# IoT Based Smart Energy Meter Billing System

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## ABSTRACT

**An automatic meter billing system using raspberry pi is a system, which automatically sends bill and other information to the owner of the meter. In the traditional system there should need one person who is going to capture the image of meter and with the help of that photo they are going to calculate difference between previous and current reading after that they will get the actual power consumption units and then they multiply the unit cost and bill generates. These all process is generated or operated by human so inaccurate reading and bill generate due to this peoples get trouble so to overcome these errors we are going to introduce our system IOT based smart energy meter using raspberry pi. In our project the power consumption is calculated by raspberry pi and after getting it in form of units, raspberry pi multiplies the unit amount, with that units and then bill sent to cloud and mail id of meter owner. This technology holds good for all electricity distribution companies, private communications, IT parks and self-containing housing projects. The implementation of this project will help in better energy management, conservation of energy and in doing away with the unnecessary hassles over incorrect billing.**

Index Terms — **Raspberry pi, Energy Meter, Current Sensor, LCD, Opto-Isolator, Buzzer, IoT, Embedded System, Raspbian OS, Python**

## 1 INTRODUCTION

The technology of e-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. In addition, they can monitor the meter readings regularly without the person visiting each house. This technology holds good for all electricity distribution companies, private communities, IT parks and self-containing housing projects. The need of the project is to develop a wireless energy meter. The Raspberry pi takes the reading from the energy meter and that reading send to the cloud. The reading of the energy meter is also sent to the user panel and admin panel. Nowadays electricity cost is high, and therefore, it becomes a necessity for the consumer to know how much electricity they, are using, in order to control the electricity bill that should come within their budget.

## 2 PROBLEM STATEMENT

Nowadays, the monitoring of electricity is still required for the human to record the meter value from the house. Customers have to receive the electricity bill then able to make payment without knowing the accuracy of power used by the house owner. The value of meter may not be very accurate as the meter value is entered by human and sometimes human may mistake when entering the meter value. This leads to serious problems when the workers have to go to the house again and re-enter the meter value in order

to correct it. Furthermore, it is difficult to keep track the customer's value of meter and calculates the usage of power for large residential area. Besides, the customer cannot plan on power consumption. It is also difficult to manage the price of customer's power used in meter without centralized server.

## 3 OBJECTIVE

The technology of e metering has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. In addition, they can monitor the meter readings regularly without the person visiting each house. A raspberry pi based wireless communication module is integrated with electronic energy meter of each entity to have remote access over the usage of electricity.

## 4 LITERATURE SURVEY

Meter Reading and Billing are among the most time consuming functions performed by municipalities and energy distribution companies. These functions have a major influence on the utilities cost, efficiency, productivity, structure and cash flow as well. Solutions based on recording readings manually, then entering it into a central billing system are time consuming, prone to errors and delays in delivering bills to customers with negative effect on cash flow. There are many methods involved in the meter reading process; this includes traditional manual methods up to fully automatic meter reading systems: For this work existing meter, reading techniques in India are analyzed and conducted an extensive study on different energy measuring instruments available now. In existing system, either an electronic energy meter or an electro-mechanical meter is fixed in the premise for measuring the usage. The meters currently in use are only capable of recording kWh units. The kWh units used then still have to be recorded by meter readers monthly, on foot. The recorded data need to be processed by a meter reading company. For processing the meter reading, company needs to firstly link each recorded power usage datum to an account holder and then determine the amount owed by means of the specific tariff in use.

### 4.1 EXISTING SYSTEM

The billing process of electricity consumption, which we are using at present, is very long process and requires lot of work force. The energy billing in India is error prone. Going to each consumer's house and generating the bill is a laborious task and requires lot of time. Errors are introduced at every stage of energy billing like errors with electro-mechanical meters, human errors while noting down the meter reading and error while processing the paid bills and the due bills. There are many cases where the bill is paid and then is shown as a due amount in the next bill. There is no proper way to know the consumer's maximum demand, usage details, losses in the lines and power theft. If any consumer did not pay the bill, the operator needs to go to their houses to disconnect the power supply. These processes are repetitive and take so much time. For overcoming all the difficulties present in the system, we are introducing fully automated billing system i.e. "Raspberry Pi Based Energy Meter Billing System".

