IOT Based Gas Leakage System

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Abstract- *This paper presents a novel robot designed as a first response to fire and hazardous chemicals in homes. Equipped with gas and flame sensors, GSM alerting, and fire extinguishing capabilities, the robot autonomously detects threats and sends SMS alerts. Built with readily available microelectronics and programmed on Arduino UNO, the system is reliable and cost-effective. This innovative project contributes to home safety by mitigating the risks of fire and hazardous gas leaks.*

Keywords- leak detection, MQ5 sensor, GSM module, Mobile alarm system, Home safety, VGG16,CNN.

I. INTRODUCTION

Fire protection is crucial for saving lives and property. As technology advances, innovative solutions like robotics emerge to address challenges like hazardous gas detection. This paper proposes an automated gas-detecting robot for enhanced household fire protection.The robot utilizes a mobile platform for wider coverage, integrates multi-sensors for comprehensive detection, and triggers alarms and SMS notifications for timely response. It can even be equipped with a water pump for automated fire control. This novel approach offers significant advantages over traditional methods, improving safety and peace of mind for homeowners.

II. EASE OF USE

A. Effortless Setup:

Forget the days of tangled wires and confusing manuals. Our gas detection system prioritizes user-friendliness from the very beginning. Installation is as simple as plugging in the base unit and connecting the sensor to your desired location. Our intuitive mobile app guides you through the process, step-by-step, with clear instructions and visual prompts. No specialized knowledge or technical expertise needed, just a few effortless clicks for guaranteed protection.

B. Constant Vigilence:

Once activated, the system becomes your watchful sentry. Advanced sensors continuously monitor the air for any trace of hazardous gas leaks. Whether it's carbon monoxide, propane, or methane, our sophisticated technology won't miss a beat. Should any anomaly be detected, you'll receive immediate alerts via SMS and push notifications on your app. This real-time monitoring ensures you're aware of any potential threat before it can escalate, allowing you to take swift action for optimal safety.

C. Action at your Command:

Our user-friendly design empowers you to respond directly to potential gas leaks. With the tap of a button on your mobile app, you can trigger the built-in buzzer for a local alert, remotely shut off the gas supply to prevent further accumulation, or even activate a connected fire extinguisher if the situation demands. This level of control puts you in charge of your home's safety, allowing you to react decisively and effectively in any situation.

Abbreviations and Acronyms :

- GSM: Global System for Mobile Communications
- SMS: Short Message Service
- LED: Light-Emitting Diode
- LPG: Liquefied Petroleum Gas
- MQ: Metal Oxide (sensor type)
- MOX: Metal Oxide Semiconductor
- VOCs: Volatile Organic Compounds

III. METHODS AND MATERIAL

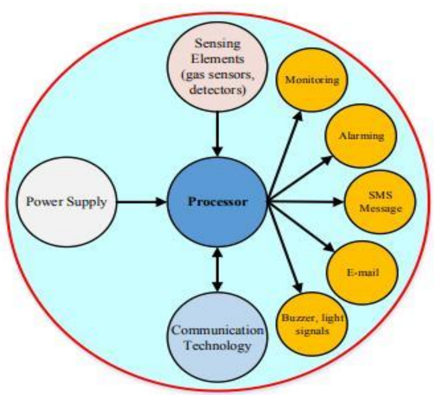
1. **Input:** Sensor Data Stream With a defined baseline or expected value.
2. **Output:** Alerts communicated through an audible buzzer and visual display on an LCD screen.
3. **Functions:**
   I. **Data Acquisition:** Extracts and interprets sensor data, identifying any significant deviations from the established reference.
   II. **Alert Activation:** Triggers the buzzer and LCD display based on detected irregularities.
   III. **Information Broadcast:** Presents visual details regarding the anomaly on the LCD screen.

4. **Success Conditions:** 1. If such data which is received through sensors are not stable or are more than threshold it will predict that there is leakage situation
5. **Failure Conditions:** Desired output is not generated due to following failures.
    1. Software Failure
    2. Hardware Failure
    3. Network Connection Failure

System Architecture:

The Internet of Things (IoT) architecture for gas leakage detection involves a network of interconnected sensors and devices strategically placed in relevant locations. These devices, equipped with gas sensors, are responsible for continuously monitoring the surrounding environment for any traces of gas. The data collected by these sensors are transmitted using specific connectivity protocols, such as MQTT or CoAP, to ensure efficient communication between devices. The entire system is designed to seamlessly integrate with cloud platforms,

1. leveraging services
2. AWS or Azure,
3. for centralized data storage



Sensor Technology:

