

PREPAID ENERGY METER FOR IMPROVED METERING AND BILLING SYSTEM

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Abstract-

The Electricity Meter Reading using GSM system consists of GSM Digital Power Meters installed in every consumer unit and a back-end database at the EB office which calculates the amount to be paid according to the number of units consumed. The GSM Digital Power Meter is a single phase digital kWh power meter with embedded GSM modem which utilizes the GSM network to send its power usage reading using Short Messaging Service (SMS) back to the energy provider wirelessly. The user interface also consists of LCD which displays the amount of power consumed. The advantages of the proposed system make the existing system incompetent. It is possible to connect to remote areas as it employs wireless technology. The new system is user friendly, easy to access and far more efficient than the existing system.

Keywords: GSM, Digital Power Meter, Short Messaging Service, Modem, GSM network.

INTRODUCTION

From the early days till today meter reading for electricity consumption and billing is done by human operators from houses to houses. This therefore requires a very large number of human operators and long working hours to acquire complete data reading and billing in a particular area. However, there may be cases where human operators miss to bill few houses in an area or restricted and slowed down by bad weather condition, transportation problems, etc.

Moreover human operators are very much likely to make mistake while billing or reading a meter and sometimes the house's electric power meter may be placed in a location where it is not easily accessible. Again printed billing has the tendency of being lost in the mail box or being never delivered. Day by day due to the increasing number of residential housings and commercial buildings, more human operators and longer working hours is needed to complete the meter reading task which eventually increases the energy provider operation costs for meter reading. To achieve efficient meter reading, reduce billing error and operation costs, an Automatic Electric Meter reading system can be introduced with every energy meter in an area. It is an effective means of data collection that allow substantial saving through the reduction of meter re-read, greater data accuracy, frequent reading, improved billing and customer service, more energy profiles and consumption trends updates and better deployment of human resource.

"Electricity meter reading using GSM" implements the emerging applications of the GSM technology. GSM is a Global system for mobile communication (GSM) and is a wide area wireless communications system that uses digital radio transmission to provide voice, data,

and multimedia communication services. A GSM system coordinates the communication between mobile telephones (mobile stations), base stations (cell sites), and switching systems. Each GSM radio channel is 200 KHz wide channels that are further divided into frames that hold 8 time slots. The GSM system includes mobile telephones (mobile stations), radio towers (base stations), and interconnection switching systems. We have selected a particular GSM modem SIM300 for our project. The message are sent from the mobile set that contain commands in written form which are then processed accordingly to perform the required task. The proposed approach for designing this system is to implement microcontroller based control module that receives its instructions and command from a cellular phone over the GSM network. The microcontroller then will carry out the issued commands and then communicate the status of a given appliance or device back to the cellular phone. First, the sent SMS is stored and polled from the receiver mobile station and then the required control signal is generated and sent to the intermediate hardware that we have designed according to the command received in form of the sent message.

OBJECTIVE

- (i) To co-ordinate appliances and other devices through Short Message Service (SMS).
- (ii) To efficiently receive and transmit data via SMS.
- (iii) Minimize power and time wastage.
- (iv) To eliminate the need of being physically present in any location for tasks involving the operation of appliances within a household/office.

PROBLEM FORMULATION

The Electricity meter reading using GSM system takes the advantage of existing GSM infrastructure that have virtually full coverage of all housing and building area across the country which lead to low infrastructure implementation cost, simple and easy installation of GSM system at consumer side as this system is no difference from existing ordinary analogue or digital meter installation. The complete Electricity Meter Reading Using GSM required an ICT expertise personnel to setup, run and maintain all the servers. The Electricity Meter Reading Using GSM provides effective, reliable and efficient wireless automatic electric meter reading, billing and notification through the use of GSM network, thus reducing human operator meter reading operation cost.

The importance of proposed work can be well understood if we keep in mind the amount of electricity being stolen every day. As a user can get his or her bill at any instant and can even pay it at any instant, so any kind of misuse by any other person can be avoided.

