

## SMART WIRELESS ELECTRONIC ENERGY METER

NIKHIL N. PATIL[1], SUMIT N. KHAMKAR[2], DILEEP M. BIND[3], VIVEK R. KURADE[4], GANESH L. SONAWANE[5]

<sup>1,2,3,4</sup> Department of EXTC, DRIEMS College, MAHARASHTRA, INDIA

<sup>5</sup> Professor, Department of EXTC, DRIEMS College, MAHARASHTRA, INDIA

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**Abstract** - This paper proposes smart, integrated power consumption monitoring system has been implemented with the use of open standard technology, commercial project & household items which actively monitors the voltage & current ration in remote system. Here a GSM based smart energy metering system using IOT which will replace traditional meter reading method. They can monitor the meter readings regularly without the person visiting each house. ATMEGA328 based power consumption monitoring system that senses parameters & shows on an LCD display. The meter readings are automatically send on Cloud generated using IOT. This system will prevent the illegal usage of electricity. It will provide pure transparency in the system. The main target of this system is to reduce miss communication between the user & distributor. This system will also help to bring transparency in electricity bills. It is more efficient & can be implemented in low cost.

**KEYWORDS:** ENERGY METER, ATMEGA328, ARDUINO, GSM MODULE, IOT, LCD

### I. INTRODUCTION

Electrical metering instrument technology has come a long way from what it was more than 100 years ago. From the original bulky meters with heavy magnets & coils there have been many innovations that have resulted in size & weight reduction in addition to improvement in features & specifications. So it is new concept in world of Electricity measurement. This concept is not only beneficial for electricity measurement but also has the capability to prevent misuse of electricity. Now a days, the energy consumption & distribution has become a big subject for discussion because of huge difference in energy consumption & energy production. At present most of the houses in INDIA has the traditional mechanical watt hour meter & the billing system is not automated. So a new system was discussed known as smart energy electronic meter which uses cloud in it. Cloud communication refers to technology that enables machines to be networked so data can be freely exchanged among these assets. It is a form of data communication that involves one or more entities that do not necessarily require human interaction or intervention in the process of communication. It can be in two ways one of them is Uplink to collect product and usage information and another is Downlink to send instructions or software updates, or to remotely monitor equipment. In our system we are using arduino for getting the Energy consumption

data of remote distance. Here we are using GSM model to transfer the data from the user meter to corresponding cloud based server using IOT (Internet of Things). IOT service to make the global system connectivity to portrait the electricity oriented records to all its respective users via online. The arduino commands the GSM module to transfer data using IOT on the cloud. In this system the ATMEGA328 Processor is used which is a single-board controller intended to make the application of interactive objects of environments more accessible. The hardware consist of simple hardware board design around an 8-bit Atmel microcontroller.

### II. LITERATURE SURVEY

[1] In the year of May 2012 the authors Abhinandan Jain, Dilip Kumar, Jyoti Kedia presented a paper titled "SMART & INTELLIGENT GSM BASED AMR SYSTEM". This paper represents the development of fully automated energy meter which is having capabilities like remote monitoring & controlling energy meter. Automatic meter reading (AMR) system continuously monitors the energy meter & sends data on request of service provider through SMS. It saves huge human labor.

[2] In the year of June 2012 the authors O. Homa Kesav, B. Abdul Rahim presented a paper titled "AUTOMATED WIRELESS METER READING SYSTEM FOR MONITORING & CONTROLLING POWER CONSUMPTION". In this paper the design presents new method for avoiding high construction & maintenance cost in the existing system. The system is designed in such a way that if the consumer is unable to pay the bill the power connection maybe disconnected automatically from remote server. The ARM 7 based hardware system consist of a processor core board & the peripheral board. The embedded C language is used as programming language in this system.

[3] In the year of November 2016 the authors S. V. Anushree T. Shanthi presented a paper titled "IOT BASED SMART ENERGY METER MONITORING & THEFT DETECTION USING ATMEGA". The main objective of the system is detection of theft of electricity increases the cost paid by customers & can have serious safety consequences. Identify the theft by sending alert SMS to owner send meter reading & rate every month to the owner. This system has an additional set up of IOT which portraits the global connection environment to the user & allow them to view

the status of meter reading from anywhere at any time theft of electricity as a material impact on customers in terms of cost & safety.

[4]The authors Rajesh T S, Anup Jose, Midhun P, .Vishnu Das presented a paper titled "SMART ENERGY METER". The traditional metering system has many disadvantages as manually reading has shortcomings such as errors in taking readings, inaccuracy, external conditions affecting readings, delayed work & location of consumers. In order to overcome the problem of traditional meter reading system automatic meter reading system is used. The three key elements in automatic meter reading system are consumption measurement, meter reading, transmission of measure data & data processing & billing.

