IOT BASED SMART ENERGY METER USING THEFT DETECTION FOR HOME MANAGEMENT SYSTEM

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***Abstract*— Electricity is one of the most important factor of our daily life. It should be in proper way for complete and proper utilization of our electricity. But in case of country there is surplus supply with electricity in many areas but there are so many areas which could not even access of electricity. Reasons for above problems are our policies of distribution that they cannot predict the exact requirements of electricity and still power theft is prevailing. In our existing system services of power companies are also not good and perfect. Customers are also not satisfied with the current system because many times they have complaint about to statistical error in monthly bills. Thus we are trying to represent the idea about minimization of error, reduce the paper work, human dependency in the system. Our aim is to reduce monthly bill by wireless technology and from remote location directly to electricity billing office. By doing this human hours and efforts are reduced which are required to visit every home in our existing system. We know that the supply of power is limited and as a responsible citizen it's our duty to use it in efficient way. We are aiming to design to prepaid system for bill payment to reduce errors and IOT based energy meter. This wireless meter can be used in industries, residential apartment, etc.**

Keywords*— *IoT, Energy Meter, Theft Sensor, Pulse Sensor, Current sensor, Voltage Sensor, Wi-Fi.

I. INTRODUCTION

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 held 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. The present project "IoT Based Smart Energy Meter" addresses the problems faced by both the consumers and the distribution companies. The system 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 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 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. 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.

Internet of Things moves the day-to-day life of people towards automation. IOT means the interconnectivity of network with physical devices, vehicles, home embedded with electronics, software, sensors, actuators, and connectivity which enable these object to connect and exchange data with each other. The IoT system 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 to operate and analyze the system data. It can be accessed by anyone, anywhere and anytime remotely across existing network infrastructure.

Electricity is the driving force behind the development of any country. With the rapid increase in residential, commercial, and industrial consumers of electricity throughout the world, it has now become imperative for utilities companies to devise better, non-intrusive, environmentally-safe techniques of gauging utilities' consumption so that correct bills can be generated and invoiced.

II. LITERATURE SURVEY

A. Vijayaraj, R.Saravanan has worked on "AUTOMATED EB BILLING SYSTEM USING GSM AND AD-HOC WIRELESS ROUTING", the central EB office has immediate access to all consumer homes for a locality with the help of an RF system. The electricity bill(EB) office can access each & every customer with the help of radio frequency system. At backend database bill is calculating according the unit consumed by the user and these bills will be displayed on LCD.[1]

B. Irfan Quazi, Sachin Kumar Gupta and Rajendra Prasad have worked on "Pre-paid Energy Meter based on AVR Microcontroller", These are various disadvantages in traditional circuits so prepaid system where invented and these systems reduced the wastage of electricity to a large extent,Here GSM is used for proper utilization of pre-paid energy meter through SMS. [2]

C. R.B Hiware, P.Bhaskar, UttamBombale, Nilesh Kumar has demonstrated on "ADVANCE LOW COST ELECTRICITY BILLING SYSTEM USING GSM". The paper includes GSM network.Here two techniques where demonstrated pre-paid as well as postpaid. Using GSM SMS of bill where send and receive to the customer. [4]

III. PROPOSED SYSTEM

A. Block Diagram

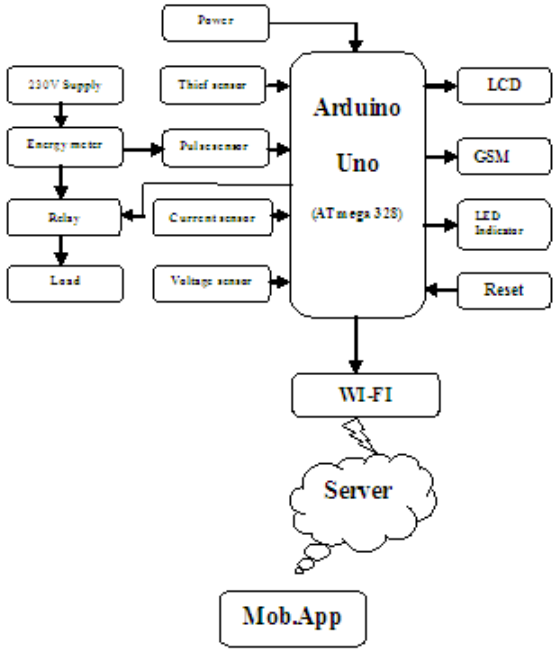

Fig.1. Block Diagram of Smart Energy Meter using Theft Detection For Home Management System

The above block diagram has following sub blocks, detailed explanation is given as follows:

a) 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 .

b) Pulse Sensor [Signal Conditioning(PC817)]

The optocoupler PC817 which we are using as signal conditioning block. As we can see on a working meter that one LED continuously blinks, it is nothing but indicates the count of power. The LED whenever blinks it produces only 0.7v which is not suitable for Microcontroller to capture, so to remove this error we are using this block. When the LED blinks the diode will conduct, transistor will get active and it will give 5v at output which we are externally giving to transistor. Whenever LED will blink the 5v supply will be provided to microcontroller and it will count them. We are using signal conditioning block to increase voltage.

c) Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

d) GSM

GSM (Global system for mobile communication) is a globally accepted standard for digital cellular communications. The concept of GSM emerged from a cell-based mobile radio system at Bell Laboratories in the early 1970s.GSM is the name standardization group established in 1982 to create common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900MHz. GSM uses narrowband Time Division Multiple Access (TDMA) for providing voice and text based services over mobile phone networks.

GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. In the US, GSM operates in the bands 850 MHz and 1900 MHz.GSM owns a market share of more than 70 percent of the world's digital cellular subscribers. GSM was developed using digital technology. It has an ability to carry 64 kbps to 120 Mbps of data rates.

e) Wi-Fi Module

Wi-Fi is Wireless Fidelity. Wi-Fi is a technology that allows electronic devices to connect to a wireless LAN (WLAN) network, mainly using the 2.4 gigahertz (12 cm) UHF and 5 gigahertz (6 cm) SHF ISM radio bands. A WLAN is usually

password protected, but may be open, which allows any device within its range to access the resources of the WLAN network.

Wi-Fi is a digital communications protocol, through which gadgets can communicate with each other in a unicast or a broadcasting manner without using any wires. The idea of fast speed wireless LAN originated when the United States Federal Communications Council, a communication agency of the US government, decided in the year 1985 to utilize a few bands of wireless spectrum without subjecting them to a license fee. Following this, the IEEE committee for 802 standards which manages networking protocols among electronic devices, formed an extension 802.11 which would work on the wireless mode. This committee was founded in the year 1990 and was headed by Victor Hayes, Father of Wi-Fi. Taking on the license free bands (now being termed as ISM bands) and collaborating with networking giants such as Nokia, Motorola etc, and the committee introduced WLAN legacy of Wi-Fi in the year 1997.

f) LCD Display

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

g) Relay

A variety of electrical and electronic devices which are classed as Output devices used to control or operate some external physical process. These output devices are commonly called **Actuators**. Actuators convert an electrical signal into a corresponding physical quantity such as movement, force, sound etc. An actuator is also classed as a transducer because it changes one type of physical quantity into another and is usually activated or operated by a low voltage command signal. Actuators can be classed as either binary or continuous devices based upon the number of stable states their output has. For example, a relay is a binary actuator as it has two stable states, either energised or latched or de-energised and unlatched, while a motor is a continuous actuator because it can rotate through a full 360º motion. The most common types of actuators or output devices are Electrical

Relays, Lights, Motors and Loudspeakers.

Solenoids can be used to electrically open latches, doors, open or close valves, and in a variety of robotic and mechatronic applications, etc. However, if the solenoid plunger is used to operate one or more sets of electrical contacts, we have a device called a relay that is so useful it can be used in an infinite number of different ways.

h) Theft Sensor (Limit Switch)

A limit switch is an electromechanically operated switch. It changes state when an object comes into physical contact with its actuator. It makes or breaks the electrical connection to indicate the state of the switch contacts. The switching action generates a signal which helps to control electric supply to the machine.

IV. SOFTWARE PART

Here for Software development we use Embedded C, Arduino IDE. Proteus for Simulation Software.

V. FUTURE WORK

In order to save electric power and to detect theft:

- There can be a system where automatic switching of electronic equipments by the use of IoT is applied.
- To make a system where user can receive SMS, if one crosses threshold of electricity usage.

VI. SCREENSHOTS AND RESULTS

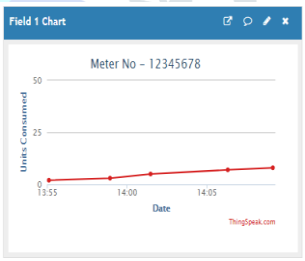

Fig.2. Graph of Units Consumed By Customer

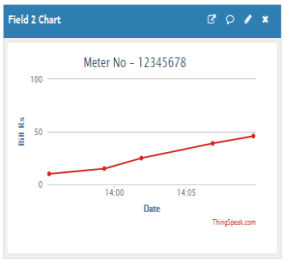

Fig.3. Graph of Bill in Rs

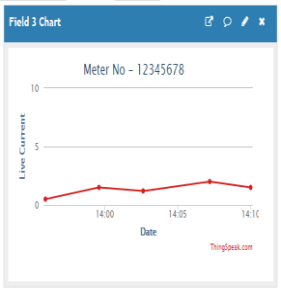

Fig.4. Graph of Live Current

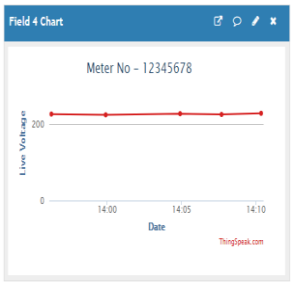

Fig.5. Graph of Live Voltages

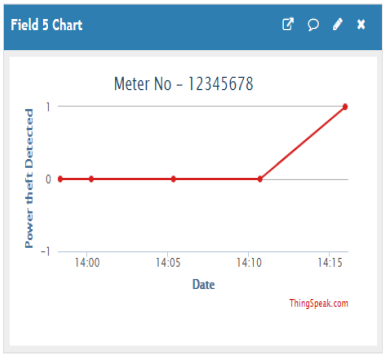

Fig.5. Graph of Theft Detected

VII. CONCLUSION

In the era of technology advancement, monitoring and controlling of energy consumption is very important. In this project, an energy consumption monitoring and controlling smart energy meter is proposed which would increase awareness of energy consumption amongst devices and users. Energy awareness at the domestic level enables the user to control the power state of the devices as per their needs which minimizes the energy use. Thus, using such smart energy meters in home management system is very important. This project achieves the objectives of

- Improving awareness of energy consumption at domestic level.
- Monitoring and controlling energy consumption at home through IoT.
- Power theft detection.

VIII. REFERENCES

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IX. PUBLICATIONS

Communication with Journal is going on ……