

# GAS LEAKAGE MONITORING AND ALERTING SYSTEM

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## **Abstract:**

Internet of Things (IoT) is the networking of 'things' by which physical things can communicate with the help of sensors, electronics, software, and connectivity. These systems do not require any human interaction. Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system can also be used in homes and offices. The traditional Gas Leakage Detector Systems though have great precision, fail to acknowledge a few factors in the field of alerting the people about the leakage. Therefore we have used the IoT technology to make a Gas Leakage Detector for society which having Smart Alerting techniques involving sending text message to the concerned authority and an ability performing data analytics on sensor readings.

**Keywords :** Internet of Things, Gas Leakage Detection, Smart Alerting Techniques

## **Introduction:**

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some

anticipating as many as 100 billion connected IoT devices and a global economic impact of more than \$11 trillion by 2025. The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities. The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the “smart home”, offering more security and energy efficiency. IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of “smart cities”, which help minimize congestion and energy consumption. IoT technology offers the possibility to transform agriculture, industry, and energy production and distribution by increasing the availability of information along the value chain of production using networked sensors

Gas leakage are a serious problem and are found in many residential, industries and vehicles such as Compressed Natural Gas(CNG). Gas leaks have been reported to cause accidents in many places. Gas leaks due to increasing demand from LPG users are often to improper and untimely action, leading to many dangerous accidents.[3] An effective method by installing a safety system such a situation as well as monitor the level of LPG in the cylinder is required so that users are aware of remaining Gas in cylinder.[4] There have been many accidents due to gas leakage in the last few years. There are some similar examples due to gas leakage. Due to gas leakage, LPG leak at one place in Pune caused loss of 4 people. And another example is, A 45 year old women, two boys and a girl were suffocated to death in a fire at a residence in Shahdara after an LPG cylinder exploded. The house caught fire due to leak in the LPG gas cylinder, resulting in the death of 4 people. There is a need for a system to detect the leakage and send the information to the first response team through wireless media. A leakage detection system that initiates a warning call or SMS will be more effective in the absence of people on-site.

## **Literature survey :**

A number of reviews on the subject of gas leakage detection techniques were done in the past either as part of research papers/technical reports on a certain leak detection method and other gas related subjects.

# Paper 1: Smart Gas Cylinder Using Embedded System

**Author :** K.Padma Priya<sup>1</sup>, M.Surekha<sup>2</sup>, R.Preethi<sup>3</sup>, T.Devika<sup>4</sup>, N.Dhivya<sup>5</sup>

## Summary:

K.Padma Priya has used two major modules namely, leakage detection module, GSM using load cell. The output of load cell is signal conditioned and provided to the ARM7 controller. The controller takes the suitable action as per the input and also indicates the LPG level on the LCD display. When the LPG level reaches below threshold it gives an indication of the same via a SMS requesting for the booking of the cylinder. The other components such as gas sensor are used to detect gas leakage.module with PIC microcontroller protect circuitry. Here the measurement of the weight of LPG cylinder is done.

