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GAS LEAKAGE DETECTOR

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ABSTRACT

LPG serves as a primary fuel source, particularly in urban regions due to its cleanliness in comparison to firewood and charcoal. Gas leakage poses a significant challenge in various sectors such as industrial facilities and residential areas. In recent times, the issue of home security has escalated due to the rising incidents of gas leaks. This has caused heightened concern among workshops, residential neighborhoods, and vehicles like CNG-powered buses and cars.

To mitigate accidents stemming from gas leaks, one effective measure is the installation of gas leak detection kits in susceptible locations. The primary objective of this study is to propose and deliberate on a design for a gas leak detection system capable of automatically identifying, notifying, and managing gas leaks. Additionally, this proposed system incorporates an alert mechanism for users, all centered around a sensor that can readily detect gas leaks.

Keywords: Arduino Uno, LPG gas sensor MQ- 2, LCD, Exhaust fan, Micro-controller, Servo motor, SMPS.

I. INTRODUCTION

Safety is of utmost importance in today's world, considering the potential for accidents to occur anywhere. Particularly in places where flammable and difficult-to-detect gases are used, the risk of accidental fires is heightened. The Internet of Things (IoT) is a cuttingedge technology that proposes the interconnection of devices and the internet. This advancement has the potential to automate numerous daily tasks. In our proposed gas detection system, we will leverage IoT to detect gas leaks, promptly alert the user, and prevent any further leakage.

Toxic gases not only pose serious health risks but are also used in large quantities in various industries. It is crucial to monitor these gases closely, as any abnormal increase in their levels can be detected, allowing for appropriate precautionary measures to be taken.

To accomplish the necessary tasks, we will utilize Arduino. This will involve interfacing a gas sensor and an LCD display, an Ethernet shield to send alert messages to the user via an Android application, and a servo motor to activate the window. The system will detect gas leaks using the gas sensor and relay this information to the Arduino board, which will then initiate further actions such as opening the window or activating a fan. In case of an emergency, nearby individuals can also be included in the alert system. The MQ2 LPG gas sensor will serve as the input device. It is important to note that gas leaks can pose a significant threat to life.

Gas leaks have tragically resulted in numerous deaths worldwide. Therefore, it is crucial to ensure that gas leaks do not escalate to a point where they become uncontrollable and cause harm to life or the surrounding environment. Additionally, it is essential to promptly notify and alert workers or residents about any gas leaks.

The "LPG Gas Sensor Module" is readily available in the market and is highly compatible with microcontrollers and Arduino. It provides a HIGH output when sensing LPG, i-butane, propane, methane, alcohol, hydrogen, and smoke gases. This module is user friendly and can be easily integrated into various systems.

II. BASIC IDEA

The The Gas leakage system is an innovative standalone device equipped with the capability to detect specific gases such as LPG using an MQ-2 sensor and promptly alert the designated recipient. This system, based on Arduino technology, is designed to efficiently identify and address the presence of target gases with precision

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and reliability. Featuring a straightforward electronic design, the Gas leakage system simplifies the execution of essential tasks. Its design specifications ensure minimal power consumption and low current draw, promoting safe operation. Additionally, it enhances safety within its surroundings, safeguarding both the environment and individuals nearby.

The Gas leakage detection system comprises two primary components: gas sensing and automated response activation.

- **First:** The proposed system will incorporate an MQ-2 sensor for gas detection, enabling timely notifications to be sent to property owners in various settings such as commercial establishments and residences. Notifications will be delivered through a dedicated app and an LCD display upon gas leakage detection.
- **Second:** Our system will not only detect gas leaks but also trigger an automated response. A mechanism will activate the fan and open windows while simultaneously shutting off electrical appliances. Users will receive notifications in the event of a gas leak.

