

Arduino based Gas Leakage Detection for Living Security

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Abstract - In this paper, we have made a gas leakage detector smart system using Nodemcu board and Arduino board, MQ6 sensor. This system is used for gas leakage detection. This system is used for safety of residence help or emergency purpose also. LPG can leak as a gas or liquid that can cause fire on small or large scale and can even cause the loss of life for its user. Liquefied Petroleum Gas is a major use of cooking in India. Liquefied Petroleum Gas is in the form of liquid which is fill in the cylinder. Multiple cases of injuries, household fire because of LPG leakage or explosion are recorded in India. India doesn't have gas leakage detection smart system. This system can also be used for other application in industries or factories that depend on liquefied Petroleum Gas and natural gas used. In this project we have used Nodemcu as a main control board. 5V DC/1Amp SMPS is used as a voltage source for control board, sensor module and other circuit. MQ6 gas sensor is used for detection of LPG gas leakage, this system indicates gas leakage through a buzzer when liquefied Petroleum Gas is detected through MQ6 sensor and it stops the liquefied Petroleum Gas supply from cylinder through solenoid valve. When liquefied Petroleum Gas leakage is identified by the system, then it sends the text message to the gas consumer and fire brigade to avoid any accident

Key Words: Arduino, Nodemcu, MQ6 sensor, LPG gas, ESP8266 WI-FI module

1. INTRODUCTION

LPG is Liquefied Petroleum Gas. It is a hydrocarbon gas produced from gas refineries with the major components of propane gas and butane gas. At atmospheric pressure, LPG is in a gaseous form, but for ease of distribution, LPG is converted to a liquid phase by applying pressure and is distributed in tubes or tanks. Liquefied Petroleum Gas is a major use of cooking in India. In case of LPG gas leakage in the kitchen, it will be very dangerous because of the fact that LPG is heavier than air. If the air is 1 per unit weight of the LPG that means gas is 2 per unit weight. So, there is need to detect the gas leakage.

There are many incidences where people, while working in kitchens or working with LPG for some other purpose have met with an accident due to gas leakage and have suffered severe burns on their bodies. According to survey the

explosion is mostly caused by the leak in LPG carrying tube. Liquefied Petroleum Gas is used for needs such as automobile fuel, industrial fuel, and domestic fuel. The main purpose of this liquefied Petroleum Gas detection smart system is to provide safety from gas explosion.

2. PROPOSED METHODOLOGY

The figure 1 shows block diagram of Arduino based gas leakage detection. Each block is showing every step of working LPG gas leakage system. There is a MQ6 sensor which detects the leakage of LPG through its heater coil and send signal to Arduino board. The Arduino board first sends signal to the solenoid valve as well as to the Nodemcu, then the solenoid valve stops the supply of LPG through cylinder. At the same time, the Nodemcu sends a short message to the user that is store in its memory. The main purpose of using Nodemcu is because it has Wi-Fi module ESP 8266 which is important to the send message through smart system to user. In this process Nodemcu also sends signal to the fan and buzzer. First buzzer starts ringing and then the fan starts to take gas out so as to avoid explosion.

