

# Smart Billing System and Tamper Detection Using Power Line Carriers

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**Abstract-** In this project introducing a new concept of Power line Communication. Here, data is multiplexed into 240V power lines which provide electricity to our various devices. This method of communication opens up a broad spectrum of applications where this technology can prove useful. In this project, demonstration of one application of this technology is experimented. This system uses existing power line as a medium of communication which is tamper free, billing and disconnection is done remotely. In addition to the above function it also sends message to the user regarding the bill details which includes unit amount and payable due date. Hence automating the process of connection / disconnection of power supplies of various consumers, by developing intelligent power meters that are able to decode this data, which carries information about the supply status of the various consumers

**Keywords** - EB, PLC, GSM

## I. INTRODUCTION

The use of communication in almost all the fields of power, gas and water generation, distribution and billing has come of age. Here with the inclusion of power line communication with the automation may lead to paradigm change in the current trend. The design presents a new methodology for avoiding the high construction and maintenance costs in the existing meter reading technology. Apart the use of meter reading with man power has become need of the day but the designed system avoids the human intervention in Power Management. The Consumer has to pay the bill in time, if couldn't, the power connection may be disconnected automatically from the remote server. It displays the corresponding billing information on LCD and data is sent to the server through the PLC Module. The microcontroller based hardware system consists of a processor core board and the peripheral board. The entire programming for microcontroller operation is based on Embedded C Language. This system provides efficient meter reading, avoiding the billing error and reduces the maintenance cost. This paper also addresses advantages of implementing the power line communication module and design detail and discusses the advanced security of the data communications. The present traditional billing system have many problems like problem of payment collection, energy thefts etc. Due to which the traditional billing system is slow, costly and unreliable. The present billing system has time and labour consuming. So it is essential to develop a billing system which solves the

problem of billing manually and also reduces the manpower.

Automating kilowatt-hour (kWh) meter reading has become a necessity for most energy suppliers as deregulation, freer customer choice and open market competition occur in the energy supply sector. Visual inspection of meters is time-consuming and labour intensive. A study, conducted by Eyre, had shown that a human meter reader could only achieve an equivalent average information rate of about 1bit/s, which is very slow. Moreover, some meters are located in places of poor accessibility that greatly increase the difficulty of reading such meters. The scope of this project is to make use of new modern technologies and implement them into more practical fields. This project deals with the implementation of Power Line Communication networks in the field of electricity billing. This type of networks can also be used for creating emergency response network. This project eliminates the need for employing EB meter readers and this set of employers can be used elsewhere. The amount of time spent in doing all these works manually can be reduced because of this kind of network implementation. Each household is allocated a particular ID so that they can be uniquely identified.

There is no chance of manipulation in this system. This model is a cost effective, practical and efficient. The data sent by the home unit then and there back end unit at the office module. This saves hours and hours of manual data entry needed for entering the data into the central system. So our module is useful in that aspect also. Though

many technological innovations are taking place in this world, existing electricity consumption billing process seems in India to be very obsolete and does not meet the latest technology available. In this project, the above said process is totally automated and the communication is made possible entirely through the power line. This communication is bi-directional at a faster data rate through long distances. By digitizing, the currently used energy meter has been completely transformed to a digital one. Hence it is beneficial to the customers as the system is made very user friendly. The automated EB billing procedure has the ability of fulfilling a set of needs for the user and the EB workers:

This system allows the user to get updated details of the power used in his/her house.

The user can also verify if the bill received is the right one or not.

Finally the wireless method sending data is feasible even when more buildings are being built into the Network.

## II. LITERATURE SURVEY

The growing demand of energy, the capacity limitations of energy management, one-way communication, the need of an interoperability of the different standards, the security of the communication and the greenhouse gas emissions, leads to emerge a new infrastructure grid: Smart Grid. Smart Meters are one of the proposed solutions for the Smart Grid. An AMR solution which provides enhanced end-to-end application. It is based on an energy meter with low-power microcontroller and the Power Line Communication standards [1],[2].

The low cost real-time ARM-based energy management system, it is conceived as part of a distributed system that measures the main power system quantities and give the possibility to manage the whole power plant. An integrated Web Server allows collecting the statistics of power consumptions, power quality and is able to interface devices for load displacement. The device is characterized by easy access to the information and the combination of a smart meter and data communication capability allows local and remote access. In this way it is possible to manage the power consumption of the power system leading to an overall reduction in consumption and costs [3].

A power load management system based on ARM-7 microcontroller and GPRS is presented. The system consists of electronic KWH meter, intelligent

management terminal (IMT) and management centre. The intelligent terminal is sued to acquire information from KWH meter, control the energy-consuming device and communicate with management centre via GPRS network. How to implement the IMT by using ARM-7 microcontroller and GPRS telecommunication module is discussed in detail. Also the software design of the terminal with high performance embedded real-time operating system [4].

