# IOT – Based Industrial Safety and Protection System

Mr. Anil Kumar K N, Asst. professor, Dept. of CSE, Rajeev Institute of Technology, Hassan, Mr. Likhith Gowda M R, Dept. of CSE, Rajeev Institute of Technology, Hassan, Karnataka Mr. Lochan K R, Dept. of CSE, Rajeev Institute of Technology, Hassan, Karnataka
Mr. Nishanth H M , Dept. of CSE, Rajeev Institute of Technology, Hassan, Karnataka

***Abstract*— IoT-Based Industrial Safety and Protection System is designed to enhance safety in industrial environments through real-time monitoring and automated response mechanisms. At the heart of the system is an Arduino microcontroller, interfaced with a range of environmental sensors to detect parameters such as temperature, gas concentration, light intensity, and motion.**

## I. INTRODUCTION

The "IoT Industry Protection System using Arduino" project represents an innovative integration of IoT (Internet of Things) and embedded technology to enhance industrial safety and operational reliability. Traditional safety mechanisms in industrial environments often rely on manual monitoring and delayed responses, which can lead to serious accidents such as gas leaks, overheating, or poor visibility. By incorporating real-time sensing and automated response features, this project offers a proactive and intelligent safety system that ensures immediate action during hazardous conditions. This system utilizes an Arduino microcontroller, multiple environmental sensors, and wireless communication modules to create an efficient and responsive industrial monitoring framework

## II. LITERATURE SURVEY

S. Sharma, R. Patel, and N. Gupta – "IoT Based Industrial Safety and Security System," Year of Publication:2020 This paper presents an IoT-based safety system designed to detect gas leaks, fires, and abnormal temperatures in industrial environments using various sensors Real-time data is transmitted via Wi-Fi to a central monitoring unit, enabling instant alerts through mobile notifications. The system ensures quick hazard detection, automated responses, and ease of integration into existing infrastructures. However, the authors raise concerns regarding network reliability and data security, especially in environments with dense physical obstructions. [1]

A. Verma and D. Singh – "Smart Gas Detection System Using IoT," Year of Publication: 2019 Verma and Singh propose a cost-effective gas detection system using MQ gas sensors and microcontrollers. Sensor data is transmitted to a cloud platform for real-time analysis, with alerts sent via mobile applications or SMS. The system is easy to deploy and suitable for small to medium industrial setups. However, it requires frequent sensor recalibration to maintain accuracy across varying gas concentrations and is heavily dependent on stable internet connectivity. [2]

R. Bansal, M. Das, and T. Roy – "IoT-Based Safety Monitoring for Industrial Workers," Year of Publication: 2021 This study introduces a wearable IoT system that continuously monitors workers' health metrics, such as heart rate, body temperature, and gas exposure levels. The data is transmitted to a central server for real-time visualization and emergency response alerts. The system emphasizes personal safety, health monitoring, and accident prevention. The authors also discuss its integration with supervisor dashboards and the importance of ergonomic design and battery efficiency for long shifts. [3]

M. Kale, S. Yadav, and P. Joshi – "Industrial Safety System Using IoT and Machine Learning," Year of Publication: 2022 is of This paper integrates IoT-based sensing with machine learning to predict and prevent industrial hazards such as gas leaks and equipment faults. The study also showcases the implementation of real-time dashboards foplant managers to visualize the data trends and respond promptly. [4]

K. Mehta and R. Sinha – "Design and Implementation of an IoT-Based Fire Detection System," Year of Publication: 2020 This paper presents a real-time IoT-based fire detection system using flame, smoke, and temperature sensors.

