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Review on IOT Based Monitoring of Industrial Parameters and Controlling Using Lora Module

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Abstract - This study describes and evaluates a LoRa-based IoT system for real-time monitoring of industrial factors like temperature, humidity, noise, and pressure. The system combines LoRa technology for long-range communication, IoT-based data visualization, and cloud-based alarm systems. This system aims to provide dependable, low-power, and cost-effective industrial monitoring in areas where standard systems fail owing to range restrictions, excessive power consumption, and network congestion. The system performs well, with a range of up to 15 km in open regions and 3-5 km in industrial situations. It consumes minimum power and has an average battery life of 6-12 months. The solution provides real-time alerting, cloud integration, and scalability for big industrial contexts. Future enhancements, such as machine learning integration, hybrid communication models, and battery life solutions, aim to address limitations such as signal interference and sensor inaccuracies and expand the system's functionality. The results show that IoT and LoRa technology can improve the efficiency and reliability of industrial monitoring systems.

Key Words: IOT , Industrial Process, DHT11 , LORA Module

1. INTRODUCTION

Industrial operations rely largely on effective monitoring systems to ensure the proper and safe operation of equipment, environmental conditions, and resource use. However, traditional industrial monitoring systems confront considerable hurdles in large-scale or remote industrial locations due to their restricted range, high power consumption, and expensive installation and maintenance costs. Existing wireless communication systems frequently struggle to meet the demands of long-distance communication in harsh conditions while simultaneously balancing real-time data transfer and energy economy. Monitoring systems in industrial environments often rely on short-range communication technologies like Wi-Fi and Bluetooth, which may not cover large areas or distant areas. Continuous data collecting, processing, and real-time warnings require significant power resources, making typical systems impractical for long-term usage without frequent maintenance or battery replacement. Many businesses prioritize an efficient, cost-effective, and scalable solution for long-range industrial monitoring that transmits data in real-time and consumes minimal power. LoRa (Long Range) technology delivers long-range, low-power communication, making it a possible answer to these difficulties. However, real-time monitoring of industrial parameters including temperature, humidity, vibration, and pressure is still underexplored and underutilized in various industries.

Fig.1: LORA Module Gateway Applications

This paper suggests designing and implementing a LoRa-based IoT system to monitor industrial metrics in real-

time with low power consumption and long-range connectivity. The system connects several sensors to a cloud-based platform for data visualization, alerts, and decision-making. The goal is to deliver a cost-effective, scalable, and dependable solution for companies that demand real-time data monitoring in large or remote environments.

2. Literature Survey

Sharma, R, and Gupta, S. (2021). The Future of IoT in Industrial Applications: A Review. Journal: Journal of Smart Manufacturing and Internet of Things. This study examines future developments in industrial IoT, with an emphasis on advancements such as artificial intelligence and machine learning that will help enterprises optimize operations.

Kaur, M., and Gupta, R. (2021). Real-time parameter monitoring in smart factories with IoT. Journal name: Journal of Industrial Technology. This article discusses the use of IoT sensors for continuous parameter monitoring in manufacturing, illustrating how these systems boost production while lowering costs.

Zhang, Z., and Sun, D. (2021). IoT and Industrial Monitoring: A Comprehensive Review. Journal name: International Journal of Industrial Engineering and Technology. This research examines the impact of IoT on industrial monitoring, focusing on predictive maintenance.

Lee, J.A., Park, Y., and Kim, S. (2020). Internet of Things applications in industrial automation. Journal: Journal of Industrial Internet of Things. This article focuses on the advantages of IoT in improving operational efficiency and minimizing downtime in industrial processes.

Patel, M.; Shah, S. (2020). Security Issues in Industrial IoT: A Review. Journal: Security and Privacy in Industrial Internet of Things Systems. This paper examines cyber security issues in industrial IoT systems and proposes methods to safeguard data flows and prevent unauthorized access.

Agarwal, P., and Rai, S. (2020). Artificial intelligence in the Industrial Internet of Things: Impact and Trends. Journal name: International Journal of Smart Technologies. This study examines how artificial intelligence may improve IoT-based industrial monitoring systems by enabling predictive maintenance and decision-making.

Patel, R., and Shah, P. (2020). Smart IoT System for Industrial Parameter Monitoring. Journal: Sensors and Actuators A: Physical. This study describes how IoT devices provide real-time monitoring, resulting in increased operational efficiency and rapid alerts to abnormal circumstances.

Zhang, Y. and Liu, X. (2020). Cloud-based IoT System for Smart Factory Monitoring. Journal: IEEE Transactions on Industrial Informatics. This study investigates how cloud-based IoT devices can monitor manufacturing characteristics and improve efficiency via real-time data analysis.

Kumar, A. and Sharma, R. (2019). IoT-based industrial monitoring system. Journal name: International Journal of Industrial Electronics and Control Systems. This article examines how IoT systems can assist cut costs and improve real-time decision-making in industrial situations.

Chaudhary, A, and Singh, N. (2019). Challenges of Implementing IoT for Industrial Automation. Journal: Industrial IoT and Security. This study discusses difficulties related to cyber security and energy management in industrial IoT deployment.

Raj V., & Gupta S. (2019). The Use of LoRa in Industrial IoT Applications. Journal name: IEEE Internet of Things Journal. This study explores how LoRa might improve industrial communication in agriculture and manufacturing by offering cost-effective, low-power connectivity.

