SMART ENERGY METERING AND THEFT DETECTION WITH IoT TECHNOLOGY

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ABSTRACT:

The Existing domestic Energy meter reading systems universally exist many problems, such as difficulty in construction, too narrow bandwidth, poor real time, not two way communication quickly etc. To solve above problems, this paper uses the wireless technology for Automatic Meter Reading system.[1] A proposed method provides the communication between the Electricity Board section and the consumer section using Internet of things (IOT) for transmitting the customer's electricity consumption and bill information that is calculated using ARM7 microcontroller.[2] The power fluctuations are monitored using the voltage sensor and current sensor is fed to the microcontroller which indicates it to the Electricity Board. Depending on the power generation, the house hold devices are controlled automatically.[3] From Electricity Board section the information regarding the bill amount and payment are communicated to the consumer via Global System for Mobile communication. The power and billing information is continuously transmitted by the use of Internet of Things and monitored by the Electricity Board section. Whenever there is power theft identified can be sent from the Electricity Board section to cut the supply to the customer.

I.   INTRODUCTION

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.

In the Internet of Things (IoT) model, many of the living and non-living things that encompass us will be on the internet in one form or another. Driven by the popularity of gadgets empowered by wire-less technological innovation such as Wireless Bluetooth, Radio Frequency Identification, Wireless-Fidelity, embedded sensor, IoT has moved out from its beginning stage and it is actually on the edge of changing the present fixed inter-net into a well featured upcoming Internet. [4]Currently there are almost nine billion inter-connected gadgets and it is estimated to touch almost fifty billion gadgets by 2020.

There is incorporation of mobile technology into MSEB automation system due to the rapidly advancing mobile communication technology and the decrease in costs. We propose a system that collects the energy consumption from residential as well as corporate zones and send it directly to the central server where processing is done on that data for preparation of bills. [5] AMR system can be divided into wire AMR system and wireless AMR system according to communication medium used. In existing system for collection of energy consumption data is that the representatives of MSEB monthly comes and visit every residential , take the snap shot and corporate and manually reads the

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consumption data from the meter. This collected data is recorded on a piece of paper along with a snap shot of the meter and finally submitted to the local MSEB office. There after the official's read the snap shot and meter readings and then gives it to the local software for bill calculations and generation of bill. We as a consumer then make the payment for the received bill. This process is so much hectic process. Man made mistakes can be countless. Human resources wasted and many other problems do occur. We finally thought of building a system that will do the above process automatically. Microcontroller is attached with our traditional energy meters that will scan the meter reading after particular period. Wirelessly, these meters reading will transmitted to the centralized server along with their unique meter number. This data will be processed by the server and automatically generates the bill. After generation of bill it will send to every consumer via SMS facility.[6]

II. RELATED WORK

From thorough review of related work and published literature, we have observed that many researchers have done rigorous work on power line communication (PLC)[7]and IoT. It is observed from the careful study of reported work that in the real world, PLC and IoT based meter can improve the efficiency of power system and can help to analyse the unnecessary loss of power in different areas.

Existing method*:* The present system only provides feedback to the customer at the end of the month that how much power is consumed in the form of bill. The consumer has no way to track their energy usage on a more immediate basis. The consumers are growing exponentially fast and load on power providing divisions is rapidly rising. In the existing system meter tampering can be done easily and it's one of the major drawback for an energy crisis.

Proposed method: In the proposed system, consumer can do power management by knowing energy usage time to time. The Customer needs to pay the bill on schedule, if couldn't, the electric power connectivity can be turned off autonomously from the distant host.

III.IDEA/MODEL:

Since IOT is cost effective compared to SMS, monitoring of energy meters at lower cost is made possible. Daily consumption reports are generated which can be monitored through Android application and/or web portal. Also, android users can pay their electric bills from their android application.

Non-android users can monitor and pay their bills online. The system is more reliable and accurate reading values are collected from energy meters. Live readings of the energy meter can be viewed through Android application. Also, the readings can be viewed online. The human intensive work is avoided and all the values are maintained in the central server. The communication medium is secure and tampering of energy meters can be identified easily. If an error occurs in the system, the value in the central server will not be updated. Once the value updated crosses the

threshold time, the server can determine that something is wrong in the system and can report the engineers in EB. Thus, identification of error becomes easier. Since the values are stored in the central database, the reports are made accessible from anywhere in the world. Also, the server is online 24x 7.

