

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 12, December 2015

## GSM Based Automatic Energy Meter Reading

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**ABSTRACT:** The technology of e- metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. This paper presents the design of a simple low cost wireless GSM energy meter and its associated web interface, for automated messaging and managing the collected data globally. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. Also they can monitor the meter readings regularly without the person visiting each house. A GSM based wireless communication module is integrated with electronic energy meter of each entity to have remote access over the uses of electricity. Live meter reading from the GSM enabled energy meter is sent back to this billing point periodically and these details are updated in a central database. A new interactive, user friendly graphical user interface is developed using AVR visual studio and C programming. With proper authentication, users can access the developed web page details from anywhere in the world. The complete monthly usage and due bill is messaged back to the customer after processing the data.

**KEYWORDS:** GSM, SIM, Energy Meter, Embedded Design, AVR studio.

### I. INTRODUCTION

GSM and GPRS based designs have developed another innovative and public utility product for mass communication. The purpose of this system is to remote monitor and control domestic energy meter. This enables the Electricity Department to read the meter readings regularly without the person visiting each house. This can be achieved by the use of micro controller unit that continuously monitors and records the Energy Meter readings in its (nonvolatile) memory location. It also makes use of a GSM modem for remote monitoring and control of Energy Meter.

The microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter.

This system aims to replace the traditional ENERGY METER. The main components of this system are microcontroller and GSM modem. These components are integrated with the device board and thus incorporate the wireless features. The GSM modem receives the SMS. The AT commands are serially transferred to the modem. In return the modem transmits the stored message through the wireless link. The microcontroller used in this case is ATMEL ATMEGA 16. SIMCOM 300 is used as the GSM modem.

Paper is organized as follows. Section II describes the key components used in the system. Block diagram and the circuit diagram of the system are given in section III. Section IV presents pictures of the completed system that has been tested. Finally, Section V presents conclusion.

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## II. RELATED WORK

GSM is a cellular network, which means that mobile phone connect to it by searching for cells in immediate vicinity. The Mobile Station refers to the mobile equipment and the Base Station Substation controls the radio link with the Mobile Station. The Network Substation performs main functions such as switching of calls between mobile users, mobile management operations, and proper operation and setup of a network. These functions are controlled by the Mobile Services Switching Centre. GSM networks operate in a number of different frequency ranges(800 to 2100 MHz)

One of the key features of the GSM is the Subscriber Identity Module(SIM) card. It is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his information after switching handsets. This system is an implementation to the ideas of the wireless communication between a mobile phone and a microcontroller. Currently the main work that has been done on this proposed system is through serial port to the computer but not wireless. If they want to switch on and off the appliance , they have to go to the remote area and on/off the appliance. But in this new design, the system need not be reprogrammed to control another home appliance without changing the programming of the microcontroller. The user will send SMS from his phone and he will be able to control the appliance.

The Energy Meter used in our system has the following objectives :

1. Programming of the mobile phone with AT(Attention) command sequence.
2. Interfacing the programming chip with the personal computer.
3. Interfacing of the mobile phone with the programmable chip
4. Sending messages from the remote phone to control device.

The microcontroller used in the system is ATMEGA 16. It is a high performance, low power Atmel 8 bit AVR RISC based microcontroller. It supports throughput of 16 MIPS at 16 MHz and operates between 4.5 – 5.5 volts. The programming of the controller is done with the help of C language in AVR studio. The code for the system is then burnt to the microcontroller using sinaprog.

