Smart LPG & Flame Detection System

An IoT-based solution for gas and flame hazard prevention

Presented by: 404 The Optimistics

The Problem in India: A Call for Urgent Action

LPG-related accidents in India pose a significant public safety hazard, especially in households, restaurants, and small commercial setups that rely heavily on cooking gas.

📉 Alarming Statistics:

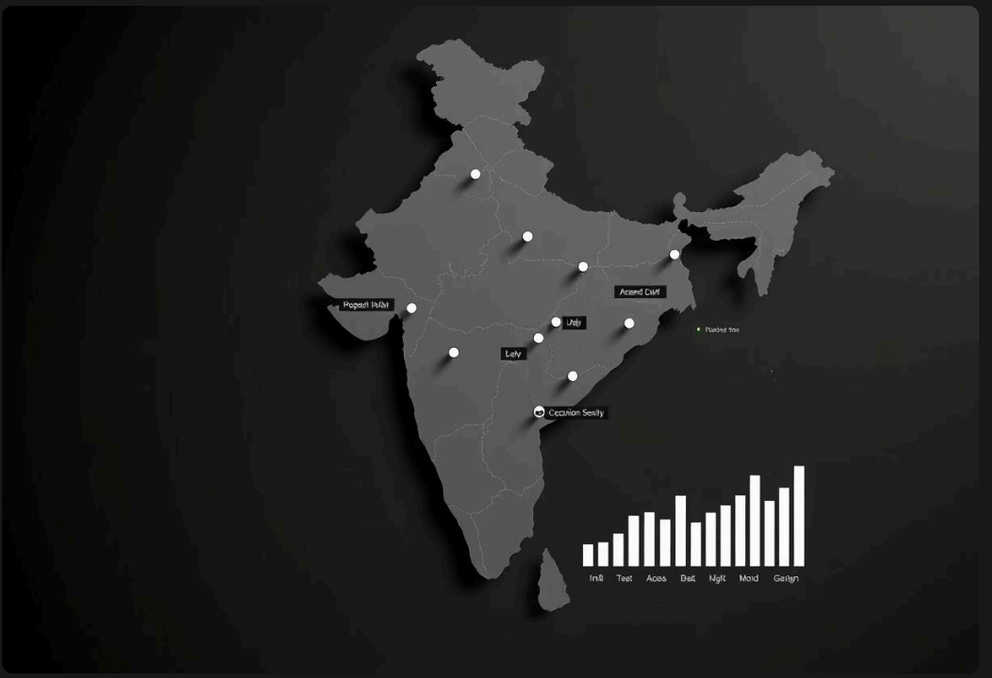
- 🧯 Over 3,500 LPG-related fire and explosion incidents are reported each year (according to NCRB data).
- ☠️ More than 900 fatalities and 2,000+ serious injuries are attributed annually to gas leaks and cylinder explosions.
- 🏚️ LPG accidents cause an estimated ₹1,200+ crore (~$150 million) in property loss every year across India.
- 🔥 68% of household fires are due to faulty gas connections or unattended cooking flames.
- 🏘️ Rural areas report higher vulnerability due to lack of early warning systems and awareness.

🛑 Root Causes:

- Absence of real-time gas/leak detection systems
- No instant alert mechanism for users
- Manual shutoff delays in emergencies
- Inadequate maintenance and inspection

⚠️ These incidents are preventable.

With the growing urban and rural LPG usage (over 30 crore active LPG connections), there is an urgent need for an affordable, automated, and real-time safety system to minimize loss of life and property.



> Safety gaps persist in both rural and urban households, underscoring the urgent need for a robust, accessible solution that can bridge the current technological void in home safety.

Our Mission: Safeguarding Homes with Smart Technology

Our project aims to develop a comprehensive LPG and flame detection system that provides real-time hazard prevention. By leveraging cutting-edge IoT technology, we seek to minimize risks associated with gas leaks and fires, ensuring the safety of lives and property.

Real-Time Hazard Detection

Instantly identify LPG leaks and open flames through sensitive sensors, ensuring immediate response to potential dangers.

