KLE Technological University

Creating Value
Leveraging Knowledge

School of
Electronics and Communication Engineering

Minor-I Project Report

on

WIRELESS ALERTING SYSTEM FOR INDUSTRIAL ENVIRONMENT

By:

1. **Goutami Naragund** USN:01FE21BEC177
2. **Manjunath Inamati** USN:01FE21BEC356
3. **Chetan Paranatti** USN:01FE21BEC163

Semester: VI, 2023-2024

Under the Guidance of

Saroja V Siddamal

K.L.E SOCIETY'S
KLE Technological University,
HUBBALLI-580031
2023-2024

SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

This is to certify that project entitled " **Wireless Alerting System for Industrial Application** " is a bonafide work carried out by the student team of " **Goutami Naragund (01FE21BEC177), Manjunath Inamati (01FE21BEC356), Chetan Paranatti (01FE21BEC163)**". The project report has been approved as it satisfies the requirements with respect to the minor project work prescribed by the university curriculum for BE (VI Semester) in School of Electronics and Communication Engineering of KLE Technological University for the academic year 2023-2024.

Siddamal	Budihal	
Saroja V Siddamal	**Suneeta V Budihal**	**B. S. Anami**
Guide	**Head of School**	**Registrar**

External Viva:

Name of Examiners	**Signature with date**
1. Supriya V. K	signature
2. Kaushik M.	25/6.

ACKNOWLEDGMENT

We express our gratitude to the faculty and management for their professional guidance throughout the project's completion. We would like to extend our thanks to Dr. Ashok Shettar, Vice-Chancellor at KLE Technological University, Hubballi, for their visionary leadership and unwavering support. Special thanks to Dr. Suneeta V Budihal, Professor and Head of SoECE, for providing us with direction and fostering our skills and academic growth. We thank our guide, Dr. Saroja V Siddamal, for their constant guidance during interactions and reviews. We acknowledge the reviewers for their valuable suggestions and inputs. Additionally, we express our thanks to the Project Coordinator Sushma Garawad and other faculty in-charges for their support throughout the completion of the project.

Goutami Naragund
Manjunath Inamati
Chetan Paranatti

ABSTRACT

In this work, the implementation of wireless alerting system is carried out as per the requirements floated by the Spicer Industry. From the design of the circuit to the final product is carried out systematically and documented. All the components details and the external products used in the process are listed below. The built product is set up in the industry campus and working well in the real-time.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

In today's fast-paced industrial environment, timely alerts are crucial for ensuring safety, maintaining operational efficiency, and preventing costly downtimes. Traditional wired alerting systems, while reliable, can be cumbersome and expensive to install and maintain. Wireless alerting systems offer a flexible and cost-effective alternative, providing ease of installation and scalability. With advances in wireless technology, it is now possible to develop robust alerting systems that can operate efficiently in various industrial settings.

1.1 Motivation

The industry that floated this project is currently facing challenges with their existing alerting systems, which are predominantly wired. These systems are not only expensive to install but also difficult to reconfigure when there are changes in the operational layout.There is a pressing need for a wireless alerting system that can overcome these limitations and provide reliable and timely alerts across the industrial plant.