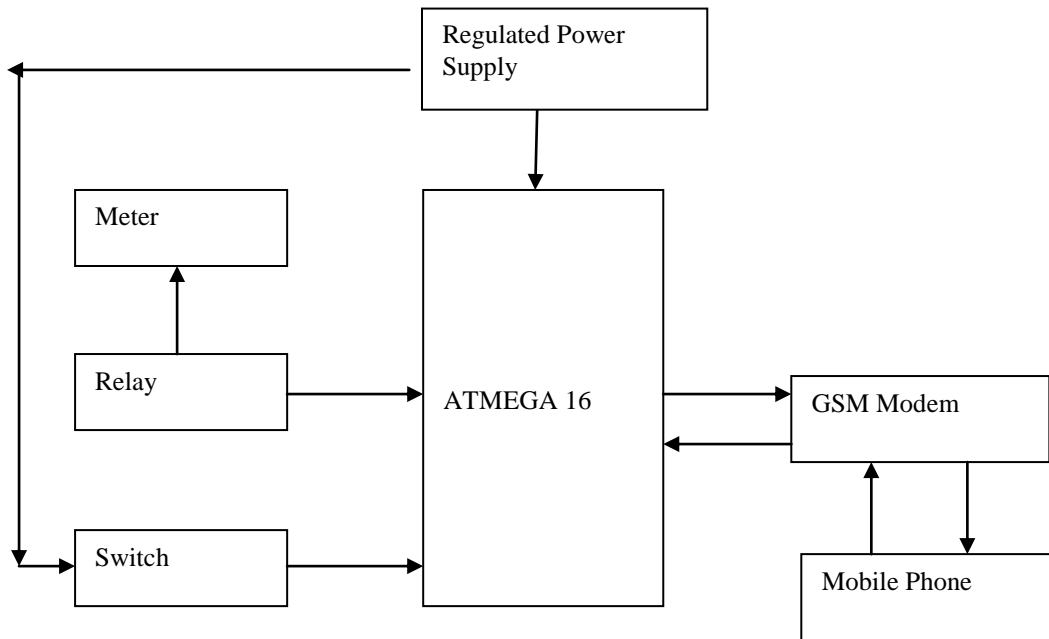
An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. 98 percent of all microprocessors being manufactured are used in embedded systems. Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also still common, especially in more complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialised in certain class of computations, or even custom designed for the application at hand.

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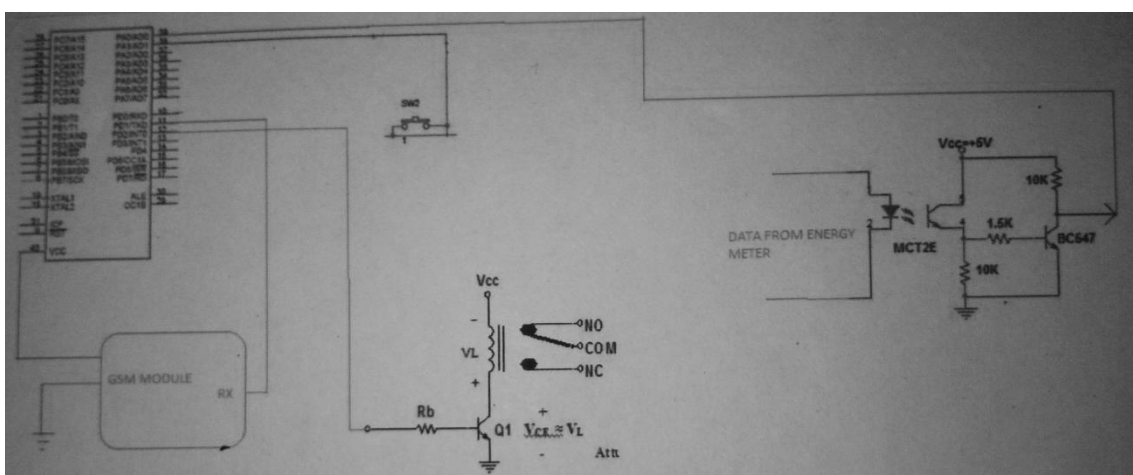
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## III. BLOCK DIAGRAM



(a)



(b)