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CIRCUIT SOLUTION

Block diagram:

Figure 1 shows the simple block diagram of our project. It consists of the power supply section, the microcontroller, the GSM modem, LCD display, EB Meter, impulse sensor. It is a simple illustration of how we have implemented our project and the various parts involved

in it. The GSM modem is controlled by the microcontroller that sends signals to the GSM to receive and transmit messages. The messages are the recorded data of the number of units of the energy meter that are stored in the microcontroller. The units are counted by a program in the microcontroller with the help of an impulse detector sensing circuit. The control messages to the GSM are sent from a mobile number already allocated for the task. The number of units as message is sent to the user mobile.

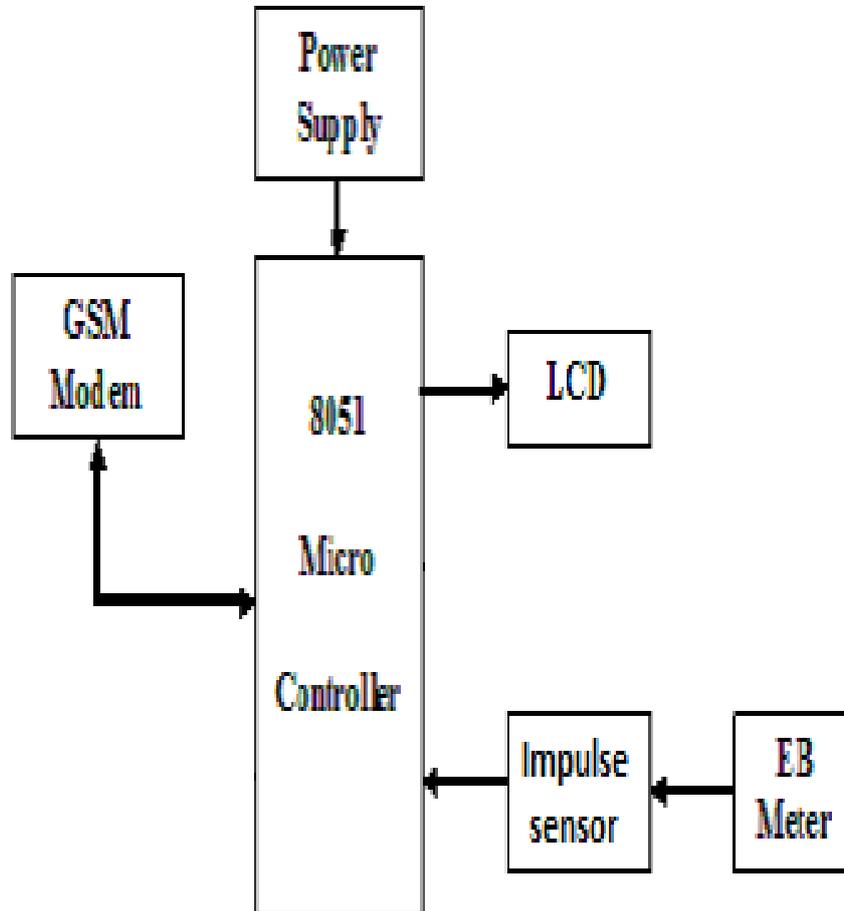


Figure 1: Block Diagram of Electricity Meter reading Using GSM.

Circuit Diagram

The figure 2 shows the circuit diagram of our project. The impulse detector circuit detects the blinking of the Energy meter with the help of a photo detector [6]. When the energy meter's led blinks the photo detector detects it and the impulse detector circuit trigger a interrupt pin of the microcontroller [7, 9].

The transmitter and the receiver pin of the GSM is connected to the receiver and transmitter pin of the Microcontroller that will be used to have transmission of control messages between the two. The programming is made as so that it counts the number of pulses that is detected by the sensor and stores the count in the controller. The controlling commands of the GSM is also sent from the controller like the AT+CMGF=1 and the AT+CNMI=1, 2,0,0,0. These two commands will enable the GSM to start and allow the text mode.

The LCD is used to display the count and the impulse of the energy meter. It is connected to port 0 and port 1 of the microcontroller. The register, read and write is connected to the port 1

and controls the reading and writing in the LCD. The power supply to the system is provided using a 12V/750mA transformer and is bridge rectifier and finally reduced to 5V using a voltage regulator.

