Smart Meter: An IOT Based Smart Meter for Live Electricity
Monitoring and Bill Payment

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ABSTRACT : With passage of time, technological involvement is more with the daily life of humans. There is lots of progress of many fields, one of them is science and technology field but many peoples do not take full advantage of it. There is scope for improvement in Electricity billing system [1]. Our existing electricity billing system has major drawbacks due to manual work. We are proposing a system which is based on wireless network. We are using client and server relationship through IOT and EB office can monitor the energy meter of all consumer homes on real time basis. We are developing an android application for prepaying system. User can add the Balance, Pay the bill and even view the bill details at each updated power consumption. The new system is easy to access user friendly and far more efficient than the existing system.

Keywords: Wireless network, Android, EB office, Internet of thing (IOT).

I. INTRODUCTION

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.

Our current system for bill payment is postpaid system and drawback of the current bill payment system is there is no control on users related to consumption of electricity. 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.

II. RELATED WORK

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]

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]

Ms.Karthiga, Mr.Vignesh, Mr Vignesh, Mr Alex v Stanislavous, Mr.Kiran Thomas have worked on “AUTOMATIC ENERGY CALCULATION THROUGH WIRELESS SMART METER USING ZIGBEE”. In this paper, development of an automatic meter reading system focusing on the design forenergy meter reading system main focused on implement of energy meter with suitable wireless communication protocol i.e ZigBee. Micro-controller continuous records the unit and calculated bill can be displayed on LCD we use micro-controller ATmega32 and ZigBee for efficient power utilization proper management of energy data and communication between meter and data centers. [3]

R.B Hiware, P.Bhaskar, Uttam Bombale, 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]

Jignesh Somabhai Prajapati, Ashwin P Patel and Vyom M Bhankhariya has worked on “Prepaid Electricity Billing System. In these technique peoples will use the electricity as they required, the proposed system uses any type of communication media like GSM, optical fiber, Microwave etc. for to establish the communication link in between power meter of customer and a centralized system (server). [5]

Deepakraj Sahu and Chaitanya Prasad Murmu have worked on “A REMOTE ELECTRICITY BILLING SYSTEM”. In pre-paid we can set the threshold value and if sense values crosses the limit then alerts message will be sending and if any person not pays bill and value crosses the extreme limit then automatically the power supply will disconnect. [6]

M.R.M.S.B. Rathnayaka, I.D.S. Jayasinghe, EniJayanth, S.J Swarnajith have worked on “Mobile Based Electricity Billing System (MoBEBIS)”. A system based on mobile to capture, process and give information on user about bill consumed. As unit consumed image gets capture all information is collected image processing technique will be done in the mobile device and these numerical value can be sent to the user. [7]

Gobhinath. S, Gunasundari. N and Gowthami. P has worked on “Internet of Things (IOT) Based Energy Meter”. The PIC-16F877A Microcontroller calculating cost and displayed in LCD and serial communication has been used to interface with the virtual terminal. [8]

E.Moni Silviya, K.Meena Vinodhini and Salai Thillai Thilagam.J has worked on “GSM Based Automatic Energy Meter System with Instant Billing”. Thus these systems gives instant bill without any manual work. Current consumption can be calculated through Infra Red(IR)sensor.ARM processor takes numerical value and accordingly display on LCD and provide information to user through alarm.User can add unit, pay bill. [9]

Myilsamy K. have demonstrated to “Automated wireless meter reading system for controlling power consumption”. This method can be used for continuously monitoring the meter reading and data is sent to the server through the GSM Module. If user unable to pay the bill according to the unit consumed then energy meter automatically cut the power supply and bill will be sent to the consumer cell phone. [10]

III. ENERGY METER

There are three types of energy meter:

1. Standard meter
2. Variable rate meter
3. Prepayment meters

1. Standard meter:The conventional energy meter is mechanical energy meter based on the phenomenon of “Magnetic Induction” It has tooth wheels and rotating aluminum wheel are called ferriwheel. It rotates based on the current flow. ferriwheel rotation makes rotation of other wheels. Since many mechanical parts are involved, mechanical breakdown, mechanical defects and chances of current theft will be higher in this energy meter.

2. Variable rate meters: Suppliers offer principle of operation of this meter is same as that of standard meters. It gives two readings one for daytime usage of electricity and other for night-time usage of electricity. In this way it allows suppliers to charge with a different rate for electricity used at night for the economy 7 tariff.

3. Prepayment meters: This meter usually accepts tokens or cards that can be bought or topped up respectively. The electricity supply will be cut, if customer stops paying.

In the below architecture diagrams we are proposing intelligent system for bill generation and bill payment using IOT. System includes client-server architecture, MYSQL database and android application at the user end.

Among three types of meter we are implementing prepayment type of modes in our system for electricity bill payment using android application.

IV. SYSTEM ARCHITECTURE

The system can be divided into 2 parts:

A. Hardware Design

B. Web Server interface design

Figure A: Block diagram of smart energy meter

A. Hardware Design

Internet of things (IOT) is the main method of communication between the energy meter and server. The reading information from the energy meter in real time is uploaded to a central database via IOT [8]. We are using AVR micro-controller which will continuously takes the current values from current sensor. We are
using HC-05 Bluetooth module which will take values from microcontroller. Relay is act as a switch and load is connected to relay.

B. Web Server interface design

1. Admin:
This module is the main part in the system architecture. It provides user-name and password to the EB office and customers. It gives the access to EB office to add and manage their information. Also, on real time basis it allows client to access the information of electricity bill.

2. Client:
Client needs to install android application on mobile. The client can login to view the bill details through the application. Also he can pay bill or add balance in case of prepaid payment system.

3. Database:
The database used in this system is MYSQL database. It is used for storing users information their login ID, password their UID numbers.

V. PROPOSED SYSTEM

We are proposing system based on IOT. It is cost effective compared to SMS system. We are developing an android application and through which daily consumption reports are monitored. Also, android users can pay their bills from their android application. [8]

Non-android users can monitor and pay their bills online. Live readings on energy meter can viewing through android application or it can be view online. The system is more accurate and reliable reading values is collected from energy meter. All values are stored maintained in central server. Error will occur if value updated crosses the threshold time, the server can determine the error and report the EB office. Thus finding errors become easy. Since the values are stored in the central database, the reports are made accessible to anywhere in the world. [8]

VI. CONCLUSION

The AVR ATmega32 micro-controller operations were studied and it is programmed in order to accomplish the objective. This energy meters saves consumer’s time by making them work “leaner”. Android application is developed to view bill, pay bill and add balance for prepaid system. This project can therefore reduce the wastage of time, paper work and unnecessary trips.

REFERENCES


[6] Deepakraj Sahu(108EE020) and Chaitanya Prasad Murmu(108EE048) “A REMOTE ELECTRICITY BILLING SYSTEM ”


