Smart Gass Guardian 360
Project Proposal

Team Name	Syntax Squad
Category	University

Problem Definition

Introduction

Gas leakage incidents in residential and commercial spaces pose severe risks to life and property, often resulting in devastating accidents and fatalities. Despite the widespread use of LPG and natural gas for cooking and heating, many households lack reliable early warning systems. Traditional gas detection methods are often manual or rely on human sensory detection, which can be dangerous and ineffective, especially during sleep hours or in poorly ventilated areas.
To address these critical safety concerns, we aim to solve this by creating an IoT-based Smart Gas Leakage Detection System that provides automated monitoring, instant alerts, and immediate protective actions. Our system aims to revolutionize home safety by offering continuous gas leak monitoring, automatic shut-off mechanisms, and multi-channel alerts to ensure household safety 24/7.

Problem Analysis

The primary challenges in gas safety include:

- Delayed detection of gas leaks leading to dangerous accumulation
- Lack of immediate automated response mechanisms
- Absence of real-time notification systems for remote monitoring
- Limited integration with modern smart home systems
- High dependency on human intervention for safety measures

These factors create a critical need for an intelligent system that can autonomously detect, respond to, and alert users about potential gas-related hazards.

Proposed Solution

Proposed Product

The Smart Gass Guardian 360 is an IoT-enabled safety device that provides comprehensive protection against gas-related accidents. It combines advanced gas and flame sensors with automated response mechanisms and multi-channel alerts. The system not only detects hazardous conditions but also takes immediate corrective actions while notifying users through multiple communication channels.

Uniqueness of the Solution

Our solution stands out through its:

1. **Comprehensive Detection**: Simultaneous monitoring of both gas leaks and fire hazards
2. **Automated Response System**:
    - Immediate gas supply shutdown
    - Automatic ventilation activation
    - Multi-level alert system
3. **Smart Communication**:
    - Real-time SMS alerts
    - WhatsApp notifications
    - Emergency phone calls
4. **Visual Status Indication**:
    - LED-based status display
    - LCD screen with detailed information
5. **Integration Capabilities**:
    - Compatible with existing smart home systems
    - Expandable for additional safety features

Technical Overview and Implementation

Technical Details

The device integrates gas and flame sensors to detect gas leaks and fire hazards. A relay module controls the gas supply, shutting it off automatically during emergencies, and activates a cooling fan to disperse leaked gas and improve ventilation. Alerts are triggered using LEDs, a buzzer, and a GSM module for SMS, WhatsApp, and call notifications. The system is powered by an ESP32 microcontroller for processing and connectivity. An LCD display provides real-time status updates, while intelligent algorithms ensure reliable detection and response. The design includes modular components for easy maintenance, fail-safe mechanisms, and backup power support for uninterrupted operation.

User Scenario

Meet the Ruwan family. They live in a high-rise apartment and often worry about gas safety, especially when away from home. After installing our Smart Gas Leakage Detection System, their peace of mind has dramatically improved. One day, while the family was asleep, the system detected a minor gas leak from their kitchen stove. Immediately, it:

1. Shut off the gas supply
2. Activated the exhaust fan
3. Triggered the alarm
4. Sent SMS and WhatsApp alerts to Mr. Sharma
5. Made an emergency call to ensure awareness

Thanks to the system's prompt response, a potentially dangerous situation was averted before it could escalate. The family now feels secure knowing they have 24/7 protection against gas-related hazards

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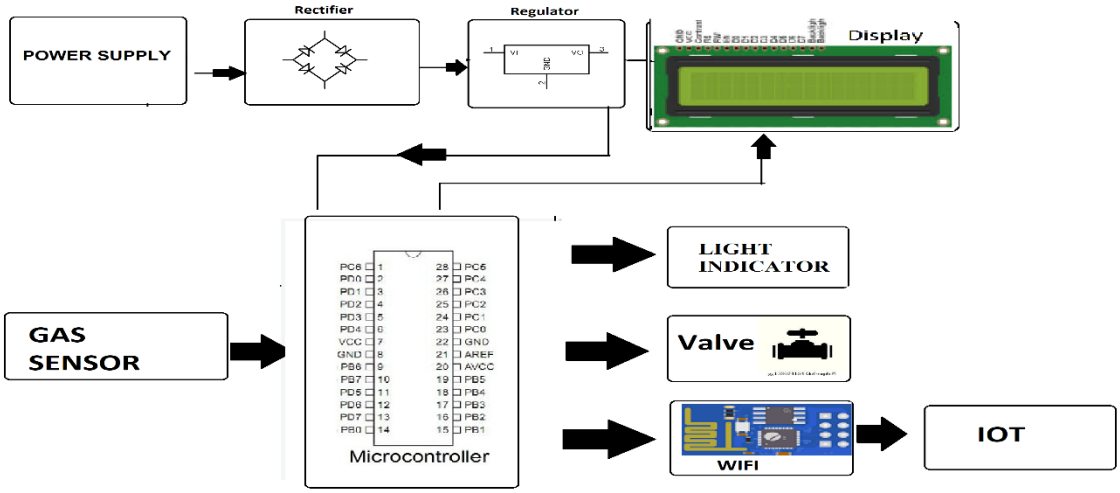
Additional Information



Hardware Components

- ESP32 microcontroller for processing and connectivity
- MQ-2/MQ-5 gas sensors for reliable gas detection
- Flame sensors for fire detection
- Relay modules for controlling gas supply and ventilation
- LCD display for status information
- LED indicators for visual alerts
- GSM module for communication
- Buzzer for local audio alerts

Software Features

- Real-time sensor monitoring
- Intelligent threshold-based detection
- State machine implementation for reliable operation
- Multi-channel communication protocols
- Automated emergency response algorithms
- System health monitoring and diagnostics

Implementation Methodology

- Modular design for easy maintenance
- Fail-safe operation mechanisms
- Regular self-diagnostic checks
- Automated calibration procedures
- Backup power support

Below is the code for our Gas Leakage Detection System project. The code implements the following key functionalities:

1. Continuous monitoring of gas (MQ2/MQ5) and flame sensors
2. Automated safety responses:
   - Gas supply shutoff
   - Ventilation fan control
   - Visual alerts (LED indicators)
   - Audio alerts (Buzzer)
3. Multi-channel notifications:
   - SMS alerts
   - WhatsApp messages
   - Emergency calls
4. LCD display for real-time status updates

The code is fully commented and includes proper error handling.

https://drive.google.com/file/d/16mHaPyKKOYSsm-VhPYUpefDFZRyo2PYv/view