SENSOR BASED GAS LEAKAGE DETECTOR SYSTEM

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Abstract: Liquefied Petroleum Gas (LPG) is a main source of fuel, especially in urban areas because it is clean compared to firewood and charcoal. 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. Gas leakage is a source of great anxiety with ateliers, residential areas and vehicles like Compressed Natural Gas (CNG), buses, and cars which are run on gas power.
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, alert and control gas leakage. This proposed system also includes an alerting system for the users. The system is based on a sensor that easily detects a gas leakage.

Index Terms - **Arduino Uno, LPG gas sensor MQ- 2, LCD, Exhaust fan, Micro-controller, Relay Board, Servo motor, LED light, SMPS.**

I. INTRODUCTION

Safety plays a crucial role in today's world as accidents are susceptible to happen anywhere. Places which make use of flammable and not easily detectable gases are susceptible to occurrence of accidental fires. the web of Things may be a futuristic technology during which interconnection of devices and therefore the Internet is proposed. The automation of the many daily chores are often change by this. Within the proposed gas detection system, we'll make use of IoT to detect leakage and alert the user along side preventing any longer leakage of the gas.

Toxic gases are one that cause serious health impacts, but also are utilized in industries in large quantities. These gases need to be monitored; such increase within the normal level of them might be known and proper precautionary measures are often taken.

Arduino are going to be wont to perform the specified task by interfacing gas sensor and LCD to display, Ethernet shield to send alert message to the user via an Android application and servo motor to turn on the window. The system will detect the gas leakage by using gas sensor and it'll inform the Arduino board which can perform the further actions i.e. opening window, turning on fan. The people within the neighbourhood also can be included just in case of an emergency. MQ2 LPG gas sensor is employed for input. The gas leakage event may involve danger for all times.

There are many deaths round the world due to gas leakage. Thus, it's ensured that one doesn't need to worry about the gas leakage becoming so intense and out of control that it can causes damage to life or the encompassing environment and also notifying and alerting the workers or residents about the gas leakage.

It gives a HIGH output when LPG, i-butane, propane, methane, alcohol, hydrogen and smoke gas is sensed. This module is extremely easy to interface with microcontrollers and Arduino and simply available in market by name "LPG Gas Sensor Module".

Various kinds of anthropogenic emissions named as primary pollutants are pumped into the atmosphere that undergoes chemical reaction and further leads to the formation of new pollutants normally called as secondary pollutants. For instance, according to the

Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), nearly all climate-altering pollutants either directly or indirectly (by contributing to secondary pollutants in the atmosphere) are responsible for health problems.

Almost every citizen spends 90% of their time in indoor air, Outdoor air quality of the cities of developed countries improved considerably in recent decades. In contrast to this, indoor air quality degraded during this same period because of many factors like reduced ventilation, energy conservation and the introduction to new sources and new materials that cause indoor pollution. The design of buildings for lower power consumption resulted in decrease of ventilation which further decreases the quality of air inside the building. This increases the need for indoor air quality.

II. BASIC IDEA

The Gas leakage system is an exceptional autonomous device which has the ability to sense a designated gases like a LPG with the help of MQ-2 sensor and reach its intended destination. It is an Arduino based system design implemented to check out and detect its required gases and perform its deliberate tasks with precision and accuracy. The Gas leakage system consists of simple electronics design which has simple mechanism with which performing the necessary tasks becomes easier. Due to its design parameters, it also requires less power and draws less current which allows us to work with the system safely. Moreover, it also adds to the safety to its environment and the people around it.

Gas leakage detector system concept will have two major part, first is sensing the gas and second is turning on fan and window and turn off the lights.

- **First:** Proposed design will have a MQ-2 sensor which will be used to detect gas to message the owner in the companies and homes etc. It will deliver message to the owner on the app and LCD as gas leakage detects.

