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GSM Based AMR

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***Abstract*— GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use. Hence the system saves a lot amount of time and energy. Due to the power fluctuations, there might be a damage in the home appliances. Hence to avoid such damages and to protect the appliances, the voltage controlling method can be implemented.**

Index Terms—GSM, AMR, Power Management

I. INTRODUCTION

In those days traditional meters are used for energy meter reading. At the end of each month a person from the EB office comes to the home for taking the meter reading. This takes much time and also causes error in reading. To overcome this problem, we use GSM based Automatic Meter Reading system. The development of a GSM automatic power meter reading system (GAPMR) is presented in [1]. GAPMR System consists of GSM Digital power Meters installed in every consumer unit and Electricity e-billing system at every provider side. It consists of standard compliance digital kWh power meter with embedded GSM modem which utilizes the GSM network to send its power usage reading using SMS back to energy provider wirelessly. At the power provider side an e-billing system is used to manage all received SMS meter reading, compute the billing cost, update the database, and to publish the billing notification to its respective consumer through SMS.

The remedy for all the problems like is labor consuming, errors with electro-mechanical meters, human errors while noting down the meter readings etc, is the GPMC GSM based power meter and control system[2]. In this system the track of the meter reading of each day and the reading with the user identification number send to the user as well as to the electricity department and Electricity e-billing system associated with electricity department will keep the track of each SMS meter reading and the appropriate bill get generated at the last day of the month and the bill is forwarded to user from the server. So there is no chance of confusion to the user for paying the bill.

II. PROPOSED SYSTEM

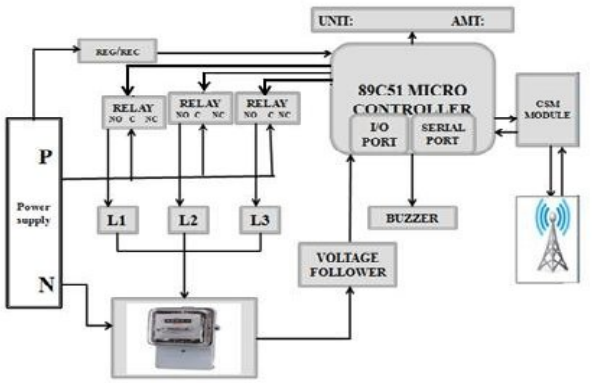

Fig.1. BLOCK DIAGRAM OF AMR SYSTEM PLACED AT HOME

Microcontroller is interfaced with the GSM module and energy meter. According to the power consumption, the meter reading continuously gets incremented. For the implementation of this system, a SIM card is required for the GSM module and an identification (ID) number is allotted to each customer. According to the requirement of the data, electricity department can send a message to the particular customer's energy meter. When microcontroller receives the message, its respective port bits are high and an interrupt signal occurs.

Microcontroller starts to execute to the interrupt service subroutine until it reaches last instruction of the subroutine. After the execution of RET instruction, microcontroller returns to the main program and continues incrementing. Every one month, the data will be sent to the electricity board automatically and also the electricity board can access the system at any time on request. Receiving this meter reading every month, the bill amount is calculated and sent to the microcontroller which displays the unit consumed and the bill amount. Notifying this message on the LCD display, the customer has to pay the bill on time that can be done through credit card, debit card or even by net banking. A separate database is followed by the authority that stores all the information about each customer and their bill statement. Failing to pay the bill will lead to the power disconnection that is again done by the microcontroller by receiving the message from the electricity board.

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III. SYSTEM DESIGN

The microcontroller used here is P89C51RD2BN.The expansion of the part number of this microcontroller is given below.

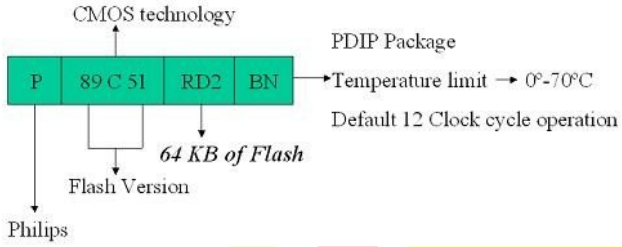

Fig.2. 89C51 MICROCONTROLLER

The P89C51RD2BN contains a non-volatile 64KB Flash program memory that is both parallel programmable and serial In-System and In- Application Programmable. In-System Programming (ISP) allows the user to download new code while the microcontroller sits in the application. In- Application Programming (IAP) means that the microcontroller fetches new program code and reprograms itself while in the system. This allows for remote programming over a modem link. A default serial loader (boot loader) program in ROM allows serial In-System programming of the Flash memory via the UART without the need for a loader in the Flash code. For In-Application Programming, the user program erases and reprograms the Flash memory by use of standard routines contained in ROM. The device supports 6-clock/12-clock mode selection by programming a Flash bit using parallel programming or In-System Programming. In addition, an SFR bit (X2) in the clock control register (CKCON) also selects between 6-clock/12-clock mode. Additionally, when in 6-clock mode, peripherals may use either 6 clocks per machine cycle or 12 clocks per machine cycle. The device also has four 8-bit I/O ports, three 16- bit timer/event counters, a multi-source, four-priority-level, nested interrupt structure, an enhanced UART and on-chip oscillator and timing circuits. The added features of the P89C51RD2BN make it a powerful microcontroller for applications that require pulse width modulation, high-speed I/O and up/down counting capabilities such as motor control.