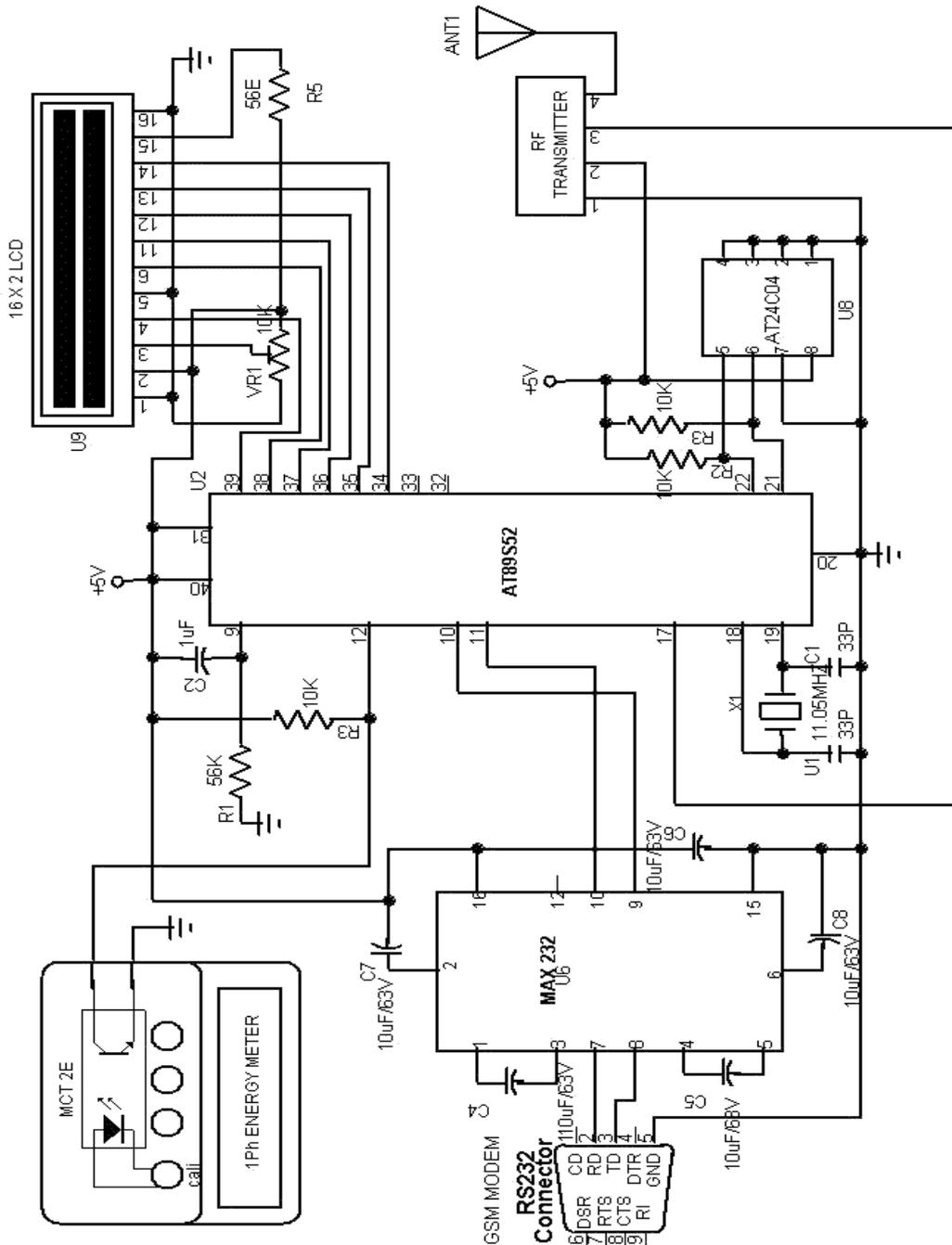


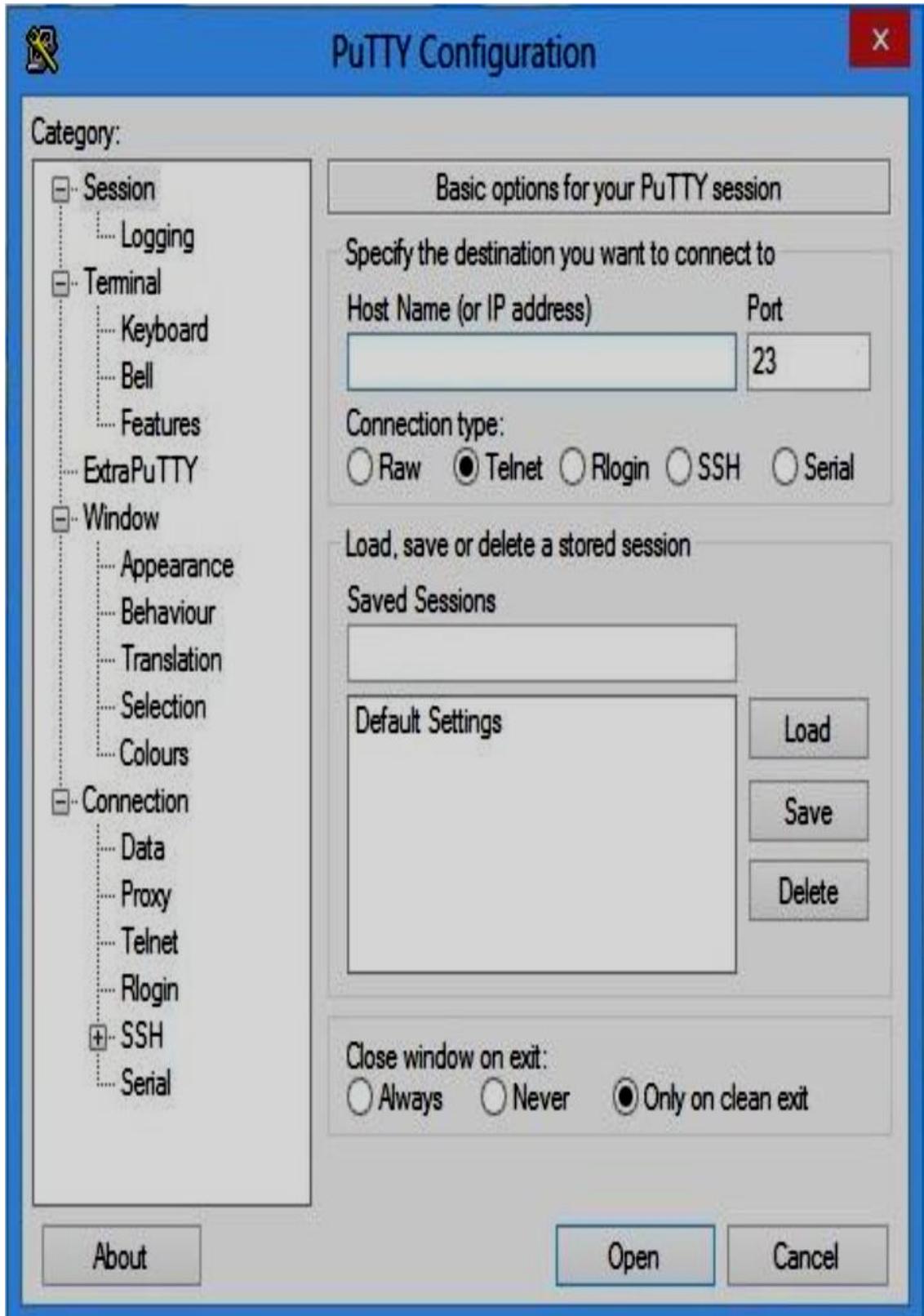
Figure 2: Circuit Diagram of Electricity Meter reading Using GSM

