

IOT Gas Pipe Leakage Detector Robot

Abstract - LPG Gas pipes fulfill very important roles for cities, industries and thus in growing economies. LPG gas is commonly used for cooking food and other stuff in both industry and Households. In today's world major cities like Mumbai, Thane, Delhi, etc. are getting LPG supply by LPG Pipeline. So, gas leakages lead to threat and creates hazardous situations because they can also lead to fire accidents. So, solution for this problem is creating the innovative robot that can sense the gas leakage from outer surface of pipeline and if it detects gas leakage send alert messages to the user with help of MQ9 gas sensor, GSM module 800c. The robot or car has wheels and it will be controlled by the user with remote controller. the robot has gas detection system and a GSM module. the robot goes on surface of pipeline and check the leakage in the pipeline if any gas leakage is sense by mq9 sensor it will send alert SMS via help of the GSM module to the respective mobile phone number

Keywords -Gas, Leakage, MQ9, LPG, GSM, Robot car, Rover, Pipeline.

1. Introduction

LPG Gas pipes fulfil very important roles for cities, industries and thus in growing economies. Liquid Petroleum Gas (LPG) LPG gas is commonly used for cooking food and other stuff in both industry and Households. The lpg gas consists or the mixture of propane (C_3H_8), mostly butane (C_4H_{10}). This both gases are dense (Heavy) and flammable in nature.

If there are some leakages in a gas pipeline that may leads fire and gas related accident and cause downfall to the economy. Examine and finding leakage manually is dangerous. the lpg gas causes skin and eyes burns. Inhaling lpg causes fainting or death sometimes. Lpg vapor causes irritation in nose and throat. For solution of this we are implementing a robot that can sense the lpg gas on pipe surface if the gas leakage is detected then SMS alert is send to the respected mobile number via use of the GSM module.

The robot consists Arduino UNO, MQ9 gas sensor, GSM800c GSM module, 16x2 LCD display and i2c display module for gas detection system

And NodeMcu, servo motors 300 RPM, L298N motor driven shield, wheels for Rover.

9V battery is connected to each module for power supply and wires are used to interconnection between them. Arduino IDE software used to upload code in both Arduino uno and NodeMcu.

2. Components used in System

The Components used to form circuit connection in the gas detection system is as follows.

2.1 components used for Gas leakage detection system.

For gas detection system following components are used to form a connection and for establishing the system

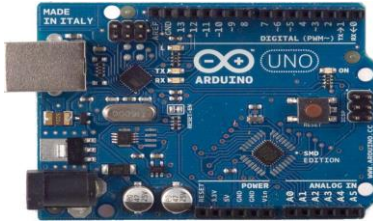


Fig (2.1-1) Arduino Uno

Arduino Uno: Arduino Uno is one of the types of the Arduino Boards. The Arduino consist microcontroller that used to perform the several operations and handling the other IOT devices like sensors and various modules.



Fig (2.1-2)16X2 Display

16X2 LCD display: the 16X2 is used for displaying the amount of gas present in air in percentage manner.



Fig (2.1-3) I2C display module

I2C display Module: I2C display module is used to connect 16X2 LCD display to Arduino board.



Fig (2.1-4) MQ9 gas sensor

MQ9 Gas Sensor: The MQ9 sensor is used to detect the LPG gas from the leakage pipeline. How mq9 gas sensor can detect the LPG gas. The mq9 gas sensor is useful for sensing the LPG gas in home as well as in the industrial use. The mq9 sensor can be able to detect LPG, CH₄, CO from the air. Mq9 sensor is highly responsive and sensitive sensor. The mq9 sensor consist A0 pin, VCC pin and GND pin. There is not an accurate or exact measurement for sensing the LPG gas from the sensor. Even lpg gas presence is 1% in air it can sense it which means it can sense and concentrate gas from 200ppm to 10000ppm. There is not an exact formula for sensing the gas but minimum 10% lpg gas is common measurement for sensing the lpg leakage. the sensor can be adjusted via using potentiometer or backside sensing adjustment setting

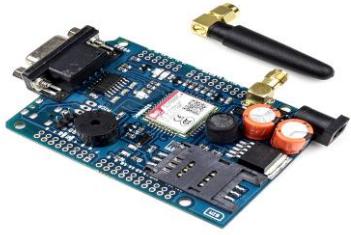


Fig (2.1-5) GSM 800C module

GSM800C Module: The GSM 800C module is used to provide GSM services as well as the GPRS and SMS services. Its used Sim card for transmitting the SMS and GPRS signal from one connection to the other connection

The GSM 800C module works with AT commands and used in 850/900/1800/1900 MHz frequencies.



