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"IOT Based Smart Kitchen System"

Aniket Tanaji Pawar, Sujit Vijay Zambare, Prathmesh Sanjay Patil, Vasim Jahangir Tamboli

[123]*Department of Electronics and Computer Science Engineering*
Padmabhooshan Vasantraodada Patil Institute of Technology, Maharashtra, India

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Abstract-*The Internet of Things (IoT) has transformed traditional household systems into smart and intelligent environments. Kitchen safety is one of the major concerns in homes due to gas leakage, fire hazards, and manual monitoring problems. The proposed IoT-Based Smart Kitchen System provides an automated solution for gas leakage detection, safety monitoring, and remote alert generation. The system uses NodeMCU ESP8266, MQ-2 gas sensor, GSM module, relay module, exhaust fan, load cell, and buzzer for real-time monitoring and control. The MQ-2 sensor continuously detects harmful gases such as LPG and methane. When the gas level exceeds the predefined threshold, the system activates a buzzer alarm, turns ON the exhaust fan automatically, and sends emergency notifications through GSM and IoT platforms. The proposed system improves kitchen safety, reduces accidents, and minimizes manual monitoring. It is cost-effective, energy efficient, and suitable for domestic as well as commercial kitchens.*

Keywords: IoT, Smart Kitchen, Gas Leakage Detection, NodeMCU, MQ-2 Sensor, GSM Module.

1. Introduction:

IoT technology has introduced automation and smart monitoring into modern homes. Smart kitchens are becoming an important part of smart home systems because they improve safety, efficiency, and convenience. In traditional kitchens, gas leakage accidents may cause fire hazards, explosions, and health problems. Therefore, a reliable monitoring and alert system is required.

The IoT-Based Smart Kitchen System continuously monitors kitchen conditions using sensors and internet connectivity. The system detects gas leakage using the MQ-2 gas sensor and automatically performs safety actions such as activating the exhaust fan, turning ON the buzzer, and sending emergency notifications.

The project also uses a load cell sensor to monitor gas cylinder weight and notify users when the gas level becomes low. The NodeMCU ESP8266 controller enables wireless communication and remote monitoring through mobile applications.

The proposed system provides an efficient, low-cost, and user-friendly solution for kitchen automation and safety management.

2. Problem Statement:

LPG gas is widely used in homes, hotels, and restaurants for cooking purposes. Gas leakage accidents are increasing due to improper monitoring and delayed detection. Existing systems mainly depend on manual monitoring and do not provide real-time alerts or automatic safety actions.

Therefore, there is a need for an IoT-based smart kitchen system that can automatically detect gas leakage, generate emergency alerts, and improve kitchen safety using automation technology.

3. Objectives:

The main objective of the proposed IoT-Based Smart Kitchen System is to improve kitchen safety and automation using IoT technology. The system is designed to continuously monitor kitchen conditions, detect gas leakage, and provide immediate safety responses. It also aims to reduce manual monitoring and minimize the risk of accidents through real-time alert generation and automatic control mechanisms.

1. To detect gas leakage using MQ-2 gas sensor.
2. To provide real-time kitchen monitoring.
3. To send emergency alerts using GSM and IoT platforms.
4. To automatically activate the exhaust fan during leakage.
5. To monitor gas cylinder weight using a load cell.
6. To reduce accidents and improve kitchen safety.

4. Literature Review:

Several researchers have developed smart kitchen and gas leakage detection systems using IoT technology.

J. Tsado et al. proposed a GSM-based gas leakage alert system for emergency notification through mobile communication. The system improved kitchen safety by generating alerts during gas leakage conditions.

M. Eisenhauer et al. discussed ambient intelligence systems

using wireless sensors and IoT devices for smart home automation. Their work explained the importance of sensor networks and remote monitoring systems.Research by the European Union on IoT discussed applications of IoT in smart homes, healthcare, and automation systems.

Existing systems mainly focus on gas leakage detection but lack automatic ventilation and remote monitoring features. The proposed system overcomes these limitations by integrating IoT monitoring, GSM alerts, automatic exhaust control, and gas level monitoring.

