PROJECT ABSTRACT

IoT LPG Gas Leakage Detector with Auto Shutoff Valve

An ESP32 LPG safety node with MQ-6 sensing, two-stage alerting, a fail-safe solenoid shutoff valve and a live PPM cloud dashboard. Delivered built-to-order with prototype, firmware, dashboard, report, PPT and viva kit.

01. Title

IoT LPG Gas Leakage Detector with Auto Shutoff Valve

02. Introduction / Background

LPG leaks are dangerous precisely because the gas is invisible and the failure mode is binary: either someone smells it in time or they don't. Standalone gas alarms only beep — if nobody is home, the beep protects nothing, and none of them can stop the leak. The engineering gap is a node that both senses and acts: detect the leak, cut the supply automatically, and notify someone who can respond, with the whole event visible remotely. This project builds that node on an ESP32: an MQ-6 sensor (datasheet LPG band 200–10000 ppm), a normally-closed solenoid shutoff valve, two-stage alerting and a live PPM dashboard.

03. Problem Statement

Gas alarms alert; they do not intervene. A student safety project should demonstrate the complete protection loop — sensing with a real semiconductor sensor, staged escalation, fail-safe actuation that closes the gas line even on power loss, and remote notification with an event log. The project addresses this with an ESP32 node whose alarm thresholds are set by the student's own calibration, so no detection figures are pre-claimed.

04. Objectives

- Sense LPG with an MQ-6 sensor through a documented burn-in and divider stage.
- Implement two-stage alerting: pre-alarm warning, then full alarm with shutoff.
- Close a normally-closed solenoid valve on the gas line on alarm (fail-safe on power loss).
- Render a live PPM gauge, valve state and timestamped event log on a cloud dashboard.
- Provide a valve self-test routine and a manual-reset interlock.

- Deliver the student-run calibration procedure for threshold setting.
- Deliver the complete student kit: prototype, firmware, dashboard, report, PPT and viva Q&A.

05. Proposed Methodology

The system is built in three layers. (1) Sensing: after the documented warm-up/burn-in, the ESP32 samples the MQ-6 divider and converts it to an indicative LPG concentration via the sensor's characteristic curve. (2) Protection logic: pre-alarm and alarm thresholds drive staged buzzing; on full alarm the normally-closed solenoid is released shut and the event is published. (3) Telemetry: the dashboard shows the live gauge, valve state and event log with phone alerts. A scheduled self-test pulses the valve and logs the result; reopening requires manual reset below the safe band.

06. System Architecture / Working

The MQ-6 heater stabilizes, then the ESP32 samples the divider and estimates concentration. Crossing the pre-alarm threshold starts intermittent buzzing and a dashboard warning; crossing the alarm threshold sounds the continuous buzzer, de-energizes the solenoid (spring shut), and publishes the event with PPM and timestamp. The dashboard raises the phone alert. Once readings fall below the safe band, a deliberate manual reset re-energizes the valve; the self-test verifies valve movement on schedule.

07. Hardware / Software Requirements

- ESP32 development board (Wi-Fi)
- MQ-6 LPG gas sensor module
- Normally-closed solenoid valve (gas-line rated) with driver relay/MOSFET
- Buzzer and status LEDs
- 12 V valve supply + 5 V logic supply
- Cloud dashboard (Blynk/ThingSpeak class) with gauge and event log
- Demo gas-test chamber accessories
- Arduino IDE (C/C++ firmware)

08. Expected Outcomes

- A working detector node that shuts the gas line on calibrated alarm conditions.
- A live dashboard with PPM gauge, valve state and event log.
- Student-set alarm thresholds documented through the calibration procedure.
- A complete report, PPT and viva Q&A on gas sensors, fail-safe design and IoT alerting.

09. Applications

- Safety-automation demonstrations for homes, hostels and canteens.
- Teaching semiconductor gas sensing and staged alarm design.
- Prototyping fail-safe actuation concepts.

10. Future Scope

- Multi-gas sensing (CO, smoke) on the same node.
- Exhaust-fan interlock as a second mitigation output.
- LoRa backhaul for the alert path in large buildings.
- Mobile app with per-event push notifications and valve control.