



Automatic Electrical Meter Reading System and Remote Monitoring Using Zigbee

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Abstract- The automatic metering system is designed to make the prevailing electricity billing system simpler and efficient. The conventional metering system is done manually. An employee of the Electricity Board will be coming to take the reading and enter in the card. There are more chances of manual error, delay in processing, tampering of the meter and misuse of the Electricity by other sources. We can automate the system and the man power can be utilized to provide quality service. The system is installed at the site of a standard utility meter and is configured for monitoring and operation by a user via keyword command programming on a data terminal or personal computer. In the Automatic System designed, the units consumed are measured at the consumer side in the form of pulses, it is transmitted to the Electricity Board side where the units consumed and amount equivalent is calculated and transmitted back to the consumer module. The monetary values are displayed both at the consumer module and electricity board side.

Index terms- Zigbee technology, Automatic meter reading system, Remote Measurement, Relay

I. INTRODUCTION

In Maharashtra, there are more than crore meters for electricity that are read every month, at a cost in salaries, transportation and other expenses that tops Rs. 3848.4 crore (2006-2007). A meter-reading system would still require someone driving by every meter and getting a reading through a hand-held receiver, but even newer technology - called an automatic meter reading system (AMR) - would eliminate even that need[6].

An AMR is a sophisticated communication link directly from the meters to the central office computers that will also speed locating service interruptions, faulty meters and service theft, as well as allowing for expanded services, such as flexible billing dates, time-of-use rates and prepaid accounts. Meters could also be turned on or off directly from the office rather than having to send out an employee to do it manually. The study shows an AMR system would save almost 2-3 crore per year by eliminating meter-reading, automating disconnects/reconnects, reducing bad debts and improving meter accuracy and reducing theft of service another positive element of the project would be lower costs for services

to the Consumer as well as many service providers of electricity, water, and gas are trying to implement this system[5]. For example Northern Ireland Water Supply Company had specified its requirements and waiting for tenders. Maharashtra state electricity board has also specified its requirements in 2004-2005.

II. LITERATURE SURVEY

This article reviews the technical features of automatic meter read (AMR) systems for residential small commercial natural gas meters, including a look at the new static gas meters. AMR systems are today quite widespread for electrical residential meters, but are still in an experimental (pilot projects) stage for other applications in utility meters, such as natural gas residential and small commercial meters. AMR systems allow the recording of gas consumption in an efficient way with some important advantages for the overall gas system, both for the provider and for the user. The main AMR benefits for the customer are:

- * Convenience. Meter readers are eliminated;
- * Efficiency. The AMR system eliminates estimated meter reads; and
- * Accuracy. The electronic unit of AMR, equipped with a reliable encoder technology, is more accurate than manual (or semi-manual) meter reads, thereby eliminating human errors.

New enablers such as automated meter reading (AMR) can be applied to capture and leverage information to help utilities proactively achieve these competitive objectives. Advanced capabilities such as predictive analysis, simulation tools, contingency analysis and network monitoring can go far in giving utilities the power to be successful.

Automated meter reading systems are an attractive technology for cutting costs while increasing speed and control of metering activities[10]. When organizations, such as utilities, military installations, large industrial parks and school districts consider automated meter reading technology, they discover most available systems carry high initial capital costs. Organizations

that purchase systems without first evaluating the full costs and benefits often find they are locked into a technology that accomplishes less than they need.

Each level of that process took time and was error prone. The introduction of handheld devices saved time and reduced errors. Drive-by metering further improved the data collection process.

This report on Automated Meter Reading Technologies explores this emerging industry in depth, focusing on the manufacturers and suppliers of AMR technology and equipment, and current trends in the AMR industry. The report also explores the market statistics pertaining to water utilities, available technology, current business requirements, and much more. The report takes a look at the newly gained interest of venture capitalists in automated meter reading technology markets and how it is affecting the industry overall. Read on to find out how this new technology is changing the today utility landscape[9].

Now a day's wireless communication has become ubiquitous around the world and its application for gauging consumption of utilities by customers is rapidly gaining pace, not only in the developed world but also in the developing countries[3].