Automated Alert Systems

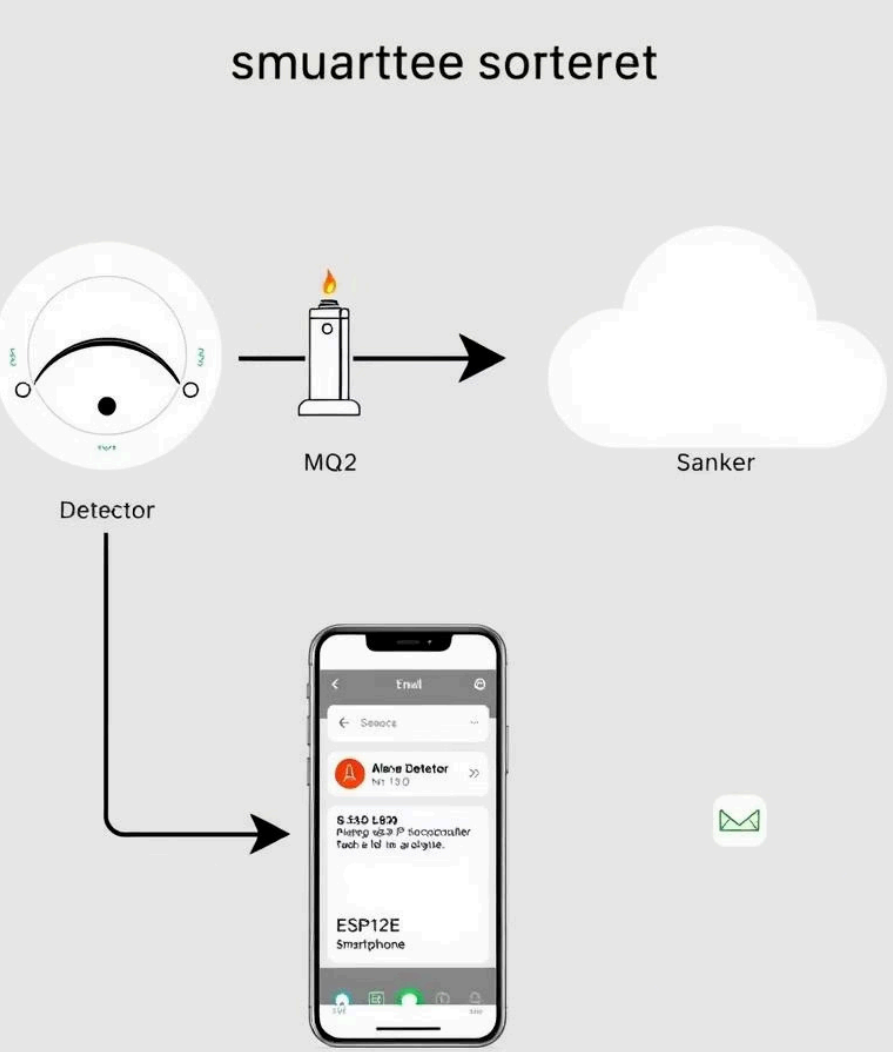
Trigger immediate sound alarms and send real-time email/SMS notifications to registered users upon detection of a hazard.

Live Status Tracking

Monitor the safety status of your environment remotely, providing peace of mind and enabling quick intervention.

Cooking-Mode Override

A smart feature to temporarily disable alerts during normal cooking operations, preventing false alarms while maintaining security.



Solution Architecture: The Blueprint for Safety

Our system architecture is designed for reliability and efficiency, ensuring seamless data flow from detection to alert. The core components work in harmony to provide a robust safety solution.

Data captured by the MQ2 and flame sensors is processed by the ESP12E microcontroller. This data is then securely transmitted to our backend, where it's stored and analyzed. In the event of an anomaly, immediate alerts are dispatched via email and SMS, ensuring stakeholders are promptly informed.

Technology Stack: Powering Our Smart Solution

We have carefully selected a robust technology stack to ensure the system's reliability, scalability, and ease of use. This blend of hardware and software components forms the backbone of our Smart LPG & Flame Detection System.

Hardware Components

- ESP12E Microcontroller
- MQ2 Gas Sensor
- Flame Sensor
- LED Indicators
- Buzzer
- Push Button

Software & Frameworks

- Arduino IDE (for ESP12E programming)
- Node.js (Backend Runtime)
- Express.js (Web Application Framework)
- Nodemailer (Email Service)
- React JS

Database & Deployment

- MongoDB (NoSQL Database)
- Render/Vercel (Backend Deployment)

TECH STACK

MERN STACK

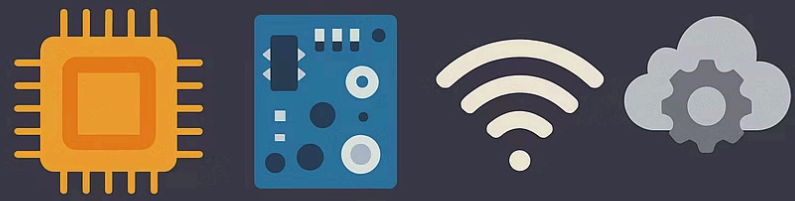
MongoDB

Express

React

Node.js

HARDWARE / IoT



Microcontroller Sensor WiFi Cloud Computing

Detailed Workflow: From Detection to Alert

The system operates through a streamlined workflow, ensuring rapid response to any detected hazards. Each step is designed for efficiency and accuracy, minimizing the time between detection and notification.

Sensor Data Collection

The MQ2 and flame sensors continuously monitor the environment for gas leaks and fire presence.

