A FUSION OF IoT BASED GAS LEAKAGE DETECTION

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Abstract - *The objective of this project is to detect the gas leakage through the utilization of IoT technique. Gas leakage is a major problem in the industrial sector, residential premises, etc. Nowadays, home security has become a major issue because of increasing gas leakage. One of the preventive methods to stop accidents associated with the gas leakage is to install a gas leakage detection kit at vulnerable places. The aim of this paper is to propose and discuss a design of a gas leakage detection system that can automatically detect the leakage of gas with the help of MQ-2 sensor and alert the user through buzzer and message. This proposed system also includes some preventive measures like opening the ventilation with the help of servo motor and shutting down of the power using relays.*

***Key Words*: IoT, MQ-2 Sensor, Servo Motor, Relays, Node MCU**

1. INTRODUCTION

All around the world and in our country, gas is the most effective, efficient, environment-friendly fossil fuel for cooking and heating in our homes, restaurants, and many other institutions. And they are known as natural gas and liquefied petroleum gas (LPG). Both of them are the novel compositions of hydrocarbon gases. And those mixtures of hydrocarbons are so much flammable, and any mishap of those hydrocarbons is so much perilous. These two types of gases can be detected by using the gas sensor MQ2 or MQ4.In our country, most people in big cities use natural gas for their cooking purpose. People from rural areas use LPG for their household cooking. .Gas leakage leads to various accidents resulting in both material loss and human injuries. The number of deaths due to explosion of gas cylinders has been increasing in recent years.The reason for such explosion is due to substandard cylinders, old valves, worn out regulators and lack of awareness in handling gas cylinders. There are numerous answers for fireplace accidents that agencies continually endorse. Smoke detectors , hearth alarms,hearth extinguishers and sprinklers are example of those gadgets. Liquefied petroleum fuel is constituent of butane and propane gases, which can be distinctly inflammable is nature. The LPG is an odourless gasoline and hence the addition Ethanethiol allows it to show case a smell throughout its leakage. An ideal gasoline sensor may be used to feel the leakage of an LPG from cars, industries ,homes and different residential regions. If there is a leakage of LPG, we will effortlessly perceive by using its concentration through the heating and cooking . As a result a protection primarily based LPG detection system is crucial to provide alertness, protection and protection from any harmful fuel leakage injuries. . The preventive measures to avoid explosion is also taken like opening the windows and shutting down of the power.

2. RELATED WORKS

Hilton Paul, Mohammad Khalid Saifullah, Md. Monirul Kabir proposed a project which aims to help LPG user by notifying on any unnoticed gas emission or leakage accident through alarming them as well as creating opportunities for them to take critical and immediate actions; it will immediately turn on a ventilation system for the leaked gas to pass out. The system includes a GSM module, which makes the user or owner of the place observant by sending a text message on their phones[1].Athish Subramanian, Naveen Selvam, Rajkumar S, R Mahalakshmi , J Ramprabhakar are the authors who discussed about the gas leakage detection system using Iot with Integrated notifications using pushbullet.In this article, Gas leakage detection system usingMQ5 gas sensor and arduino uno controller is incorporated with a cloud storage for data collection and also used for storing and analyzing data. Gas leaked is converted from Parts Per Million (PPM) to volts through the arduino IDE and results in notifying the user when the threshold limit is crossed,through the internet and also through a buzzer /LED for physical notification[2].Md. Rakibul Islam, Abdul Matin, Md. Saifullah Siddiquee discussed a Real-time gas leakage detection and LoRa wireless communication technology- based notification system are accompanied by the multistage safety features in the kitchen as well as in the house have been inaugurated in this paper. The buzzer were activated, thereupon a GPS sensor identified the geographical position of the affected area, and LoRa client stored the measured data to Ubidots IoT platform, afterword data was sent to the user and police station, and eventually, the main power circuit at home was tripped off, and the exhaust fan was activated for avoiding further accidents[3].Gautami G. Shingan, S.V.Sambhare are the authors who discussed about the Smart gas cylinders.In this project it also detects the leakage of gas from LPG cylinder using gas sensor which is very sensitive to detect presence of LPG (composed of mostly butane and propane)[4].Junaidy B. Sanger, Lanny Sitanayah, Vivie