III. METHODOLOGY

AMR stands for Automatic Meter Reading. A device which remotely obtain meter readings and transmits this data to the system's computer via communication media such as phone lines, power lines or dedicated cables for processing. AMR devices can detect outages, remotely connect and disconnect services, detects tampering as well as other uses. Economic benefits include increased cash flow, lower labour and equipment cost, increased accuracy and lower costs. Some customer satisfaction benefits include improved service quality, more customer choices and faster response time.

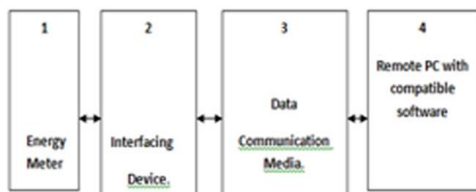


Fig.1:- System Overall Architecture

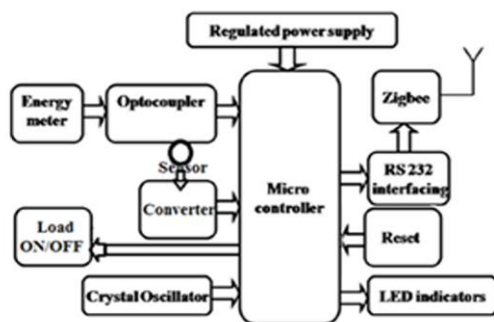


Fig.2:- Block Diagram of Transmitter

A. AVR ATmega16

In this section, we describe the overall architecture of the Atmel AVR ATmega16. We begin with an introduction to the concept of the reduced instruction set computer (RISC) and briefly describe the Atmel Assembly Language Instruction Set. A brief introduction is warranted because we will be programming mainly in C throughout the course of the book. We then provide a detailed description of the ATmega16 hardware architecture. This is the basic hardware configuration of Atmega16. PORT A is configured with eight tact (momentary) switches with accompanying de-bouncing hardware. The AVR core allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers[8].

B. OPTOCOUPLER

An optocoupler (or an optoelectronic coupler) is basically an interface between two circuits which operate at (usually) different voltage levels. The key advantage of an optocoupler is the electrical isolation between the input and output circuits. With an optocoupler, the only contact between the input and the output is a beam of light. Because of this it is possible to have an insulation resistance between the two circuits in the thousands of mega ohms. Isolation like this is useful in high voltage applications where the potentials of two circuits may differ by several thousand volts.

C. KA2281 IC

The KA2281 is a monolithic integrated circuit consisting of a 2 –channels LED level meter driver which was designed for use in stereo radio cassette tape recorder and home stereos.

D. RELAY

We know that most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

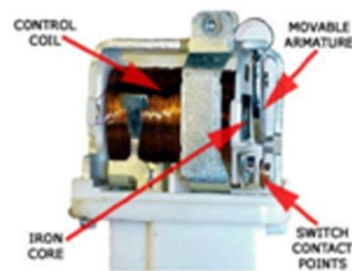


Fig.3:-Relay

E. PIEZO SENSOR

A piezo electric sensor is a device that uses the piezo electric effect to measure changes in pressure, acceleration, strain or force by converting them to an electrical charge. The prefix piezo is Greek for ‘press’ or ‘squeeze’. A piezo electric transducer has very high DC o/p impedance.

