IoT-ENABLAD SMART ENERGY METERING SYSTEM FOR CONSUMERS AND UTILITIES

[1]**Mrs.Akshatha N M**
Assistant professor
Dept. of EEE
Yenepoya Institute of Technology
Thodar, Moodbidri, D.K, Karnataka

[2]**Mr.Abhinav B S**
Dept. of EEE
Yenepoya Institute of Technology
Thodar, Moodbidri
D.K, Karnataka

[3]**Mr.Aman Seena Krishna**
Dept. of EEE
Yenepoya Institute of Technology
Thodar, Moodbidri
D.K, Karnataka

[4]**Mr.Gokul Raj M**
Dept. of EEE
Yenepoya Institute of Technology
Thodar, Moodbidri
D.K, Karnataka

[5]**Mr.Muhammed Sanin K**
Dept. of EEE
Yenepoya Institute of Technology
Thodar, Moodbidri
D.K, Karnataka

Abstract : This comprehensive energy management system offers homeowners a suite of tools for efficient electricity consumption. Through a user-friendly mobile app, real-time energy monitoring provides clear insights into consumption habits, while granular control allows users to manage electricity supply to individual rooms, promoting targeted efficiency. Tailored energy-saving recommendations, derived from personalized usage patterns, empower informed decision-making. The system's precise data not only ensures accurate billing but also automates processes, reducing manpower requirements for both homeowners and utility providers.

INTRODUCTION

The IoT-based smart electric meter is a ground breaking solution reshaping to manage households electricity. By merging advanced metering capabilities with the Internet of Things, it offers real-time monitoring, remote control, and intelligent automation. Homeowners gain granular insights into energy consumption patterns, enabling informed decisions to reduce costs. This device goes beyond monitoring, allowing control of individual room electricity supply through a user-friendly app, bolstering efficiency and safety by remotely managing power usage. Simultaneously, it streamlines billing by integrating with payment gateways, automating disconnection upon non- payment, reducing manual processes, and cutting administrative costs. This innovation fosters a symbiotic relationship between users and utility providers, enabling remote monitoring, targeted energy-saving recommendations, and collaborative efforts toward energy conservation.

The IoT-based smart electric meter represents a paradigm shift in energy management. Its integration of IoT capabilities empowers households with real-time insights and control over electricity usage, driving informed decisions and cost reduction strategies. Through remote control features and seamless payment integration, it simplifies billing processes, ensuring timely payments and reducing administrative burdens for utility providers.

LITERATURE REVIEW

[1] A Review on Smart Energy Meter with Theft & Billing" by Chauhan et al. (2021) This paper r"eviews the development of smart energy meters, focusing on their ability to detect energy theft and improve billing accuracy. The authors discuss various smart energy meter technologies, including advanced metering infrastructure (AMI), and their role in reducing energy losses and improving revenue collection for utility providers.

[2] IoT Based Smart Electrical Meter for Smart Homes" by Jhon Lennon (2018) This paper proposes an IoT-based smart electric meter system for smart homes. The system utilizes an ESP32 microcontroller, a Wi-Fi module, and a current sensor to monitor energy consumption and provide real-time data to homeowners via a mobile app. The system also incorporates a relay to control electricity supply to individual rooms.

[3] IOT Based Smart Energy Meter" by International Journal of Scientific Research in Computer Science,Engineering and Information Technology (2020) This paper discusses the benefits of IoT-based smart energy meters for both homeowners and utility providers. The authors highlight the ability of smart meters to improve energy efficiency, reduce costs, and enhance customer satisfaction.

[4] A Survey on Smart Meter Security" by S. Tripathi et al. (2018) This paper surveys the security challenges and vulnerabilities associated with smart meters. The authors emphasize the need for robust security measures to protect smart meter data from unauthorized access and manipulation.

METHODOLOGY

Problem Statement: Inefficient energy usage: Traditional electric meters provide limited information about energy consumption patterns, making it difficult for homeowners to identify and address areas of high energy usage. Limited control over energy usage: Traditional electric meters provide no control over energy consumption. preventing homeowners from optimizing energy usage based on occupancy patterns and individual appliance usage.

Objectives:

Empower homeowners with real-time energy monitoring: Provide homeowners with real-time energy consumption data, enabling them to identify peak usage patterns, potential energy-saving opportunities, and make informed decisions about their energy usage habits.

