Gas Detection System using Arduino

Raeesa[1]
Dept. of IS&E
Yenepoya Institute of technology, Moodbidri
Mangalore, India

Navashree[2]
Dept. of IS&E
Yenepoya Institute of technology, Moodbidri
Mangalore, India

Relin Jane Mascarenhas[3]
Dept. of IS&E
Yenepoya Institute of technology, Moodbidri
Mangalore, India

Seema Jenitha Tauro[4]
Dept. of IS&E
Yenepoya Institute of technology, Moodbidri
Mangalore, India

Mrs. Deeksha K R[5]
Assistant Professor
Dept. of IS&E
Yenepoya Institute of technology, Moodbidri
Mangalore, India

Abstract— **The Internet of Things aims to automate the lives of the world by giving the direction with or without the human intervention which will automate the tasks which may be bigger or smaller that we encounter. Because the Internet of Things intends to simplify operations, it is also feasible to use its benefits to reinforce present security standards. The essential goal of every project, protection, has not gone ignored by IoT. In open or closed situations, gas leakage may be dangerous and lethal. While traditional gas detection systems are quite accurate, they are unaware of a few key aspects in the area of warning people of a leak. As a result, we've built the application for both industry and the society which will detect the leakage of gas and also monitor the gas availability. Alerting techniques that include sending text messages to the relevant authorities as well as the ability to analyze sensor reading data. Nowadays, gas leakage and detection are major concerns in our daily lives. Carbon pollution is a major issue that must be addressed. LPG gas is very flammable, posing a risk to both people and property. To avoid such catastrophes, a significant amount of effort has gone into developing reliable systems for detecting gas leaks. Some leak detection techniques were created to cause the leak to be discovered since it is not always essential to know about the presence of a leak in order to take corrective action. Our major objective is to recommend a gas detection equipment that includes gas leakage detecting hardware to households in the area. This can monitor and warn about harmful chemicals in the air at workplaces such as factories, and it may also be used in households by alerting through an LCD display and sending a message to a registered phone number.**

Keywords— LPG – Liquid Petroleum Gas, LCD – Liquid Crystal Display, GSM- Global System for Mobile Communications, MQ – 2 sensor, Arduino, IoT – Internet of Things

I. INTRODUCTION

The Internet of Things (IoT) is a technology where the things are embedded which is connected over the internet like software and the internet enabled sensors which is collecting the data in the cloud. The data can be retrieved when it is required. The data is retrieved for the requested data only where as other data will be stored in the cloud which is hidden.

Seamless connection between people, processes, and things is now feasible because to the capacity to link common goods such as kitchen appliances, automobiles, thermostats, and baby monitors to the internet via embedded devices. Physical objects may trade and capture each other. The characteristic of the IoT are connectivity which is internet connectivity over the hardware to the system controls; things which is any object which is connected over the internet; data which is collected from the sensors or any electronic devices; communication which the device is communicating with the data and analyze the data generated; intelligence which is based on the analysis of the data and the responding capability for the generated data for further process; action which linked to the intelligence where the manual actions may or may not be required ; and lastly, ecosystem which is important characteristics where the system or application should be designed based on the effective results in environment where there is harm from the application.

The gas detection

Operators in the area where the leak is occurring can be alerted by a gas detector, giving them the chance to evacuate. Because many gases may be hazardous to biological life, such as people or animals, this sort of equipment is essential. Increased levels of these gases in the atmosphere will be highly hazardous. These gases may be combustible at particular temperatures and humidity levels, toxic once they exceed the required limits, or a contributing element in an area's air quality, creating issues like smog and impaired visibility, which can lead to significant injuries and even harm to people's health. Many civilizations have built-in fire-fighting systems.

