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A Survey on Different Methods of Automatic Meter Reading Systems

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ABSTRACT: Automated Meter reading systems are important and an applicable technology that can lead to a better standard of living, because the metering has become a part of our day today life. Our project is an attempt to solve many disadvantages of the traditional meter reading systems are that which requires more human resources, efficiency, accuracy, delayed work, absence of customer during employee visit home etc... There are different technologies to overcome the difficulties in traditional meter reading system. Meter reading using GSM, GPRS etc are some of these technologies. AMR using GSM automatically reads the energy consumed and sends it to the service provider using short messaging services (SMS).The GPRS meter reading system will collect the real time data of industrial and residential electricity, and then sends the data to the electricity board through GSM/GPRS network. Here describes a survey of different technologies used for various methods of automatic meter reading systems.

KEYWORDS: AMR-GSM-GPRS-Power Line Communication

I.INTRODUCTION

Traditional electricity billing system is very lengthy and erroneous one. Now a day ,a person who goes to every customer premise and manually takes the readings and then bill is issued. This requires huge number of workers and large time for billing. Visiting of consumer's home is sometimes causes a number of problems. Sometimes houses are found be closed, this makes interruptions on employee's duty. For manual reading may leading to erratic results, especially when the meter is placed inside the home or in a difficult-to-access place. In the typing stage again there are chances of errors. The erroneous reading, not accurate billing, manual labour, large labour cost and time consuming are some disadvantages of these system.. In case of failure in bill settlement by customer, the employees of electricity board have to personally visit the customers' house and cut off the supply. Hence large time and labour power is wasted. This might create problems for the customer at the time of payment. Thus the Automatic Energy Meter Reading (AMR) [1] system is introduced to avoid these difficult task.. Hence the proper utilization of electricity must be done.

In every aspect of life automation is required to reduce the work. So we have to designed Automatic Energy Meter Reading system using power line communication. The Automatic meter reading system will overcome the current old method of electricity billing process. The Automatic Meter Reading System is a modern power measuring system which is also used to measure gas, water and electricity. This project eliminates the need for employing meter readers by EB and this set of employees can be used elsewhere. Also the system is fully controlled automatically by this technique. This system automatically collects the consumption and status of data from energy metering device and transfer the data to Electricity Board (EB) office by using Power lines. After verifying customer's id number, bill will be issued and stored into database. The proposed system automatically disconnects supply when payment periods exist. It also does provide accurate meter reading.

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II. AMR SYSTEM USING GPRS TECHNOLOGY

Meter reading is an important part of the daily work of power enterprises. Automatic meter reading, or AMR, is one of the latest Machine to Machine (M2M) application that have a huge contribution to the technology of automatically collecting consumption of energy, diagnostic, and status data from metering and transferring that data to a central database for billing, troubleshooting, and analyzing. The accurate readings, real-time, low cost of information collection and control for meter are advantages remote reading technique. The Automatic meter reading system (AMRS) is an integrated technology to collect data automatically and process by special equipment to meter with the use of telecommunications, computer technology. It greatly ensure real-time meter reading and to avoid errors caused by manual meter reading and also saves manpower, material resources, reduce labour cost.

Traditional meter reading, which depends on manual reading on site at a fixed date, has many deficiencies in real-time and accuracy. GPRS automatic meter reading system is a gradually developed intelligent system combined with the power meter reading characteristics, it can collect the real time data of industrial and residential electricity, and then sends the data to the remote management through GPRS network[2].

According to the hardware data collecting system for meter reading a software design model for sending and collecting a variety of meter data is given. At last, the form of these data stored in the database .In this system, the meter reading from the various nodes will sent to the master node via GPRS modem. In both section the microcontroller is connected to the GPRS modem. The energy meter is connected with load and energy consumption is monitoring using an IR sensor.

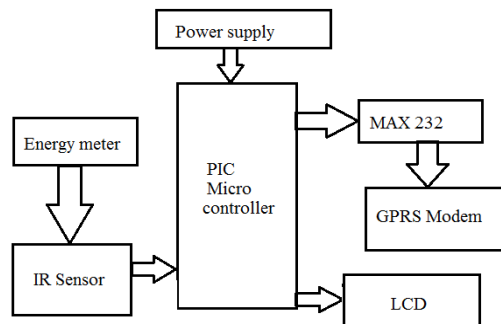


Fig 1: AMR using GPRS at customer side

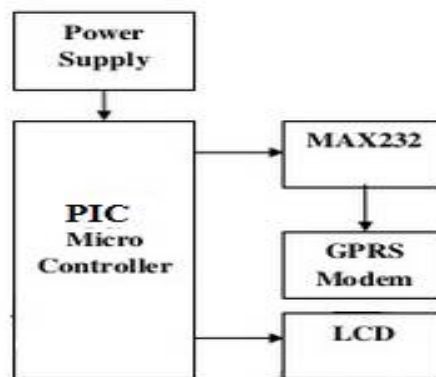


Fig 2 : The block diagram of AMR using GPRS technology at vendor side

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The number of unit is sent to the master node via GPRS modem. The block diagram of AMR using GPRS technology is shown in fig 1 & 2.

By the system, it can not only save the human resources, but also accurate supply and reliable meter reading data to load prediction and control, so that the overall economic efficiency of the power industries can be improved and the management level progressed. Web Services is a technique that enables the application independent of programming language and platform. For development requirements of automatic meter reading system of the power enterprises, builds a web Services based GPRS automatic meter reading system with Web Services technology which is easy interactive, extensible, open and easy maintenance.

