Gas Leakage and Detection System

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Abstract: Gas leakage is a critical safety concern that poses severe risks, including explosions, fires, and health hazards, in industries, residential areas, and vehicles. Detecting and mitigating gas leaks in a timely manner is essential to prevent life-threatening incidents and property damage. This research presents an advanced gas leakage detection and prevention system utilizing Arduino Nano, ESP8266, and Blynk IoT for real-time monitoring, automated alerts, and safety controls. The system incorporates an MQ-6 gas sensor to detect LPG gas leaks, displaying gas concentration levels in PPM on an LCD screen. When a hazardous concentration is detected, the system immediately activates an alarm, sends real-time notifications via the Blynk IoT platform and website, automatically shuts off the gas regulator, and trips the electricity supply to prevent further escalation. Designed for residential, commercial, and industrial applications, this cost-effective and highly reliable solution enhances safety by providing continuous monitoring, rapid response, and automated preventive measures.

Keywords:

Gas Sensors, Alert System, Gas Monitoring, Gas Leak Detection, Control Unit, Blynk IoT, Automatic Regulator Switch, Electricity Trip

1.Introduction

Gas leakage is a serious problem and is increasingly observed in various places such as industries, homes, and vehicles. A Gas Leakage and Detection System is a safety mechanism designed to detect the presence of hazardous gases and prevent accidents caused by leaks. These systems are commonly installed in homes, industrial plants, commercial buildings, and laboratories where gases like methane, LPG (liquefied petroleum gas), or carbon monoxide are used or stored. Since these gases are highly flammable and toxic, any leakage can result in explosions and fires.

Our system utilizes gas sensors that continuously monitor the presence of gases in the air. These sensors work by measuring changes in electrical resistance when gas molecules come into contact with the sensor surface. The data is then processed by a control unit, such as an Arduino Nano, which evaluates the gas levels. If the sensor detects a dangerous concentration of gas, the system triggers an alarm, which may include audio warnings like buzzers and visual indicators such as flashing lights to alert people in the vicinity.

Additionally, our gas leakage detection system is equipped with ESP8266 Wi-Fi module, enabling real-time monitoring through Blynk IoT. This feature allows users to check the live status of gas levels and receive instant alert notifications on their smartphones, ensuring timely action. Advanced features like automatic shut-off valves can be

integrated to cut off the gas supply in case of a leak, further minimizing risks. The system operates on the main power supply but also includes a backup battery to ensure continuous functionality during power failures.

2. Literature Survey

[1] In 2016 Falohun, A.S. was developed Dangerous gas detection using an integrated circuit and MQ- 9. The system aims to detect natural gas leaks, which can occur due to accidents or malfunctioning valves. The gas detector, built using an MQ-9 chemical sensor and an integrated circuit, provides alerts in case of leakage, ensuring building occupants are warned early to take necessary action. The system was designed to be simple, cost-effective, and highly responsive, making it suitable for both residential and industrial settings where gas leaks can pose serious risks. During testing, the system demonstrated its reliability in detecting gas leaks quickly and triggering the alarms in time for users to take necessary safety actions.

[2] In 2022 Tommy, Alexander was Implement a Gas Leakage Detection System Using the MQ-6 Sensor. The test is carried out by programming the coding on the device so that it displays the voltage on the sensor in standby or LOW and HIGH conditions. From the results of the tests carried out, the device is on standby or in a LOW condition at a voltage of 0.24 volts. The tool will detect or be in a HIGH state at voltages from 2.33 Volts onwards. Tests are carried out to determine the sensor reading distance to detect gas leaks. In this test, the application of gas is carried out by narrowing the gas outlet hole to determine the gas detection limit within centimeters. The results obtained are the maximum distance detected by the gas sensor is 18cm.

[3] In 2017 Srinivas, Chalasani and Ch Mohan Kumar was developing Toxic gas detection and monitoring utilizing internet of things. Framework for toxic gas and radiation discovery checking cautioning has been created to defeat the drawback looked in more established techniques by utilizing Wi-Fi module and web of things. Consequently the utilization of serial correspondence makes the framework with Arduino controller and IoT. The IoT door associate remote sensor connects with the web, guarantee the operation of the gas and alcohol observing framework. It utilized just constrained sensor. Created application additionally utilized for checking gas and radiation in android portable.

