SMART ENERGY USING IOT

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Abstract

A smart energy meter is a device that measures electricity consumption in real-time and communicates this data to an energy supplier or user. The device can provide detailed information about energy usage, such as peak consumption times, allowing users to adjust their habits and reduce their energy consumption. The benefits of using smart energy meters are numerous. They can help reduce energy bills by giving users real-time data on their energy usage and identifying areas where energy is being wasted. This information can help people make informed decisions about how to reduce their energy consumption. Smart energy meters also help energy suppliers manage the grid more efficiently. By having access to real-time data on energy consumption, they can predict future demand and plan accordingly. This can lead to a more stable grid and fewer blackouts. In addition to providing real-time data, smart energy meters can also be remotely controlled by energy suppliers.

Keywords: *Smart Energy Meter, Automated Billing System, Theft Detection of Current, IOT, SMS Notification, Blynk App,*

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1.   INTRODUCTION:

A smart energy meter with Blynk application and ESP32 is a system that uses the ESP32 microcontroller and Blynk application to monitor and control energy consumption in a household or building.

The ESP32 is a low-cost, low-power microcontroller that can be programmed to connect to Wi-Fi networks, collect data from sensors, and communicate with other devices. The Blynk application is a mobile app that allows users to control and monitor devices connected to the internet.

The smart energy meter system with Blynk application and ESP32 uses current transformers (CT) to measure the energy consumed by the appliances and devices in a household or building. The CTs are connected to the ESP32, which collects the energy data and sends it to the Blynk server through Wi-Fi.

The Blynk application allows the user to monitor their energy consumption in real-time, view historical data, and receive notifications when certain thresholds are reached. The user can also control their energy usage by turning appliances on and off remotely using the Blynk app.

2   LITERATURE SURVEY

[1]   Smart sensory energy metering. Introduction: SSEM (Smart Sensory Energy Metering) is an electronic device that records consumption of electric energy and allows customers to program how and when their home uses energy.

[2]   Smart grid plays an important role in our current society and in our networks. Smart meters play a vital role. Smart meter provides immediate monitoring of reliable status, automatic information collection, user interaction and energy control. It also provides a double flow of information between consumers and suppliers,

provides better control and efficiency. It also provides real-time consumption information and provides power control.

[3]   When building the power management system, Smart Meter (SM) plays an important role in helping users feel active and determine energy consumption. As a result, multiple efforts have been made to improve the function of this device in order to contribute to the reduction of energy consumption towards a green economy and sustainable development. In addition to SM, other protocols have been developed to achieve intelligent, convenient and safe management and control between buildings or building blocks.

[4]   Anitha et al., proposed "Smart energy meter surveillance using IoT" about IoT, internet of things as an emerging field and IoT based devices have created a revolution in electronics and IT. The foremost objective of this project is to create awareness about energy consumption and. efficient use of home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks.

[5]   Devadhanishini et al., "Smart Power Monitoring Using IoT" that energy Consumption is the very important and challenging issue. Automatic Electrical Energy meter is used in large electric energy distribution system. The integration of the Arduino WIFI and SMS provides the system as Smart Power Monitoring system. Smart energy meter provides data for optimization and lessthe power consumption. This system also includes a motion sensor such that if there is no human in house or house it will automatically turn off the power supply.

[6]   Mohammed Hosseiu et al., presented a paper titled "Design and implementation of smart meter using IoT" describing the growth of IoT and digital technology. The future energy grid needs to be implemented in a distributed topology that can dynamically absorb different energy sources. IoT can be utilized for various applications of the smart grid consisting power consumption, smart meter, electric power demand side management and various area of energy production. In this paper, the Smart Energy Metering (SEM) is explained as the main purpose of SEM is necessary for collecting information on energy consumption of household appliances and monitor the environmental parameters and provide the required services to home users

[7]   Himanshu K Patel et al., demonstrated "Arduino based smart energy meter" that removes human intervention in meter readings and bill generation thereby reducing the error that usually causes in India. The system consists the provision of sending an SMS to user for update on energy consumption along with final bill generation along with the freedom of reload via SMS. The disconnection of power supply on demand or due to pending dues was implemented using a relay. The system employs GSM for bidirectional communication.