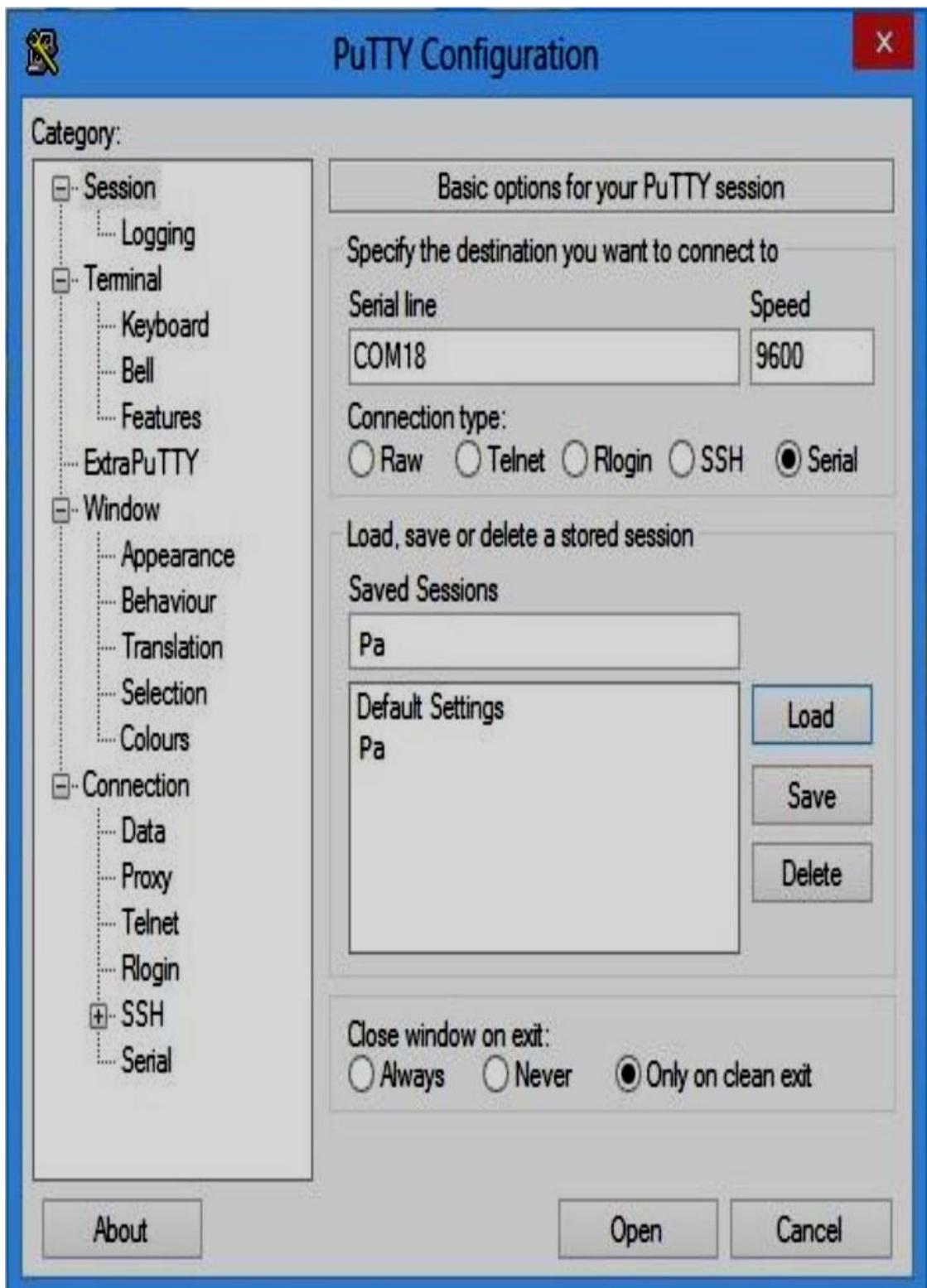
RESULT AND DISCUSSION

Step 1:

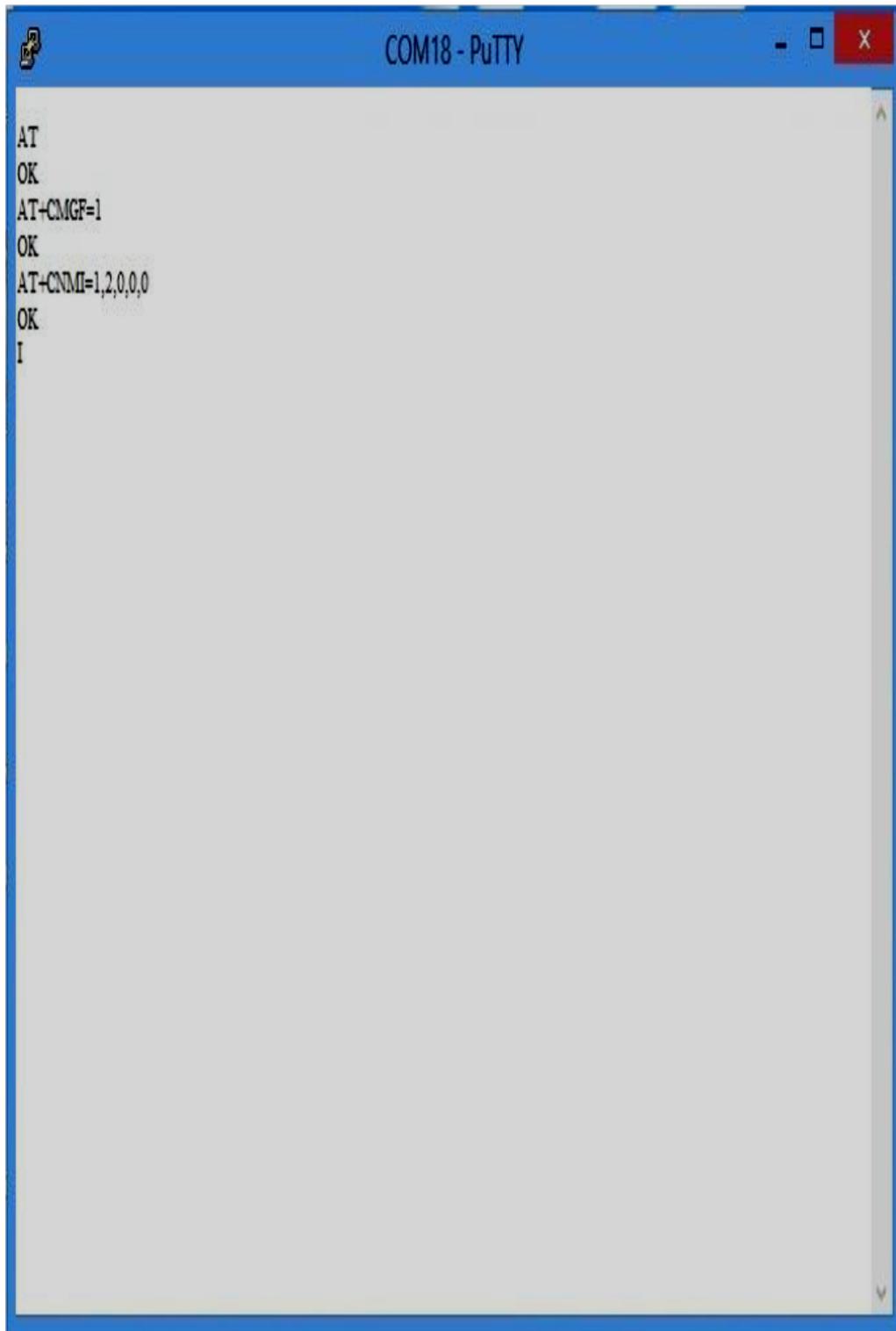
For interfacing the GSM modem with the computer we are using the PUTTY software. It is used to create the hyper terminal window in Windows 7 OS. After installing the PUTTY software a window appears where we can select the COM port, then select serial communication for interfacing the GSM modem.

After the interfacing is done then a hyper terminal appears in the screen. Using AT commands in this hyper terminal we can operate the MODEM.



