SMART INDUSTRIAL LOAD SWITCHING

A PROJECT REPORT SUBMITTED

IN PARTIAL FULFILMENT FOR THE AWARD OF

THE DEGREE OF

BACHELOR OF TECHNOLOGY
IN
ELECTRONICS & INSTRUMENTATION ENGINEERING

Submitted by

ANEESHA DACHA **19071A1010**

TAMASOMA JYOTIRGAMAYA
Estd. 1995

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
AICTE Approved; UGC Autonomous; JNTUH Affiliated; UGC “College with Potential for Excellence”; NAAC “A++” Grade

ISO 9001:2015 Certified; QS I.GAUGE “Diamond” Rated; NIRF 2019: 109th Rank Engineering (151–200 Band Overall)

NBA Accredited: CE, CSE, ECE, EEE, EIE, IT, ME, AE; JNTU-Recognised Research Centres: CE, CSE, ECE, EEE, ME

2023

SMART INDUSTRIAL LOAD SWITCHING

A PROJECT REPORT SUBMITTED

IN PARTIAL FULFILMENT FOR THE AWARD OF

THE DEGREE OF

BACHELOR OF TECHNOLOGY
IN
ELECTRONICS & INSTRUMENTATION ENGINEERING

Submitted by

ANEESHA DACHA **19071A1010**

Under the Guidance of
Mrs S.Vandana
Assistant Professor, Dept. of EIE, VNR VJIET

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
AICTE Approved; UGC Autonomous; JNTUH Affiliated; UGC "College with Potential for Excellence"; NAAC "A++" Grade
ISO 9001:2015 Certified; QS I.GAUGE "Diamond" Rated; NIRF 2019: 109th Rank Engineering (151–200 Band Overall)
NBA Accredited: CE, CSE, ECE, EEE, EIE, IT, ME, AE; JNTU-Recognised Research Centres: CE, CSE, ECE, EEE, ME

2023

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING

VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

AICTE Approved; UGC Autonomous; JNTUH Affiliated; UGC "College with Potential for Excellence"; NAAC "A++" Grade

ISO 9001:2015 Certified; QS I.GAUGE "Diamond" Rated; NIRF 2019: 109th Rank Engineering (151–200 Band Overall)

NBA Accredited: CE, CSE, ECE, EEE, EIE, IT, ME; JNTU-Recognised Research Centres: CE, CSE, ECE, EEE, ME

TAMASOMA JYOTIRGAMAYA

Estd. 1995

CERTIFICATE

This is to certify that the project titled **"SMART INDUSTRIAL LOAD SWITCHING"** is being submitted, by **ANEESHA DACHA (19071A1010)**, in partial fulfilment of the requirement for the award of degree of **Bachelor of Technology in Electronics and Instrumentation Engineering**, to the Department of Electronics and Instrumentation Engineering at the **Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology** is a record of *bona fide* work carried out by her under my guidance and supervision. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree.

Mrs S. Vandana
Assistant Professor
Dept. of EIE, VNRVJIET
Hyderabad

Dr. R. Manjula Sri
Prof. and Head of the Dept.
Dept. of EIE, VNRVJIET
Hyderabad

External Examiner

ACKNOWLEDGEMENTS

This is an acknowledgement of the intense drive and technical competence of many individuals who contributed to the success of my project.

I express my special gratitude to my Project Guide, **Mrs. S. Vandana, Assistant Professor**, Department of Electronics & Instrumentation Engineering, VNRVJIET, for her guidance and help provided in the successful completion of my project titled **“Smart Industrial Load Switching”**. I thank her for the earnest cooperation she extended to me in executing the current project work.

I express my sincere thanks to **Dr R. Manjula Sri,** Professor & Head of the Department of Electronics & Instrumentation Engineering, VNRVJIET, and to other faculty members in the Department for guiding me through my education at the Institute and for encouraging me all through. I particularly thank my mentor **Dr.K.Sudha Rani** for helping me through my journey at VNRVJIET. I also extend my gratitude to the Project Coordinator, **Dr M. Harikrishna**, Associate Professor with the Department of EIE, for his valuable guidance and for streamlining the review process for my project work. My thanks are also due to the other members of the Review Panel and all other faculty members.

I express my thanks to **Dr C.D. Naidu**, Principal-VNRVJIET, for enabling me to use the Institute facilities and resources for the successful completion of my project work.

ANEESHA DACHA

DECLARATION

I hereby declare that the project work titled **"Smart Industrial Load Switching"** submitted, towards partial fulfilment of requirements for the degree of Bachelor of Technology in Electronics and Instrumentation Engineering, to the Department of Electronics & Instrumentation Engineering at the Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology, Hyderabad, is an authentic work and had not been submitted to any other University or Institute for any award of degree or diploma.

ANEESHA DACHA
(19071A1010)

ABSTRACT

Smart industrial load switching enables the efficient control and management of electrical loads in industrial settings. The system aims to enable efficient control, monitoring, and automation of industrial loads. It involves the use of intelligent switching devices that can automatically turn equipment on and off based on load factors.

In this project, a prototype is created and demonstrated an overload scenario using loads as bulbs. When the load is excessive, it promptly switches off, and the data is updated on the server in a matter of seconds. The authorities keep an eye on this and can take appropriate action.

The project highlights the significance of software and IoT in revolutionizing industrial load management for enhanced efficiency and sustainability. The integration with IoT enables real-time data collection, analysis, and decision-making capabilities, leading to improved load balancing, predictive maintenance, and overall productivity..In addition, smart load switching can improve the reliability and safety of industrial equipment by reducing the risk of overloading and power surges. It can also help extend the lifespan of equipment by minimizing wear and tear caused by unnecessary use.

In industries where there are flammable gases, conventional switches that generate sparks pose a risk to human life. Hence, it is necessary to replace them with a safer and smarter system. Currently, touchscreen-based switches are being used, but they still require human interference. To eliminate the risk of human exposure to hazardous environments, this is to automate the system, and remove the need for a person to be present at the location.

Overall, smart industrial load switching offers significant benefits to industries in terms of energy efficiency, sustainability, and operational efficiency. Its adoption is likely to increase in the coming years as more industries prioritize sustainable practices and seek ways to reduce their energy costs and environmental impact.

LITERATURE SURVEY

Ankush Meena, Arpit Gangwal, Himanshu Vijay, Chetan Prajapat, and Jitendra Singh in the paper "Touch Controlled Switch Board with Multiple Load Switches" stated that people are setting a priority on their security and safety, where they use the concept of a switch that can be activated and deactivated by touching a TTP223 module rather than a standard switch. which guard us against shocks. This circuit can be used in moist regions, industries, electrical doorbells, and toys, but requires human involvement for operation.

Shreya Sankrityayan, and Ananya Sankrityayan in the paper "Touch Screen Based Industrial Load Switching" describe that the complexity of the circuitry is increased by the number of hardware components employed in the touch method. Microcontrollers, disc or triac, optoisolators, and transformers are used.

Sejal Bagde, Pratiksha Ambade, Manasvi Batho, Piyush Duragkar, Prathmesh Dahikar, and Avinash Ikhar in the paper "Internet of Things (IoT) Based Smart Switch" proposed an Android application with a unit comprising of ESP8266 Wi-Fi module, relay, logic level converter module, capacitive touch sensor module and also a Wi-Fi technology has been used to control the switches.

Sahil Saini, Neha Bharti, and Sunikshita Katoch in the paper "Industrial Automation using Programmable Switching Control" described that switching of industrial loads using a user-programmable logic control device for sequential operation is demonstrated in this paper. This operation is typically used for repetitive tasks. For simple operations like sequential switching of loads, programmable logic controllers used in industrial applications are extremely expensive. It operates in three modes.

S Ashok and R Banerjee in the paper "Load-management applications for the industrial sector" stated that the goal of the load-management system is to keep the load as constant as possible, allowing the system load factor to approach 100%. The best features of load management are lower maximum demand, lower power loss, better equipment utilization, and lower maximum demand charges. It requires more energy.

"Design and Development of Smart Load Switching System for Industrial Applications" by S. Chakraborty and S. Sarkar. This paper presents a design and development methodology for a smart load-switching system that uses microcontroller-based circuitry and wireless communication to control individual loads in an industrial setting.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Objective

The main motive of this project is to detect the load of equipment and if it exceeds a predetermined threshold value, an action is to be taken. When an overload arises in an industry, it takes human involvement to turn it off. Yet, handling a heavy load could cause sparks and be quite risky. In order to avoid the human involvement required by the touchscreen-based switch, in which the function is carried out automatically and without humans. This aids in lowering errors and raising accuracy. In order to address industrial issues, the touch is being upgraded to smart.