- **Second:** In our system we are going to design gas leakage detector as well as delivering message. There will be a device to detects gas and turning on the fan and window and turn off the electricity. User will get a message when gas will leak.
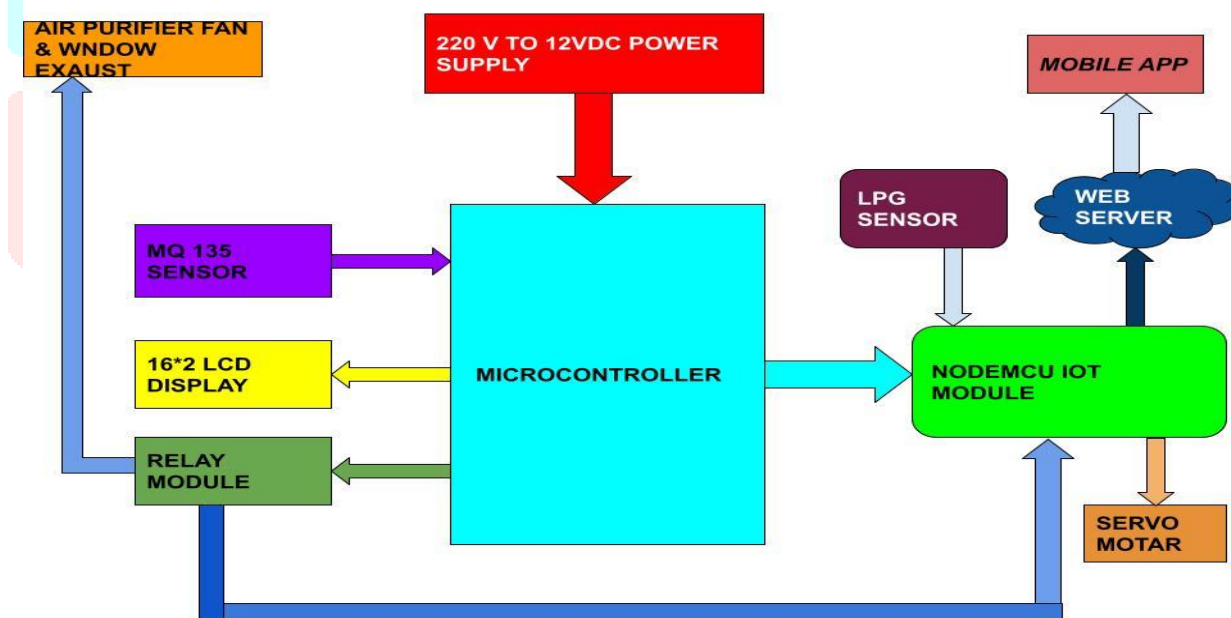
2.1 BASIC BLOCK DIAGRAM OF SYSTEM

Figure 2.1 Basic Block Diagram Gas Leakage System.

2.2 WORKING OF PROJECT

This proposed method consists of gas leakage detection system, weight measurement module, microcontroller, IoT module and alert system. The main basic Arduino Mega2560 micro controller requires the power supply ranging from 7-12 volts which can be build by using different components like step down transformer, rectifier, filter and regulator which are readily available as adapters these days.

Supply can be either from an ac to dc adapter or battery. The board can operate on at 7-12 volts. If voltage < 7V then board becomes unstable. If voltage > 12V then board get damaged. The Main platform we are using to build the project is Arduino Mega 2560 which provides us the flexibility to write the code effectively in convenient way and also it will provides us features like Inexpensive, cross platform, simpler and clear programming environment, open source and extensible software, easy for beginners, the Arduino Mega 2560 is a microcontroller board based on the AT mega 2560 (datasheet)It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC to-DC adapter or battery to get started. With the above features it force us to use in our project design.

The other main component we are using in our project is use of Load cell. A load cell is a transducer that is used to convert a force into electrical signal, which is used to measure of a LPG gas cylinder weight so that we can expect and alert the user with in how many days the cylinder is about to empty.

There are different Load cells available in the market with different weight measurement capabilities. The Gas Sensor is also one of the components used to detect the leakage of the LPG Gas (Methane & Propane) which converts one form of the signal into other form.

III. LITERATURE SURVEY

[1] Gas Leakage Detection Based on Arduino And Alarm Sound, Rhonnel S. Paculanan, Israel Carino, International Journal of Innovative Technology and Exploring Engineering (IJITEE) Vol 8, April 2019.

LPG leakages are a mutual hindrance in household and manufacturing nowadays. It is very life threatening if you will not distinguish and modified right away. The idea behind our project is to give a solution by power cut the gas provision as soon as a gas leakage is perceived apart from activating the sounding alarm. In addition to this, the authorized person will receive a message informing him about the leakage.

[2] Sanjoy Das, Sahana S, Soujanya K Swathi M C, "Gas leakage detection and prevention using IoT": International Journal of Scientific Research % Engineering Trends. Vol 6, Issue 3, May-June 2020, ISSN (online): 2395-566X.

This paper fundamentally manages the advancement of a straightforward gas spill locator at the underlying stage and after that changing this basic gadget into a most progressive gas identifier framework later on. Gas sensors have been specifically utilized which has high affectability for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM (Worldwide System for versatile communication) module, which sends SMS as soon as gas leakage is detected. Keywords: Arduino, MQ-6 Gas Sensor, LCD, LPG, Stepper.

