



National University of Science and Technology (NUST)
School of Electrical Engineering and Computer Science(SEECS)

Microprocessor Systems

Project Report of Power Hive
(An IOT Based Home Automation System with Energy Meter)

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Project Report:

POWER HIVE (IoT-Based Home Automation System)

1. Introduction

The IoT-Based Home Automation System project aims to revolutionize household management by integrating Internet of Things (IoT) technologies. This system enables remote control and automation of various household devices, enhancing convenience, energy efficiency, and overall user experience. Additionally, the project incorporates an IoT-based energy meter to provide users with real-time insights into their electricity consumption patterns, empowering them to make informed decisions about energy usage and optimize efficiency.

2. Problem Statement

Conventional home management systems often lack the flexibility and intelligence needed to meet the demands of modern living. Users face challenges in remotely controlling and automating their household devices, leading to inefficiencies in energy consumption and inconvenience in daily routines. The absence of a comprehensive IoT-based solution exacerbates these challenges, highlighting the need for a more advanced and adaptable approach to home automation, which also includes energy monitoring.

3. Objectives

The objectives of the IoT-Based Home Automation System project are as follows:

- Enable remote monitoring and control of household devices via the Internet.
- Implement automation features to optimize energy usage and enhance convenience for users.
- Develop a user-friendly interface that allows seamless interaction with the system.
- Integrate various sensors and actuators, including an IoT-based energy meter, to facilitate intelligent decision-making and adaptive behavior.

4. Methodology

Incorporating an IoT-based energy meter into the system adds an essential layer of functionality, providing users with real-time insights into their electricity consumption patterns. The energy meter is typically a smart device equipped with sensors and communication capabilities, enabling it to measure electricity usage accurately and transmit the data to the central hub or cloud-based platform for analysis and visualization.

The energy meter integrates seamlessly into the existing infrastructure of the IoT-based home automation system, utilizing the same communication protocols and interfaces. It is typically installed at the main electrical panel or at specific points of interest within the home, allowing for comprehensive monitoring of energy usage across various circuits and appliances.

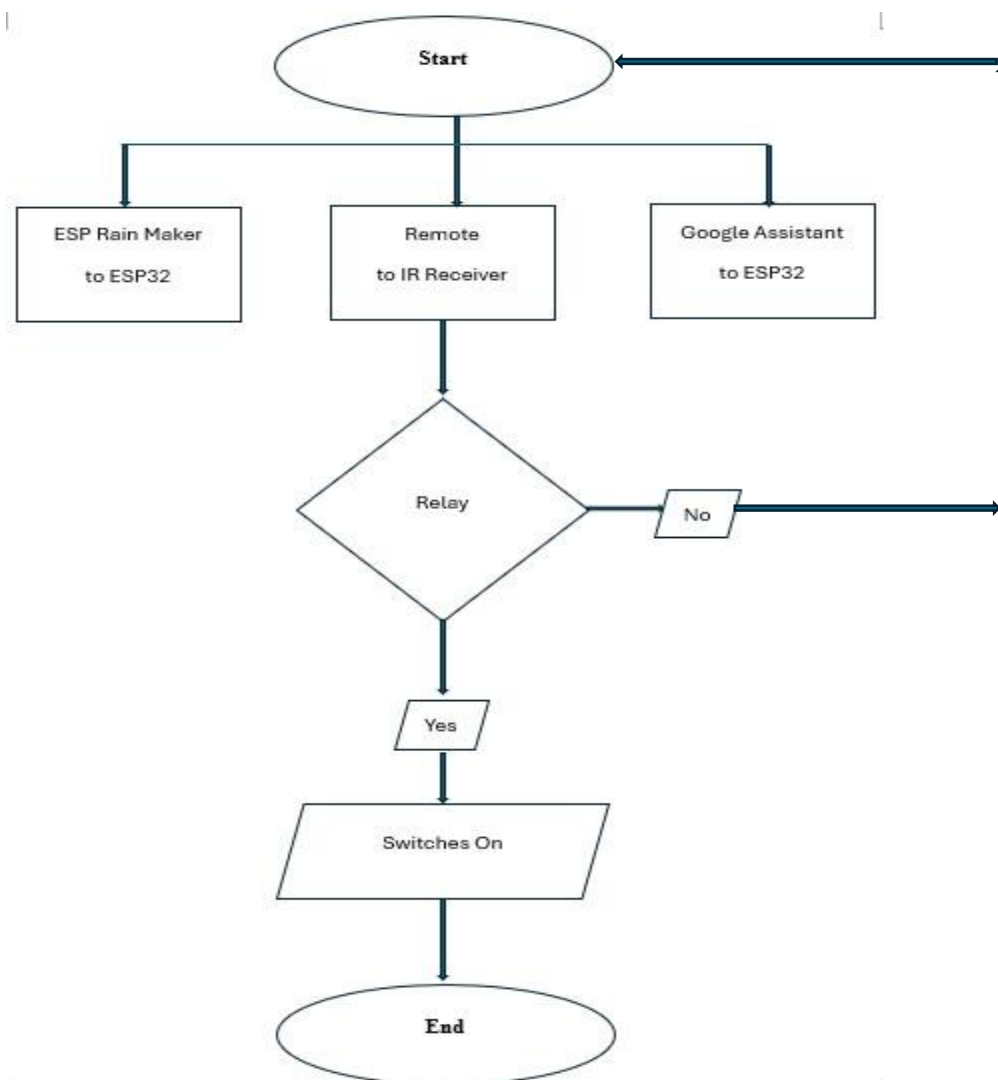
Through the integration of the energy meter, users gain access to valuable information such as real time energy consumption, historical usage data, and trends over time. This empowers them to make informed

