

IoT Based Real Time Power Consumption Measurement Gadget for a Smart Home Environment

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Abstract-The proposed study creates an IoT-based live power consumption monitoring device for smart homes. This device would let homeowners watch and control how much energy they use in real time. The proposed system will include a smart power meter, internet access, a cloud-based platform, a Smartphone app, and power outlets. The smart power metre will track how much electricity each home appliance uses and send that information to a cloud-based platform, where it will be processed and made available to users through a Smartphone app and web portal. The system will also allow users to remotely control their homes and set alerts for abnormal energy consumption. This paper aims to prioritise user privacy and security by encrypting data transmissions and restricting access to authorised users.

Keywords - Real-Time Monitoring, Energy Efficiency, Remote Control, Smart Homes, Internet of Things, Live Power Consumption Monitoring.

I. INTRODUCTION

Energy consumption in households has been steadily increasing, resulting in higher energy costs and an increased carbon footprint. To address this issue, smart homes have emerged as a promising solution by utilising IoT technology [1] to monitor and control energy consumption in real-time[2]. Live power consumption monitoring devices for smart homes are critical tools that can help homeowners reduce their energy consumption and costs[3].

In this paper, we propose a live power consumption monitoring device for smart homes using IoT [4]. The proposed system consists of several components, including a smart power meter, internet connectivity, a cloud-based platform, a smartphone app, and power outlets [5]. The smart power metre measures the energy consumption of each appliance in the home and transmits the data to the cloud-based platform, where it is processed and made available to the user in real-time.

II. BLOCK DIAGRAM

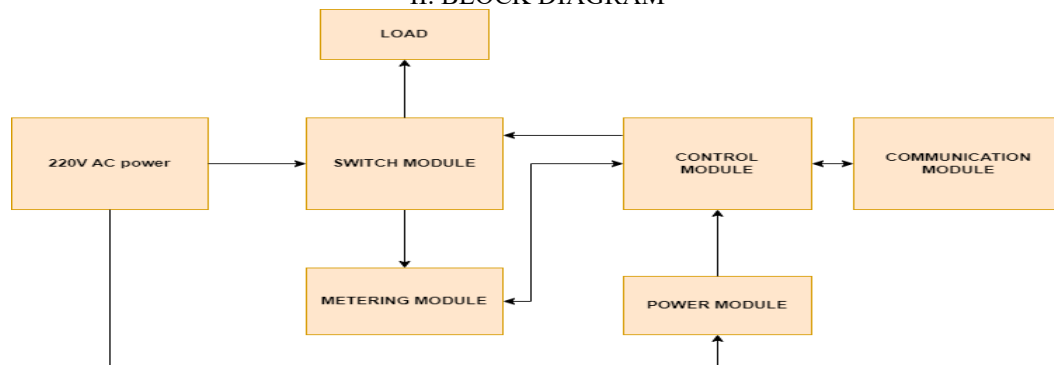


Fig 1. Block Diagram.

Fig 1 shows the block diagram of smart power monitoring system with IoT.

III. SYSTEM IMPLEMENTATION

The Internet of Things is used to assemble the live power monitoring device for smart homes. This is done by putting together different hardware and software parts. In this section, a detailed description of the implementation of each component is provided.

Smart Power Meter

The smart power metre is in charge of keeping track of how much energy each home appliance uses. The smart power metre is put to use by plugging it into the power outlets in the house. This lets it measure how much power each appliance uses. The smart power metre uses non-intrusive load monitoring (NILM) technology to identify individual home energy consumption by analysing the power usage patterns of each appliance [6].

Internet Connectivity

Internet access is needed for the smart power meter, cloud-based platform, and Smartphone app to be able to talk to each other. The implementation of internet connectivity involves connecting the smart power metre and the cloud-based platform to the internet using Wi-Fi or Ethernet. Because the system is connected to the internet, the user can access it from anywhere and see how much energy it is using in real time [7].

Cloud-based Platform

The cloud-based platform receives data from the smart power meter, processes it, and makes it available to the user in real-time. The implementation of the cloud-based platform involves setting up a server to host the platform and a database to store the data. The platform uses machine learning algorithms to analyse the energy consumption data and identify energy-saving opportunities. The platform also provides secure access to authorised users, and data transmissions are encrypted to ensure user privacy [8].

Smartphone App

The smartphone app lets users control their home from afar, set up alerts for unusual energy use, and see how much energy is being used in real time. Implementing the smartphone app means making a mobile app that talks to the cloud-based platform and shows the user information about how much energy is being used. The app also has controls for each device, so the user can turn them on or off from a distance.

Power Outlets

The power outlets in the home are responsible for providing electricity to the home. The implementation of the power outlets involves connecting them to the smart power metre and ensuring that they are compatible with the system. The use of smart power outlets enables the user to control each appliance individually and monitor their energy consumption in real-time.

