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# Smart Industrial Safety Monitoring and Alert System using Raspberry Pi

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***Abstract -*** *The rapid advancement of Internet of Things (IoT) technology has enabled the development of systems for automatic monitoring and alerting in industrial settings. Industrial accidents, such as gas leaks or fires, can lead to significant setbacks. To address this, we propose a system utilizing IoT concepts to monitor industrial applications and generate alerts or alarms to prevent mishaps. Our system employs flame and gas sensors to detect fires and gas leaks, along with other sensors such as temperature detectors, PIR sensors for trespass detection, and current and voltage monitoring. Data from these sensors are continuously scanned and transmitted online for real-time monitoring. The system, implemented using Raspberry Pi and interfaced with an LCD screen, provides a comprehensive approach to industrial safety, aiming to reduce both human and economic losses.*

**Key Words:** Internet of Things (IoT), industrial safety, sensors, Raspberry Pi, fault monitoring, Wi-Fi module

## 1. INTRODUCTION

In today's workplaces, ensuring safety is paramount. Accidents can lead to significant losses, both in terms of human lives and financial resources. Therefore, having a robust system in place to maintain a secure environment and promptly notify stakeholders in case of emergencies is crucial. Our project aims to address this need by developing a comprehensive industrial monitoring and alerting system. By integrating various sensors and IoT technologies, we seek to detect potential hazards such as fires, gas leaks, unauthorized access, and abnormal temperatures. Additionally, we aim to incorporate fault monitoring mechanisms to identify and mitigate electrical issues like phase failure, voltage fluctuations, and frequency variations. The system utilizes Raspberry Pi as a central controller, enabling real-time data processing and online communication through Wi-Fi connectivity. By providing timely alerts and enabling remote monitoring, our system aims to enhance industrial safety and minimize the impact of accidents.

## 2. LITERATURE REVIEW

Previous studies have extensively explored various aspects of industrial safety and IoT integration. Research by Zheng et al. (2018) delves into smart manufacturing systems, emphasizing IoT's role in enhancing safety and efficiency. Similarly, Glória et al. (2017) discuss IoT gateway implementation for smart environments, providing insights into sensor integration and data management.

Other studies, such as Rigelsford (2003), focus on GSM network applications in remote monitoring, while Dinardo et al. (2018) examine machine condition monitoring in Industry 4.0 scenarios. These works underscore the importance of real-time data transmission and predictive maintenance facilitated by IoT technologies.

Challenges and opportunities in IoT-based industrial monitoring systems have also been highlighted. Schallock et al. (2018) discuss the learning factory concept for Industry 4.0, emphasizing the need for skills development beyond technical training. Additionally, Redl et al. (1998) explore GSM and personal communication systems integration, addressing issues related to network reliability and data security.

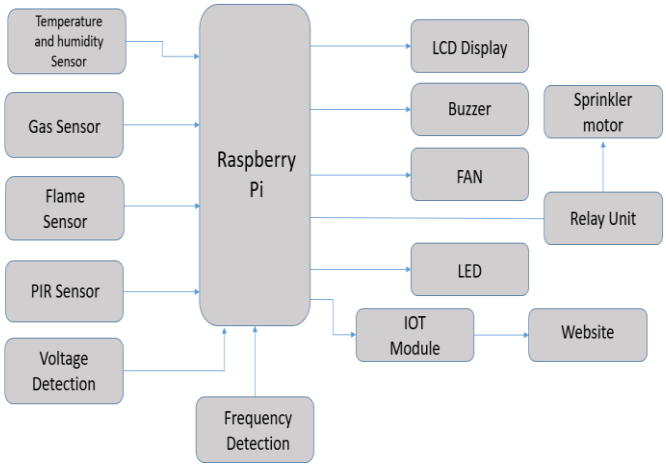
By synthesizing findings from existing literature, we gain valuable insights into IoT's potential for enhancing industrial safety and risk management. These insights inform our project's design and implementation, guiding us toward effective solutions for ensuring safer industrial environments.

## 3. PROPOSED SYSTEM

Our project aims to create a secure industrial environment through the implementation of an advanced monitoring and alerting system. It encompasses the detection of various potential hazards, including fire, gas leaks, abnormal temperatures, and unauthorized access. Additionally, the system is equipped to monitor electrical parameters such as voltage, frequency, and phase faults, ensuring comprehensive coverage of safety-critical aspects.
In the event of a fire outbreak, for instance, the system employs flame and gas sensors to detect smoke and elevated temperatures. Once a hazard is identified, the information is relayed to a Wi-Fi module for real-time transmission to the central control unit, which utilizes a Raspberry Pi micro-controller. This micro-controller is programmed to trigger an alarm, activate a buzzer, and display relevant information on an LCD screen, alerting personnel to the emergency.