### III. BLOCK DIAGRAM

This paper consist of following blocks Arduino UNO AVR controller is central for all controlling this smart energy meter. Energy meter is another important one in this system which is used for live reading of electricity consumption & which is interface with controller to communicate with server & which operates according server commands. Total blocks of the system is shown below:

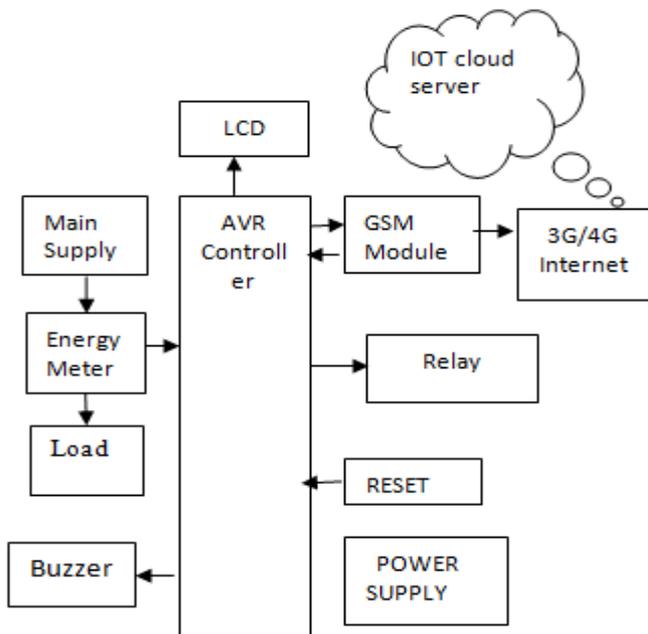


Fig. 1: Block diagram of Smart Energy Meter System  
[Note: Power Supply is connected to all the respective components]

The above diagram represented the block diagram of our system. It consist of sensor for detecting current going to the load so that we can calculate the total power demanded by the load which are sensed & further processed by microcontroller kit. Microcontroller drives LCD display

which displays the values. Further switching section & relay circuits are provided for driving loads if required. When the readings from the sensor deviate with respect to the input values from the controller. The microprocessor send out a signal to the effecters to adjust the setting back to the input values.

### IV. FUNCTIONS OF COMPONENTS

[1]ARDUINO: It is an open source computer hardware & software & software company project & user community that designs & manufactures single-board microcontrollers & microcontroller kit. Hardware means arduino circuit & software means where we can type our program or command the arduino. So basically it has two sides like programing to control the project & hardware means arduino device.



Fig. 2: ARDUINO UNO

It is tool for control the project or give the instruction to the circuit or project. Arduino UNO is very easy to use & it is cost efficient & easily available in the market. The simple c programing language is used & very easy to implement the program like just connect the arduino to computer using connector cable & implement the program.

[2]ENERGY METER: an energy or electric meter is a device that measures the amount of electrical energy consumed by a residential, commercial or an electrically powered device.



Fig. 3: ENERGY METER

Electric meters are typically in calibrated in billing units, the most common one being the kilowatt hour. It measures electrical units which was used in a electrical appliances. Electrical energy meter is nothing but the device which is used to count the electrical units. SI unit of unit is Kilowatt hour [Kwh]

$$72 \text{ cycles} = 1 \text{ unit} = 1 \text{ Kwh}$$

$$1000 \text{ watts} = 1 \text{ kilowatt}$$

For example, 1000 watts in one day

$$\begin{aligned} \text{Therefore } 1000 \times 24 &= 24000 / 1000 \\ &= 24 \text{ Kwh} = 24 \text{ units} \end{aligned}$$

[3]GSM MODULE: GSM is a mobile communication modem it stands for Global System for Mobile communication. A GSM modem is a specialized type of modem which accepts a SIM card & operates just like a mobile phone. From the mobile operator perspective a GSM modem looks just like a mobile phones. When a GSM modem is connected to a computer this allows the computer to use the GSM modem to communicate over mobile network.



Fig. 4: GSM modem

While this GSM modems are most frequently used to provide mobile internet, internet connectivity many of them can also be used for sending & receiving SMS. It is used for transmitting mobile voice & data service operate at the 850 MHz, 900 MHz, 1800 MHz & 1900 MHz frequency bands.

[4]LCD: Most common LCD's connected to the microcontroller are 16 x 2 & 20 x 2. This means 16 character per line by 2 line & 20 character per line by 2 line respectively.



Fig. 5: LCD

An LCD or Liquid Crystal Display, is a type of screen that is used in many computers, TV's, digital cameras, tablets & cell phones.

[5]RELAY: It is electrically operated switch. Relay are used where it is a necessary to control a circuit by a low power signal or where several circuit must be control by one signal.



Fig. 6: RELAY

Relays with calibrated operating characteristics & sometimes multiple operating points are used to protect electrical circuits from overload or faults. It used to shutting off power supply when due limit is over.

