

IOT AND GSM BASED SMART ENERGY METER

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1. ABSTRACT

According to present scenario, energy saving is very important because of difference between demand and power generation. The IoT And GSM Based Smart Energy Meter system will be controlled by using Wi-Fi module. The Internet of Thing (IoT) is the media to transfer the data under the network without any help of a human to human or human to computer interrelation. The electrical load can be consumed regularly by paying the required amount. When the electricity bill is not paid then the supply will be OFF through the service provider A meter readings Collection is not efficient, because a meter reader has to physically be on consumers site to record the readings and handover the bills to the consumer every month.

This procedure is known as meter reading. The main drawback of this system is that person appointed form service provider has to go area by area and he has to collect the meter reading of every consumer and after one week handover the bills. This system have errors such as extra bill amount or notification from electric board even though the bills are paid are common errors. To overcome this problem we have to contact the division office of the electricity board. So to overcome this drawback we have come up with an idea which will eliminate the third party between the consumer and service provider, even the errors will be overcome.

In this paper the idea of IoT and GSM based smart energy meter has been introduced. The Arduino-UNO is used because it is energy efficient, fastest and has two UARTS. A small modification on the already installed meters can convert the existing meters into smart meters. GSM module is used to provide information through SMS. It can easily approach the meter working through web page that we have designed. Meter Automation is

possible like Auto ON & OFF and Sending of Notification by service provider.

2. INTRODUCTION

Energy conservation is the important needs in these days. Increasing the demand for energy consumption there energy monitoring will be taking important role hence it is considering as the research focusing on both electricity consumer and provider. This paper provides the ability to get the electricity bill, electricity providing days, and the previous bill also. Using the Internet of Things technology the transferring data is very easy to see for both the providers and consumers and even easy to make payment of electricity bill and to keep the continuation process and discontinuous process easily.

In the present billing system the service provider companies are unable to keep track of the changing maximum demand of consumers. Consumer are getting problems like high electricity bills, but that bills have been already paid. Poor reliability & quality of electricity supply even if bills are paid regularly also problems by human errors.

The remedy for all these problems is to keep tracking the consumers load on regular time basis for accurate billing, also track maximum demand and to detect beginning value. These all features are used to designing an efficient energy billing system. The present paper "IoT Based Smart Energy Meter" gives solution for problems faced by both the consumers and the distribution companies. Smart energy meter used in this system utilizes features of embedded system. Embedded system is the combination of hardware and software in order to apply required functionality. In this paper Arduino is compared with other controllers, and the application of GSM and Wi-Fi modems to introduce 'Smart' concept. by using GSM modem the consumer and service provider will get reading of energy meter with the corresponding amount. By

using Arduino unit which continuously monitors and keep record of energy meter reading in permanent memory because of this system there is no need of reading the meters monthly by visiting a person at each home. The supplier can easily disconnect power supply of any house whenever it is necessary.

3. ARCHITECTURAL MODEL:

Figure 1 shows the Architectural Diagram of proposed system. It is explained as follows

- Energy meter reads energy consumed by various household appliances and display reading on meter . a LED present on energy meter blinks continuously for counting meter reading which is based on count of blinking. Normally 3200 blinking count is considered as 1 unit.
- In this project our aim is to develop Arduino Uno system which is used as main controller to continuously monitor energy meter.
- Arduino measures the unit consumption based on blinking of LED on energy meter.

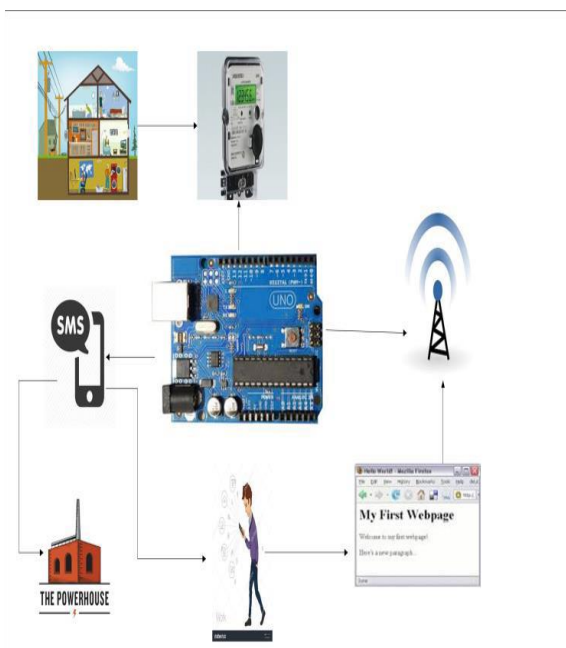


Figure 1: Architectural Diagram

- Webpage continuously displays cost of energy consumed by considering measured reading and per unit cost which is accessible for service provider.
- At the end of month bill with cost will be calculated and send to consumer and supplier in form of text message at first day of every month.