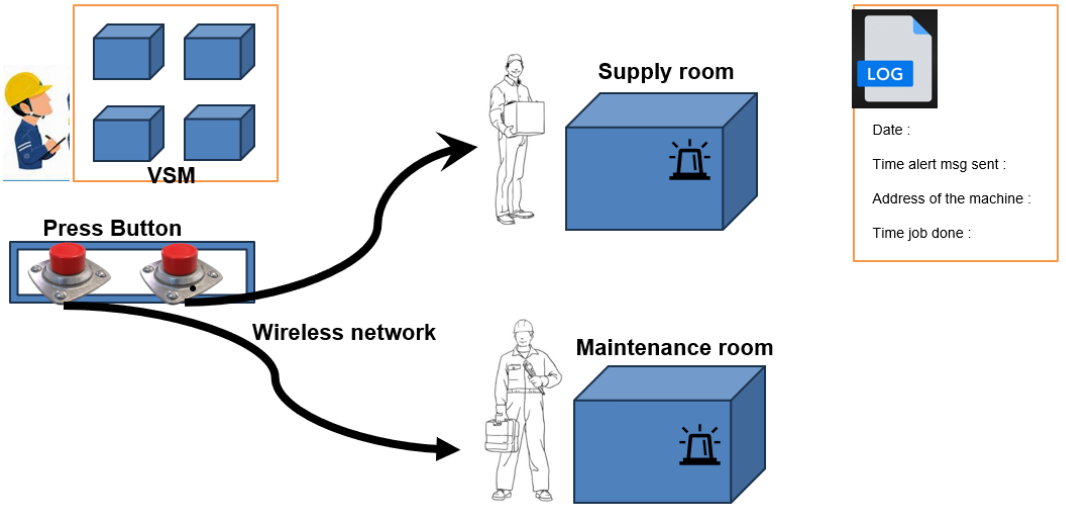

Figure 1.1: Pictorial representation of requirements.

1.2 Objectives

The primary objective of this project is to design and develop a wireless alerting system that meets the specific needs of the industry. The system should be:

- Reliable and accurate in providing timely alerts.
- Easy to install and maintain.
- Track the efficiency of the service provider.
- Track date and time and specifications of the alert message.

1.3 Literature survey

The existing literature and technological options for developing a wireless alerting system suitable for industrial applications were reviewed. Through our literature survey, we identified three primary technologies for wireless communications: GSM modules, Blynk, and Arduino IoT Cloud. After evaluating the advantages and limitations of each, we selected Arduino IoT Cloud for our project. Below is a detailed analysis of each option and the rationale behind our final choice.

1. GSM Modules
   GSM (Global System for Mobile Communications) modules are widely used for wireless communication in various applications. They provide reliable long-range communication by leveraging the cellular network infrastructure. However, implementing a wireless alerting system using GSM modules in an industrial setting presents several challenges:

   - High Cost: Each controller in the system requires a separate GSM module, significantly increasing the overall cost.
   - Complexity: The need for multiple modules complicates the system architecture and maintenance.
   - Scalability Issues: Expanding the system would require additional GSM modules, further escalating costs and complexity.
   - Track date and time and specifications of the alert message.

   Given these constraints, GSM modules were deemed unsuitable for our project

2. Blynk
   Blynk is an Internet of Things (IoT) platform that allows users to create mobile and web applications for the Internet of Things. It supports various microcontrollers and communication protocols, providing an easy-to-use interface for developing IoT solutions. Despite its advantages, Blynk was not selected for the following reasons:

   - Limited Customization: While Blynk is user-friendly, it offers limited flexibility for complex industrial applications that require extensive customization.
   - Dependence on Third-Party Services: Blynk relies on third-party servers, which may pose reliability issues and potential security concerns for industrial applications where data integrity and system reliability are critical.

   Due to these limitations, Blynk was not considered the optimal choice for our project.

3. Arduino IoT Cloud
   Arduino IoT Cloud is a platform that enables the creation and management of IoT devices with ease. It supports various Arduino boards and provides a robust environment for building IoT applications. After careful consideration, we selected Arduino IoT Cloud for the following reasons:

   - Ease of Integration: Arduino IoT Cloud seamlessly integrates with Arduino hardware, making it easier to develop and deploy the wireless alerting system.
   - Scalability: The platform supports scalable solutions, allowing for future expansion without significant additional costs.
   - Customization: It offers extensive customization options, enabling the development of tailored solutions to meet specific industrial requirements.
   - Security and Reliability: Arduino IoT Cloud provides secure communication protocols and reliable performance, essential for industrial applications.