2.2 components used Wi-Fi controlled Robot.

Fig (2.2-1) NodeMcu ESP8266 NodeMcu: NodeMcu is an open source IOT development platform. It has firmware that operates with a Wi-Fi soc Espressif Systems, and hardware based on the ESP-12



module.

Fig (2.2-2) servo motors (BO motors)

Servo Motoes 300RPM: The Servo motors are used for wheel Spinning

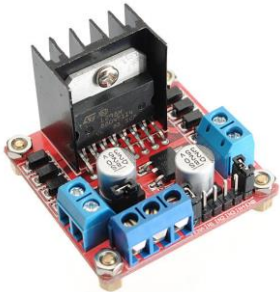


Fig (2.2-3) L298N Motor

L298N Motor driven shield: the L298N motor driven shield which used to control rovers' wheels direction.

2.3 Other Components

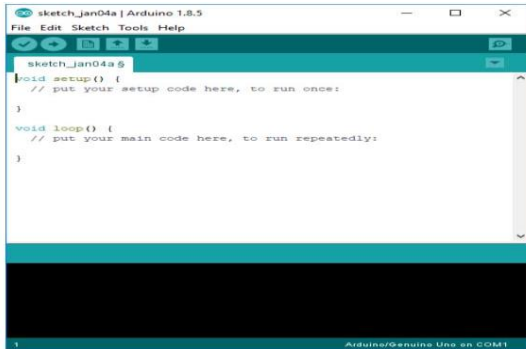


Fig (2.3-1) Arduino IDE

Arduino IDE: Arduino IDE is used for coding Arduino and NodeMcu and upload code into them.



Fig (2.3-2) 9V battery

9V Batteries: 9V Batteries are used for provide power supply to Arduino, GSM module, NodeMcu and L298N motor driven shield



Fig (2.3-3)

Jumper Wires: Jumper wires are used for establish connection between IOT components.

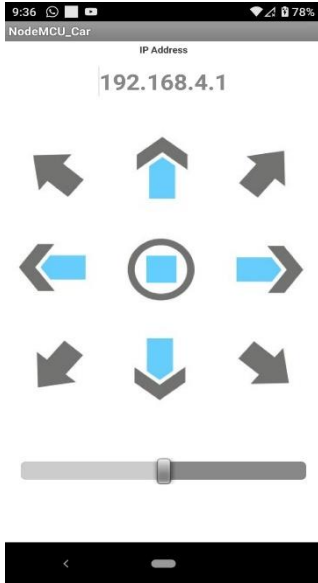


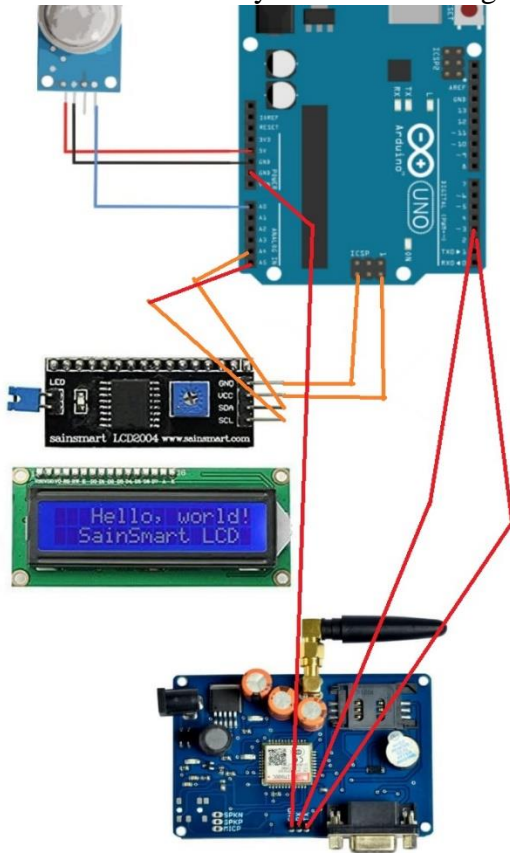
Fig (2.3-4)

NodeMcu Car mobile application: The NodeMcu car mobile application is used for controlling the rover with Wi-Fi technology through the mobile.