2.1 BASIC BLOCK DIAGRAM OF SYSTEM

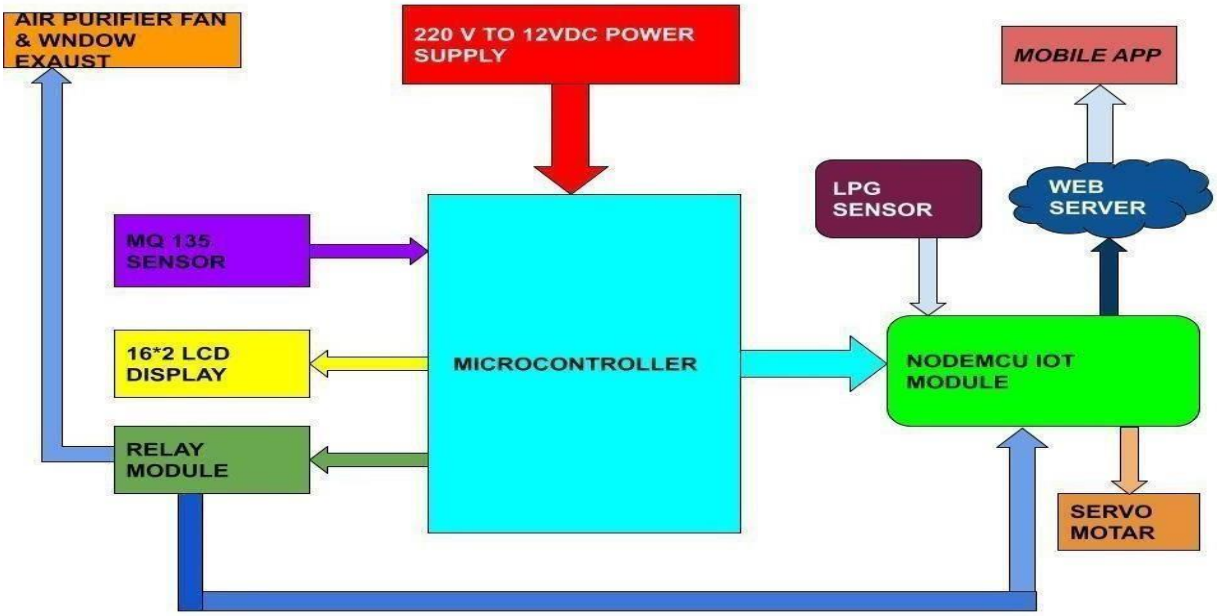

Figure 2.1 Basic Block Diagram Gas Leakage System.

2.2 WORKING OF PROJECT

1. The primary microcontroller used is the Arduino Mega2560, which requires a power supply ranging from 7-12 volts. This power supply can be created using components like a step-down transformer, rectifier, filter, and regulator, which are easily available as adapters nowadays.
2. The power supply can be obtained from either an AC to DC adapter or a battery, with the board operating within the voltage range of 7-12 volts. If the voltage drops below 7V, the board becomes unstable, while exceeding 12V can damage the board. The Arduino Mega 2560 is chosen as the main platform for its flexibility in coding, affordability, cross-platform compatibility, user-friendly programming environment, open-source nature, and extensibility. It can be connected to a computer via USB or powered by an AC to DC adapter or battery.
3. Another important component in this project is the load cell, which converts force into an electrical signal to measure the weight of an LPG gas cylinder. This allows for estimating and alerting the user about the remaining days until the cylinder is empty.
4. Various load cells with different weight measurement capabilities are available in the market. Additionally, a gas sensor is used to detect the leakage of LPG gas (Methane & Propane) by converting one form of signal into another form.

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III. LITERATURE SURVEY

[1] In April 2019, Rhonnel S. Paculanan and Israel Carino published a study on Gas Leakage Detection using Arduino technology and Alarm Sound in the International Journal of Innovative Technology and Exploring Engineering (IJITEE) Volume 8.

Nowadays, both households and manufacturing face the common problem of LPG leakages, which can be extremely dangerous if not detected and addressed promptly. Our project aims to provide a solution by automatically cutting off the gas supply upon detecting a leak, in addition to activating an alarm. Furthermore, an authorized person will be notified via a message about the occurrence of the leakage.

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

The study focuses on developing a basic gas leak detector using gas sensors with high sensitivity to propane and butane, and later upgrading it into an advanced gas detection system.

[3] The article titled "IoT Based Gas Leakage Monitoring System" by Amatul Munnaza, Rupa Tejaswi, Tarun Kumar Reddy, and Saranga Moahan was published in the Journal of Xi'an University of Architecture & Technology (JXUAT), Volume 12, Issue 5, 2020, with the ISSN number 1006-7930.

(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

[4] 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 document presents a design for an industrial monitoring system that utilizes the Internet of Things (IoT). The system involves transmitting data from a gas sensor (MQ-5) to a data cloud to detect gas leaks in different atmospheric conditions.

The system is managed by an Arduino (UNO-1) serving as the central processor unit. When a gas leak is detected by the sensor, an alarm is triggered through a buzzer, with the location of the leakage displayed on an LCD screen.

[5] Gas Leakage Detection and Prevention System, authored by Shreyas Thorat and Neha Tonape, is a research paper published in the International Journal of Trendy Research. The paper was published in December 2020 and is identified by the volume number 4, issue number 7, and the ISSN number 2582-0958.

