# AUTOMATED ELECTRICITY BILLING SYSTEM USING GSM

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*Abstract*— **The present billing system of electricity which we are using is error prone and time consuming. It also requires man power for taking the readings of meter. Errors get introduced at every stage of energy billing, like errors with electro-mechanical meters, human errors while noting down the meter reading and error while processing the paid bills and the due bills. There are many cases where the bill is paid and then is shown as a due amount in the next bill. For overcoming all the difficulties present in this system we are introducing fully automated billing process. In the proposed system front end is user friendly and can be operated easily by having minimum computer knowledge. The system consist of one GSM modem connected to the electric meter. GSM modems consists of SIM cards possessing unique number. User interface consists of LCD which displays the power consumed and remaining amount. User also consists of a mobile phone/desktop application through which the system can be recharged.**

Keywords--GSM modem, LCD, SIM card, Microcontroller, Energy meter.

## I. INTRODUCTION

The traditional electricity billing is done manually. So there is a chance of occurrence of errors. We have to wait in a queue for a long time for paying the bill in the electricity board. It is time consuming and labor consuming process. If we are not able to pay the bill on time, we may be forced to pay the fine along with the bill. So it is not a consumer friendly. These problems can be fixed by using a prepaid electricity billing system. So here we are introducing a automated electricity billing using GSM technology.

In this proposed work we are implementing a prepaid electricity meter consisting of LCD display, GSM modem, Microcontroller AT89C52 programmed with embedded C. When we use the electricity the amount which we had used is calculated by energy meter at user interface. This information is passed to microcontroller. This controller decodes the information given by the electric meter and transmits the information to LCD module and GSM modem.GSM modem consists of a SIM card possessing unique number that transmits the information to user module which is nothing but the cell phone. The user can recharge the electric meter by just

sending a message through the cell phone/desktop application. When the amount becomes lesser than the threshold, an alert message is send to the user. This message is send until the balance becomes zero. If the user fails to recharge, the load gets off.

There are situations like, we are going outside power is not there. So we will forget to switch off all fans and lights. If the power comes before consumer comes back to home, leads to power wastage. This situation can be overcome by sending a message to the microcontroller. The whole process is done automatically without any manual involvement hence the probability of occurrence of error is negligible. The overall intention is to control, track and monitor the electricity consumption.

## II. LITERATURE SURVEY

### A.PROBLEM STATEMENT OF PROPOSED SYSTEM

The problems of the existing system are overcome in the solution which is the electric supply is controlled automatically using prepaid energy meter which is more efficient.

### B. PROPOSED SYSTEM

- High reliability
- Control by using wireless communication
- It consumes less power
- Less expensive
- Requires less man power

### C. SURVEY

Prepaid billing system is introduced in order to avoid steeling of electricity as well as to save more time of consumers by keeping them away from queues. Initially, the recharge coupons will help to recharge the electricity by prepaid method. So that the consumer feels like more comfortable in using the electricity compared to present system. The amount will be reduced as per the usage of consumers. No need to bother about the month end at all. If

the balance gets reduced he will be getting a message from electricity board that conveys his balance is getting low. So that an alert will always be there to remind them. And the other feature of the system is the consumer is allowed to switch off the main system while he is going out of his home. So that he can save the electricity as well as his amount too. A consumer number will be given to all consumers in different pattern which should be highly confidential. The system will be having the facility to show the balance and the energy consumption. The consumer will lose his connection if the consumer will not recharge at the proper intervals [1].

The present system of energy billing is error prone and also time and labor consuming. Errors get introduced at every stage of energy billing like errors with electro-mechanical meters, human errors while noting down the meter reading, and errors while processing the paid bills and the due bills. The home appliances which consume more power cause an increase in the payment of excessive bills. The remedy for all these problems is GPMC(GSM based power meter and control system) is developed which consist of the integration of a single phase Class 1, IEC61036, standard compliance digital kWh power meter. It will keep track of the meter reading of each day and the reading with the user identification number send it to the user as well as to the electricity department and Electricity 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 are no chances of confusion to the user for paying the bill. The GPMC also feature distribution control system which controls the power of the appliances remotely [2].