1.2 Introduction

As technology is advancing, industries are also getting smarter. Modern industries are gradually shifting from conventional switches to centralized control systems. The Smart Industrial loading switching is a method where the load when deviated gets switched off automatically. This method is the contrary approach to the conventional and touch screen method. Here, the IOT concept is used to convert it into a smart solution. The current sensor senses the load value and the bulbs are connected to show the current status. Apart from this, a Wi-Fi module helps to receive a message on the phone to monitor remotely.

Rapid industrialization and growing demand for energy have increased the need for efficient energy management systems. One of the critical components of any energy management system is load switching, which enables the distribution of power to various loads. The traditional approach to load switching involves manual operation, which is time-consuming, inefficient, and prone to human errors. This can result in excessive energy consumption, higher operating costs, and decreased productivity.

To overcome these challenges, smart industrial load switching has emerged as a viable alternative. Smart load-switching systems leverage advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), and machine learning (ML) to enable real-time monitoring and control of energy consumption.

1.3 Motivation

This project aims to develop a smart industrial load-switching system that uses IoT technology to monitor and control energy consumption in real-time. The proposed system is designed to provide accurate, timely, and reliable information about energy consumption, allowing users to identify potential areas for improvement and make informed decisions about load switching. The system is expected to reduce energy consumption, lower operating costs, and improve productivity, making it an attractive option for industries looking to improve their energy management capabilities.

1.4 Scope for the Work

The implementation of a smart load-switching system in industrial settings has enormous potential to improve energy efficiency, reduce energy consumption, and enhance operational performance. As technology continues to advance and new innovations emerge, there are several future opportunities and potential benefits for smart load-switching systems in industrial applications.

Technology is Rapidly growing these days and everything is improving. Our project can be further improved to remove the necessity of human interference completely.

In the project when there is an overload the switch turns off and after this situation an Engineer needs to check the situation and depending on that take necessary action this can be made into a system where the system can analyze and act by itself.

CHAPTER 2

PROJECT OVERVIEW

Smart Industrial Load Switch is a system that uses software and IoT technologies to optimize and automate industrial load management. It aims to improve energy efficiency, reduce costs, and increase productivity in industrial operations. The smart industrial load switch project aims to revolutionize industrial load management by incorporating IoT technologies. Industrial loads, such as machinery, equipment, and lighting systems, consume significant energy in manufacturing facilities and industrial settings. Traditional methods of load management often lack efficiency and real-time monitoring capabilities. However, by integrating IoT into load switches, this project aims to optimize energy consumption, improve operational efficiency, and address common challenges in industrial load management.

One of the key advantages of smart load switching is its ability to optimize energy usage in real time. By monitoring individual loads and adjusting energy consumption as needed, the system can reduce energy waste and prevent equipment overload, leading to significant energy savings over time. In addition, the system can detect and respond to equipment failures or other issues, preventing downtime and minimizing the impact on productivity.

The design of the smart load-switching system should take into account several factors, including the energy consumption and load management practices of the industrial setting, the compatibility with existing infrastructure, and the reliability and safety of the system. The selection of the right smart load-switching devices is also critical to the success of the system. Devices such as intelligent circuit breakers, solid-state relays, and power monitors can be used to monitor and control individual loads in real time.

The implementation of the smart load-switching system requires careful planning, installation, and integration with existing infrastructure. It may also require adjustments to the facility's energy management practices and protocols, as well as employee training to ensure proper use and maintenance of the system.

Testing and monitoring the smart load-switching system is critical to ensure its reliability, safety, and compatibility with existing equipment and infrastructure. Through the simulation of various load scenarios and monitoring of energy consumption and load management data, the system can be fine-tuned to optimize energy usage and prevent equipment overload. Additionally, ongoing monitoring and analysis of energy consumption data can help identify opportunities for further optimization and improvement.

In conclusion, the implementation of a smart load-switching system can provide numerous benefits to industrial facilities, including improved energy efficiency, reduced energy costs, and increased reliability. The design and implementation of such a system require careful consideration of factors such as energy consumption and load management practices, device selection and evaluation, and system testing and monitoring. By developing and implementing a smart load-switching system, industrial facilities can not only reduce their environmental footprint but also improve their bottom line and competitiveness in an increasingly energy-conscious market.

CHAPTER 3
METHODOLOGY

The fundamental idea behind the development of smart systems is to fully automate the management of various devices and appliances in order to make people's daily life easier, more convenient and well-managed. The next step is to select the appropriate smart load-switching devices and IoT sensors that will be used to monitor and control individual loads. This involves considering factors such as compatibility with existing infrastructure, reliability, cost-effectiveness, and scalability. The selected devices should be capable of communicating with each other and with the central control system in real time, using protocols such as Wi-Fi, Bluetooth, or Zigbee.

After selecting the devices, the next step is to design and install the smart load-switching system. This involves wiring the devices to the electrical panels or individual loads, setting up the IoT sensors and gateways, and configuring the central control system. The central control system should be designed to collect data from the IoT sensors and use it to make real-time decisions on load switching and energy optimization. It should also provide a user-friendly interface for monitoring and controlling the system, as well as generating reports and alerts.

Software and hardware integration is critically important as it ensures the seamless operation and optimal performance of technology systems. The integration allows the software to leverage the capabilities of the hardware, enabling advanced functionality and efficient resource utilization. It ensures that the software can effectively communicate with and control the hardware, leading to enhanced user experiences and improved system efficiency. Without proper integration, software and hardware components may not work together effectively, resulting in compatibility issues, decreased performance, and limited functionality. Therefore, software and hardware integration is vital for maximizing the potential of technology systems and delivering high-quality, reliable solutions.

3.1 Hardware

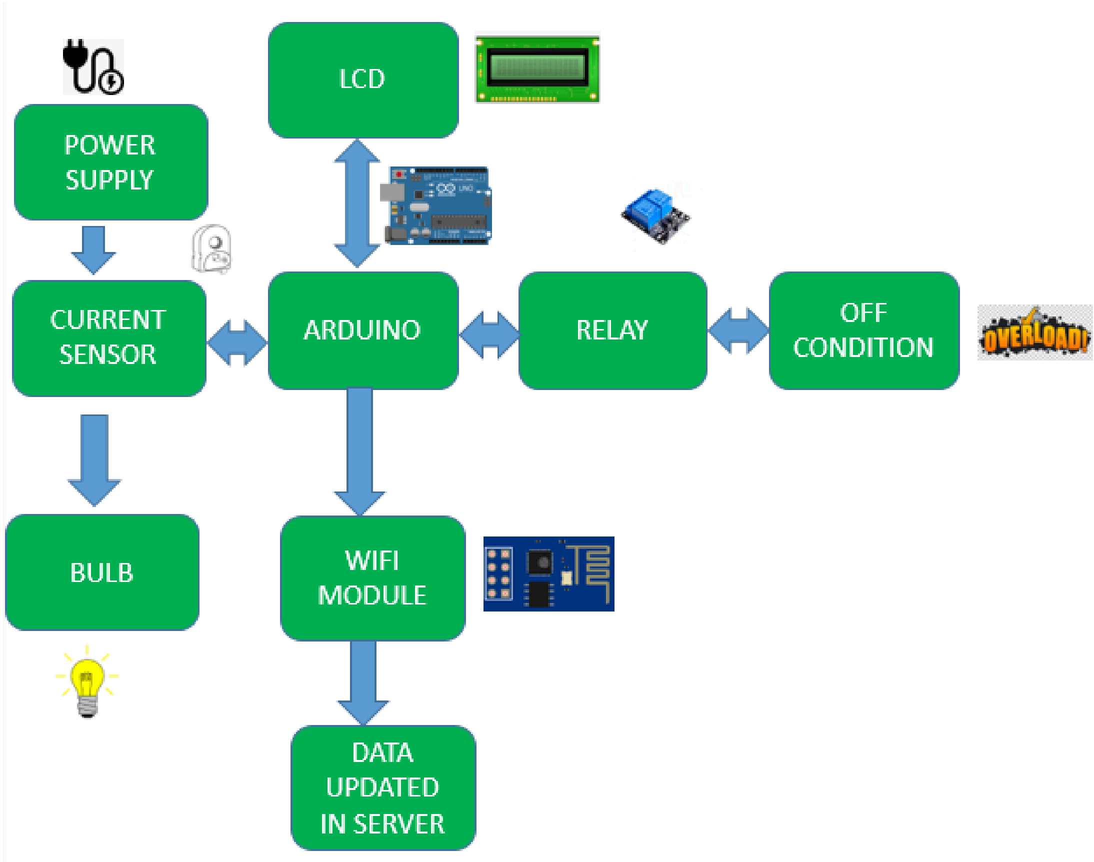

Fig 3.1. Block Diagram.