[3] Dr. Chetana Tukkoji, Mr. Sanjeev Kumar, "Review paper on- LPG Gas leakage detection using IOT": IJEAST – International Journal of Engineering Applied Science & Technology, Vol 4, Issue 12, April 2020 IJEAST (online): 603-609.

This paper provides a brand new approach to discover LPG discharge supported microcontroller based Arduino. To alert on Liquefied rock oil Gas (LPG) leakage and preventing any unwanted incident, we need to apply some cautions to discover the discharge. It can be developed associate degree Arduino based LPG gas detector alarm, if gas leakage happens. The LPG detector MQ 6 is associate degree correct LPG sensing device that acquires the signal intensity. Associate degree economical Arduino based signal process mechanism is followed that effectively quantizes the non-inheritable electrical signal. The intensity of the LPG leakage is classed into 3 categories, such as LOW, MEDIUM and HIGH based on square measure. This paper conjointly shows the ratio and temperature over the alphanumeric display. The importance and connection of the paper is very beneficiary for man as a result of it's a vital caution for our domestic life.

[4] Amatul Munnaza, Rupa Tejaswi, Tarun Kumar Reddy, Saranga Moahan "IoT Based Gas Leakage Monitoring System": Journal of Xi'an University of Architecture & Technology (JXUAT), Vol 12 ISSN No: 1006-7930, Issue 5, 2020.

The foremost object of this work is to monitor gas leakage in any industries using gas sensor and Spartan 6 FPGA process. Structure a cloud-based monitoring system is very important to reduce the cost of preserve servers, to avoid data misplaces and to make the access easy with multiple internet linked devices (computer, tablet, mobile phone) at the similar time anywhere in the world. With Internet of Things (IOT), we can control any electronic equipment in homes

[5] B. F. Alshammari, M. T. Chughtai, "IoT Gas leakage detector and warning generator". Engineering and Technology and Applied Science Research Volume 10, Issue August 2020, pp no. 6142-6146.

This paper presents an industrial monitoring system design using the Internet of Things (IoT). The gas sensor (MQ-5) captured information is posted into a data cloud. The sensor detects the leakage of gas under most atmospheric conditions. All the components

are controlled by an Arduino (UNO-1) that acts as a central processor unit in the setup t. As soon as a gas leakage is detected by the sensor, the alarm is raised in the form of a buzzer. This alarm is supported by an LCD to display the location of leakage.

[6] Gas Leakage Detection and Prevention System, Shreyas Thorat, Neha Tonape, International Journal of Trendy Research, Vol 4, Issue 7, Dec 2020, ISSN NO: 2582-0958.

The objective of this project is to present the design of a automatic alarming system, which can detect and prevent liquefied petroleum gas leakage in various premises. This system alerts the user by sending him a phone call and alerting the neighbors by buzzer alarm after the gas leaks above setpoint1.The servo motor is used to close the gas pipe valves. This device ensures safety and prevents suffocation and explosion due to gas leakage. This project is implemented using Arduino uno and simulated using Arduino ide and proteus software.

[7] Rohan KH1, Navanika Reddy, Pranamya Maddy, Sachit Girish, Dr. Badari Nath K-"IOT based gas leakage detection and Alerting system": JRP Publications,Vol. 1(1), pp no. 002-006, February 2021.

Gas leakages are causing massive explosions in places throughout the world.The conventionally available gas leakage detectors only have the provision to alarm the user who is physically present at the spot . Hence, to overcome this limitation, this project implements a model which sends an email to the user in case there is a leakage. This model detects the leakage of Liquid Petroleum Gas & Benzene. The prototype of this model generates an email to the concerned person using IFTTT web service. An LED is also used as a visual alarm at the site of leakage.

3.1 HISTORY

The first gas detector in the industrial age was the flame safety lamp (or Davy lamp) was invented by Sir Humphry Davy (of England) in 1815 to detect the presence of methane (firedamp) in underground coal mines.

- Gas leak detection methods became a concern after the effects of harmful gases on human health were discovered. Before modern electronic sensors, early detection methods relied on less precise detectors. Through the 19th and early 20th centuries, coal miners would bring canaries down to the tunnels with them as an early detection system against life-threatening gases such as carbon dioxide, carbon monoxide and methane.

- The world's first gas detection company, Johnson-Williams Instruments (or J-W Instruments) was formed in 1928 in Palo Alto, CA by Dr Oliver Johnson and Phil Williams. J-W Instruments is recognized as the first electronics company in Silicon2 Valley. Over the next 40 years J-W Instruments pioneered many "firsts" in the modern age of gas detection, including making instruments smaller and more portable, development of a portable oxygen detector as well as the first combination instrument that could detect both combustible gases, vapors as well as oxygen.