**Step 2:**

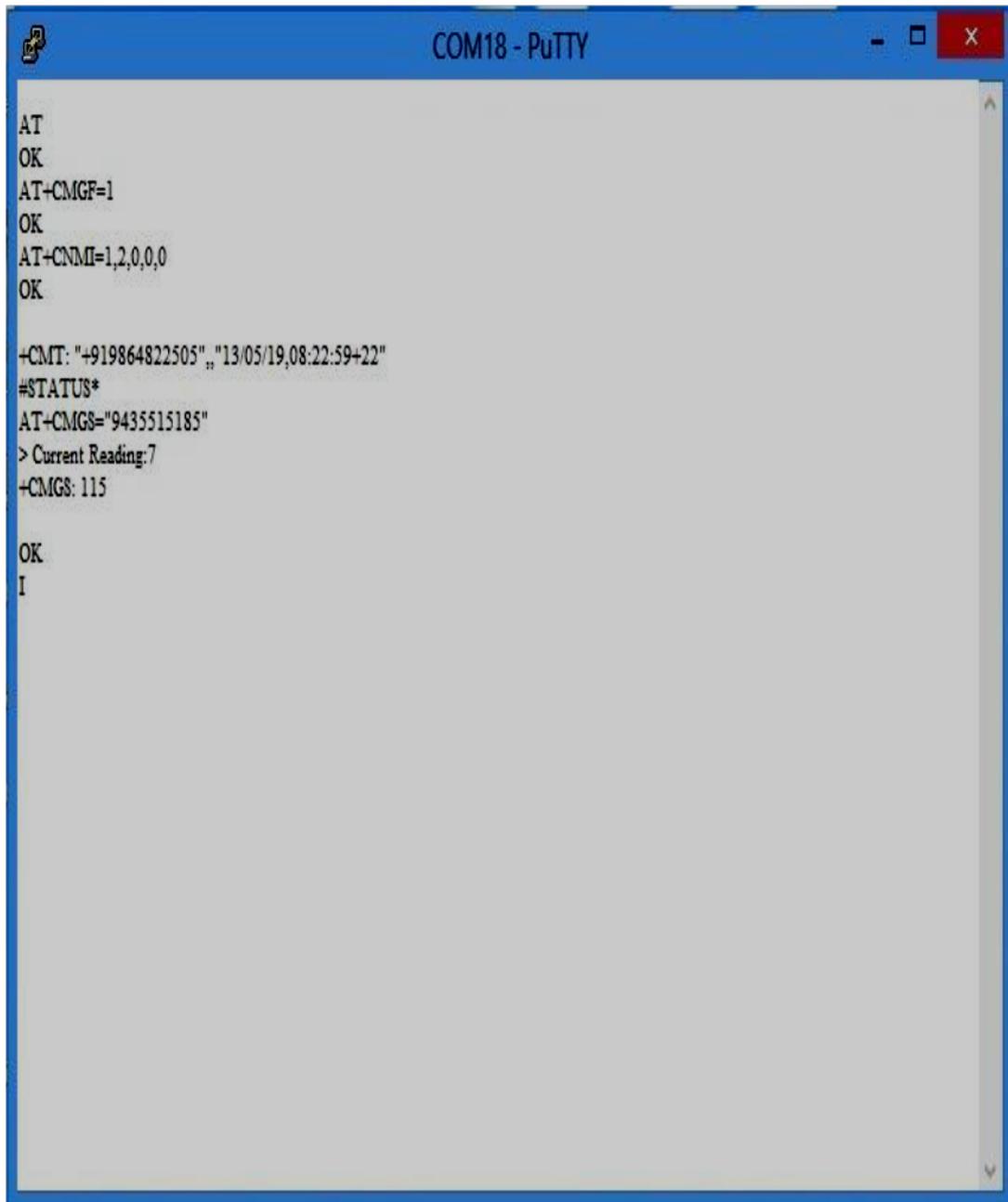
At first when initializing the Electricity Meter Reading using GSM system, the microcontroller sends command to operate the GSM modem. The GSM modem will now read the immediate incoming messages.



```
COM18 - PuTTY
AT
OK
AT+CMGF=1
OK
AT+CNMI=1,2,0,0,0
OK
I
```

Step 3:

Whenever the GSM modem gets the command message i.e. "STATUS", for sending the present meter reading. Then the GSM modem will send the current meter reading to the mobile number which is stored in the microcontroller.



```
COM18 - PuTTY
AT
OK
AT+CMGF=1
OK
AT+CNMI=1,2,0,0,0
OK
+CMT: "+919864822505", "13/05/19,08:22:59+22"
#STATUS*
AT+CMGS="9435515185"
> Current Reading:7
+CMGS: 115

OK
I
```

CONCLUSION

There is a lot of wastage of power due to inefficient consumption of electricity by consumers. The distribution company, most of the time, has to receive huge amounts due to pending bills which results in substantial revenue losses and also causes hurdles to modernization because of lack of funds. The consumer, on the other hand, is facing problems like receiving due bills for bills that have already been paid and poor reliability of electricity supply. The remedy for all these problems is to keep track of the consumers load on a timely basis, which will help assure accurate billing, track maximum demand, and detect online theft. These are all the features to be taken into account for designing an efficient energy billing system. The present project incorporates these features to address the problems faced by both the consumers and the distribution companies.

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