A Review on Digitalized Electricity Billing System Using ZIGBEE

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Abstract-**This paper present a developed Automatic Meter Reading system for Energy Management using ZIGBEE. The proposed system monitors the amount of electricity of every consumer at all the time. This digital energy management system will overcome the current old method of electricity billing process. It will eliminate the need for employing Electricity Board meter readers and this set of employees can be used elsewhere. In the case of any un payment of billing the system will give the alerts through an alarm circuit. After the alarm circuit, the consumer has to take an alternative solution to pay bill. Otherwise, the circuit breaker will come into OFF position and the supply will be tripping-off coming from EB. The information about the particular consumer will be sent to EB through GSM (Global System for Mobile Communication Network).Then, the consumer has to give the requisition to EB for making the circuit breaker coming into normal with the help of AMR microcontroller, which is programmed to monitor the parameters of electrical energy. This system helps to avoid illegal usage of electricity, monitoring the energy. The implementation and demonstration of the system were made.**

Key Words- AMR, ZIGBEE, Digital Energy Management, GSM

I. INTRODUCTION

An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device. Electric utilities use electric meters installed at customers' premises to measure electric energy delivered to their customers for billing purposes. The early billing process used to be handled manually. Every possibility for manual errors, Complaints on Non-receipt of bills / wrong entries in bills, could not provide the expected results in so many aspects hence there is a desperate requirement for Automated Billing systems. Automated Meter reading systems are an invaluable technological advancement that can lead to a better standard of living. It solves many issues of the traditional meter reading system like need for human resources, efficiency, accuracy, delayed work, unavailability of customer during metering visit by employee, etc. Moreover it is more economical and helps to save energy in a more efficient and effective way. For AMR, we were using ZigBee technology. It is a bidirectional wireless communication technology of short distance, low complexity, low cost, low power consumption, and low data rate, mainly used in automatic control. It mainly works on 2.4GHz ISM band with 20~250kbit/s data rate, 100m~1.5km maximum transmission range, and a typical 100m distance. ZigBee provides data integrity check and authentication, and uses AES-128 security algorithm. Each application has the flexibility to determine its safety properties. It uses collision avoidance mechanism, and at the same time it reserves a dedicated time slot to require a fixed bandwidth of the communication service, avoid the competition and conflicts when data is sent. Zig Bee Protocol is free of royalties. Our paper deals with the implementation of digital energy meters for improved metering and billing system.

II. PROPOSED SYSTEM

a) Power Supply Section

The rectifier-filter combination constitutes an ordinary dc power supply. The dc voltage from an ordinary power supply remains constant so long as ac mains voltage or load is unaltered. However, in many electronic applications, it is desired that dc voltage should remain constant irrespective of changes in ac mains or load. Under such situations, voltage regulating devices are used with ordinary power supply. This constitutes regulated dc power supply and keeps the dc voltage at fairly constant value. The output from the rectifier is pulsating dc .These

pulsations are due to the presence of ac component in the rectifier output. The filter circuit removes the ac. component so that steady dc voltage is obtained across the load.

b) Input Section

The circuit starts with the Mains 230V AC Input, followed by a SPDT Relay. The load is connected to a current sensor. When current is consumed by the load it is sensed by the current sensor & a respective proportional reading is passed on to the Energy Meter. Energy Meter consists of two main components, analog to digital converter (ADC) & frequency generator. The output of the current sensor which is a voltage proportional to current consumed is given to the ADC, wherein ADC converts the analog voltage into digital voltage. This DC voltage is in the form of pulses. The frequency generator converts these signal into pulses of certain frequency. Frequency generator generates a pulse at its output after receiving a predefined set of pulses from the ADC. This pulse is given to the micro controller for further processing. Micro controller performs multiple tasks at its output. It displays the energy meter readings on the LCD display also encodes the reading and transmits it through the ZigBee module, to the control relay.