5. Proposed System

The proposed IoT-Based Smart Kitchen System is designed to improve kitchen safety using IoT and automation technologies. The system continuously monitors the kitchen environment using sensors and automatically responds during emergency conditions.

The MQ-2 gas sensor detects harmful gases such as LPG and methane. The sensor output is continuously monitored by the NodeMCU ESP8266 controller. When gas concentration exceeds the threshold value, the controller activates the buzzer alarm and relay module.

The relay module automatically switches ON the exhaust fan to remove leaked gas from the kitchen. Simultaneously, the GSM module sends emergency SMS alerts to registered users, while the IoT platform provides real-time notifications through mobile applications.

A load cell sensor is also integrated into the system to monitor gas cylinder weight and notify users when the gas level becomes low.

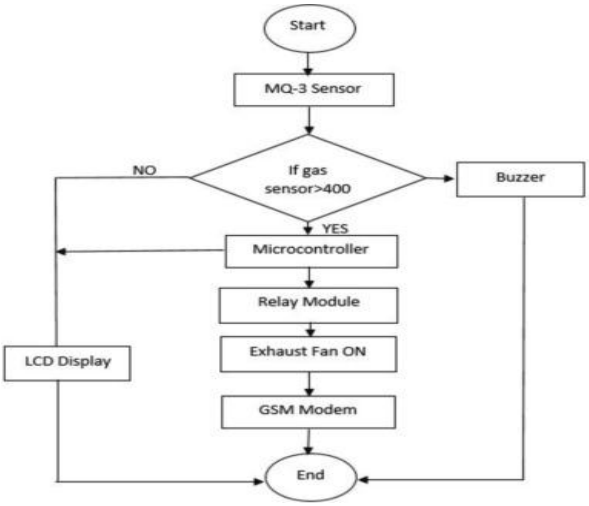
The proposed system provides:

- Real-time monitoring
- Automatic emergency response
- Remote notification system
- Gas cylinder monitoring
- Improved kitchen safety

6. Methodology:

The proposed system uses sensors, controllers, and communication modules to improve kitchen safety and automation.The MQ-2 gas sensor continuously monitors LPG and harmful gases in the environment. The sensor sends data to the NodeMCU controller. When the gas concentration exceeds the threshold value, the controller activates the buzzer and relay module.The relay module automatically switches ON the exhaust fan to remove leaked gas from the kitchen. Simultaneously, the GSM module sends emergency SMS alerts to the user. The IoT platform provides real-time monitoring using mobile applications.

The load cell sensor measures gas cylinder weight and informs users when the gas level becomes low.



7. System Architecture

The system architecture consists of sensing, processing, communication, and safety control units.

The MQ-2 gas sensor and load cell act as input sensing devices. These sensors are connected to the NodeMCU ESP8266 controller, which processes sensor data and controls output devices.

The controller communicates with:

- Relay module
- Exhaust fan
- GSM module
- Buzzer
- IoT cloud platform

The relay module controls the exhaust fan automatically during gas leakage conditions. The GSM module and IoT platform provide remote alerts and notifications.

This architecture ensures smooth communication, real-time monitoring, and efficient emergency response.

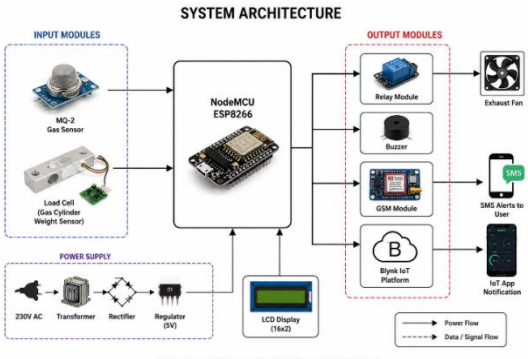


Fig. 2. System Architecture of IoT Based Smart Kitchen System

8. Implementation

The proposed IoT-Based Smart Kitchen System is implemented using both hardware and software modules to achieve real-time gas leakage detection, monitoring, and automatic safety control. The implementation process includes sensor integration, controller programming, communication setup, and testing of emergency response mechanisms.

