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Design and Implementation of Automatic Electricity Meter Reading Using GSM

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***Abstract*— This paper presents a method for designing and implementing a GSM based remote automatic energy meter reading. The designed device is installed with the energy meter installed in consumer's home. It collects the input from the energy meter converts those input to suitable signals for microcontroller. These signals from microcontroller are sent to the service provider using a GSM module. The service provider calculates the consumption and forwards a SMS to the consumers registered mobile number. Implementation of this project will reduce the cost of providing utility to the consumers. The experimental outcome was quiet promising.**

Keywords— GSM module, microcontroller, energy meter, smart metering system.

I. INTRODUCTION

Every month we can see a person standing in front of our house from Electricity board or water Board whose duty is to read the energy meter and handover the bills (electric) to the owner of that house. This is nothing but meter reading. According to that reading we have to pay the bills. The main drawback of this system is that person has to go area by area and he has to read the meter of every house and handover the bills. The Electricity board has to give privileges for these people to do their duty monthly. The thing, Government will not appoint any particular persons for this duty. The people working in these boards will go on a particular day and do their duty leaving all their pending works. Due to this, their work will be delayed and this is great loss for government. To overcome this drawback we have come up with an idea and this idea will help the government and it will save the time of the employees working in these boards.

In this project we try to automate the billing of energy meter. In this project the front end is User friendly and the employees can work on this software with minimum knowledge of Computers. Employees can read the meter by sitting in the Office

II. ORGANIZATION OF PAPER

The paper is divided into three sections. First section of the paper focuses on the general introduction of automatic energy meter reading. Second section shows the block diagram and working. Third section describes the components used in the system. Finally, the result and future scope is covered in the fourth section.

III. BLOCK DIAGRAM

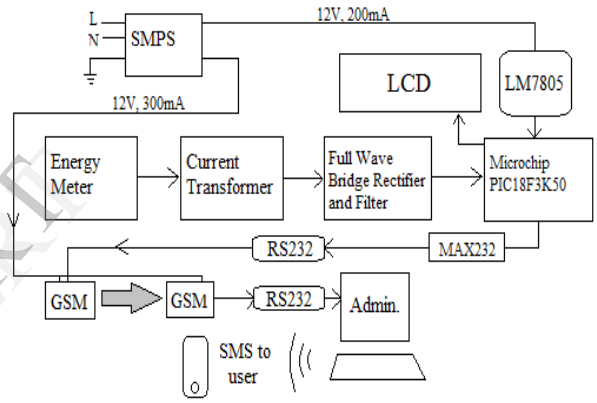

Fig:-1 Block diagram of Automatic Energy Meter reading system.

The embedded system shown above contains following component:

Microchip PIC18F3K50 is a 20-pin USB Flash microcontroller, GSM modem, a Switched mode power supply, LM7805 voltage regulator, DB9 serial connectors, MAX232 IC, a Current Transformer for PCB, an LCD interface.

IV. WORKING OF SYSTEM

Figure 1 shows a sketch of our automatic energy meter reading system. The system continuously senses the amount of AC current flowing through the line and the sensed AC current is then converted to a DC current and is fed to the microcontroller. DC current is proportional to the current flowing through the lines. Microcontroller measures this input DC current and calculates the power consumed and stores it in EEPROM. At the end of a specified time interval microcontroller forward these readings to the utility provider using a GSM 900 modem. The provider upon receiving this information calculates the total amount of consumption according to their respective tariffs and sends

an SMS to the registered user whose information is maintained in provider's database.

Switched Mode Power Supply: It uses a switching regulator for the purpose of converting electrical power efficiently. SMPS uses electric power from an external source or from AC mains and is capable of providing a constant and regulated power to the load. SMPS generally use a Pass Transistor the switches very quickly at 60Hz and 1MHz in order to minimize the energy wastage.
The input from the mains is converted to a 12V DC voltage by the SMPS and is applied to voltage regulator LM7805. Another 12V DC supply is provided to the GSM module.
Current Transformer: It is used for calculating the AC current. When the current to be measured is very high and cannot be used directly a current transformer is used to sense and generate a current which is directly proportional to the current to be measured. A current transformer is to isolate the circuit from the very high current flowing in the main line.

