**🏠 Gas Leakage Prevention in Residents**

**🔥 1. Problem Statement**

Gas leakage in residential kitchens is a serious safety hazard. Many households rely on manual detection (smell or visible flames), which leads to delayed responses, potential explosions, and health risks.

There is a lack of an affordable, automated, real-time system to detect gas leaks and trigger early alerts or shut off the gas supply.

**💡 2. Proposed Solution**

Design a smart IoT-based gas leakage prevention system that:

* Detects gas leaks using a reliable gas sensor (e.g., MQ-6)
* Sends real-time alerts via mobile app or buzzer
* Automatically shuts off the gas valve using a servo motor
* Logs gas exposure data for trend prediction and future prevention
* Can be integrated with home automation (optional)

**⚙️ 3. System Architecture**

**Gas Cylinder / Stove** → **Gas Sensor** → **ESP32 / Arduino** → **Wi-Fi / Buzzer + Mobile App** → **Auto Cutoff Valve + Cloud Logging**

**📦 4. Hardware Components**

| **Component** | **Purpose** |
| --- | --- |
| MQ-6 Gas Sensor | Detect presence of LPG/diesel gas |
| ESP32 / NodeMCU | Microcontroller with Wi-Fi |
| Servo Motor / Solenoid Valve | Shut off gas supply automatically |
| Relay Module | Control solenoid valve (if used) |
| Buzzer / RGB LED | Local alert for leak |
| Power Supply | Operate the system continuously |

**📲 5. Software Modules**

**a. Mobile App**

* Receives alerts when gas is detected
* Shows current sensor values
* Manual override to turn off gas
* Leak history log

**b. Firmware (Microcontroller)**

* Read gas sensor data
* Trigger alarm if threshold crossed
* Control cutoff valve
* Send data to app/cloud

**c. Cloud Backend (Optional)**

* Store gas readings over time
* Predict leakage trends
* Push safety reminders

**🌐 6. Communication Protocols**

| **Function** | **Protocol** | **Usage Scenario** |
| --- | --- | --- |
| Device ↔ App | Wi-Fi (Blynk/HTTP) | Real-time alerts |
| Device ↔ Cloud | MQTT / Firebase | Logging & analytics |
| OTA Updates (optional) | Wi-Fi | Update firmware remotely |

**🤖 7. Optional AI/ML Model**

* **Inputs:** Gas level readings over time, frequency of leaks
* **Output:** Predict risk zones or likelihood of future leaks
* **Toolchain:** TensorFlow Lite, Edge Impulse, or regression models
* **Deployment:** On-device (ESP32) or via cloud inference

**🧠 8. Unique Value Proposition**

* Affordable system for homes and apartments
* Real-time auto shutoff = life saving response
* Bluetooth/Wi-Fi-based alerts – ideal for mobile-first families
* Can be integrated with smart home systems or Alexa/Google Home
* Prediction model enhances long-term prevention

**⏱️ 9. Development Timeline**

| **Phase** | **Time Estimate** |
| --- | --- |
| Hardware setup | 2–3 hours |
| Sensor + servo integration | 3–4 hours |
| Firmware development | 4 hours |
| App setup & testing | 4–5 hours |
| ML model (optional) | 3–5 hours |
| Final integration & demo | Remaining time |

**🚀 Conclusion**

The **Gas Leakage Prevention System for Residents** aims to deliver safety, automation, and peace of mind to households. By combining sensor-based leak detection with real-time alerts and automatic shutoff mechanisms, the solution addresses a critical safety concern with a smart and scalable approach. With optional AI features and app integration, it is ideal for both independent homes and smart apartment systems.