PROJECT ABSTRACT

Industrial Compressed Air Leak and Pressure Monitor with Dashboard

A ring-main pressure monitor that logs line pressure, detects leaks from off-hours pressure-decay tests and ultrasonic scan flags, and reports compressor duty and air energy on an industrial dashboard.

Project type: Hybrid — hardware prototype + dashboard

Availability: Built to order

Suitable branches: IoT & Embedded, Electrical, Electronics / E&TC

Technologies: ESP32 · Pressure transducer · Ultrasonic leak detection · Decay-test analysis · HTML/JS dashboard · Arduino IDE

Price: Request a quotation

Prepared by Projectech · projectech.in — for academic project reference.

1. Introduction / Background

Compressed air is the most expensive utility in many plants: leaks of 20–30 % are common, each one forcing the compressor to run longer and hotter. Yet leaks are invisible and pressure is rarely logged, so the waste continues for years. A pressure-and-leak monitor makes the waste visible: a transducer on the ring main logs pressure continuously, off-hours decay tests quantify the leak rate, and ultrasonic scan results pin flagged joints to the dashboard. This project builds that monitor on an ESP32 around a model air line.

2. Problem Statement

Plants lose money to leaks they cannot see: no pressure history means no leak quantification, and no leak quantification means no repair priority. The project gives the maintenance team numbers — line pressure trace, estimated leak rate in L/min, compressor duty cycle and kWh consumed — plus a flagged-joint list from the ultrasonic scan workflow, so repairs start with the worst offenders.

3. Objectives

- Log ring-main line pressure continuously with an industrial transducer.
- Estimate leak rate from off-hours pressure-decay tests.
- Record ultrasonic leak-scan flags against joint IDs.
- Compute compressor duty cycle and daily air-energy consumption.
- Present pressure trends, leak events and energy on the dashboard.

4. Proposed Methodology

The transducer samples line pressure on a 2 s cadence; the firmware timestamps every dip and recovery and classifies demand spikes versus leak signatures. During the scheduled off-hours window the decay test runs: with no demand, the pressure fall rate converts to an estimated leak rate in L/min. Ultrasonic scan flags entered against joint IDs appear in the event table. The dashboard renders the pressure chart, leak-rate KPI, duty and energy cards.

5. System Architecture / Working

The **process layer** (model ring main, pressure transducer, compressor relay feedback), the **edge layer** (ESP32: sampling, decay-test analysis, event classification), and the **operations layer** (dashboard with live pressure chart, leak KPIs, energy cards and the event log).

6. Hardware / Software Requirements

- ESP32 development board (controller + Wi-Fi).
- Industrial pressure transducer on the model ring main.
- Model compressor with relay/duty feedback.
- Ultrasonic leak-scan workflow (flags entered against joint IDs).
- Single-page industrial dashboard (HTML/CSS/JS); Arduino IDE firmware.

7. Expected Outcomes

- Continuous pressure trace with classified dip/recovery events.
- Off-hours decay test producing an estimated leak rate in L/min.
- Compressor duty and daily kWh reported on the dashboard.
- Complete student kit: prototype, firmware, wiring docs, report, PPT and viva Q&A.;

8. Applications

- Workshop and factory air lines hunting leak-driven energy waste.
- Energy-audit demonstrations with before/after leak-repair data.
- Pneumatics labs teaching pressure instrumentation.

9. Future Scope

- Automatic leak localization with distributed pressure nodes.
- Integration with plant SCADA over Modbus/TCP.
- ML-based anomaly detection on the pressure signature.