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Iot Based Gas Leakage Detection Sysyem Using Arduino

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Abstract:
The Internet of Things (IoT) aims to automate the lives of the world by giving the path with or without human interference which will automate the tasks which may be bigger or smaller than we encounter. Because the Internet of Things (IoT) intends to simplify working, It is also practical to use well-being to reinforce present security standards. The essential goal of every project has not gone ignored by IoT. In open or closed situations, gas leakage may be savage. While traditional gas detection systems are noiseless and accurate, they are unaware of a few key aspects in the area of warning people of a leak. As a result, we have built the implementation for both industry and the society which will detect the leakage of gas and also monitor the gas availability. Alerting techniques that include sending messages to the applicable command as well as the ability to analyse sensor reading data.

These days, gas leakage and detection are major concerns in our daily lives. LPG gas is very burnable, posing a risk to both people and property. To avoid such accidents, a notable amount of try has gone into developing reliable systems for detecting gas leaks. Our significant objective is to recommend a gas detection that includes gas leakage detecting hardware to households in the area. This can monitor dangerous chemicals in the air at workplaces and it may also be used in households by alerting through an LCD.

Gas detectors can be used to detect combustible, flammable and toxic gases and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may be used in firefighting.

Gas Leakage is the process of identifying potentially hazardous gas leaks by sensors.These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected. Exposure to toxic gases can also occur in operations such as painting, fumigation, fuel filling, construction, excavation of contaminated soils, landfill operations, entering confined spaces, etc.

Introduction

LPG is a source of energy that does not replenish itself. By extracting it from rock oil and gas, it is obtained. LPG is very combustible and, as a result, it need to be kept away from sources of a solenoid and during a blowy space in order to ensure that any run will be carried out without risk. As a result of the fact that LPG vapors are more steam than air, particular attention must be paid during the storage process to ensure that any runoff does not drop to the bottom and get concentrated in a region that is low in truthfulness and difficult to spread. Because it is an alkane, LPG gas does not have any odor when it is in its natural condition. It is really a completely distinct chemical that is responsible for the odor that we experience whenever there is a run. This component is added to the gas at the same time as it is being released from the majority of storage terminals. It is the purpose of this article to be able to detect gas leaks in homes, restaurants, schools, and other locations, and to communicate with the

people who are in the surrounding area. Gas sensors are now being used on a national scale in a variety of fields, including safety, health, appliances, and others. Through the use of a MQ2 sensor, this study presents an implementation. For a variety of applications, the MQ2 sensor is used for the purpose of identification of gas leakage. In addition to that, the gadget continues to show the leakage in the LCD. In order to determine the concentration of gas, the MQ2 sensor generates an analog value, which may then be transformed into a digital signal by using an A to D Convertor that is installed inside the device. On the basis of the same digital measurement, the user is able to establish the low, medium, and hazardous levels for leakage that are associated with the paper. In order to separate the strength values, two thresholds are used, and on the basis of this differentiation, it is classified into three distinct groups. In every industry, liquefied petroleum gas, often known as LPG, is used. Additionally, it is used for applications related to industry.

The primary benefits of an LPG system There are a lot of accidents that occur, and the results of such incidents include both material and product loss as well as harm to people. Through the use of a gas sensor, our frame's primary objective is to discern between the gas that is found in homes and other varieties that are produced at home. Following the identification of the individual, the message will be delivered to them.

Combustible gas may be detected with the use of a MQ-2 sensor. The material that makes up this gas sensor is sulphur nitroxide. In the presence of fresh air, this sensor has a reduced conductivity. After then, the output of this sensing element will start decreasing. Following the establishment of the gas outflow, the microcontroller will switch on the LED and Buzzer. This low signal is monitored by the microcontroller, which will then create the gas outflow. As soon as the gas leakage is identified, the buzzer is activated, and a message that reads "leakage detected" is shown on the liquid crystal display (LCD).

