SMART POWER AUTOMATION

A MINI-PROJECT REPORT

Submitted by

KAAROKKI R 210701101

KEERTHIKA V 210701121

LAKSHME KAARTHIKAA S 210701129

in partial fulfillment of the award of the degree

of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI

RAJALAKSHMI ENGINEERING COLLEGE,

CHENNAI An Autonomous Institute

CHENNAI

APRIL 2024

BONAFIDE CERTIFICATE

Certified that this project **"SMART POWER AUTOMATION** " is the bonafide work of "**KAAROKKI R (210701101), LAKSHME KAARTHIKAA S(210701129) AND KEERTHIKA V (210701121)"** who carried out the project work under my supervision.

SIGNATURE
Dr. P. Kumar,
HEAD OF THE DEPARTMENT,

Professor and Head,
Computer Science & Engineering
Rajalakshmi Engineering College(Autonomous)
Thandalam, Chennai -602105.

SIGNATURE
Dr.N. Duraimurugan, M,E., Ph.D.

Academic Head, Associate Professor,
Computer Science & Engineering
Rajalakshmi Engineering College (Autonomous)
Thandalam, Chennai -602105.

Submitted for the **ANNA UNIVERSITY** practical examination Mini-Project work viva voce held on _____

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

We express our sincere thanks to our beloved and honorable chairman **MR. S. MEGANATHAN** and the chairperson **DR. M. THANGAM MEGANATHAN** for their timely support and encouragement.

We are greatly indebted to our respected and honorable principal **Dr. S.N. MURUGESAN** for his able support and guidance.

No words of gratitude will suffice for the unquestioning support extended to us by our head of the department **Dr. P. Kumar** for being an ever supporting force during our project work.

We also extend our sincere and hearty thanks to our internal guide **Dr.N.Duraimurugan,M.E., Ph.D** for his valuable guidance and motivation during the completion of this project. Our sincere thanks to our family members, friends and other staff members of information technology.

TABLE OF CONTENTS

CHAPTER NO. **PAGE**

TITLE

LIST OF FIGURES

LIST OF ABBREVIATION

ABBREVIATION	ACRONYM
PIR - Sensor	Passive infrared Sensor
DC	Direct current motor
CPU	Central processing unit

ABSTRACT

This paper proposes an Internet of Things (IoT) based solution for power management in rooms, aiming to minimize energy wastage when spaces are unoccupied. The system employs a network of sensors to detect human presence within a room. Upon detecting no occupants, it triggers an automatic shutdown of non-essential electrical devices and lighting to conserve energyThe implementation involves using sensors such as passive infrared (PIR) sensors or ultrasonic sensors to detect the presence of a person within the room. When a person enters the room, the sensor detects the motion or presence and triggers a microcontroller-based control unit. This control unit is programmed to actuate a relay or switch mechanism that disconnects the power supply to the room's electrical outlets.Conversely, when the room is empty, and no motion or presence is detected for a specified period, the control system reverts to its default state, restoring power to the outlets. This automated functionality eliminates the need for manual intervention to switch off lights or appliances when leaving a room, promoting energy conservation and reducing electricity costs.The project integrates hardware components such as sensors, a microcontroller (e.g., Arduino or Raspberry Pi), and a relay circuit. Software programming is implemented to manage sensor inputs, decision-making logic, and relay control. Additionally, the system can incorporate supplementary features like status indicators or override controls for user flexibility.The Automatic Power Supply Control System offers a practical and efficient solution for optimizing energy usage in indoor environments. By seamlessly integrating presence detection with power management, the system contributes to sustainability efforts and offers a user-friendly approach to energy conservation in residential, commercial, and industrial settings. This abstract encapsulates the objectives, methodology, and benefits of the project, highlighting its potential impact on energy efficiency and convenience.

.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The “SMART POWER AUTOMATION” proposes the development of an Automatic Power Supply Control System based on presence detection. This system offers a practical solution to automatically manage the power supply in rooms by detecting the presence or absence of individuals. When a person enters a room, the system activates, ensuring that power is available for use. Conversely, when the room becomes unoccupied, the system intelligently turns off the power supply to conserve energy.

1.2 SCOPE OF THE WORK

The “SMART POWER AUTOMATION” has tremendous scope especially in houses which helps to conserve the energy highly.The scope of the Automatic Power Supply Control System project encompasses the design, development, and implementation of a functional system that automatically controls the power supply to a room based on detected human presence.