- Before the development of electronic household carbon monoxide detectors in the 1980s and 1990s, carbon monoxide presence was detected with a chemically infused paper that turned brown when exposed to the gas. Since then, many electronic technologies and devices have been developed to detect, monitor, and alert the leak of a wide array of gases.

- As the cost and performance of electronic gas sensors improved, they have been incorporated into a wider range of systems. Their use in automobiles was initially for engine emission control, but now gas sensors may also be used to ensure passenger comfort and safety. Carbon dioxide sensors are being installed into buildings as part of demand-control ventilation systems. Sophisticated gas sensor systems are being researched for use in medical diagnostic, monitoring, and treatment systems, well beyond their initial use in operating rooms. Gas monitors and alarms for carbon monoxide and other harmful gases are increasingly available for office and domestic use, and are becoming legally required in some jurisdictions.

- Originally, detectors were produced to detect a single gas. Modern units may detect several toxic or combustible gases, or even a combination. Newer gas analyzers can break up the component signals from a complex aroma to identify several gases simultaneously.

- Metal-oxide-semiconductor sensors (MOS sensors) were introduced in the 1990s. The earliest known MOS gas sensor was demonstrated by G. Sberveglieri, G. Faglia, S. Groppelli, P. Nelli and A. Camanzi in 1990. MOS sensors have since become important environmental gas detectors.
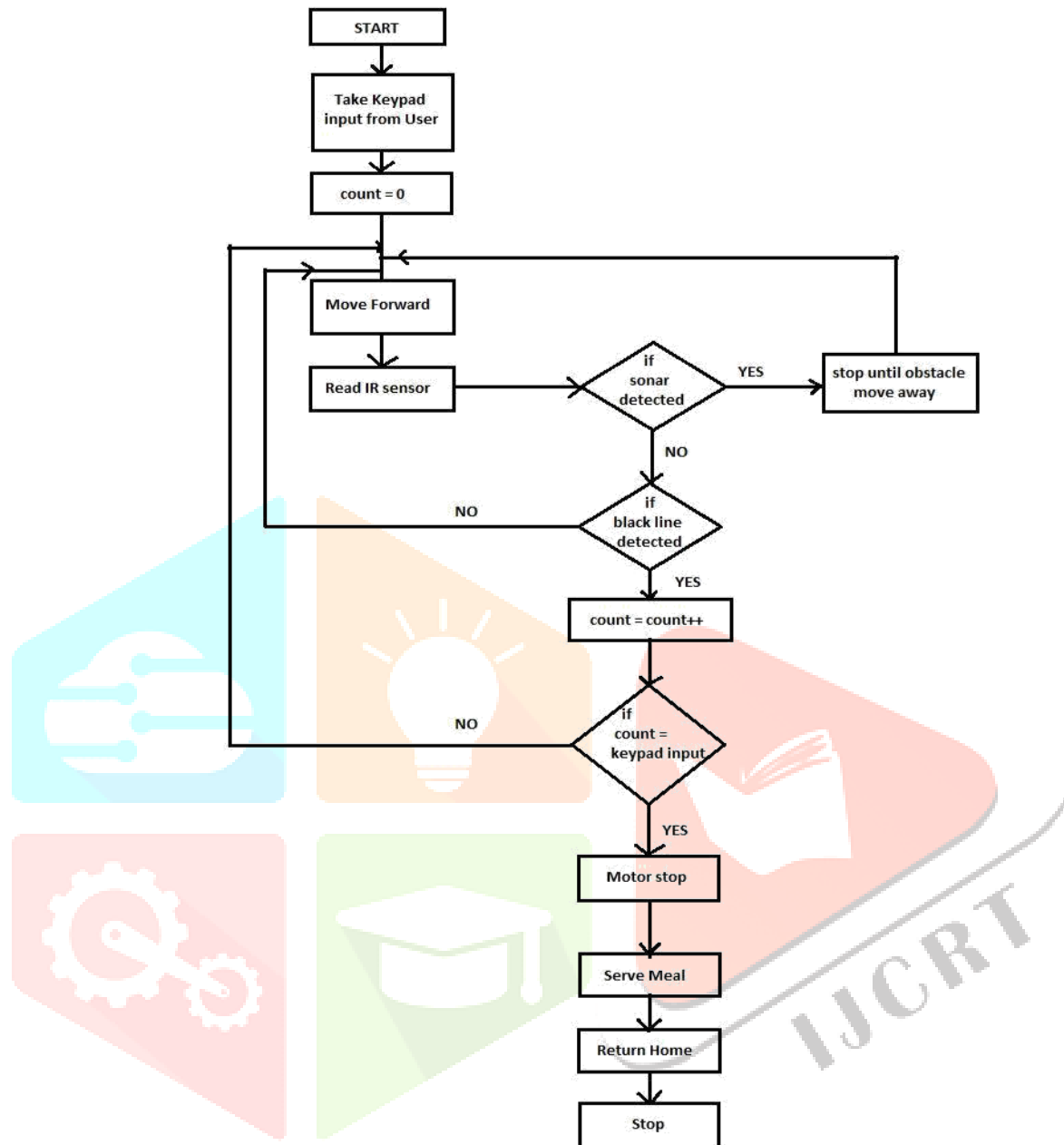
IV. FLOW CHART

