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# IOT Based Smart Energy Monitoring Theft Detection and Disconnection

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**ABSTRACT:** Electricity is one of the most important components in our daily life. There are several advantages of electricity like it is produced from renewal sources. But as the population in the world is increasing day by day. The consumption in electricity is also increases.as the electricity is prepared from natural resources it is limited.so this leads to energy crisis.it is one of the major issues that the world is facing.it is scaled down to a certain extent by careful observing of our energy usage and avoiding energy wastage. Also, there is another issue called power theft. Power theft is a measure of stealing electricity. So we are introducing a new system that will monitoring and also will find energy theft easily. The energy meters are connected to the pic microcontroller through an optocoupler. The optocoupler sensor gives interrupt each time the meter ashes to the programmed pic microcontroller and the pic microcontroller process this data to the NodeMCU module then NodeMCU module send this data to the blynk app. The readings of main energy meter are compared so as to identify the theft status. whenever there is difference in the two values a message that theft has occurred intimate to the consumer through app. We can access the app from anywhere on the globe at any time using logging credential. We can also compare the main and sub energy meter with the electricity department bill reading so as to identify the power theft that theft intimate to the consumer through app and as well as send a message from GSM.

**KEYWORDS:** Node MCU, Energy meter, Optocoupler, GSM modem, LCD display, PIC microcontroller, Blynk app

## I.INTRODUCTION

In present days the electricity demand is increased by a huge rate as the population is increasing as it has been utilized for several purposes like industries, agriculture etc. There it has become difficult to handle the electricity requirement.so there is an urgent need to save the electricity because the new generations should not suffer. Also, in olden the electricity measurement was different [1]. In India, people were using a traditional way of billing.an employee from electricity department visits every house and takes the readings from it.the method of traditional billing is applied according to the rules given by the department of electricity. This method is very time consuming and the employee has also should face very great difficulties in very risky areas where the people were not willing to pay the bill.it become vital importance for the utility companies to implement best environmental safety techniques to measure utility usage [2]. also another major drawback is Electricity theft. Robbery of electricity is a criminal practice of stealing electricity. Every year more than 90 billion of electricity was theft. The electricity theft includes Direct hooking from line Bypassing the energy meter, Physical obstruction, ESD attack on electronic meter to overcome this we are using the smart energy meter which involves automatic bills. It is one of the best ways to overcome the risks of traditional billing. Because traditional billing contains waste of time and Resource in smart meter, we can monitor the energy utilization too. In the view of increasing notice in the merchandise the consumers behavior can be carefully observed and analyzed. the usage of energy decoration can be facilitated in refining the behaviors of the consumers. the electricity market can be reengineered with the setting of these meters. because it gives two ways of advantages saving the energy and also eradicates carbon dioxide emissions [3]. Confidence and reliability of these meters is constructed only when consumers have better quality of experience. opportune usage of consumers can be decreased as the smart meters are connected to online billing [4].

## II.LITERATURE SURVEY

**Prof Landi** from university of Campania Italy has published a paper in 2011 in which she explained such as real time ARM-based energy management system which is of low cost it is created as it is a part of an distributed system quantities and gives the probability to manage the power plant .An integrated web server is allowed to collect the stats of power usage, quality of power and should be able to interfere devices for load displacement .The device is characterized by easy access to the information and combination of smart meter and data communication capability allow local and remote access.in this way it is possible to manage the power consumption of power system leading to an overall reduction of usage and costs [5]

**Garrab and ben Abdallah** wrote a paper about smart energy meter in 2012.In this paper they explained the rising demand of energy, the storage limitations of management of energy, one-side communication, the need of an interoperability of the different standards, the communication security and the emissions of greenhouse gas, leads tobirth a new infrastructure grid: Smart Grid. Smart Meters are one of the proposed solutions for the Smart Grid. In thispaper, an AMR solution which provides enhanced end-to-end application. It is based on an energy meter with low-power microcontroller MSP430FE423A and the Power Line Communication standards. The microcontroller will include an energy metering module ESP430CE1. The paper aim is to realize a real time pricing thanks to the proposed communication infrastructure. This solution is with great interest in economical and low carbon society point of view [6].

**B.S Koay, S.S cheh** from Hong kong written a paper on smart grids.In this paper they explained how the measurement of electronic energy is constantly replacing the existing technology of electrotechnical measurement meters particularly in China and India. In 2004, the digital counter began replacing electrotechnical papers in Singapore. A cordless digital energy meter will certainly offer more convenience to the meter readout task. Bluetooth technology is chosen as a possible cordless solution to this problem. In this paper, we show the problems of conception and implementation of a Bluetooth energy meter. This energy meter can pick the reading of energy consumption. [7]