3. EASE OF USE

The block diagram shown in figure 2 gives proposed 'IoT BASED SMART ENERGY METER' system.

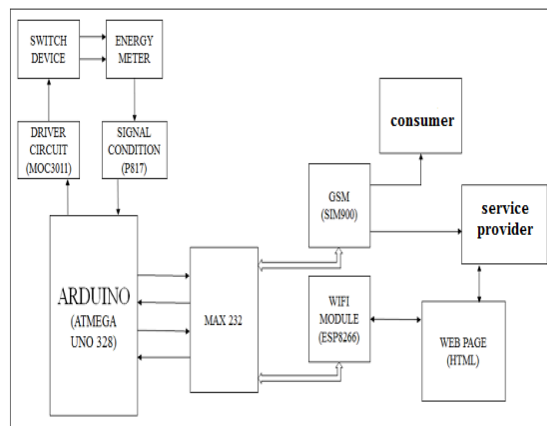


Figure 2: Block Diagram Representation

3.1 ENERGY METER:

Energy meter is the device used for measuring total energy consumption by consumer. Energy meter reads voltage and current & calculates its product to give value of power.

3.2 SIGNAL CONDITIONER:

figure 3 shows internal working of opto-coupler. It is used as signal conditioning block. one LED continuously blink on energy meter which indicates count of power. LED produces only 0.7volt when it blinks. this voltage is not suitable for arduino board to capture. hence this block is used to remove error. Diode will conduct when LED blinks & transistor get activate to give 5volt at output which are externally giving to transistor . when LED blinks 5volt supply will be provided to Arduino board. signal conditioning block is used to increase voltage.

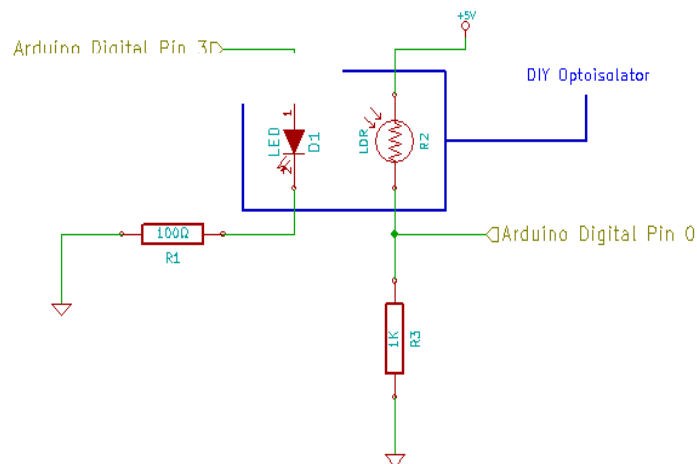


Figure 3 : Signal Conditioning Circuit

3.3 ARDUINO UNO (ATMEGA 328):

Figure 4 shows the Functional Diagram of ARDUINO UNO Board.

Entire function of this system is depend on Arduino Uno board 5volt supply is given to arduino by opto-coupler. Arduino counts the supply to calculate power consumed & its cost. These values continuously stores on webpage & consumer can visit any time to check their consumption.

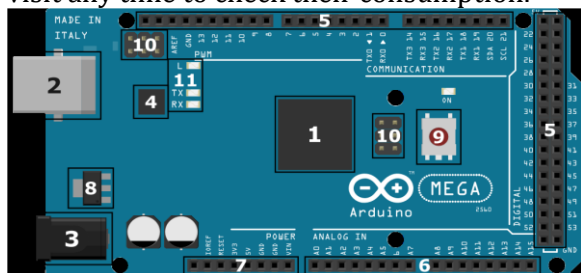


Figure 4: Photograph Of A Typical ARDUINO MEGA

3.4 MAX 232:

Images of MAX 232 is shown in figure 5. For serial communication MAX232 is used with GSM module & Wi-Fi module. it provides TTL to components according to requirement. TTL is connected to arduino through MAX232 for GSM.

