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IOT based Gas Detection and Notifying System

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A B S T R A C T

In recent years, the growth of Internet of Things (IoT) technology has enabled significant advancements in home and industrial safety systems. This project focuses on developing an IoT-based gas leakage detection and notification system aimed at enhancing safety by providing real-time alerts to users via their smartphones. The system employs gas sensors capable of detecting harmful gases like LPG, methane, and carbon monoxide. When a gas leakage is detected, the sensor data is processed by a microcontroller, which triggers an immediate alert through a connected IoT platform. This platform sends notifications to the user's smartphone, ensuring timely awareness of the potential hazard.

The core components of the system include gas sensors, a microcontroller, and a Wi-Fi module to enable internet connectivity. The system is designed to continuously monitor the environment for gas leaks, and upon detection, it not only sends alerts but can also trigger additional safety mechanisms, such as activating an exhaust fan or shutting off the gas supply. This dual approach minimizes the risk of accidents and enhances response times.

Through the integration of IoT technology, this project aims to provide a cost-effective, efficient, and reliable solution for gas leakage detection. It significantly improves user safety by offering immediate, remote notifications, which are crucial in preventing potential disasters. The proposed system can be easily installed in homes, industrial settings, and commercial spaces, contributing to safer environments and peace of mind for users.

1. Introduction

Gas leakage is a critical issue that poses severe risks to both life and property. Accidental gas leaks can lead to explosions, fires, and harmful health effects, highlighting the need for robust detection and alert systems. Traditional gas detection methods, while effective, often lack the immediacy and accessibility provided by modern technologies. The advent of the Internet of Things (IoT) presents an innovative approach to enhancing gas leak detection systems, making them more responsive, efficient, and user-friendly.

This report introduces an IoT-based gas leakage detection and notification system designed to address the limitations of conventional methods. By leveraging IoT technology, the system ensures real-time monitoring and instant notifications, significantly reducing the response time in the event of a gas leak. The system is comprised of advanced gas sensors, a microcontroller for processing data, and a Wi-Fi module for internet connectivity, which collectively facilitate continuous environmental monitoring and immediate alert dissemination.

The proposed solution offers several advantages. It provides users with real-time updates directly to their smartphones, allowing for rapid response regardless of their location. Additionally, the system can be programmed to activate safety mechanisms, such as shutting off the gas supply or turning on ventilation systems, further mitigating the risk of accidents.

This report delves into the design, implementation, and testing of the IoT-based gas leakage detection system. It explores the underlying technologies, system architecture, and practical applications, emphasizing the system's capability to enhance safety in residential, commercial, and industrial environments. Through this project, we aim to demonstrate how IoT can be harnessed to create more intelligent, responsive, and reliable safety systems, ultimately contributing to safer living, and working spaces.

Abbreviation

IOT – Internet of Things

LPG – Liquified Petroleum Gas

2. Literature Review

Gas Sensors and Detection Technologies: Gas sensors form the cornerstone of any gas leakage detection system. Metal-Oxide-Semiconductor (MOS) sensors, such as the MQ series (MQ-2, MQ-6), are widely recognized for their high sensitivity to gases like LPG, methane, and propane. These sensors operate by changing their resistance when exposed to gas, which can be easily measured and interpreted by a connected microcontroller. Studies have confirmed the reliability and accuracy of MOS sensors in detecting hazardous gas concentrations, making them ideal for integration into IoT-based systems.

IoT Integration: The incorporation of IoT technology into gas leakage detection systems has been a focal point of recent research. IoT-enabled systems utilize microcontrollers like Arduino or Raspberry Pi, equipped with Wi-Fi modules, to facilitate real-time data transmission and remote monitoring. This connectivity allows the system to send immediate alerts to users, significantly enhancing the speed of response to potential gas leaks. Research indicates that these systems not only improve detection accuracy but also enable scalability and flexibility in various applications.

