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Intelligent Gas Leakage Detection System with IoT Using ESP 8266 Module

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ABSTRACT: Recent trend is the development of Smart homes all around the world. Home automation has become very affordable and many people, industries has started to automate daily routines like light, fans, setting the temperature, etc.. The main objective of the project is to build a Gas leakage detector using LPG gas sensor and also connect it with IoT using ESP module for safety and security. Arduino is used as the main controller. The final output of the project is used to detect leakage if gas from cylinders and also notify the user by connecting via IoT software.

KEYWORDS: Arduino, ESP Module, Internet of things (IoT), LPG, MQ5 sensor, Thingspeak, Thingtweet.

I. INTRODUCTION

It has become important factor nowadays to bring the technology into our home and office. By making the place smart, the day-to-day activities are becoming more and easier. The development of home automation has become mandatory in homes as people are moving towards to the smart home concepts. With the help of assistant systems like 'Okay Google', 'Alexa' and 'SIRI', the normal routine activities like turning ON the light can be implemented with just a single voice command. With these comforts flowing into a person's life, it has become essential to protect it from damages and accidents. This is where 'Internet of things (IoT)' comes into picture. As only the regular works has become smart, the things used are still the same like Gas cylinder in homes. According to the reports, over 1500 LPG accidents happen in India every day. This is equivalent to the death of 1500 people including the children. Even the neighbourhood is affected in a single accident. So there comes the need to bring in technology to prevent accidents. IoT is a fast-growing technology in Industries, Cars. IoT is basis for Industry 4.0 development

The primary objective of the project is to detect the gas leakage of LPG cylinders, which are commonly used in Indian homes, and alarm the user and the surrounding neighbourhood using IoT. The supply gas will also be stopped with the use of solenoid, ultimately preventing the chance of accident. Open source IoT software called "**Thingspeak**" is used for this project. The software has feature to connect with Arduino and can also connect the user's mobile and social media like twitter, to send notification. The people in the neighbourhood can also be included in case of an emergency. MQ5 LPG gas sensor is used for input. A 12V buzzer is connected along with the circuit to indicate the user offline.

II. LITERATURE SURVEY

Selvapriya C et al [1], this paper describes that using LPG gas sensor for sensing the leakage and produce the result in audio and visual formats also alerts human via Short Message Service (SMS). The sensor has excellent sensitivity combined with a quick requital time. The sensor has also sense iso-butane, propane and cigarette smoke. This paper provides design approach on both software and hardware.

AravindaBeliraya [2], this paper discusses about the design of gas leakage detector. To detect Gas Leakage (like LPG leak, Butane leak, Methane leak) or any such petroleum based gaseous substance that can be detected using MQ5 Sensor. Setup an SMS based Alert Mechanism and send 3 SMS (3 alert messages) to 2 specified mobile numbers (input



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inside the Arduino program). Produce a sound alarm upon gas leak and stop the alarm once gas leak is under control (gas presence in atmosphere is under normal range). Displays status in an LCD using a (16×2) LCD module.

Prof. K.R.Katole [3], this paper is based on a system which is used to detect various hazardous gases with the help of Arduino. This work changes the presently available systems that are set industrial areas and this system can also be used in houses and at work place. The primary aim of the work is to design Arduino based hazardous gas detecting system using gas sensors. The toxic gases like butane (also known as LPG), methane and carbon monoxide are sensed and displayed on the LCD display. The concentration of these will be shown in the form of percentage by LCD display.

T.Soundarya et al [4], this paper discusses the design of gas leakage safety device for LPG is highly inflammable and can burn even at some distance from the source of leakage. Most fire accidents are caused because of a poor-quality rubber tube or when the regulator is not turned off. The supply of gas from the regulator to the burner is on even after the regulator is switched off. By accident, if the knob is turned on results in the gas leaks. This paper deals with the detection, monitoring and control system of LPG leakage. Using relay DC motor the stove knob is automatically controlled. Along with safety measures the system has additional advantage of automatic rebooking of cylinder when the level of gas goes below the normal weight of cylinder.

Harsh Mehta et al [5], this paper deals with the IoT connection of any sensor to make a smart home. Temperature sensors will also detect the high and low temperatures which will identify the temperature and will notify it on device. The android application developed will allow user to manually switch ON and off the lights. This gives a huge advantage on the smart home system using IoT.

T.H.Mujawar et al [6], this paper proposed system to design a gas leakage detecting system with the help of an Arduino Nano microcontroller, gas sensor and a XBee . The sensor node will detect a minute concentration of the gas according to the voltage output of a sensor and also collects the gas leakage data thereby locating the specific area of the sensor node. XBee sends the data from gas sensor to the monitoring system that is displayed on LabVIEW GUI. A GSM module was as a communication tool between the microcontroller unit and mobile phone unit.