c) Communication Section

ZigBee Technology is used for communication purpose. ZigBee is the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for wireless personal area networks (WPANs) first announced in year 2004. ZigBee is targeted at radio frequency (RF) applications that require a low data rate, low-power consumption, and secure networking. ZigBee operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and 2.4 GHz in most jurisdictions worldwide, including Thailand. The technology is intended to be simpler and cheaper than other WPANs such as Bluetooth. ZigBee protocols are intended for use in embedded applications requiring low data rates and low power consumption. ZigBee's current focus is to define a general purpose, inexpensive, self-organizing, mesh network that can be used for industrial control, embedded sensing, medical data collection, smoke and intruder warning, building automation, home automation, etc. The resulting network will use very small amounts of power so individual devices might run for a year or two using the originally installed battery.

d) Control Section

The microcontroller used in the system is ATMEGA 16. It is a high performance, low power Atmel 8 bit AVR RISC based microcontroller. It supports throughput of 16 MIPS at 16 MHz and operates between 4.5 – 5.5 volts. The programming of the controller is done with the help of C language in AVR. An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. 98 percent of all microprocessors being manufactured are used in embedded systems. Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also still common, especially in more complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand. Relay control unit is interfaced with the energy meter and microcontroller. Depending on the information received from the remote station, the relay driver can control the Relay unit to disconnect or resume the power connection.

e) Output Section

The liquid-crystal display has the distinct advantage of having low power consumption than the LED. It is typically of the order of microwatts for the display in comparison to the some order of milli watts for LEDs. Low power consumption requirement has made it compatible with MOS integrated logic circuit. Its other advantages are its low cost, and good contrast. The main drawbacks of LCDs are additional requirement of light source, a limited temperature range of operation (between 0 and 60° C), low reliability, short operating life, poor visibility in low ambient lighting, slow speed and the need for an ac drive.

III. PRINCIPLE OF OPERATION

In proposed system, we have used digital energy meter. It use current and voltage sensor itself to measure the power ratings, and it is given to the slave microcontroller IC, It is already programmed for calculating values,

such as amount of power utilized consumer, last date for paying bill, reset old readings, day by day update status, etc. The technology behind that, there is interconnection between the consumer and EB department. The thing is, if the consumer knows the amount bill means, it is possible to corruption on meter readings. So, the ZIG-BEE technology is used to transmit and receive the details about the corresponding consumer. So it is not possible corruption both master and salve side i.e., (consumer and central office side). If the consumers not pay the bill means the connection will be disconnected through the relay logic. The idea behind this proposed system is very simple that is, from this we have used ZIGBEE technology using data transmitting and receiving purpose. But in case of this technology is very costly, if it is used in every consumer means. So, we have planed to the transceiver is only a distribution section. From this cost is reduced. After paying the electricity bill they have given the password that is used to connection will disconnect or connect. We have transmitter section on every distribution section, and the receiving section in electricity board so, the entire control is on electricity board. From this the security of data transmission and reduced the manpower on electricity board
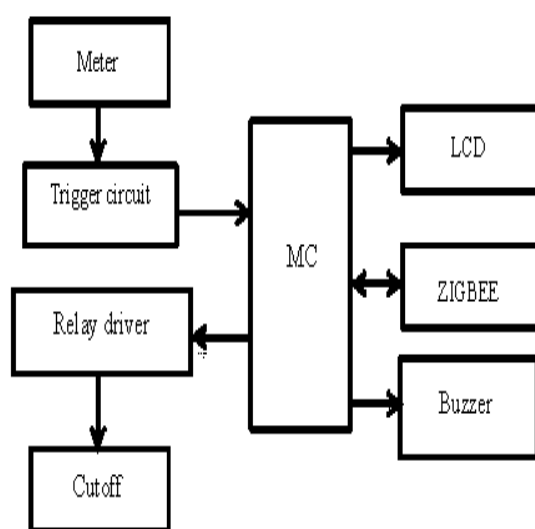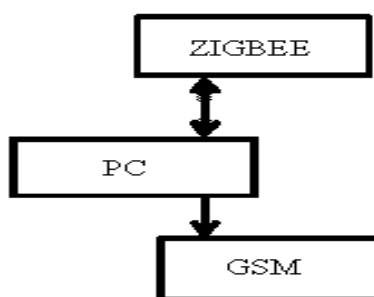

Fig.1.Consumer module

Fig.2.Office module

IV. PROPOSED ALGORITHM

For the purpose of updating the units continuously variable is introduced .In case of any interrupt (READ, CUTOFF, MAKE ON), it work based on that. In case of billing calculations takes place and send it to the office. In

case of no payment, supply will be cut off. After the payment, make on the supply, based on the need, the interrupts will send. After getting the billing calculation, make the bill and send it to the consumer.