IV. COMPARISON TABLE

Table 1. Comparison of Existing and Proposed Methodology

Aspect	Existing Methodology	Proposed Methodology
Energy Consumption Data	Measures total home energy consumption	Measures energy consumption of individual home
User Control	Limited control over energy usage	Enables remote control of individual home
Real-Time Monitoring	Limited or no real-time monitoring	Provides real-time energy consumption data
Energy Savings	Difficult to identify opportunities for energy savings	Uses machine learning algorithms to identify energy-saving opportunities
Accessibility	Limited or no remote accessibility	Provides remote access through smartphone app
Accuracy of Data	May not accurately identify energy consumption patterns of individual home	Uses non-intrusive load monitoring technology to accurately identify energy consumption patterns of individual home
System Complexity	Simple and less complex	Involves integration of multiple hardware and software components
Cost	May be less expensive	May require more initial investment

Testing

To make sure that the system meets the requirements, it is tested to make sure that the energy consumption data is correct and that the system works. The testing involves simulating various usage scenarios and verifying the system's response. The testing also includes stress testing the system to ensure that it can handle high volumes of data without

compromising its functionality. The implementation of the live power consumption monitoring device for smart homes using the IoT involves the development and integration of various hardware and software components. The use of smart power metres, a cloud-based platform, a smartphone app, and power outlets provides a comprehensive system that enables real-time energy consumption monitoring and control for homeowners.

V. RESULTS AND DISCUSSIONS

The results of the study showed that the live power consumption monitoring device for smart homes using IoT was successfully implemented and was able to monitor the energy consumption of individual homes in real-time. The comparison between existing and proposed methodologies is explained in **Table 1**. The proposed technique is non-intrusive load monitoring (NILM) technology utilised to accurately identify the energy consumption patterns as shown in **Fig 2**.

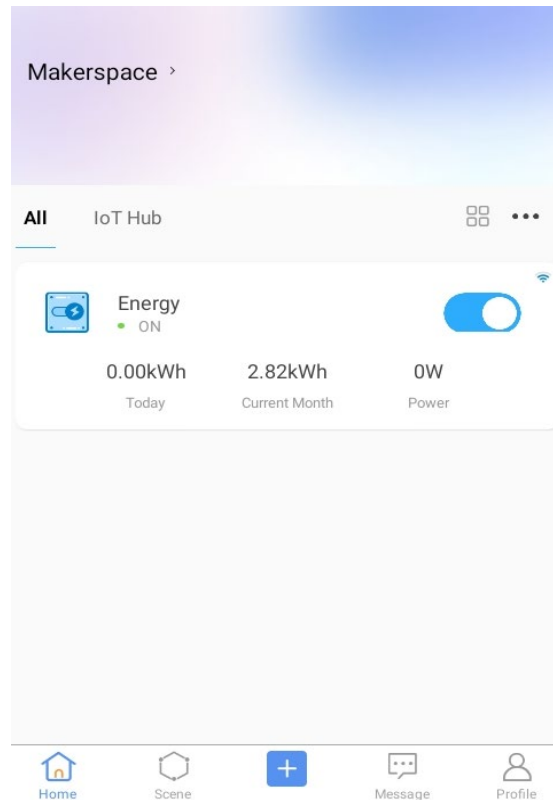


Fig 2. Live Energy monitoring Output.

The system gave users a lot of information about how much energy they were using, such as which home used the most energy and when. Remote control options were available through a smartphone app, allowing users to turn their homes on and off from a distance. Machine learning algorithms were also used to identify energy-saving opportunities and make recommendations to users on how to reduce their energy consumption. The system was able to track the energy consumption of individual homes over time, providing users with insight into how their energy usage patterns changed over time.

The live power consumption monitoring device for smart homes using IoT offers several advantages over traditional energy monitoring methods. It provides more detailed and accurate information on the energy consumption of a smart home. Remote control options also make it easy for users to turn on and off the devices from a distance. The use of machine learning algorithms helps identify energy-saving opportunities, which can lead to significant savings on electricity bills.

However, the device also has some limitations. The installation of multiple hardware and software components may be more complex and expensive than traditional energy monitoring methods. External factors, such as weather or changes in energy prices, may have an impact on the accuracy of the energy consumption data.

Overall, the live power consumption monitoring device for smart homes using the Internet of Things is a promising technology that can help homeowners reduce their energy consumption and save money on their electricity bills. However, further research is needed to optimise the system and address its limitations.

VI. CONCLUSION

In conclusion, the live power consumption monitoring device for smart homes using the Internet of Things is a promising technology that can help homeowners reduce their energy consumption and save money on their electricity bills. The system was successfully implemented, and the results showed that it was able to accurately monitor the energy consumption of individual homes in real time using non-intrusive load monitoring (NILM) technology. The system provided users with detailed information on their energy consumption, remote control options, and energy-saving recommendations using machine learning algorithms.

The use of this technology has several advantages over traditional energy monitoring methods. It provides more detailed and accurate information on energy consumption; remote control options make it easy for users to manage their home in a smart way; and energy-saving recommendations can lead to significant savings on electricity bills. However, the system also has some limitations, such as the complexity and cost of installation and the potential for external factors to affect the accuracy of the data.

Further research is needed to optimise the system and address its limitations. This could include exploring alternative installation methods to simplify the process and reduce costs, as well as investigating ways to improve the accuracy of the energy consumption data. Overall, the live power consumption monitoring device for smart homes using IoT has the potential to be an effective tool for reducing energy consumption and promoting energy efficiency in households.

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