IV. WORKING PROTOTYPE DETAILS

In proposed system, we replaced the traditional meter by metering module which consist of metering IC and microcontroller which scans the energy meter automatically after every month and transmits this collected data to the remote station through the GSM network. After receiving this data is stored in the database and process on it for the creation of bills. As soon as bills are generated, it will send to the consumers via GSM network. Internet of things (IOT) is the main method of communication between the energy meter and the web server. IOT, being a 2.5G mobile technology, is available all over the world. It is also ideally suitable for data transfer over an always on-line connection between a central location and mobile devices. The cost is per kilobyte of data transferred, in comparison to SMS where the cost is per message. The reading information from the energy meter in real time is uploaded to a central database via IOT Each user of the system may access this information via the Internet.8051 microcontroller is interfaced with energy meter and PIC 18F4550 which acts as the master controller through RS-232. The receive pin of RS-232 of PIC is connected to the transmit pin of RS-232 of 8051. The transmit pin of RS-232 of PIC is connected to the receive pin of RS-232 of SIM900 module.8051 microcontroller monitors every pulse of the energy meter. It sends the measured reading to PIC 18F4550 every time the value is changed. PIC 18F4550 gets the reading from 8051 and then communicates with SIM900 through AT commands and transmits the reading information through IOT to the central server.
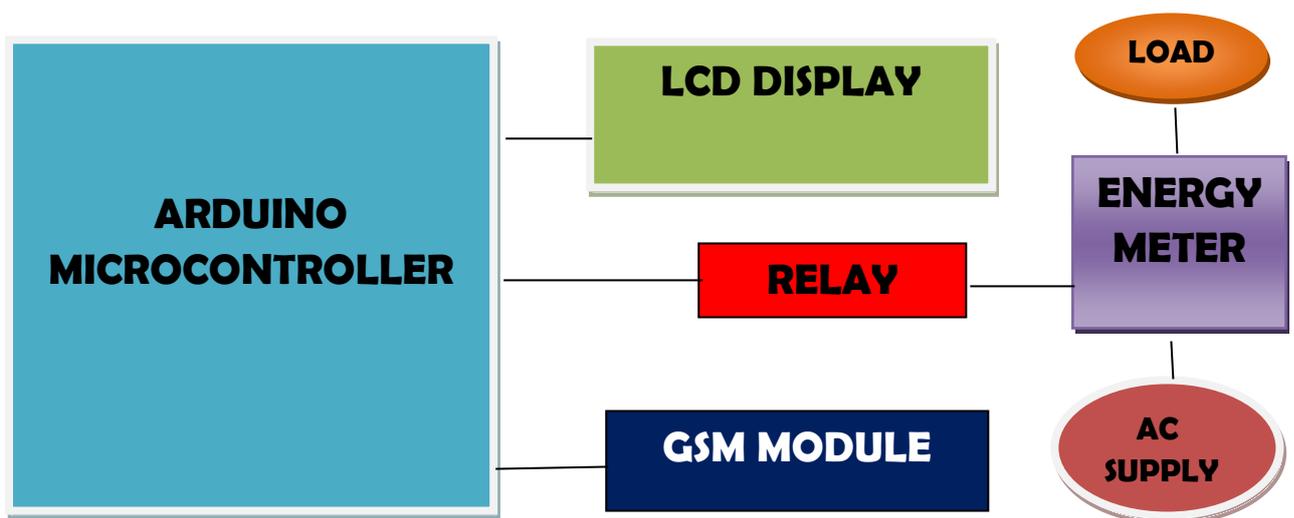

Fig.1.IOT based smart metering structure

In this system power supply is provided to meter. A GSM unit shows the interfacing with the microcontroller. Transmission of usage details is send to office modem using user modem. Every

consumer has unique number provided by corresponding authority. Hardware implementation includes following points as discussed below.

V.SOFTWARE DESIGN IMPLEMENTATION

In software design part we have created web portal design. In this users are categorized as consumer and staff. Any time any where user can login using login option. Administrator can perform various tasks like registration, updating the database, message setting. Using serial port/ USB admin can connect the GSM modem to web portal. For that initially hardware setup is required then selecting particular port admin can connect to the system. For receiving SMS from meter. It is disconnected only when administrator disconnects it. Registration of consumers, preparation of bills is performed in this part.

VI. RESULTS

The GSM output format has been analyzed.ThePIC16F877A Microcontroller the operations were studied and it is programmed and the system working model was developed in order to accomplish the objective. "The IOT based Energy meter" saves the customer's time by making them work "leaner". The operation of the calculating the power cost is simple and doesn't involve delays. Instead of using DAQ which is very costly in this project PIC (16F877A) microcontroller along with serial communication has been used to interface with the virtual terminal. The IOT based Energy meter for calculating cost and displayed in LCD has been achieved using MPLAB and PIC 16F877A. The power cost is send through serial communication to the Virtual terminal constructed in PROTEUS. This project can therefore enlighten management about wasted time, and unnecessary trips, book keeping and billing because it gives an accurate accounting of units driven because the prevention of malpractice. According to FDA and CTIA , the available scientific evidence does not show that any health problems are associated with using wireless devices. Therefore, use of wireless automatic meter reading is not expected to yield any negative health effects on the consumers.

VII.CONCLUSION and FUTURE ENHANCEMENT

Conclusion In the era of smart city advancement, this project is concentrated on the connectivity & networking factor of the IoT .In this project, an energy consumption calculation based on the counting of calibration pulses is designed and implemented using PIC18F46K22 MCU in embedded system domain. In the proposed work, IoT and PLC based meter reading system is designed to continuously monitor the meter reading and service provider can disconnect the power source whenever the customer does not pay the monthly bill and also it eliminates the human involvement, delivers effective meter reading, prevent the billing mistake. The Project has achieved following objectives,

1. Ease of accessing information for consumer from energy meter through IoT.
2. Theft detection at consumer end in real time.
3. LCD displays energy consumption units and temperature.
4. Disconnection of service from remote server.

Future enhancement in the present system, IOT energy meter consumption is accessed using Wi-Fi and it will help consumers to avoid unwanted use of electricity. The performance of the system can be enhanced by connecting all household electrical appliances to IoT. So, in future following objectives can be achieved to save power and avoid thefts [8],

1. We can make an IoT system where a user can monitor energy consumption and pay the bill Online.
2. We can make a system where a user can receive SMS, when he/she crosses threshold of electricity usage slab.
3. We can make a system which can send SMS to the concerned meter reading man of that area when theft detected at consumer end.

VII. REFERENCES:

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