D.Kumenap are the authors who discussed about the paper, develop a wireless system to detect cigarette smoke, especially each gas component in it.This system utilises Arduino microcontroller and several sensors, including MQ-135 , MQ-2 , MQ-7 and MQ- 9 to sense and collect data, which will be transmitted wirelessly to Raspberry Pi & using an ESP8266 ESP-01 Wi- Fi module . Then develop three programs: an Arduino program, a Python program for Raspberry Pi,and a Hypertext Preprocessor (PHP) program for the web server[5].

3. METHODOLOGY

The system is divided into three parts which are the sensing unit, control unit, and output actuator. For the sensing unit, MQ- 2sensor is used. For the control unit, the main controller that controls the operation of the system is the NodeMCU while the smartphone or laptop is used as a user interface which displays the gas leakage level ,temperature and humidity in the room, presence of human (output actuator). There are two fire preventing devices installed in this system which are servo motor which is used for opening the ventilation, relays which are used for power off.

The system operation will start with initialization of its functions. The MQ-2 sensor will take some time to self-calibrate to get precise data of gas concentration. In the initial stage if the gas level reaches the threshold of 400 to 500 then the buzzergets on and notifies the user. If the gas level reaches between 500-600 message alert is send to the user. If the level reaches between 600 to 700 then the ventilation will be open with the assitance of servo motor. And finally when the threshold reaches above 700 the power will off with the help of relays switch.

The MQ-2 sensor will detect the presence of gas by using the analog I/O pin. When gas is detected, the analog I/O pin will send a (High) signal to NodeMCU and then the NodeMCU will send the signal to the IoT platform where the IoT platform will trigger a notification to the IoT application on the user's smartphone or laptop. In a normal condition, the analof I/O pin will send a (Low) signal to the NodeMCU which indicates there is no presence of gas. The analog I/O pin of the sensor will send data to the NodeMCU in the form of voltage and the voltage additional information.

4. PROCEDURE

4.1 Ardunio UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, ora Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

4.2 Node MCU

Node MCU is used as an interface between the arduino and the cloud. It is used as a path for storing the data in the cloud from arduino.It is an open source platform which can connect objects and let data transfer using the Wi-Fi protocol.

4.3 MQ2 Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as methane, butane, LPG, smoke. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.

4.4 Humidity and Temperature sensor

Humidity and temperature measurements with DHT11 sensor. The DHT11 sensor which provides calibrated digital outputs for temperature and humidity. The DHT11 sensor uses a proprietary 1-wire protocol which we will be exploring here and implementing with the PIC16F628A microcontroller that will receive the temperature and humidity values from the sensor and display them on a 16×2 character LCD.

4.5 PIR sensor

Passive infrared (PIR) sensors use a pair of pyroelectric sensors to detect heat energy in the surrounding environment. These two sensors sit beside each other, and when the signal differential between the two sensors changes (if a person enters the room, for example), the sensor will engage. That may mean it triggers an alarm or notifies authority.

4.6 Servo Motor

A Servo Motor is a small device that has an output shaft. This shaft can be positioned to specific angular positionsby sending the servo a coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft. If the coded signal changes, the angular position of the shaft changes.