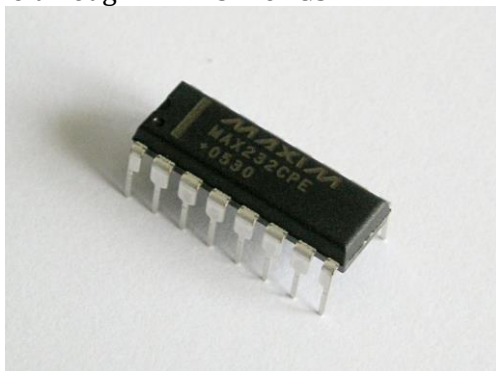


Figure 5: MAX 232

3.5 GSM MODULE (SIM900):

Figure 6 shows the photograph of GSM Module. GSM means Global System for Mobile communication. for mobile communication modem system it is widely used in all over world. It is an open and digital cellular technology & it is used for transmit mobile voice and data services operates at the 850MHZ, 900MHZ, 1800MHZ, 1900MHZ frequency bands. It is able to carry 64kbps to 120Mbps of data rates.

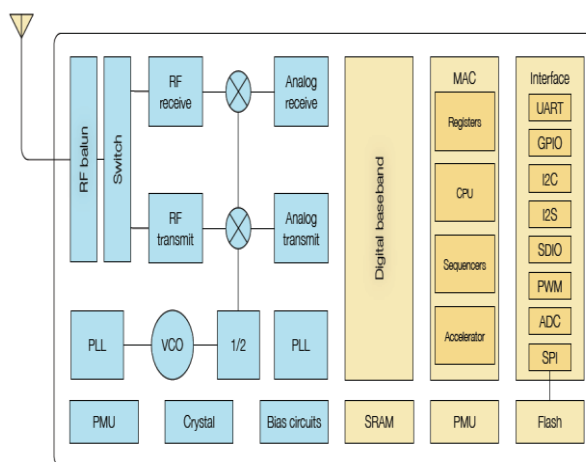
To send message of total energy consumption with cost to both supplier & consumer, GSM is use in this Project.



Figure 6: Photograph Of A Typical GSM Modem

3.6 Wi-Fi MODULE (ESP8266):

Figure 7 shows the Diagram of GSM Module. Wi-Fi means Wireless Fidelity. with the help of Wi-Fi supplier can ON & OFF the energy meter is possible. Reading of units with its cost can be displayed on webpage. Wi-Fi also helps consumer to access Arduino board and meter.



Figur7: Functional Diagram Of ESP8266EX

3.7 WEBPAGE (HTML):

Figure 6 shows the Screenshot of WEBPAGE. To operate Arduino and energy meter webpage is designed with help of HTML. . HTML stands for Hypertext Markup Language. To create web pages and web applications with Cascading Style Sheets (CSS) and JAVA scripts this standard language is used. Web browser receives HTML documents from a Web server or from local storage and make available them into multimedia web pages.
[http://iotgecko.com/ imp](http://iotgecko.com/imp)

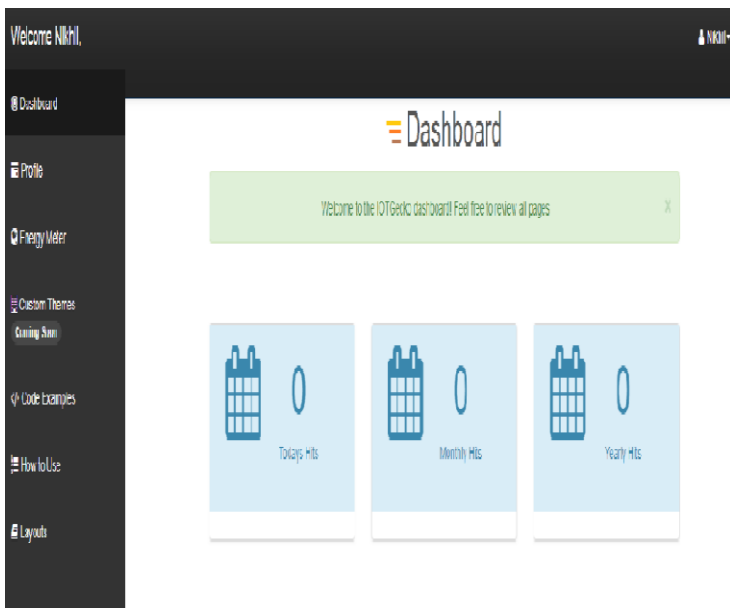


Figure 8: iotgecko.com/Dashboard.aspx

4. ABBREVIATION USED

- a. Internet of Things - IoT
- b. Light Emitting Diode. - LED
- c. Global System for Mobile - GSM
- d. Wireless Fidelity - Wi-Fi
- e. Hyper-Text Markup Language - HTML
- f. Cascading Style Sheets -CSS

5. EQUATIONS AND MATHEMATICAL CALCULATION:

Our system contain very simple and short calculations.
 Usually different meters have different readings.
 Mostly, 3200 blinks = 1 unit but it can depends on manufacturer.