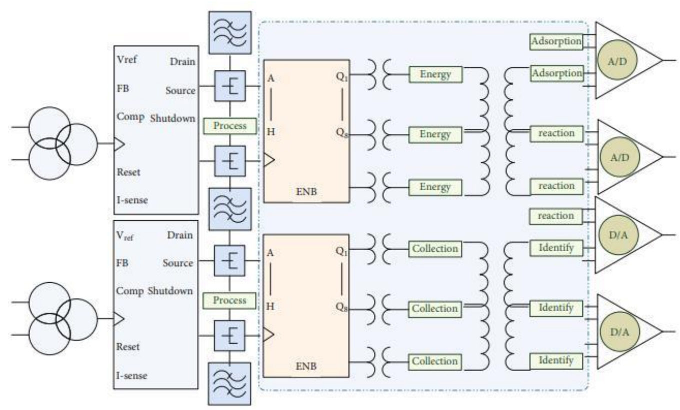
Various gas sensors play a crucial role in the system's efficacy. These sensors differ in terms of technology, sensitivity, and response time. The selection criteria for these sensors are meticulous, considering factors such as the type of gas to be detected, environmental conditions, and the desired level of accuracy. Calibration of these sensors is a critical aspect to ensure ongoing reliability. Regular maintenance routines are implemented to guarantee long-term accuracy and effectiveness, taking into account the potential environmental factors that might affect sensor performance

Real-Time Monitoring and Alerting:

Real-time monitoring capabilities form the backbone of the gas leakage detection system. The system is designed to provide instantaneous alerts in the event of a gas leak. Immediate alert mechanisms, including sirens, visual indicators, and notifications, are activated to ensure swift response. Integration with mobile applications and other communication channels, such as SMS or email alerts, further enhances the reach and ensures that relevant stakeholders are promptly informed about the gas leakage, enabling them to take timely actions to mitigate potential risks.

Data Analytics:

Data analytics are harnessed to derive meaningful insights from the vast amount of information collected by the gas detection system. Trend analysis and anomaly detection algorithms are employed to identify patterns or deviations that might indicate potential issues.and analysis. This cloud integration not only facilitates real-time monitoring but also enables advanced analytics for proactive gas leak detection.



Historical data storage is crucial not only for compliance and auditing purposes but also for performance evaluation and system optimization. Machine learning algorithms are applied for predictive analysis, enabling the system to anticipate and prevent potential gas leakages based on historical patterns.

TABLE 1 : Parts and materials of gassensor

S. No	Parts	Materials
1	Gas Sensing Layer	Sno2
2	Electrode	Au
3	Electrode Line	Pt
4	Heater coil	NI-cr alloy
5	Resin base	bakelite

Power Efficiency and Sustainability:

Strategies for optimizing power consumption are implemented to ensure the long-term sustainability of IoT devices. This includes the use of low-power components, efficient power management systems, and, where applicable, the integration of renewable energy sources. Battery management, power supply, and sensor connection are key aspects of these strategies. Practices are put in place to extend the operational life of devices, balancing the need for continuous monitoring with energy conservation. These measures contribute to a sustainable and eco-friendly gas leakage detection system.

Case Studies:

Real-world implementation examples showcase the versatility and effectiveness of the IoT-based gas leakage detection system across diverse environments. Performance metrics, including response times and detection accuracy, highlight the system's success in preventing potential hazards. Success stories illustrate how the system has safeguarded lives and property. Challenges faced during deployment, such as environmental variability and technological limitations, provide valuable insights, and lessons learned contribute to ongoing improvements in system design and implementation.

Circuit Diagram

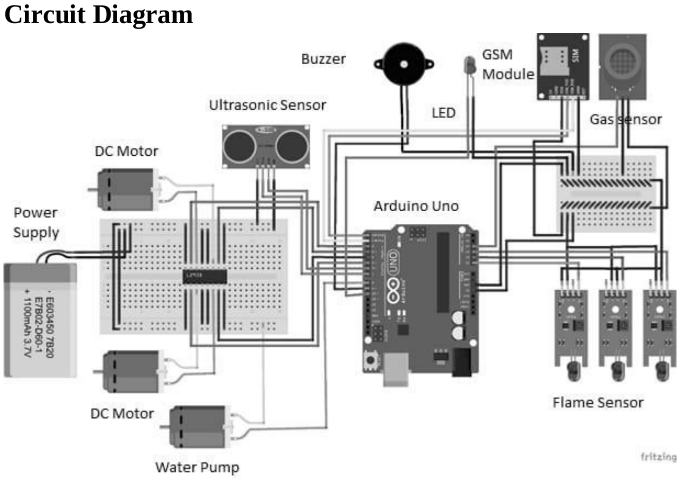


Fig ; circuit diagram of system

VI. CONCLUSION

In summary, the gas leakage detection system presented in this paper represents a significant advancement in safety technology. The contributions of this system lie in its robust architecture, sensor technology selection, and real-time monitoring capabilities. Data analytics, power efficiency, and sustainability measures are integral aspects of its functionality. Future research should focus on further refining the system, exploring additional applications, and expanding its capabilities to address emerging challenges in gas safety. The closing remarks underscore the profound significance of IoT-based gas leakage detection in enhancing safety standards and protecting communities from potential disasters.

VII. ACKNOWLEDGEMENT

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