LPG Gas Leakage Detection And Prevention Using NodeMCU, MQ-6 Sensor

Mrs Hemalatha K N[1], Pallavi S[2]
[1]Assistant Professor, Dept of Computer Science & Engineering
[2]Dept of Computer Science & Engineering
[1, 2] Atria Institute of Technology, Bangalore

Abstract- *Now a day's home security has been a major issue because of increased gas leakage. LPG Gas leakage is a great anxiety with residential areas and vehicles like CNG, buses, cars which is run by gaspower. One way to stop accidents linked with the gas leakage is to fixLPG gas leakage detection device at adequate places. The Project is aimed at developing the security of home against the unexpected incident of LPG gas leakage.In particular,MQ-6 gas sensor has been used which has high sensitivity to LPG gas detects that used in our premises. The system works perfectly as the topic suggests. This research will help in thedetection oft gas leakage and impede any accident that would occur if such a system was not present. In the paper, a system has been proposed which lessens the chances of accidents and ensure safety by the virtue of existing electronics and technology.*

Keywords- MQ-6 Gas sensor, Internet of Things (IoT),Node MCU, LCD (Liquid crystal display), Wi-Fi module.

I. INTRODUCTION

Embedded systems described as, 'a computer system with a dedicated function within a larger mechanical and electrical systems, often with real-time constraint, are being employed to detect the excess of gas in the marked environment.

This gas detection and alert system will not only alert us of the leakage but will also mechanically turn off the knob of the gas cylinder to seize any leakage of gas. Moreover, this system informs the concerned person by emailing and dropping a message on their mobile. This gives a larger degree of safety to any gas setup in any circumstances.

Nowadays, as the lives of people have to fasten, their attention has got divided into multiple areas, in such a case people might forget to take all the necessary measures while cooking and leave the burner on or the knob of the regulator lose, which could be dangerous. For any flammable substance to be present in the site and coming in contact with the gas can cause a blast, asset loss, life loss, resource wastage and the list only adds.

In this paper, we focus on gas leakage detection in which gas sensors are used for detection of leakage and also providing an alert to users by SMS using GSM with that of the turning off option using android application.

II. LITERATURE SURVEY

A. Design and Implementation of Gas Leakage Monitoring and Detection Alarm System using Arudino module

Gas leakage detection system is commonly used in home, commercial and industrial sectors and high raised buildings also. In this system, we have described a new approach for gas leakage detection system at a very low concentration. The leakage detects with the help of gas sensors. It also sends notification display the message on the monitor to the users which can alert the users that there is gas leakage in the floor.

B. LPG Leakage Control Using SIM800L with MQ-2 Sensor and Stepper Motor Based on Arudino UNO

The design of the LPG leakage control using SIM800L With MQ-2 sensor based on Arduino UNO is done for finding the result of measurement in the form of changes of output value detected by MQ-2 sensor.From the research result of LPG leakage detection control using SMS through SIM800L with MQ-2 sensor and stepper motor based on Arduino UNO.

C. Gas Leakage Detection and Prevention Kit

A gas leakage system has been designed whereby application of embedded systems and involvement of Internet of things (IoT) in it, a system is obtained that enables us to notify the concerned person. In the paper, a system has been proposed which lessen the chances of accidents and ensure safety by the virtue of existing electronics and technology.
Here IOT is limited to emailing and messaging nevertheless an app can be developed featuring many more viable services.

D. Automatic LPG Cylinder Booking and Leakage Detection using Arduino UNO

In automatic gas cylinder booking we continuously measure the amount of gas present in the cylinder using load cell which is interfaced with Arduino UNO and displaying weight of cylinder on LCD display. When gas level goes below the set level then message will be send to the gas agency and notification about same is given to the user using GSM module. So, user get cylinder within time.

In gas leakage detection process, any gas leakage is checked by gas sensor (MQ-6) which is interfaced with Arduino UNO. When leakage is detected BO (battery operated) motor will be immediately turn off the gas regulator-switch at the same time it informs the user about the gas leakage by sending the SMS, turning on the buzzer and also displaying message on LCD.

III. EXISTING METHODOLOGY

The result of Existing System is determined by using a lighter to collect leaked gas around the gas sensor after sensing procedure if sensor value is greater than the threshold value then micro-controller will perform its programmed tasks:

1. Immediately turn off the regulator knob to stop the further leakage
2. Within 2-4sec the relay will cut off the main power supply.
3. Buzzer starts beeping and a message is displayed on LCD to alert the users and nearby people.
4. Wi-Fi module will send SMS/E-mail using the cloud to the users.
5. The exhaust fan will turn out all enclosed gas from the environment. When reset button of MCU pressed the system will get refreshed.

IV. LIMITATIONS OF EXISTING SYSTEM

1. 1.Automatic Knob off like dripping system in main boards.
2. 2.If buzzer starts beeping suddenly, there could a scenario of panic among the old people and even small kids at house for a sudden sound could create a lot more issues like unconsciousness ,heart attacks etc. This is one of the disadvantage of the existing system.
3. WiFi module can send SMS/Email etc but if no one present at home and then the receiver getting the message is of waste. Hence this would again be the disadvantage of the existing system.