III. AMR SYSTEM USING GSM

The system includes a 32-bit ARM microprocessor to deal with power data processing and relay control, which transmits the power consumption values periodically, via an existing GSM network[3] to a master station. Management Center in EB side is a mainly a computer or a network of computers, which collects the data sent from the AMR interface. The block diagram of ARM system is shown in fig 3. To implement this system, an ARM processor based board is used. It uses a 32-bit processor with on-chip counter/timer module, PWM, ADC, and UART module to interface a GSM energy meter and modem. The energy meter which generates the pulses, which is counted by microcontroller and incremented the number of units of the energy is to be consumed. The digital energy meter is having a LED which blinks for a definite number of times to indicate the energy consumed. These pulses are fed to ARM system which is programmed to count these pulses. The system reads these pulses and after counting finite number of pulses it increments the internal counter by one which indicates the number of units consumed.

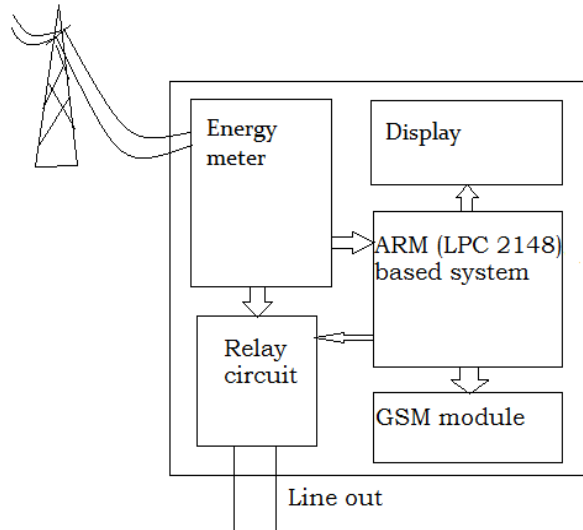


Fig 3: AMRS using GSM

The system has ARM LPC 2148 based board. The LPC 2148 have inbuilt interrupt, UART, on-chip timer and ports for interfacing energy meter. The standard C programming used for programming the ARM system. The energy meter used provides output pulse indicating the energy units. It provides 1000 pulses when it consumes 1 unit of energy. The pulses are given as input to the ARM based system which counts the pulses and increments the internal counter, which is intended to count the unit, after counting 1600 pulses. When a message is received, the interrupt service routine interrupts the ARM which checks the message type and sends either energy meter reading or disconnects the supply[4]. The code in ARM Controller check the contents of message received itself and takes the decision. While the system is performing the task of sending message, the counting of pulses from meter is going on in another ISR.

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IV. AMR SYSTEM USING POWER LINE COMMUNICATION

The Electricity billing process is very length and erroneous. Now a days, energy meter readers goes to every customer’s premise and takes the reading manually This requires huge number of labours and long working hours for billing. To avoid this difficult task, Automatic Energy Meter Reading (AMR) system is introduced. This system provides efficient and effective wireless automatic power meter reading, billing and notification through the GSM network. But this system will have more cost . Hence considering all the points a way is found which reduces the complexity and cost of system. The meter reading data is sent by the home unit to the EB office through power lines. This saves lot of manual data entry needed for entering the data of meter reading into the central system.

The power line communication[5] used here is bi-directional. Sometimes the noises are introduced due to interference of external disturbances in power line. During these case the data transmission may be interrupted and error may introduced in the data. To avoid this error a dedicated micro controller is used to enable data transmission even in the noisy power line and also at any weather condition.

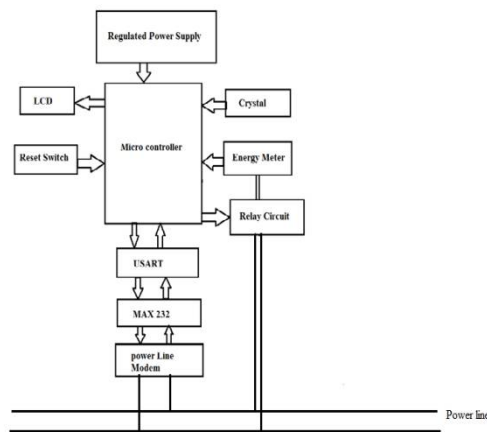


Fig 4 : The block diagram of AMR vendor side

The customer section consists of digital energy meter and control system.. The output of the energy meter is a digital pulse, which depends upon the load used. These digital pulses are given as the input to the Electricity board section through the opto coupler. Hence the energy consumed by the consumer is calculated digitally. This is then displayed in LCD.

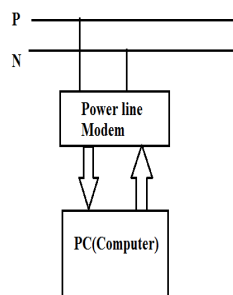


Fig 4 : The block diagram of EB side

The vendor section consists of the POWER LINE MODEM which is a transceiver i.e. it can transmits and receives the data. The power line modem receives the number of units counted by the microcontroller and transmits it to the electricity side. These are received by the modem placed in the EB side and sent to personal computer(PC). The bills



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are calculated using software by the PC and sent to the micro controller through the same POWERLINE MODEM. Hence the number of units consumed and the amount is displayed in the LCD.

V.CONCLUSION

Based on all the systems surveyed, their advantages and drawbacks, this paper presents the features that make up an ideal AMR system and provides a overall insight of the various methodologies applied for AMR so far thus providing a base for further research in this area. Based on the performance criteria considered, several systems were compared and now we come to a conclusion that, when it comes to Reliability and Feasibility GSM topped the charts but when Coverage and Communication protocol used comes in to picture PLC steals the stage.

Other suggestion would be to include a web/mobile interface that gives a real-time feedback of the energy consumption, maybe even give the amount of energy consumed by every device in every room and also give energy conservation tips too, based on the data obtained. The real-time data thus obtained can also be used to build a prediction model over it, for predicting the energy demands trends of the future, over any given time period.

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