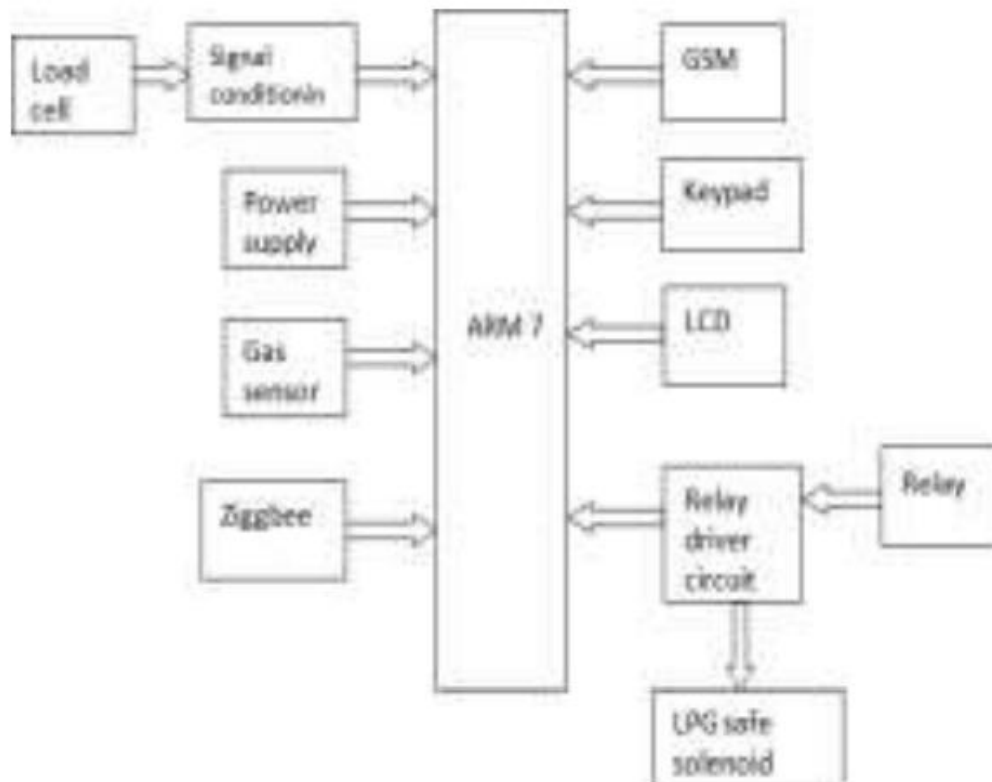


Figure 1: Smart Gas Cylinder Using Embedded System

## Paper 2: Automation of LPG Cylinder Booking and Leakage Monitoring system

**Author :** Abhishek B N, Bharath, Gunasheel B, Vinodh Kumar G, Veeresh

### Summary:

Abhishek B N used LPC2148 microcontroller, GSM module, exhaust fan and MQ5 sensor here the load cell measures the weight of the cylinder. The output of the same is converted to digital data with the help of A/D converter. This data is then fed to the controller as an input. The controllers perform actions as per the input data. In case if there is an any gas leakage it is detected by MQ5 sensor in addition to if the exhaust fan is also turned on to release the gas out the room. Also the gas leakage alert is provided to the customer if form of SMS with the help of GSM for this is the TTL output is converted to CMOS logic with the help of RS232 module and provided to the GSM.

