

SMART ENERGY METER USING IoT

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ABSTRACT -Monitoring and keeping tracking of your electricity consumption for verification is a tedious task today since you need to go to meter reading room and take down readings. Well it is important to know if you are charged accordingly so the need is quite certain. Well we automate the system by allowing users to monitor energy meter readings over the internet. Our proposed system uses energy meter with arduino system to monitor energy usage using a meter. The meter is used to monitor units consumed and transmit the units as well as cost charged over the internet using Wi-Fi connection. This allows user to easily check the energy usage along with the cost charged online using a simple web application. Thus the energy meter monitoring system allows user to effectively monitor electricity meter readings and check the billing online with ease. It presents a low cost and flexible energy meter monitoring system using IOT. This technology offers new and exciting opportunity to reduce our work and to prevent the equipments from damages.

Keywords—Energy meter, Arduino module, IoT, WI-Fi, webpage.

(I) INTRODUCTION

Today the technology is getting improved and used for the ease in our day to day life. The life is getting automated for the simplicity, security, saving electricity and time. In the present billing system the distribution companies are unable to keep track of the changing maximum demand of consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality

even if bills are paid regularly. The remedy for all these problems 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. These are all the features to be taken into account for designing an efficient energy billing system.

In this work, the idea of smart energy meter using IoT and Arduino have been introduced. In this method we are using Arduino because it is energy efficient i.e. it consumes less power, it is fastest and has two UARTS. In this work, energy meters which are already installed at our houses are not replaced, but a small modification on the already installed meters can change the existing meters into smart meters. The use of GSM module provides a feature of notification through SMS. One can easily access the meter working through web page that we designed. Current reading with cost can be seen on web page. Automatic ON & OFF of meter is possible. Threshold value setting and sending of notification is the additional task that we are performing)

The present project "IoT Based Smart Energy Meter" addresses the problems faced by both the consumers and the distribution companies. The paper mainly deals with smart energy meter, which utilizes the features of embedded systems i.e. combination of hardware and software in order to implement desired functionality. The paper discusses comparison of Arduino and other controllers, and the application of GSM and Wi-Fi modems to introduce 'Smart' concept. With the use of GSM modem the consumer as well as service provider will get the used energy reading with the respective amount, Consumers will even get notification in the form of text through GSM when they are about to reach their threshold value, that they have set. Also with the help of Wi-Fi modem the consumer can monitor his consumed reading and can set the threshold

value through webpage.

The internet of things (IoT) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms of communication between things and people, and between things themselves. Building IoT has advanced significantly in the last couples of years since it has added a new dimension to the world of information and communication technologies.

This system enables the electricity department to read the meter readings monthly without a person visiting each house. This can be achieved by the use of Arduino unit that continuously monitor and records the energy meter reading in its permanent (non-volatile) memory location. This system continuously records the reading and the live meter reading can be displayed on webpage to the consumer on request. This system also can be used to disconnect the power supply of the house when needed.

The challenge for the embedded industry is to unlock the value of this growing interconnected web of devices, often referred to as the Internet of Things (IoT), describing it as the ultimate tool in our future surveillance. This network has the power to reshape our cities.

(II) DESCRIPTION

Every user who is experienced in the existing system may think of a system that may add more flexibility and run with some common applications such as android. The proposed system is designed in such a way to avoid the limitations of the existing system. The proposed system supports more flexibility, comfort, ability and security.

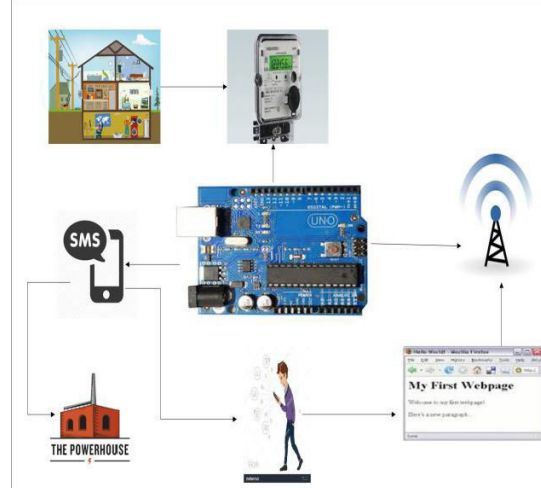


Figure 1: Architectural Diagram

When the various appliances of the household consume energy the energy meter reads the reading continuously and this consumed load can be seen on meter.

We can see that the LED on meter continuously blinks which counts the meter reading based on.

The blinking, the units are counted. Normally, 3200 blinks is one unit.

