



AUTOMATIC ENERGY METERS MONITORING IN BUILDINGS AND APARTMENTS USING IOT TECHNOLOGY

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Abstract-The term "internet of things" (IOT) refers to an emerging technology that uses the internet to manage and track electrical and mechanical equipment, vehicles, and other pieces of hardware that are also online. With IoT, users can monitor and manage non-digital objects through a familiar graphical user interface (GUI) accessible from anywhere with an internet connection. The goal of this project is to create a system for monitoring and billing energy use as well as controlling loads through the Internet of Things (IoT). Because going to the meter reading room and taking down readings is a necessary part of the verification process nowadays, keeping track of your power usage may be a time-consuming chore. Of course, knowing whether or not you were charged fairly is crucial, thus this necessity is undeniable. We simplify things by integrating internet-based meter reading monitoring for all consumers. Our suggested solution employs an energy meter coupled with a microcontroller system to track electrical consumption. The meter keeps tabs on how much energy is used and sends that data, along with the associated bill, through a Wi-Fi network. Blink, an IoT-based app, makes it simple for users to monitor their energy use and associated costs from anywhere, at any time. That's why it's so convenient that you

can easily keep tabs on your power use and billing with

the help of the energy meter monitoring system. In this Project, a Single Channel AC Load12-0-12 Transformer is utilized as the Main source of Energy, and its operation may be regulated by an Internet of Things Application. Converting 12V AC to 12V Dc requires a bridge rectifier. By combining the functions of voltage regulators with filter capacitors, it is possible to generate a stable DC voltage. We've developed a straightforward method for remotely checking in on your home's energy use with a web-based IoT cloud application, no matter where you happen to be in the globe. It's simple to set up and operate while saving a tone of power.

Keywords: *Energy Meter Monitoring, IoT, Node MCU, Wifi Module, Blynk*

1. INTRODUCTION

The Internet of Things (IoT) is a relatively new breakthrough technology that entails adding sensing and communication capabilities to everyday objects in order to collect and analyze data. These Internet of Things-enabled gadgets may be used to keep tabs on a wide range of crucial environmental, electrical, and physical indicators. Thereafter, this data is analyzed, sorted, and used to the solution of a variety of real-world issues. Managing electrical power to minimize

wasteful use is one such pressing issue. Smart electricity meters that use the Internet of Things may assist with this issue by delivering more detailed information about energy use. Common electric meters from energy providers in the current Indian context record overall power use. The customer has no way of knowing how much electricity each gadget is using. Neither can this kind of meter store data nor do any sort of analysis on it. For billing purposes, electricity use must be recorded manually at each meter position since the meter itself lacks a communication feature. Due to the inherent nature of the procedure, mistakes are likely to occur. Smart power meters allow for the automated monitoring, logging, and analysis of a whole building's electricity use. Boosting public understanding of energy issues and revealing the largest electricity users are two additional benefits. This information may be safely transferred to the electricity provider, eliminating the need for manual billing and the accompanying margin for mistake. As a result, both the power provider and the user will benefit from a reduction in electricity loss.

Using time and energy to read electric utility meters. The primary goal of this project is to use IoT to automatically assess power consumption in household appliances and create its bill. This is made possible thanks to IoT's efficient and cost-effective ability to send the information of energy consumers wirelessly. Implementing the energy grid in a distributed topology that can dynamically absorb multiple energy sources is essential. Smart meters for power generation and consumption, demand-side management strategies, and other functions in the energy sector are only some of the many ways in which the Internet of Things (IoT) may be used in the context of the smart grid.

An electric instrument known as an energy meter may be used to keep track of how much power is being used. The consumer is made aware of the price and frequency of their power use in order to reduce their monthly bill. There is less of a need for human labor thanks to the energy meter, which displays the number of units utilized and transmits that information to both the client and the electrical board. Whenever and wherever, the user may see their power use.

1.1 PROBLEM STATEMENT

While digital energy meters provide many benefits, there is always room for improvement, both from the perspective of the user and the provider. Here are some issues that have been noticed with those energy meters and should be fixed:

As a result, a sizable workforce is needed to handle meter reading and associated operations, such as bill payment.

