

IOT Based Intelligence of Electric Meter

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Abstract: Electricity is one of the basic requirements of human beings, which is widely used for domestic, commercial and agricultural purposes. There is a great demand for electricity and it is increasing day by day, also there are lots of problem regarding its distribution and metering. The electrical supply line extends over millions of kilometers depending on the consumer and it's a tedious job to collect the information related to the energy consumption from each consumer. The meter reader has to travel all the way and collect the required data. The collected data must be processed in the central database. In this paper a wireless method is proposed which puts emphasis on Intelligent Energy Meter reading and bill generation using Arduino Mega and Ethernet Shield. The monthly generated bill will be sent to the consumer through SMS using GSM900. In case of failure of payment by a consumer the controller wirelessly using the concept the Internet of Things (IOT) can disconnect the power supply using a relay of the consumer.

Index terms- Energy meter, ArduinoMega (microcontroller), IOT, GSM900 Ethernet shield, Web server

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. The energy meter reading is a difficult job where the meter reader has to travel on foot and take the readings from each consumer manually to generate the bill. Also this method of collecting data becomes problematic and costly when readings have to be collected from vast and often scattered rural areas. For households at

the top of huge buildings, individual housing plots etc the traditional meter reading process is inefficient. There are chances for missing the bills, absence of consumer etc. If we automate this process of collecting the consumed energy and the payment system, it will help to reduce the difficult task. This paper suggests a new network communication system for energy meter reading which integrates communication technology and software system along with the existing meters. 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 consists of simple hardware board design around an 8-bit Atmel microcontroller. By identifying the consumer's number, the communication channel and thereby the information regarding energy consumption of each individual consumer can be noticed. Thus the central office can verify the energy meters performance as and when required. This will also help to avoid any misuse or break down of energy meter. Finally after collecting the required data for a particular period which is demanded by the consumer can be send to them as SMS (Short Messaging System). This system will prevent the illegal usage of electricity. It will provide pure transparency in the system.

II. LITERATURE SURVEY

An extensive study has conducted on different energy measuring instruments which are available today. In the present scenario either an electronic energy meter or an electro-mechanical meter is fixed in the premise for measuring the usage. Such meters are capable only for recording kWh units. The kWh units recorded by meter readers must be updated monthly, on foot. The recorded data need to be processed by a meter reading company and a copy of it should be provided to the consumer. Many systems built on various platforms have been proposed for Automatic Meter Reading. There are two types of meter reading systems depending up on the mode of transmission, wire-based and wireless. Wired AMR system includes Power Line Carrier (PLC), Telephone Line Network (optical/ cable) and several related works are available. In the year of May 2012 the authors Abhinandan Jain, Dilip Kumar, JyotiKedia 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. 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 portrays 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.

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 Fig.:- Electronic Energy Meter Bill [2] 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.

Problem Statement:

Using "Real Time Internet Connectivity" the project enlightens the miscommunication and un-transparency to the customer by providing the real time data on cloud server (Internet Of Things) at the same time it helps the billing company for the sophisticated billing architecture.



Fig.:- Electronic Energy Meter Bill [1]

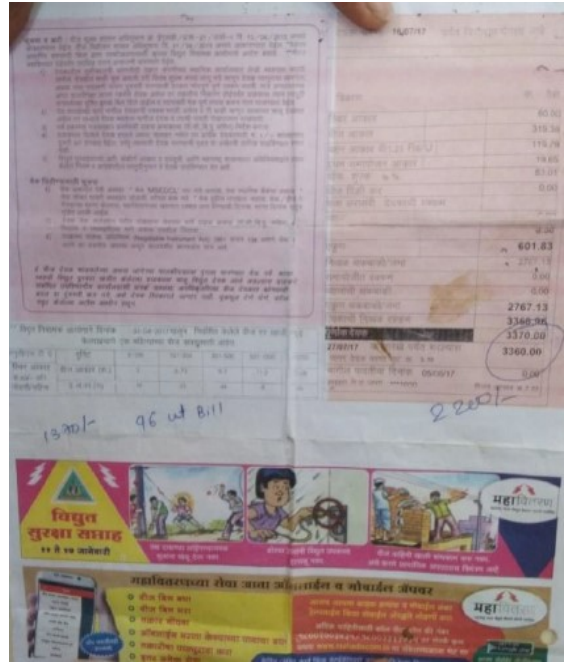


Fig.:- Electronic Energy Meter Bill [2]



Ram Prasad, a marginal farmer in Chhattisgarh's Mahasamund district, was left in shock when he received an electricity bill of whopping Rs. 76.73cr from the State Power Distribution Company.

Fig.:- Hike News of Electricity Bill

III. IMPLEMENTATION DETAILS:

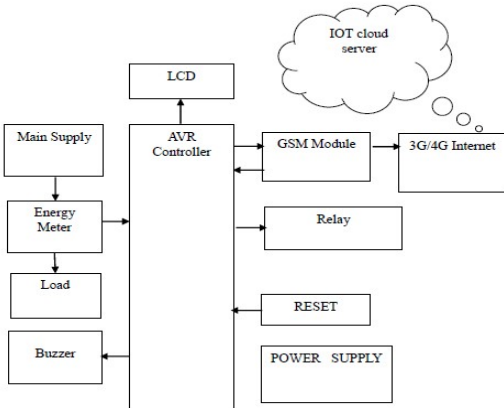


Fig.- Block diagram of Smart Wireless Electronic Energy Meter System

This project consists of following blocks Arduino UNO AVR controller is heart for all controlling the smart energy meter. Energy meter is another important device in this system which is used for live reading of electricity consumption & which is interfaced with controller to communicate with server & which operates accordingly to server commands. Total blocks of the system are shown in above figure. 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 is provided for driving loads if required. When the readings from the sensor deviate with respect to the input values from the controller. The microcontroller sends out a signal to the effecters to adjust the setting back to the input values.