An Internet of Things (IoT)-based gas leakage detection system that makes use of Arduino should establish the context by highlighting the crucial need of safety in situations where gases such as LPG, methane, and carbon monoxide are routinely employed. These environments include houses, industries, and labs. In the event that gas leaks are not discovered, they represent significant dangers to both human life and property. These leaks often result in fires, explosions, or health problems that are caused by the inhalation of poisonous fumes. Despite the fact that traditional gas detection systems are important, they often do not have the capability to provide real-time warnings or remote monitoring capabilities, which makes them less efficient in averting mishaps. In order to produce a solution that is low-cost, efficient, and scalable for real-time gas leakage monitoring and alerting, this project makes use of the power of the Internet of Things (IoT) and the technology of Arduino. By combining gas sensors with the Arduino platform and Internet of Things-enabled devices, the system is able to continually monitor gas levels and warn users promptly via smartphone notifications or alarms, even when the users are not physically present at the place. Not only does the project want to improve safety, but it also intends to include automation elements that may activate safety measures, such as turning off the gas supply or activating ventilation systems, in order to reduce the likelihood of an escalation occurring in the event of a leak. The Arduino-based system is an appropriate option for a wide variety of applications because to

its user-friendliness, affordability, and versatility. These characteristics make it suitable for a wide range of applications, from private houses to large-scale industrial settings. The introduction, in its whole, explains the need of a dependable gas leakage detection system, emphasizes the advantages of integrating the internet of things, and defines the goals of designing a safety mechanism that is practical, cost-effective, and user-friendly.

Literature Survey

Author's: Ch. Manohar Raju and N. Sushma Rani

They proposed prototype depicts a mini mobile robot which is capable to detect gas leakage in hazardous places. Whenever there is an occurrence of gas leakage in a particular place the robot immediately read and sends the data to android mobilethrough wireless communication like Bluetooth. They develop an android application for android based smart phones which can receive data from robot directly through Bluetooth.

Author's: Pal-Stefan Murvaya, Ioan Sileaa

They proposed 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 observation or portable detectors are able to detect very small leaks and the leak location, but the detection time is very long disadvantages. For example, all external techniques which involve detection done from outside the pipeline by visual

Author's: S Shyamaladevi and V G Rajaramya, P Rajasekar

They told about their project ARM7 based automated high performance system for LPG refill booking and leakage detection and methodology to make their project. The paper is designed based on modular approach which is easy to analyze as LPG cylinder booking unit, gas leakage monitoring unit at the consumer end and server system unit at the distributor side. MQ2 sensor is placed in the vicinity of the gas cylinder. In the advent of leakage, the resistance of the sensor decreases increasing its conductivity. Corresponding pulse is fed to microcontroller and simultaneously switches on the buzzer and exhaust fan.

Author's: Metta Santiputri, Muhammad Tio

They propose a device to overcome the probable called the Gas Leak Detection device based on IoT (Internet of Things). It will monitor the content of flammable gas in the air, the presence of humans, and the presence of fire in the house continuously. With this device, it is expected that the number of future accidents can be reduced and will not cause major losses.

Proposed System

Microcontrollers or relays, as well as liquid crystal displays (LCDs) and a buzzer, operate the sensors. In addition to reducing the amount of signal that is delivered, this voltage rule sector is responsible for transforming alternating current into direct current. The sensors are able to detect any leaks of gas. In this location, the MQ-2 sensor is functioning to determine the amount of LPG present in the air. The gasses that fall on the scale between 200 and 10000 parts per million are able to be identified, and the response time is almost instantaneous. Because of the sensors, an analog power would be produced as a consequence. Within the context of a sequential communication circuit, the transformation from an analog resistor to voltage is carried out. The microcontroller informs the user of that pressure. A

12-bit analog to digital converter is used in order to do the digital conversion of this current analog voltage. Within the advanced system of a gas detection system, the implementation is responsible for putting an end to both the monitoring and detection of gases that pose a significant threat to the environment. The MQ 2 sensor is the sensor that is used in the process of gas observation. This sensor is used to hear a variety of gases. Once the sensor has determined that there is a leak in the gas, it will transmit the signal to the Arduino UNO so that it may continue its work. Furthermore, the Arduino UNO will be linked to other hardware components. This is accomplished by sending the signal to the LCD using the Arduino UNO, which then displays the warning message as LPG. Detected, appropriately, the buzzer should be activated so that the persons in the background will be warned,

Methodology

1. System Design

Objective:

The system should be able to detect gas leakage, raise an alert (buzzer, LED), and send real-time data to a cloud platform for monitoring and notifications.

Sensor Placement:

Install gas sensors in potential leakage points, near appliances that use gas, or in industrial areas.

2. Hardware Setup

Gas Sensor Integration:

Connect the MQ-series gas sensor to the Arduino. The sensor has three pins: VCC (Power), GND (Ground), and the signal pin (which goes to an analog input of the Arduino).