The project is implemented on a small scale as the implementation of this project using industry-standard equipment is practically not possible. There are different components that have been interfaced together to implement the idea of a Smart Industrial Load Switch. The main part of the project is the Arduino which is like the brain of the project which receives inputs from different devices and sends information to different devices after all the processing.

The different components connected to the Arduino are

- Current sensor
- Relay
- Wifi module
- LCD Screen

These are the major components connected to the Arduino.

The Current sensor is used to sense the flow of current and sends information to the Arduino, depending on this information the Arduino sends a signal to the relay if the current value crosses the threshold value. Once the threshold value is crossed the bulbs are turned off. The bulbs here are used as a load that draws current, after this process the Arduino communicates with the Wifi Module and LCD to Display the Output. This Wifi module is connected to an IOT Interface which helps us observe the system's condition from a distance and take the necessary action and the LCD Displays the condition on the screen.

3.1.1 Components

- Arduino Uno
- Bulb Holders
- Rectifiers
- Wifi Module
- LCD Screen
- Relays
- Current Sensors

1. **Arduino Uno:** Arduino Uno is a popular open-source microcontroller board that is designed to be easy to use and versatile. It is based on the ATmega328P microcontroller and features 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and an ICSP header. The board can be programmed using the Arduino Integrated Development Environment (IDE), which makes it easy for beginners to get started with programming.

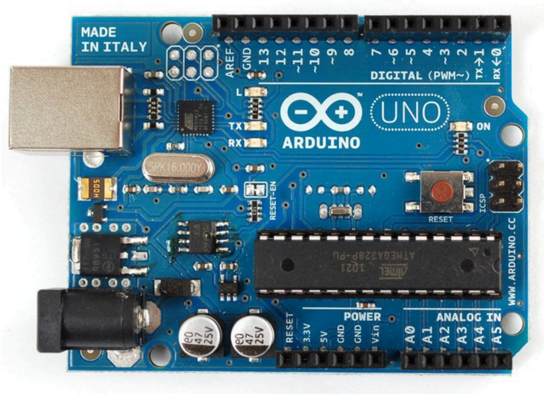

Fig 3.2. Arduino Uno.

2. **Bulb Holders:** A bulb holder, also known as a lamp holder, is a device that holds a light bulb in place and connects it to an electrical circuit. There are different types of

bulb holders available, including screw-in, bayonet, and bi-pin holders, which are designed to fit different types of light bulbs.Bulb holders are typically made from materials such as plastic or ceramic, which are good electrical insulators. They may also feature metal contacts that allow the bulb to be connected to the circuit. Some bulb holders also include features such as switches or dimmers that allow the user to control the brightness of the light.

Fig 3.3. Bulb holder.

3. **Rectifiers:** A rectifier is an electronic device that converts AC (alternating current) power to DC (direct current) power. This is important because most electronic devices require DC power to function, while the power grid provides AC power. Rectifiers are typically made from diodes, which are electronic components that allow current to flow in only one direction. There are two main types of rectifiers: half-wave rectifiers, which allow only half of the AC waveform to pass through, and full-wave rectifiers, which allow the entire waveform to pass through. Rectifiers are used in a wide range of applications, including power supplies, motor controllers, and audio amplifiers. They are also used in battery charging circuits to convert AC power from a wall outlet to DC power that can be used to charge a battery.

Fig 3.4. Rectifier .

4. **Wifi Module:** A WiFi module is an electronic device that allows a device to connect to a wireless network using the WiFi protocol. WiFi modules typically include a microcontroller, WiFi transceiver, and an antenna. They can be used to add WiFi connectivity to a wide range of devices, including IoT devices, cameras, and sensors. WiFi modules are typically designed to be easy to use and integrate into existing designs. They may include firmware that allows the user to configure the device using a web interface, or they may be programmable using a high-level programming language.

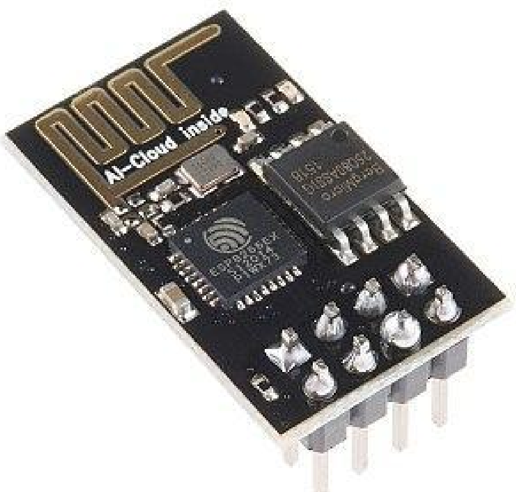

Fig 3.5. Wifi Module.

5. **LCD Screen:** An LCD (liquid crystal display) screen is a type of flat-panel display that uses liquid crystals to create images. LCD screens are commonly used in electronic devices such as televisions, computer monitors, and mobile phones. LCD screens consist of a layer of liquid crystal material sandwiched between two layers of polarizing material. When an electric current is applied to the liquid crystal material, it changes the polarization of the material, which allows light to pass through and create an image. LCD screens are popular because they are energy-efficient and offer high resolution and color accuracy. They are also lightweight and thin, which makes them suitable for use in portable devices.

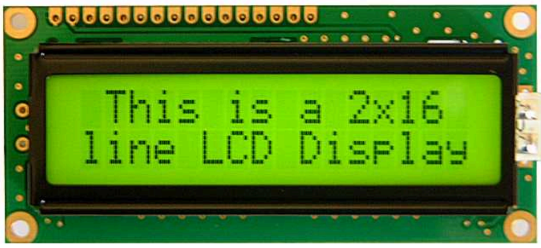

Fig 3.6. LCD Screen.

6. **Relays:** A relay is an electronic switch that allows a low-power signal to control a high-power circuit. Relays consist of a coil, which generates a magnetic field when current is applied, and a set of contacts, which are opened or closed by the magnetic field. Relays are commonly used in applications where it is necessary to control a high-power circuit using a low-power signal, such as in industrial automation

Fig 3.7. Relay

7. **Current Sensor:** A current sensor is an electronic device that is used to measure the electric current flowing through a circuit. It is a crucial component in many electrical and electronic projects, especially in those involving power control and energy management. The basic principle behind the operation of a current sensor is the measurement of the magnetic field generated by the current flowing through a conductor. This magnetic field can be detected and converted into an electrical signal by the sensor, which can then be used for various purposes, such as monitoring and control.

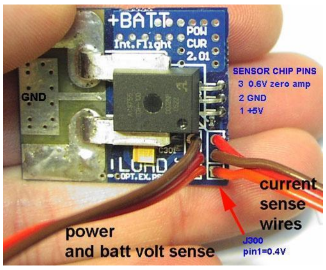

Fig 3.8. Current Sensor

The ESP8266 module serves as the system's central processing unit in our setup and is in charge of facilitating signal transmission and reception between the Android app and the web server.

Two crucial parts make up our smart system.

- Display unit
- Protection unit.

This smart device's main component for processing commands and controlling them is the Arduino. For its supply, the bridge rectifier may transform three-phase current into DC. The displaying devices are coupled to current sensors. The system's current sensor (ZMCT103C) is designed to work well with microcontrollers like the Arduino and has a 10 Ampere operating capacity. This current sensor device can offer communication networks low-cost AC current sensing options. Relays and circuit breakers are employed in front of the load as part of this system's protection unit to protect the system from various faults such as overcurrent faults, transient faults, and others. The overcurrent fault cannot impact the system because the protective mechanisms trip the supply to the load when an overcurrent fault occurs on the system's live line.