IV. PROJECT MODEL



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. 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. It mainly consists of a regulating IC 7805 and a bridge rectified and it provides a regulated supply approximately 5V.

The step down transformer is used to convert 230V to 5V. To regulate the voltage from the bridge rectifier, capacitors are connected. Capacitors C_p filter the output voltage of the rectifier but their output is not regulated and hence 7805 is connected which is specially designed for this purpose. The 100uF and 10uF capacitors are used for further filtering the current and thus we get a smooth 5V power supply.

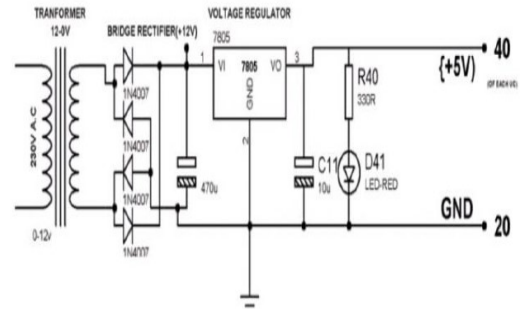


Fig.- Circuit Diagram of Power Supply

Proteus:

PROTEUS is easy-to-use PCB software for beginners. What's Special? This electronics design software consists of two applications, one for drawing schematics and the other for PCB layout. Express PCB circuit board layout program allows you to complete your layout in a few simple steps. The same is the case with Express SCH. These both have the same user Interface.

Proteus Software:

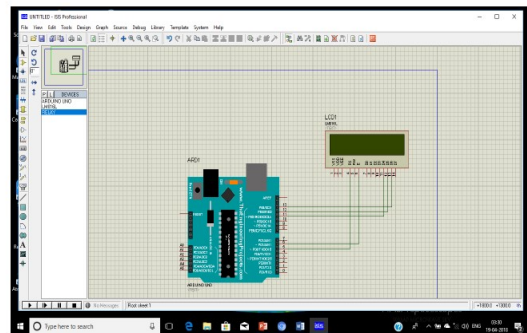


Fig.- PROTEUS Software

V. RESULT

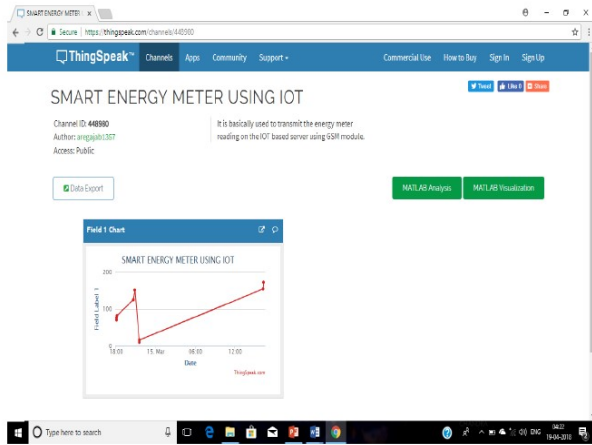


Fig.-: create a server on ThingSpeak.com

Here is this figure we getting the graph of pulse count vs date. We are using the Thingspeak.com website to getting the password and ID we getting channel id as 448980 and it access is public. By using this kind of website we are getting the free password and id for us.

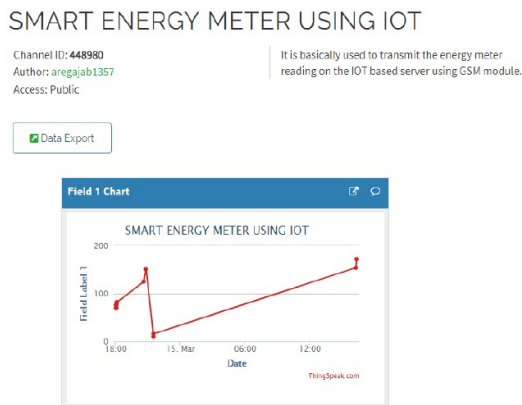


Fig.-: Results on server

Thus we can get the result as a graph of date vs pulse count by using this graph we can able to get the exact pulse count and also chart is showing the day wise pulse count so that user can able to understand day wise pulse count. This graph is use to tract the energy consumption by user also those who are going to make the bill for them also it is use full for them to tract the pulse count and also user can also able to get the pulse count.

SMART ENERGY METER USING IOT

Channel ID: 448980
 Author: aregajab1357
 Access: Public

It is basically used to transmit the energy meter reading on the IOT based server using GSM module.

Data Export

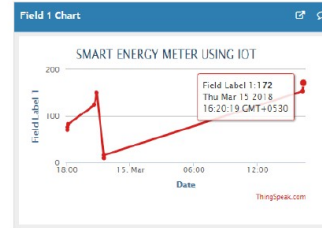


Fig.-: Result on a server with Date and Time

Thus we can get the result as a graph of date vs pulse count by using this graph we can able to get the exact pulse count and also chart is showing the day wise pulse count so that user can able to understand day wise pulse count. This shows that the field level of pulse count vs date and also shows that the pulse count in this figure field level is shows that the Thursday march date -15, 2018 and time -16:20:19 at a particular time and date how much pulse count is read by the remote meter reading.

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. FUTURE SCOPE

1. It can be used for electricity measurement as well as gas and water.
2. Different software development strategies and various programming techniques can be exploited to enhance system efficiency.
3. This system can also implement on Wi-Fi.
4. Improved security systems.

VIII. APPLICATIONS

- Efficient system
- Commercial areas

- Integrated billing system

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