[6]POWER SUPPLY: Power supply is a circuit it converts unregulated DC into constant DC with the help of rectifier. It converts AC supply into DC.

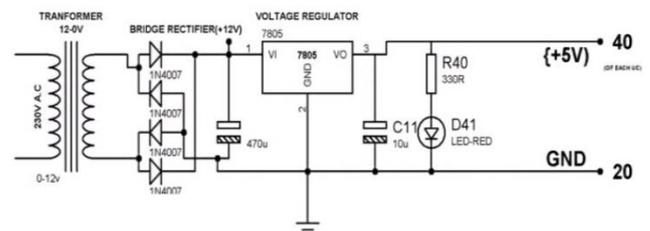


Fig.7: POWER SUPPLY

Its function is to supply a stable voltage to a circuit or device that must be operated within certain power supply limits. The output from the regulated power supply maybe alternating or unidirectional, but is nearly always DC.

[7]Internet Of Things (IOT): Using the ThingSpeak.com we get a free cloud server. This cloud server provides 500 Mb as a storage.

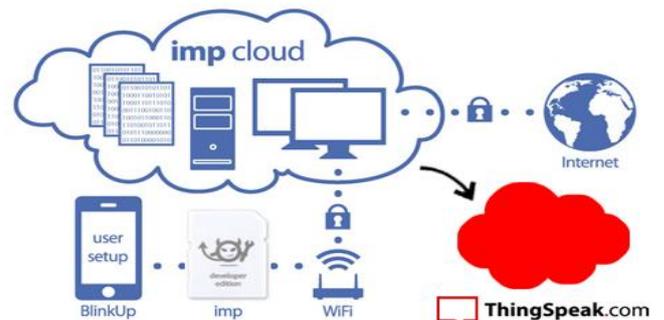


Fig. 8: IOT

Sign Up for a Thing Speak account then Create a new Channel by going to your Channels page and clicking Create New channel & update your Channel via URL. View your Channel feed & Follow a tutorial for common devices and applications

## V. WORKING

The main load from the MSEB or the various distributor is given to the meter. The main load consist of 230 volt and 12-14 ampere current. The various home appliances get the power supply from the energy meter. Then the relay is connected to the CAL LED that is blinking LED. The relay consist of opto coupler IC in it. This IC has 6 pins. The relay is used to provide constant current voltage supply to the appliances. It is operated by relatively small electric current that can turn on or off a much larger electric current. The heart of relay is electromagnet. The relay can work either as switch (turning things on or off) or as amplifier (converting small current into large). Now the realy is connected to the arduino. The connection is such that arduino uno / AVR microcontroller is linked to the blinking LED present in energy meter. Here meter is interfaced with microcontroller through the pulse i. e always blink on the meter further that pulse is calculated as per its blinking period, using this principle we calculated it for 1 unit an accordingly what charge will be for unit. This blinking represent 1 cycle i. e 1 blink is equal to 1 cycle. Then the 72 cycles count makes 1 unit the SI unit of energy meter unit is Kwh.

72 cycles = 1 unit = 1 Kwh

1000 watts = 1 kilowatt

The AVR controller act as a central controller of the whole system. The required input power to the AVR is provided by the energy meter with respect to power supply circuit. This power supply circuit help us to get 5 volt to run the whole system. The AVR works in bi-directional. It gives & takes commands. It take the command from user which will be implemented or prograded by user with the help of proگرامing C language & give this command to the specific component. The ATMEGA328 IC is used in AVR controller in which program will be implemented give the commands to the components. The input from the AVR is given to the LCD which is of 16 x 2 to display the current reading of user's energy meter. The output given to the LCD is tracked by the AVR to keep the track of the amount of usage done by the user. Here we have developed a technology where we can control & restrict the usage of energy by adding the amount of unit. If the limit is exceed, then the AVR commands the buzzer to buzz & notify the user to stop the buzzer. The reset button is used to stop the buzzer. The other output from AVR is given to the cloud server through using internet. For internet we have a 3G/ 4G GSM module which consist of telecom network (3G / 4G SIM card). It has data connection using which it will upload the data on cloud server. This

cloud server is freely available on ThingSpeak.com. They provide free cloud space up to 500 Mb as a cloud server. Using ThingSpeak.com we can create our own server by creating an account which will gives us & MSEB or provider an application Id & password which is accessible only for particular user & distributor.

## VI. CONCLUSION

The designed energy monitoring system has proven to successfully acquire accurate measurements for energy meter. A very systematic approach has been used for the overall design of the project, in which power consumption factors were to be controlled. This system will bring transparency between provider & consumer.

The IOT based energy meter for calculating consumed power & displayed in LCD has been achieved. The consumed power is send through serial communication to the virtual terminal constructed in PROTEUS. This project can therefore enlighten management about wasted time & unnecessary trips, book keeping & billing because it gives an accurate accounting of units driven because of the prevention of malpractice.

## VII. REFERENCES

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