3. Problem Definition

Gas leakage is a critical safety concern that arises due to faulty equipment, corrosion, physical damage, or improper installation. Leaks can result in severe hazards, including fires, explosions, and exposure to toxic gases such as carbon monoxide (CO), which can cause dizziness, nausea, respiratory issues, or even fatal poisoning. Additionally, some gases displace oxygen in the air, leading to suffocation risks, while others contribute to environmental pollution and climate change. Given these dangers, preventing gas leaks through regular maintenance, proper installation, and advanced leak detection systems is essential to ensure safety in residential, commercial, and industrial environments.

4. Proposed Working
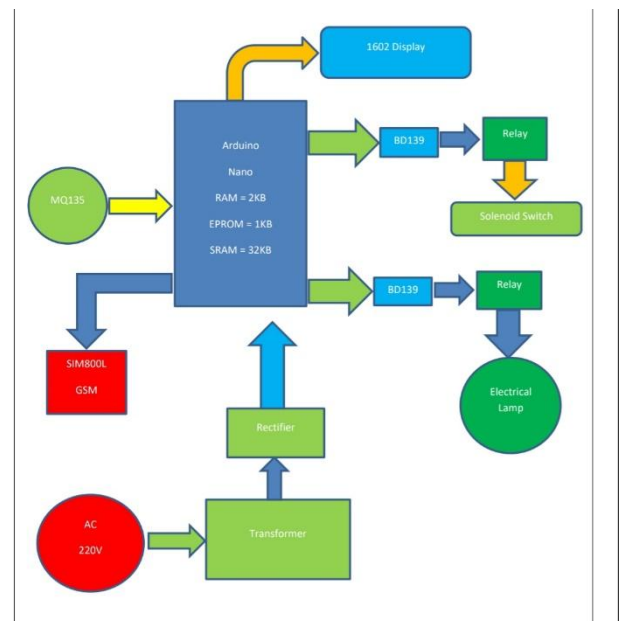
Our system is a comprehensive gas leakage detection and prevention framework that consists of gas sensors, data acquisition units, processing algorithms, and automated safety mechanisms. Gas sensors are strategically deployed in high-risk areas to continuously monitor target gases such as LPG, methane, and carbon monoxide.

These sensors generate electronic signals that are transmitted to a control unit (Arduino Nano) for processing. The Arduino microcontroller, which functions as the brain of the system, receives input signals from the gas sensors, analyzes them, and triggers appropriate actions. If a gas leak is detected, the system activates both audible and visual alarms, sends real-time

notifications via Blynk IoT to homeowners, building managers, or safety personnel, and automatically shuts off the gas supply using an electromechanical valve.

Additionally, the system includes data logging capabilities, recording gas leakage incidents for reporting, diagnostics, and future analysis. This feature enhances system reliability and allows for preventive maintenance and safety assessments in residential, commercial, and industrial settings.