V. FLOWCHART
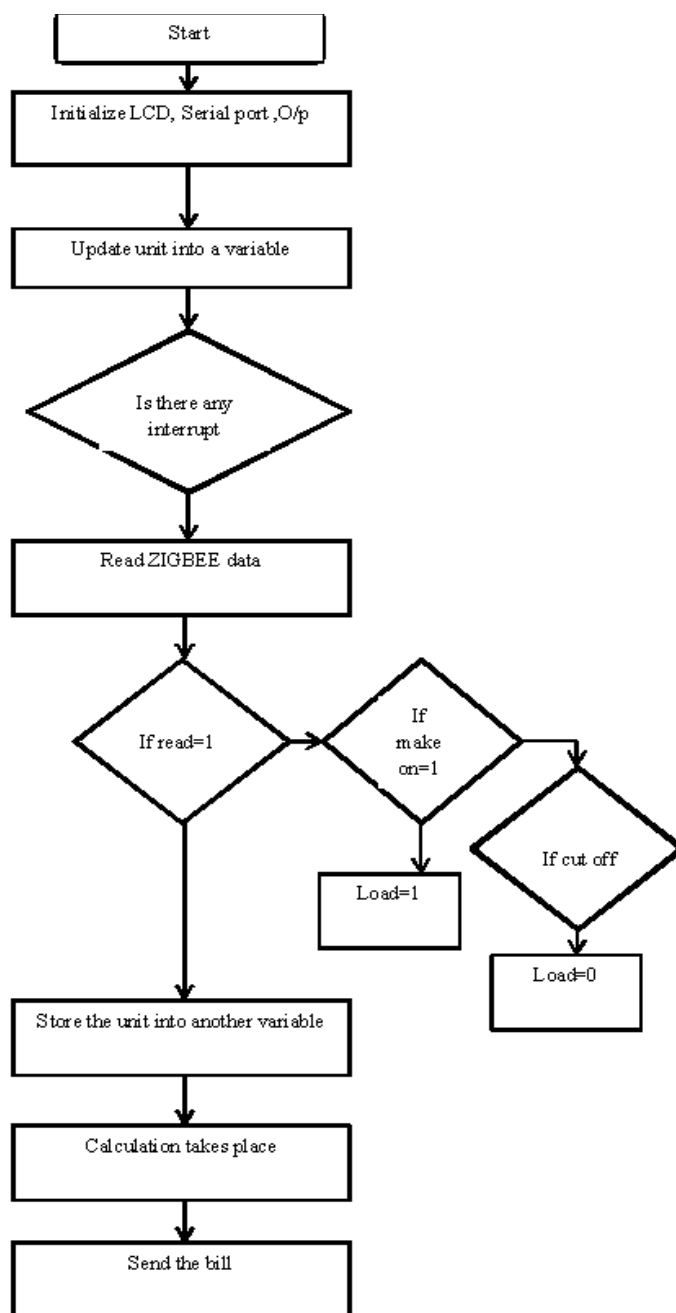
VI. CONCLUSION

The traditional billing system is slow, costly and unreliable. So it is essential to develop a billing system which solves the problem of billing manually and also reduces the manpower. The remedy for all these problems is to keep track of the consumers load on a timely basis, which will help assure accurate billing, track maximum demand, and detect online theft. These are all the features to be taken into account for designing an efficient energy billing system which can control the usage of electricity on consumer side to avoid wastage of power. Prepaid energy meter is a concept to minimize the Electricity theft with a cost efficient manner. The users are not bound to pay excesses amount of money, users have to pay according to their requirement. It can reduce problems associated

with billing consumers living in isolated areas and reduce deployment of manpower for taking meter readings. Digital energy metering is more reliable and user friendly

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