decisions about their energy usage habits, identify potential areas for optimization, and ultimately reduce energy costs.

Furthermore, the energy meter can be integrated with the automation features of the system, enabling automated responses based on energy usage thresholds or user-defined preferences. For example, the system can automatically adjust thermostat settings or turn off non-essential devices when energy consumption exceeds a certain limit, helping to optimize energy usage without sacrificing comfort or convenience.

Overall, the IoT-based energy meter enhances the functionality and value of the home automation system by providing users with actionable insights into their energy consumption and enabling intelligent automation strategies to improve energy efficiency.

5. Flow Chart



6. Simulation

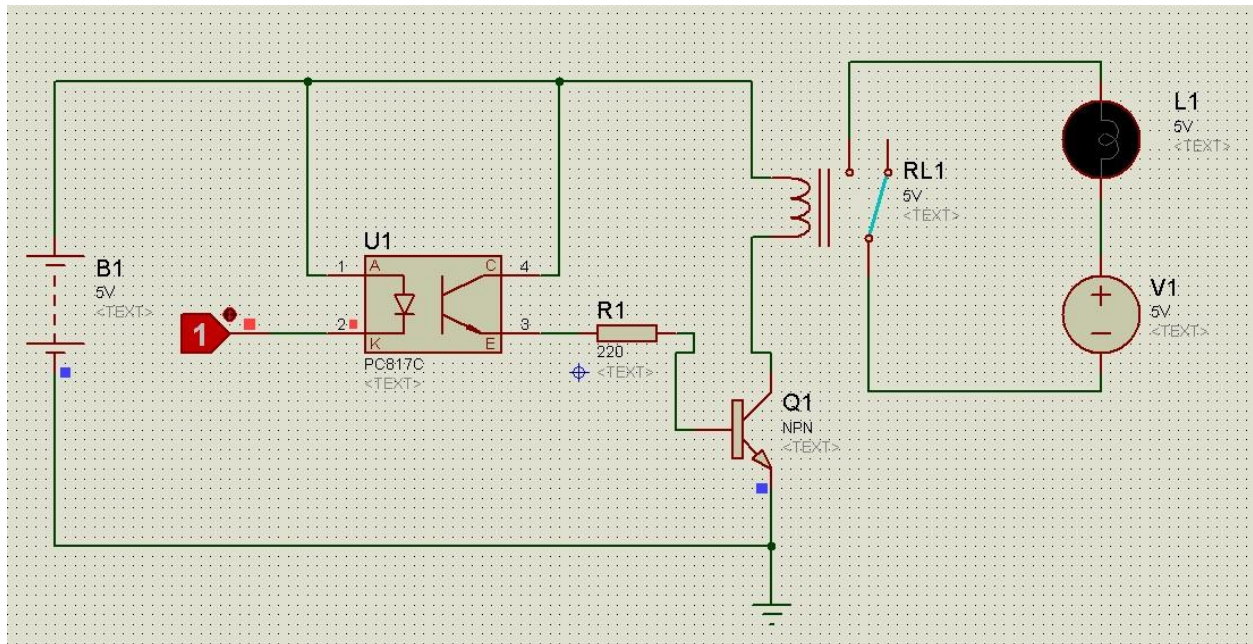


Figure 1: Relay Circuit Using BJT and Transistor

7. AutoCAD Module

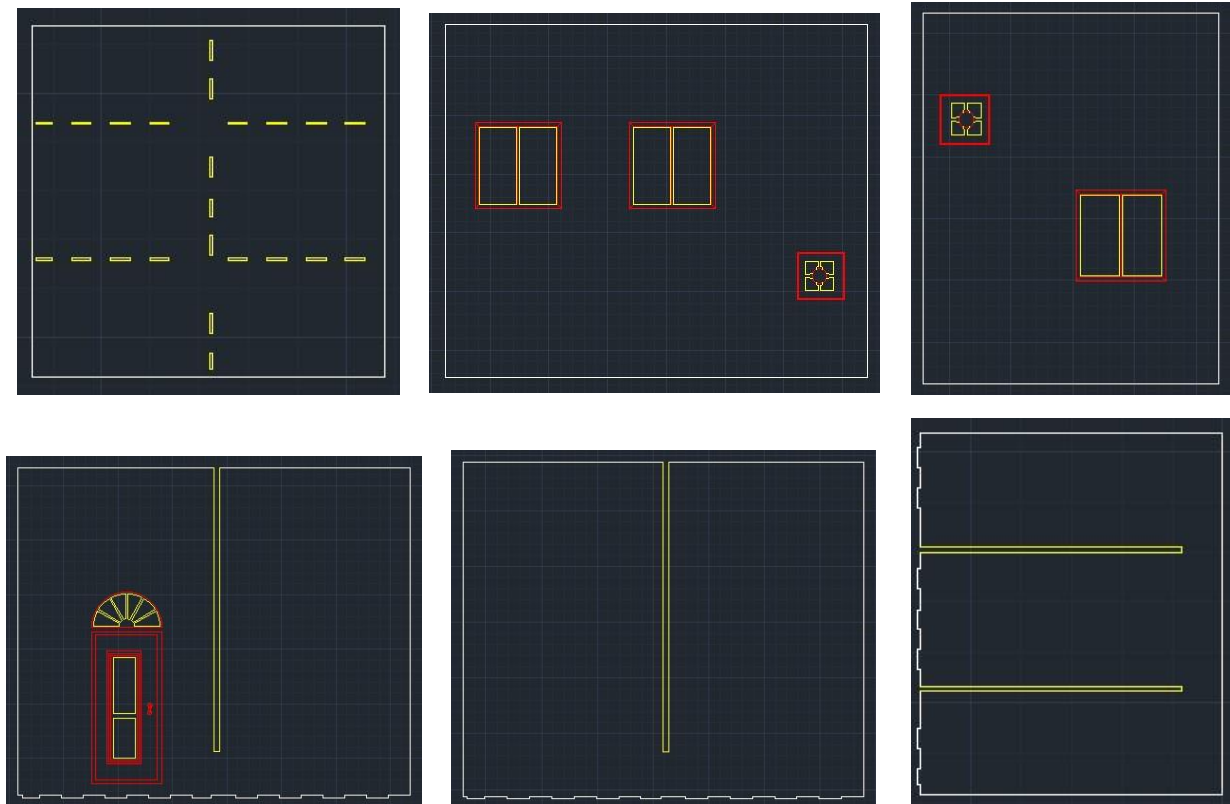


Figure 2: AutoCAD Files

8. Resources

To implement the IoT-Based Home Automation System, the following resources are required:

- ESP32 microcontroller board
- Relay modules for device control
- Various sensors (e.g., temperature, humidity, motion)
- IoT-based energy meter for monitoring electricity consumption
- Wi-Fi connectivity for Internet access
- Control interfaces (e.g., Google Assistant, IR remote, ESP Rain Maker App) - Development tools and software for programming and testing

9. Results

The project yields the following results:

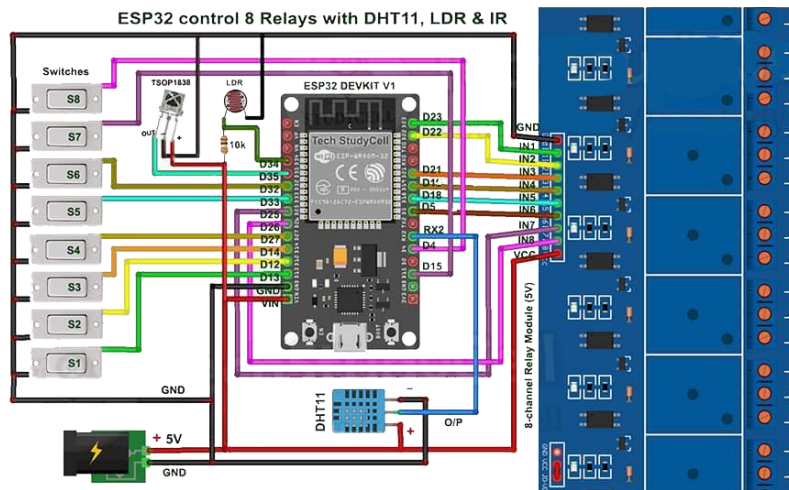


Figure 3: Automation Circuit

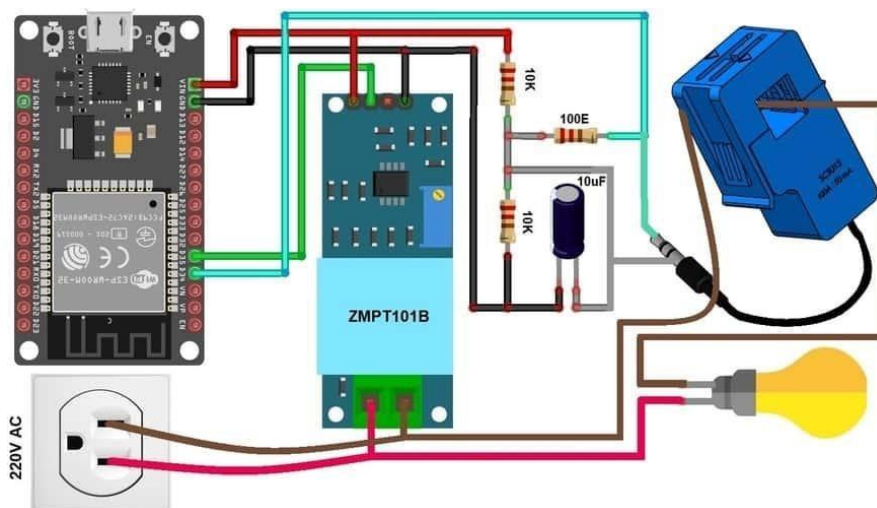


Figure 4: Relay Module

POWER HIVE

AN IOT BASED HOME AUTOMATION SYSTEM

An IoT home automation system allows remote control of household devices via the Internet, optimizing convenience and energy efficiency.

The ESP32 microcontroller serves as the backbone of the Smart Home Automation Project, orchestrating seamless integration between various interfaces and devices. Through its robust architecture and support for multiple communication protocols, such as Wi-Fi and MQTT, the system ensures reliable and efficient operation, empowering users with enhanced control over their home environment. With its user-friendly interface and advanced automation capabilities, the project not only streamlines daily tasks but also contributes to energy conservation and improved time management for homeowners.

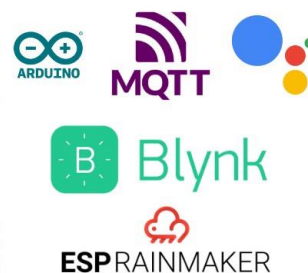
Problem Statement

Traditional home management lacks remote control and automation, leading to energy wastage and inconvenience. Users struggle to efficiently manage devices, especially when away from home.

Solution

Developing an IoT-based home automation system will enable remote monitoring and control of household devices, optimizing energy usage and enhancing convenience.

Software Used



Remembering to switch off lights and devices when leaving a room for more than a few minutes is a simple yet effective way to conserve energy.

