

# Voucher Based Prepaid Electricity Supplier with Auto Cut Off

Bhavna Patel, Shrikant Mhaskar  
bhavna07patel@yahoo.co.in,mhaskarshree@gmail.com

## ABSTRACT

Scientific inventions have made this world worth living. They have provided us with various means of comforts and luxuries. The invention of electricity is one of the greatest of its wonders. Indeed, we cannot even dream of living in absence of electricity in modern times. There is no walk of life in which it is not used these days.

Right from a simple bulb to a highly complex system needs electricity to work. The use of electricity is every where in the world. Hence the calculation of usage of electricity is important phenomenon to calculate the realisation out of it.

## I. INTRODUCTION

Every one who uses the electricity is required to make the payment for the amount of electricity used by them. The procedure every where is to use the electricity first and after the month bill will be generated. This type of payment is called POSTPAID billing system, commonly implemented every where.

A scheme of Electricity billing system called PREPAID ENERGY METER can facilitate in improved cash flow management in energy utilities and can reduce problem associated with billing consumer living in isolated area and reduces deployment of manpower for taking meter readings.



### A. Existing System

Present system works on post-paid type of bill payment. In this system every user is provided with a meter that calculates the usage of electricity. One person at the end of the month comes to take the reading manually which is passed on later to calculate the bill amount.

This generated bill then distributed to the user and finally user makes the payment at the counter in a long queue.

### B. Drawbacks of Existing System

- Requires manpower to collect reading.
- Human errors are possible in manual reading collections.
- Cheating can be done to reduce the bill amount.
- Needed staff to print the bill and then to distributes the same.
- Waste the customer's time for making payment due to long queue.
- Loss may occur if any customer does not pay the bill amount.

### C. Proposed System

The proposed system will be connected to the meter of the customer and the pulse of meter will be passed on to our proposed system. The working of the system will be as follows-

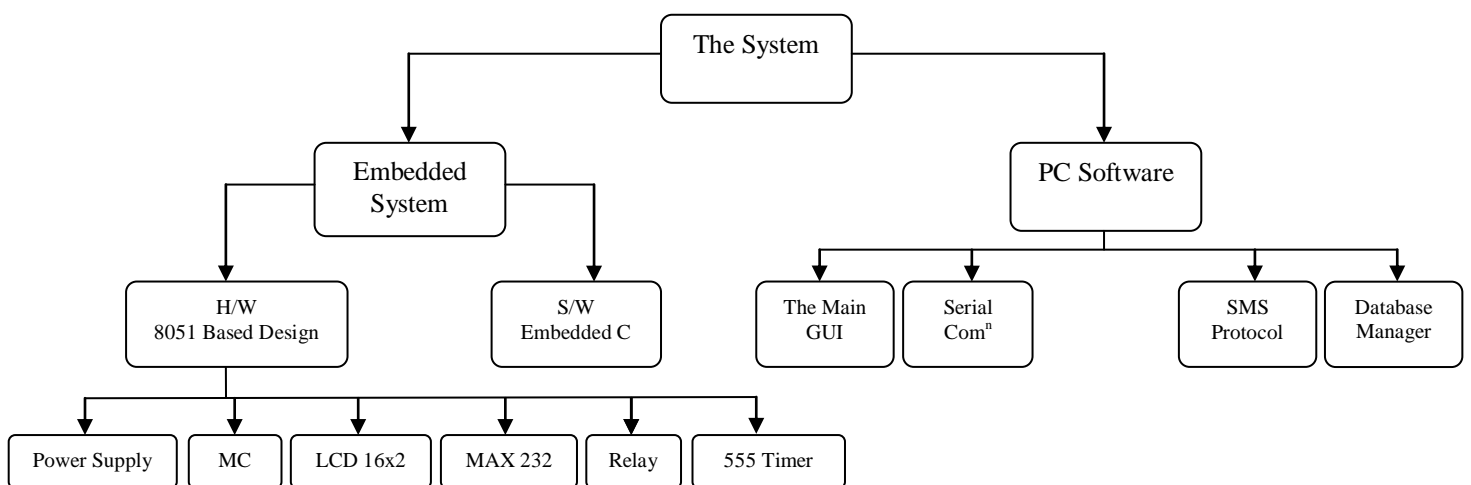
- Customer will by the desired value of electricity vouchers which will be commonly available.
- Customer will send SMS containing Voucher ID along with the Consumer ID to the electricity department.
- A SMS Server at department side will crosscheck all these information.
- After all verification of SMS, the system will generate SMS containing units which will be sent to the registered Meter ID against this Consumer ID.
- The meter will be able to accept SMS & will update the pre-paid units in the system.
- The system will start decrementing the units as per the uses on each pulse received from meter.
- Once the prepaid unit reaches to a predefined lower limit system will activate the buzzer to intimate the customer for low balance in the system.
- If not refilled and prepaid units is exhausted, system will trigger the relay to cut off the power supply which will resume on refilling.