Enable control over energy usage: Implement room-level control capabilities, allowing homeowners to manage electricity supply to individual rooms, reduce energy consumption in unused areas, and optimize energy usage based on occupancy patterns.

Improve billing accuracy and reduce manpower requirements: Enhance billing accuracy by utilizing precise and timely energy consumption data, and reduce manpower requirements by automating meter readings and billing process.

Working:

The energy meter is divided in to two parts. On the hardware side, the current and voltage sensors is used for real-time and precise electricity measurement. Communication modules, such as Wi-Fi, play a crucial role in enabling seamless data transmission between the smart meter, mobile app, and cloud server. Solid-state relays contribute to enhanced energy management by providing precise control over electricity distribution to individual rooms or appliances. On the software side, development efforts focus on creating microcontroller firmware responsible for overseeing various functions such as data acquisition, communication, relay control, and power management. A user-friendly mobile app is developed to empower homeowners, allowing them to monitor energy consumption, control electricity distribution at the room level, and receive timely notifications. Integration with a cloud server becomes a central hub for storing and analyzing consumption data, enabling seamless communication between the smart meter and the mobile app, and managing payment processing.The incorporation of robust security measures, including encryption and access controls, is imperative to safeguard sensitive information and ensure the system's integrity and privacy. The synergy of these hardware and software elements results in a comprehensive smart metering solution that not only accurately measures energy consumption but also facilitates efficient billing processes and encourages responsible energy usage. In the smart meter automated billing system, where supply cutoff is implemented for nonpayment, the process begins with the systematic recording of a customer's energy consumption over a billing period. This data serves as the basis for generating an automated bill with a specified due date. Automated notifications are then sent to customers to remind them of the impending payment deadline, promoting awareness and encouraging timely action.

ADVANTAGES

- Automatic disconnection for Non- payment.

- Remote monitoring and control.

- Room-level control.

APPLICATIONS

- Real-time energy monitoring: Track energy consumption in real-time to identify peak usage patterns and potential energy saving opportunities

- Room-level control: Control electricity supply to individual rooms to reduce energy consumption in unused areas and optimize energy usage based on occupancy patterns.

- Remote disconnection for non- payment: Ensure timely and consistent revenue collection by enabling automatic disconnection upon non-payment.

- Improved billing accuracy: Precise energy consumption data enables accurate billing and reduces the risk of billing errors.

- Reduced manpower requirements: Automate meter readings and billing processes reducing the need for manual data entry and customer service interactions.

CONCLUSION

In conclusion, the IoT-enabled smart energy meter project has successfully achieved its objectives by implementing a robust system for monitoring and managing energy consumption. Through this endeavor, significant benefits have been realized, including improved energy efficiency, cost savings, and a reduced environmental footprint. Insights gleaned from the project have provided valuable information on energy consumption patterns and areas for optimization. Despite encountering challenges, such as technical complexities and interoperability issues, the project team has effectively navigated through them. Looking ahead, there is immense potential for further innovation and expansion, including the integration of renewable energy sources and advanced analytics capabilities. The long-term impact of this project on energy management and sustainability cannot be understated, and continued support and collaboration are essential for its ongoing success and broader adoption in the pursuit of a more efficient and sustainable energy future.

FUTURE SCOPE

The future scope of IoT-enabled smart energy meters is expansive and promising. These meters will not only revolutionize the way we monitor and manage energy consumption but also play a crucial role in transforming our energy infrastructure towards greater efficiency and sustainability. With real-time monitoring capabilities, consumers and utilities alike will have access to detailed insights into energy usage patterns, enabling proactive decision-making and optimization of energy resources. Predictive maintenance algorithms will help prevent potential issues before they occur, ensuring minimal downtime and maximizing the lifespan of energy meters. Moreover, the integration of smart meters with emerging technologies such as blockchain and advanced analytics will pave the way for innovative solutions like dynamic pricing, demand response programs, and peer-to-peer energy trading, fostering a more resilient and decentralized energy ecosystem. By harnessing the power of IoT, smart energy meters will not only empower consumers to make informed decisions about their energy usage but also enable utilities to better manage grid operations, reduce energy waste, and mitigate environmental impact.

REFERENCE

[1]."Smart Energy Meter Data Analytics for Electricity Consumption Prediction" by D. T. Nguyen et al. (2014)

[2]."IoT-Based Smart Energy Management System for Smart Homes" by M. A.Hossain et al. (2018)

[3]. "A Survey on Demand Response in Smart Grids" by M. Mohseni et al. (2010)