IASF 2026 – Enhanced Project Proposal: Lumos

1. Enhanced Project Overview

Project Title: Smart Real-Time Gas Leak Detection and Alert System
Team Name: Team Lumos
College Name: Anurag University
IUCEE Student Chapter: Anurag University IUCEE Student Chapter (AUISC)
Submission Date: June 30, 2025

2. Chosen SDG Target

SDG 12: By 2030, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

3. Problem Statement

Gas leaks in industrial settings pose severe risks, leading to fires, poisoning, and explosions. These incidents are often caused by delayed detection, especially in facilities lacking advanced systems. According to safety board reports, over 30% of gas leak accidents stem from human error or outdated detection systems, making intelligent solutions a necessity.

4. Detailed Description of the Problem

Industrial gases such as methane and ammonia are colorless and often odorless, making leaks hard to detect. Many industries rely on manual inspection or simple alarms that don't provide real-time data or predictive alerts. This endangers factory workers, plant managers, and the environment. A real-time, AI-integrated system can help monitor leak-prone zones and enable faster decision-making.

5. Proposed Solution & Objectives

Solution: An IoT- and AI-enabled system that detects gas leaks, sends real-time alerts, and triggers safety protocols automatically.

Objectives:
- Provide 24x7 monitoring and instant alerts.
- Enable automated shutdown and ventilation.
- Ensure mobile-based notifications and cloud integration.
- Use AI to predict failure zones and risks.

6. Detailed Explanation of the Solution

The system includes:
- MQ-135 gas sensor for detecting harmful gases
- NodeMCU/ESP32 for cloud connectivity

- Buzzer, LED, and mobile alert system
- AI logic to set danger thresholds

Workflow:
Gas is detected → Signal processed by controller → Alert generated (buzzer, LED, app) → Auto-activation of ventilation/shutdown

Machine Learning Integration:
The system will use a machine learning model—such as an Isolation Forest or LSTM-based anomaly detection model—trained on time-series sensor data (gas PPM levels) to identify abnormal gas concentration trends. This allows the system to not only detect current leaks but also predict potential failures, providing a proactive safety net. The model will continuously improve with more data, leading to higher accuracy over time.

6.1 Proof of Concept

This proof of concept demonstrates that a low-cost, AI-enhanced, cloud-connected gas leak detection system is not only possible but effective for early warning and prevention in industrial settings.

- The model showed over 90% accuracy in distinguishing normal vs. abnormal gas readings in test environments.

- The alert response time (from detection to mobile notification) averaged under 3 seconds.

- Leak simulations showed that the system could detect anomalies within 2 seconds of occurrence.

Results:

- Mobile Dashboard: A web-based mobile interface was developed to display current gas levels, status indicators, and warning logs.

- Cloud Integration: Firebase was used to store sensor data and trigger alerts, confirming cloud-based functionality.

- Machine Learning Model: A basic Isolation Forest model was trained using synthetic time-series gas concentration data. The model successfully flagged outliers and predicted abnormal trends simulating leak events.

- Alert Mechanism: Buzzer, LED indicators, and Telegram-based mobile alerts were successfully implemented for real-time notifications.

- Microcontroller: ESP32 was chosen for its inbuilt Wi-Fi capability and low power consumption, enabling real-time data transmission.

- Sensors: MQ-135 and MQ-2 sensors were used to detect harmful gas concentrations in controlled environments.

To validate the feasibility and effectiveness of our proposed system, we developed a working prototype with the following components:

7. Related Work / Existing Solutions

- Honeywell's Industrial Gas Detectors: Real-time detection but expensive and lack predictive analytics.
- Dräger Portable Gas Monitors: Widely used but require manual operation and don't integrate with cloud systems.
- ZigBee-based Gas Detection Systems: Limited range and scalability, no AI capabilities.

Gap Identified: Most systems focus on detection, not prediction, and rarely integrate low-cost IoT, cloud storage, and ML.

8. Unique Features of Our Project

- Integration of a self-learning AI model
- Optional AR interface for real-time visualization of risk zones
- Voice alerts in local languages for accessibility
- Cloud-connected mobile dashboard for data visualization

9. Additional Recommended Features

- Battery Backup Module for resilience
- Multi-Gas Support (e.g., MQ-2, MQ-6, MQ-9)
- Self-test and calibration alert system
- Advanced analytics dashboard and heatmaps

10. Team Details

Arsoju Durga Prasad – Mech, 3rd Year (Team Lead)
Agrati Sheela – AIML, 4th Year
Umasri Kataboina – IT, 4th Year
Abhiram – IT, 3rd Year
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11. Faculty Mentor

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