Embedded System for Hazardous Gas Detection and Alerting using ARM

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Abstract:

This project aims to develop a real-time gas detection and alert system using a Raspberry Pi 4 as the central controller and an MQ-6 sensor for propane and LPG detection. The system continuously monitors the gas levels and sends SMS alerts to designated authorities if they exceed a predetermined threshold, ensuring timely response and enhancing safety in various environments.

Keywords: Gas detection, Raspberry Pi, MQ-6 sensor, GSM, SMS alert

Methodology:

1. Problem and Existing Solutions:

Gas leaks pose a significant threat, potentially leading to explosions and fires. Traditional detection methods often involve manual checks or bulky, stationary systems. These limitations necessitate the development of portable and efficient solutions for continuous monitoring and prompt alerts.

2. Proposed System:

This project proposes a cost-effective and user-friendly gas detection system with the following key components:

Raspberry Pi 4: Acts as the central processing unit, responsible for controlling the system, processing sensor data, and triggering alerts.
MQ-6 Sensor: Chosen for its high sensitivity to propane and LPG at a relatively affordable price.
GSM Module: Enables the system to send SMS alerts to designated phone numbers upon detecting gas levels exceeding the set threshold.

3. System Development:

3.1 **Hardware Setup:**

Connect the MQ-6 sensor to the Raspberry Pi's analog-to-digital converter (ADC) pins for reading sensor data.
Integrate the GSM module with the Raspberry Pi using its serial communication interface (e.g., UART).
Connect an LCD display (optional) to visually display real-time gas levels and system status.

3.2 **Software Development:**

Develop Python code on the Raspberry Pi to:
Read sensor data from the MQ-6 sensor.
Apply calibration to compensate for sensor drift and ensure accurate readings.
Implement an algorithm to compare the measured gas levels with the predefined threshold.
Trigger SMS alerts using the GSM module in case of exceeding the threshold.
(Optional) Display real-time gas levels and system status on the LCD (if connected).

4. **Testing and Evaluation:**

Test the system in a controlled environment with varying gas concentrations to validate sensor accuracy and alert functionality.
Evaluate the system's performance metrics, including response time, sensitivity, and reliability.
Refine the system based on testing results and user feedback to optimize performance and functionality.

5. **Conclusion:**

This gas detection system utilizes readily available components and open-source software, making it accessible and adaptable for various applications. The project contributes to improved safety measures by providing real-time monitoring, prompt alerts, and portable operation, potentially preventing accidents and saving lives.