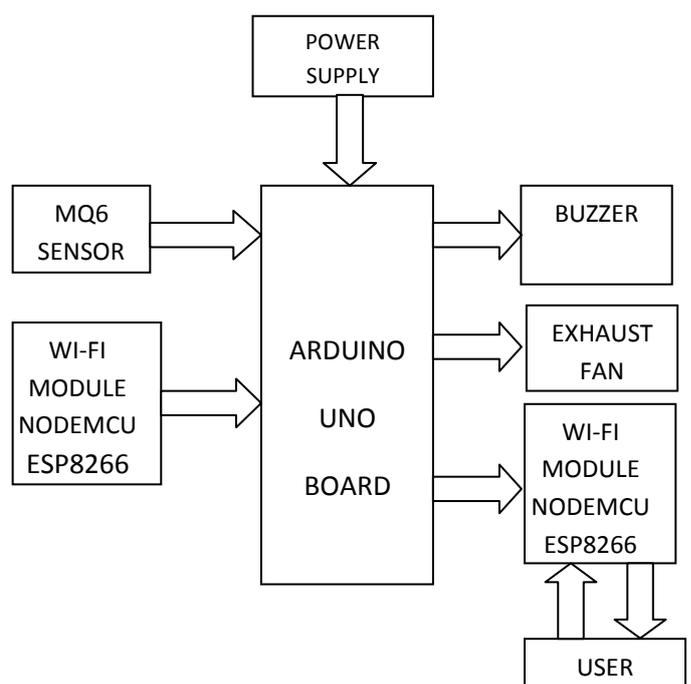


Fig.1 Block diagram of gas leakage detection

output to an ADC and the heater coil with the voltage of 5. Figure 3 shows MQ6 Sensor,



Fig.3 MQ6 Sensor

The MQ-6 module is the module which is used in gas leakage detecting equipment in household equipment's and industry purpose. This system has high responsiveness to LPG, iso-butane, propane and LPG. It is also used for detecting for the presence of alcohol, cooking fumes and cigarette smoke. The system gives out the concentration of the gases present as an analog voltage equivalent to the concentration of the gases. The module also has an onboard comparator for comparing against an adjustable preset value and giving out a digital high or low. It can be easily interfaced with the Arduino or Raspberry Pi. MQ-6 gas is the sensor which has high sensitivity to Propane, Butane and LPG and Natural gas. This type of sensor could be used for detecting variety of combustible gas, especially Methane, as it is provided with low cost and suitable for different application.

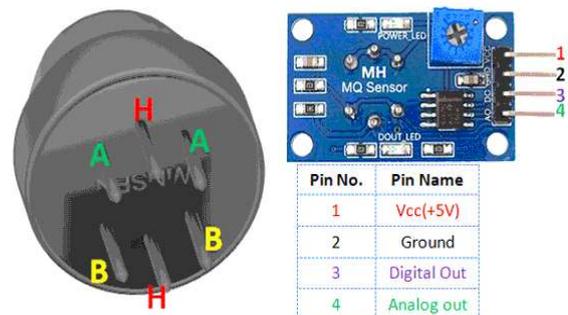


Fig.4 Pin Configuration

When there is a leakage of the LPG the MQ6 senses the leakage of LPG and generates buzzer at the source where the leakage of the gas is originated. This is a widely used sensor and it can be easily installed at the places where there is use of gases. There is a power supply that is SMPS which creates a 5V DC supply. MQ6 has 6 pins. In MQ6 it has material inside which gets hot at 5V and remains hot. The condition at which the buzzer starts is when the gas molecules reach between