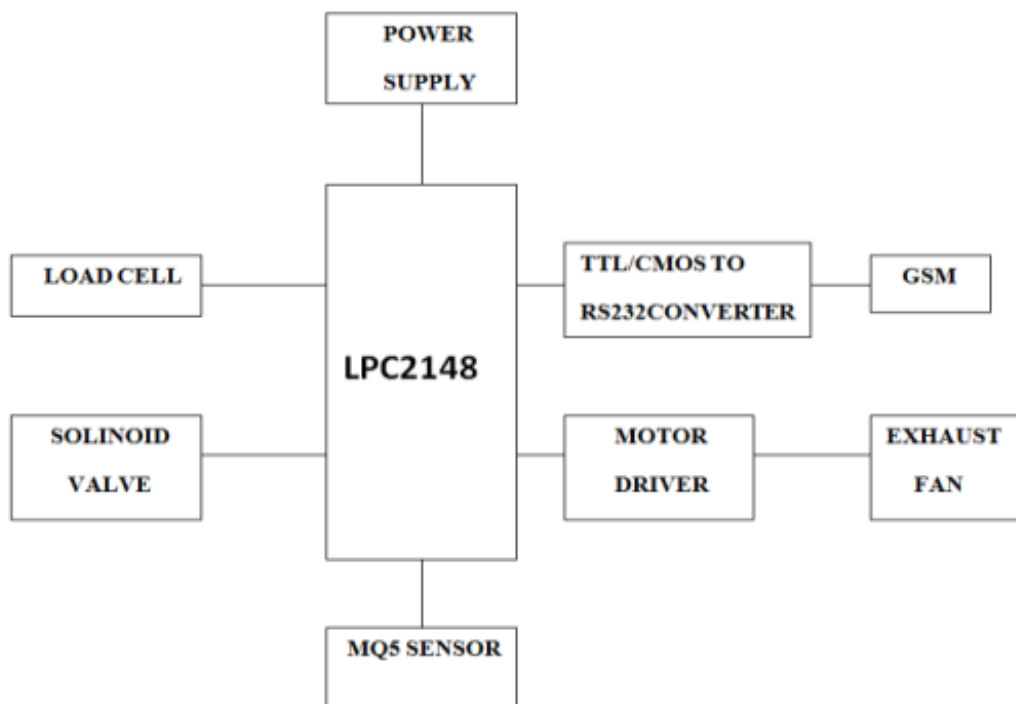


Figure 2: System block diagram

## Paper 3: IOT Based Smart Gas Monitoring System

**Author :** Anandhakrishnan S, Deepesh Nair, Rakesh K, Sampath K, Gayathri S Nair

### Summary:

Anandhakrishnan S has implemented a system which consist of ARDUINO UNO controller. It's an advanced processor here the major modules excluding the ARDUINO UNO are MQ2 sensor, wifi module, load cell. This project has introduced a feature of internet in it. The load cell a feature of internet in it. The load cell weights the LPG cylinder. Then the load cell output is given as input to the ATDUINO UNO. The wifi module is used to facilitate the communication amongst the other module. The LCD display, displays the level of cylinder. The internet provides the information about the gas level reaching below threshold to the gas agency after this cylinder is auto booked.

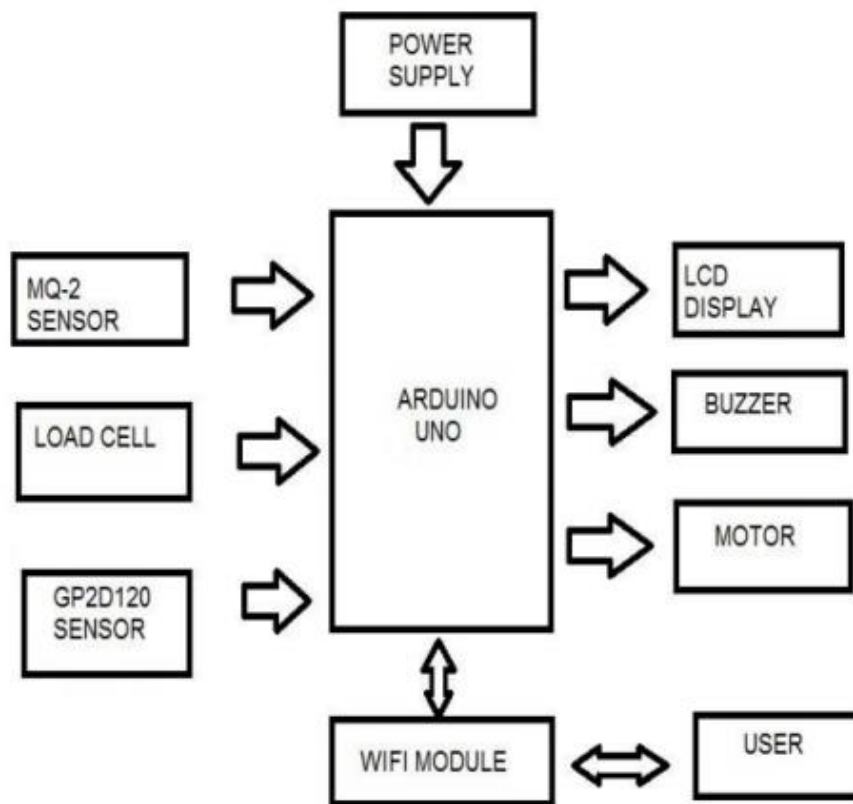


Figure 3 : Block diagram of the system

## Paper 4: Model-based gas leakage detection and isolation in a pressurized system via Laguerre spectrum analysis

**Author** : Johansson, A.; Birk, W.; Medvedev, A.,

### Summary:

The gas leakage detection system is designed using PIC microcontroller. The gas weight sensor is used to measure the weight of cylinder. The gas detection sensor is used to detect gas leakage if any. In case of gas leakage exhaust fan is turned on. The Max232 is used to interface GSM to microcontroller, buzzer indicates gas leakage. Modelling and gas leakage detection in a pressurized system are discussed. It is shown that by use of model-based methods, leakages can be detected and isolated with high accuracy. Furthermore, representing signals by their Laguerre coefficient is a means of representing necessary calculation without significantly affecting the accuracy of the result.

