

# Iot Based Smart Energy Meter Monitoring and Billing System.



Manisha Tejawani, Prachi Rane, Moin Syed, Oyesh Patel, Pragyan Pandey

**Abstract:** Paper introduces a system which provides a platform for a consumer to monitor the meter reading via “ThingSpeak” and control the energy consumption, it will also support in keeping the track of energy meter billing. This system helps us to reduce turmoil’s and energy related dissent. The system is implemented using Atmega328P microcontroller and ESP8266 Wi-Fi module. This system do not require the replacement of the energy meter but we associate this system with the installed energy meter that benefit the consumer, the base for designing and implementation of a system is

IoT (Internet of Things). The instantaneous data will be fetched from the meter and uploaded on the ‘ThingSpeak’ IoT cloud platform.

**Keywords:** ATMEGA328P microcontroller, ESP8266 Wi-Fi module, Energy Mete, ThingSpeak.

## I. INTRODUCTION

To measure the amount of energy consumed by domestic, commercial and industrial user, energy meter is being used. As the population of energy consumers are gradually increasing the smart energy meter helps to ease the energy management system. The paper depicts the solution for reducing human involvement in energy management for the domestic and industrial consumers. All the data monitoring is done via a web based portal provided with a dedicated internet connection. The system has to be made in such a way that the power consumption is analysed properly. Currently the system we use required human involvement which leads to the time consumption also, it has always been a necessity that a particular individual or person from the energy department should visit the consumer house and note down the readings and therefore errors can get introduced .So in order to overcome the stress, smart energy meter is introduced. In this work, the system uses Atmega328p microcontroller because it is energy efficient hence it consumes less power. The system will combine with the energy meter which is already installed in place of residence.

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The consumer can easily access the figures of energy meter through a webpage. The distribution companies are unable to keep track of the changing maximum demand of consumers due to this consumer is facing problems like receiving due bills for the bills that have already been paid. So to overcome these problems the remedy is to keep track of the consumers load on timely basis, which will help to assure accurate billing, track maximum demand and to detect threshold value. By considering the present scenario it is important to build an efficient energy meter. The present project “IoT Based Smart Energy Meter Billing and Monitoring System” addresses the problem faced by both the consumers and the distribution companies.

This system make it easier for the electricity department to read the meter readings monthly without a labour work. This can be achieved by the use of Atmega328p unit that continuously monitor and records the energy meter reading in its memory location. The consumers can continuously record the reading and the live meter reading can be access to the consumer on request.

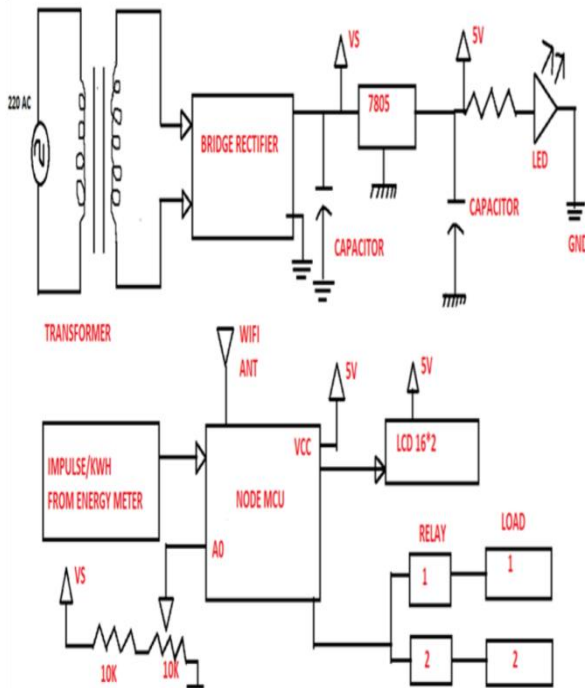
## II. LITERATURE SURVEY

The basic idea is to get an appropriate reading from the energy meter through the SMS service by a GSM module is implemented by Rahman [1]. The system presents the update module in which SMS service is replaced by the Wi-Fi module so that it includes even more features with the help of internet also system provides more flexibility to the consumers to revote his/her conventional post-paid meter to work as a prepaid one presented by Rahul Rajesh B, Mohan Kumar S, Nayab Z Sharief [2]. The system presented by Karthikeyan S, Bhuvanewari P.T.V is cost effective as it requires a simple upgrade on the existing meters than complete replacement because it is light weight and compact due to SoC for control and communication, the basic idea is too strengthened and also to enhance performance of an Energy Meter [3]. Modern day smart grid technology relies heavily on communication networks for two-way communication between load, generation, transmission, and control center so considering this an advanced metering infrastructures (AMI) is used in this system, proposed by Saikat Saha, Swagata Mondal [4].

## III. SYSTEM DESIGN

The design of the system includes power supply, Atemga328p Micro-controller, Esp8266 Wi-Fi module, Relay, Switch, LCD display. The load is driven by the relay which is connected to the Atemga328p and an Energy Meter, Wi-Fi modems to introduce ‘Smart’ concept. The Wi-Fi modems assist the consumer to monitor the consumed readings.