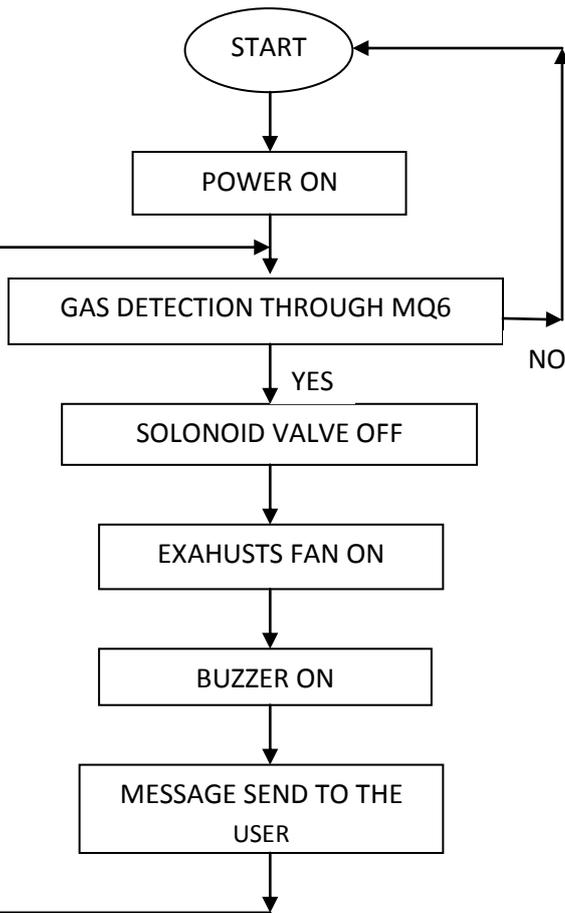


Fig.2 Flow diagram

The liquefied Petroleum Gas leakage detection smart system first detects the gas leakage using gas sensor and alert the user through sending message. The system also turns on the alarm and exhaust fans so that the leaked gas can be sent out. Large source of energy is hydrocarbon, mostly it is used in domestic and industrial application. Flammable hydrocarbons gas means liquefied Petroleum Gas which is mixture of propane and butane. LPG (liquefied Petroleum Gas) which is produce from refining of crude oil and gas. It is a source of energy electric power generator; domestic cooking industrial ovens and it serves as a fuel for vehicles. Some of the people cannot predict the low concentrated smell of the gas and so in these conditions we can have the system which can be essential and protective from the harmful accidents or incidents.

2.1 LPG GAS DETECTION SENSOR MQ6

The MQ6 sensor can detect the concentrations of gas between 200ppm to 10000ppm. This sensor has very quick response as well as it has a high sensitivity. The output given by the system is an analog resistance. The required elements for the system are load resistance, and connection of the

100ppm to 1000ppm the output turns on and activate the buzzer. There are two types of gas detectors namely portable and fixed gas detectors. The portable gas detector is used in the surroundings of human beings. While fixed gas detector is used in places like hospitals, factories and etc.

2.2 ARDUINO UNO BOARD

We use Arduino UNO board as a main board in LPG gas leakage smart system. The figure 5 shows the simulation of LPG gas leakage detection smart system. In this system main board used is Arduino UNO. It connects to the display and sensor and also Nodemcu to send the data or short message to the user. Main program is saving in Arduino. Arduino has flash memory up to 32kb (0.5 kb is used for Bootloader) and also SRAM up to 2KB and EEPROM 1KB. Arduino has clock speed up to 16 MHz which is comfortable to this application. Digital input/output pins are 14 (out of which 6 provide PWM output). Analog input pin is 6 (A0-A5). Microcontroller is used in Arduino is ATmega328P-8bit family microcontroller. Operating voltage of Arduino is 5V. Recommended input voltage is 7 to 12V. Input voltage limit is 6V to 12v. DC current on input/output pins 40 mA. DC current on 3.3V pin 50 mA.

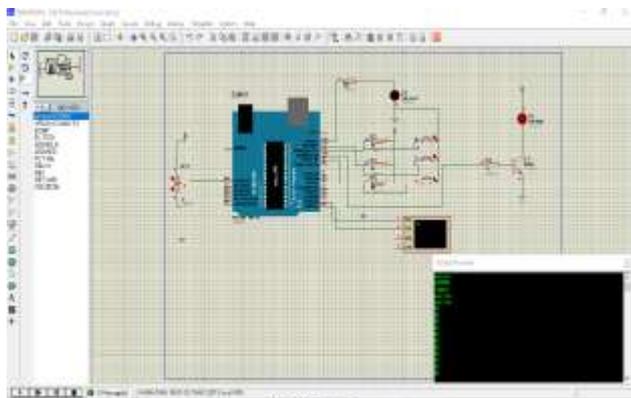


Fig.5:Simulation

Fig.5 Simulation of LPG gas leakage detection smart system

Arduino UNO also consists other components such as crystal oscillator, serial communication and voltage regulator etc. to support the microcontroller. The program is writing on Arduino programming app/software. The whole program is saved in its memory which is already on board. Program is all about gas detection first we check the gas is present in the air or not then gas LPG is not present then check again if LPG gas is present then switch ON the buzzer and also switch ON fan speed and send message to the owner or user of that area and stop the flow of gas through the solenoid valve immediately.

2.3 NODEMCU ESP 8266 DEVELOPMENT BOARD

Nodemcu is mainly development board which consists of Wi-Fi module (ESP8266). This module shares data through Wi-Fi like short message to user of LPG gas detection smart system.



Fig.6 NODEMCU ESP 8266 Development Board

Nodemcu has another program for sending a short message to saved phone number. If LPG gas is detected through MQ6 sensor and it send signal to microcontroller and it send signal to Nodemcu and next main process is done by Nodemcu to send short message to user. The program to send message is store in its memory.