5. Result
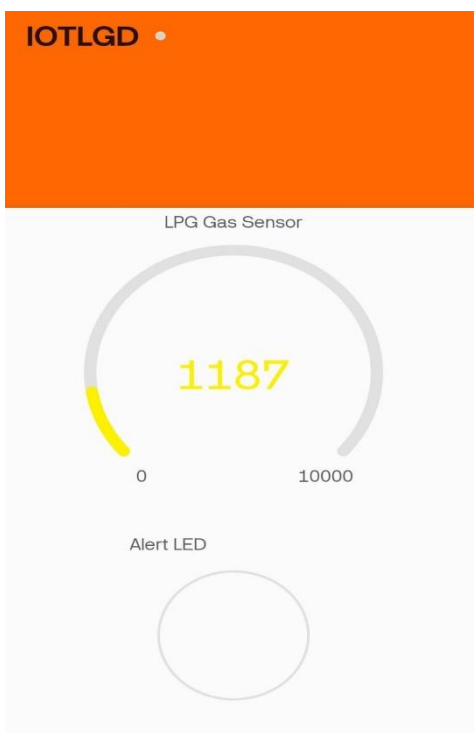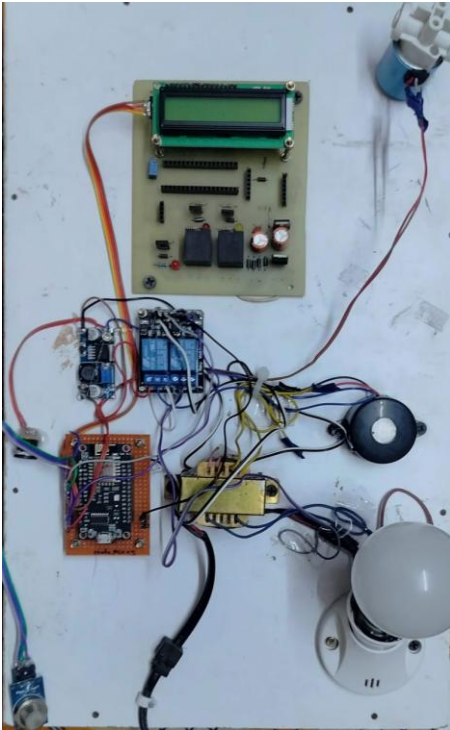
The Gas Leakage Detection System is designed to automatically detect and respond to gas leaks, ensuring safety in residential, commercial, and industrial environments. The system provides real-time gas monitoring, detecting hazardous levels of LPG gas using an MQ-6 sensor and immediately triggering safety mechanisms.

When a gas leak is detected, the system activates audible and visual alerts, including a buzzer and LED indicator, to warn occupants. Additionally, it sends instant notifications via the Blynk IoT platform, allowing users to monitor gas levels remotely through a mobile application or website.

To prevent potential hazards, the system automatically shuts off the gas regulator and trips the electrical supply, reducing the risk of explosions and fire incidents. The integration of ESP8266 and Arduino Nano ensures efficient data processing, while a relay module controls the safety actions.

The implementation includes comprehensive testing, including unit, integration, system, and acceptance testing, to ensure reliability and effectiveness. Additionally, the system offers data logging and analysis capabilities, enabling users to review gas concentration trends and optimize safety measures.

6. Benefits

1. Detect Gas Leak

   The system is equipped with an MQ-6 gas sensor capable of detecting harmful gases such as LPG, methane, and carbon monoxide at an early stage. By preventing gas accumulation, the system significantly reduces the risk of explosions, fires, and poisoning. Its proactive detection mechanism ensures enhanced safety for homes, industries, and commercial spaces.

2. Notifications via Blink IOT

   Unlike traditional gas detectors, this system leverages ESP8266 with Blynk IoT to provide instant alerts via mobile notifications and a web platform. Users receive real-time gas leak alerts, allowing them to take immediate action remotely, such as shutting off the gas supply or notifying emergency services. This feature ensures safety even when users are away from the premises.

3. Automatic Gas Shut-Off
  To prevent potential hazards, the system integrates an electromechanical valve that automatically shuts off the gas supply when a leak is detected. This function minimizes the risk of fire and explosions by stopping the gas flow at its source, ensuring maximum protection for occupants and property.

4. 24/7 Continuous Monitoring
  The system provides round-the-clock air quality monitoring with real-time gas level tracking. Unlike manual inspection methods, the automated monitoring process ensures immediate leak detection at any time of the day or night, making it a reliable solution for both residential and industrial applications.

7. Conclusion

The Gas Leakage Detection System utilizing GSM with Call Alert provides an efficient, automated, and proactive solution for gas safety. By enabling real-time monitoring, automatic leak detection, and instant alert notifications, the system ensures timely action to prevent potential hazards. Its integration of sensor technology, IoT connectivity (Blynk), and automated safety mechanisms, such as gas shut-off and electricity trip functions, enhances overall reliability and effectiveness.

By reducing manual intervention and optimizing safety protocols, this system significantly minimizes the risks associated with gas leaks, explosions, and toxic exposure. Designed for residential, commercial, and industrial applications, it contributes to a safer, more secure, and technology-driven environment, ensuring enhanced protection for lives and property.

8. References

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