**Dr. K A Radhakrishna Rao** from PES college of engineering has written a document This document explains PIC18F46k22 Microcontroller based on the design and implementation of energy meter employing IoT concept. The design of proposed system eliminates the humancontribution to Electricity maintenance. The Buyer must payfor the utilization of electricity on schedule, in case he could not pay, the power transmission can be turned off automatically from the remote server. The user may observe the energy consumption in units from a web page by providing IP address of the machine Flight sensing unit connected to an Energy meter. Flight detection unit connected to an energy meter will warn the company side when the malfunction occurs in an energy meter and sends the Flight detection information via PLC modem and theft detected will be displayed on enterprise terminal window. [8]

**Prof S.V Anushree** presented a paper on smart energy meter in which he says that the ultimate aim of the paper is to identify the electricity stealing rises the money which has been paid by the consumers and can have various safety rules. we can determine the stealing of electricity by sending a message alert to the concerned customer /owner and also sending reading of energy usage to the owner This device also had an added advantage that it allows to use the services of an IOT which acts as a worldwide connection environment to the consumer and also agrees them to see the current situation of meter readings from a remote location around the globe at all times the stealing of electricity as a material impact on customers in terms of cost and safety [9]

## III.PROPOSED SYSTEM

Due to many disadvantages in the proposed system. We are introducing a new system called smart energy meter. Smart energy meters are digital meters and its size is almost equal to analog meters. Smart energy meters are more accurate and gives more sophisticated readings than kwhr sothat utility can plan the expansion of network and power quality. It's design is such that it will measure load current and voltage by the use of sensors instead of normal current transformers and then gives these values of voltage and current into power factor controller IC and energy metering IC the power factor and power calculations respectively

### FEATURES OF SMART METER

- To get auto reading of energy meter and send it to customer.
- It also measures voltage, load current, real power, power factor and No. of units consumed
- Consumer will be able to check the status of his power consumption from anywhere
- To use the electricity in an effective manner
- The increased ability for load management during peak load times
- *Block* Makes more efficient use of grid resources
- Allows the user to switch between conventional to renewable based on the tariff

### DIAGRAM

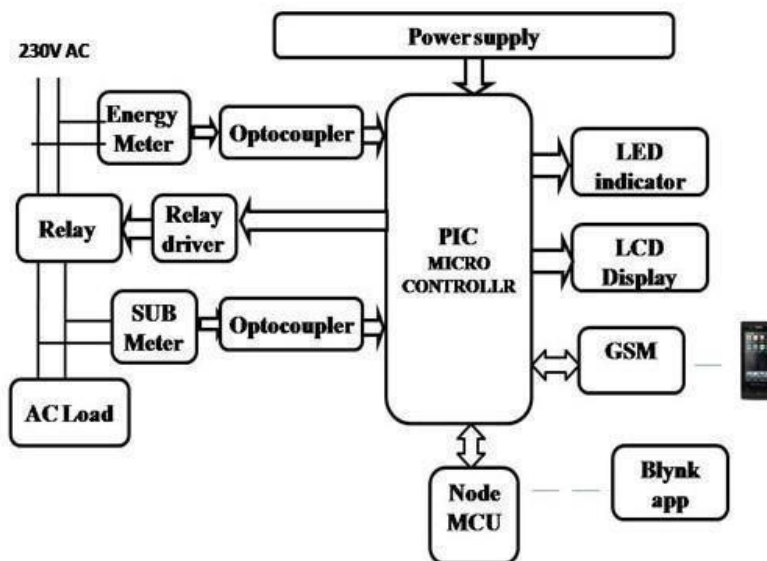


Figure 1: Smart energy meter Block Diagram

### WORKING OF SMART ENERGY METER

The energy meters are connected to the PIC Microcontroller through an optocoupler. The optocoupler sensor gives an interrupt each time the meter LED ashes to the programmed PIC microcontroller and PIC microcontroller process this data to the Nodemcu module then NodeMCU module send this data to the blynk app. The readings of the main energy meter and sub energy meters are compared so as to identify the theft status. Whenever there is difference in the two values, a message that theft has occurred intimate to the consumer through app. We can access the app from anywhere on the globe at any time using logging credential. So the consumers can easily track their energy usage so that effective monitoring of power consumption is possible.

The readings of the main energy meter and electricity department bill reading are compared so as to identify the power theft that theft intimate to the consumer through app and as well as send to the message to GSM. The consumer can set their power limit through app. The readings exceed their set limit then system turns off the power supply automatically using relay. Here relay works as switch to on/off the power supply which is connected to the load. The consumers can turn on /off the power supply when they require through app using IOT. The status of the project is display on LCD.