The system sends alerts via Wi-Fi and activates an automatic sprinkler system to reduce manual intervention. It is cost-effective for use in warehouses and factories. [5]

## III. PROPOSED SYSTEM

The project titled "IoT-Based Industrial Safety and Protection System**"** is designed to enhance safety standards in industrial environments by leveraging the capabilities of the Internet of Things (IoT Industrial workplaces often involve exposure to hazardous conditions such as toxic gas leaks, sudden temperature spikes, smoke emissions, and the potential for fire outbreaks. These incidents, if not detected and managed in time, can lead to severe consequences including injuries, equipment damage life. The proposed system will consist of multiple environmental sensors—such as MQ gas sensors, DHT11 temperature and humidity sensors, smoke and flame detectors—interfaced with a microcontroller unit like the ESP32. These components will continuously gather environmental data and transmit it to a cloud platform using Wi-Fi or GSM communication modules. Cloud services such as Firebase, Blynk, or Things Board will be used to store and visualize data, send notifications, and issue alerts in case of abnormal readings. In addition to alert generation, the system will be capable of activating emergency response mechanisms such as turning on exhaust fans, triggering buzzers, or even shutting down machinery automatically to prevent escalation. This real-time response capability enhances the decision-making process and enables remote monitoring by supervisors through mobile applications or web dashboards.

it suitable for small- and medium-scale industries that cannot afford high-end industrial safety infrastructure. The project also emphasizes energy-efficient operation and modularity, allowing additional sensors or safety features to be integrated as needed. Furthermore, by storing historical data, the system enables predictive analysis and trend monitoring, which can help in identifying recurring hazards and planning preventive measures.

monitoring, which can help in identifying recurring hazards and planning preventive measures. Ultimately, this project addresses the urgent need for intelligent, automated, and remotely accessible industrial safety systems, reducing human risk and ensuring With IoT technology, we can integrate a wide range of sensors and automation tools to create a smart, responsive safety system that not only detects hazards but also communicates them instantly to relevant personnel.

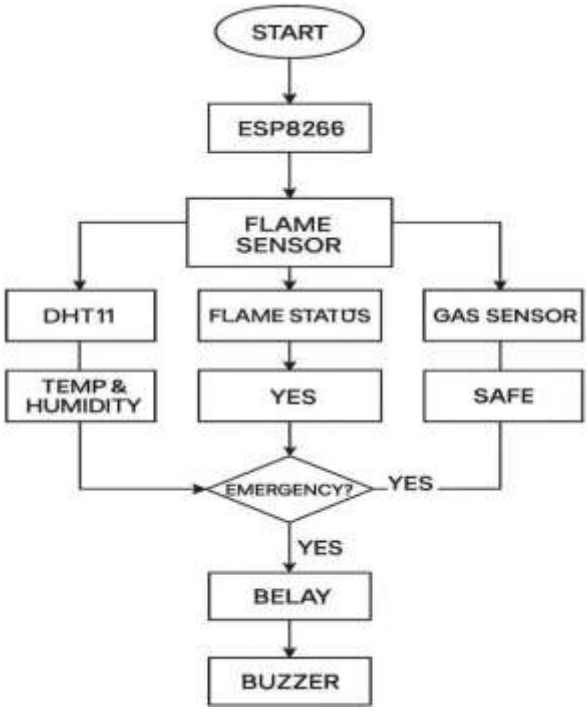


**Fig 1:** Flow Chart of IOT-Based Industrial Safety And Protection System

The IoT Industry Protection System is designed to automate the monitoring and protection of industrial environments by integrating a variety of sensors with Arduino or NodeMCU. This system continuously monitors critical conditions

such as gas leaks, fire, overheating, and lighting levels to ensure a safe working environment. Using gas sensors, flame sensors, temperature sensors, and light sensors, the system collects real- time data and processes it to detect potential hazards.

Upon detecting any dangerous condition, the system triggers a series of actions such as sounding a buzzer, activating a ventilation fan through a relay module, or shutting down industrial equipment to prevent further damage.

**1. Sensor Data Acquisition**

- DHT11 Sensor is used to measure ambient temperature and humidity, which are essential for monitoring safe operating conditions.
- Flame Sensor detects the presence of open flame/fire by analyzing infrared light.
- Gas Sensor (MQ series) monitors the concentration of gases (e.g., LPG, methane) to detect leaks or hazardous emissions**.**

**2. Microcontroller (ESP8266 NodeMCU)**

- Acts as the central processing unit.
- Reads data from the connected sensors through digital and analog pins.