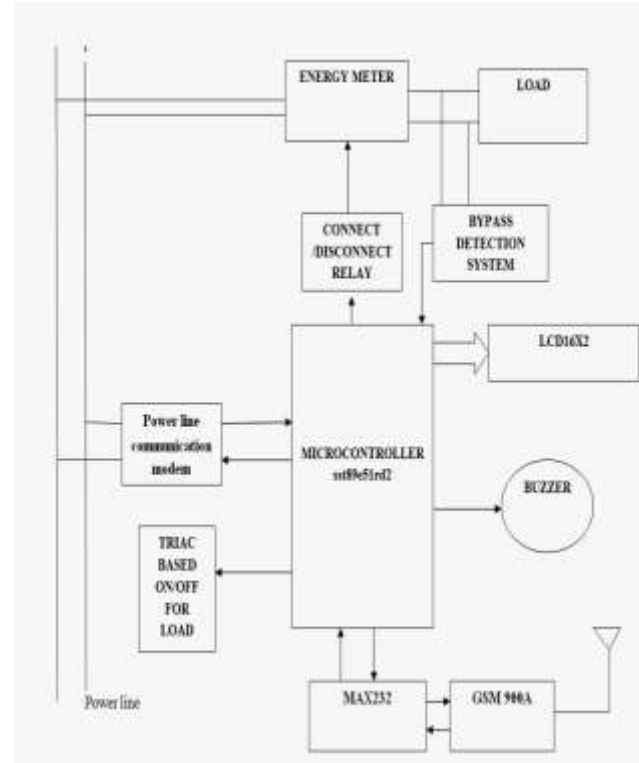
Electronic energy meter is capable of taking readings and can store it into its memory. Taking energy meter reading is time consuming and an expensive task. The meter reader travels for a long distance and take the reading manually to prepare the bill. Consumers have to go to the billing office, stand in a long line and submit the bill. This is a boring job and time consuming also. It can be avoided by remote monitoring of electronic energy meter and prepaid billing system by the use of cash card. In this paper measurement of energy, remote monitoring, preparing of bill and billing system is presented. Low cost ATMEGA8L microcontroller is used here to control the whole system. Sampling of voltage and current is done by it. Then it processes data to achieve power in that instant. Then it stores the value of total energy consumed by the consumer and can calculate energy charge according to the tariff. LCD display is attached with this system to show total energy consumed, power factor and amount of charge etc. Communication between central energy distribution office and energy meter is done through power line. Complex tariff rate set up and cash card based billing is possible in this system. Electronic meter gives high accuracy for nonlinear loads than conventional rotating disc type electro-mechanical meter. Greater accuracy and stability can be maintained in this system [5].

The microcontroller includes an energy metering module ESP430CE1. The aim of the work is to realize a real time pricing thanks to the proposed communication infrastructure. This solution is with great interest in economical and low carbon society point of view [8].

## III. DESIGN METHODOLOGY

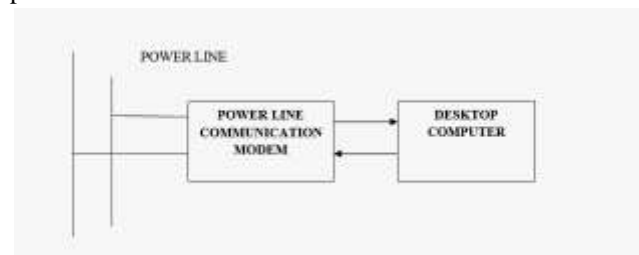
The high level block diagram of the power line communication based meter reading system consist of a pair of power line communication modulator and demodulator (modem) power supply section supplies power to all other components with required Power. The sst89e51rd2 microcontroller module takes the data from the energy meter and performs the necessary control operations like breaking the circuit through Relay control unit and the required information to the billing unit through

power line communication module. The MAX-232 is the peripheral used as a logic level voltage converter in serial communication. The user can obtain the status of the energy consumption and the billed amount.



**Fig. 1: Block Diagram Consumer Side module**

Then it sends the commands to the microcontroller section and the required information is sent to the user meter through PLC if consumer fails to pay the billed amount in time, the disconnection and reconnection can be done by sending their corresponding commands to the controller. Whenever a request is received by the user to the controller and the data has been sent the DC buzzer gives a beep sound as an indication that a request has received and sends the data to the user and LCD is used to provide visual information.