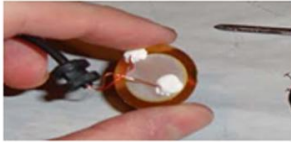


Fig.4:-Piezo Sensor

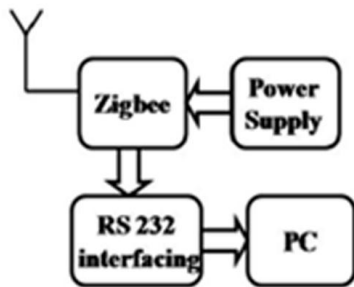


Fig.5:- Block Diagram of Receiver

F. Zigbee

In this project the data will be transmitted from the attendance entering system to the main server using wireless technology. The past several years have witnessed a rapid growth of wireless networking. However, up to now wireless networking has been mainly focused on high-speed communications, and relatively long range applications such as the IEEE 802.11 Wireless Local Area Network (WLAN) standards. The first well known standard focusing on Low-Rate Wireless Personal Area Networks (LR-WPAN) was Bluetooth. However it has limited capacity for networking of many nodes. There are many wireless monitoring and control applications in industrial and home environments which require longer battery life, lower data rates and less complexity than those from existing standards. For such wireless applications, a new standard called IEEE 802.15.4 has been developed by IEEE. The new standard is also called ZigBee, when additional stack layers defined by the ZigBee Alliance are used[2],[3].

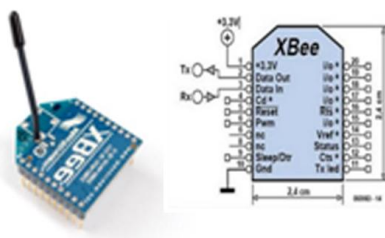


Fig.6:-Pin Diagram of Zigbee

G. MAX232 IC

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage level from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3V, a typical hysteresis of 0.5V, and can accept +30V/-30V inputs[7].

IV. OUTPUT AND RESULT



Fig.7:- Printed circuit board of work done

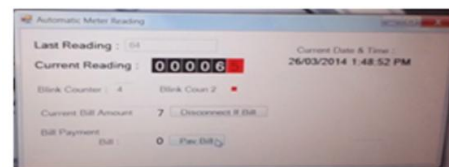


Fig8:-Main Form (AMR)

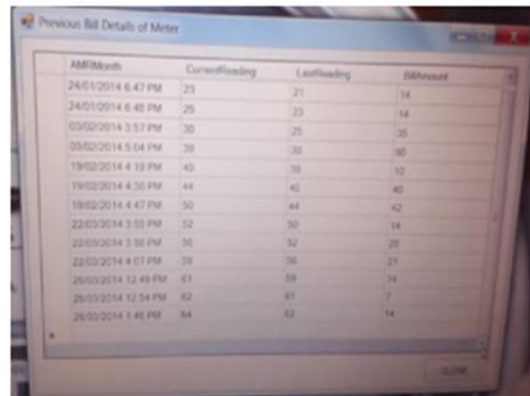


Fig.9:-Meter Bill Detail

V. SOFTWARE APPLICATION

Visual Basic .NET (VB.NET) is an object-oriented computer language that can be viewed as an evolution of Microsoft's Visual Basic (VB) implemented on the Microsoft .NET Framework. Its introduction has been controversial, as significant changes were made that broke backward compatibility with VB and caused a rift within the developer community. The great majority of VB.NET developer use Visual Studio.NET as their integrated development environment (IDE). Program written in VB.NET require the .NET framework execute.

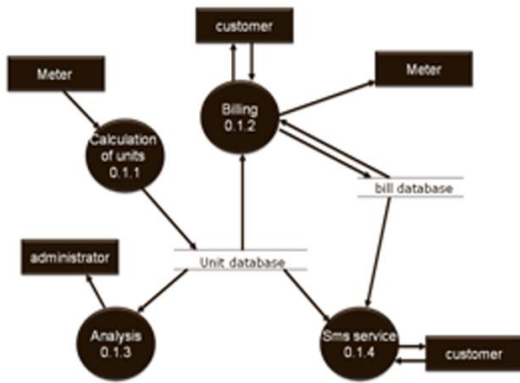


Fig.10:- System Operation Flowchart

VI. CONCLUSION

Automatic Meter Reading (AMR) is a unique solution for problems in existing manual system. Automatic Meter Reading is self assured automation system. Implementation of Automatic Meter Reading with the help of standalone system is an innovative idea. There are more chances of manual error, delay in processing, tampering of the meter and misuse of the Electricity by other sources but with the help of Automatic Meter Reading, we can easily overcome this anomalies. Using prepaid services, we can make proper use or storage of electricity. Economic benefits include increased cash flow, lower labour and equipment cost, increased accuracy and lower costs some customer satisfaction benefits include improved service quality, more customer choices and faster response time.

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