The system experimental findings of various units is being displayed in this part. This paper uses an Arduino board to monitor and control a variety of electrical appliances using an Android smartphone to showcase the concept of a smart automation system. IoT is one of the newest technologies that may be utilized for automation, thus it comes with a number of challenges. The lack of standards for combining sensors, relays, circuit breakers, applications, and other existing devices is one of the major difficulties. It is difficult to provide linked devices with unique IP addresses while maintaining their privacy and security in a smart environment. Extreme caution should be used when collecting, storing, and safeguarding data because IoT deals with enormous amounts of data generated from numerous devices deployed in an environment. Data analytics and visualization can be used in the future to effectively monitor and control IoT devices in a smart environment.

S.No	Power1	Power2	Power3	Total	Status	Date
1	76	77	0	153	Normal	2023-04-12 12:46:00
2	76	0	0	76	Normal	2023-04-12 12:45:11
3	77	77	51	205	Over_Load	2023-04-12 12:40:42
4	76	77	80	233	Over_Load	2023-04-12 12:28:59
5	76	77	0	153	Normal	2023-04-12 12:28:38
6	76	0	0	76	Normal	2023-04-12 12:27:49
7	77	0	0	77	Normal	2023-04-11 17:47:30
8	75	96	102	273	Over_Load	2023-04-01 11:27:54
9	75	0	103	178	Normal	2023-04-01 11:27:12
10	76	95	103	274	Over_Load	2023-04-01 11:16:13
11	76	0	103	179	-	2023-04-01 11:15:39
12	76	0	0	76	-	2023-04-01 11:14:50
13	76	0	0	76	-	2023-04-01 11:14:01

Fig 3.9. IOT server data.

.

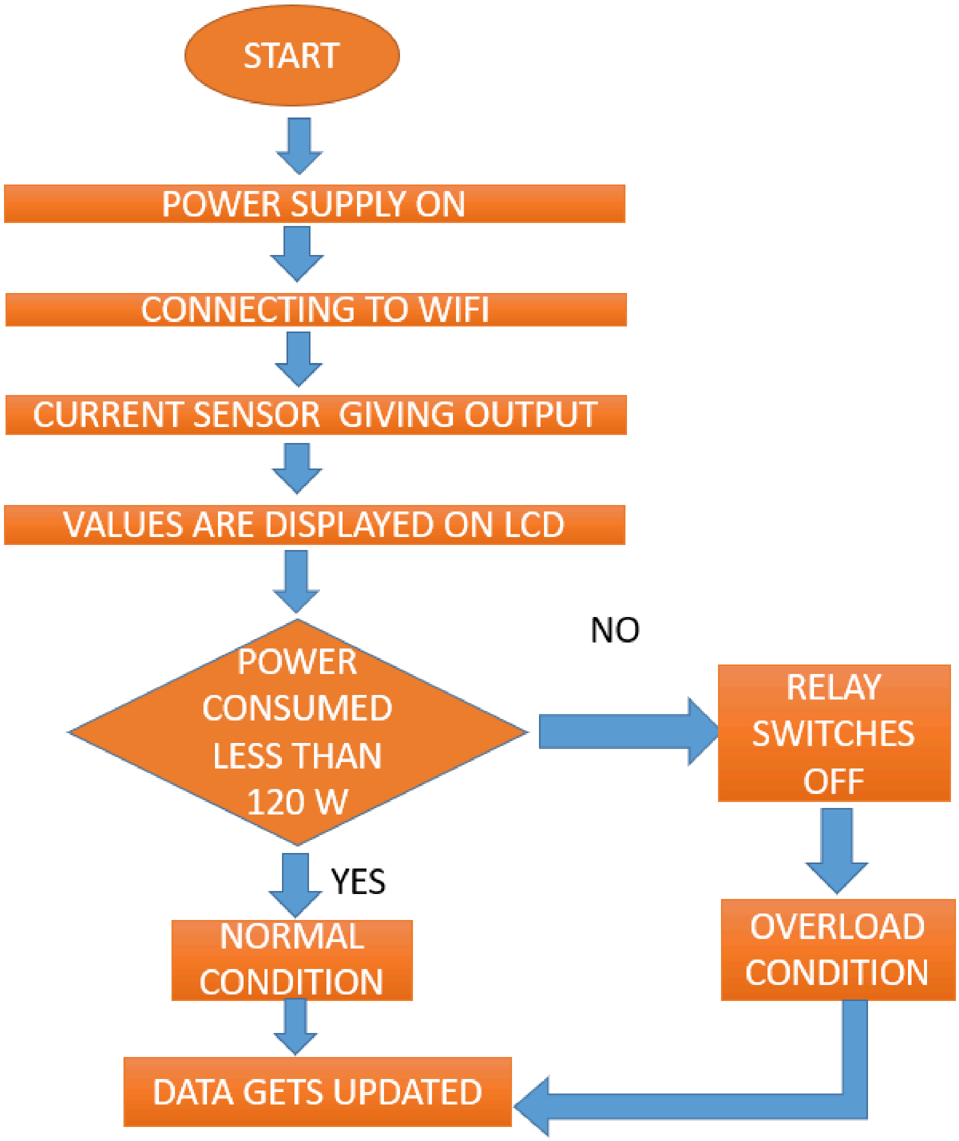

Fig 3.10. Flow Chart.

3.2 Software

The software part of a smart industrial load switch project plays a crucial role in enabling efficient control, monitoring, and automation of industrial loads. In this article, the significance of the software component and its integration with the Internet of Things (IoT) in such projects is being explored.

A smart industrial load switch is designed to manage and regulate the power supply to various electrical loads in an industrial setting. Traditionally, this task was performed manually or through basic automation systems. However, with advancements in technology, the integration of software and IoT has revolutionized industrial load management.

The software component of a smart industrial load switch project consists of various elements that work together to ensure optimal performance and efficiency. One of the key aspects is the embedded firmware that runs on the load switch itself. This firmware is responsible for controlling the switching operations, monitoring power consumption, and communicating with other devices in the network.

To enable seamless communication and control, the load switch firmware is typically equipped with networking protocols such as Modbus, MQTT, or OPC-UA. These protocols facilitate interoperability and integration with other industrial control systems, allowing for centralized monitoring and control of multiple load switches.

Moreover, the software component includes a user interface that provides a graphical representation of the industrial loads and their status. This interface allows operators to visualize real-time data. It also enables remote access, which is particularly useful in scenarios where operators need to monitor and control loads from a control room or even remotely.

The integration of IoT further enhances the capabilities of a smart industrial load switch project. IoT involves connecting physical devices, such as load switches, to the internet, enabling them to communicate and share data. By connecting load switches to the IoT network, real-time data from various sensors and meters can be collected and analyzed.

This data can provide valuable insights into energy consumption patterns, load balancing, and predictive maintenance.

In an IoT-enabled smart industrial load switch project, the software component interacts with cloud-based platforms or edge computing systems. These platforms collect and analyze the data generated by the load switches and provide advanced analytics and decision-making capabilities. Machine learning algorithms can be applied to detect anomalies, predict failures, and optimize energy consumption.

Furthermore, the software component enables integration with higher-level enterprise systems such as SCADA (Supervisory Control and Data Acquisition) or MES (Manufacturing Execution Systems). This integration allows for seamless coordination between the load switch operations and other industrial processes, enabling efficient resource allocation and improved overall productivity.

In conclusion, the software part of a smart industrial load switch project is essential for enabling intelligent control, monitoring, and automation of industrial loads. It encompasses embedded firmware, networking protocols, user interfaces, and integration with IoT and cloud-based platforms. By leveraging these software capabilities, industrial load management becomes more efficient, reliable, and adaptable to changing operational requirements.

Advantages of IOT:

The Internet of Things (IoT) has emerged as a transformative technology with a wide range of applications across various industries. In this article, the advantages of IoT and how it is revolutionizing our lives will be discussed.

1. Connectivity and Interoperability: One of the key advantages of IoT is its ability to connect and interconnect a vast array of devices and systems. By enabling communication and data exchange between physical objects, IoT creates a networked ecosystem where devices can seamlessly interact and collaborate. This connectivity allows for improved efficiency, automation, and coordination in various domains, including smart homes, healthcare, transportation, and manufacturing.

2. Data Collection and Insights: IoT generates an enormous amount of data from sensors, devices, and systems. This data provides valuable insights into patterns, trends, and real-time information about the physical world. With IoT, businesses and organizations can collect and analyze data on a large scale, leading to better decision-making, process optimization, and resource allocation. For example, in agriculture, IoT sensors can monitor soil moisture levels, weather conditions, and crop health, enabling farmers to make data-driven decisions to optimize irrigation and increase yield.