1.3 PROBLEM STATEMENT

The “SMART POWER AUTOMATION” project addresses the problem of energy wastage due to inefficient power management in indoor environments. One common issue is the unnecessary consumption of electricity when rooms are unoccupied, leading to increased utility costs and environmental impact. Manual methods of switching off lights and devices upon exiting a room are prone to oversight and inconvenience.

1.4 AIM AND OBJECTIVES OF THE PROJECT

The aim of “SMART POWER AUTOMATION” is to develop an Automatic Power Supply Control System that intelligently manages electricity usage in indoor environments by automatically controlling the power supply based on detected human presence. This system will contribute to energy conservation efforts by ensuring that power is only supplied to rooms or areas when they are occupied, thereby reducing unnecessary electricity consumption and promoting sustainability.The project aims to demonstrate a practical and effective solution for reducing energy waste in indoor settings while enhancing user convenience. The smart power automation system will showcase the application of IoT technology in promoting sustainable energy practices and contribute towards creating more efficient and environmentally-friendly power management systems.

CHAPTER 2

LITERATURE SURVEY

This paper [1] provides a comprehensive overview of communication technologies and standards used in smart grids. It covers topics such as SCADA systems, PLCs, RTUs, and communication protocols like DNP3 and IEC 61850. It explores the interoperability challenges among different communication protocols and standards in smart grid deployments.It examines the role of advanced communication techniques in enabling real-time monitoring, control, and automation in power systems.

This research [2] discusses various IoT applications in power systems, including energy monitoring, demand-side management, predictive maintenance, and fault detection. It also highlights challenges and future research directions in this area. It Highlights the potential of IoT analytics for improving operational efficiency and customer engagement in electricity utilities.It considers the integration challenges of diverse IoT devices and platforms within existing power infrastructure

This project paper [3] provides a comprehensive review of AI techniques such as machine learning, deep learning, and optimization algorithms applied to smart grids. It covers applications like load forecasting, energy management, and grid optimization.It examines the computational complexities and scalability issues associated with implementing AI algorithms in real-time grid operations.It discusses the potential synergy between AI techniques and traditional power system optimization methods.

This research [4] discusses cybersecurity challenges in smart grids and presents solutions such as intrusion detection systems, encryption techniques, and blockchain-based security mechanisms. It also addresses privacy and data integrity issues.It considers the impact of insider threats and human errors on smart grid security, emphasizing the need for robust access control mechanisms.It discusses the emerging trends in anomaly detection and threat intelligence for proactive cybersecurity defense in power systems.

This study [5] discusses the challenges and opportunities in implementing smart power grids, including integration of renewable energy, demand response strategies, grid stability, and regulatory considerations. It also highlights emerging trends and future prospects in this field.It explores the potential benefits of transactive energy systems and peer-to-peer energy trading platforms in future smart power grids.It considers the role of data analytics and visualization tools in empowering consumers to make informed energy choices and optimize their electricity usage.

CHAPTER 3

SYSTEM SPECIFICATIONS

3.1 HARDWARE SPECIFICATIONS FOR APPLICATION

Processor	**:** Pentium IV Or Higher
Memory Size	**:** 256 GB (Minimum)
HDD	**:** 40 GB (Minimum)

3.2 SOFTWARE SPECIFICATIONS

Application	**:** ARDUINO IDE

3.3 HARDWARE COMPONENTS FOR PROTOTYPE

Sensor	**:** PIR-Sensor
Board	**:** Microcontroller
H Bridge motor	:Motor

CHAPTER 4

MODULES DESCRIPTION

Microcontroller

This is a microcontroller setup for the smart power automation system which acts as the CPU of the whole system. This takes inputs from the Sensors and triggers the actuators.

PIR - Sensor

These sensors or ultrasonic sensors detect the presence of a person within the room. When a person enters the room, the sensor detects the motion or presence and triggers a microcontroller-based control unit

H-Bridge motor DC Motor

The H-bridge circuit allows the motor to be driven in both forward and reverse directions by controlling the current flow through it. By toggling the switches in specific combinations, you can change the polarity across the motor terminals, thus changing its rotation direction.A DC (direct current) motor is an electrical machine that converts electrical energy into mechanical energy through the interaction of magnetic fields. It operates based on the principle of electromagnetic induction, where a current-carrying conductor in a magnetic field experiences a force.

