAPIKey);
  delay(1000);
}
```

VI. PICTURES

Figure 3. *Calibrating MQ-2 Gas Sensor*

Figure 4. *assembling all of the components*

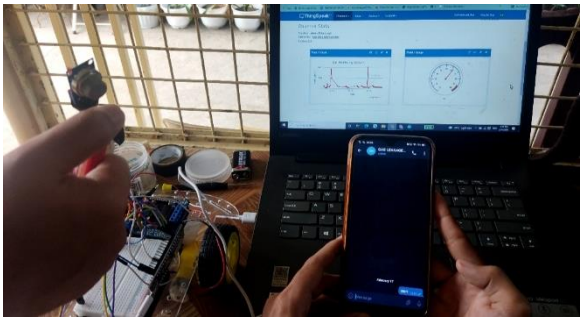

Figure 5. *testing the roboticar*

In figure 3, the calibration of the mq2 gas sensor is shown because when the student first tries it, it does not detect any gas. However, after a few minutes, it begins to work as shown in figure 4, where the student assembles all the components to function as a roboticar.

On the other hand, as illustrated in Figure 5, the student conducts testing to ensure that the project's objectives are met, which include the specific objective "To utilize a line follower robot and to apply the ESP8266 NodeMCU and MQ2 gas sensor for gas leakage detection." and the general objective "To develop a robot car capable of detecting gas leaks and monitoring an LPG tank." As the trial progresses, there are circumstances in which the student failed, not in the roboticar, but in the code and also in the wiring,

which caused the roboticar to fail to perform as the objectives required.

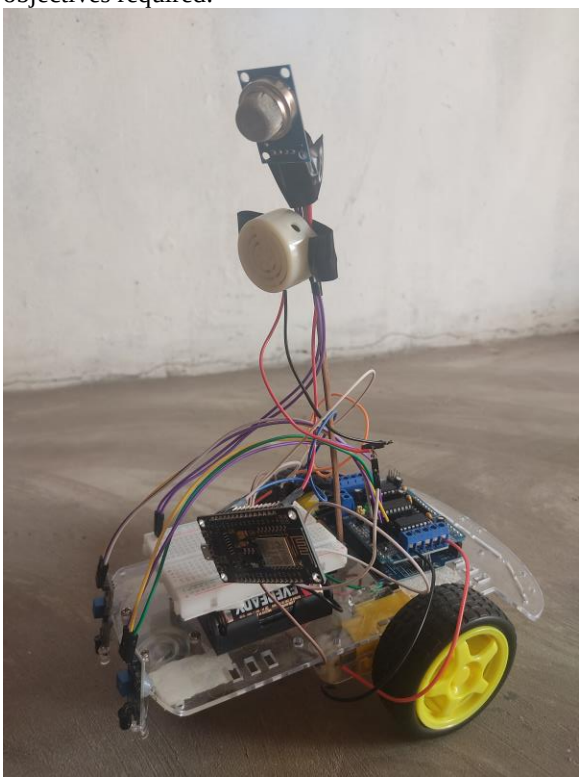

Figure 6. *roboticar's final appearance*

The student accomplished the project's objectives in this many trials, as demonstrated in the video demonstration. The students acknowledge that some aspects of the project could be improved, but this is only a prototype for combating gas leakage in order to avoid injuring or losing loved ones.