II. LITERATURE SURVEY

The device which is used to detect the gas is already present the market which is widely used in many places like industries where there is plenty of chances of the explosion which may lead to massive destruction and the lose of man power; in homes, where the LPG gas used most widely in our daily necessity where it can detect the leakage of LPG gas; in cars, where most of the vehicles contains the cylinder and many more places. Dr. Walter Snelling was the first to introduce LPG gas in 1910. It's a blend of butane and commercial propane. It is very combustible, and numerous accidents occur as a result of LPG leaks. As a result, it is necessary to identify and prevent gas leakage. Gas Detectors can be classified in a variety of ways. They're divided into categories based on the type of gas they detect, the technologies that power the sensor's output, and the components that impact the sensor's operation (semiconductors, oxidation, catalytic, photoionization, infrared, etc.). In our daily lives, we utilize a variety of gadgets for various purposes, and the majority of them have the ability to emit any type of gas or chemical when in operation in the air. In many scenarios, it is difficult for human to keep an eye on the levels of the concentration of the leaked gas or to detect whether there is leakage of gas or not. If there is any leakage in gas when there is no one around, it may cause explosion when there is even a spark or the surrounding will have the harmful gas which may lead to suffocation and will lead to have health issues in breathing. There are many application for detection and monitoring of the leakage of gas, but still the researchers will make the efforts in making the advanced application where the cost of the application will be lesser.

Authors of [1] proposed system defines that detection and monitoring of the LPG gas is sensed using MQ – 5 sensors. In the system, when the leakage of gas is detected, the buzzer will be on, along with that the alert message will be displayed in the LCD. And while monitoring of gas based on the cylinder weight, which is measured using the load sensor, it will send the message to the owner of the application or system.

Authors of [2] proposed system, the authors used the pushbullet for the rapid transfer of the data of the message using the Wi-Fi module which functions when there is leakage of gas which is connected to the Arduino UNO.

Authors of [3] proposed system, the sensor which is used to detect LPG gas is MQ – 6, for methane gas, the sensor used is MQ – 4, and benzene is detected using the sensor using MQ – 135 respectively. The output of the sensors will be given in form of PPM. Further, ESP32 is used for the sending and receiving of the messages.

Authors of [4] proposed system, the application is for the monitoring of the gas where it sends the message. NodeMCU's is powered as the sensors where the load sensors always monitor the cylinder. If the weight is less, then it will be displayed using ubidots.

Authors of [5] proposed system, where the LPG gas management is proposed for the cost which is low. Along with detection and monitoring, the system also calculate the temperature and humidity concentration.

III. METHODOLGY

The sensors are powered by microcontrollers, relays, LCD displays and a buzzer. This voltage regulation sector is responsible for converting alternate power to direct current as well as lowering the transmitted signal. The sensors can detect the gas leak. The sensor MQ-2 is employed here to detect LPG levels in the air. The gasses in the range between 200 and 10000 ppm may be detected as well as the reaction time is quite rapid. The outcome of the sensors would be an analog strength. A serial communication circuit converts the change from analog resistor to voltage. The microcontroller reads that voltage. This analog voltage is digitally converted using a through 12-bit ADC.

In the proposed system of gas detection system, the application contains both the monitoring and detection of the gases which are very harmful for the surrounding. In the detection of the gas, the sensor which is used to sense many gases is MQ – 2 sensor. After the detection of leakage in the gas, the sensor sends the signal to the Arduino UNO for the further process where other hardware components are connected to each other. Through Arduino UNO, it send the signal to the LCD display for displaying the alert message as "LPG Detected", accordingly, the buzzer be on so that the surrounding people will the alerted, as well as the main power supply will be cut off. Using the relay of 5V, the power supply is given to on the Exhaust fan to remove the harmful gas from the surrounding. Even the Owner of the application will receive the message through GSM module.
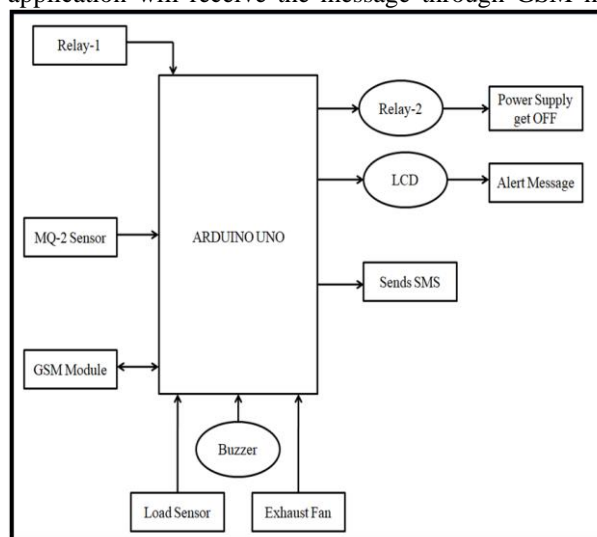
In the monitoring system, the LPG cylinder is considered where the application is using the load sensor to weigh the cylinder. If the threshold value which is set to 3Kg is greater than the volume of the Cylinder, then the signal is sent to Arduino Uno which then proceeds the signal to the GSM modem which will send the SMS to the agency for booking of the Gas cylinder. It is then stored the status of the booking the web page which will be easier to use.