**3. Decision and Control Logic**

- The ESP8266 continuously evaluates the incoming data.

## IV IMPLEMENTATION STEPS

The NodeMCU adds Wi-Fi connectivity, allowing remote monitoring and control via a cloud platform or mobile app, enabling users to receive alerts and monitor data from anywhere.

- **Setting Up NodeMCU**

The initial setup involves configuring the NodeMCU board using the Arduino IDE:

- Install the Arduino IDE and add the ESP8266 board support via the Board Manager.
- Install necessary libraries:
- Blynk
- DHT sensor library
- ESP8266WiFi
- Connect NodeMCU via USB, select the appropriate COM port and board from Tools > Board.

- **Sensor Integration and Wiring**

- DHT11 Sensor (Temperature & Humidity) → D2
- Gas Sensor (MQ series) → A0
- Flame Sensor → D7
- Relay Module (for fan control) → D4
- Buzzer (for alerts) → D5

Ensure external power is supplied where needed, especially for fan control via relay.

- **Data Acquisition and Monitoring**

In the main loop:

- Read environmental data from DHT11.
- Monitor gas levels from the analog input.

## V. RESULT AND DISCUSSION

The implemented Industrial Protection System effectively achieved its objectives during testing and operation. The NodeMCU-based setup was able to continuously monitor environmental conditions, including temperature, humidity, gas concentration, and flame presence. Sensor readings were accurately captured and processed every two seconds, ensuring real-time responsiveness. When abnormal conditions such as a gas leak or flame were detected, the

system automatically activated the buzzer and relay (fan), providing immediate local alerts.

The integration with the Blynk IoT platform allowed real-time data visualization and alerts on a connected mobile device. Users were able to receive live updates and monitor the system status remotely. Additionally, the system demonstrated reliable Wi-Fi connectivity, with automatic reconnection in case of network loss. Overall, the results confirmed the system's ability to detect hazardous conditions promptly and respond effectively, making it a practical solution for enhancing safety in industrial environments.

The Industrial Protection System was successfully designed and implemented using NodeMCU, multiple sensors, and the Blynk IoT platform. The system effectively monitored key environmental factors such as temperature, humidity, gas levels, and fire hazards, making it a practical and low-cost safety solution for industrial spaces. Real-time monitoring through the Blynk app ensured that users could remotely track conditions and receive alerts, while the automatic activation of safety mechanisms like the buzzer and fan improved emergency responsiveness.

The results confirmed that the system was both functional and reliable under various test scenarios. Its modular design allows for easy upgrades or modifications, and its dependence on open-source tools makes it accessible for future development. Overall, the project demonstrates how IoT technology can be leveraged to improve safety, reduce risk, and enhance monitoring in industrial environments

**OVERVIEW IOT- Based Industrial Safety And Protection System**

The following figure shows the result of the proposed systems:

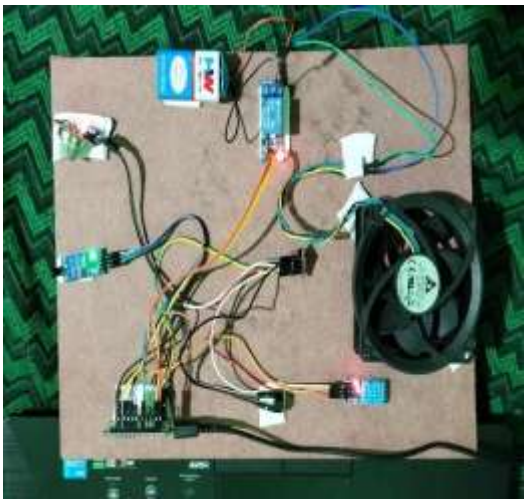

**Fig 2:** Tested Result

The above diagram represents a working prototype of an IoT-based industrial safety system, featuring sensors for gas, temperature, and flame detection connected to a microcontroller