V. PROPOSED METHODOLOGY

The result of Propose System is determined by using a lighter to collect leaked gas around the gas sensor after sensing procedure if sensor value is greater than the threshold value, then will perform its programmed tasks:

1. A message is displayed on LCD with Voice message to alert the users and nearby people.
2. Wi-Fi module will send SMS/E-mail using the cloud,firebase etc in which the user who receives the message can turn off the knob switch control by android app whereever he is.
3. This system, as its 50% profile of work is meant to alert the user, even the dumb can identify the leakage as the LCD(prototype) screen turns ON with the voice message and begin to flash a message with voice and display 'Gas detected Alert ON'.
4. In case of absence of any mobile lives in the premises of gas leakage or the presence of any paralyzed or movement disabled handicapped, the feature of Auotmatic knob OFF switch is of great service.
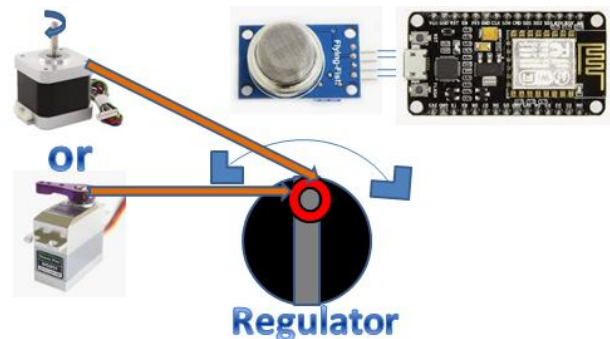

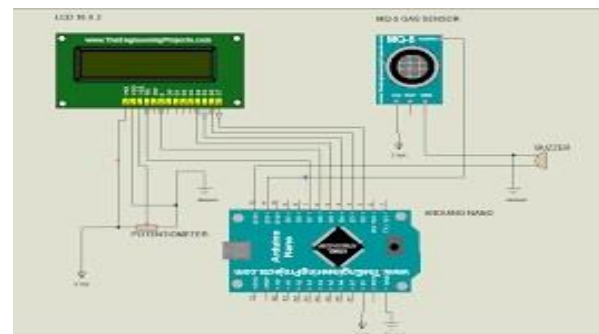Fig 1: Proposed Methodology Design

VI. SYSTEM ARCHITECTURE

Fig 2: System Architecture Design

This system is combination of both hardware components and software components. Google cloud service namely Firebase is used along with the setup for storage and retrieval of data.

a) Software used – Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to the Arduino compatible boards, but also, with the help of third party cores, other vendor development boards. We make use of WiFiManager module and firebase module for our system.

Firebase module enables NodeMCU to communicate with google cloud firebase and utilize its services. It ensures secured communication of data over the internet since Asymmetric encryption method is followed. The data to be sent is encrypted at client side before transmission using its encryption mechanism making using of unique client id or key. Data transmission is fast and well secured.The data stored at cloud is encrypted again using google's own security mechanism.

WiFi Manager ensures reliable network connectivity to wireless network. When the setup is installed for the first time, the board activates access point mode, connecting to which leads us to a captive portal via L4 redirection on a mobile or pc connected to same Access Point (AP). The captive portal should be password protected for enhanced security. In the captive portal, one or more WiFi credentials can be added to which user might want to connect in future. Once done, the board changes its state to default mode attempting to connect to WiFi. If a WiFi is down, it will automatically attempt to connect to other WiFi station using credentials fed via captive portal.The credentials entered is not hard coded onto the board via software code, instead it gets stored in RAM and firmware which isn't accessible to users.

This ensures reliable and secured connectivity to the internet.

b) Cloud services Used: Firebase

Firebase is a Backend-as-a-Service (BaaS) app development platform which provides hosted backend services such as a realtime database, cloud storage, authentication, crash reporting, machine learning, remote configuration, and hosting for your static files.Database is stored under the format of JSON and is to synchronized with clients in realtime. Firebase uses NoSQL type for its database that removes the constraints when interacting with tables, fields. This helps user to freely create and decorate database. It provides numerous features such as user authentication.

The sensor readings captured from the sensors (ultrasonic sensor, gas sensor, temperature sensor etc) by

NodeMCU are sent to firebase. The mobile or desktop web applications can fetch the data from the cloud after user authentication check and it can be shown to the end users for monitoring. The user can send appropriate control signal as when required which gets stored in firebase directly. The control commands are read by IoT board and changes can be reflected by sending required control signals to the sensors or devices attached to it.
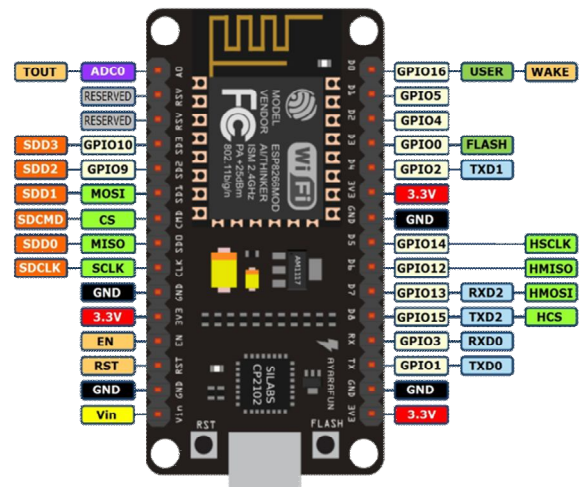
c) Hardware Used