3. Enhanced Efficiency and Automation: IoT enables automation and increased efficiency by streamlining processes, reducing human intervention, and minimizing errors. Connected devices can communicate with each other, exchange data, and trigger actions based on predefined rules or algorithms. This automation leads to improved productivity, reduced operational costs, and enhanced safety. For instance, in manufacturing, IoT-powered sensors can monitor equipment performance, predict failures, and initiate maintenance activities, minimizing downtime and optimizing production.

4. Improved Quality of Life: IoT has the potential to significantly enhance the quality of life for individuals. Smart homes equipped with IoT devices can provide personalized and convenient experiences, such as automated lighting, temperature control, and home security. In healthcare, IoT-enabled devices can monitor patients remotely, enabling timely interventions and reducing the need for hospital visits. IoT-powered wearable devices can track fitness levels, heart rate, and sleep patterns, promoting healthier lifestyles.

5. Safety and Security: IoT technologies offer advancements in safety and security across various domains. Connected surveillance systems, smart locks, and fire alarms enable real-time monitoring and alerts. In industries, IoT can improve workplace safety by detecting hazardous conditions and issuing warnings. Additionally, IoT enables asset tracking, preventing theft, and facilitating recovery in case of loss or damage. However, it is crucial to prioritize security measures to mitigate potential risks and protect against unauthorized access or data breaches.

6. Environmental Impact: IoT can play a significant role in sustainability and environmental conservation efforts. By monitoring and optimizing energy consumption, IoT can help reduce carbon footprints in buildings and cities. Smart grids can efficiently distribute and manage electricity, promoting renewable energy integration. IoT-enabled waste management systems

can optimize collection routes, minimize overflowing bins, and reduce pollution. Overall, IoT's ability to gather and analyze data empowers organizations and individuals to make informed decisions toward a greener future.

7. Enhanced Customer Experience: IoT enables businesses to deliver personalized and tailored experiences to customers. By leveraging data from connected devices, organizations can gain deeper insights into customer behavior, preferences, and needs. This information can be used to provide customized recommendations, improve product offerings, and enhance customer support services. IoT-powered beacons and sensors can also enable location-based services, enhancing customer engagement and satisfaction.

In summary, the advantages of IoT are far-reaching and impactful. From improved efficiency and automation to enhanced safety, sustainability, and customer experiences, IoT has the potential to transform industries, streamline processes, and enrich our lives in numerous ways. As IoT continues to evolve, its potential to drive innovation and create new possibilities remains limitless.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

The results of a smart industrial load-switching project can vary depending on the specific system design and implementation, as well as the energy management practices of the industrial facility. However, some general results and discussions can be provided based on the potential benefits and outcomes of such a project. One potential result of implementing a smart load-switching system is improved energy efficiency. By monitoring and controlling individual loads in real time, the system can optimize energy usage and prevent energy waste. This can result in significant energy savings over time, as well as reduced energy costs for the industrial facility.

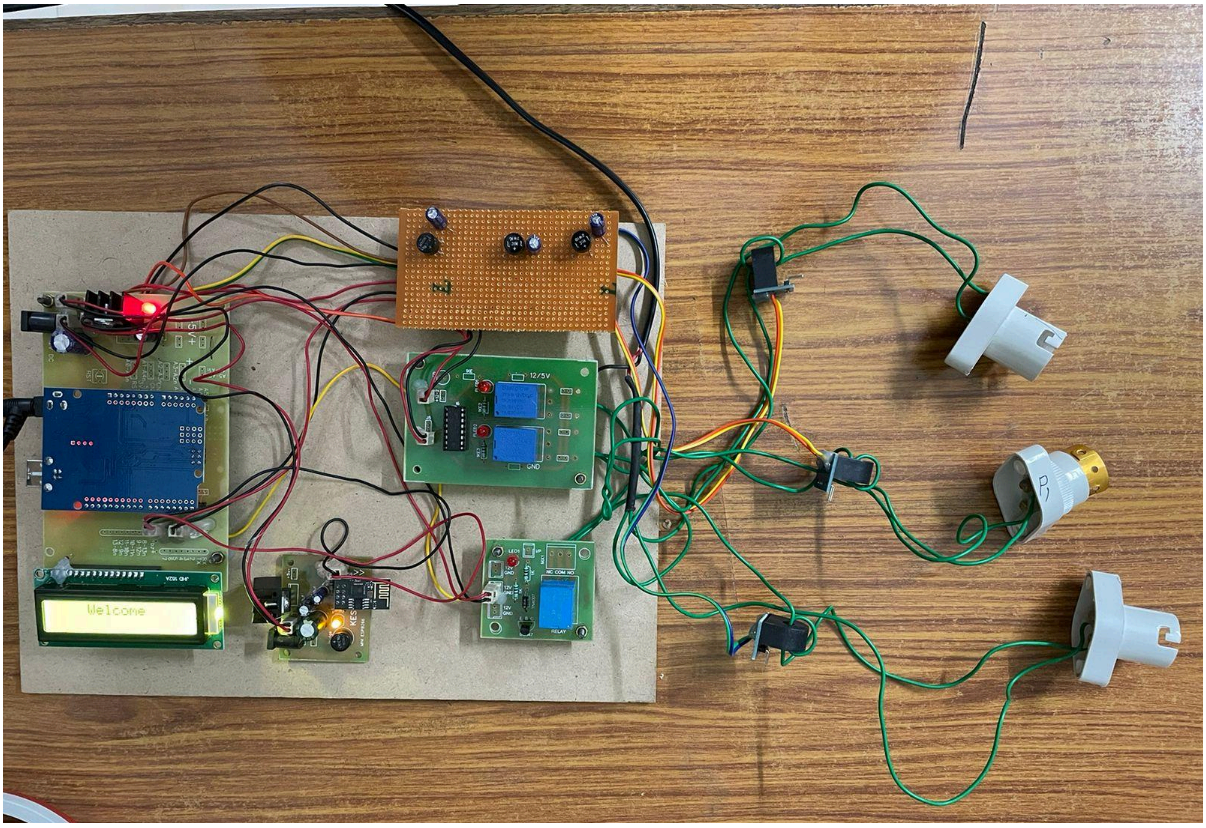

Fig 4.1. Hardware Implementation

The hardware components utilized are depicted in Fig 4.1.It consists of functional relays, current sensors, bulb holders, an Arduino Uno, rectifiers, an LCD, and a Wifi module.

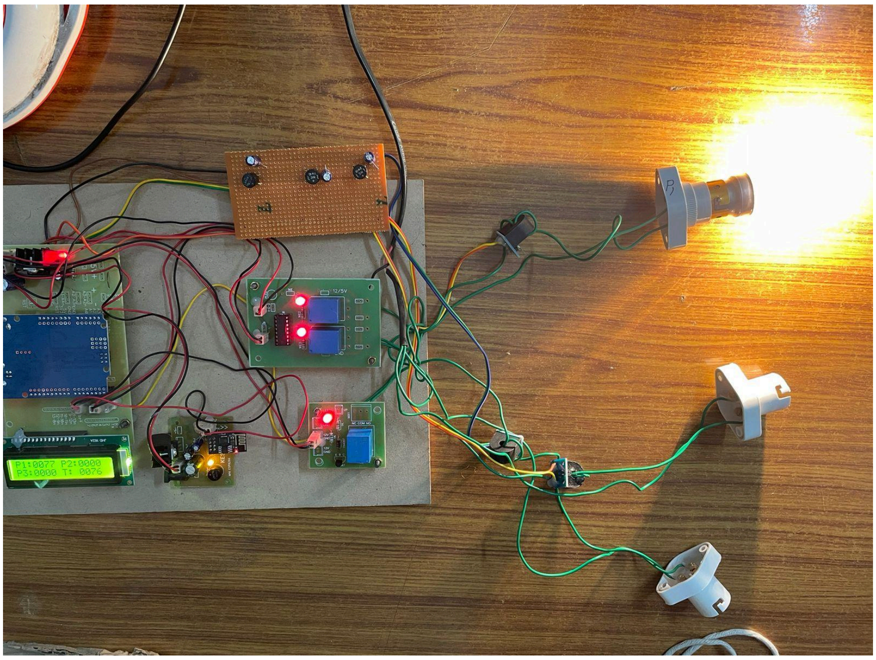

Fig 4.2. First load Placement

When one of the three loads is provided in order to demonstrate that it is in normal condition and not above the threshold which is 180W.When the first bulb is placed of 60W , it draws a Power of 76W with the residual error(60+15 or 60-15). This can be omitted with the use of high-quality bulbs.

