AUTOMATIC MEASUREMENT AND MANAGEMENT OF ENERGY METER DATA AND BILLING CYCLE

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Abstract-- **A country like India where corruption lies everywhere we cannot imagine what size of losses are made by our country every day in all the areas. One of the major areas is stealing electricity in our nation. As all of us know very well that the production of electricity in our nation is much below then its demand or requirement. Over this the production cost of electricity is also very high. If the scenario in the county is above, then it is the responsibility of all citizens to use electricity efficiently, avoid misuse of it and very importantly pay for electricity honestly. On the other side it is the responsibility of Government to cut down the expenses wherever possible to bring down the cost of electricity. Govt. spends a big amount for the meter reading and bill printing which ultimately adds to the electricity cost. This paper presents the development of an Energy Meter which is having capabilities like remote monitoring and controlling of energy meter. Automatic Meter Reading system (AMR) continuously monitors the energy meter and sends data on request of service provider through SMS. It saves huge human labour. The data received from an energy meter has been stored in database server which was located at electricity Board station through SMS gate way for further processing by energy provider. Energy provider sends electricity bill either by e-mail, SMS or by post.**
This system allows to the customers to pay bill online either by credit card, debit card or by net banking. This system provides freedom to electricity companies to take action against lenient customers who have outstanding dues, otherwise companies can disconnect the power of customer. Companies can re-connect the power after deposition of dues. This system also gives the power cut information and tempering alert.
Key term: AMR (Automatic Meter Reading), SMS (Short Message Service), EM (Energy Meter).

I. INTRODUCTION

Energy meter includes Automatic meter reading, or AMR, the technology of automatically collecting consumption, diagnostic, and status data of energy metering devices and transferring that data to a central database for billing, troubleshooting, and analyzing. This advance mainly saves utility providers the expense of periodic trips to each physical location to read a meter. Another advantage is billing can be based on near real time consumption rather than on estimates based on previous or predicted consumption. This timely information coupled with analysis, can help both utility providers and customers better control the use and production of electric energy. EM technologies include handheld, mobile and network technologies based on telephony platforms (wired and wireless), radio frequency (RF), or power line transmission. The ability to remotely read utility meters not only dispenses with the problems of owners being out when the meter needs to be read, it also allows detailed usage profiles to be generated and so aids predictions of demand. This technology mitigates labour cost, collection time, avoids late payment. Adding to this it increases data security, improved customer service, reduced revenue losses. This system is not only sending the data but also it does provide power disconnect/connect feature, power cut feature and tempering alert feature. All these advantages give this product an edge over other pragmatically prevailing devices.

II. BACKGROUND OVERVIEW

A. Existing System

Current system of meter reading is the manual one. One person from dept. comes and writes down the reading of each and every meter. A huge no. of persons are appointed all over the country to perform this job. Govt. has started clicking the image of every meter and the same is printed on the bill statement to prove the correct reading in billed in the statement. But still it is the manual system and very much time consuming.

B. Drawbacks of Existing System

Being the manual system there are space open for manual errors like writing wrong reading, typing error while entering the reading in system. Malpractices are possible to reduce the bill amount. The person who writes the meter reading can take bribe and write lower reading than the actual one. A huge amount of money is spent as the salary of the persons employed for this. This system is very much time consuming.

C. Proposed System

In our proposed system the person who will take the meter reading will carry a mobile phone in which our application will be preinstalled. Every meter will be supported with our system which will continuously read the meter ID and its reading and same will be transmitted via BT modem on BT frequency. As soon as the person will run our application software in his mobile one by one all the meter IDs with their respective reading will be received by him in his mobile and will get saved in the memory card of the mobile automatically.

The benefits of our system are clear…

☐ Smart automated processes instead of manual work.

☐ Accurate information from the network load to optimize maintenance and investments.

☐ Customized rates and billing dates.

☐ Better network performance and cost efficiency.