Chaudhary, A., & Singh, N. (2019). Challenges of Implementing IoT for Industrial Automation. Journal: Industrial IoT and Security. This article discusses the fundamental obstacles of integrating IoT in industrial environments, with a focus on cyber security and IoT device energy usage.

Singh, M., and Gupta, R. (2018). LoRa is a low-power, wide-area network for industrial IoT. Journal: The International Journal of Advanced Networks and Systems. This paper explains how LoRa offers dependable connectivity for industrial IoT systems, particularly for remote applications.

3. Proposed System

3.1. System Design

The system includes LoRa modules, sensors (DHT22, ADXL345, BMP280), a microcontroller (such as ESP32), and cloud integration tools. The microcontroller takes data from the sensors and transmits it wirelessly via the LoRa module. The LoRa module delivers data to a LoRa Gateway, which then sends it to cloud platforms like Thing Speak and AWS IoT. Cloud dashboards offer

real-time visualization and warnings based on predefined thresholds.

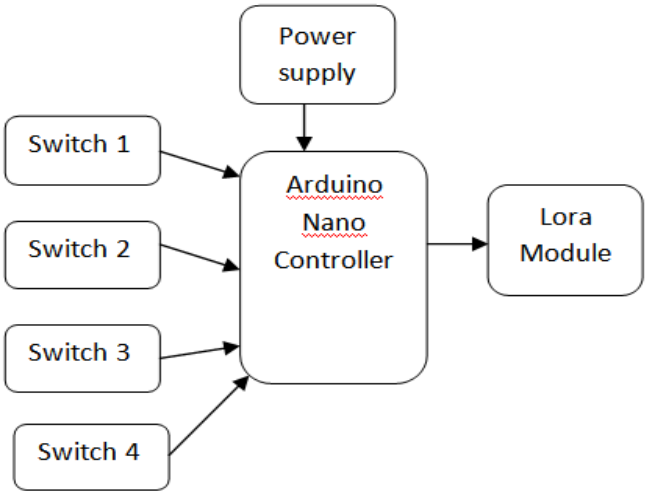

Fig 2: Transmitter Block Diagram

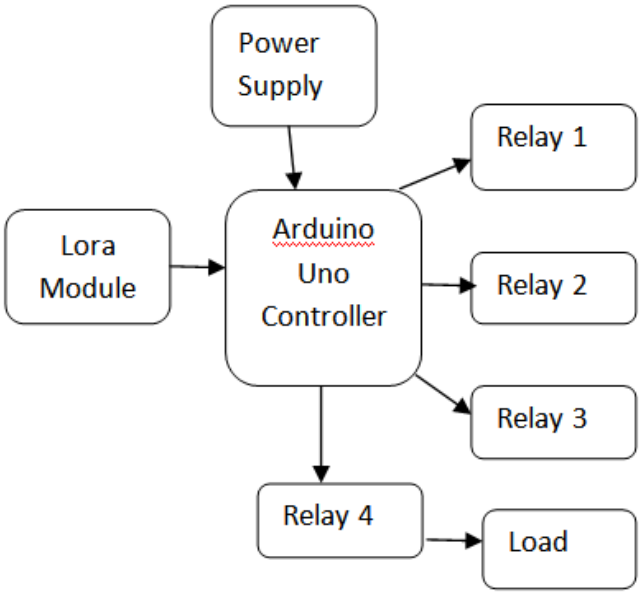

Fig 3: Receiver Block Diagram

Above block diagrams show the transmitter and receiver system of the proposed project. In which lora module is used to controlling the load connected across the controller .The LoRa network transmits sensor data over long distances and provides cloud-based tools for data visualization (e.g., Grafana, Power BI) and warnings via SMS, email, and push notifications.

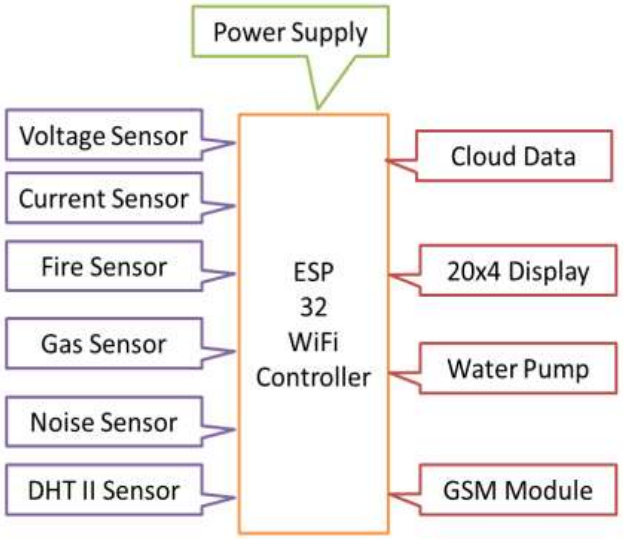

Fig.-4: System Design & Architecture

Figure 4 shows the monitoring system of the industrial parameters in which voltage sensor, current sensor, fire sensor, gas sensor, noise sensor, temperature sensors are used to monitor in industry. Also all the data which comes from the attached sensors are shown on lcd display as well as iot cloud platform.

3. CONCLUSIONS

The LoRa-based IoT industrial parameter monitoring system has shown to be a successful and cost-effective solution for industrial settings. The system provided dependable data transfer, minimal power usage, and seamless cloud connection for real-time monitoring and alerts. Despite small issues with interference and sensor accuracy, overall performance was encouraging. Future plans include integrating machine learning for predictive maintenance, incorporating solar power for longer battery life, and improving communication protocols for faster data transfer and reaction times.

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