10. Hardware Implementation

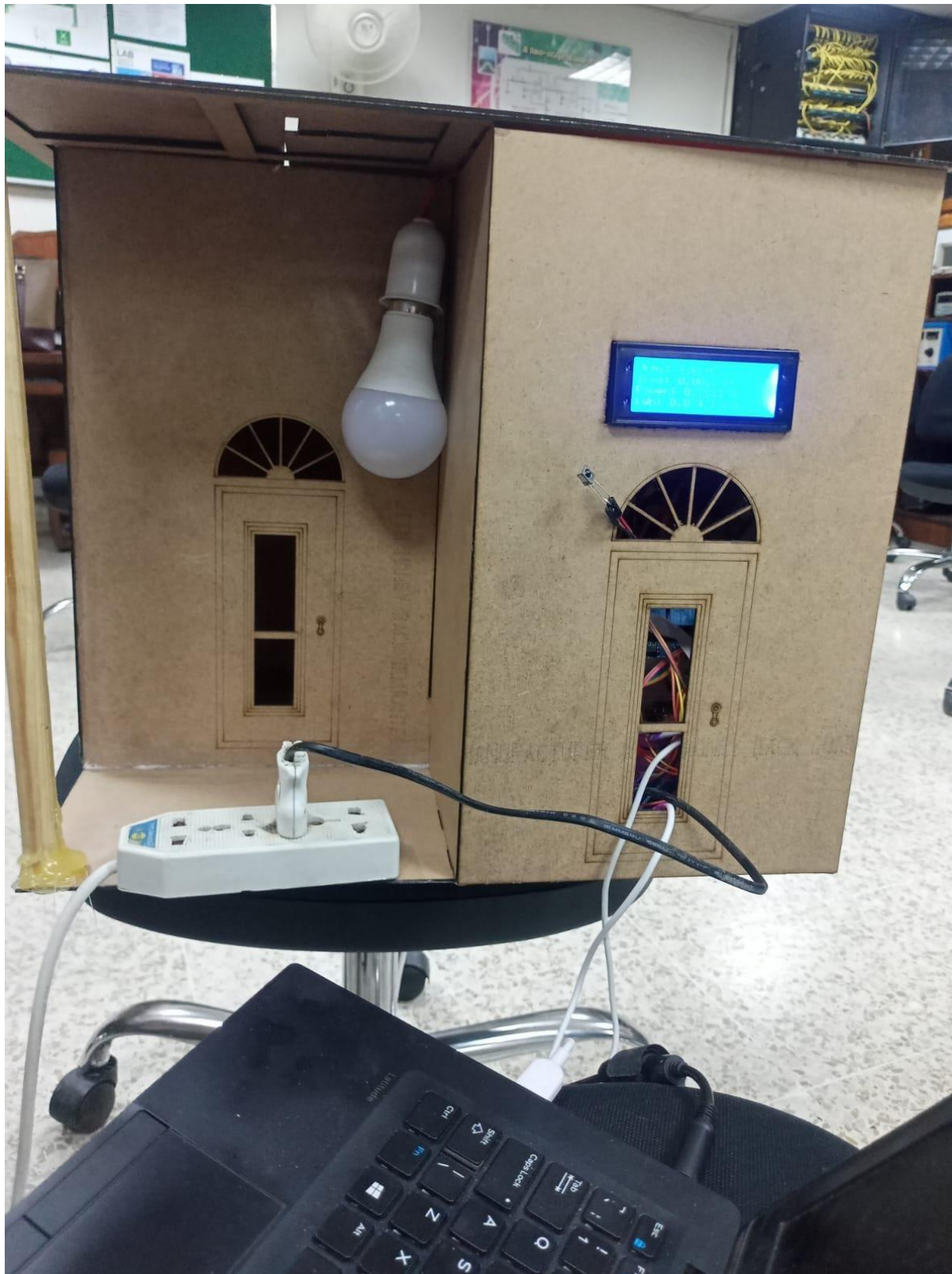
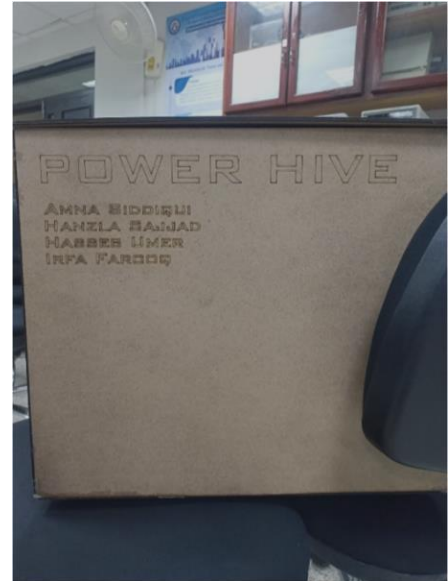


Figure 5: External Hardware



11. Code

[CLICK HERE TO EXCESS CODE](#)

12. Conclusion

The IoT-Based Home Automation System project successfully demonstrates the feasibility and effectiveness of integrating IoT technologies into household management. By providing users with remote control, automation, and energy monitoring capabilities, the system significantly enhances convenience, energy efficiency, and overall user experience.

13. References

Any external sources of information, references, or documentation consulted during the project's development are cited here. This may include academic papers, technical manuals, online resources, or other relevant materials.

- [ESP32 Home Automation](#)
- [ESP32 with Google Assistant](#)
- [IR Sensor for Remote](#)
- [IOT based Energy Meter](#)