   Based on these factors, Arduino IoT Cloud was determined to be the most suitable platform for developing our wireless alerting system

1.4 Problem statement

WIRELESS ALERTING SYSTEM FOR INDUSTRIAL ENVIRONMENT

1.5 Application in Societal Context

Our project aligns with several Sustainable Development Goals (SDGs) by promoting efficiency, inclusivity, innovation, and responsible resource management. Satisfies the requirements floated by the industry.

1.6 Project Planning and bill of materials

The project is divided into several key phases to systematically approach the development of the wireless alerting system. The first phase involves requirement analysis and a feasibility study. During this phase, specific requirements from the industry are identified, and a feasibility study is conducted. The second phase is system design, where the architecture of the wireless alerting system is designed, and appropriate hardware components and software tools are selected.

The third phase is development and integration. In this phase, the software for the alerting system is developed and integrated with the selected hardware.The fourth phase is testing and validation, where the system is tested under various scenarios to ensure reliability and accuracy. The system's performance is validated against predefined criteria.

Table 1.1: Bill of materials.

Sl.No	Name	Cost	Quantity
1	ESP32 Wroom	450	1
2	Emergency push button	170	6
3	Hi-Link 220V AC to 5V DC Converter	230	1
4	Hi-Link 220V AC to 3V3 DC Converter	230	1
5	PCB	531	1

1.7 Organization of the report

- Chapter 2 consists of detailed steps involved in System design.
- Chapter 3 consists of process flow and final design.
- Chapter 4 consists of the alignment of our project towards SDGs.
- Chapter 5 consists of validation results.

Chapter 2

System design

Introducing a cutting-edge solution for managing maintenance and supply chain issues within a network of plants housing various machines. Each machine is outfitted with a display unit signaling its operational status: green for normal functioning and red for issues. To address maintenance or supply chain problems and others , every machine is equipped with six buttons. Upon activation, these buttons wirelessly notify the designated personnel, facilitating prompt resolution of the identified issue.

2.1 Functional block diagram

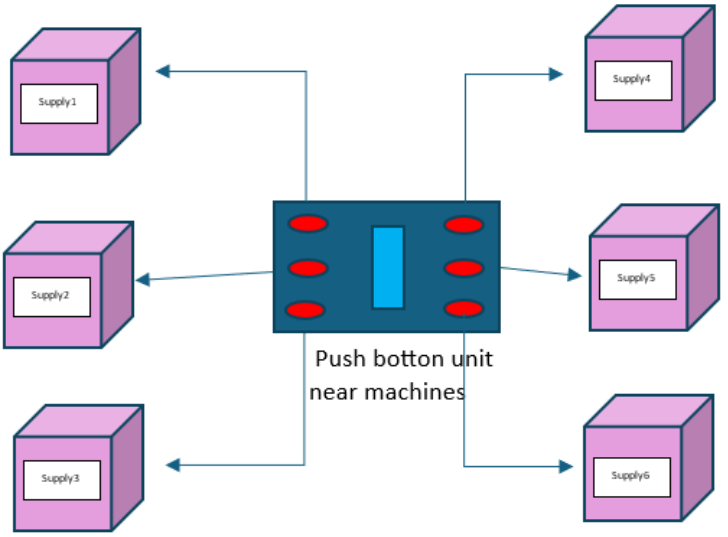

Figure 2.1: Functional block diagram.

2.2 Design alternatives

Each alternative involves different technologies and approaches, each with its own set of advantages and limitations. By evaluating these design alternatives, we can ensure that the final system meets the specific needs of the industry in terms of reliability, scalability, cost-effectiveness, and ease of implementation.

In this project, we examined multiple options for wireless communication and microcontroller platforms to determine the best combination for our system. This thorough evaluation process allowed us to make an informed decision on the optimal design for our wireless alerting system.