### 4.2 PROPOSED SYSTEM

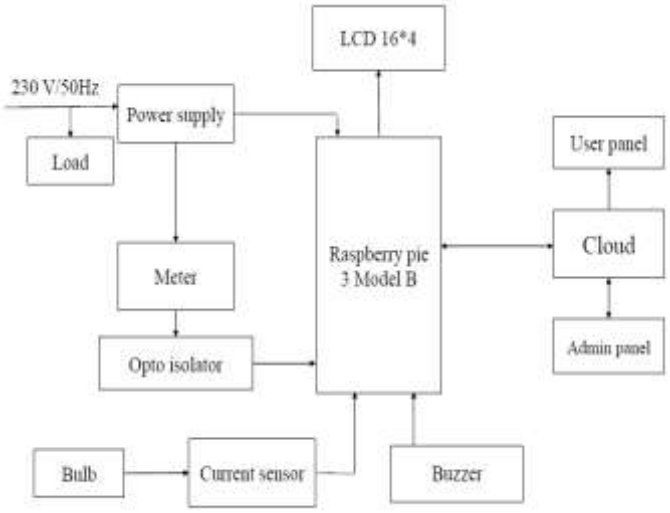
The purpose of our project is remote monitoring and control of the Domestic Energy meter. This system enables the Electricity Department to read the meter readings regularly without the person visiting each house. It sends meter reading to the consumer & Service provider through cloud. A RASPBERRY-Pi unit continuously monitors and records the Energy Meter readings in its permanent (non-volatile) memory location. Raspberry Pi board is used as the Central Unit of this Project. Energy measuring circuit is connected to Raspberry Pi Board. In this system, we give a unique Id number for every energy meter. This system continuously monitors the energy consumption and sends monthly to the service provider and the user. The meter reading is stored in database of Raspberry Pi board. Customer will be updated with weekly consumption of energy and amount of the bill. A 100 or 200-watt bulb is connecting to the current sensor. The current sensor senses the wattage of bulb so that power consumption of bulb can be obtained. Also for purpose of tripping the line we have connect the LED. When the supply is cut LED will off and after supply

is given LED glow. Therefore, that operator can trip the supply in case of danger or for other purposes.

In this proposed system we are going to use the Raspberry pi 3 model B controller to count the pulse from meter as we seen in paper[2] they also used the Raspberry pi controller and to send the billing details they used the GSM modem, here we are not restricted to use the GSM modem to send billing details, we send the billing details to cloud which design through the IP address of the Raspberry pi 3 model B. at the cloud there are two panel, one is user panel which is used to send the billing details to user and second is the admin panel which is authorized distribution company, the admin panel is having the authority to manage the meter system and only admin panel can access the meter.

# 5 DESIGN METHODOLOGY

## 5.1 BLOCK DIAGRAM




## 5.2 CONSTRUCTION DETAILS

The Raspberry Pi 3 Model B is the latest development platform from the Raspberry Pi Foundation. It is at equally at home as the brains behind embedded electronics prototypes or at the center of a Plex driven media center. Essentially a tiny PC, the Pi 3 is compatible with several different operating systems and is plug-and-play with a variety of peripherals. We need to measure the number of units consumed depending upon the usage of power i.e. load. To demonstrate the load consumption, we have used incandescent bulbs of 60W and 100W. Power supply circuits built using filters, rectifiers and then voltage regulators. Starting with an AC voltage, then filtering to a dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level and finally, regulating to obtain a desired fixed dc voltage. A 100 or 200-watt bulb is connecting to the voltage sensor. The voltage sensor senses the wattage of bulb so that power consumption of bulb can be obtained. Also for purpose of tripping the line we have connect the LED. When the supply is cut LED will off and after supply is given LED glow.

## 5.3 POWER MEASUREMENT CONSIDERATIONS

Calculating and displaying power information will always have some associated ripple that will depend on the integration period used in the MCU to determine average power and on the load. For example, at light loads, the output frequency may be 10 Hz. With an integration period of two seconds, only about 20 pulses will be counted. The possibility of missing one pulse always exists as the ADE7757 output frequency is running asynchronously to the MCU timer. This would result in a 1 in-twenty or 5% error in the power measurement.

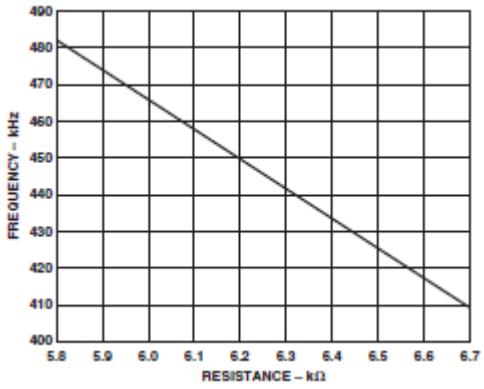



**Fig. 5.1 Effect of RCLKIN on Internal Oscillator Frequency (OSC)**

# 6 ADVANTAGES AND APPLICATION

## 6.1 ADVANTAGES

- The system designed reduces the efforts of manual data collection of energy meter. The users are not bound to pay excesses amount of money.

- Customer service is also improved by using this. By the use of this energy meter, the billing delay and extra cost due to disconnection or reconnection can be removed and we can use the electricity in a controlled manner, which helps the consumer to save their money through better energy management.
- It reduces human efforts.
- It reduces overall cost of traditional meter billing system.

### 6.2 APPLICATIONS

- It can be used as automated power billing in Homes, Commercial buildings, Small scale Industries, etc. The Adaptive meter, which is designed, can be installed in homes, commercial buildings and industries by making certain modifications as per the requirement in which both the suppliers and the consumers are provided with better services regarding meter billing and payment.

## CONCLUSION

An attempt has been made to make a practical model of 'IOT Based Smart Energy Meter.' The propagated model is used to calculate the energy consumption of the household, and even make the energy unit reading to be handy. Hence, it reduces the wastage of energy and bring awareness among all. Even it will deduct the manual intervention. In this system, smart energy meter is designed so supplier can disconnect service to the consumer in the event of meter tampering or unauthorized use of energy. It makes the relation between utility and user more transparent and reliable. Power saving is possible which contributes towards the minimization of the problem of energy crisis.

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