4.7 Relays

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms such as make contacts and break contacts.
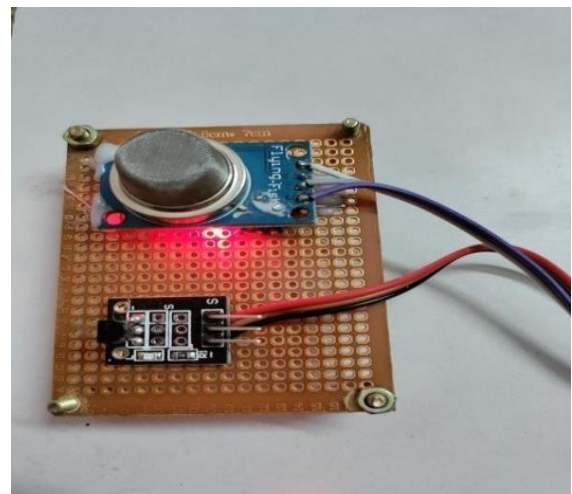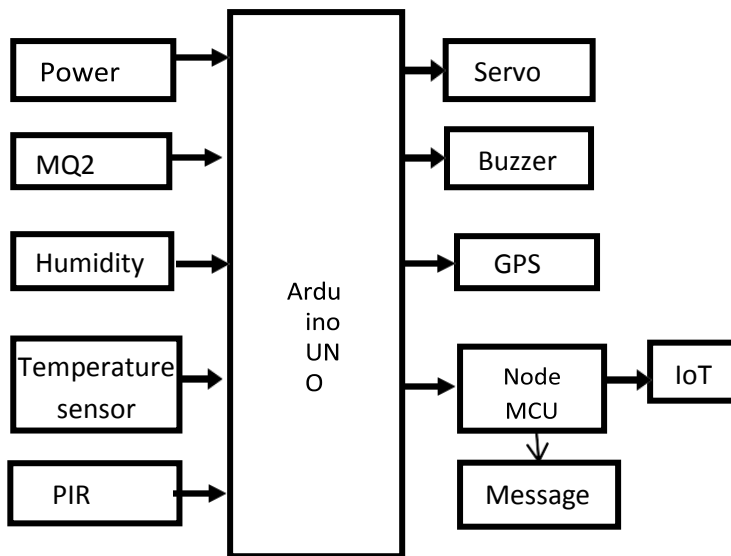
5. BLOCK DIAGRAM

- The first part of this project is to design alarm circuit to be equipped in the prototype. Whenever the presence of gas leakage is detected by the receiver circuit, signals will be sent to the relay circuit. The alarm system will automatically triggered to warn users of the leakage.

- Next after the first part, the second part would be the design of the circuit of emergency shutdown valve circuit. The Servo Motor will Open the Windows the source of gas automatically leakage go out of the room occurs to avoid severe consequence from this incident.
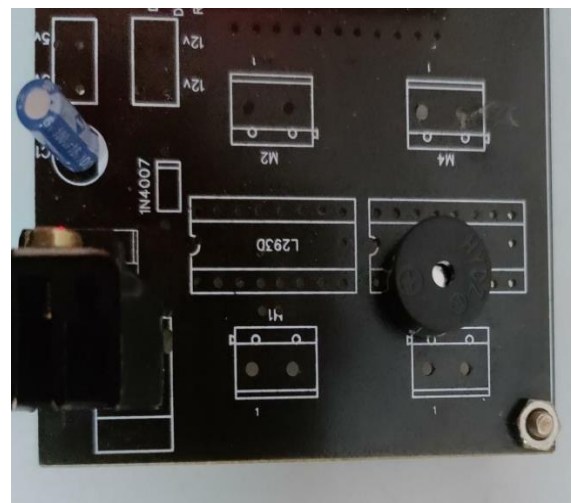
6. WORKING

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. Second step is make to

sending message to user .Additionally If there is a continous leakage, then the windows will be opened using servo motor moreover power will be shut down in the next level using relay.