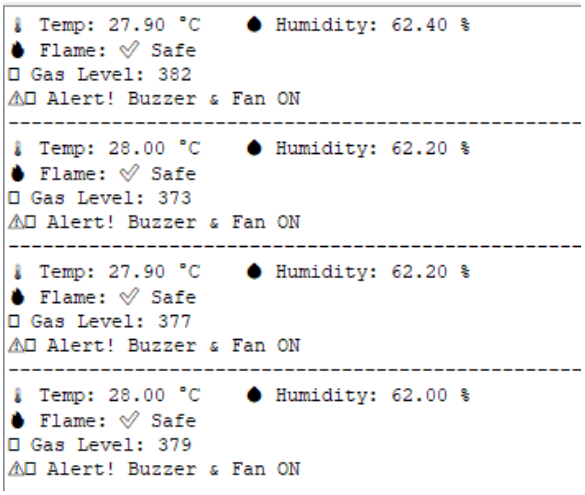


**Fig 3:** Gas Detection

The image displays real-time sensor readings from an IoT-based industrial safety system, including temperature, humidity, gas level, and flame status. Despite safe flame detection, elevated gas levels trigger an alert. As a result, the system activates the buzzer and fan for safety.

## CONCLUSION

The Arduino-based IoT Industry Protection System provides a cost-effective and scalable solution for enhancing safety and operational monitoring across various industrial sectors such as manufacturing plants, chemical processing units, and energy facilities. By leveraging integrated sensors and real-time monitoring capabilities, this system significantly improves hazard detection and risk management, helping prevent accidents caused by gas leaks, overheating, and environmental anomalies.

In the event of a system fault or emergency condition, immediate alerts are generated, allowing timely intervention to mitigate potential damage or hazards. Compared to traditional industrial safety systems, the Arduino-based IoT solution offers a more compact, affordable, and energy- efficient alternative, making it suitable for widespread deployment in both small- and large- scale operations..

## REFERENCES

[1] S. Sharma, R. Patel, and N. Gupta. "IoT Based Industrial Safety and Security System." This paper presents an IoT-based safety solution using sensors to detect gas leaks, fire, and temperature variations, with real-time alerts and automated responses in industrial environments (2020).

[2] A. Verma and D. Singh. "Smart Gas Detection System Using IoT." The study introduces a cost-effective IoT-based gas detection system using MQ sensors and cloud- based real-time alerts, though requiring frequent calibration (2019).

[3] R. Bansal, M. Das, and T. Roy. "IoT-Based Safety Monitoring for Industrial Workers." This research explores wearable IoT devices for monitoring worker health and safety, offering real-time alerts and long-term health data logging (2021).

[4] M. Kale, S. Yadav, and P. Joshi. "Industrial Safety System Using IoT and Machine Learning." The paper integrates IoT and ML to predict hazards like gas leaks and equipment faults with real-time dashboards for proactive as the per act of the response (2022).

[5] K. Mehta and R. Sinha. "Design and Implementation of an IoT-Based Fire Detection System." This study presents a fire detection system using flame, smoke, and temperature sensors with Wi-Fi alerts and automatic sprinklers, while noting the challenge of false alarms (2020).

[6] L. Reddy, V. Kumar, and P. Shah. "Real-Time Monitoring of Industrial Parameters Using IoT." The paper outlines a system for real-time monitoring of temperature, humidity, and gas levels using IoT-enabled sensors for industrial automation (2018).

[7] V. Lesi, Z. Jakovljevic, and M. Pajic. "Security Analysis for Distributed IoT-Based Industrial Automation." This study focuses on the cybersecurity risks and resilience strategies for distributed IoT networks in industrial control systems (2020).

[8] P. Fraga-Lamas, D. Barros, S. I. Lopes, and T. M. Fernández-Caramés. "Mist and Edge Computing Cyber-Physical Human-Cantered Systems for Industry 5.0." The paper presents a cost-effective thermal imaging safety system leveraging IoT, mist computing, and edge intelligence for smart industrial environments (2023).