Fig. 1.(a) Block Diagram of the system (b) Circuit diagram of the system

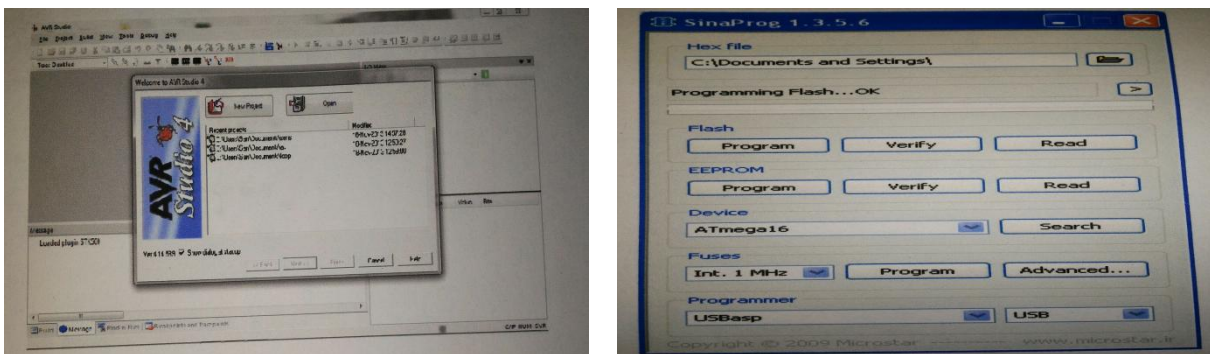
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## IV. EXPERIMENTAL RESULTS

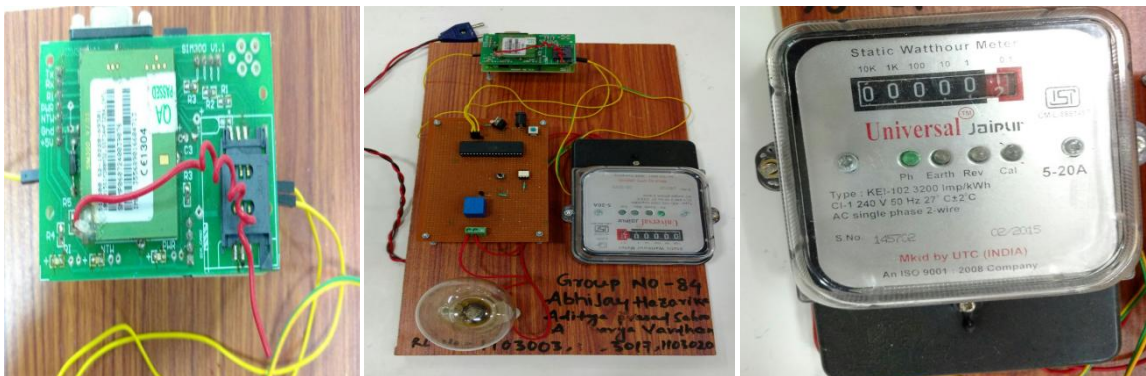
Figures shows the various softwares and the components used in the GSM based automatic energy meter. AVR studio and the Sinaprogram used in the system are shown in figure 2. (a) and (b) respectively. The GSM module that has been used for the purpose, the completed system and the energy meter used in the system are shown in figure 3. (a), (b) and (c) respectively.



(a)

(b)

Fig. 2. Software for GSM based automatic energy meter (a) AVR studio for the C programming (b) Sinaprogram for burning program to the controller.



(a)

(b)

(c)

Fig. 3. GSM based automatic energy meter (a) GSM module used in the system (b) Completed and successfully tested system (c) Energy meter used in the system

## VI. CONCLUSION

The prototype of the GSM based display electronic noticeboard was efficiently designed. This prototype has facilities to be integrated with a display board thus making it truly mobile. The toolkit accepts the SMS, stores it, validates it and then display it in the LCD module. The SMS is deleted from the mobile each time it is read, thus making room for the next SMS. The major constraint is the use of '\*' as the termination character of the SMS and the display of one SMS at a time.

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These limitations can be removed by the use of higher end microcontrollers and extended RAM. The prototype can be implemented using commercial display boards. In this case, it can solve the problem of instant information transfer in the campus.

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