- Staffing levels are high because meter reading and associated tasks, like as bill payment, need a lot of attention.
- Billing mistakes caused by sloppy meter readers and, on sometimes, billing estimates.

2. LITERATURE REVIEW

Anitha et al., [1] proposed The use of IoT for monitoring smart energy metres is only one example of how the internet of things (IoT) is reshaping the electronics and information technology industries. This project's primary goal is to raise consciousness about the need of reducing one's energy footprint via the responsible use of electricity and household appliances. The current method for billing electricity has substantial flaws because of the amount of human labor required. With the use of IoT, this setup will provide data on meter reading and power outages in the event of excessive energy use. With the aid of a GSM module, the Arduino esp8266 micro controller is programmed to carry out the goals. All the drawbacks of the current energy meter would be eliminated in this suggested model. Apart from being shown on the LCD, all of the relevant information is sent to the user's mobile device through the Internet of Things and the GSM module. As a result of the Internet of Things, we can save time and reduce the need for human intervention.

Devadhanishini et al., [2] Sensible Power Measurement The high and difficult cost of powering IoT devices is a major concern. In large-scale electric energy distribution systems, automatic electrical energy meters are employed to track use. The system functions as a Smart Power Monitoring system thanks to the incorporation of Arduino's WIFI and SMS. A smart energy meter may help you optimize your energy use and save costs. With the

addition of a motion detector, the electricity to the home may be shut off while nobody is present.

Mohammed Hosseiu et al., [3] introduced the development of Internet of Things devices and digital technologies in a paper titled "Design and implementation of smart meter utilizing IoT." The energy grid of the future will have to be built on a distributed network capable of dynamically integrating a wide variety of power sources. The Internet of Things (IoT) has several potential smart grid applications, including energy production and distribution, energy consumption, smart metering, and electric power demand side management. The article explains Smart Energy Metering (SEM), whose primary goal is to gather data on energy consumption from home appliances, as well as to monitor environmental factors and provide appropriate services to home users.

Himanshu K Patel et al., [4] shown off a smart energy meter based on the Arduino platform, which can automatically read and generate bills without any human involvement, eliminating a common source of inaccuracy in India. An SMS may be sent to the user to provide an update on energy use, a final bill can be generated, and the system allows for reloading through SMS.

3. METHODOLOGY

This project aims to provide a system for monitoring and billing energy use as well as controlling loads through the Internet of Things. Since you have to physically visit the meter reading room and record the readings, keeping tabs on and documenting your power use for verification purposes is a time-consuming chore nowadays. As knowing whether or whether you are being charged fairly is obviously crucial, this requirement is beyond question. We simplify things by enabling online monitoring of energy meter data. Energy Meter, a meter used in our suggested system, is connected to an Arduino-based microcontroller. The meter keeps track of the amount of energy used and sends that data, along with the associated cost, out to the utility company over a wireless (Wi-Fi) network (Node MCU). The Energy Meter is hooked up to a 100W light bulb serving as the load. A user can just log into their

Blynk account, which is based on the Internet of Things, to see their energy use and associated costs. This means that customers can easily keep tabs on their power use and bills thanks to the energy meter monitoring system. An Internet of Things application also allows for the management of a single AC load channel. To check the load condition, an LCD module is used. The LCD module communicates with the Arduino through pins 2, 3, 4, 5, and 6, while the Node MCU connects via pins 10 and 11.

We are using a 12V transformer-based power supply to power the whole system. It is possible to convert 12V AC voltage to 12V DC voltage using a full wave rectifier circuit based on a single 1N4007 diode. The DC output voltage is maintained at 5V or 12V with the help of a voltage regulator such as a 7805 or 7812. Buzzer modules, Node MCU's, and other simple circuits all need these voltages to function. Capacitors with integrated filters are used to provide a steady, filtered DC voltage.