Use the sensor's analog output to measure gas concentration levels.

Wi-Fi Module Setup:

Connect the ESP8266/ESP32 to the Arduino to enable internet connectivity. Buzzer/Alarm:

Connect a buzzer to the Arduino to produce an audible alert when gas is detected. LEDs (optional):

Connect LEDs to indicate the system's status (e.g., green for safe, red for danger). Relay Module:

If you want the system to automatically activate ventilation or shut off gas valves, connect a relay module to control external devices.

3. Arduino Programming

Gas Sensor Reading:

Write a code that reads the sensor values through the analog input. The MQ sensors provide different resistance levels based on the gas concentration.

Threshold Setting: Define a threshold value for gas detection. If the sensor value exceeds this threshold, it triggers the alarm and initiates further actions.

Wi-Fi Connectivity: Program the ESP8266 or ESP32 to connect to a Wi-Fi network and send sensor data to a cloud platform.

Cloud Integration: Use HTTP POST/GET or MQTT protocols to send data to the cloud. Platforms like Thingspeak allow you to monitor gas levels in real-time and set up alert systems via email/SMS.

Alarms & Alerts: Write code to activate the buzzer and LEDs when gas levels exceed the defined threshold.

4. Cloud Platform Setup

Create Account: Register on a cloud platform like Blynk, Thingspeak, or AWS IoT. Data Monitoring:

Set up a dashboard on the cloud platform to visualize real-time gas levels. Notifications:

Configure alerts (email, SMS) on the cloud platform to notify users if a gas leak is detected.

5. Testing & Calibration

Sensor Calibration: Test the gas sensors using small amounts of the gases they are designed to detect (e.g., LPG, methane). Ensure the sensors are calibrated properly to avoid false positives/negatives.

System Testing: Test the entire system for

functionality, ensuring the buzzer, LED, and notifications work as expected during a gas leak.

6. Deployment

Install the system in the desired area, ensuring that the sensor placement optimizes detection. Ensure that the Arduino and Wi-Fi module have a reliable power source and internet connectivity.

Block Diagram

A gas leakage detection and monitoring system is a crucial system used to detect the presence of hazardous gases in an environment to prevent potential dangers such as explosions, asphyxiation, and fire outbreaks. These systems are commonly used in industrial facilities, commercial buildings, and residential spaces where gas leaks may occur.