The aim of this project is to showcase an automatic alarm system design that can identify and stop liquefied petroleum gas leaks in different locations. Once the gas surpasses setpoint1, the system notifies the user through a phone call and alerts neighbors with a buzzer alarm. A servo motor is employed to shut the gas pipe valves, ensuring safety and averting suffocation or explosions caused by gas leaks. The project is executed with Arduino Uno and simulated with Arduino IDE and Proteus software.

[6] 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 leaks have led to significant explosions worldwide. Traditional gas detectors can only alert those present physically, so this project introduces a system that sends an email notification to the user in case of a leak, specifically for Liquid Petroleum Gas and Benzene. The prototype utilizes IFTTT web service to send the email and includes an LED visual alarm at the location of the leak.

IV. HISTORY

- During the industrial age, the flame safety lamp, also known as the Davy lamp, was invented by Sir Humphry Davy in 1815 as the first gas detector to detect methane in coal mines. It was a significant development in ensuring the safety of miners.
- Prior to electronic sensors, early gas leak detection methods relied on less precise detectors. Coal miners used canaries as an early detection system against harmful gases such as carbon dioxide, carbon monoxide, and methane in the 19th and early 20th centuries.

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- Johnson-Williams Instruments, founded in 1928 by Dr Oliver Johnson and Phil Williams in Palo Alto, CA, was the world's first gas detection company. They made advancements in gas detection technology, including smaller and more portable instruments, the development of a portable oxygen detector, and the creation of the first combination instrument that could detect combustible gases, vapors, and oxygen.
- Before the 1980s and 1990s, carbon monoxide presence was detected using chemically infused paper that changed color when exposed to the gas. However, the development of electronic household carbon monoxide detectors revolutionized the detection of this harmful gas.
- With the improvement of electronic gas sensors, they have been integrated into various systems. They are used in automobiles for engine emission control, passenger comfort, and safety. Additionally, carbon dioxide sensors are installed in buildings for demand-control ventilation systems, and research is being conducted on the use of sophisticated gas sensor systems in medical diagnostics, monitoring, and treatment.