1) Board: NodeMCU

Fig 3: NODEMCU

NodeMCU is an open-source firmware and development kit which helps you to build a prototype or build IoT product. It includes firmware which runs on the ESP8266 WiFi SoC from the espressif Systems, and hardware which is based on the ESP-12 modules. The firmware uses the Lua scripting language. The sensors are attached to its own pin. Analog and digital sensors are attached to analog and digital pins respectively. The board can be programmed using software Arduino IDE in C/C++ to control pins. Data can be written to or read from the pins.

2. Sensor Used:MQ -6 gas sensor

Sensitive material of MQ-6 gas sensor, which with the lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is found more higher along with the gas concentration rising. We use the simple electrocircuit to Convert change of conductivity which corresponds output signal of gas concentration. MQ-6 gas sensor has high sensitity to LPG, Propane and Hydrogen, also could be very much used to Methane and other combustible steam, it is with low cost and suitable for each different application.

Fig 2: MQ-6 Gas Sensor

3.Motor Used:Stepper Motor

Stepper motors are the DC motors that moved in discrete steps. They have multiple coils that are organized in many groups called "phases". Byenergizing each phase in the sequence, the motor will rotate, one step at a eachtime. With a computer controlled stepping you can achieve very much precise positioning and/or speed control.
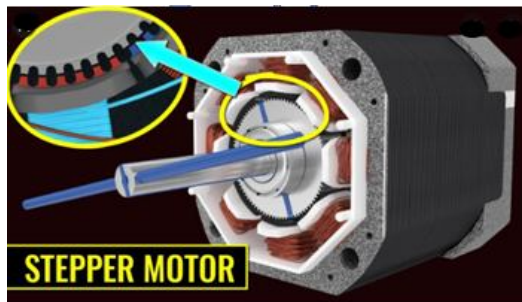

Fig 3: Stepper Motor

VII. CONCLUSION

This paper relates to a system for detecting Liquid Petroleum Gas and automatically shutting off the source of the liquid and/or gas leak. More particularly, this mechanism pertains to a system for electronically detecting harmful gas leaks, by electronically transmitting an alarm signalling such gas leak on the dispay and electronically receiving the alarm through a buzzer, also activating a mechanism which shuts off the regulator thereby stopping the gas leak.

VIII. FUTURE ENHANCEMENT

The network reliability can be improvised by providing provision to connect to internet via ethernet as well. More sensors can be implemented and integrated to get further beneficial information out of the system and its environment. Local storage of data can be maintained for buffering the data from the sensors temporarily in case of network failure. By creating a large database of sensorsindividual gas detections can be carried out in factories.

This system can also be used in vehicles where vehicles run on LPG or by choosing another sensor we can also use to detect CNG gas .

REFERENCES

[1] Brown, Eric (13 September 2016)."Who Needs the Internet of Things?".Linux.com. Retrieved 23 October 2016.

[2] Brown, Eric (20 September 2016)."21 Open Source Projects for IoT". Linux.com. Retrieved 23 October 2016.

[3] "Internet of Things Global Standards Initiative".ITU. Retrieved 26 June 2015

[4] Gayathri S Nair, Anandhakrishnan S, Deepesh Nair, Rakesh K, Sampath K, -"IOT Based Smart Gas Monitoring System" e-ISSN: 2278-1676,p-ISSN: 2320-3331, PP 8287, (IOSR-JEEE).

[5] Ashish Shrivastava, RatneshPrabhaker, Rajeev Kumar and Rahul Verma, GSM-based gas leakage GSM detection system, www.ijtra.com, International Journal of Technical Research and Applicationse-ISSN: 2320-8163, 2016.

[6] Prof.M.Amsaveni, A.Anurupa, R.S.AnuPreetha, C.Malarvizhi, M.Gunasekaran, GSM-based LPG leakage detection and controlling system, The International Journal Of Engineering And Science (IJES) ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805, March 2015.

[7] A Review of Microcontroller based LPG Gas Leakage Detector, Vasudev Yadav, Akhilesh Shukla, Sofiya Bandra, Vipin Kumar, Ubais Ansari, Suraj KhannaJournal of VLSI Design and Signal Processing Volume 2 Issue 3 2016.

[8] Zhao Yang, Mingliang Liu, Min Shao, Yingjie Ji Research on leakage detection and analysis of leakage Point in the gas pipeline system. In OpenJournal of Safety Science and Technology; 2016.

[9] S Shyamaladevi, V G Rajaramya, P Rajasekar, P Sebastian Ashok. ARM7 based automated high performance System for LPG refill booking & Leakage detection. 2017.