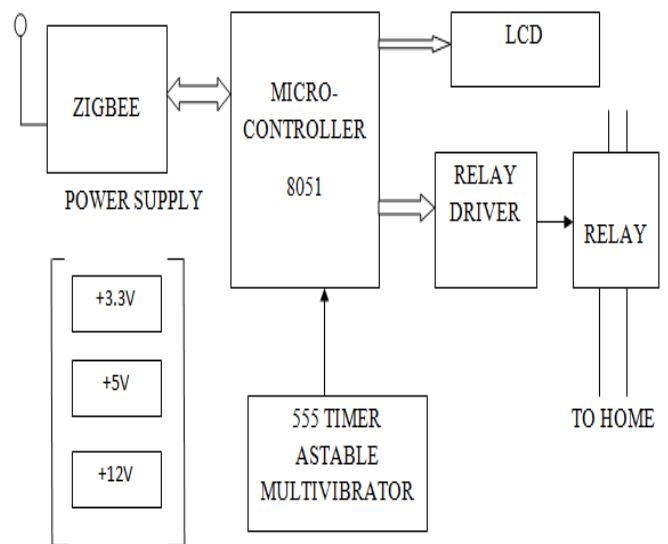☐ Detection of tampering of meter.

III. THE PROPOSED SYSTEM

A. Block Diagram

The Block Diagram of the system is represented in Fig 1.

PC Side
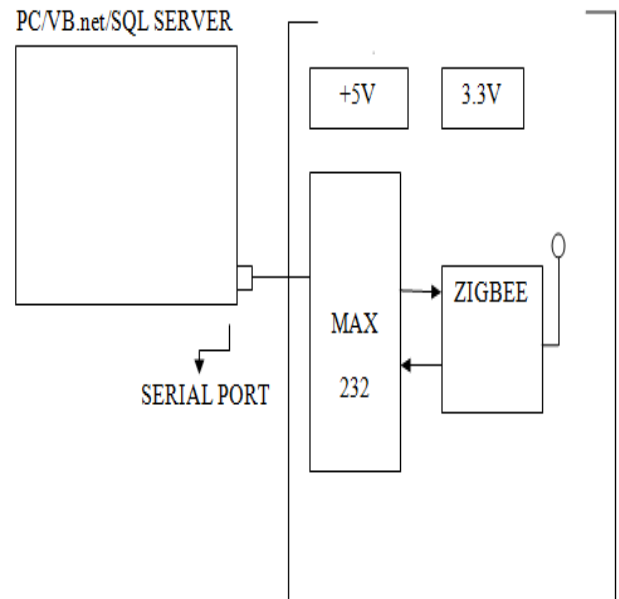
Meter Side

Figure 1: Block diagram of Energy Meter

B. Explanations of Blocks

The following are the brief explanations of the working principle of the various major blocks or sections used in the system…

▢ Power Supply

This unit will supply the various voltage requirements of each unit. This will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge Rectifier. It will convert 230VAC into desired 5V/12V DC.

▢ Microcontroller

This unit is the heart of the complete system. It is actually responsible for all the process being executed. It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the Microcontroller. The controller here user will be of 8051 family. 8051 microcontroller sends the most current reading from the 555-Timer to the LCD where the meter reading is displayed. The microcontroller also keeps on storing the reading received from the 555-Timer in to its RAM where the previous readings are overridden by the most recently received reading from the 555-Timer.
 The code will be written in Vb.net and SQL server and will be burned or programmed into the code memory using a programmer. This unit requires +5VDC for it proper operation. Pin diagram of 8051 is represented in Fig 2.
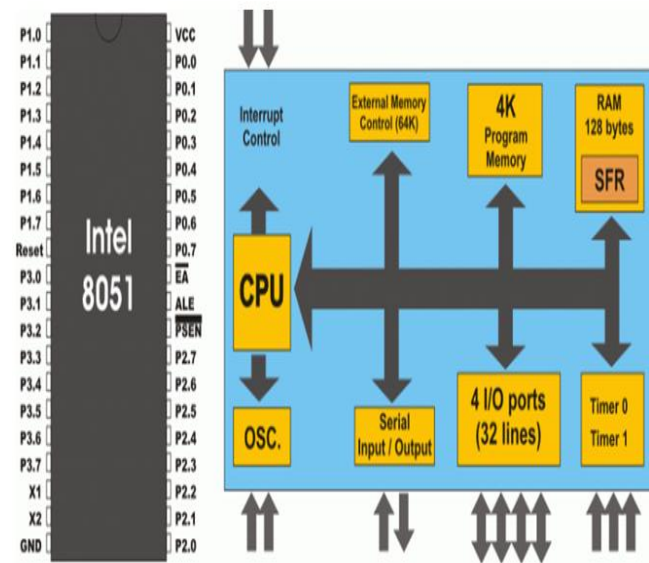
Fig 2: Pin diagram of 8051

▢ LCD 16x2

It is called Liquid Crystal Display. We are going to use 16x2 character LCD. This will be connected to microcontroller. The job of LCD will be to display all the system generated messages coming from the controller.