Table 2.1: Morphological chart

Functions/Means	**Option 1**	**Option 2**	**Option 3**
Wireless Communication	GSM Module	Blynk	Arduino IoT cloud
Micro-Controller	ESP32	Raspberry Pi	ESP8266

2.3 Final design

Wireless Communication : Arduino IoT Cloud
Arduino IoT Cloud is a platform that enables the creation and management of IoT devices with ease. It supports various Arduino boards and provides a robust environment for building IoT applications.
Micro-Controller : ESP32 Wroom32
The unique antenna design of ESP32-WROOM-DA has resulted in the module's excellent wireless communication, even under difficult circumstances. Thus, makers using ESP32-WROOM-DA can now develop IoT applications that need stable connectivity over a broad spectrum, or deploy Wi-Fi in challenging and hazardous environments, or overcome communication problems in Wi-Fi-dead spots.

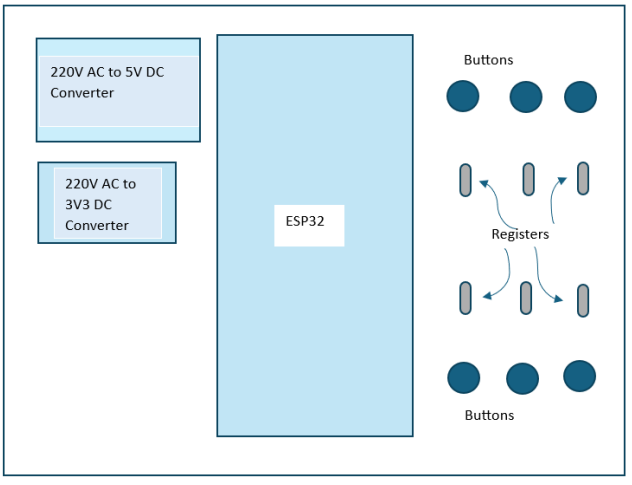

Figure 2.2: Final design

Chapter 3

Implementation details

3.1 Specifications and Final system architecture

schematic Hakbekuuu.....

3.2 Flowchart

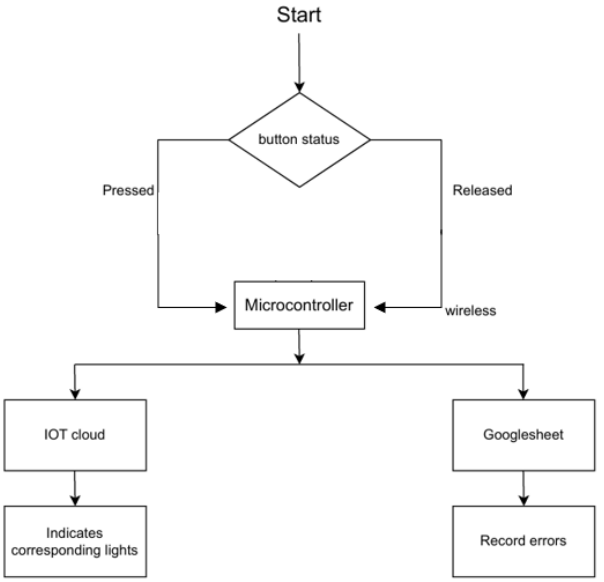

Figure 3.1: Flow chart

After finalizing the design and thoroughly testing all components on a zero PCB (prototype board), we proceeded to the PCB fabrication stage. This step is crucial for transitioning from a prototype to a fully functional and reliable product. The design was meticulously reviewed to ensure it met all performance and reliability requirements before sending it for fabrication.
The Figure 3.2 and Figure 3.3 showcase the 3D view and layout of the PCB. These files are essential for the PCB fabrication process, providing a detailed blueprint of the board's structure and component placement.