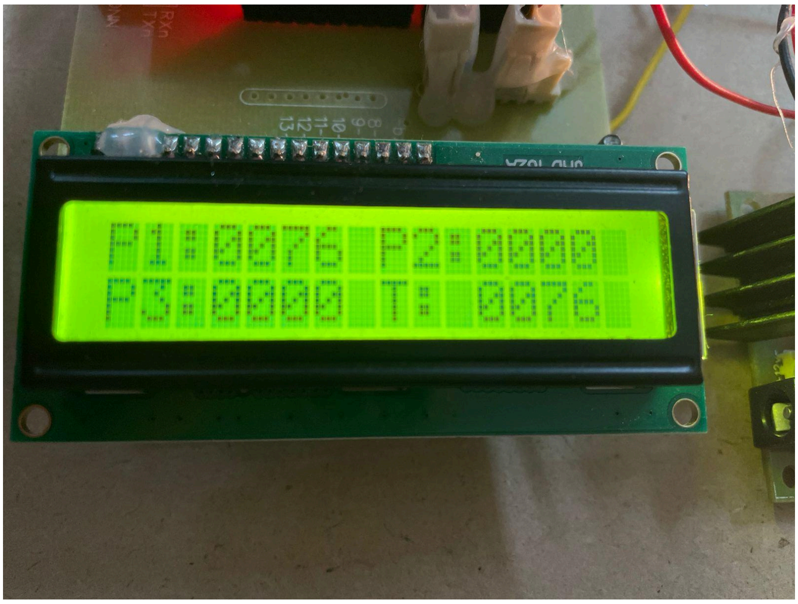

Fig 4.3. Display on LCD for first load

On an LCD, the power levels of the corresponding loads are shown.P1 is the power consumed by the first load and P2 is the power consumed by the second load and P3 is the load consumed by the third load. As there is only one load placed the power drawn by it is 76W and the total is 76W.

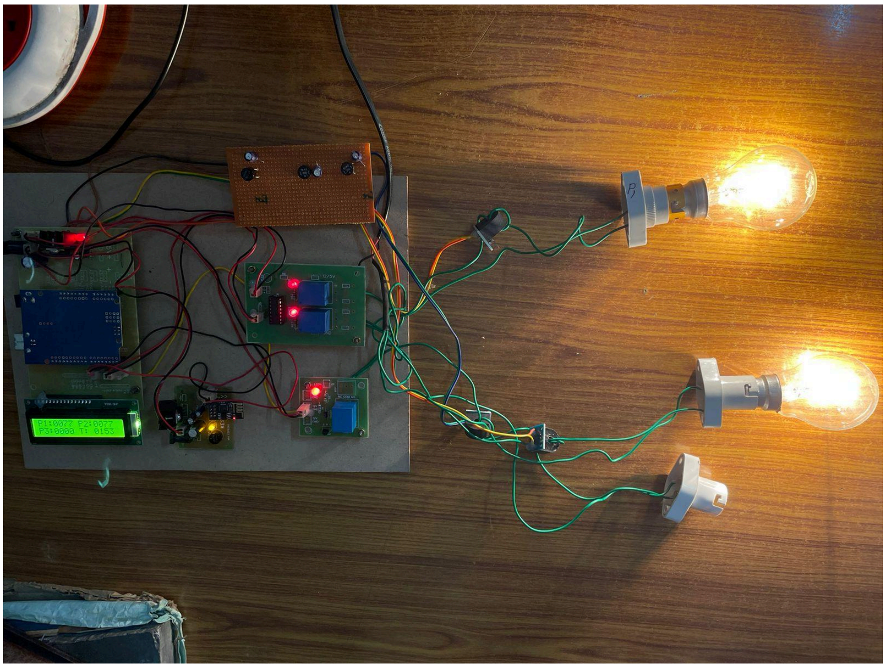

Fig 4.4. Two bulbs of same loads

This is a similar condition where two of the three loads are provided in order to demonstrate that it is in normal condition and not above the threshold.

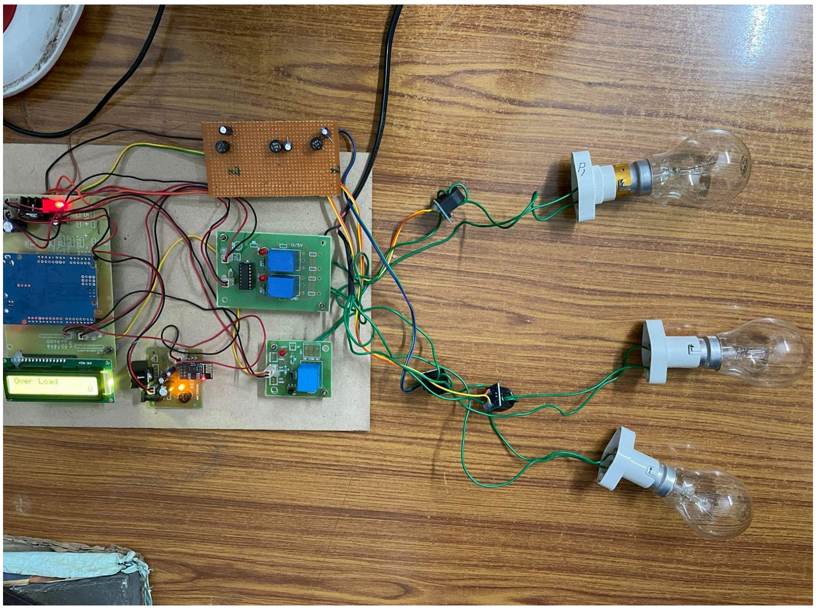

Fig 4.5. Bulbs turned off due to Overload condition

When all three loads are present and the cutoff is crossed, an overload problem is indicated, and all the bulbs are turned off.

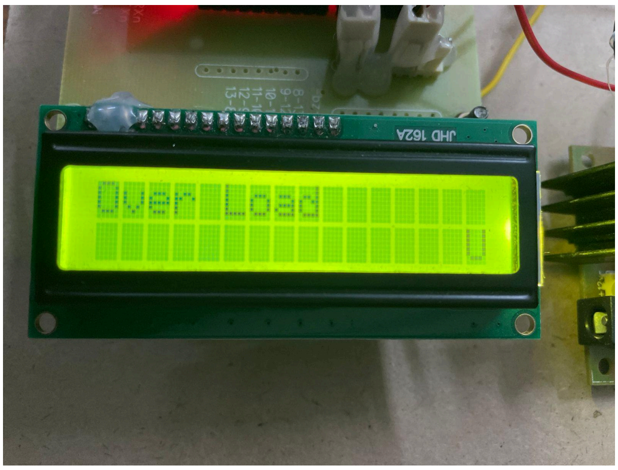

Fig 4.6. Overload indication on LCD

After obtaining the overload state, the message is shown on the LCD.The alphabet U at the bottom right indicates that the data is updated to the server.

Another potential result of a smart load-switching system is increased equipment reliability. By detecting and responding to equipment failures or issues in real time, the system can prevent downtime and minimize the impact on productivity. This can result in increased overall equipment effectiveness (OEE) and improved operational efficiency. Furthermore, a smart load-switching system can provide valuable insights into energy consumption and load management practices. By collecting and analyzing data on energy usage and load characteristics, the system can help identify opportunities for further optimization and improvement. This can lead to more informed decision-making and more effective energy management practices in the industrial facility.

4.2 Discussion

In terms of discussion, it is important to note that the success of a smart load-switching project depends on several factors. These include the quality and compatibility of the smart load-switching devices used, the integration of the system with existing infrastructure, and the energy management practices and protocols of the industrial facility. It is also important to consider the potential challenges and limitations of the system, such as the need for ongoing maintenance and monitoring, the potential for system malfunctions or errors, and the potential for resistance from employees or stakeholders.

Overall, a smart load-switching project has the potential to provide significant benefits to industrial facilities in terms of improved energy efficiency, equipment reliability, and energy management practices. However, careful planning, implementation, and ongoing monitoring and evaluation are necessary to ensure the success and sustainability of such a system.