This system continuously monitors the energy meter and calculate the amount of units consumed per day as well as the monthly units consumed and according to the consumed units the bill gets generated which can be accessed by the consumers on webpage. The units in the energy meter can also be shown by the Liquid Crystal Display i.e. LCD. As shown in fig1.



**Fig1: Block Diagram of the proposed system**

The proposed system is designed in such a way that it will not tampered the installed Energy Meter. The system takes input from an Energy Meter it will continuously records the reading and the live meter reading can be displayed on webpage on consumer request.

## IV. METHODOLOGY

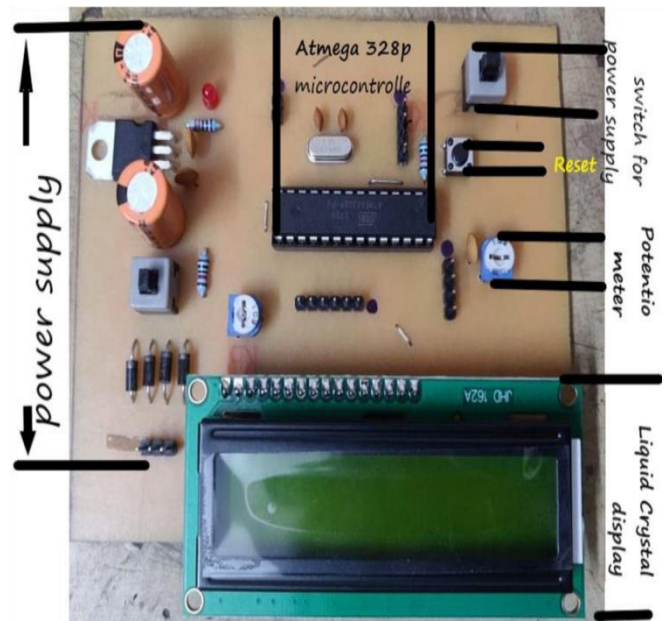
The architecture and working principal of the proposed system is explained below.

The power supply circuit consist of transformer to convert the 240 volts in to 6 volts followed by bridge rectifier to minimize the AC current, capacitor is used to filter the present AC current (filtering circuit), resistors, led, switch (for ON-OFF state), Ic 7805 to get the accurate 5 voltage in an output (Voltage regulator that restricts the output voltage=5v).The Connection of Atmega328p microcontroller IC followed by relay, liquid crystal display is established. Refer figure 1

The schematic of the proposed system is constructed then the PCB formation is done. Connection of the PCB and the energy meter is established. When the appliances of the household consume energy the energy meter reads the reading continuously and this consumed load can be seen on meter. The energy meter has LED which continuously blinks and as per the blinking of LED on energy meter the microcontroller measures the units consumed.

As per the blinking of LED when the LED blinks 3200 it will consumed one unit. The consumed units along with the cost of the consumed units (bill) is continuously displayed on web page. The consumed units will also displayed on LCD.

The system setup is shown in figure 2.



**Fig2: The proposed system**

## V. DESCRIPTION

The technology is getting upgraded every time. As the existing system uses more time consumption every user who is experienced in the existing system thinks of the system which consumes less time and added more flexibility. The proposed system uses Atmega328p microcontroller that can process the impulses taken from the Energy Meter. The consumer's energy meter is monitoring continuously and the number of calories/units is displayed on the LCD.

In the energy meter there is LED which blinks continuously. The blinking of 3200 blinks of an LED gives 1 unit of power consumption.

As per this knowledge the microcontroller IC counts the number of blinks and according to the number of units consumed the bill get generated also the real time analysis can be accessed by the webpage. Also the threshold value is set so the notification will be send to the consumer and it will increase the awareness about the daily consumption of energy.

## V. UNITS

The unit of electricity is Kilowatt hour (kWH).

1kWH = 1000 watt for 1 hour.

Example: 1000watt bulb used for 1 hour gives 1kWH.

## VI. ADVANTAGES

- From this system consumer can set the monthly electricity billing budget. Hence less wastage of energy.
- Every month the person from electricity department has not to visit the consumer house for the note down the consumed energy hence labour work get reduced.
- The cost of this device is not more because the system uses the low cost equipment and also the installed energy meter will not be replaced or tampered. From the installed energy meter by an authorized this system takes the input.