Onengiye M. Georgewill et al [7], this paper presents the design and implementation of SMS based Industrial/Homes Gas Leakage Monitoring and Detection Alarm System (SMS-GLMDAS). Gas leakage is a major concern at homes, offices, industries etc. Many homes and industries had fallen victims of inferno due to unknown Gas leakage at a hidden point. This is dangerous and requires high security to avoid life and property being destroyed. One of the preventive measures to avoid the danger associated with gas leakage is to install a gas leakage detector at vulnerable locations, hence SMS-GLMDAS is proposed. The system is designed to prevent loss/death to occur through gas leakages and hence remote safety of life and property. The system consists of hardware and software; all were designed, built, programmed, and integrated. The program codes written using Embedded C-language and system test carried out to ensure optimum performance. The time it takes the user to receive an SMS from the system control unit when Gas leakage is detected is also checked and tested for accuracy to ensure prompt delivery of the early warning message of the system.

Anitha A [8], this paper describes the importance of Internet of Things which is growing at a rapid rate as huge number of devices and objects are getting associated to the Internet. Home security is a very useful application of IoT and we are using it to create an inexpensive security system for homes as well as industrial use. The system will inform the owner about any unauthorized entry or whenever the door is opened by sending a notification to the user. After the user gets the notification, he can take the necessary actions. The security system will use a microcontroller known as Arduino Uno to interface between the components, a magnetic Reed sensor to monitor the status, a buzzer for sounding the alarm, and a Wi-Fi module, ESP8266 to connect and communicate using the Internet. The main advantages of such a system include the ease of setting up, lower costs and low maintenance.

Girish Yadav [9], this paper deals with the importance of Internet Of Things (IOT) is an upcoming technology that makes use of Internet to control/monitor physical devices connected to the Internet. To the Arduino, an ultrasonic sensor that detects the movement of a person is used in unison with a Piezo buzzer. An effort is being made to use a



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GSM module with the Arduino. This will be used to send and receive messages. A message would be sent to the authorised number whenever an unwanted movement is detected by the sensor. On detection of an unauthorised movement, first the buzzer starts sounds alarm at a particular tone and then the message is sent to the user/owner. In addition to this, an effort would be made to use a Wi-Fi module also. This Wi-Fi module is used to connect to the Internet in order to send and receive the data. The received data is projected onto a cloud based server dashboard to detect flow of intruder in the system. Lastly, a cloud storage system called pCloud.com is used to store the information, documentation and research related to this project.

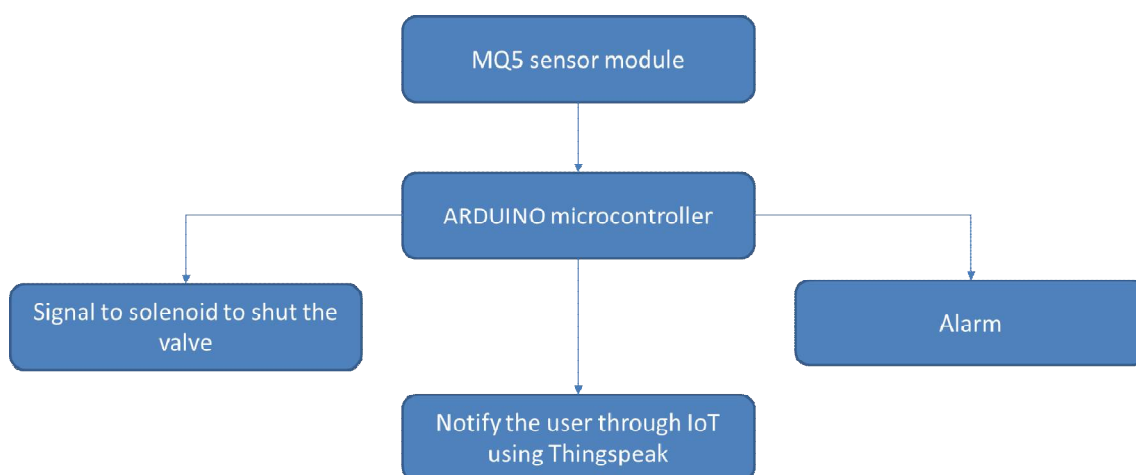
Abhishek Gupta [10], this proposed a system that is designed and implemented to meet the health and safety standards for the gas bank of Hotel Management Department of Dr.B.R.Ambedkar Institute of Technology, Port Blair, Andaman& Nicobar Islands. The proposed system is tested and the results are verified by producing an early warning signal under the less severe condition and activate a high pitched alarm during the leakage of LPG and provide a safeguard to the users.

Ganesh D et al [11], the proposed system in this paper uses the gas sensor which placed in the leak points, which senses the concentration value of toxic gases such as carbon mono-oxide and it imitates to the mobile device when the concentration value exceeds the normal value. The signal given to the PIC microcontroller which intimates the mobile device through zigbee communication module. This article proposes context-aware system architecture for leak point detection in the large scale petrochemical industry. This architecture is a new scheme for accurate leak point detection, which is more consistent with practical application in the large scale petrochemical industry.