## III. USER INTERFACE

There are two user interfaces in the proposed system, they are
1. Mobile phone
2. Desktop application

The user can recharge his/her electric meter through mobile phone/desktop application. Once recharged the user can use the electricity. When the balance becomes less than some threshold value, an alert message is send to the users mobile phone as FIG 1. Once the balance become zero the load gets off, this is indicated by an alert message send to the user as shown in FIG 2.



FIG 1: Message due to less balance



FIG 2: Message due to zero balance

## IV. SOFTWARE REQUIREMENT

1. Embedded C :

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. Embedded C use most of the syntax and semantics of standard C, e.g., main() function, variable definition, datatype declaration, conditional statements (if, switch. case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, unions, etc.

2. Keil :

Keil is an IDE (Integrated Development Environment) which is used to develop an application program, compile and run it even the code can be debugged .It is a simulator where we can check the application code even in the absence of the hardware board.

3. NET :

**.NET** is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large library and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for .NET Framework execute in a software environment (as contrasted to hardware environment), known as the Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management, and exception handling.

## V. SYSTEM ANALYSIS AND DESIGN

Systems development can generally be thought of as having two major components: Systems analysis and Systems design. System design is the process of planning a new business system or one to replace or complement an existing system. But before this planning can be done, we must thoroughly understand the old system and determine how computers can best be used to make its operation more effective. System analysis is the process of gathering and

interpreting facts, diagnosing problems, and using the information to recommend improvements to the system.

*A. HIGH LEVEL DESIGN*

A high-level design provides an overview of a solution, platform, system, product, service, or process. Such an overview is important in a multi-project development to make sure that each supporting component design will be compatible with its neighboring designs and with the big picture.

The highest level solution design should briefly describe all platforms, systems, products, services and processes that it depends upon and include any important changes that need to be made to them. A high-level design document will usually include a high-level architecture diagram depicting the components, interfaces and networks that need to be further specified or developed.
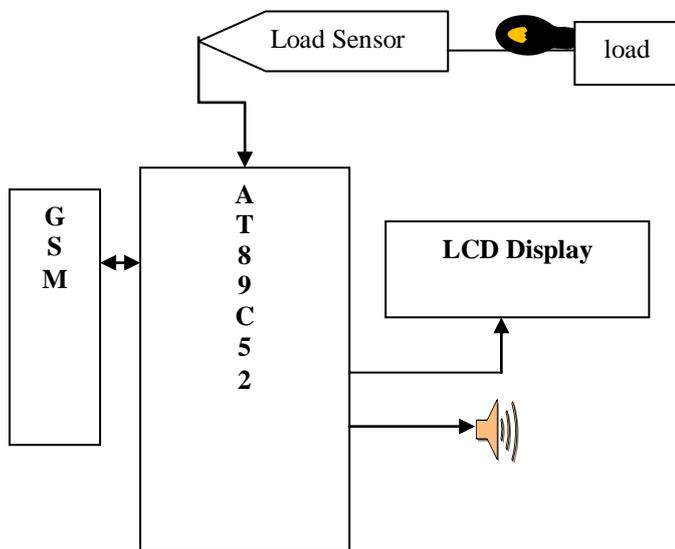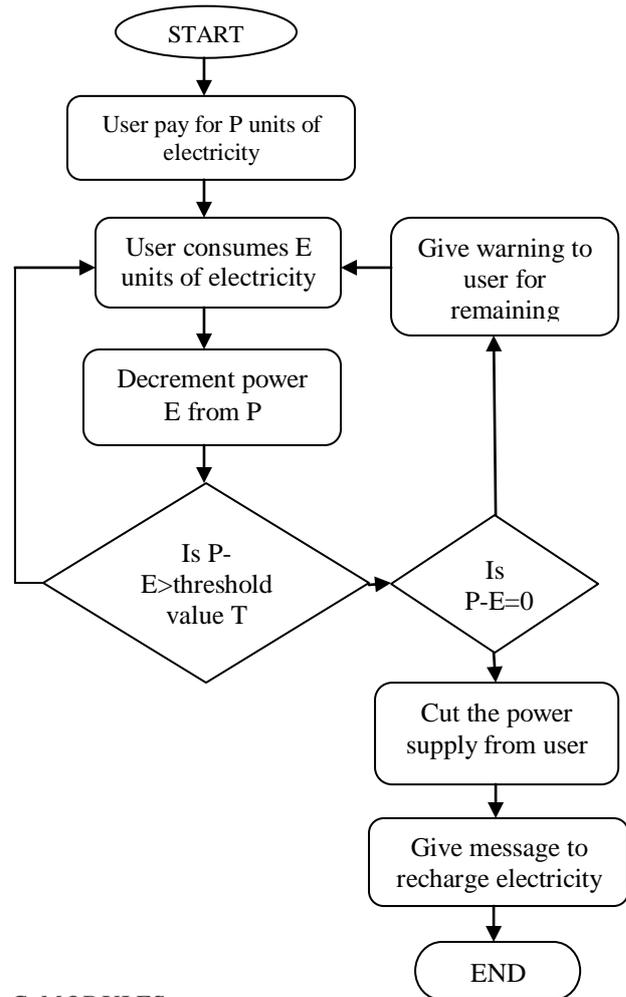