## VII. RESULT

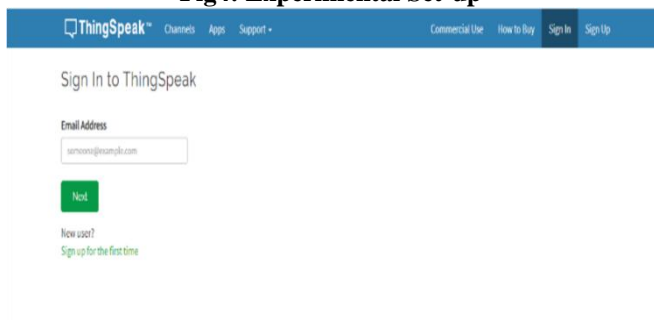


**Fig3: The display of Energy and Pulse.**

As the LED blinking of 3200 blinks consumes the 1 unit which requires the heavy load so in this system instead of considering 3200 pulses = 1 Kwh , So we are monitoring 32 pulses as it gives us 0.01 Kwh .

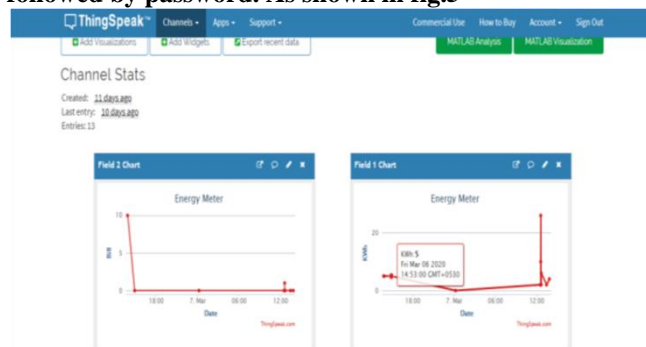


**Fig4: Experimental Set-up**



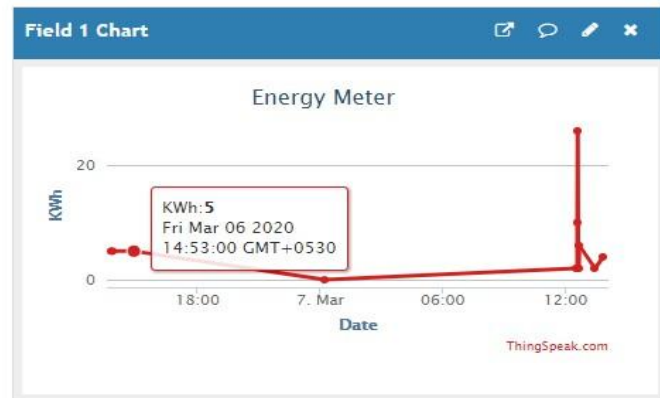
**Fig5: Sign In To ThingSpeak**

**First Login in “ThingSpeak” Enter the Email Address followed by password. As shown in fig.5**

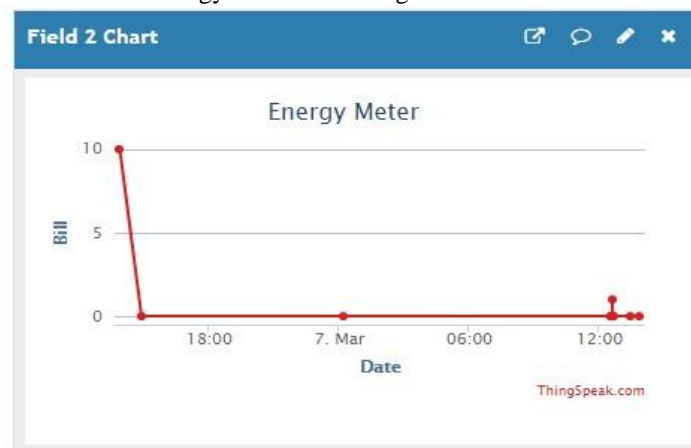


**Fig6: Graph of Energy Consumed.**

In the website the consumer can access the amount of energy consumed in the form of graph. Also the bill get generated in the system we assumed that when the energy meter get 1000wh the system starts generating the bill.



This is the actual view of the graph, the consumer and customer can even see the time, date, day, and how they consumed the energy. As shown in fig.6



The consumer and customer can even monitor the date and the bill in the graph. AS shown in figure above.



**Fig7: Result**

As per the knowledge when 1Kwh is consumed the bill get generated (1Kwh = 1 unit). In this system 3200 blinks of led = 1 unit.

Let A= Number of led blinks  
B= Number of units consumed  
C= Cost of consumption.

If

3200 blinks = 1 unit

So

$B \text{ (Number of units consumed)} = A / 3200$

Assume cost of 1 unit = 5 Rupees ( Depending upon the department the cost vary as well as in some energy meter 1500 = 1 unit as it depends on the manufacturer).



$B \text{ (Total bill)} = B * 5$

The following system keeps the track of units consumed and accordingly generates the bill which can be access by consumer on web page.

## VIII. CONCLUSION

An electric 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 customer's premises for billing purposes at the end of the month a person from the electricity department has to visit the consumer premises and note down the reading. This system makes trouble-free for electricity department to access the energy consumed by the consumer from the customer Id also the consumer monitor the energy consumed per day and every day bill get generated on the webpage. The system reads the data from the energy meter without tampering it, the proposed model is used to calculate the energy consumption of the household. Hence the wastage of energy is less and it also bring awareness among all.

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