CHAPTER 5

SYSTEM DESIGN

5.1 FLOW CHART

A flowchart is a type of diagram that represents an algorithm, workflow or process. The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem.

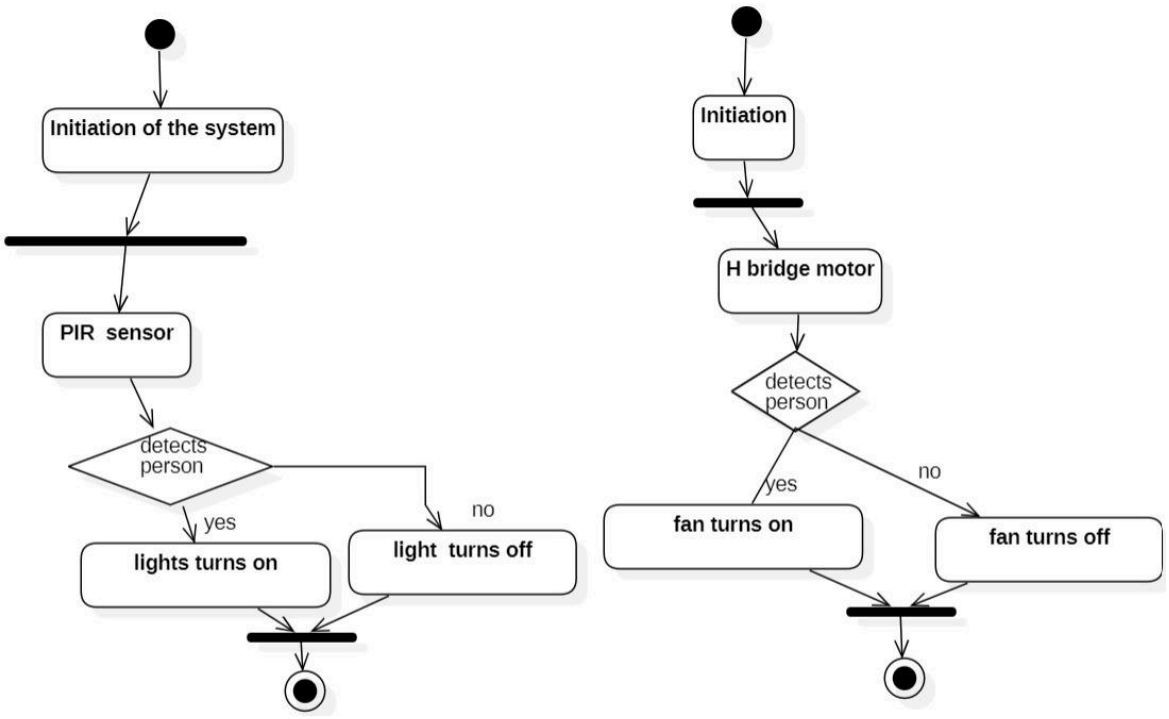

Figure 5.1 Flow Chart

5.2 CIRCUIT DIAGRAM

The circuit diagram explains the connections made with the hardware components and the board. The microcontroller is connected with the DC power supply and the VCC and GND are connected. The Sensors, LED and fan are given connection with the DC power supply and the pins are connected as per the requirements.