## II. THE PROPOSED SYSTEM

### A. System Overview

The above proposed system will be divided into the following sub modules or sections...



### B. Block Diagram

The Block Diagram of the system is attached behind.

### C. Explanations of Blocks

The following are the brief explanations of the working principle of the various major blocks or sections used in the system...

- **Power Supply**

This unit will supply the various voltage requirements of each unit. This will be consists of transformer, rectifier, filter and regulator. The

rectifier used here will be Bridge Rectifier. It will convert 230VAC into desired 5V/12V DC.

- **Microcontroller**

This unit is the heart of the complete system. It is actually responsible for all the process being executed. It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the Microcontroller.

The controller here user will be of 8051 family. The code will be written in Embedded C and will be burned or programmed into the code memory using a programmer. This unit requires +5VDC for it proper operation.

- **LCD 16x2**

It is called Liquid Crystal Display. We are going to use 16x2 character LCD. This will be connected to microcontroller. The job of LCD will be to display all the system generated messages coming from the controller. LCD will provide interactive user interface.

This unit requires +5VDC for it proper operation.

- **MAX 232**

This section will be used to convert TTL logic into RS232 logic and vice-versa. In TTL---logic 1 is +5V and logic 0 is 0V. In RS232---logic 1 is -10V and logic 0 is +10V. This unit will provide interface that is required to communicate microcontroller with RS232 based devices using serial communication link. The MAX232 IC is dedicated for the logic conversion. This unit is also called as Logic Convertor OR Level Convertor.

This unit requires +5VDC for it proper operation.

- **555 Timer**

The 555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays, or oscillation. Here we are using it in Astable Multivibrator mode for generating clock pulses. The frequency depends upon the external register connected to the IC.

This unit requires +5VDC for it proper operation.

- **Relay Driver**

As microcontroller cannot supply more current to driver high current sinking device; we will use relay driver circuit to drive the relays.

We will use ULN2803 IC for this purpose. It has in built 8 Darlington Pairs to drive 8 channels each of 300mA. Also it can bear up to 50V.

This unit requires +12VDC for it proper operation.

- **Relay**

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Here we are using SPST (Single Pole, Single Throw) Type Relay. It will be used to switch ON OR OFF the electrical path between two contacts.

This unit requires +12VDC for it proper operation.

#### D. Features

The Following are the prominent features of the above discussed system...

- No queue for bill payment.
- Refilling by SMS
- Creates reusability of NOKIA 3310,
- Automatic cut-off of the supply.
- No delay in billing cycle.

- Indication of refilling before cut-off.
- No excess use of electricity.
- Improves cash flow management for electricity department.
- Reduces man power requirement for billing system.
- Reduces the risk of non payment.
- Reduces the cheating probability.

#### E. Technology & Programming Languages

As microcontrollers are the core of these days digital circuit design in industry, this system uses it for the centralized operation and digital processing. The technology used here is embedded technology which is the future of today's modern electronics.

The followings are the various Programming Languages & Technologies that are going to be used in the proposed system...

*For Embedded System...*

- Embedded Technology,
- 8051 Family Based Controller,
- Embedded C - Keil Compiler,
- Eagle Software for PCB Designing,
- F-Bus Protocol for SMS Communication.

*For PC System...*

- VB.net 2008 Based Application Software,
- Serial Communication Protocol,
- SMS Communication using AT Commands,
- MSAccess2007 Based Database,

#### F. Project Development Methodology or Steps

The following will be development steps so as to achieve the working Prototype Model of the above proposed system...

- Defining the Problem,
- Understanding the Need & Usability in industry and society (Market Analysis),
- Developing Block Diagram,
- Designing Circuits of individual blocks,
- Testing circuits in LAB & Finalizing,
- Developing PCB on PC,
- Getting the PCB printed from market,
- Soldering the components,
- Performing various Basic Experiments to test the PCBs,
- Developing Flowchart for the entire process,
- Writing actual Software Program,
- Compilation & Burning,
- Testing and Debugging,
- Developing Flowchart for PC Side Software,
- Developing Data Flow Diagram,
- Writing actual code.
- Finally Running the system and,
- Documentation.

### III. SCOPE & APPLICATIONS

Only the imagination can limit the applications of the above proposed system.

Though the following are some examples...

- Specialized for electricity department.
- For any customer billing system.

- For customized pre-paid services.

#### IV. CONCLUSION

By the realization of the above proposed system one can learn many aspects of a digital electronics circuit. This will give the complete knowledge of designing microcontroller based system and developing embedded software.

We will also learn the software development strategies and various programming techniques for PC based applications.

#### V. ENHANCEMENTS

##### A. Limitations

As generally all systems have some limitation, here are some listed for the proposed system...

- Uses only NOKIA 3310/3315 for refilling.
- System simulates the pulses as we are not using actual meter.