The system which is proposed has the features like;

1. Gas leakage is sensed using MQ-2 sensor, when it is more than threshold value given which is interfaced by Arduino UNO.
2. The buzzer will be on to notify the surrounding people.

3. Using the relay on, the power supply will be off and then there will a display on the LCD for detection of the alert message like "LPG gas detected!".
4. When the application is on, the exhaust fan will on to pull out the gas which is leaked from the surrounding.
5. Load sensor is used to weigh the LPG cylinder.
6. The threshold value is set to the 3Kg, where the volume of the cylinder is below the threshold value then the message is sent to the agency for booking of the LPG gas cylinder.
7. The status of the booking is stored in the database for the purpose of checking the status regularly.

In the proposed system, there are two functions that is leakage of LPG gas detection ---and the monitoring of the gas. The gas detection is done using MQ–2 sensor because it can detect hazardous gases including LPG gas. The proposed system will the used both for the industry as well as the household purpose. In case of home application, the gas is monitored, where the load sensor is used to weigh the cylinder. If threshold value is greater than the weight of the cylinder, then the application sends the message to the agency for booking of the gas cylinder. The threshold value is set to 3kg of the cylinder.

IV. SYSTEM REQUIREMENT

Specification of a system requirements seems to be a documentation or group of paperwork describing the platform as well as program application's characteristics and behavior. It comprises a number of aspects which attempt to measure the functional requirement that users need to please their diverse users.

A. Hardware Requirement

A full series of functionality, usable, efficiency, interaction, reliability, architecture, criticality as well as clearly explaining should be defined and analyzed by hardware. The minimum CPU speed, storage as well as disk space necessary for Windows is included in these requirements. In nearly all instances, your hardware surpasses these specifications, ensuring that the capabilities operating on the server deliver sufficient performance. We thus use needs such as Arduino, sensors and everything.

1. *MQ – 2 Sensor:* MQ2 is amongst the most common gas sensors throughout the MQ sensor series. The detection method performed on resilience shifts in sensing element whenever the gas comes into touch only with substance. It also is referenced as nothing more than a Gas Sensor of metals metal oxides style. Gas concentration can indeed be detected via a network of simple voltage splitters.

2. *GSM module:* The main use of a GSM module, including the SIM 900, is to connect to a desktop with several refers to many types including such TTL Output (for Arduino, 8051 as well as other microcontrollers) and RS232 Output that directly interacts with a desktop.

3. *Load sensor:* The load cell senses the weight as well as supplies an analog electrical voltage to the HX711 Load Amplifier Module. HX711 is really a 24-bit ADC that enhances the output including its charging cell and transforms it digital. This increased value was sent into the Arduino. Arduino currently detects and converts the

HX711 output into kilogram weight as well as shows something on an LCD.

4. *LCD Display:* The LCD is a flat-screen display with the main operative mode of using liquid crystals. For businesses and customers the usage of LEDs in desktops, tv, computer monitors as well as computer monitors is broad and different. The use applications are extensively employed.

5. *Arduino UNO:* Arduino Uno is a microcontroller sensor module on ATmega3288 (datasheet). There are 14 incident electrical pins, six analog inputs, a 16 MHz cells and the environment, a USB connection, a charging port, an ICSP as well as a backspace key (of which 6 can be used as PWM outputs). The microcontroller provides everything you need to support.