## CALCULATIONS

Before going to the calculations, first we have to keep in mind the pulse rate meter. There are two pulse rates of energy meter first is 1600 imp/kwh and second is 3200 imp/kwh. here we are using 3200 imp/kwh pulse rate energy meter. first we need to calculate the pulses for 100 watt, means how many times pulse LED will blink in a minute for the load of 100 watts  
Pulse = (pulse\_rate \* watt \* time) / (1000 \* 3600)

So pulses for 100 watt bulb in 60 seconds, with energy meter of 3200 imp/kwh pulse rate can be calculated as below  
Pulses =  $3200 * 100 * 60 / 1000 * 3600$

Pulses = 5.33 pulse per minute

Now we need to calculate power factor of a single pulse, means how much electricity will be consumed in one pulse

PF = watt / (hour \* pulse)

PF =  $100 / 60 = 5.33$

PF = 0.3125 in a single pulse Units = PF \* Total pulse / 1000

Total pulses in an hour is around  $5.33 * 60 = 320$  Units =  $0.3125 * 320 / 100$

Units = 0.1 per hour

If a 100 watt bulb is lighting for a day then it will consume Units =  $0.1 * 24$

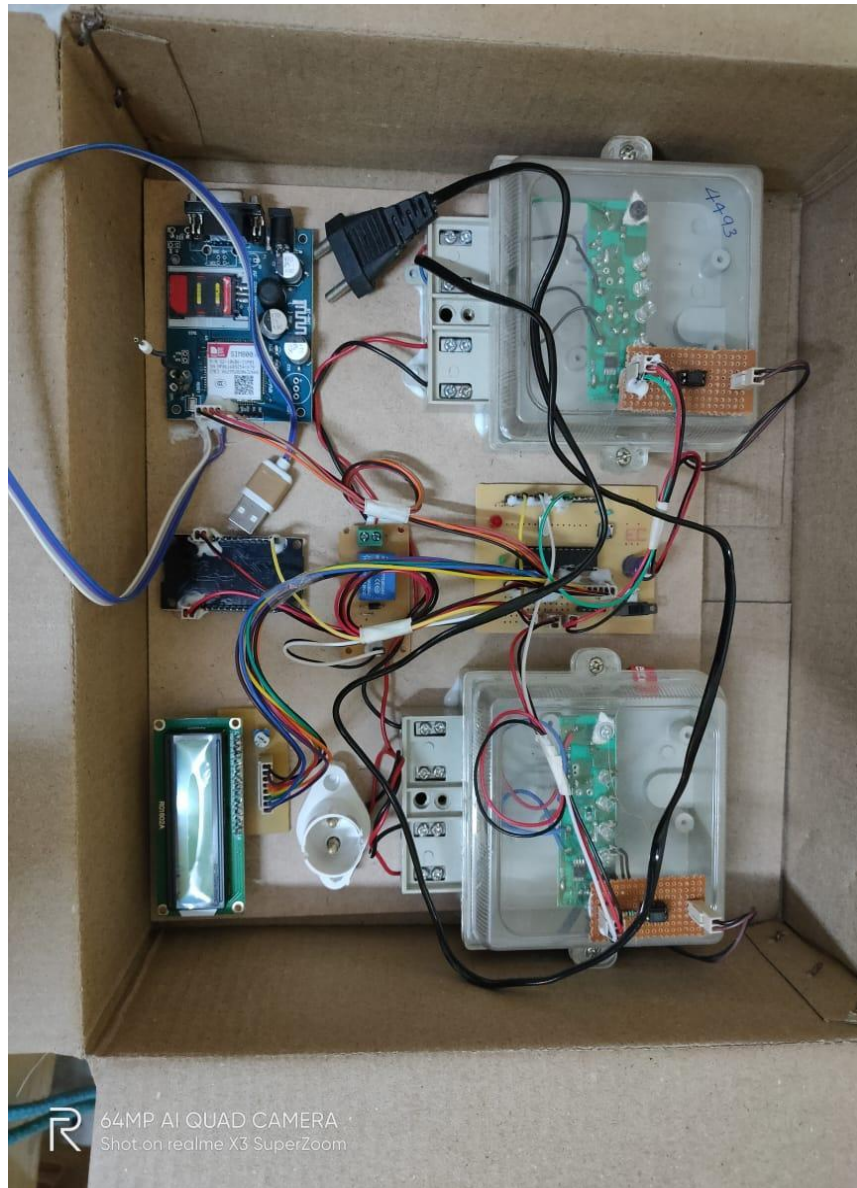
Units = 2.4 Units

And suppose unit rate is at your region is 5 rupees per unit then you have to pay

2.4 Units Rs: Rupees =  $2.4 * 5 = 12$  rupees

## IV. EXPERIMENT AND RESULTS

The paper "IOT BASED SMART ENERGY METER MONITORING, THEFT DETECTION AND DISCONNECTION" aim is to design a smart energy meter using IOT and GSM. All input and output modules are interfacing to the PIC microcontroller and PIC microcontroller process this data to the NodeMCU module then NodeMCU module sends this data to the blynk app.



Prototye of IoT based smart energy monitoring theft detection and disconnection

### V.CONCLUSION AND FUTURE SCOPE

The paper “IOT Based Smart Energy Monitoring Theft Detection and Disconnection. concludes that integrating features of all the hardware components used have been devolped in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC’s with the help of growing technology, the project has been successfully implemented thus the project has been successfully designed and tested.

The performance of the system can be further enhanced by connecting all the household appliances to the IOT. Online bill payment can also be implemented so as to make the system more user-friendly.



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