Smart Monitoring and Control of Energy Meter using IoT

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Abstract-*This paper describes the smart monitoring and control of energy meter using IoT and PIC16F877A46 Microcontroller. The proposed system design eliminates the human involvement in Electricity maintenance. The User needs to pay for the usage of electricity on schedule, in case that he couldn't pay, the electricity transmission can be turned off autonomously from the distant server .The user can monitor the energy consumption in units from a web page .GPRS unit performs the IoT operation by sending energy meter data to web page .The Hardware interface circuit consists of PIC16F877A Microcontroller, MAX232, LCD display ,GSM unit performs the an operation by sending energy meter data to user mobile phone by a SMS to the registered mobile number.*

Keywords-PIC16F877A, IOT, MAX232,LCD, GPRS.

I. INTRODUCTION

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. 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. 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. 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 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.

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)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. SYSTEM ARCHITECTURE

1.1. PIC16F877A:

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS

(complimentary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of
PIC 16F877[1].

Fig.1 PIC16F877A

Fig.2 GSM

1.2GSM Modem

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection.[2]

1.2 MAX232

In this circuit the MAX 232 IC used as level logic converter. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply EIA 232 voltage levels from a single 5v supply. Each receiver converts EIA-232 to 5v TTL/CMOS levels. Each driver converts TLL/CMOS input levels into EIA-232 levels [4].

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Fig 3 Relay

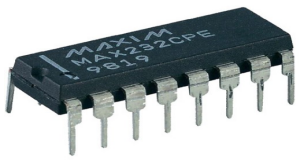
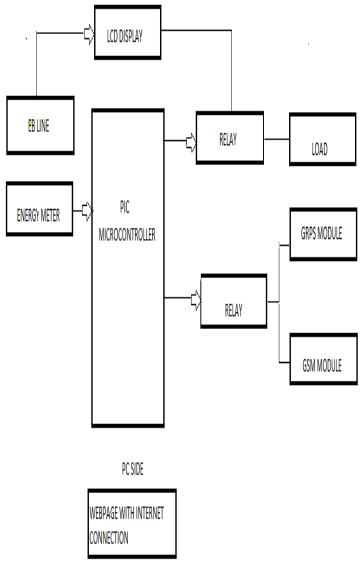


Fig 4 MAX 232

1.4 RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations[3].

IV.BLOCK DIAGRAM



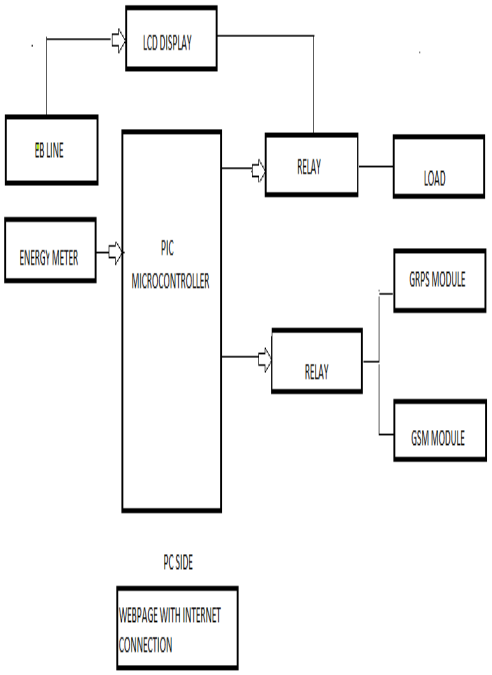


Fig.6 Block Diagram of proposed system

V. 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.

VI. ADVANTAGES OF PROPOSED SYSTEM

The users can be aware of their electricity consumption. The human work of collecting readings by visiting every home at the end of every month can be avoided by generating Electricity bills automatically. Theft of electricity can be avoided by tamper proof energy meters. The errors in the system can be identified quickly.