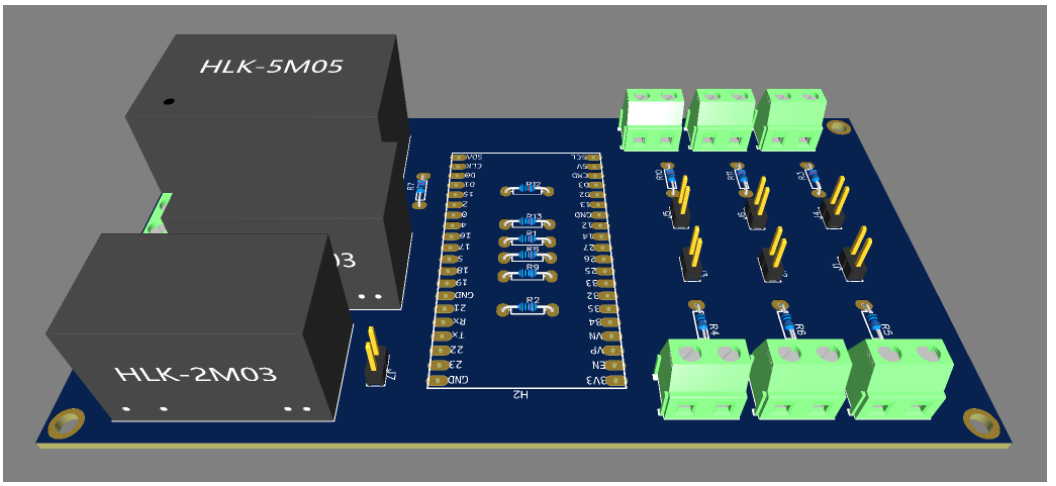

Figure 3.2: 3D view of PCB

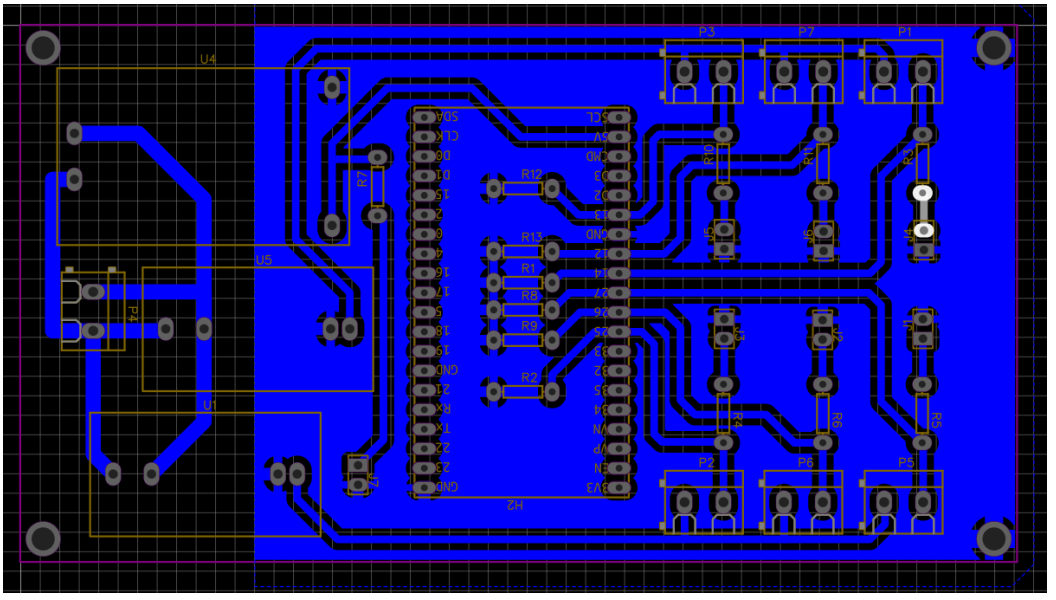

Figure 3.3: PCB Layout design

Chapter 4

Alignment with SDG

4.1 Introduction to SDGs

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, represent a global call to action to end poverty, protect the planet, and ensure prosperity for all by 2030. Comprising 17 interconnected goals, the SDGs address a wide range of critical issues, including social, economic, and environmental dimensions of sustainable development. Their importance cannot be overstated, as they provide a comprehensive framework for addressing the most pressing challenges facing humanity today.