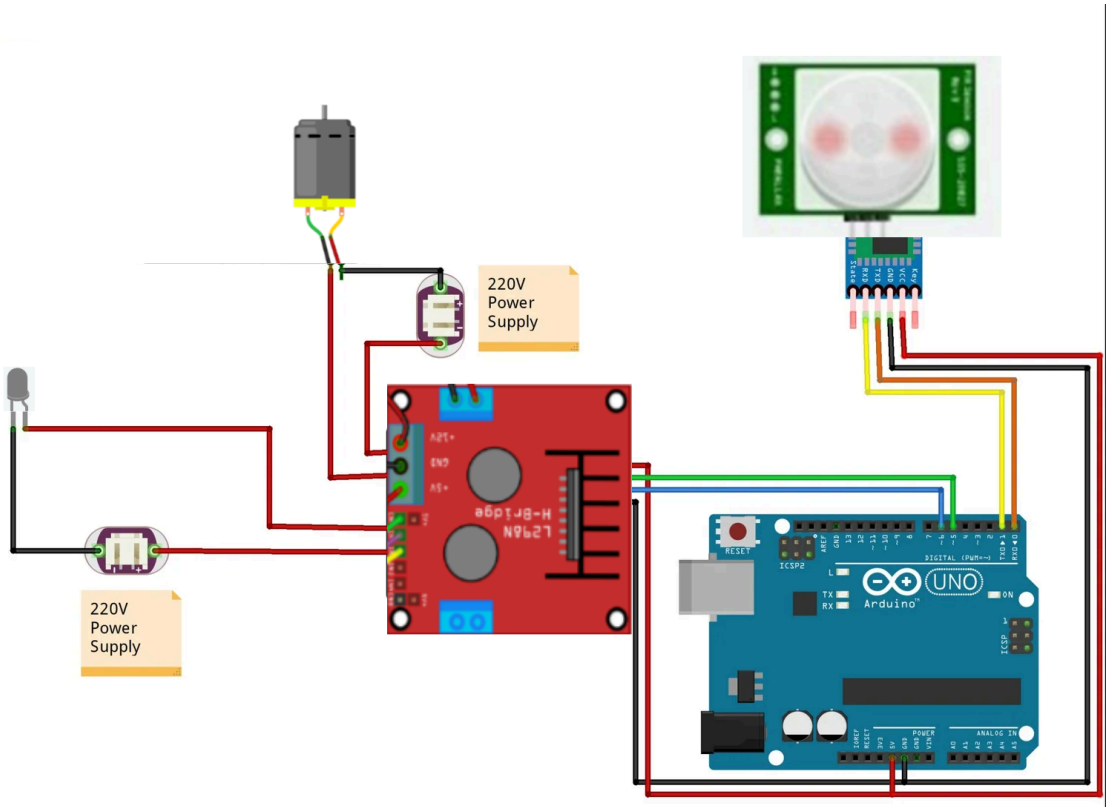

Figure 5.2 Circuit diagram

From the above figure 5.2, the connections are made

CHAPTER 6

CODING

1. Setup

```
void setup() {

  Serial.begin(9600);
  pinMode(2,OUTPUT);
  pinMode(3,OUTPUT);
  pinMode(4,OUTPUT);
  pinMode(5,OUTPUT);
  digitalWrite(5,HIGH);
}
```

2. Loop

```
void loop() {
  Serial.println(analogRead(A0));
  if(analogRead(A0)>400)
  {
    analogWrite(3,60);
    digitalWrite(5,LOW);
    delay(2000);
    analogWrite(3,0);
    digitalWrite(5,HIGH);
    delay(2000);
}
```