S.No	Power1	Power2	Power3	Total	Status	Date
1	76	77	0	153	Normal	2023-04-12 12:46:00
2	76	0	0	76	Normal	2023-04-12 12:45:11
3	77	77	51	205	Over_Load	2023-04-12 12:40:42
4	76	77	80	233	Over_Load	2023-04-12 12:28:59
5	76	77	0	153	Normal	2023-04-12 12:28:38
6	76	0	0	76	Normal	2023-04-12 12:27:49
7	77	0	0	77	Normal	2023-04-11 17:47:30

Fig 4.7. Overload Status in the Server

The data that has been updated on the server is shown in the Fig 4.7.There are three columns here with different load powers, and another column is used to calculate the total to verify if it exceeds the threshold.The status column displays the load's current status in order to make our task easier.This will enable us to take the required action. Power1 indicates power of first load; Power2 indicates power of second load; Power3 indicates power of third load.The Total is calculated by summing up all the three Powers.The threshold is given as 180W ; with each bulb of 60W.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

Smart industrial load switching is a technology that is increasingly being adopted by industrial facilities to improve their energy efficiency and reduce their overall energy consumption. This report has explored the design, implementation, and testing of a smart load-switching system for an industrial setting, with a focus on the benefits of this technology and the factors to consider when developing such a system.

The implementation of a smart load-switching system has numerous benefits, such as improved energy efficiency, reduced energy costs, and increased reliability. By monitoring and controlling individual loads in real time, the system can optimize energy usage and prevent equipment overload, leading to significant energy savings over time. Additionally, the ability to detect and respond to equipment failures or other issues can help prevent downtime and minimize the impact on productivity..

The implementation of the smart load-switching system requires careful planning, installation, and integration with existing infrastructure. It may also require adjustments to the facility's energy management practices and protocols, as well as employee training to ensure proper use and maintenance of the system.

In conclusion, the implementation of a smart load-switching system can provide numerous benefits to industrial facilities, including improved energy efficiency, reduced energy costs, and increased reliability. The design and implementation of such a system require careful consideration of factors such as energy consumption and load management practices, device selection and evaluation, and system testing and monitoring. By developing and implementing a smart load-switching system, industrial facilities can not only reduce their environmental footprint but also improve their bottom line and competitiveness in an increasingly energy-conscious market.

5.2 Future scope

The implementation of a smart load-switching system in industrial settings has enormous potential to improve energy efficiency, reduce energy consumption, and enhance operational performance. As technology continues to advance and new innovations emerge, there are several future opportunities and potential benefits for smart load-switching systems in industrial applications.

Cloud-based monitoring and management: The integration of cloud-based systems in smart load switching will provide industries with enhanced monitoring and management capabilities. Cloud-based systems can collect and analyze data from multiple sites, enabling real-time monitoring, alerting, and control of energy usage across different facilities.

Artificial intelligence and machine learning: As machine learning and artificial intelligence (AI) continue to evolve, smart load-switching systems can be designed to learn from historical data and predict future energy usage patterns, helping industries to optimize energy usage and reduce costs. Machine learning algorithms can also be used to detect equipment failures or other issues, alerting facility managers and preventing downtime.

IoT integration: The integration of smart load-switching systems with the Internet of Things (IoT) will provide industries with a more comprehensive view of their energy usage and equipment performance. IoT devices can collect data from multiple sources and enable real-time analysis of energy usage, equipment performance, and other relevant factors. This data can be used to identify areas for improvement and optimize energy usage.

In conclusion, the future of smart load-switching systems in industrial applications is promising, with numerous opportunities for further integration, optimization, and innovation. As industries continue to prioritize energy efficiency and sustainability, smart load-switching systems will play an increasingly important role in managing energy usage and reducing costs. By adopting these systems, industries can not only improve their bottom line but also contribute to a more sustainable and energy-efficient future.

REFERENCES

1. (Journal Paper Example) Boggs, S. A. and Fujimoto, N., “Techniques and instrumentation for measurement of transients in gas insulated switchgear,” *IEEE Transactions on Electrical Installation*, vol. ET-19, no. 2, pp. 87–92, Apr. 1984.
2. (Book Example) Peck, R. B., Hanson, W. E., and Thornburn, T. H*., Foundation Engineering*, 2d ed. New York: McGraw-Hill, 1972, pp. 230–292.
3. (Corporate/Organisation Report Example) Dale, S. J., “Performance of a technical and economic feasibility study of an HVDC compressed gas insulated transmission line,” Westinghouse Electric Corporation, Trafford, PA, Final Report, Dec. 1983.
4. (Conference Article Example) Cookson, A. H., and Pedersen, B. O., “Thermal measurements in a 1200 kV compressed gas insulated transmission line,” *Seventh IEEE Power Engineering Society Transmission and Distribution Conference and Exposition*, Atlanta, GA, pp. 163–167, Apr. 1979.
5. (Patent Example) Cookson, A. H., “Particle Trap for Compressed Gas Insulated Transmission Systems,” U.S. Patent no. 4554399, Nov. 1985. [B3] EPRI EL-2040, Project
6. (Thesis/Dissertation Example) Diessner, A., “Studies on Compressed Gas Insulation.” Master’s thesis, Stanford University, 1969.
7. (Website/Webpage Example) Plagiarism. (n.d.). In *Wikipedia*. Retrieved August 10, 2004, from https://en.wikipedia.org/wiki/Plagiarism
8. (Website Example1) American Psychological Association. (n.d.). Divisions. Retrieved from http://www.apa.org/about/division/