Furthermore, the system incorporates fault monitoring mechanisms to detect and address electrical anomalies promptly. This includes monitoring voltage levels, detecting current variation. In case of any abnormalities, the system

initiates corrective actions, such as shutting down power supply or activating preventive measures.
The integration of sensors and control components with the Raspberry Pi enables efficient data processing and analysis, facilitating timely decision-making and response to emergencies. Moreover, the system's connectivity to an IoT platform allows for remote monitoring and management, ensuring that relevant stakeholders can access real-time information and take appropriate action as needed.




Overall, our proposed system offers a comprehensive solution for industrial safety, leveraging IoT technology to mitigate risks, enhance situational awareness, and minimize the impact of emergencies on personnel and assets.

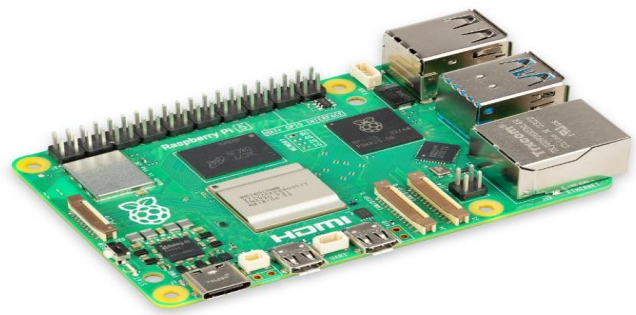
A. Sensors

Sensors play a crucial role in our project, serving as the foundation for studying various industrial parameters. The gathered data enables us to determine threshold values and make informed decisions. In alignment with our project's objectives, we have carefully selected a set of sensors. These sensors are currently utilized in industrial applications or exhibit the precision required for future advancements.

The following is the list of sensors used:

| SENSOR | SPECIFICATION |
|---|---|
| Temperature and Humidity Sensor | DHT11 Sensor |
| Gas Sensor | MQ2 Sensor |
| Flame Sensor | IR Flame sensor |
| PIR Sensor | HC-SR501 |
| Power Sensor | INA219 |

B. Raspberry Pi



In our project, we leverage the capabilities of the Raspberry Pi, a versatile single-board computer, to enhance data processing and control functions. The Raspberry Pi serves as a cost-effective and efficient solution for integrating sensor data, facilitating real-time analysis, and contributing to the overall success of our industrial parameter monitoring system.

C. Fault indication and prevention mechanism

Our project aims to study the industry parameters and also provide some small scale automated prevention if any of the mentioned parameters start deteriorating the plant. Thus components like fans, LEDs, buzzer, Sprinkler motor are also interfaced with the main controller for preventive action. The LEDs and buzzer are used to raise an alarm for potential fire break out or any gas leakage. A fan will be helpful for providing cooling action and can also act as an exhaust if there is gas leakage. Sprinkle motor is used to sprinkle water in case of fire break out. Along with all these applications we also plan to tackle a worst case scenario where the nearest fire station will be intimated when things go out of hand and there's fatal risk to life and property.

## 4. ADVANTAGES AND DISADVANTAGES

Advantages
1) Real-time data is available
2) The information regarding the plant operation can be obtained even miles apart from it
3) Reliable and consistent data
4) Manual errors can be avoided

Disadvantages
1) Damage caused which beyond the sensor’s capacity still prevail
2) Data can’t be accessed on time if there are any internet issues

## 5. CONCLUSION

This paper introduces a robust IoT-based system designed to enhance industrial safety by monitoring various factors such as fire, gas leakage, trespassing, and abnormal temperatures. The integration of sensors, fault monitoring, and real-time online data transmission presents a comprehensive approach to preventing and mitigating industrial accidents. The system's potential impact lies in its ability to improve incident response times and reduce both human and economic losses in industrial settings.

**REFERENCES**

1. "Zheng P. et al 2018 Smart manufacturing systems for Industry 4.0: Conceptual framework, scenarios, and future perspectives Frontiers of Mechanical Engineering"
2. "Glória A., Cercas F. and Souto N. 2017 Design and implementation of an IoT gateway to create smart environments Procedia Computer Science"
3. "Rigelsford J. 2003 GSM Networks: Protocols, Terminology and Implementation Sens. Rev."
4. "Redl S., Weber M. and Are W. H. Y. 1998 GSM and Personal"
5. "Dinardo G., Fabbiano L. and Vacca G. 2018 A smart and intuitive machine condition monitoring in the Industry 4.0 scenario Meas. J. Int. Meas. Confed."
6. "Schallock B., Rybski C., Jochem R. and Kohl H. 2018 Learning Factory for Industry 4.0 to provide future skills beyond technical training Procedia Manufacturing"