Fig.7 Wi-Fi Module

Nodemcu has memory 128Kbytes and storage is 4Mbytes. Power is provided through USB micro USB port. Input Power voltage is 3V or 5V used with 3.3V Regulator which inbuilt on board using pin VIN. Developer of this board is ESP8266 Open Source Community. Operating system is used in Nodemcu is XTOS. CPU is ESP8266. The main purpose of the board is to communicate with user or send message to it immediately.

3. APPLICATION OF SMART LEAKAGE SYSTEM

a) INDUSTRIAL COMBUSTIBLE GAS DETECTOR

In industry there are many situations where working is done related to the various gas and there is no any gas leakage detection system then if any danger situation or explosion happened and cause many deaths. To avoid it, this system is very useful.

b) IN HOUSE GAS LEAKGE SMART SYSTEM

All most all Indians use LPG Gas for cooking. So it is very important to use smart leakage detect system to avoid explosion or any bad situation if any human who lives in that house forgots to turn off gas cylinder or if any type of incident are happened then this system helps the user to avoid all bad situations.

c) IT IS MOSTLY APPLICABLE IN THE LPG STORAGE AREAS

In the gas store it is very essential to avoid big explosions in that area and also to avoid wastage of gas if there is any small leakage it well help to detect it and to avoid leakage and wastage of non-renewable sources.

4. RESULT

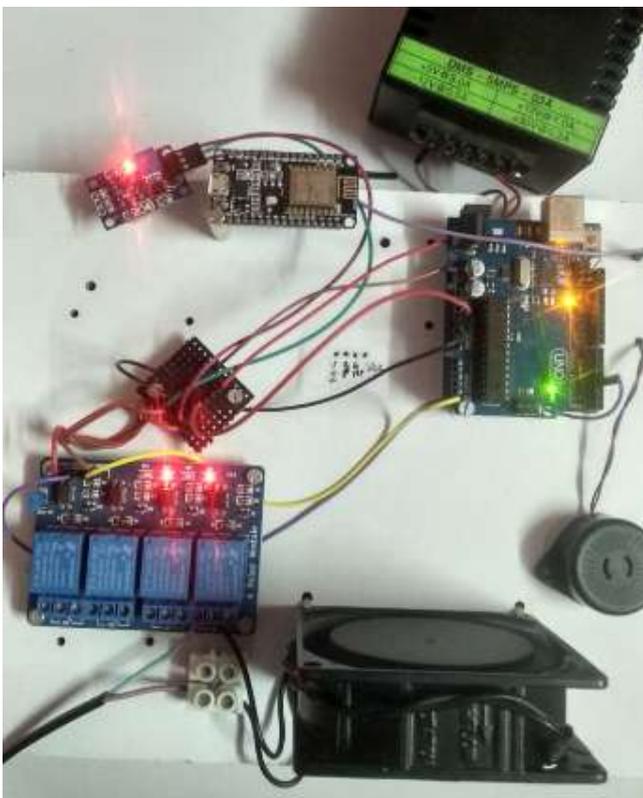


Fig. 8 Complete Prototype

The Figure 8 shows complete prototype used for the LPG gas detection. First it detects the gas leakage using MQ6 gas sensor through its heater coil, and sends signal to Arduino board .The Arduino board first send signal to the solenoid valve as well as to the Nodemcu, then the solenoid valve stops the supply of LPG through cylinder. At the same time, the Nodemcu sends a short message to the user that is store in its memory. Nodemcu also sends signal to the fan and buzzer. First buzzer starts ringing and then the fan starts to take gas out so as to avoid explosion.

5. CONCLUSION

In this project we learnt that how LPG gas leakage smart system is important to avoid bad situation or explosion in our country. The main reason of this project is safety. In our country it is important to use this system to improve security. Gas leakage leads to severe accident resulting in material losses and human injuries. Gas leakage occurs mainly due to poor maintenance of equipment and inadequate awareness of the people. Hence, LPG leakage detection is essential to prevent accidents and save human lives.

6. REFERENCES

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