6. *Buzzer:* Maybe a piezo buzzer is known as the Arduino buzzing. Essentially, you can link a small speaker straight to an Arduino. Clients can make this sound like a noise at the frequencies they specify. This buzzer causes a piezoelectric reversal effect depending on the noise.

7. *Relay:* Relay having 220V as well as a 5V input, when needed, is utilized in the circuit to turn off electricity. There are 5 pins in the relay. The digital pins including its Arduino board are linked with one pin. One is linked to the switch to connect the 220V power source. This power is redirected to the devices through to the other pin. Other 2 are grounded, one in the main energy source and another one for the Arduino board.

8. *Exhaust Fan:* If the excessive gas released already makes it more likely of missing in order to counteract it, an exhaust fan is used for evacuation. Exhaust fans usually able to extract hot or wet air from the a small, localized zone to let clean air from another place (maybe a door or a ventilation) in order to replace it. The heated air extracted by an electric fan is pushed via a heat exchanger and driven out outside.

V. SYSTEM DESIGN AND IMPLEMENTATION

System design involves developing systems aspects such as structure, subsystems as well as parts, the ranging from various interfaces with information passing through the network. System design might be regarded as an application to research and development of systems approach. The process planning, implementation phases and engineering design professions are inherently overlapping.

Flow chart shows the whole range of operations to be carried out by the proposed gas leak detecting system. The components are started at the right position. The sensors detect gasses in the environment. The simple presence of LPG throughout the air is here sensed with the MQ-2 sensor. These sensors have the quick response time. If the concentration of the gas is present in the air, then all the devices at the place will be powered OFF. The system will ON the exhaust fan in order to pull out the gas present in the environment. The LCD will display the alert message whereas the buzzer will alert to the surrounding. The notification will be sent to the owner. To send the message to registered number, the GSM modem is required because it will help to send the signal to the number.

Special Issue - 2021

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
NCCDS - 2021 Conference Proceedings

In case of home application, the gas is monitored, where the load sensor is used to weigh the cylinder which will about 3 kg. The threshold value is set on the basis of the weight where the cylinder detects for every 30 mins. If the value of less than or equal to the threshold value, then load sensor sends the signal interface to Arduino UNO, where this will send the message to the number which is being registered in the Arduino program. If the threshold value is greater the weight of the cylinder, then the application will send the message to the agency for booking the new gas cylinder.
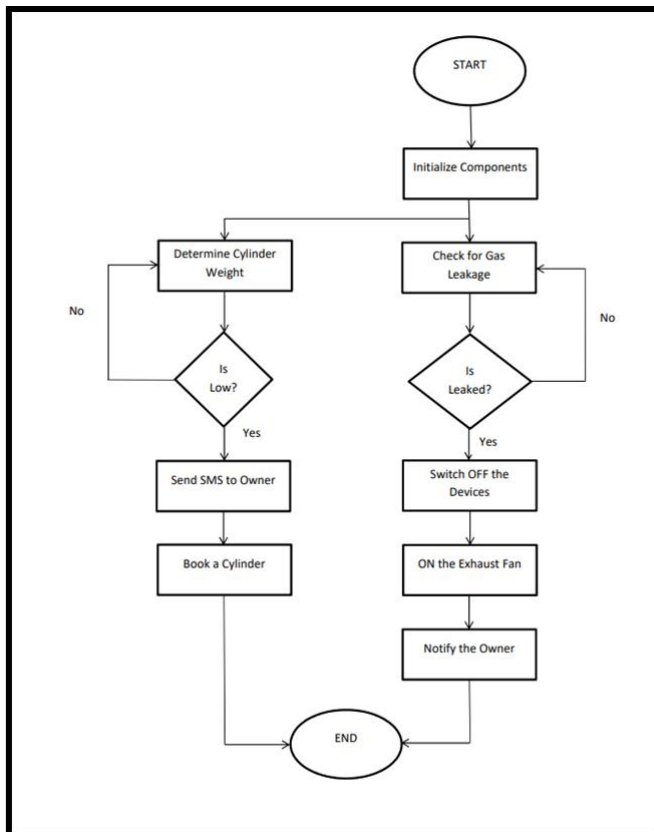
VI. CONCLUSION