8.1 Hardware Components

The hardware section of the system consists of the following components:

- NodeMCU ESP8266
- MQ-2 Gas Sensor
- Relay Module
- GSM Module
- Exhaust Fan
- Buzzer
- Load Cell
- LCD Display
- Transformer
- Connecting Wires and Power Supply

The MQ-2 gas sensor is placed near the gas stove or LPG cylinder to continuously monitor harmful gases such as LPG and methane. The sensor output is connected to the NodeMCU ESP8266 controller, which processes the sensor data in real time.

The relay module is connected to the exhaust fan and acts as an automatic switching device. Whenever gas leakage is detected, the NodeMCU activates the relay module, which automatically turns ON the exhaust fan to remove leaked gas from the kitchen environment.

A buzzer is used to provide an immediate audio alert during leakage conditions. The GSM module is integrated to send SMS alerts to registered users for emergency notification. The load cell is connected to monitor the weight of the gas cylinder and identify low gas conditions.

The LCD display shows system status messages such as gas level condition, leakage alerts, and fan status. A transformer and regulated power supply are used to provide stable voltage to all hardware components.

8.2 Software Components

The software implementation is carried out using:

- Arduino IDE
- Embedded C Programming
- Blynk IoT Platform

The program is developed using Embedded C in Arduino IDE and uploaded to the NodeMCU controller. The software continuously reads sensor values and compares them with predefined threshold levels.

The Blynk IoT platform is used for remote monitoring and notification services. It allows users to monitor kitchen conditions through smartphones or web applications in real time.

The software performs the following operations:

- Reading MQ-2 sensor values
- Detecting gas leakage conditions
- Activating buzzer alarms
- Controlling relay module and exhaust fan
- Sending GSM alerts
- Updating IoT dashboard notifications
- Monitoring gas cylinder weight

System Testing

The implemented system was tested under different gas leakage conditions to evaluate performance, response time, and reliability. LPG gas was carefully released near the MQ-2 sensor to verify leakage detection capability.

Experimental testing confirmed that:

- The sensor accurately detected gas leakage
- The buzzer alarm activated immediately
- The exhaust fan operated automatically
- GSM alerts were sent successfully
- IoT notifications were received in real time
- The load cell monitored gas cylinder level accurately

The developed system demonstrated stable performance with low power consumption and fast emergency response, making it suitable for practical smart kitchen applications.

9. Results:

The developed smart kitchen system was tested under different conditions. The MQ-2 sensor successfully detected LPG gas leakage and generated alerts immediately.

The buzzer alarm and exhaust fan responded automatically during gas leakage conditions. GSM alerts and IoT notifications were successfully sent to the user.

The load cell accurately measured gas cylinder weight and indicated low gas conditions. The system demonstrated stable performance with low power consumption and fast response time.

The results show that the proposed system is reliable, efficient, and suitable for real-world kitchen safety applications.

LPG Level (ppm)	Alarm	Solenoid	Fan	SMS
220	OFF	ON	OFF	---
236	OFF	ON	OFF	---
259	ON	ON	ON	Leakage Alert
289	ON	ON	ON	Leakage Alert

Weight (KG)	Alarm	SMS
29	OFF	---
25	OFF	---
20	OFF	---
18	ON	LPG Cylinder Level: LOW

10. Conclusion:

The IoT-Based Smart Kitchen System is an effective solution for improving kitchen safety and automation. The system continuously monitors gas leakage using the MQ-2 sensor and provides immediate alerts through GSM and IoT technologies.

Automatic safety actions such as activating the exhaust fan and buzzer help prevent accidents and improve user safety. Additional features such as gas level monitoring and remote notifications increase system efficiency and convenience.

The project is low-cost, user-friendly, and suitable for modern smart homes. Thus, the proposed system represents an important step toward safe and intelligent kitchen environments.

11. References:

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