[8]   Bibek Kanti Barman, et al., proposed "smart meter using IoT" on efficient energy utilization plays a very vital role for the development of smart grid in power system. Hence proper monitoring and controlling of power consumption is a main priority of the smart grid. The energy meter has many problems associated to it and one of the key problems is there is no full duplex communication to solve this problem, a smart energy meter is proposed based on Internet of Things.

[9]   Garrab et al., proposed AMR approach for energy saving in Smart Grids using Smart Meter and partial Power Line Communication" on the raising demand of energy. Smart meters are one of the proposed solutions for the Smart Grid. In this article, an AMR solution which gives detailed end-to-end application. It is based on an energy meter with low-power microcontrollerMSP430FE423A and the Power Line Communication standards. The microcontroller includes an energy metering module ESP430CEl.

[10]   The Landi et al., presented "ARM-based Energy management system using smart meter and Web server about a low-cost real-time ARM-based energy management system. An integrated Web Server helps to collect the statistics of energy consumptions, power quality and is to interface devices for load displacement. The device is used to access the information. In this way it is possible to manage the power consumption of the power system leading to a consumption of power.

3. PROPOSED SYSTEM

The implementation of a smart energy meter system that involves automatic bill generation each month, live monitoring in Blynk, and theft of current detection through a Blynk notification is a significant step towards efficient energy management. It aims to provide households and businesses with the necessary tools to monitor their energy consumption and detect any instances of electricity theft or misuse

3. SYSTEM ARCHITECTURE
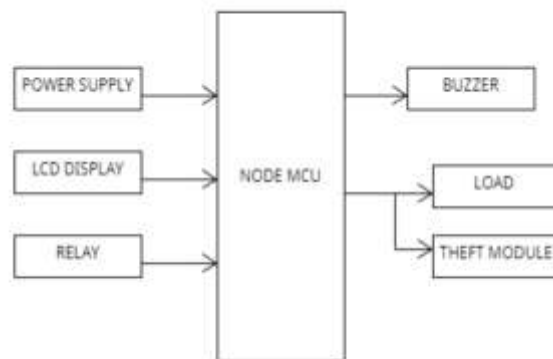
The device is characterized by easy access to the data and therefore the combination of a smart meter and digital communication capability allows local and remote access. In this way, it is possible to manage the power consumption by the electrical appliances and also check the amount of power consumed by our appliances in terms of money. The Wi-Fi unit performs the IoT operation by sending energy meter data to the cloud which may be accessed and displayed on an LCD screen.
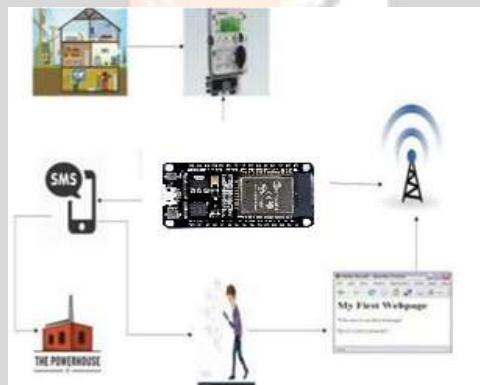
A smart energy meter is an electronic device that records consumption of electrical energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing Smart meters enables two-way communication between the meter and central system. Utilities are one of the electrical departments, which install these devices at every place like homes, industries, organizations, commercial buildings to measure the electricity consumption by loads such as lights, fans, refrigerators and other appliances.

Energy meter measures the voltage and currents, calculate their product and give instantaneous power. This power is integrated over a time interval, which gives the energy utilized over that time period.

The introduction of the Internet of Things (IoT) has brought significant advancements in the field of smart energy meters. IoT is a network of physical devices, vehicles, home appliances and other items embedded with sensors, software, and connectivity which enable these objects to connect and exchange data. The integration of IoT in smart energy meters has made it possible to remotely monitor and control energy usage in homes and businesses.

One of the popular platforms used to develop IoT-based smart energy meter applications is Blynk. Blynk is a user-friendly platform that allows developers to build IoT projects easily and quickly. It enables developers to create custom mobile apps to control and monitor IoT devices remotely. With Blynk, developers can build a user-friendly mobile application that allows users to track their energy consumption in real-time, set energy usage limits, and receive alerts when energy usage is exceeded.

The use of Blynk in smart energy meters has numerous benefits. Firstly, it allows for the creation of user-friendly applications that are easy to navigate and understand. Users can quickly monitor their energy consumption and track their energy usage patterns, which can help them identify areas where they can reduce their energy consumption.