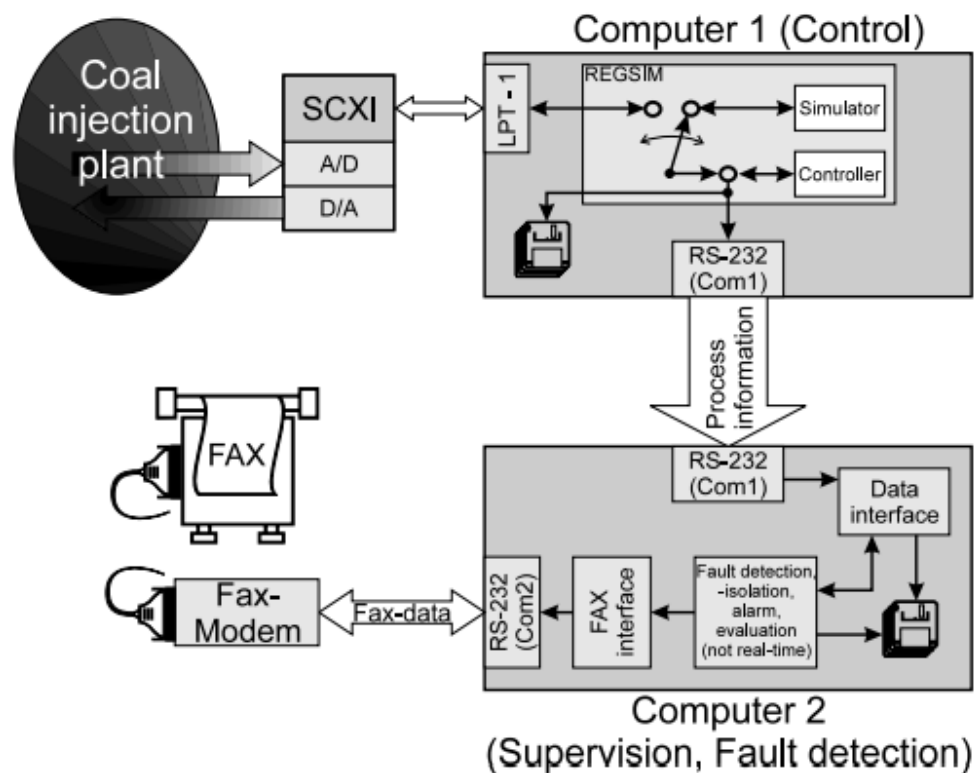


Figure 4: Hardware structure, data flow and used components.

## Paper 5: Design and implementation of an economic gas leakage detector

**Author :** A.Mahalingam, r. T. Naayagi, n. E. Mastorakis

### Summary:

A.Mahalingam, r. T. Naayagi, n. E. Mastorakis gave the formulation of many problems in previous gas leakage detectors. They told that several standards have been formulated for the design of a gas leakage detection system such as IEEE, BS 5730, and IEC. For this work, the recommended UK safety standards have been adopted. The proposed alarm system is mainly meant to detect LPG leakage, which is most commonly used in residential and commercial premises. The system detects not only the presence of gas (gas leak), but also the amount of leakage in the air, and accordingly raises an appropriate audio visual alarm. The objective of the system is to detect LPG gases such as propane and butane. The allowed UK level for butane is 600 ppm above which it is considered to be of high level and poses a danger. The proposed system ensures a continuous monitoring of the gas levels. If the gas level increases above the normal threshold level of 400 ppm butane (LPG), the system starts to issue early warning alarms at 100ms interval, which implies low level gas leakage. If the leakage level increases to 575 ppm of butane (LPG), the system activates high severity audio alarms at 50 ms intervals warning the occupants to run to safety.

