



# IoT Based Energy Meter

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**Abstract:** Electricity is an important invention without which life on Earth is impossible. So obviously there is a need for measuring the consumed electricity. It is accomplished by the wattmeter, but a person from TNEB has to visit each house for measuring the power consumption and for calculating the bill amount. So it requires much of manual work and consumes time. And using IoT based energy meter we have reduced the usage of non-renewable energy sources and increased the usage of renewable energy sources. In order to avoid all these drawbacks we have intended to construct an IoT based energy meter. So the proposed energy meter measures the amount of power consumed and uploads it to cloud, from which the concerned person can view the reading. The power reading is sent to cloud using ESP 8266, a Wi-Fi module. The power reading from digital wattmeter is read using the optocoupler and transmitted digitally to the Arduino. So it automates the process of measuring the power consumption at homes using IoT and thereby enabling remote access and digitalization. In Smart meter we are connected both of the renewable source line and EB line as the input. When the load level is below the threshold level then automatically output will be taken from input of renewable power source. When the load level is above the threshold level then automatically output will be taken from input of EB source. If the balance is reached null value the EB line will be terminated after the meter distributed energy only on renewable resources.

**Keywords:** Digital wattmeter, Optocoupler, Arduino Uno, ESP 8266

## I. INTRODUCTION

Today the world is facing such an environment that offers challenges. Energy crisis is the main problem faced by our society. A relevant system to control and monitor the power usage is one of the solutions for this problem. One approach through which today's energy crisis can be addressed is through the reduction of power usage in households. Though there is rapid development in technology, labour-intensive works are been continued. Analog energy meter that was used during ancient days are insensitive to minute power changes. The values that we get from the analog energy meter are not accurate. So the inaccurate reading leads to imprecise generation of bills. These issues have been resolved by digital wattmeter as it samples the voltage and current thousand times a second. Even though the shortcoming of analog energy meter had been overcome by the digital energy meter, a person from the Electricity board should visit each and every house to note down the power reading and to calculate the bill amount. To carry out this procedure at least a person should be available in each of their respective houses when the person from the electricity board arrives. So the consumers cannot engage themselves in their private work

according to their needs, because the time at which the person arrives from the Electricity board is unknown. Moreover it does not provide privacy as an unknown person enters into our house for power reading and calculation.

This project is designed in such a way to overcome all the above hindrances caused by the former mechanisms of measuring power. The use of wireless communication technology, there are many uses are available in automating various industrial aspects for reducing labour force. The availability of wireless communication media has made the exchange of information fast, secure and accurate. Mismanagement of electrical energy is a prevalent problem in the contemporary world. To overcome this potential crippling flaw in electricity distribution, an effective monitoring system has to be developed. The project proposes an integrated hardware and software to solution for wireless monitoring of energy consumption of the end user. Energy monitoring through cloud is cost effective and it provides a feasible solution for remote monitoring.

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BASED ENERGY METER. Here the power reading is uploaded to cloud using ESP 8266. It is an UART (Universal Asynchronous Receiver/Transmitter) to Wi-Fi module which allows microcontrollers to connect to a Wi-Fi and make simple TCP/IP connections using AT commands. The wi-fi module is a best device and it is low cost and best Wi-Fi module suitable for adding WiFi functionality to an existing microcontroller. It is one of the leading platforms for IoT (Internet of Things). As there is no human involvement in the entire process, there is no chance of manual errors. These put more control into the hands of customers by giving them more detailed information about power consumption.

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overcome this potential crippling flaw in electricity distribution, an effective monitoring system has to be developed. Our paper proposes an integrated hardware and software solution for wireless monitoring of energy consumption of the end user. Energy monitoring through cloud is cost effective and it provides a feasible solution for remote monitoring.

The consumers are increasing rapidly to use of renewable sources. The consumer must be facilitated by giving them an ideal solution that is the concept of IoT (Internet of Things) BASED ENERGY METER. Here the power reading is uploaded to cloud using ESP 8266. It is an UART (Universal Asynchronous Receiver/Transmitter) to Wi-Fi module which allows microcontrollers to connect to a Wi-Fi and make simple TCP/IP connections using AT commands. The wi-fi module is an impressive, low cost Wi-Fi module suitable for adding WiFi functionality to an existing microcontroller. It is one of the leading platforms for IoT (Internet of Things). As there is no human involvement in the entire process, there is no chance of manual errors. These put more control into the hands of customers by giving them more detailed information about power consumption.

## II. EXISTING SYSTEM

For this work accessible meter reading techniques in India are analysed and a widespread study was conducted on different energy measuring instruments available now. An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device. Electric utilities use electric meters installed at customers' premises for billing purposes. The meters currently in use are calibrated in kWh units. The conventional mechanical energy meter is based on the phenomenon of "Magnetic Induction". The meter that have a revolving aluminium Wheel called Ferri wheel then many wheels Based on the flow of current and the Ferri wheel rotates which makes rotation of other wheels.