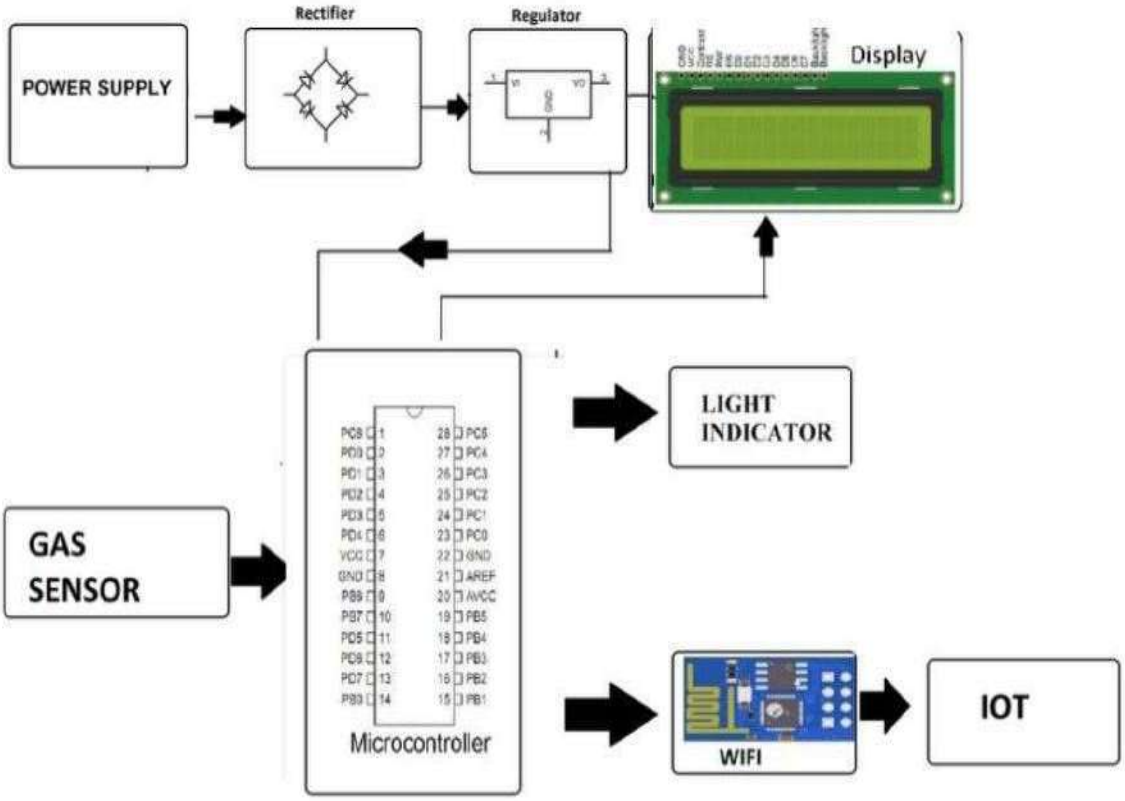

Fig 3.4.1: Block diagram

Working

The IoT-based gas leakage detection system operates through a series of integrated components designed to enhance safety and efficiency. After deployment, the system functions as follows: Real-Time Monitoring: The system employs smart gas sensors that continuously monitor gas levels in real-time. These sensors detect specific gases, such as methane or propane, converting their concentrations into electrical signals.

The finished device is connected to the IOT module over Wi-Fi. The maximum and minimum parameters

of the gas can be set in the device accordingly. The device will continuosly monitor the level of gas in the surrounding air with the help of MQ-2 gas sensor. If any abnormal reading is found, which is more than set parameters of the maximum level than can be present in the air, the LED lights will glow red and these readings will be transferred over the IOT module and the user will be alerted about this leakage. Once the gas leakage is detected, the buzzer is turned ON and a "Leakage detected" message is displayed on the LCD.

S.No	Gas_Status	Date
1	Gas_Detected	2024-09-26 11:01:23
2	Gas_Not_Detected	2024-09-26 11:01:02
3	Gas_Detected	2024-09-26 11:00:41
4	Gas_Not_Detected	2024-09-26 11:00:00
5	Gas_Not_Detected	2024-09-24 13:56:50
6	Gas_Detected	2024-09-24 13:56:33
7	Gas_Not_Detected	2024-09-24 13:41:57
8	Gas_Detected	2024-09-24 13:41:40
9	Gas_Not_Detected	2024-09-24 13:38:17
10	Gas_Detected	2024-09-24 13:38:00
11	Gas_Not_Detected	2024-09-24 13:36:56
12	Gas_Not_Detected	2024-09-23 13:54:01
13	Gas_Not_Detected	2024-09-23 13:48:42
14	Gas_Not_Detected	2024-09-23 13:21:37
15	Gas_Detected	2024-09-23 13:21:20
16	Gas_Not_Detected	2024-09-23 12:39:37
17	Gas_Detected	2024-09-23 12:39:15
18	Gas_Detected	2024-09-16 14:05:56
19	Gas_Not_Detected	2024-09-16 14:05:26
20		2024-09-16 14:03:34

Fig 5.1.1: output

"The IoT-based gas leakage detection system, comprising Arduino Uno, MQ-2 gas sensor, and ESP8266 Wi-Fi module, demonstrated remarkable efficacy in detecting LPG, propane, and methane leaks. The system accurately detected gas concentrations between 300-5000 ppm, with a response time of 5-10 seconds. Upon detection, the system triggered an alarm, sent SMS notifications to authorities, and uploaded real-time data to the cloud server via Wi-Fi. The results showed.

The system's wireless connectivity enabled remote monitoring, data analytics, and prompt action against potential gas leaks. The integration of MQ-2 sensor and ESP8266 Wi-Fi module with Arduino Uno proved to be a cost-effective and efficient solution for gas leakage detection, making it suitable for industrial, commercial, and residential applications."

Conclusion

In conclusion, the IoT-based gas leakage detection system provides a robust solution for enhancing safety in various settings. By leveraging real-time monitoring and automated alerts, the system ensures prompt responses to gas leaks, significantly reducing the risk of accidents and potential harm. Its ability to facilitate remote access and data analysis empowers users to make informed decisions and implement preventive measures. Overall, this technology not only enhances safety and operational efficiency but also underscores the importance of adopting smart solutions for risk management in today's connected world. As IoT continues to advance, the potential for further improvements and innovations in gas detection systems remains promising.

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