Programme Code

```
int sti=0;
String inputString = "";         // a string to hold incoming data
boolean stringComplete = false;  // whether the string is complete

void lcdbasic()
{
  lcd.begin(16,2);
  lcd.clear();
  lcd.print("P1:");//3,0

  lcd.setCursor(8,0);
  lcd.print("P2:");//11,0

  lcd.setCursor(0,1);
  lcd.print("P3:");//3,1

  lcd.setCursor(8,1);
  lcd.print("T:");//10,1
}
void setup()
{
  char ret;

  pinMode(relay1, OUTPUT);pinMode(relay2, OUTPUT);pinMode(relay3, OUTPUT);
  pinMode(buzzer, OUTPUT);

  digitalWrite(relay1, LOW);digitalWrite(relay2, LOW);digitalWrite(relay3, LOW);
  digitalWrite(buzzer, HIGH);

  Serial.begin(9600);
  mySerial.begin(115200);

  //Smart industrial load switch
  lcd.begin(16,2);
  lcd.clear();
  lcd.setCursor(0, 0);lcd.print("    Welcome   ");
```

```
  lcd.setCursor(0, 0);lcd.print("    Welcome  ");
     delay(2500);


   wifiinit();
  delay(2500);

  lcd.clear();
  lcd.print("P1:");//3,0

  lcd.setCursor(8,0);
  lcd.print("P2:");//11,0

  lcd.setCursor(0,1);
  lcd.print("P3:");//3,1

  lcd.setCursor(8,1);
  lcd.print("T:");//10,1


 digitalWrite(relay1, HIGH);digitalWrite(relay2, HIGH);digitalWrite(relay3, HIGH);
}

char bf3[50];
int g=0,f=0,count=0,lc=0;

int cntlmk=0;

int current1=0;
int current2=0;
int current3=0;

int power1=0;
int power2=0;
int power3=0;
int powert=0;
```

```
int powert=0;

void loop()
{
  current1 = analogRead(A0);
  power1   = (current1/5);
  lcd.setCursor(3,0);convertl(power1);  delay(500);

  current2 = analogRead(A1);
  power2   = (current2/5);
  lcd.setCursor(11,0);convertl(power2);  delay(500);

  current3 = analogRead(A2);
  power3   = (current3/5);
  lcd.setCursor(3,1);convertl(power3);  delay(500);

  powert = (power1 + power2 + power3);
  lcd.setCursor(11,1);convertl(powert);  delay(500);

  if(powert > 180)
    {delay(1000);
      lcd.clear();lcd.print("Over Load");

     digitalWrite(relay1, LOW);digitalWrite(relay2, LOW);digitalWrite(relay3, LOW);

      upload(power1,power2,power3,powert,"Over_Load");
      while(1);
      lcdbasic();
    }
     cntlmk++;
  if(cntlmk > 15)
    {cntlmk=0;
            upload(power1,power2,power3,powert,"Normal");
      lcdbasic();
    }
}
```

```
char bf2[50];
void upload(int s1,int s2,int s3,int s4,const char *s5)
{
  delay(2000);
  lcd.setCursor(15, 1);lcd.print("U");
  myserialFlush();
  mySerial.println("AT+CIPSTART=4,\"TCP\",\"projectsfactoryserver.in\",80");

  //http://projectsfactoryserver.in/storedata.php?name=pf5&s1=25&s2=35
  //sprintf(buff,"GET http://embeddedspot.top/iot/storedata.php?name=iot139&s1=%u&s2=%u&s3=%u\r\n\r\n",s1,s2);

      delay(8000);
  //https://projectsfactoryserver.in/storedata.php?name=iotgps&lat=17.167898&lan=79.785643
      memset(buff,0,strlen(buff));
      sprintf(buff,"GET http://projectsfactoryserver.in/storedata.php?name=iot231&s1=%u&s2=%u&s3=%u&s4=%u&s5=%s\r\n\r\n",s1,s2,s3,s4,s5);

//      memset(buff,0,strlen(buff));
  //     sprintf(buff,"GET http://projectsfactoryserver.in/storedata.php?name=iot4&s1=%s\r\n\r\n",s1);

      myserialFlush();
      sprintf(bf2,"AT+CIPSEND=4,%u",strlen(buff));
      mySerial.println(bf2);

         delay(5000);


          myserialFlush();
          mySerial.print(buff);

              delay(2000);

              mySerial.println("AT+CIPCLOSE");
       lcd.setCursor(15, 1);lcd.print(" ");
}

char readserver(void)
```

```
char readserver(void)
{
  char t;
  delay(2000);
  lcd.setCursor(15, 1);lcd.print("R");
  myserialFlush();
  mySerial.println("AT+CIPSTART=4,\"TCP\",\"projectsfactoryserver.in\",80");

  //http://projectsfactoryserver.in/last.php?name=amvi001L

      delay(8000);
      memset(buff,0,strlen(buff));
      sprintf(buff,"GET http://projectsfactoryserver.in/last.php?name=iot4L\r\n\r\n");
      myserialFlush();
      sprintf(bf2,"AT+CIPSEND=4,%u",strlen(buff));
      mySerial.println(bf2);

         delay(5000);


          myserialFlush();
          mySerial.print(buff);

        //read status
         while(1)
         {
            while(!mySerial.available());
             t = mySerial.read();
            // Serial.print(t);
             if(t == '*' || t == '#')
             {
               if(t == '#')return 0;
               while(!mySerial.available());
                t = mySerial.read();
              //  Serial.print(t);
                delay(1000);
```

```
              delay(1000);
               myserialFlush();
              return t;
           }
        }
             delay(2000);

       mySerial.println("AT+CIPCLOSE");
       lcd.setCursor(15, 1);lcd.print(" ");
       delay(2000);
return t;
}

void clearserver(void)
{
  delay(2000);
  lcd.setCursor(15, 1);lcd.print("C");
  myserialFlush();
  mySerial.println("AT+CIPSTART=4,\"TCP\",\"projectsfactoryserver.in\",80");

  //sprintf(buff,"GET http://projectsfactoryserver.in/storedata.php?name=iot1&s10=0\r\n\r\n");
      delay(8000);
      memset(buff,0,strlen(buff));
      sprintf(buff,"GET http://projectsfactoryserver.in/storedata.php?name=iot4&s10=0\r\n\r\n");
      myserialFlush();
      sprintf(bf2,"AT+CIPSEND=4,%u",strlen(buff));
      mySerial.println(bf2);

         delay(5000);


          myserialFlush();
          mySerial.print(buff);

          delay(2000);
          myserialFlush();
```

```
        mySerial.println("AT+CIPCLOSE");
        lcd.setCursor(15, 1);lcd.print(" ");
        delay(2000);
}


void wifiinit()
{
 char ret;
  st:
  mySerial.println("ATE0");
  ret  = check((char*)"OK",50);
  mySerial.println("AT");
  ret  = check((char*)"OK",50);
  if(ret != 0)
  {
    delay(1000);
   goto st;
  }

     lcd.clear();lcd.setCursor(0, 0);lcd.print("CONNECTING");
  mySerial.println("AT+CWMODE=1");
   ret  = check((char*)"OK",50);
 cagain:

  myserialFlush();
  mySerial.print("AT+CWJAP=\"");
  mySerial.print(ssid);
  mySerial.print("\",\"");
  mySerial.print(password);
  mySerial.println("\"");
  if(check((char*)"OK",300))goto cagain;
  mySerial.println("AT+CIPMUX=1");
  delay(1000);
```

```
  lcd.clear();lcd.setCursor(0, 0);lcd.print("WIFI READY");
}


/*
void wifiinit()
{
  mySerial.write("AT\r\n");              delay(3000);lcd.clear();lcd.print("WIFI-1");
  mySerial.write("ATE0\r\n");            delay(3000);lcd.clear();lcd.print("WIFI-2");
  mySerial.write("AT+CWMODE=3\r\n");     delay(3000);lcd.clear();lcd.print("WIFI-3");
  mySerial.write("AT+CWJAP=\"iotserver\",\"iotserver123\"\r\n"); delay(5000);lcd.clear();lcd.print("WIFI-4");
  mySerial.write("AT+CIPMUX=1\r\n");delay(3000);     lcd.clear();lcd.print("WIFI-5");delay(2000);
  lcd.clear();
  lcd.print("WIFI Connected");
  delay(1000);
}
*/
void convertl(unsigned int value)
{
  unsigned int a,b,c,d,e,f,g,h;

      a=value/10000;
      b=value%10000;
      c=b/1000;
      d=b%1000;
      e=d/100;
      f=d%100;
      g=f/10;
      h=f%10;


      a=a|0x30;
      c=c|0x30;
      e=e|0x30;
      g=g|0x30;
      h=h|0x30;
```

```
      c=c|0x30;
      e=e|0x30;
      g=g|0x30;
      h=h|0x30;
    // lcd.write(a);
   lcd.write(c);
   lcd.write(e);
   lcd.write(g);
   lcd.write(h);
}
void convertk(unsigned int value)
{
  unsigned int a,b,c,d,e,f,g,h;
      a=value/10000;
      b=value%10000;
      c=b/1000;
      d=b%1000;
      e=d/100;
      f=d%100;
      g=f/10;
      h=f%10;
      a=a|0x30;
      c=c|0x30;
      e=e|0x30;
      g=g|0x30;
      h=h|0x30;


  // lcd.write(a);
  // lcd.write(c);
  // lcd.write(e);
   lcd.write(g);
   lcd.write(h);
}
```

Switching1

by Smart Load

Submission date: 10-May-2023 12:09PM (UTC+0530)
Submission ID: 2089278411
File name: SMART_INDUSTRIAL_LOAD_SWITCHING_1.docx (4.77M)
Word count: 6644
Character count: 38627

Switching1

ORIGINALITY REPORT

15%	13%	4%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.coursehero.com Internet Source	5%
2	www.vnrvjiet.ac.in Internet Source	2%
3	www.researchgate.net Internet Source	1%
4	vnrvjiet.irins.org Internet Source	1%
5	"00/02647 Thermal and electrochemical studies of carbons for Li-ion batteries. 2. Correlation of active sites and irreversible capacity loss", Fuel and Energy Abstracts, 200009 Publication	1%
6	www.ijraset.com Internet Source	<1%
7	electronicsprojects.in Internet Source	<1%
8	www.ijnrd.org Internet Source	

		<1%
9	www.indiamart.com Internet Source	<1%
10	www.irjmets.com Internet Source	<1%
11	Krishnaveni A, Harsha H M, J Vishnu Reddy, K Praveen, Adarsh Reddy Mulumudi. "IoT and AI based Forest Fire Prediction and Animal Monitoring System", 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS), 2023 Publication	<1%
12	www.dgp.toronto.edu Internet Source	<1%
13	www.ukessays.com Internet Source	<1%
14	www.trademarkelite.com Internet Source	<1%
15	J.F. WHITFIELD. "EXTRA-LOW-VOLTAGE SYSTEMS", Elsevier BV, 1966 Publication	<1%
16	N Bhuvan Abhishakth, N Deep Kamal, G Muthu Arasan, P Baraneedharan. "Effective Reduction of Power Consumption with Thermo Electric Module (TEM) and Wireless	<1%

PROJECT DEMONSTRATION AT SHOW AND TELL

GUIDE: Mrs. S.Vandana

TEAM:

ANEESHA DACHA	19071A1010
J. SAI TARUN	19071A1021
N. GAURAV SRINIVAS	19071A1031