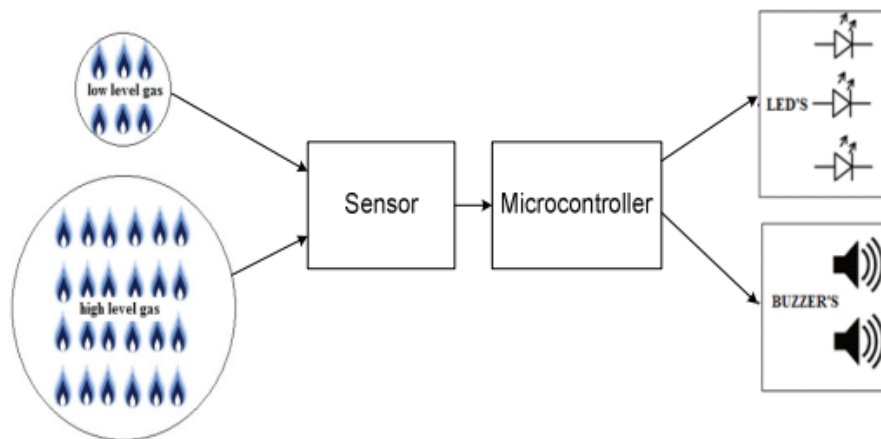


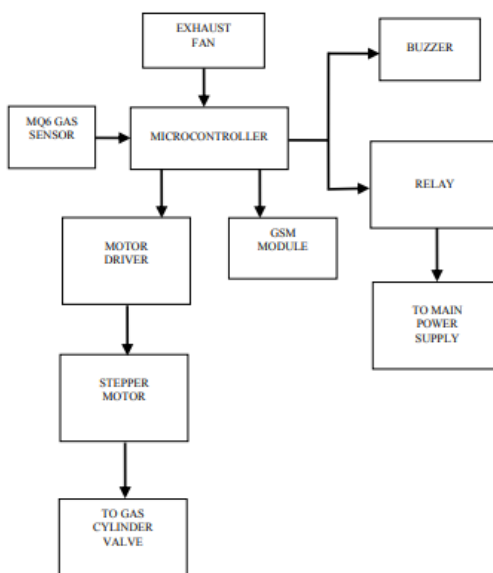
Fig. 5 Block diagram of the proposed gas leakage detection system

## Paper 6: GSM based LPG leakage detection and controlling system

**Author :** Prof. M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi, M.Gunasekaran

### Summary:

The leakage of LPG gas is detected by the MQ-6 gas sensor. Its analog output is given to the microcontroller. It consists of predefined instruction set. Based on this, the exhaust fan is switched on. So, the concentration of gas JASC: Journal of Applied Science and Computations Volume VI, Issue I, January/2019 ISSN NO: 1076-5131 Page No:96 inside the room gets decreased. Then, the stepper motor is rotated thus closing the knob of the cylinder. Because of this process, the leakage of gas is stopped. The relay is switched to off the power supply of the house. The buzzer produces an alarm to indicate the gas leakage. Then, the user is alerted by SMS through the GSM module. They proposed their methodology that the system takes an automatic control action after the detection of 0.001% of LPG leakage. This automatic control action provides a mechanical handle for closing the valve. We are increasing the security for human by means of a relay which will shut down the electric power to the house. Also by using GSM, we are sending an alert message to the users and a buzzer is provided for alerting the neighbors about the leakage.





## **Paper 7: Automated unified system for LPG using microcontroller and GSM module**

**Author :** B. B. Did paye, Prof. S. K. Nanda

### **Summary:**

In this paper they told about their research on leakage detection and review Their paper proposed an advance and innovative approach for LPG leakage detection, prevention and automatic booking for refill. In advance, the system provides the automatic controlling of LPG regulator also if leakage is detected the system will automatically turn off the main switch of power supply. Hence it helps to avoid the explosion and blast.