The time to execute the instruction is calculated by using the following expression,

$$T(inst) = (MC \times Cn) / (crystal\ frequency)$$

Number of Machine Cycles for an instruction to execute and Cn is the number of clock cycles for one machine cycle. For 89C51RD2BN the number of clock cycles for one machine cycle is 12. For example, if the number of machine cycles to execute a instruction is 1 and the oscillator frequency used is 11.0592MHz, the time to execute an instruction is 1.085 □s.

Basic Features of 89C51

- 80C51 Central Processing Unit
- On-chip Flash Program Memory with In-System Programming (ISP)
- In Application Programming (IAP) capability
  - Boot ROM contains low-level Flash programming routines for downloading via the UART
  - Supports 6-clock/12-clock mode via parallel programmer (default clock mode after Chip Erase is 12-clock
- 6-clock/12-clock mode Flash bit erasable and programmable via ISP
  - 6-clock/12-clock mode programmable "on-the-fly" by SFR bit
  - Peripherals (PCA, timers, UART) may use either 6-clock or 12- clock mode while the CPU is in 6-clock mode
  - Speed up to 20 MHz with 6-clock cycles per machine cycle (40 MHz equivalent performance); up to 33 MHz with 12 clocks per machine cycle
  - Fully static operation
  - RAM expandable externally to 64-kilo bytes
  - Four interrupt priority levels
  - Seven interrupt sources
  - Four 8-bit I/O ports
  - Full-duplex enhanced UART
- Framing error detection
- Automatic address recognition
- Power control modes
  - Clock can be stopped and resumed
  - Idle mode
- Power down mode
- Programmable clock-out pin
  - Second DPTR register
  - Asynchronous port reset
  - Low EMI (inhibit ALE)
  - Programmable Counter Array (PCA)
  - PWM
  - Capture/compare

Liquid crystals are a phase of matter whose order is intermediate between that of a liquid and that of a crystal. The molecules are typically rod-shaped organic matters about 25 Angstroms in length and their ordering is a function of temperature. The molecular orientation can be controlled with applied electric fields. LCD is made up of two sheets of polarizing material with the liquid crystal solution between them. An electric current passed through the

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liquid causes the crystals to align so that light cannot pass through them, which results in display of character as per the applied voltage in its data lines. The driver is provided to drive the LCD. It stores the display data transferred from the microcontroller in the internal display RAM and generates dot matrix liquid crystal driving signals. Each bit data of display RAM corresponds to on/off state of a dot of a liquid crystal display.

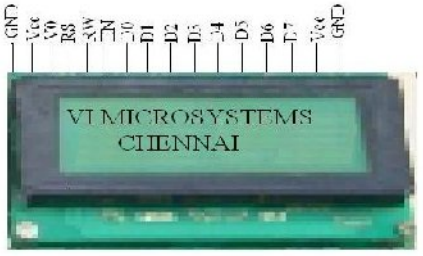

Fig.3. LCD PIN DESCRIPTION

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

IV. RESULTS AND DISCUSSION

GSM was designed to grow and meet the needs of new technologies. GSM is currently composed of EDGE, 3GSM, and GPSR. Each member of the family is designed to solve a particular need.

EDGE is an upper level component used for advanced mobile services such as downloading music clips, video clips, and multimedia messages. GPSR is designed for "always-on" systems that are needed for web-browsing. 3GSM is the GSM running on third generation standards for multimedia services.

GSM Network consists of three main parts:

- Mobile Station (MS): carried by the subscriber.
- Base Station Subsystem (BSS): controls radio link with mobile station. Network & Switching Subsystem (NSS): mobility management and switching of calls between mobile users, and between mobile and fixed network users.

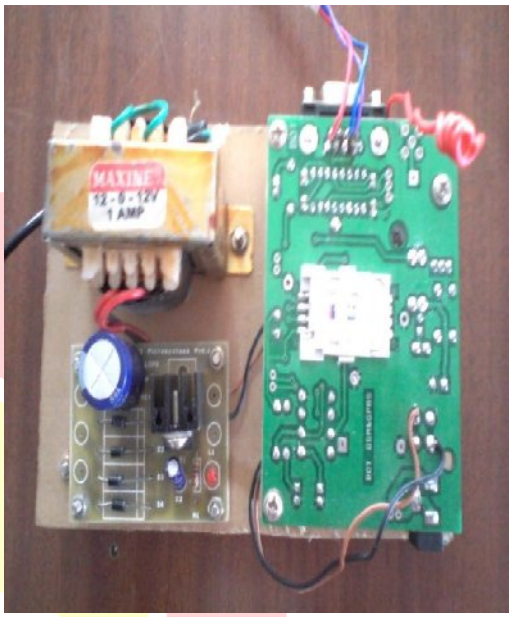

Fig.4.LAYOUT OF SYSTEM PLACED AT EB OFFICE

V. CONCLUSION

GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use. Hence the system saves a lot amount of time and energy. Due to the power fluctuations, there might be a damage in the home appliances. Hence to avoid such damages and to protect the appliances, the voltage controlling method can be implemented.

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