In the table1 below, we break down the total cost of the proposed system and the individual components. Our suggested layout makes use of a commonplace energy meter known as a Universal Single Phase Energy Meter. To convert this standard energy meter into an Internet of Things-based smart energy meter, further components like a Node MCU and a Relay module are added. Additionally, it allows users to remotely operate their household appliances. Existing prepaid meters may use the aforementioned accessories as well. Due to the convenience of operating their home appliances from afar, customers may now pay their energy bills without first having to guess how much power they would use in a given month. The data in Table suggests that the cost of the accessories is low, making their integration with standard or prepaid energy meters a wise investment.

Table1: Analysis

SL NO.	PARTICULARS	QTY	PRICE	AMOUNT
1	ARDUINO UNO	1	1400	1400
2	LCD MODULE 2X16	1	280	280
3	12V TRANSFORMER	1	400	400
4	VOLTAGE REGULATORS 7805	2	20	40
5	VOLTAGE REGULATORS 7812	1	20	20
6	CAPACITORS	10	30	150
7	RESISTORS	15	12	180

8	VERO BOARD	5	80	400
9	SOLDER	1	30	30
10	FLUX PASTE	1	30	30
11	ENERGY METER	1	800	800
12	NODE MCU	1	550	550
13	WIRES AND CABLES	1	300	300
14	RELAY MODULE	2	100	200
15	SCREWS AND SPACER	1	100	100
16	LOADS & HOLDERS	2	150	500
17	HARDWARE & DESIGN	1	1500	1500
18	CODING AND DOCUMENTATION	1	1500	1500
19	SOLDERING IRON	1	350	350

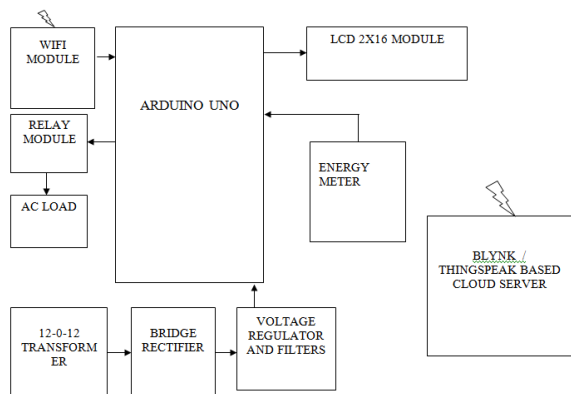


Fig1: Block Diagram of Proposed Model

4. RESULTS



Fig2: Proposed KIT

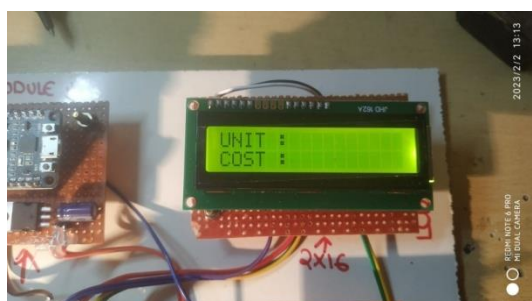


Fig3: Output1



Fig4: Output2

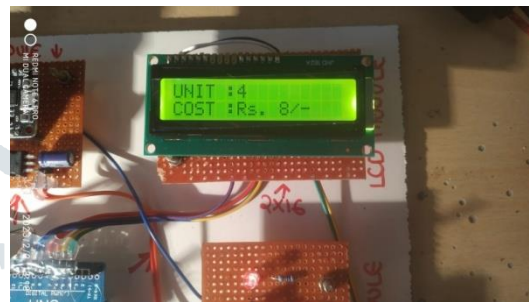


Fig5: Output3

5. CONCLUSION & FUTURE SCOPE

A Node MCU and an Internet of Things (IoT)-implemented energy meter form the basis of this system, which aids in regulating energy use. It eliminates the need for human interaction, enables accurate meter reading, and helps keep bills accurate and straightforward. The key benefit is that it takes fewer people to run and maintain, has lower costs, and has transparent unit accounting. Via IoT, consumers have easier access to data collected by their energy meters. LCD shows the kilowatt-hour energy use. Maintaining a constant vigil over the meter reading and transmitting that information to a central server is an essential function. Access to this information is not restricted by location or time. Moreover, Embedded Technology may be used to incorporate a power theft and automatic power cutoff mechanism within the system.

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