Real-Time Notification Systems: A critical component of IoT-based gas detection systems is the ability to provide real-time notifications. Platforms such as Blynk, ThingSpeak, and MQTT are commonly used to send alerts via SMS or mobile applications. These platforms allow for the customization of notification settings and can be programmed to trigger additional safety measures, such as shutting off gas valves or activating ventilation systems. Studies have shown that these notification systems effectively reduce the time to respond to gas leaks, thereby preventing accidents and ensuring user safety.

Applications and Case Studies: The application of IoT-based gas leakage detection systems spans various environments, from residential to industrial settings. Case studies demonstrate the effectiveness of these systems in real-world scenarios. For instance, in industrial environments where multiple sensors and stringent safety protocols are required, IoT systems have been shown to manage complex setups efficiently. In residential settings, these systems provide peace of mind by ensuring that users are promptly alerted to any gas leaks, regardless of their location.

3. Working

The whole system is powered by household electric connection no alternate power source is need in the start a transformer is connected to change the current from alternating current to Direct current which is dispersed in the whole project

The buzzer, module, LCD display and the gas sensor is connected through relays and we have two extra relay to handle the gas connection and the electric supply of the whole house hold or the area where the project is being used

First the sensor senses the gas particle in the air and then passes the signal through the relay to the fan and the module, with the help of relay the fan is switched on the massage is passed to the module and with the help internet connectivity the notification is send to the user to alert about the gas leak in the same time a message id displayed on the LCD screen to and the buzzer starts making sound to inform the people around the area to safety measures

The module here used is ESP8266 microcontroller and the connection type is Wi-Fi where the connection id and password of the wireless network id embedded in its code and we are using the Blyn IOT app to establish a connection between the user and the project. So, there are real time alert provided to the user.

* Components used:

1) Modul

Here, we are using ESP8266 microcontroller. The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller chip designed by Espressif Systems. It has gained widespread popularity for its affordability, versatility, and ease of use in IoT applications. It helps us to connect out project to through internet connectivity

Image: MCU Module

2) LPG Gas sensor

An LPG Gas Sensor Module is a device designed to detect the presence of Liquefied Petroleum Gas (LPG) in the environment. It typically includes a gas sensor, such as the MQ-2 or MQ-6, which changes resistance in the presence of LPG. The module converts this change into an electrical signal that can be read by microcontrollers, triggering alarms or notifications when gas levels exceed a certain threshold.

Image: LPG Gas sensor

3) Buzzer

Image: Buzzer

4) 16*2 LCD display

Image: 16*2 LCD display

5) Exhaust fan

Image: Exhaust Fan

6) Connecting wires

7) Relay

Relay having 220V as well as a 5V input, when needed, is applied in the circuit to turn off the electricity. There are 5 pins in the relay. The digital pins encompass its Arduino board are linked with one pin. One is linked to the switch to attach the 220V power source. This power has deviated to the devices between the other pin. The other 2 are beach one in the main energy source and another one for the Microcontroller board.

Image: Relay

4. Results

5.Applications & Features

The module is low-powered, and portable; hence, it is used in other applications such as Smoke Detector.

ii. They can be used in a household where the owner must regulate and detect the gas leakage in the absence of the owner.

iii. Gas detectors can be used to detect gases that catch fire easily, that are flammable, and which exhaust the oxygen (oxygen depletion).

iv. This module can be seen at various Oil Plant, Manufacturing units to monitor the various process and where there is the constant use of oil takes place.

v. Ensure worker's health. Get an immediate gas alert. Prevent fire hazards about leakage.

6. Conclusion

In conclusion, the literature underscores the transformative potential of IoT in enhancing gas leakage detection systems. By integrating advanced sensor technology with real-time data processing and notification capabilities, IoT-based systems offer a significant improvement over traditional method. These advancements contribute to creating safer living and working environments, underscoring the importance of continued research and development in this field.

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