In recent days, the Internet of Things has acquired its broad prominence. Thanks to its diverse sources of applications that have paved the way for human beings to live in a smooth, healthy and simpler way. The suggested detector of gas leakage in the area of security seems promising. The goal to make this model has always been to introduce a revolution on safety to reduce and therefore eliminate any large or little risk that may arise from the leaking of toxic and hazardous gases. One such application area is monitoring of gas reservations and gas leakages for both household and industrial applications. While the identification of gas leak has been one

of the main problems, while there are numerous ways. This study therefore provided a new approach, depending on microcontroller, for gas reservation and gas detectors.

The sensor employed in this version is capable to monitor, identify and inform the client to the remainder of the pressurized gas, and to also take certain actions without obstructing the prebooking of the new cylinder. This device may be easily placed into an alert device or an LPG display indicator for extra advantages. It is a low cost but extremely efficient device for detecting gas leakage and may play a key role in avoiding LP Gas leakage exploration. The major aim of this effort is to maintain security and to make it simpler to reserve gasses and detect leaks to prevent tragedies caused by carelessness.

REFERENCES

[1] Suma V, Ramya R Shekar, Akshay Kumar A, "Gas Leakage Detection Based on IOT," *Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology* [ICECA 2019] IEEE Conference Record # 45616; pp.no 1312 – 1315.

[2] M Athish Subramanian, Naveen Selvam, Rajkumar S, R Mahalakshmi, J Ramprabhakar , "Gas Leakage Detection System using IoT with integrated notifications using Pushbullet-A Review", *Proceedings of the Fourth International Conference on Inventive Systems and Control (ICISC 2020) IEEE Xplore Part Number: CFP20J06-ARTI*; pp.no 359 – 363.

[3] Ravi Kishore Kodali, Greeshma, R.N.V, Kusuma Priya Nimmanapalli, Yatish Krishna Yogi Borra, "IOT Based Industrial Plant Safety Gas Leakage Detection System", *International Conference on Computing Communication and Automation (ICCCA), pp.no, 1-5*, published in 2018.

[4] Nagib Mahfuz, Shawan Karmokar, Md. Ismail Hossain Rana, "A Smart Approach of LPG Monitoring and Detection System Using IoT", *11th International Conference on Computing Communication and Networking Technologies(ICCCNT),* published in 2020

[5] Asmita Varma, Prabhakar S, Kayalvizhi Jayavel, "Gas Leakage Detection and Smart Alerting and Prediction Using IoT", *2017 Second International Conference On Computing and Communications Technologies (ICCCT'17) 2017 IEEE,* pp.no, 327-333.

[6] T.Soundarya, J.V.Anchitaalagammai, G. Deepa Priya, S.S. Karthick kumar, "Cylinder LPG Gas Leakage Detection for Home Safety", *Journal of Electronics and Communication Engineering (IOSR-JECE),* published in 2014.

[7] Legg, SW and Wang, C and Benavides-Serrano, AJ and Laird, CD Optimal gas detector placement under uncertainty considering *ConditionalValue-at-Risk*, Journal of Loss Prevention in the Process Industries Volume 26 Elsevier Publisher 2013

[8] Amsaveni, M and Anurupa, A and Preetha, RS Anu and Malarvizhi, C and Gunasekaran, Mr Gsm based LPG leakage detection and controlling *system*, The International Journal Of Engineering And Science (IJES) ISSN (e) 2015

[9] Fraiwan, Luay and Lweesy, Khaldon and Bani-Salma, Aya and Mani, Nour A wireless home safety gas leakage detection system, Biomedical Engineering (MECBME), 2011 1st Middle East Conference on IEEE

[10] Vorapojpisut, Supacha A Lightweight Framework of Home Automation Systems Based on the IFTTT Model, The International Journal Of Engineering And Science (IJES) ISSN (e) 2015.