Keywords: Components, Gas, Leakage, IOT, NodeMcu, Arduino, MQ9, sensor, devices, GSM, Modules.

3.Connections and Circuit diagrams

3.1 Gas Detection System Circuit Diagram and connections



Fig(3.1-1)

1) I2c display module to Arduino
I2c VCC pin to Arduino VCC pin
I2c GND pin to Arduino GND pin
I2c SDA pin to Arduino A4 pin
I2c SCL pin to Arduino A5 pin

2) Arduino to Mq9 gas sensor connection
Mq9 VCC pin to Arduino VCC pin
Mq9 GND pin to Arduino GND pin
Mq9 A0 pin to Arduino A0 pin

3) Arduino to GSM800c module connection
GSM TX pin to Arduino D2 pin
GSM RX pin to Arduino D3 pin
GSM GND pin to Arduino GND pin

3.2 NodeMcu car circuit Diagram and connections

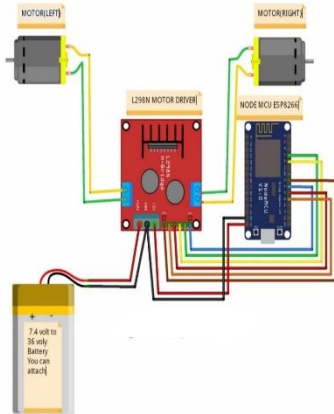


Fig (3.2-1)

The 4 servo motors are separated in 2 groups. 2 servos are connected each other diagonally and 4 wires coming out from the servo motors. The L298N motor has 4 output pins each wire goes into each output pin socket.

The connection between L298N motor driven shield and Nodemcu

- Nodemcu D3 to L298N Input4
- Nodemcu D4 to L298N Input 3
- Nodemcu D5 to L298N Enable A pin
- Nodemcu D6 to L298N Enable B pin
- Nodemcu D7 to L298N Input 2 pin
- Nodemcu D8 to L298N Input 1 pin
- Nodemcu GND pin to GND pin
- Nodemcu VIN pin to 5V Input/output pin

4.Result (Output)

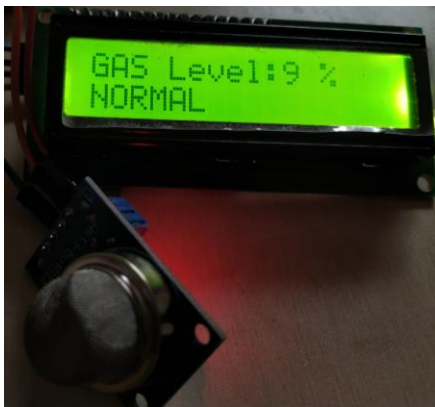


Fig (4-1)

Gas message displayed is normal and percentage of the gas is showing on the 16X2 display. (Gas range from 1:1% to 1:9% is normal that means no leakage is there)



Fig (4-2)

Gas message is displayed Danger and gas leakage percentage is also displayed on 16X2 display. When Gas leakage range is above the 1:10% then danger message is displayed on the screen and Alert messages are send to the user with help of the GSM module

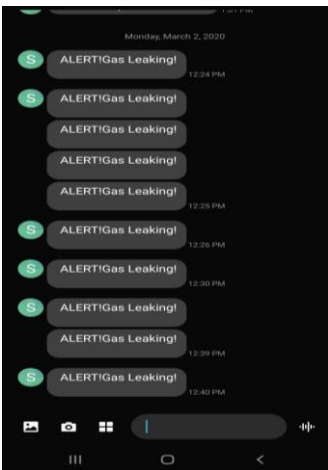


Fig (4-3)

Alert messages send when Gas leakage is detected by the MQ9 sensor with a help of the GSM 800C module

5. Conclusions

We implemented Gas Leakage detection system by using Arduino Uno, NodeMcu, MQ9 gas sensor, LCD Display. While implementing the project we learn lot about Arduino, Gas sensors, Nodemcu and many other IOT devices. LPG Gas Leakage leads a huge problem in many industries and households. We are going to design such a robot that can detect Gas Leakages effectively by using a MQ9 gas sensor and alert user by sending an alert message by using the GSM800C module to the respective mobile phones. Hence our Project will definitely prove to be an important for households and industries.

References

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