In our project we are trying to develop, a system in which Arduino Uno act as main controller, which continuously monitor energy meter.

As per the blinking of LED on energy meter the Arduino will measure the unit consumption.

The measured reading with the calculation of the cost will be continuously displayed on web page that we have designed.

Threshold value can be set on webpage with the help of Wi-Fi, as per the consumer's requirement. When the consumers reading will be near about to the set threshold value it will send a notification value to the consumer.

This threshold value notification will increase the awareness amongst the consumer about the energy.

When the consumer gets the

notification he can visit the webpage and change the threshold value.

If the consumer is not aware with the threshold notification, then the meter will automatically get off. Then the consumer has to visit the webpage again and increment the threshold value. By the incrementation, the meter will automatically get ON.

Finally the overall monthly bill with cost will be sent to customer as well as service provider in the form of text at first day of every month.

(2) ARDUINO UNO (ATMEGA 328)

Arduino board is the heart of our system. Entire functioning of system depends on this board. Arduino reacts to the 5v supply given by opto-coupler and keeps on counting the supply and then calculates the power consumed and also the cost. This data, it continuously stores on webpage, so that users can visit any time and check their consumption. It even reacts accordingly as per programed, to the situations like message sending during threshold value etc..

(3) WI-FI MODULE (ESP8266)

Wi-Fi stands for Wireless Fidelity. We are using Wi-Fi which acts as heart for IoT. Through Wi-Fi the consumer can set changes in threshold value, he can ON and OFF the energy meter. Time to time the readings of units and cost are displayed on webpage. Consumer can access the Arduino board and meter with help of Wi-Fi.

(4) WEBPAGE (HTML)

We designed webpage for operating Arduino and Energy Meter with the help of HTML. HTML stands for Hypertext Markup Language. It is a standard markup language for creating web pages and web applications with Cascading Style Sheets (CSS) and JAVA scripts it forms a triad of cornerstone technologies for World Wide Web. Web browser receives HTML documents from a Webserver or from local storage and render them into multimedia web pages.

HTML describes the structure of web page semantically and originally included cues for the appearance of the document. HTML elements are the building blocks of HTML pages.

(5) OVERVIEW OF INTERNET OF THINGS

The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical system, which also encompasses technologies such as smart grids, virtual power plants, smart homes and smart cities. Each thing

(III) EASE OF USE

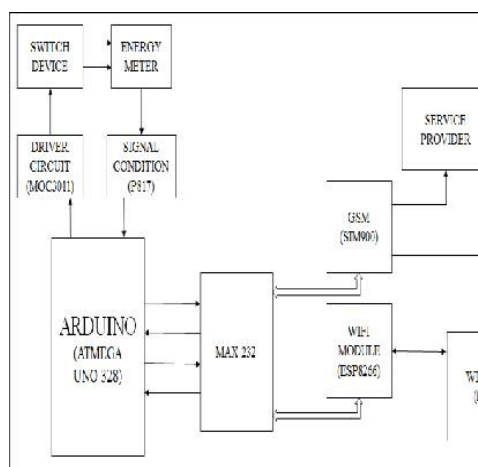


Figure 2: Block Diagram Representation

The above block diagram represents our proposed IoT

BASED SMART ENERGY METER' system:

(1) ENERGY METER

Energy meter or watt-hour meter is an electrical instrument that measures the amount of electrical energy used by the consumers. Utilities is one of the electrical departments, which install these instruments at every place

like homes, industries, organizations, commercial buildings to charge for the electricity consumption by loads such as lights, fans, refrigerators and other home appliances.

Energy meter measures the rapid voltage and currents, calculate their product and give instantaneous power. This power is integrated over a time interval, which gives the energy utilized over that time period.

is uniquely identified through its embedded computing system but is able to interoperate within the existing internet infrastructure

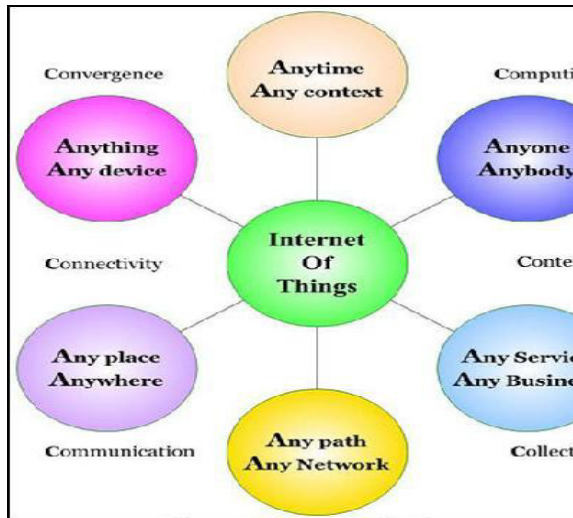


Figure 3: IoT Representation

People also want to communicate with all non-living things through internet such as home appliances, furniture's, stationeries, cloths etc. The people already have a lot of technologies to interact with living things but IoT enables to communicate with non-living things with comfort manner. IoT is a convergence of several technologies like ubiquitous, pervasive computing, Ambient Intelligence, Sensors, Actuators, Communications technologies, Internet Technologies, Embedded systems etc.