##### B. Drawbacks

This system has certain drawbacks also as listed...

- SMS are not in real time.
- SMS services will be charged.

##### C. Future Modifications

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done...

- Any mobile phone can be used to refill the system,
- System can be refilled by a prepaid smart card.

#### REFERENCES

##### A. Embedded Books & Websites

- [1] Myke Predko, *Programming and Customizing the 8051 Microcontroller*, Edition 1999, Tata McGraw-Hill, Page:157-167.
- [2] Muhammad Ali Mazidi, Janice Gillispie Mazidi, *8051 Microcontroller and Embedded Systems*, Prentice-Hall, Page:183-193, 236, 243.
- [3] Dogan Ibrahim, *Microcontroller Projects in C for the 8051*, Newnes, Page:29-161.
- [4] Kenneth J. Ayala, *The 8051 Microcontroller ARCHITECTURE, PROGRAMMING and APPLICATIONS*, WEST PUBLISHING COMPANY, Page:131-197.
- [5] Michael J. Pont, *Embedded C*, Edition 2002, Addison Wesley, Page: 57-87,217.
- [6] [www.beyondlogic.org](http://www.beyondlogic.org)
- [7] [www.discovercircuits.com](http://www.discovercircuits.com)
- [8] [www.electronicsexperts.com](http://www.electronicsexperts.com)

##### B. Electronics Books & Websites

- [1] Ramakant A. Gayakwad, *Op-Amps and Linear Integrated Circuits*, 4<sup>th</sup> Edition, Prentice-Hall, Page:342, 417, 455.
- [2] Robert L. Boylestad, Louis Nashelsky, *Electronic Devices and Circuit Theory*, 10<sup>th</sup> Edition, Prentice-Hall, Page:342, 417, 455.
- [3] R.P.Jain, *Digital Electronics*, Tata McGraw-Hill
- [4] [www.electronic-circuits-diagrams.com](http://www.electronic-circuits-diagrams.com)

- [5] [www.circuitstoday.com](http://www.circuitstoday.com)
- [6] [www.circuitlake.com](http://www.circuitlake.com)

##### C. Software Books & Websites

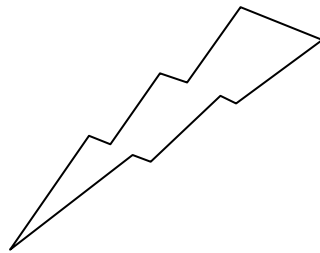
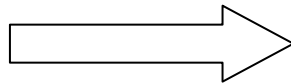
- [1] Gary Cornell & Jonathan Marrison, *Programming VB.Net: A Guide for experienced programmers*, Second Edition 2002, ASPToday Publication, ISBN (pbk): 1-893115-99-2, 424 Pages.
- [2] Dave Grundgeiger, *Programming Visual Basic.Net*, First Edition 2002, O'Reilly Publication, ISBN: 0-596-00093-6, 464 Pages.
- [3] Evangelos Petroustos, Mark Ridgeway, *Mastering Microsoft Visual Basic 2008*, First Edition, Wiley Publishing, ISBN: 978-0-4701-8742-5.
- [4] James R. Groff, Paul N. Weinberg, *SQL: The Complete Reference*, First Edition, Osborne/McGraw-Hill, ISBN 0-07-211845-8.
- [5] Brian W. Kernighan, Dennis M. Ritchie, *The C programming Language*, First Edition 1988, Prentice-Hall, ISBN 0-13-110370-9.

##### D. Other Books & Websites

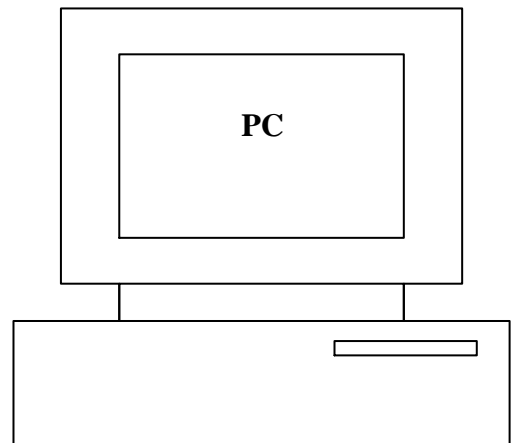
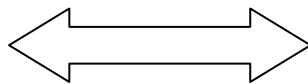
- [1] [www.alldatasheets.com](http://www.alldatasheets.com)
- [2] [www.wikipedia.org](http://www.wikipedia.org)
- [3] [www.keil.com](http://www.keil.com)
- [4] [www.hobbyprojects.com](http://www.hobbyprojects.com)

### THE SYSTEM BLOCK DIAGRAM

Pre-paid Voucher  
ID-xxx-xxx-xxx-xxx  
Cost:xxx Units-xxx



### SMS Sever at Electricity Department



### Electricity Meter-Add on at User Home