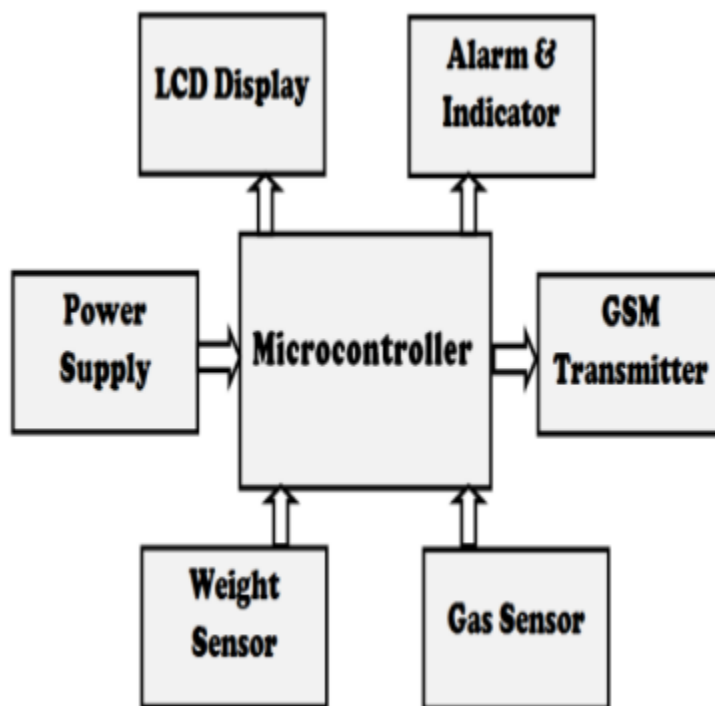


Figure 7: System Block diagram

## Paper 8 : Gas leakage detection and control

**Author :** Srinivasan, Leela, Jeya bharathi, Kirthik,Rajasree

### Summary:

In this research paper they told about gas leakage detection and control. In this paper, the gas leakage resulting into fatal inferno has become a serious problem in household and other areas where household gas is handled and used. It alerts the subscriber through the alarm and the status display besides turning off the gas supply valve as a primary safety measure.[4]

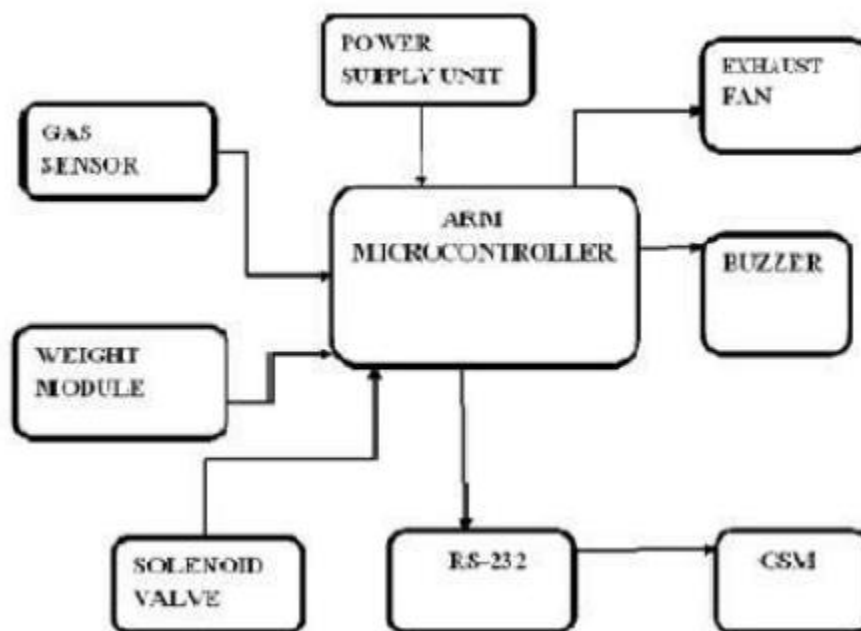


Figure 8: System Block diagram

## Paper 9 : Gas leak detection and localization techniques

**Author :** Pal-Stefan Murvaya, Ioan Sileaa,

### Summary:

They told in their survey on gas leak detection and localization techniques various ways to detect the gas leakage. They introduce some old or new technique to detect the gas. The proposed techniques in their paper are nontechnical methods, hardware-based methods which include acoustic methods, optical methods and active methods. In their survey they told a wide variety of leak detecting techniques is available for gas pipelines. Some techniques have been improved since their first proposal and some new ones were designed as a result of advances in sensor manufacturing and computing power. However, each detection method comes with its advantages and disadvantages. Leak detection techniques in each category share some advantages and disadvantages.