LCD will provide interactive user interface. This unit requires +5VDC for it proper operation.

▢ Zigbee

ZigBee is the set of specs built around the IEEE 802.15.4 wireless protocol. The 802 groups is the section of the IEEE involved in network operations and technologies, including mid-sized networks and local networks. Group 15 deals specifically with wireless networking technologies, and includes the now ubiquitous 802.15.1-working group, which is also known as Bluetooth. The name "ZigBee" is derived from the erratic zigging patterns many bees make between flowers when collecting pollen. This is evocative of the invisible webs of connections existing in a fully wireless environment. While Bluetooth focuses on connectivity between large packet user devices, such as laptops, phones, and major peripherals, ZigBee is designed to provide highly efficient connectivity between small packet devices.

▢ 555 Timer

The 555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays, or oscillation. Here we are using it in Astable Multivibrator mode for generating clock pulses. The frequency depends upon the external register connected to the IC. This unit requires +5VDC for it proper operation

C. Technology & Programming Languages

As microcontrollers are the core of these days digital circuit design in industry, this system uses it for the centralized operation and digital processing. The followings are the various Programming Languages & Technologies that are going to be used in the proposed system…

For Embedded System…
▢ Vb.net
▢ 8051 Family Based Controller,
▢ SQL server
▢ Eagle Software for PCB Designing,

For Mobile System…
▢ Serial Communication Protocol (SPP),
▢ J3ME Based Mobile (MIDlet) Programming,
▢ Bluetooth Programming-JSR-82.
▢ File Handling.

D. Results

The experimental setup is shown in Fig 3, where load is connected to the meter and Fig 4 represent a message has sent to the customer with their meter id and units consumed.
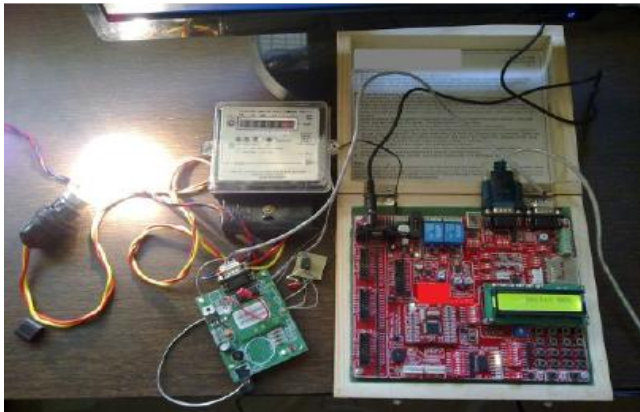
Fig 3: Experimental setup

Fig 4: Message to customer

E. Project Development Methodology or Steps

The following will be development steps so as to achieve the working Prototype Model of the above proposed system…

 Defining the Problem,
 Understanding the Need & Usability in industry and society (Market Analysis),
 Developing Block Diagram,
 Designing Circuits of individual blocks,
 Testing circuits in LAB & Finalizing,
 Developing PCB on PC,
 Getting the PCB printed from market,
 Soldering the components,
 Performing various Basic Experiments to test the PCBs,
 Developing Flowchart for the entire process,
 Writing actual Software Program,
 Compilation & Burning,
 Testing and Debugging,
 Developing Flowchart for Mobile Side Software,
 Developing Data Flow Diagram,

 Writing actual code.
 Finally Running the system and,
 Documentation.

IV. SCOPE & APPLICATIONS

Only the imagination can limit the applications of the above proposed system.

Though the following are some examples…
 Electric meter reading
 Gas meter reading

V. ADVANTAGES AND FUTURE SCOPE

The system designed reduces the efforts of manual data collection of energy meter. Also, data which is received at service provider side is easy to manipulate for bill generation and other such tasks. With this system we can collect the reading as well as control the supply to the user. With addition of software at service provider side, the customer can be informed of current meter reading, bill for current cycle, status of the line and other parameters to the customer with either message or a phone call.

VI. CONCLUSION

With this system the service provider can collect the bill any time with a single message. The data collection and manipulation task becomes fast and easier. Any modification can be made to the code in less time. Changes in rate or unit calculation can be done very effectively.

VII. FUTURE MODIFICATIONS

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done…
 The range can be increased,
 Multiple meter can be connected simultaneously,
 Can be used with any mobile.

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