Prepaid Energy Meter using GSM

INTRODUCTION:
This project is based on VTU syllabus. The proposed system is based on ATMEL 89S52 µcontroller which is in our syllabus.

For doing this project we use some of the software like

- Embedded C for programming the application software to the microcontroller.
- Protel schematic software is used for designing the circuit diagram for this project.
- Express PCB software is used for designing the PCB for this project.

(Since PCB making is a big process and involves lot of machineries which are expensive, we are going to outsource this to the manufacturer.)

ABSTRACT:
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/water meter and handover the bills (electric or water) 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 and Water authority has to give privileges for these people to do their duty monthly. The thing is, 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.

The aim of the project is to automate the prepaid billing of energy meter and water 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. For front end designing Java is used.

COMPONENTS USED:
- Microcontroller : AT89C51
- Real Time Clock : DS1307
- EEPROM Memory : AT24C04 (4K)
- LCD : 2x16 characters
- Power Supply : 5v DC
- GSM modem : 900/1800 MHz
SOFTWARES USED:
- Embedded
- KEIL m-vision

WORKING PRINCIPLE:

This project is useful for billing purpose in Electricity board and in water authority. Instead of going to every house & taking the readings, in this project by just sending an SMS we can receive the readings of the house and we can recharge the electric bill. This system uses Java Basics software, which is designed as the application platform to send or receive SMS using the Modem, then process and stores the data. Java software has two main functions 1) to interact with Modem and read the COM port 2) maintain the database.

In this project the micro controller & the GSM unit is interfaced with the Energy meter/water meter of each house. Every house has a separate number, which is given by the corresponding authority. The GSM unit is fixed in the energy meter/water meter.

The amount of consumption is stored in memory authority as SMS. Using this software we can send the SMS through Modem to that particular number which is assigned by these authorities and wait for the response. On other end the modem will receive the data in the form of a command and informs the controller to do the readings. After the readings the controller will send data to the modem. Modem, in turn sends data to the other end. In the office the GSM unit will receive the data and the Java software will calculate the total consumption. The number assigned by the authorities is Unique. Using GSM we can get the response very fast due to which time is saved. After completion of the pulse the power will cut again consumer wants to send an SMS for recharge.

This is due to reduce illegal power using with out paying the money.
BLOCK DIAGRAM:

- **Micro Controller**: AT89S52
- **ENERGY METER**
- **WATER METER**
- **RS232 Converter**
- **Power Supply**
  - Transformer
  - Rectifier
  - Regulator (7805)
  - Filter
- **LCD (Display)**
  - LCD Driver
  - LCD Glass

Connectors and interfaces are indicated by arrows.
COMPONENT DESCRIPTION:

Power supply:

The microcontroller and other devices get power supply from AC to DC adapter through voltage regulator. The adapter output voltage will be 12V DC non regulated. The 7805 voltage regulators are used to convert 12 V to 5VDC.

Vital role of power supply in ‘Remote billing of energy meter/water meter using gsm modem’

The adapter output voltage will be 12V DC non regulated. The 7805/7812 voltage regulators are used to convert 12 V to 5V/12V DC.

Micro controller-AT89S52

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.
**Features:**

- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Full Duplex UART Serial Channel
- Fully Static Operation: 0 Hz to 33 MHz

**Vital role of Micro controller-AT89S52 in ‘Remote billing of energy meter/water meter using GSM modem’ is as follows.**

- It will transmit the consumption amount to MODEM
- It will acts a master to communicate with memory
- Whenever command is sent to reset the memory, controller resets the memory
- Controller takes the pulses from the energy meter and increments the Unit which depends upon the calculations and stores in memory.
- Microcontroller also switches off the energy meter whenever the command is sent from the server. This happens when the owner has not paid the bill.

**GSM modem (900/1800 MHz)**

Semen’s GSM/GPRS Smart Modem is a multi-functional, ready to use, rugged unit that can be embedded or plugged into any application. The Smart Modem can be controlled and customized to various levels by using the standard AT commands. The modem is fully type-approved, it can speed up the operational time with full range of Voice, Data, Fax and Short Messages (Point to Point and Cell Broadcast), the modem also supports GPRS (Class 2*) for spontaneous data transfer.

**Description of the interfaces**

The modem comprises several interfaces:

- LED Function including operating Status
- External antenna (via SMA)
- Serial and control link
- Power Supply (Via 2 pin Phoenix™ contact)
- SIM card holder
- LED Status Indicator

The LED will indicate different status of the modem:

- OFF  Modem Switched off
- ON  Modem is connecting to the network
- Flashing Slowly  Modem is in idle mode
- Flashing rapidly  Modem is in transmission/communication (GSM only)

Vital role of GSM modem in ‘Remote billing of energy meter/water meter using GSM modem’

Is as follows:

- User GSM modem will transmit the consumption amount to office MODEM.
- Office MODEM will receive the data sent by the user MODEM.
- Instead of IR we are using GSM because in IR lots of disturbance will be there when distance is more.
- GSM is less costly when compared to IR.

External EEPROM memory (2/4/8/32/64 Kbytes)

These memory devices are used to store the data for offline process. The AT24C02A / 04A/ 08A/32/64 provides 2048/4096/8192/32,768/65,536 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 56/512/1024/4096/8192 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24C02A/04A/08A is available in space saving 8-pin PDIP.

Features:

Internally Organized 256 x 8 (2K), 512 x 8 (4K) or 1024 x 8 (8K)
2-Wire Serial Interface (I2C protocol)
High Reliability
- Endurance: 1 Million Write Cycles
- Data Retention: 100 Years
- ESD Protection: >3000V

Vital role of External EEPROM memory in ‘Remote billing of energy meter/water meter using GSM modem’ is as follows
- Used to store the amount of unit the user consumed.
- We can store the data in microcontroller also but the main drawback when compared to memory is that, when there is no power the data is lost which is stored in microcontroller. Due to this memory is used to store the units.

**LCD (LIQUID CRYSTAL DISPLAY)**

LCD’s can add a lot to your application in terms of providing a useful interface for the user, debugging an application or just giving it a "professional" look. The most common type of LCD controller is the Hitachi 44780, which provides a relatively simple interface between a processor and an LCD. Inexperienced designers do often not attempt using this interface and programmers because it is difficult to find good documentation on the interface, initializing the interface can be a problem and the displays themselves are expensive.

LCD has single line display, Two-line display, four line display. Every line has 16 characters.

**Vital role of LCD in 'Remote billing of energy meter/water meter using GSM modem' is**

Used to display the status of device

**Real Time Clock (RTC – DS1307)**

This is used to maintain the current time in off line processing. The DS1307 Serial Real-Time Clock is a low power; full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially via a 2-wire, bi-directional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power sense circuit that detects power failures and automatically switches to the battery supply.

**Features:**

- It uses I2C protocol
  - Real-time clock (RTC) counts seconds, minutes, hours, date of the month, month, and day of the week, and year with leap-year compensation valid up to 2100.
  - Two-wire serial interface Consumes less than 500nA in battery backup mode with oscillator running

**Vital role of Real-time clock in ‘Remote billing of energy meter/water meter using GSM modem’ is**
Used to get the real time and date.

APPLICATION OF REMOTE BILLING OF ENERGYMETER/WATERMETER USING GSM MODEM:
Used in Homes.

FUTURE ENHANCEMENT:

We are sending bills through post, instead of this, we can add a printer in every house and if we give print command from the server, it will print the bill and the user can get the bill over there only.