No. of units (Y) = (X/3200)

In our case 3200 blinks of LED is 1 unit. But for practical purpose,

Assumption we made in our system,
 1 blinks = 1 unit of power consumption.

X=Y

Let,

X = number of blinks of LED

Y = number of units of electricity.

Z = cost of consumption.

Basically,

But in our case,

$Y = (X/1)$

Assume that 1 unit cost = 2rs.

$Z = Y * 2rs.$

6. OVERVIEW OF INTERNET OF THINGS

Figure 9 shows the block diagram for Typical IOT.

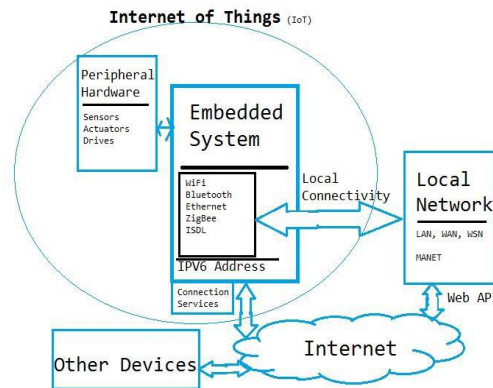


Figure 9: Typical IOT

The IoT permits objects to be sensed and controlled remotely across existing network infrastructure, to creating opportunities for more direct integration of the physical world into computer-based systems. this results in increased efficiency, accuracy and economic benefit. It also reduces a human intervention. When IoT is built up with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical system. It includes different technologies like smart grids, virtual power plants, smart homes and smart cities. All things are uniquely identified through its embedded computing system but is not able to interoperate beyond existing internet infrastructure.

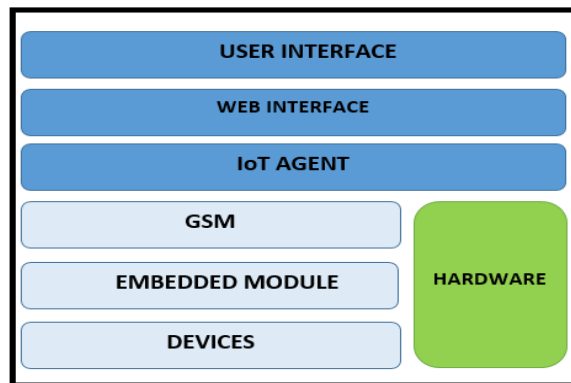


Figure 10: Interfacing of Hardware

Now day's peoples are interested to communicate with non-living things using internet such as home appliances, furniture's, stationeries,

cloths etc. Today we have number of technologies to communicate with living things but by using IOT we are able to communicate with non living things comfortably. IoT is a combination of several technologies like ubiquitous, pervasive computing, Ambient Intelligence, Sensors, Actuators, Communications technologies, Internet Technologies, Embedded systems etc.

[5] “Design and classification of smart metering systems for the energy diagnosis of buildings” IEEE 2015. by Luigi Martirano, Matteo Manganeli, Danilo Sbordone,

7. Benefits of ARDUINO board than other controller:

8051 microcontroller, pic 16f/18f, ARM7, msp430, Intel Galileo Gen 2 etc. Are well controller available in the market, but ARDUINO is the best among all this controllers, beca

1. Arduino contains two UARTS, one in hardware and other in software, but pic 16f/18f and 8051 has only one UART.
2. Msp430 has 3 UARTS its cost is very high than ARDUINO.
3. cost of ARDUINO is as compared to other controller.
4. Other boards like Intel Galileo gen 2 are very costly and complicated to handle.
5. The programming of Arduino is very easy as compared to other devices.
6. it is very simple and useful for the new start students.

8. CONCLUSIONS

This project is used to make practical model of ‘IoT Based Smart Energy Meter. By using Proposed model we can calculate energy consumption of the household and make energy unit reading easy. Because of this wastage of energy will be reduced and bring awareness among all. Even it will help to reduce manual interventions.

9. REFERENCES

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