Our project "Wireless Alerting System for Industrial Environment" aligns with several Sustainable Development Goals (SDGs) by promoting efficiency, inclusivity, innovation, and responsible resource management.

Figure 4.1: Sustainable Development Goals

- **SDG 9**: Industry, Innovation, and Infrastructure - This goal focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. Our project directly aligns with this goal by improving industrial infrastructure through monitoring and alert systems.

- **SDG 12**: Responsible Consumption and Production - This goal aims to ensure sustainable consumption and production patterns. Our project contributes to this goal by optimizing equipment usage, reducing unnecessary downtime, and minimizing resource waste through timely maintenance alerts.

- **SDG 8**: Decent Work and Economic Growth- Industrial equipment monitoring systems help create employment opportunities in the maintenance, repair, and supply chain management sectors. By improving the productivity and reliability of industrial processes, these systems contribute to economic growth and the creation of sustainable livelihoods.

By addressing these SDGs, your project can demonstrate its commitment to promoting sustainable development and contributing to global efforts to tackle pressing societal and environmental challenges.

Chapter 5

Implementation Results and Future scope

5.1 Implementation Results

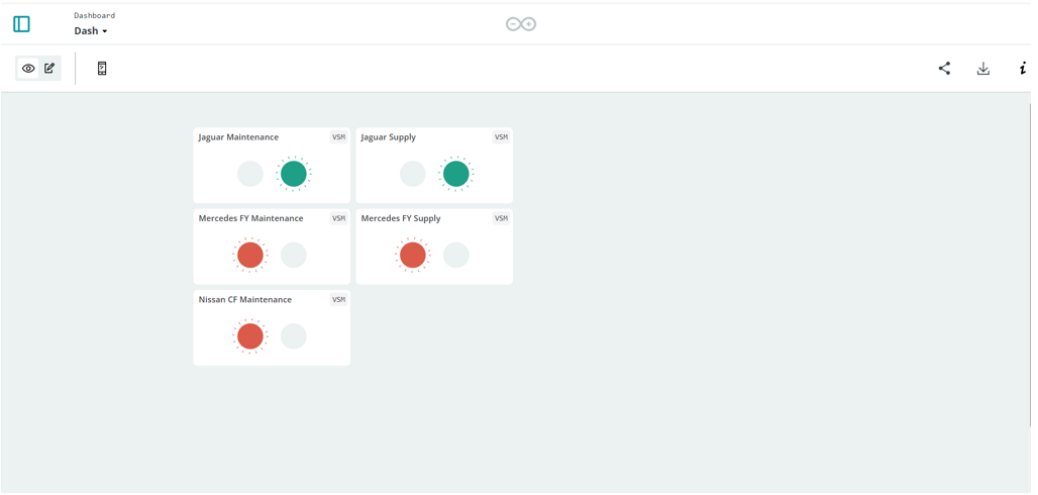

Figure 5.1: Dashboard created using Arduino IoT Cloud

Finally, we have developed a comprehensive dashboard that provides real-time monitoring of the push button status in our wireless alerting system. This dashboard shown in Figure 5.1 is designed to be user-friendly and intuitive, ensuring that users can quickly and easily understand the current state of the system.

The Figure 5.2 illustrates two critical components of our wireless alerting system: the entries of alerts in Google Sheets and the notifications popping up on our mobile devices. These features enhance the system's efficiency and ensure that alerts are promptly and accurately communicated to the relevant users.
The Google Sheets integration allows for real-time logging and tracking of all alert events. Each time a push button is pressed, an entry is automatically created in the Google Sheet. Simultaneously, our system ensures that real-time notifications are sent to users' mobile devices whenever an alert is triggered.