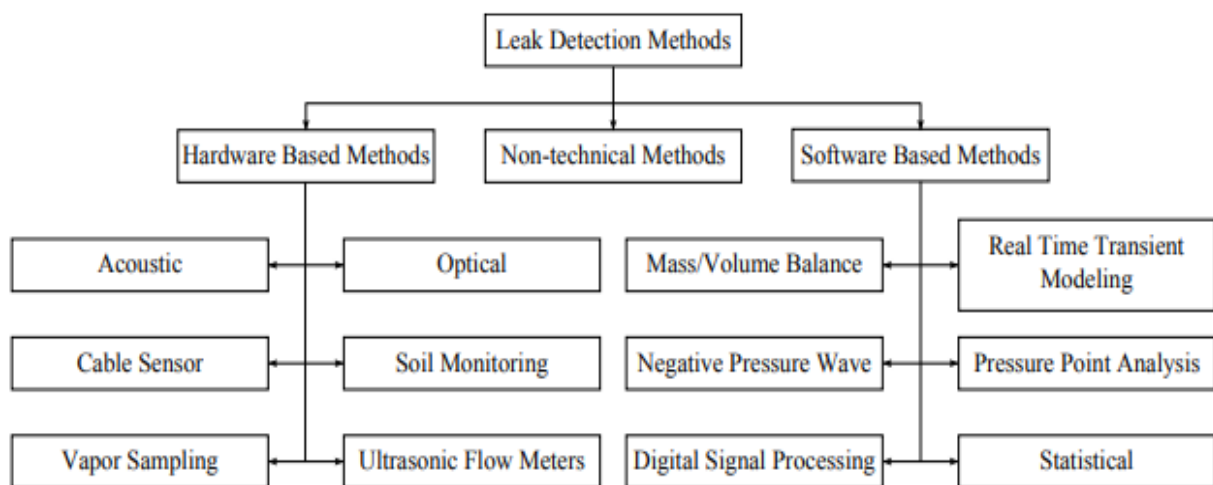


Figure 9 : Classification of gas leak detection techniques based on their technical nature

## Paper 10 : Dangerous gas detection using an integrated circuit and MQ-9

**Author** : Falohun A.S., Oke A.O., and Abolaji B.M

### Summary:

In this paper they proposed their dangerous gas detection using an integrated circuit and MQ-9. In this basically, they used an embedded design which includes typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction device. The amount and type of detectors and the type of fire alarm system that one chooses for property protection will depend on the owner's property protection goals, the value of the property and the requirements of the owner's insurance company. Generally, heat detection will be used in all areas that are not considered high value. Here again, one of the most common mistakes in fire alarm generally, heat detection will be used in all areas that are not considered high value. Here again, one of the most common mistakes in fire alarm system application is to provide partial protection of a building and expect high performance from the installed systems of any kind. System application is to provide partial protection of a building and expect high performance from the installed systems of any kind.

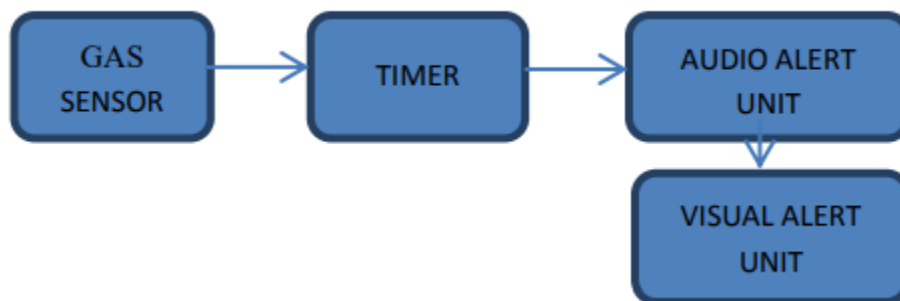


Figure 10 : Block diagram of user interface system

## **Future scope:**

- As no system is perfect, neither is this one. So it leaves us with the further scope of improvement. In addition to gas leakage detection, the weight measurement system can also be incorporated, thus giving the user intimation about the refill time of cylinder.
- A Mobile Application can be created for this system which can give information about the concentration of gas present in the area, setting reminders to check gas level, also to predict the gas leak by giving values.
- The use of Pressure sensor along with the system can provide an extra feature of Automatic Gas Booking. Like other sensors, the pressure sensor can constantly monitor the amount of gas present in cylinder and send a booking SMS if it reaches certain level.
- Relay motors can be added into the system to provide more safety. These motors can switch off the Main Gas Supply and Main Power supply in case the gas concentration exceeds certain limit.

## **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.