FLOW CHART

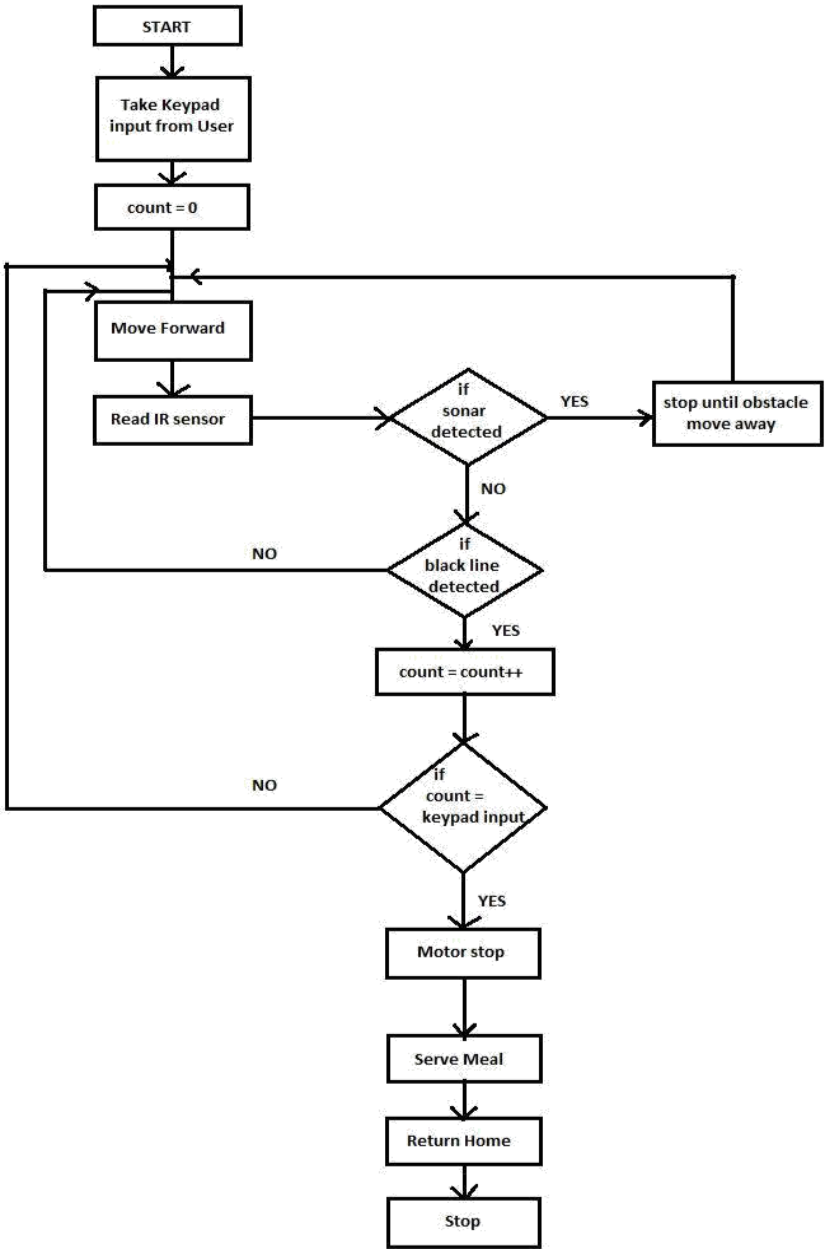

Figure 4.1 Flow Chart

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V. PHOTOGRAPHS OF CIRCUIT BUILD

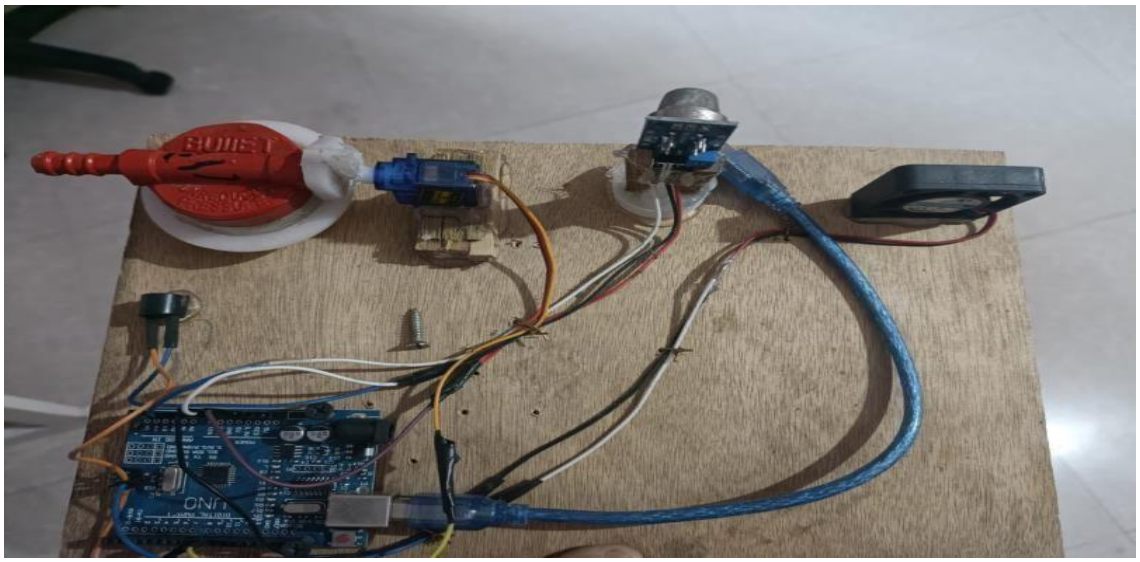

Figure 5.1 Final look of LPG Gas Detector System

APPLICATIONS

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

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

DISADVANTAGES

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

VI. RESULT & DISCUSSION

In The Arduino Based LPG gas Monitoring System utilizes the MQ-4 gas sensor and LM-35 Temperature sensor as input devices. For the prototype, the system also incorporates the Piezoelectric buzzer, 16x2 LCD display, and IOT module as output devices.

This project aims to provide alert messages to the house holders through buzzing the buzzer and sending SMS notifications. Additionally, the system includes automatic doors and windows opening to allow the compressed gas to disperse freely into the air, thereby preventing any potential fire accidents.

VII. CONCLUSION

The suggested system streamlines gas detection and prevention for users of all technical levels. This approach facilitates the wireless transfer of alert notifications to users, enabling them to conveniently link devices through a Smartphone from anywhere. It is suitable for various present-day societal uses and holds significant promise for the future. This convenient control over devices such as exhaust fans reduces the risk of accidents in

the environment. The use of the Arduino microcontroller also contributes to making the system more cost-effective. The system's quick access and control features enhance its utility. Additionally, it is utilized to alert consumers about gas wastage when removing utensils from the burner through the use of an object detection sensor.

VIII. REFERENCES

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[3] 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.

[4] 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.

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