CHAPTER 7

SCREEN SHOTS

1. CONNECTION

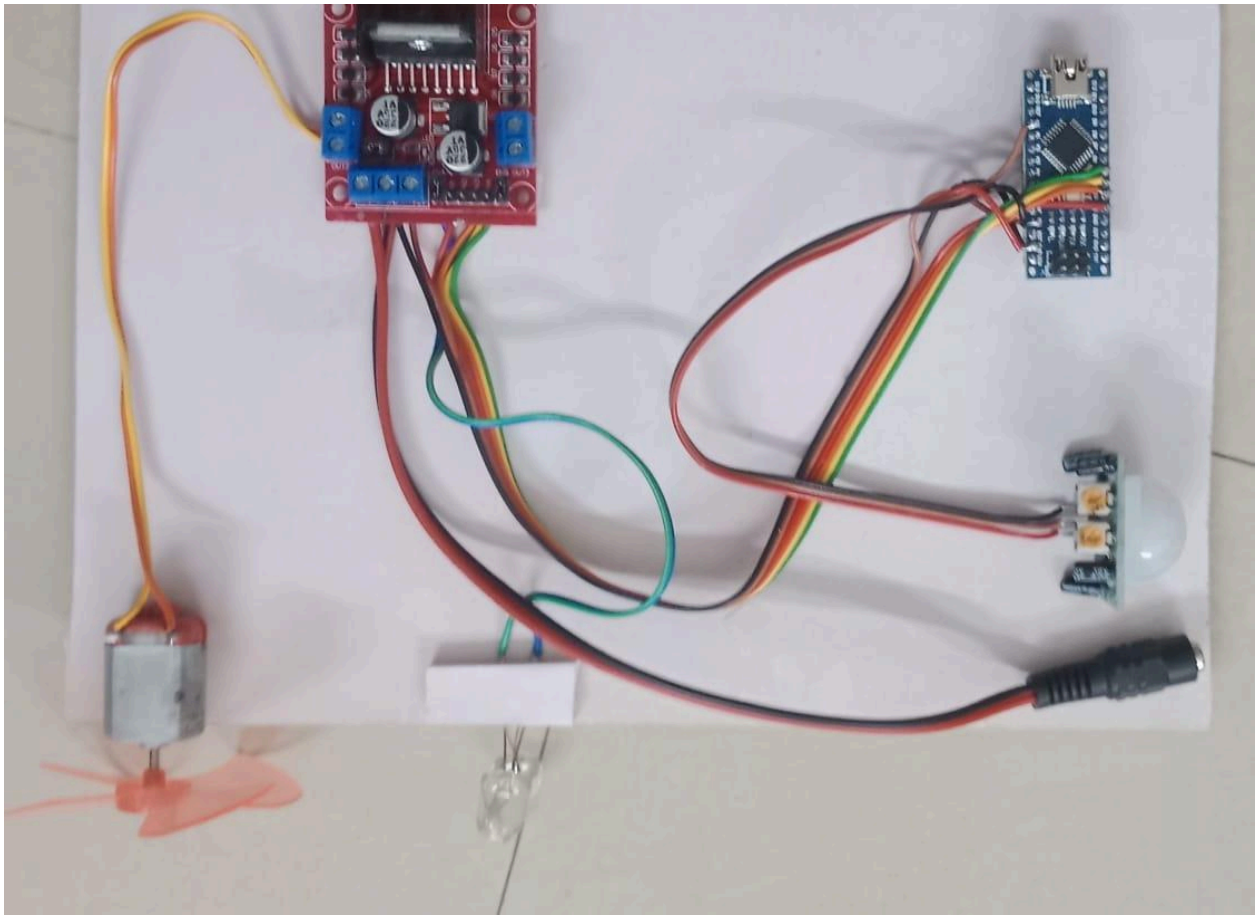

Figure 7.1 Connection Setup

In the above setup, when the PIR sensor detects the motion or presence and triggers a microcontroller-based control unit.The DC motor receives the electrical energy and converts it into mechanical energy. Connections are made to the light and fan. When the power supply is provided to the given set up, if the sensor detects the presence, then the light and fan gets on and runs on a delay of 2s.

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

In conclusion,the development of smart power automation has successfully demonstrated the feasibility and effectiveness of using IoT technologies to optimize energy usage in indoor environments. By automatically managing power supply based on human presence detection, the system significantly reduces energy waste and contributes towards sustainability efforts. Throughout the project, key objectives including sensor integration, control unit development, and power management optimization were achieved, resulting in a functional prototype that showcases the potential benefits of automated power control systems.Looking ahead, several enhancements can be implemented to further enhance the capabilities and usability of the Automatic Power Supply Control System. Future developments could focus on integrating machine learning algorithms to predict occupancy patterns and optimize power management strategies accordingly. Additionally, expanding the system's compatibility with smart home platforms and mobile applications would improve user accessibility and control. Incorporating energy monitoring and analytics features would empower users with insights to make informed decisions about their energy consumption. Moreover, exploring alternative energy sources such as solar or wind power integration could further enhance the system's sustainability and reduce environmental impact. These future enhancements aim to transform the Automatic Power Supply Control System into a comprehensive and adaptable solution for efficient energy management in various indoor settings.

REFERENCES

[1] Saleh, M., Yuen, C., et al. (2013). Smart Grid Technologies: Communication Technologies and Standards. *IEEE Transactions on Smart Grid*, 4(2), 747-756.

[2] Hussain, Z. A., Alwadi, K. A., et al. (2019). Internet of Things (IoT) Applications in Power Systems: A Review. *IEEE Access*, 7, 162574-162593.

[3] Yazdi, H. S., Kermani, R. G., et al. (2019). Artificial Intelligence Techniques for Smart Grids: A Comprehensive Review. *Sustainable Cities and Society*, 51, 101724.

[4] Chen, X., Jiang, Y., et al. (2020). Cybersecurity in Smart Grids: A Review of Challenges and Solutions. *IEEE Access*, 8, 101929-101951.

[5] Singh, R. R., Bansal, R. C., et al. (2021). Smart Power Grids: Challenges and Opportunities. *Renewable and Sustainable Energy Reviews*, 137, 110603.