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Wireless Transmission of Energy Meter Data

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Abstract

The main purpose of our project is to develop an automatic data transmission system. In order for the consumer to avoid having to pay the wrong amount which frequently occurs due to erroneously generated inflated bills, the generation of an electricity bill must be done with care. The conventional system still in use has people appointed by the MSEDCL for taking the photos of the energy meter readings. This process is time consuming and tedious. These readings are then collected at the MSEB Office where a bill is generated according to the reading on the photo. We have proposed a new system in order to avoid the mistakes generated due to human error while either taking the photos or entering the data to calculate the amount to be paid. This system consists of a basic 8051 microcontroller which will count the number of LED pulses coming from the energy meter and which are used as an indication of the amount of electricity consumed. A MAX 232 converts the signal from the microcontroller to RS232 level understood by the computer and is transmitted wirelessly by an RF ZigBee transmitter to its receiver which in turn wirelessly transmits the data to a GSM module and a computer. This enables us to send an SMS containing the units consumed along with the amount to be paid, to the consumers according to a unique customer ID assigned to each household or business. A bill is also generated with the data received by the computer using Visual Basic. The main advantage of using this new system is that the human interference is eliminated by transmitting the necessary readings

wirelessly. It will also provide the customer with the ability to cross check the readings of their monthly energy meter reading with the one that is printed on the bill.

Keywords: Automatic Meter Reading (AMR), Wireless transmission

I. INTRODUCTION

An energy meter is a device that measures the amount of electric energy consumed by electrically powered devices and is used to generate bills for the amount of electricity consumed in our daily life. There are different types of energy meters such as prepaid, analog, digital, etc. They are typically calibrated in billing units, the most common one being the kilowatt hour [kWh]. When you use electricity to power a 1000-watt vacuum for 1 hour, you use 1,000 watt-hours (1,000Wh) of electricity. Our utility bill usually shows what we are charged for the kilowatt-hours used. They are usually read once each billing period, typically of one month. MSEDCL usually generates the electricity bill by taking the photos of readings on the conventional energy meter which is a time consuming procedure. The difference between one month's reading and the next is the amount of energy units that have been used for that billing period.

In order to make human life more comfortable, easy and to save time and to maintain exactness; we need to switch to meters with wireless transmission. Wireless communication modules (such as GSM, CC2500 RF Transceiver and ZigBee) enable the conventional energy meters to become wireless energy meters. [1][2] This also helps the electricity department to keep tabs on electricity thefts and possible tampering with the energy meter. It also allows the consumer to monitor power cuts. [2] The system implemented is cost effective as we have used components that are not too expensive and which are easily available. This system can be used for many years without any problems and thus wireless meters will be useful and have a good scope for large scale implementation. The system has 100% accuracy as long as the energy meter works without any problems and the overall system is wired correctly.

II. BLOCK DIAGRAM

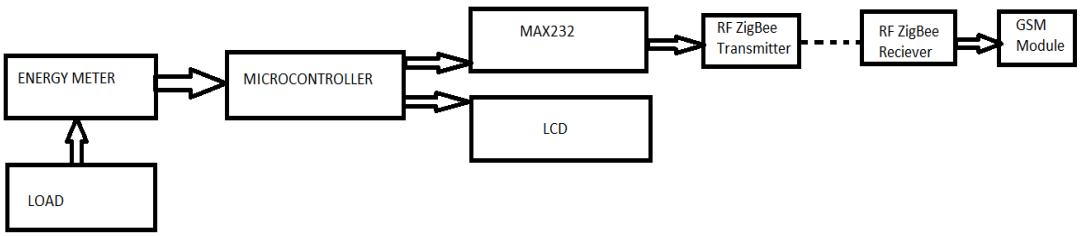

Fig (a): Block diagram of the proposed system

For the demonstration, a 60 watt light bulb has been used as the load. The electricity consumed by this light bulb is measured by an energy meter, manufactured by Jaipur Electronics. This electro-mechanical, single phase device is a true RMS meter which ensures good performance and contains a sealed electromagnetic impulse counter, indicated by an LED. The LED pulses are counted by an 8051 microcontroller which has been chosen for its simplicity in programming and cheapness. The microcontroller then transmits the number of pulses counted to MAX232 and a 16x2 LCD as shown in fig (a) above. The LCD displays the present value of the electricity consumed. The MAX232 is used to communicate between the microcontroller and a computer. It is a level converter and is used to convert Transistor-Transistor Logic (TTL) of microcontroller to RS232 level understood by the computer. This RS232 signal is then transmitted via RF ZigBee which is a wireless technology that requires less power consumption. The ZigBee then wirelessly transmits the signal to a GSM module and a computer. The GSM is a special type of module which operates just like a mobile phone and requires the use of a SIM card and subscription to a mobile operator. By connecting this GSM module to a computer we can send a message to the consumer regarding the billing period and the amount to be paid by a particular due date.