ESP12E Processing

The ESP12E microcontroller reads, processes, and analyzes the sensor data in real-time.

Backend Communication

Processed data is sent via a POST request to the secure Node.js backend.

Data Storage & Status Update

The backend stores the data in MongoDB and updates the system's live status.

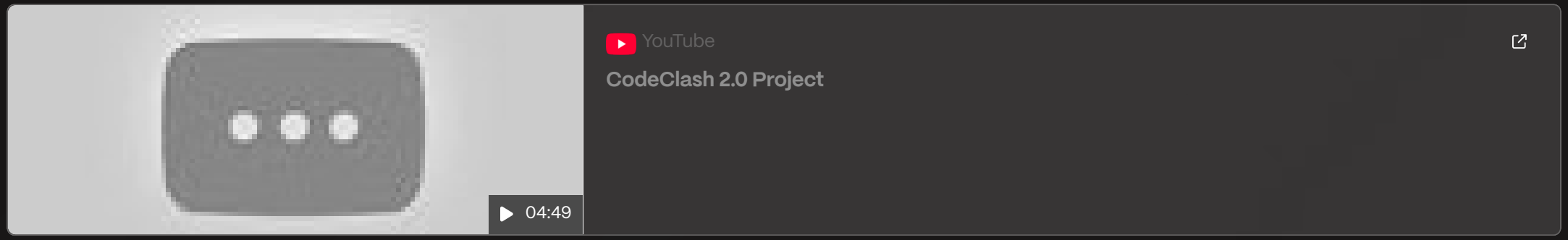
Abnormal Alert Dispatch

If abnormal conditions are detected, the backend triggers email/SMS alerts to registered users.

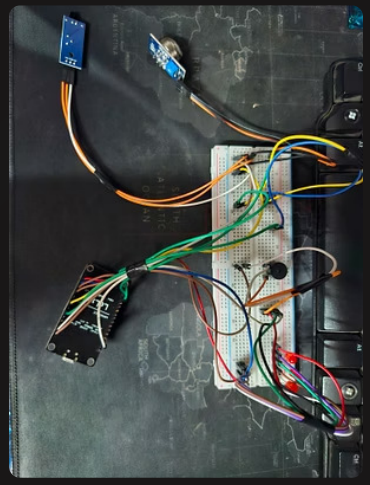
User Status View

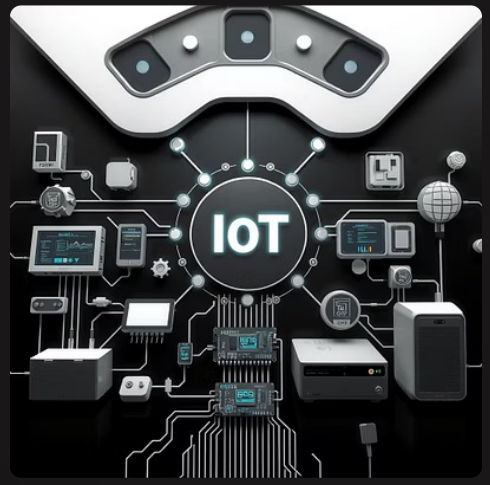
Users can access a dashboard to view the current status and historical data of their environment.

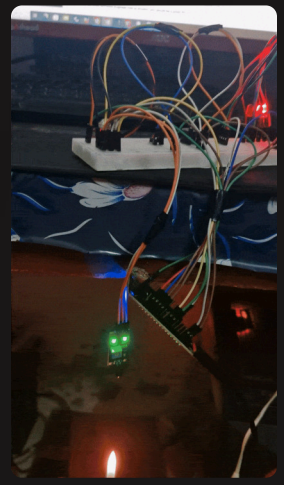
Live Demo & Hardware Build



Witness the Smart LPG & Flame Detection System in action. Our live demonstration showcases the seamless integration of hardware and software, providing real-time responses to simulated gas leaks and flames. The visual and auditory alerts confirm the system's effectiveness.







Observe the LED indicators change color (e.g., green for safe, red for danger) and hear the immediate activation of the buzzer upon hazard detection. We will also demonstrate an example of the real-time alert email received, showcasing the critical information provided to the user.

Impact & Benefits: A Safer Future for All

Our Smart LPG & Flame Detection System offers significant advantages, enhancing safety and providing peace of mind across various settings. Its affordability and expandability make it a transformative solution for communities.

Enhanced Safety & Early Warning

Provides crucial early warnings for gas leaks and potential kitchen fires, dramatically reducing response times and mitigating risks.

Versatile Application

Ideal for diverse environments including homes, bustling food stalls, student hostels, and commercial kitchens.

Affordable for India

Designed with cost-effectiveness in mind, making advanced safety technology accessible to a broader population in India.

Future Expansion

The system's modular design allows for future integration with home automation systems and additional safety features.

Thank You!

Questions?