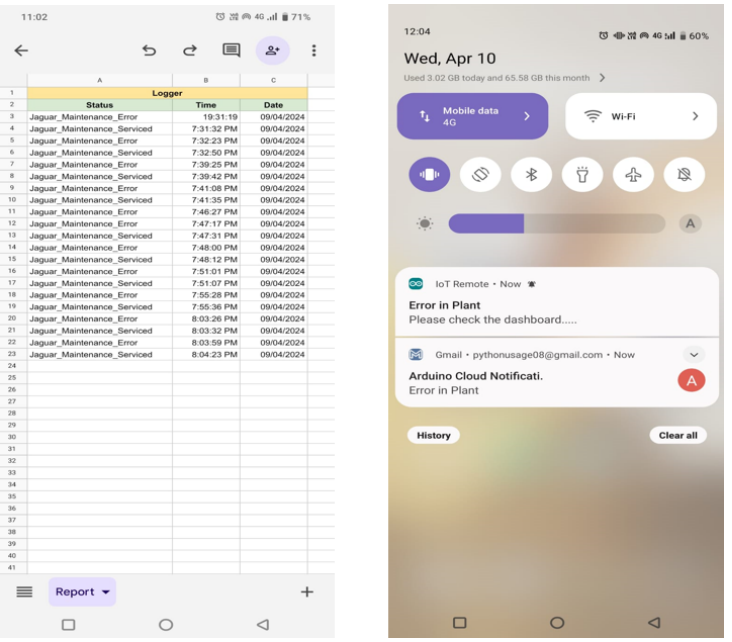

Figure 5.2: Google sheet entries and Mobile Notifications

5.2 Future scope

The wireless alerting system developed in this project holds significant potential for future enhancements and applications. As technology continues to advance and industrial needs evolve, several areas can be explored to further improve and expand the system's capabilities. Here are some potential future developments:

- **Enhanced Data Analytics**
  Incorporating advanced data analytics and machine learning algorithms can help in predictive maintenance and trend analysis. By analyzing historical data, the system can predict potential failures before they occur and optimize maintenance schedules, thus reducing downtime and maintenance costs.

- **Improved User Interface and Mobile App Development**
  Enhancing the user interface for better user experience and developing dedicated mobile applications can improve accessibility and ease of use. Mobile apps can provide real-time notifications, system status updates, and allow users to interact with the system directly from their smartphones or tablets.

- **Integration with Existing Industrial Systems**
  Ensuring compatibility and seamless integration with existing industrial systems (e.g., SCADA, ERP) can provide a more comprehensive monitoring and management solution. This will enable the wireless alerting system to work in conjunction with other industrial control systems, providing a unified platform for monitoring and control.

Bibliography

try-1

ORIGINALITY REPORT

13%	12%	3%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.slideshare.net Internet Source	3%
2	community.apachefriends.org Internet Source	2%
3	www.coursehero.com Internet Source	2%
4	www.rhydolabz.com Internet Source	1%
5	ijip.in Internet Source	1%
6	fastercapital.com Internet Source	1%
7	raw.githubusercontent.com Internet Source	<1%
8	www.cse.ust.hk Internet Source	<1%
9	Rohan Garg, B Dastagiri Reddy. "IoT Smart Plug based on ESP8266 Wi-Fi Chip", 2022 3rd	<1%

International Conference on Smart Electronics and Communication (ICOSEC), 2022
Publication

10	publisher.uthm.edu.my Internet Source	<1 %
11	www.robotics.org.za Internet Source	<1 %
12	eprints.uthm.edu.my Internet Source	<1 %
13	usermanual.wiki Internet Source	<1 %
14	terrapass.com Internet Source	<1 %
15	Hatem Taha AbuEltayef, Khaldoun S. AbuAlhin, Khalil M. Alastal. "Addressing non-revenue water as a global problem and its interlinkages with sustainable development goals", Water Practice & Technology, 2023 Publication	<1 %

Exclude quotes	On	Exclude matches	< 5 words
Exclude bibliography	On		