This will be converted into corresponding measurements in the display section. Since there are many mechanical parts are involved, then mechanical defects and breakdown are common for all. If there is the chance of current that will be higher and the electronic energy meter is based on DMT (Digital Micro Technology) and uses no moving parts. So the EEM is known as Static Energy Meter. In EEM the accurate function is controlled by a specially designed IC called Application Specified Integrated Circuit. Application Specified Integrated Circuit is constructed only



for specific applications using Embedded System Technology. In addition to ASIC, analogue circuits, Voltage transformer, Current transformer etc are also present in EEM to Sample current and voltage. The 'Input Data' that is nothing but voltage that is compared with a programmed 'Reference Data' (Voltage) and finally a 'Voltage Rate' will be given to the output. This output is then converted into 'Digital Data' by the AD Converters (ADC) present in the Application Specified Integrated Circuit. The output of ASIC is available as "Pulses" indicated by the LED placed on the front panel of EEM.

### III. PROPOSED SYSTEM

Since IoT is cost effective compared to SMS, monitoring of energy meters at lower cost is made possible. Daily consumption reports are generated which can be monitored through web portal. The current system of electrical energy billing is erroneous and also time consuming. Errors introduced at every stage are due to electro -mechanical meters .human errors while noting down the meter reading. This paper reduces the deployment of manpower for taking meter readings. It has many advantages from both suppliers as well as consumer's point.

#### A. Problem Statement

The Electricity Board have got used to the manual process and they go along with it even though there are many concerns coupled with it. Because of the human errors after getting faulty bill, it is problem of user to get it corrected from the energy supply board. In that case customer has to stopover the office, stand in a queue and get it corrected. The problem is just because of human intervention. To avoid human intervention in the billing process, in this new production, an automatic reading meter system came into use.

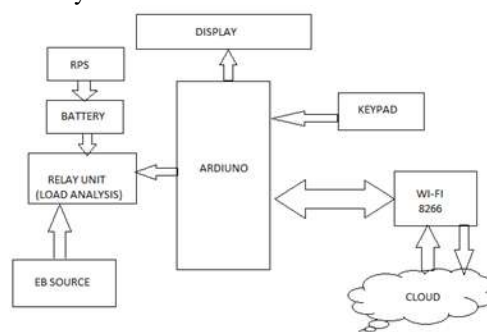
#### B. Block Diagram of IoT based energy meter

In our project the main objective and goal is to develop an Internet of Things based energy meter reading displayed for units consumed and cost thereupon over the internet in chart and gauge format.

For this innovative work we had taken a digital energy meter whose blinking LED signal is interfaced to a microcontroller through an Optocoupler (4N35). The blinking LED flashes 3200 times for 1 unit. The optocoupler gives eading each time the meter LED flashes to the programmed microcontroller. The microcontroller takes this reading and sends it to cloud using ESP 8266. ESP 8266 is a Wi-Fi module, which provides internet facility for microcontroller. Here Ardiuno is used as a microcontroller.

ESP 8266 transmits the data serially to the Thing Speak web page for display that can be viewed from anywhere in the world in multilevel graphical format.

The Arduino microcontroller can be provided with a 3V supply and ESP 8266 is powered by a 5V adapter. Arduino microcontroller is programmed using microcontroller IDE and the Wi-Fi module is programmed using AT commands in the same Arduino IDE. The consumed power reading is displayed on Thing Speak website along with cost to be paid for consumption in graphical and gauge format respectively.



#### C. Working of Smart Energy Meter

The Metering Section system consists of the following components: Arduino Uno, lcd, Keypad, Wi-fi module , Relay unit, Inverter, Driver Circuit and Battery. The input powers are EB line and Renewable power source. The Renewable resources connected to battery. The battery terminal are connected to SPDT Relay at normally closed pin. And then output of the relay connection line is connected to the positive terminal of inverter and the negative terminal is connected to the negative terminal of the battery. The driver circuit unit is connected to controller. And the driver circuit monitor the load. After it give trigger to the SPDT relay. The inverter output line is connected to DPDT relay. Similarly EB lines are connected to the relay. Relay connection line are connected to load line of the meter output. Keypad is input device the keypad is interface with pic controller. It used for recharging purpose. Lcd display these interface with controller. it is used for display the amount, voltage level of the battery, what type of load are used. ESP 8266 this is transmission and receiving device. It used for transmit or receive any data.

The Distribution Section system consists of internet connection with computer. The computer that can able to



connect with particular ip address of the cloud. Then all meters are monitored and controlled by server.

#### IV. CONCLUSION

The development in technology about electrical distribution system is a non-stop process. In this project work, wireless meter reading system is calculated to endlessly monitor the meter reading and cost. It avoids the human involvement, provides capable meter reading, and avoids the billing mistake and human intervention. The advantages of this project are it requires less manpower, cost and units are displayed on the website. By using iot based energy smart meter we have reduced the usage of non-renewable energy sources and increased the usage of renewable energy sources. Utilizing these smart meters it is easy to monitor the usage of people's electricity requirement from the power distribution station itself. Since it is dual usage in domestics it will overcome the power shortage crisis.

#### Future Work

Implement STA algorithm in Prepaid Meter to encrypt and decrypt Token .Connect Meter unit with mobile and remote devices to access and get real time data.

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