The main advantage of the project is

a) We can enhance the billing method in electricity board.
b) We can reduce Requirement of Human resource .
c) We can reduce the Probability of error occurring.
d) User can have knowledge about the bill periodically.
e) Accurate readings are obtained by the customers and utility providers.
f) Readings can be sent remotely over the web to the utility providers.
g) Employees need not to be physically present at the site.

V. FLOW CHART

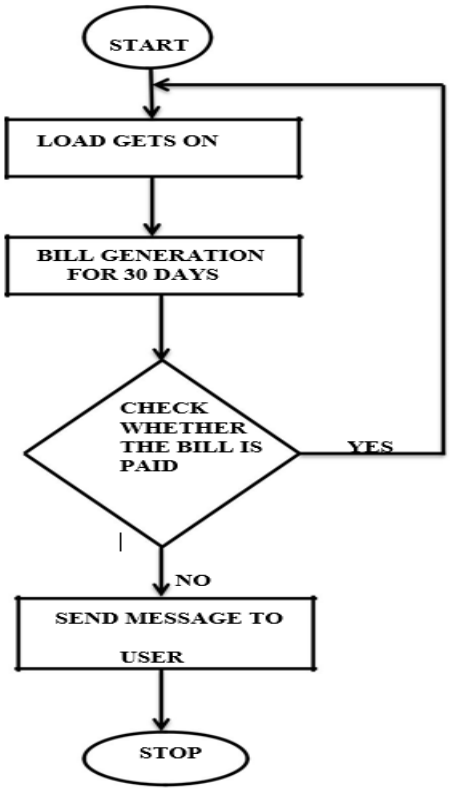


Fig.7 flow Diagram of proposed system

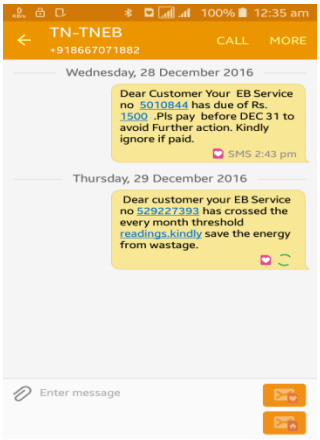


Fig:8. Message sent to concerned person

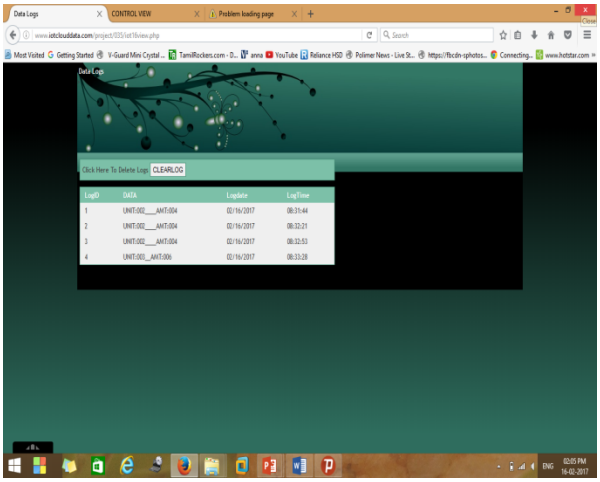


Fig:9 Meter reading uploaded in web page

VI. CONCLUSION

Live Electric Meter Reading and Billing system is successfully implemented using existing Electronic Energy Meters where GPRS is used as the communication medium to get the values of the meter. The earlier versions had used SMS as the communication medium; however the current implementation uses GPRS which reduces the cost of communication and enables frequent updates of the readings. The proposed system avoids electricity theft to a large extent and also makes the energy meter tamper proof. This system also helps the users to be aware of their energy consumption. The information is transmitted to the EB server using GSM/GPRS modem on GSM network using direct TCP/IP connection with EB server through GPRS. EB server uses PHP scripts to get the values from the energy meter and stores this information in database. This information is available to authorized users of the system via website over the internet or using mobile application.

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