Bridge Rectifier: A full wave bridge rectifier is used to convert the sensed AC current by the current transformer into a DC current. The current is passed through a rectifier with 4 diodes and then it is passed through a capacitor also known as filtering capacitor. The output of the capacitor is a constant DC current which is proportional to the sensed AC current.

Microchip PIC18F13K50: It is a 8-bit , 20- pin flash microcontroller and also a high performance RISC CPU. There are 3 ports provided with it PORT A, B and C. Port C being 8 bits wide and is used for both reading the sensed current and also for interfacing with the LCD. 2 out of 4 bits wide Port B is used to interface with MAX232. The collected data is then stored in EEPROM.

MAX232: It is used to convert the signals in the RS-232 serial port to TTL logic level that be 0V and 5V. The RS232 voltage ranges from -3V to -15V and from +3V to +15V. Using a male DB9 connector the data to be sent is forwarded to the GSM module.

LM7805 Regulator: It is a 3 terminal linear voltage regulator and is used for circuits requiring a regulated power supply. For the proposed system the regulator has it's input from the SMPS. The 12V input is applied to the pin 1 and the voltage is regulated down to 5V which is then applied to the circuit.

LCD Interface: The LCD is interfaced in 4 bit mode. And the data is sent in nibbles.

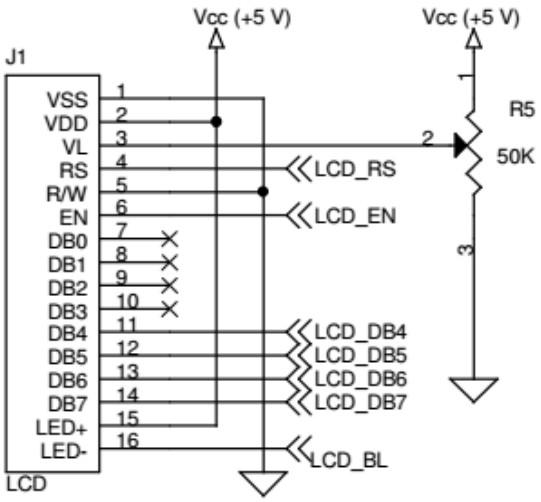

Figure 2: LCD interface with lower four bits left unconnected.

Owing to the fact that execution of a command takes approximately 1.64msec, it will be sufficient to wait about 2msec for the LCD. Only higher four bits (D4-D7) are used while others are grounded. And reset and enabled are also connected to microcontroller. VL pin is connected to a potentiometer and can be used to set the contrast.

GSM Modem: Global System for Mobile communications (GSM: originally from Group Special Mobile) is the most popular standard for mobile phone in the world. GSM/GPRS Smart Modem is a multi-functional, ready to use, rugged and versatile modem that can be embedded or plugged into any application. The Smart Modem can be customized to various applications by using the standard AT commands. The modem is fully type-approved and can directly be integrated into our project with any or all the features of Voice, Data, Fax, SMS, and Internet etc.

V. CONCLUSIONS

The proposed prototype system is implemented and tested for the desired functionalities. The system sent 5 SMS to a pre-specified phone number in 5 test runs which yields a hundred percent success rate. The whole test procedure is done in a laboratory having the mentioned criteria for optimal performance. Based on several experiments conducted under various conditions, it is verified that this system was able to read the current and calculate the amount of power consumption and is able to send SMS to the user.

Implementation of the system will undoubtedly reduce the cost of providing the service to the consumers. The system can be upgraded to work in prepaid mode with few modifications. Use of the system will also result in lesser use of paper use for printing the bills on

VI. REFERENCES

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