Ashish Shrivastava et al[12], the proposed system in this journal is a GSM based Gas detection systems. The system was developed for propane and butane gases, and a GSM module is used to send messages to the user in case of leakage. The paper provides approach for both software and hardware.

III. FLOWCHART AND COMPONENTS

FLOWCHART:



COMPONENTS:

- 1) Arduino UNO Microcontroller.
- 2) MQ5 LPG Gas Sensor
- 3) ESP 8266 Module
- 4) Direction Control Valve
- 5) Thingspeak IoT software: Channel ID – 602069 ; Author - yuvakarathi

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IV. WORKING AND GRAPH

The ultimate aim of the project is to make a finished product of Gas leakage detection system for Household. With the advancement of internet in homes, the safety can be further increased with introduction of Internet of things. The product consists of outer wooden casing in shape of a box to carry the Arduino controller, solenoid, MQ4 sensor, ESP Wi-Fi module and a Buzzer.

The mouth of the sensor is placed right above the mouth of cylinder and the pipeline. A solenoid is placed such a way that whenever there is signal, it will close the pipe to stop the flow of gas. Arduino acts as brain of control. ESP module is used as the Wi-Fi module to connect Arduino with IoT. The Arduino signal is interfaced with IoT software called Thingspeak. The purpose of this software is to activate the online alert messages to the user. The working of Thingspeak is to create a flow chart the signals sent by Arduino and send alert messages as Twitter messages to user's account via an App developed by Thingspeak called "Thingtweet". In this way, many users including the neighborhood can be interfaced so that when there is problem everyone in surrounding gets to know and can act immediately. Apart from this, a 12V buzzer is connected with Arduino to indicate the user offline. The buzzer is set to a time limit. The product is cost efficient and can also be implemented in hotels.

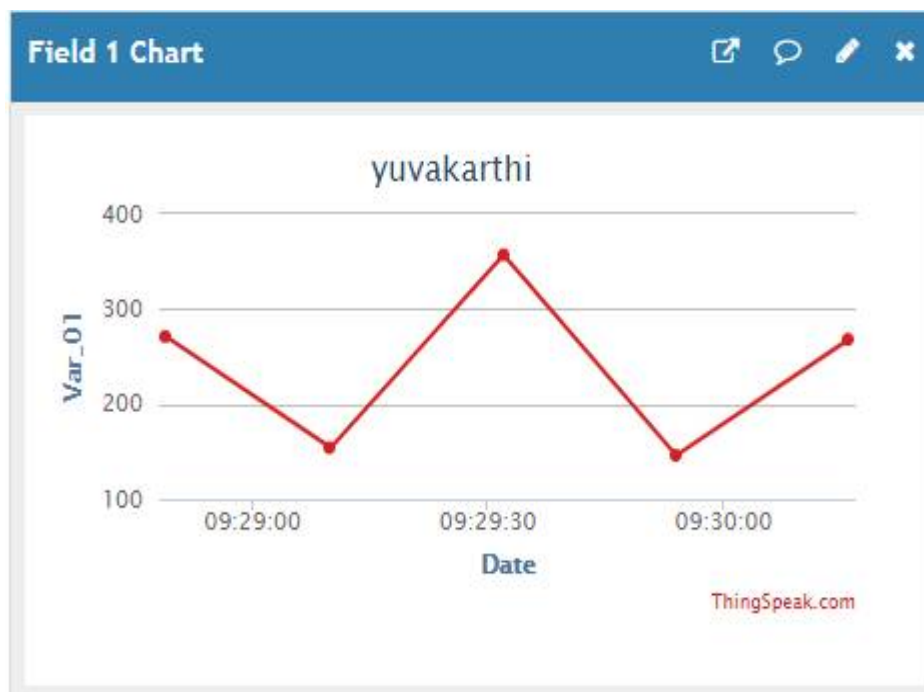


Fig.1 Time Chart for different gas input in Thingspeak

Var_01 indicates the amount of gas detected by the MQ5 sensor. The limit has been set to 300, so whenever the signal crosses 300, the input is sent to Arduino through which control goes to Solenoid valve and Buzzer. Simultaneously, the twitter alert message is sent to user's twitter account. This process happens very quickly and can prevent further leakage of gas. The twitter accounts of the neighbor can also be interfaced to indicate them in case of emergency.

V. CONCLUSION

This system provides a control action during gas leakage by closing the solenoid valve. And it activates the alarm and also sends alert messages to the users within a short time. It is an economical system which can be installed in apartments, hotels and wherever it is needed. The cost of the proposed system is lesser than the commercially available



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detectors in the market. It can help us to prevent from accidents in all directions. There are some products available which are similar to this gas leakage detector but those are not cost efficient and doesn't have any safety mechanisms. If this product becomes commercial, it will overcome all demerits of other similar products.

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