

**IOT PROJECT PROPOSAL**

**Members:**

**Mubashir Ajaz(21K-3277)**

**Huzaifa Quaid (21k-3272)**

**Muneeb Khan(21k-3238)**

**Project Proposal: IoT-Based Smart Gas Leak Detector & Auto Shutoff System**

**Introduction and Motivation** Gas leaks in residential, commercial, and industrial environments are a significant safety concern, often leading to fire hazards, explosions, and health risks due to the inhalation of toxic gases. Traditional gas leak detection systems rely on manual intervention or basic alarms, which are insufficient to prevent accidents effectively. With the rapid advancement of IoT (Internet of Things) technologies, there is an opportunity to develop a smarter, more proactive solution that not only detects gas leaks but also takes immediate action to mitigate risks.This project proposes an IoT-based smart gas leak detection and auto shutoff system that integrates real-time monitoring, automated control, and user notifications to enhance safety and prevent accidents. The system is designed to be cost-effective, user-friendly, and scalable for various applications, including homes, restaurants, and small businesses.

**Literature Review** Gas leak detection has been a critical area of research due to its implications for safety and health. Traditional systems use sensors like MQ-2 or MQ-6 to detect combustible gases and trigger alarms. However, these systems often lack automated control mechanisms or remote monitoring capabilities. Recent advancements in IoT have enabled the development of smart gas leak detectors that integrate Wi-Fi modules (e.g., ESP8266) for real-time alerts and cloud-based monitoring.

Studies have explored the use of IoT for real-time gas monitoring in industrial settings, but these solutions are often expensive and complex. Other research has focused on low-cost sensor networks for home safety, but these systems typically lack automated shutoff mechanisms. This project builds on existing technologies to create a comprehensive, low-cost solution that combines detection, automatic shutoff, and user-friendly interfaces, addressing the gaps in current systems.

**Problem Statement** Gas leaks from LPG cylinders or pipelines in homes, restaurants, and small businesses are a significant safety concern. Current solutions rely on manual detection or basic alarms, which do not actively prevent accidents. There is a need for an automated system that can detect gas leaks, notify users in real-time, and automatically shut off the gas supply to minimize risks. Additionally, the system should provide a user-friendly interface for monitoring and control, making it accessible to non-technical users. The proposed system aims to address these challenges by integrating IoT technologies, real-time monitoring, and automated control mechanisms.

**Research Questions/Objectives** **Research Questions:**

1. How can IoT technologies be leveraged to create a smart gas leak detection and auto shutoff system?
2. What are the optimal thresholds for gas concentration levels to trigger alarms and automatic shutoff?
3. How can the system ensure reliable communication between hardware components and user interfaces?
4. What are the most effective methods for simulating and testing the system before deployment?

**Objectives:**

1. To design and develop a hardware-based IoT system for gas leak detection and automatic shutoff.
2. To implement a real-time monitoring system with user notifications via a web dashboard or mobile app.
3. To simulate the system using software tools (e.g., Proteus/TinkerCAD) for visualization and testing.
4. To ensure the system is cost-effective, user-friendly, and scalable for various applications.

**Tentative Methodology/Circuit Design** **Methodology:**

1. **Hardware Design:**
   * Use an MQ-2 gas sensor to detect gas leaks.
   * Integrate an Arduino Uno as the main controller for processing sensor data.
   * Implement a servo motor to act as an automated shutoff valve.
   * Use an ESP8266 Wi-Fi module for IoT connectivity and remote monitoring.
   * Include a buzzer for local alerts and an LCD display to show real-time gas levels.
   * Optionally, add a GSM module for SMS/call alerts (if available).
2. **Software Design:**
   * Develop firmware for the Arduino Uno to process sensor data and control the servo motor.
   * Create a web dashboard or mobile app for real-time monitoring and control.
   * Use MQTT or HTTP protocols for communication between the hardware and the IoT platform.
   * Simulate the system using Proteus or TinkerCAD to visualize gas leak detection and valve shutoff.
3. **Testing and Validation:**
   * Test the hardware system with controlled gas leak scenarios.
   * Validate the accuracy of gas concentration thresholds and response times.
   * Ensure reliable communication between the hardware and IoT platform.

**Circuit Design** **Components:**

* Arduino Uno (Controller)
* MQ-2 Gas Sensor (Gas Detection)
* Servo Motor (Auto Shutoff Valve)
* ESP8266 Wi-Fi Module (IoT Connectivity)
* Buzzer (Alarm)
* LCD Display (Real-time Gas Level Display)
* GSM Module (Optional for SMS/Call Alerts)

**Circuit Connections:**

* Connect the MQ-2 sensor to the Arduino’s analog input pins.
* Connect the servo motor to the Arduino’s PWM pins.
* Interface the ESP8266 with the Arduino for Wi-Fi communication.
* Connect the buzzer and LCD display to the Arduino’s digital pins.
* Optionally, connect the GSM module for SMS/call functionality.