Secondly, Blynk allows for the development of personalized alerts and notifications. Users can receive alerts when their energy consumption exceeds a predetermined limit, which can help them avoid high energy bills. Additionally, users can receive notifications when their energy consumption is high during peak hours, which can help them adjust their energy usage accordingly.

Thirdly, Blynk enables the development of energy-saving features. For example, smart energy meters can be programmed to automatically turn off appliances when not in use or to adjust energy consumption during peak hours. This can help users reduce their energy consumption and lower their energy bills.

Finally, Blynk allows for remote monitoring and control of energy consumption. Users can control their energy usage remotely through their mobile devices. For example, they can turn off appliances or adjust their energy consumption when they are away from home. This can help users save energy and reduce their carbon footprint.

5. PRACTICAL IMPLEMANTATION

To analysis the proposed energy monitoring system, the system is practically implement in the lab. The details practical implementations are explained below
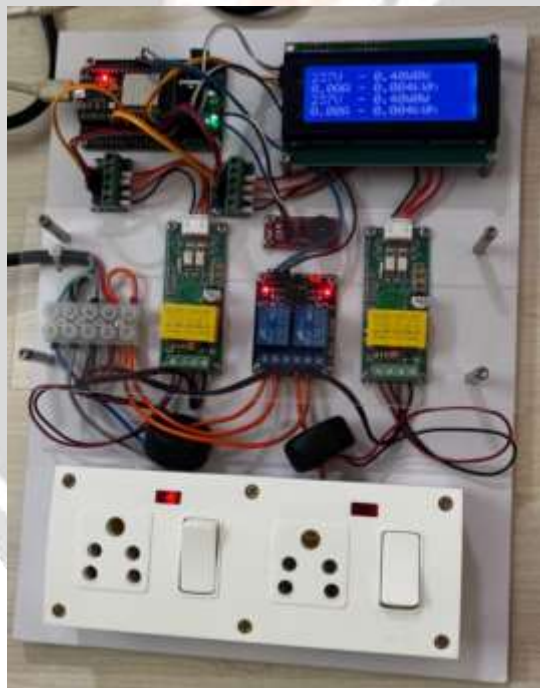
6.SMART METER FUTURE IN INDIA

According to India Smart Grid Forum (ISGF), by 2020, almost every building in urban and semi-urban areas on earth will have broadband internet connectivity [5]. This can eliminate the need of data concentrator units/gateways as it becomes possible to upload data from smart meters directly to internet which can be downloaded at Head End System at any instant. Also the Government of India aims to implement 250 million smart meters, replacing conventional meters, eyeing its technological advantages [6]. Smart meters can be connected to a Wi-Fi network in the home or building or neighborhood which links the meter with broadband internet to send meter data. The Head End System and the Meter Data Management System (MDMS) can aggregate data by connecting to internet. Also, data can be send to utility applications and consumer's

application on their smart phones eliminating the need for In-Home Displays. The Govt. of India was pursuing a program, National Optical Fiber Network, to provide broadband connectivity to 250,000 villages, which was decided to expand to 600,000 villages under the Digital India program for providing universal broadband access to all . These schemes may bring broadband access to most part of the country and will establish a dedicated fiber backbone network for the Indian power system.

7. CONCLUSION

The Internet Of Things based Smart Energy Meter helps in energy monitoring through the internet which provides us with real time power consumption and allows us to keep our consumption constantly in check. It eliminates the chances of manual error delay in processing and electricity theft thus we get accurate readings and justified electricity bills. The direct exchange of data between the meter and the utilities,made possible because of IOT, transforms it into an automated system that offers improved service quality and faster response time despite the reduced manual labour which in turn reduces the labour cost thus providing us with furthermore economic benefits.

The smart energy meter uses advanced sensors and connectivity to provide accurate readings and eliminate the chances of manual error. This ensures that we receive justified electricity bills based on our actual consumption, rather than an estimate or a faulty reading.

Moreover, the direct exchange of data between the meter and utilities is made possible by IoT technology. This transforms the entire system into an automated one, offering improved service quality and faster response time, all while reducing manual labour costs. This automation allows the system to quickly detect any faults or energy theft, thus preventing any unnecessary expenses on the user's part.

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