Figure 4.1 Flow Chart

V. RESULT & DISCUSSION

In Arduino Based LPG gas Monitoring System MQ-4 gas sensor, LM-35 Temperature sensor, (for prototype) as input devices and Piezoelectric buzzer,16x2 LCD display and IOT module used as output devices. These project gives alert message by buzzing the buzzer and trough SMS to the house holders. We also provide automatic doors and windows opening, so that the compressed gas can spread in to air freely. Hence a fire accident does not occurs.

5.1 PHOTOGRAPHS OF CIRCUIT BUILD
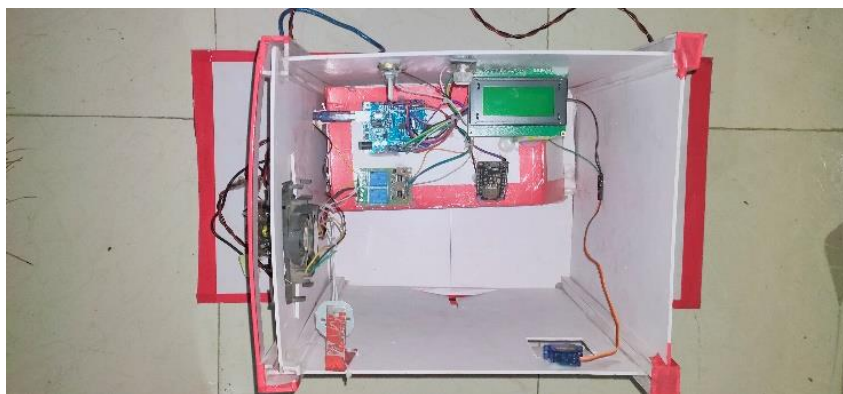
1.   **Final Look LPG Gas Detector System**:

Figure 5.1 Final look of LPG Gas Detector System

VI. CONCLUSION

6.1 FEATURES

The proposed system makes the gas detection and its prevention easier for quite user, whether technically sound or not.
This technique wirelessly transfers alert notification to the user and therefore the user can easily connect the devices through a Smartphone from any location.
It's utilized in wide selection of applications in present day society and introducing a vast scope to the longer term. This easy control over the devices like exhaust fan makes the environment less accident- prone.
Using the Arduino microcontroller also makes the system cheaper. Quick access and control makes the system very useful. It also uses to alert the consumers about the wastage of gas while removing the utensils from the burner by using an object detection sensor.

6.2 APPLICATIONS

1)   Safety Industries
2)   Indore Air Quality
3)   Medical And Life Science Industries
4)   Industrial Applications
5)   Aerospace Industries
6)   Transportation Industries

6.3 ADVANTAGES

1)   Strong Sheild
2)   Continuous Monitoring
3)   Displaying The Message On LCD
4)   Alert on Mobile Application
5)   High Accuracy
6)   Low Power Consumption

6.4 DISADVANTAGES

1)   Detected Any Moisture
2)   Will not Find Very small Leak
3)   Accuracy of Location need to be carefully verified

6.5 FUTURE SCOPE

In addition to the developed system, the systems are often enhanced by adding an impact element which controls the gas leakage if it exceeds the required upper explosive level for the varied gases within the plant area. This will be achieved by any gas leakage indication in any a part of the plant alerts the room then the control valve is shut off. Therefore preventing any hazard arising thanks to gas leakage.

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[2] Gas Leakage Detection Based on Arduino And Alarm Sound, Rhonnel S. Paculanan, Israel Carino, International Journal of Innovative Technology and Exploring Engineering (IJITEE) Vol 8, April 2019.

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[6] B. F. Alshammari, M. T. Chughtai, "IoT Gas leakage detector and warning generator". Engineering and Technology and Applied Science Research Volume 10, Issue August 2020 .6142-6146.

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