III. RESULT

The electricity consumed by the light bulb which was counted by the number of LED pulses and transmitted to the computer by the 8051 microcontroller and RF ZigBee is then multiplied by a predetermined amount per unit. The amount to be paid is thus calculated and sent to the consumer via text message.

We have used Visual Basics which is a programming language developed by Microsoft to design a Graphical User Interface (GUI) which displays the total billed as well as unbilled units as shown in fig (b). We chose to use Visual Basic as it does not involve a substantial amount of syntax and coding. We can simply drag and drop controls such as buttons and dialogue boxes and then define their appearance and behavior. Every consumer will have a specific user ID assigned along with a mobile number and address associated with that ID. Once a bill for a particular billing period has been generated, it can be accessed by the consumer online as well as being received as a text message. This ensures that no errors are generated and the customer can cross check the amount to be paid.

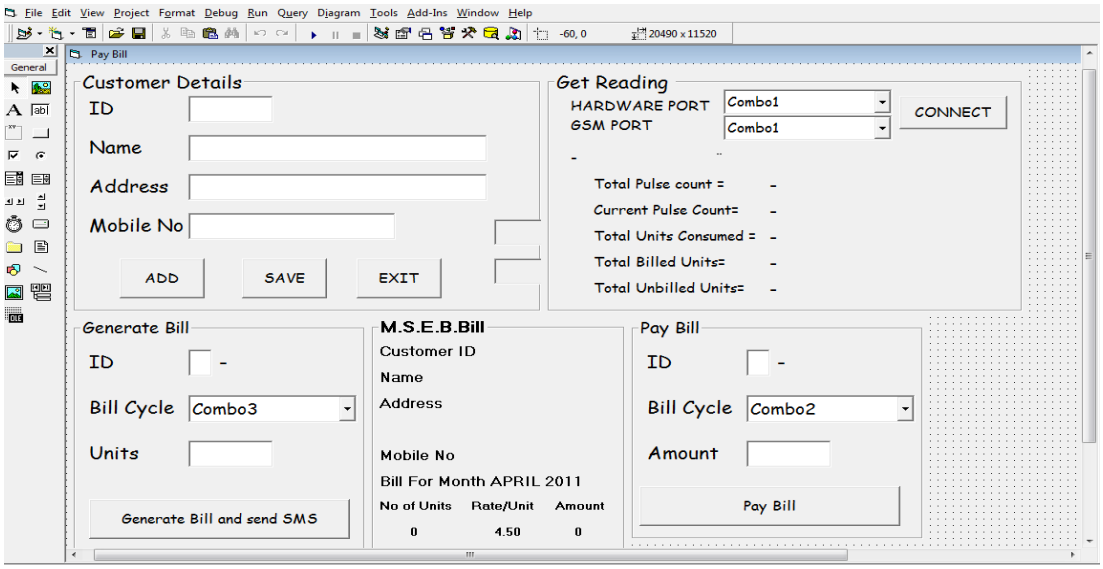

Fig (b): GUI of the proposed system

IV. CONCLUSION

Using the proposed system we have achieved the successful wireless transmission of the power consumption displayed on the energy meter to the computer. The amount to be paid was calculated and accordingly a bill was generated which can be accessed by the consumer on the computer from anywhere in the world. The same was also received via SMS. The major advantage of this system is the reduction in the use of paper which is normally used to print the bills. The manual labor required will be drastically reduced and so will any errors they may cause. The drawback of the system is the transmission range of ZigBee which is limited up to a distance of 10 to 20 meters. Also while one ZigBee receiver is sufficient, the number of ZigBee transmitters increases according to the number of energy meters being monitored, thus increasing the cost of the project and the area required by the overall system.

V. ACKNOWLEDGEMENT

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