**Fig. 2: Block Diagram Electricity Board Side module**

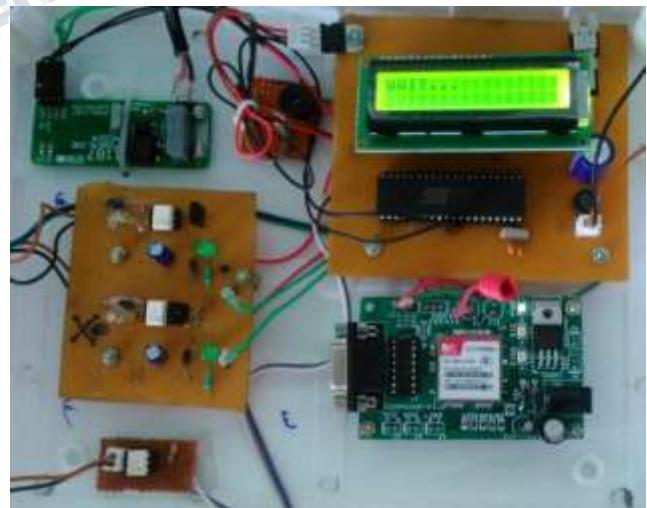
#### IV. RESULTS

The system consists of two modules. Module1 is an electricity board side module, which consists of power line device and PC, which is connected to 230V power line to send and receive the data as shown in Fig 3 [6]. Module2 consists of watt hour meter SSR, power line module [7]. GSM unit and detection system.



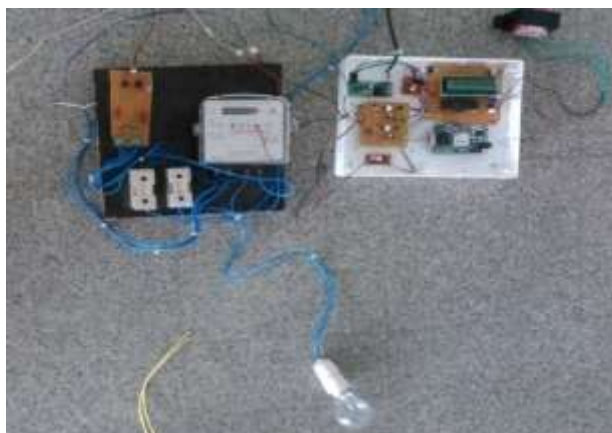
**Fig. 3 Electricity Board side module**

The board side sends the command to the customer side module through PLC modem, it sends the command B for to announce the bill by calculating the energy consumed by the user, \$ to send a bill amount, C for connect the line and D for disconnect the line.



**Fig. 4 Consumer side module showing display part**





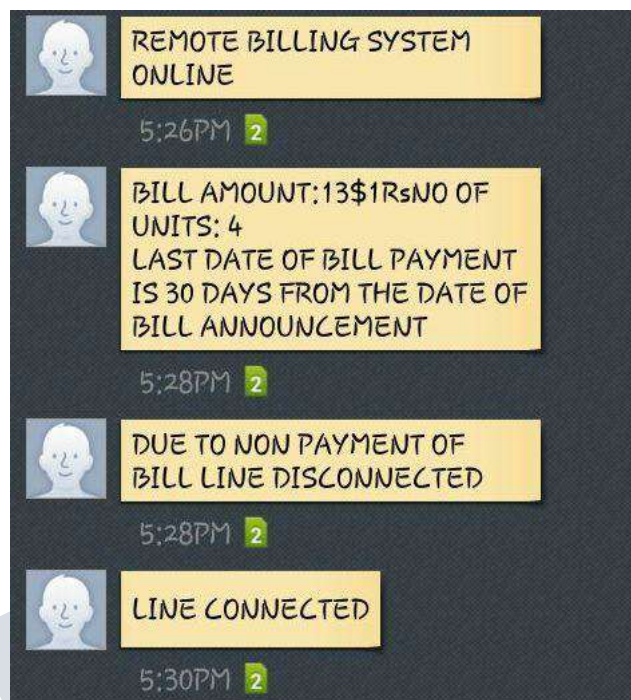
**Fig. 5 Customer side module showing energy meter part**

The Fig. 4 and Fig 5 shows the Consumer side module showing energy meter and display part respectively. When the power is turned on it displays wait in LCD display at this time the I/O ports are gets initialized.



**Fig. 6 Notification on board side**

Fig. 6 shows the notification on board side. It shows various information like the theft detection along with the meter number.



**Fig 7. Message delivered to the customer mobile**

## V. CONCLUSION & FUTURE SCOPE

The aim of the project is achieved by implementing Electricity board side module and Consumer side module with its back end connected to PLC. Based on the energy consumption, Electricity board side module sends the billing amount with due date to the customer home module through power line and also to the registered mobile number via GSM module. Connection and disconnection is done on the basis of payment. Tamper detection is done without the knowledge of the tampering customer. The customer also gets details of the bill on his mobile phone through which he/she can pay the bill. The advantages of this model are, Automation of all features including communication from the EB office to the customer. Saves data using automatic control and storage systems. It involves less cost to communicate. This system increases productivity. To increase a number of customers to communicate and automate.

The designed system can be implemented by using the prepaid technology. In future the bills can be linked to Bank account, which reduces the manual payment and also reduces the risk of disconnection.

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