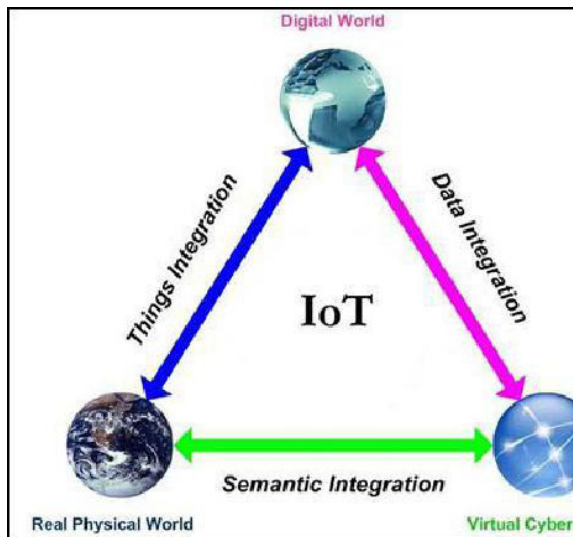


Figure 4: IoT Working

(6) Why ARDUINO board than other

controller?

Well known, controllers to us are 8051, pic 16f/18f, ARM7, msp430, other latest boards like Intel Galileo Gen 2 etc. Out of all these ARDUINO is the best.

We require two UARTS, but pic 16f/18f and 8051 has only one UART.

Whereas ARDUINO has two UARTS as required, one in hardware and other in software.

Msp430 has 3 UARTS but it is very costly than ARDUINO.

ARDUINO is even less in cost as compared to other controller.

Other boards like Intel Galileo gen 2 are very very costly and complex to handle.

The best part of Arduino usage is that its programming is very easy as compared to other devices.

For the new start by students it's very feasible and easy to use.

(IV) ABBREVIATION USED

IoT - Internet of Things LED - Light Emitting Diode. Wi-Fi - Wireless Fidelity HTML - Hyper-Text Markup Language

(V) UNIT

Normally, basic unit of electricity is Kilowatt hour (KWh).

1kWh = 1000 watt for 1 hour.

Example,

Ten 100watt bulbs used for 1 hour gives 1kWh.

(VI) ADVANTAGES

TO THE CONSUMERS

Can set the monthly electricity billing budget.

No need to wait for the month end bill.

They know exactly how much power is being utilized.

Efficient use of energy.

TO THE UTILITY

Less labor cost. There is no need of human operator to go to the consumers address to take down the reading.

Remote access of the meter reading. Optimum generation cost, raw material, losses and hence increase in revenue.

The readings recorded can be used by R&D department.

(VII) RESULT

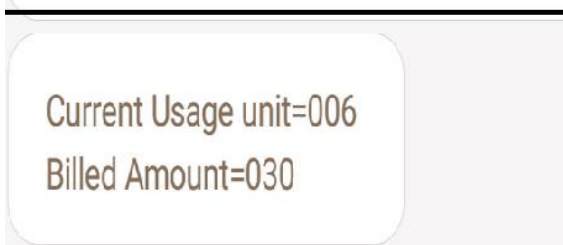
1] Our proposed system web page, where threshold is taken as 5units. Forward represents +5 and reverse -5 units. Current unit with cost will be displayed.



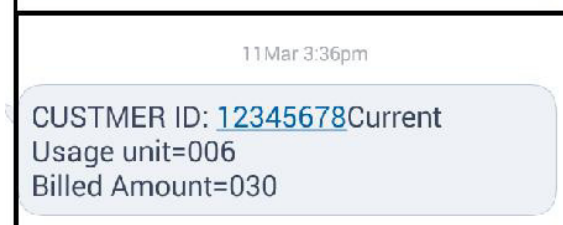
2] When threshold is about to over the following message will be sent to consumer.



3] Monthly consumption of power will be send as message to the consumer with total bill of electricity.



4] The monthly bill with unit consumption and user Id will be sent to service provider.



(VIII)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 in 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.

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