Fig 1: Block Diagram

*B. LOW LEVEL DESIGN*



*C. MODULES*

The microcontroller & the GSM unit are interfaced with the Energy meter of each house. Every house has a separate number, which is given by the corresponding authority.

- Interfacing with the GSM Module
- LCD Interface with Microcontroller
- Embedded Processor
- MAX 232 (Communication Interface)

**A. A. Interfacing with the GSM Module**

Global system for mobile communication is globally accepted standard for digital cellular communication. The microcontroller output is not compatible with the GSM module. To make it compatible we require MAX 232 connector.

This will enable the microcontroller to send a message to a predefined phone number. Here MAX232 acts as driver which converts TTL levels to RS232 levels. For serial interference GSM modem requires the signal based on RS232 levels [4].

**B. LCD Interface with Microcontroller**

An LCD is an industry standard liquid crystal display (LCD) display device designed for interfacing with embedded electronics. These screens come in common configurations of

347

8x1 characters, 16x2, and 20x4 among others. The system also consists of a display system having a LED. When the meter is working, LED glows when GSM module sends the message. LCD module has 8-bit data interface and control pins. One can send data as 8-bit or in pair of two 4-bit nibbles [3].

To display any character on LCD micro controller has to send its ASCII value to the data bus of LCD. For e.g. to display 'AB' microcontroller has to send two hex bytes 41h and 42h respectively. LCD display used here is having 16x2 sizes. It means 2 lines each with 16 characters. In this system we can find power usage instantaneously through the readings of this LCD.As we are using prepaid system this is very useful to know when to recharge and how many units still left for usage.

## C. Embedded Processor

The power consumption circuit and GSM module are interfaced through the ports of standard microcontroller AT89C52. The processor Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip and Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and low cost solution to many embedded control applications. This 8052 module is interfaced with GSM modem, LCD module, EB meter, load etc.

When power is being consumed the readings got noted by EB meter and displayed by LCD. When maximum consumption is reached and there is a need of recharge it is displayed by LCD and information is passed to the microcontroller. The controller is programmed in such a way that it sends the information to consumer module which is nothing but a cell phone .If consumer did not recharge within specified time then a message is sent from GSM modem connected to PC at electricity office to GSM modem connected to microcontroller which automatically disconnects the power supply to that particular consumer. When consumer recharges his/her balance then again message is sent from electricity board to controller that connection is re-established. Hence the process is fully automatic.

## VI. APPLICATIONS

- The system can be incorporated for almost all types of users.
- The concept is well suited especially for villages and interior areas.
- Household electrical systems.
- Hotels and short term residential houses.
- Industrial power consumers.

- Shared meter systems.

## VII. CONCLUSION AND FUTURE ENHANCEMENT

Everyone is more concern about their time in this busy world; few of them send a proxy or neighbours to pay their electricity bill. These difficulties can be easily avoided by using prepaid electricity billing system. Every consumer can recharge their EB account through their cell phones. Consumers can also control the wastage of energy by this system. Most importantly the manual error made by the employees while taking readings can be vanished by this system. The secret consumer ID given by the EB makes the users account more secure.

The automated electricity billing system using GSM can be future expanded to,

- The system can be interfaced with the sensors to check different types of meter tampering and fault conditions.
- This controller can have one embedded power factor controller to correct the power factor.
- In this project the data communication is through a mobile network which is little bit expensive media but it can be modified to communicate through Ethernet communication using TCP/IP protocols.

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