7. IMPLEMENTATION

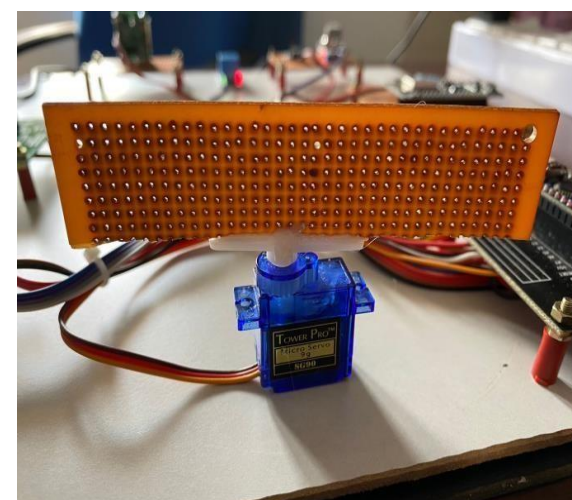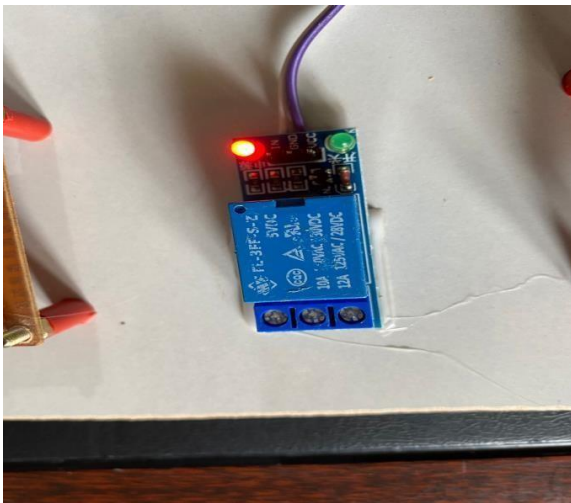The implemented part of the gas detection shown below:

FIG-1 MQ-2 GAS AND TEMPERATURE SENSOR

FIC-2 BUZZER

FIG-3 SERVO MOTOR
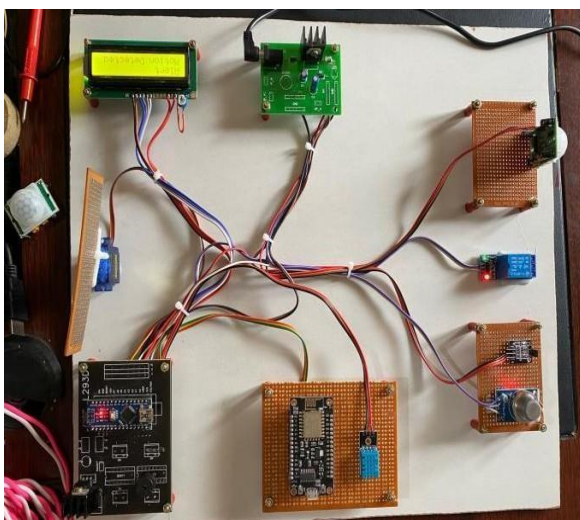
FIG-4 RELAY

FIG-5 LCD DISPLAY

FIG-5 FULL WORKING SYSTEM

a) Sensor MQ-2 is used to sense the gas or smoke present in the placed atmosphere.

b) When the gas reaches its threshold value buzzerbe activated to produce the alert sound.

c) If the gas leakage occurred in constant amount, windows/ doors in the incident spot will be automatically opened using servomotor to avoid increasing pressure in closed room.

d) The power supply will be cutoff using relay mechanism hence there will be no chance to produce spark and it will avoid firing in theleakage area.

8. DISCUSSION

In this model, we have discussed only about the indication of gas leakage . This is just the beginning era for the technology. In this era, itself it has reached the peak of its' level and also further being developed. Later on, we just like to enhance this project by adding some specific features such as not only the indicating leakage but also opening of the door, switching off of the electricity. We would like to work on this so that it may helpful for us to learn more about prevention of flameable gas leakage.

9. CONCLUSION

In recent households, the use of LPG is taking a big troll. From the use of cylinder up to the use of petroleum pipelines. The biggest threat in using this technology is security and our project will prove to be boom for households and industries. This work has presented a methodology for gas leak detection in environment using the current technology. This system is not expensive and can be installed on every vehicle easily.

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