

GSM BASED AUTOMATIC PREPAID ENERGY METER WITH TARIFF STRUCTURE

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ABSTRACT

This paper presents the design and modeling of a GSM-based Energy Recharge System for prepaid Metering. The present system of energy billing in India 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, processing errors. The aim of the project is to minimize the error by introducing a new system of Prepaid Energy Metering using GSM. The GSM module provides a mode of communication between the user/ and provider. This will enable the user to recharge his/her electricity account from home. We can easily implement many add-ons such as energy demand prediction, real time dynamic tariff as a function of demand and supply and so on. In this paper, the idea of a Prepaid energy meter Using a PIC16F877 microcontroller has been Introduced. This concept provides a cost efficient Manner of electricity billing. The present energy Billing systems are discrete, inaccurate, costly and Slow. They are also time and labour consuming. The major drawback of traditional billing system is Power and energy theft. This drawback is reduced By using a prepaid energy meter which is based on The concept “ Pay first and then use it” . Prepaid Energy meter also reduces the error made by Humans while taking readings to a large extent and There is no need to take reading in it. The prepaid Energy meter uses a recharge card which is Available in various ranges (i.e. Rs. 50, to Rs. 100.). The recharge is done by using a mobile And the meter is charged with the amount. According to the power consumption, the amount Will be reduced. The Display shows the remaining amount of energy on the LCD and consumed unit. A relay system has been used which shut Down or disconnect the energy meter and load Through supply mains when the recharge amount is Depleted. The tariff structure has been introduced into two mode ,day and night for economical operation.

KEYWORD : - GSM: Global satellite modem ,LCD: Liquid crystal display, relay, LED: Light emitting diode, ADC: Analog to digital conversion etc.

1. INTRODUCTION

Electricity plays a vital role in growth of our country. Even though power production corporations focusing highly on generation, transmission and distribution, they are meeting power loss due to illegal consumption of electrical power from the transmission lines by the consumers. Power theft has become a great challenge to the

electricity board. The dailies report says that Electricity Board suffers a total loss of 8 % in revenue due to power theft every year, which has to be controlled. This research paper identifies the power theft and indicates it to the Electricity board through GSM network. It also deals about the remote monitoring of an energy meter in the proposed system.

In the field of electrical or electronics current and energy consumption, which may effect on stabilization of the components, are playing an important role. In case of Industries, the industrialists have to monitor and control the usage of electrical energy level. The main objective is to prevent energy usage beyond the maximum allotted energy by the power supplier, by preventing from over load usage. Energy consumption is audited by using current transformer connected series to the load. Then the current is measured by implementing Analog to Digital Conversion (ADC) techniques of the PIC (Peripheral Interface Controller) microcontroller, if any invariance is found tripping device takes the charge there by removing the excess load and invariance. Microcontroller is giving control signals to tripping various equipment provides controlling feature. Output can then be displayed in the LCD (Liquid Crystal Display). The difference with other existing system is that even transmission line theft can also be detected apart from the meter bypassing .The additional feature of this system is that there is no need of manual interface as the entire system is fully automated and also meter reading also accurately calculated in this system, which overcomes the traditional manual meter reading.

1.1 LITERATURE SURVEY

1.1.1 TRADITIONAL SYSTEM

Traditional meter reading is done by the human operator, this require a more number of labor operator and long working hour to achieve the complete area data reading and billing. Due to the increase in the development of residential building and commercial building the meter reading task increases which require more number of human operators. It should be clear that such methods are very time consuming and does not satisfy the business requirements for the power company, in addition to the large number of errors incorporated in the reading process. This type of systems cannot provide transparency.

1.1.2 EXISTING SYSTEM

In existing system either an electronic energy meter or an electro-mechanical meter is fixed in the premise for measuring the usage. The meters currently in use are only capable of recording kWh units. The kWh units used then still have to be recorded by meter readers monthly, on foot. The recorded data need to be processed by a meter reading company. For processing the meter reading, company needs to firstly link each recorded power usage datum to an account holder and then determine the amount owed by means of the specific tariff in use.

1.1.3 PROPOSED SYSTEM

The present power usage reading is made manually by moving to the consumer locations. This requires large number of labor operators and long working hours to accomplish the task. Manual billing is sometimes restricted and delayed by bad weather conditions. The printed billing also has the tendency of getting lost. Over the last few years, Smart (Prepaid) Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. This mechanism, essentially, requires the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. Readings made by human operators are prone to errors. This project addresses the above mentioned problems. The development of GSM infrastructure in past two decades made meter reading system wireless. The GSM infrastructure, which has national wide coverage, can be used to request and retrieve power consumption notification over individual houses and flats. Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. The use of Prepaid Energy meter is still controversial. On the one hand, those that support the diffusion of prepaid meters claim that they benefit both consumers and utilities because they help users to consume more efficiently and to improve the management of their budget, while allowing firms to reduce financial costs.

2.1.1 BLOCK DIAGRAM

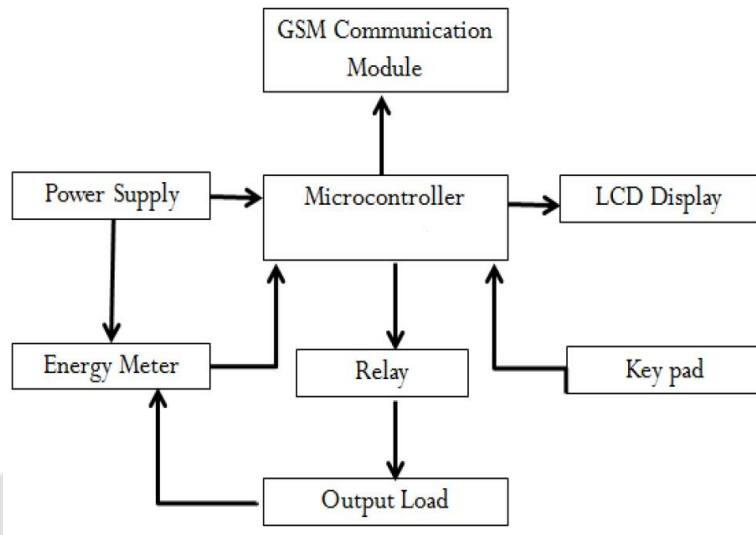


Fig: Basic block diagram of system

2.1.2 CIRCUITE DIAGRAM

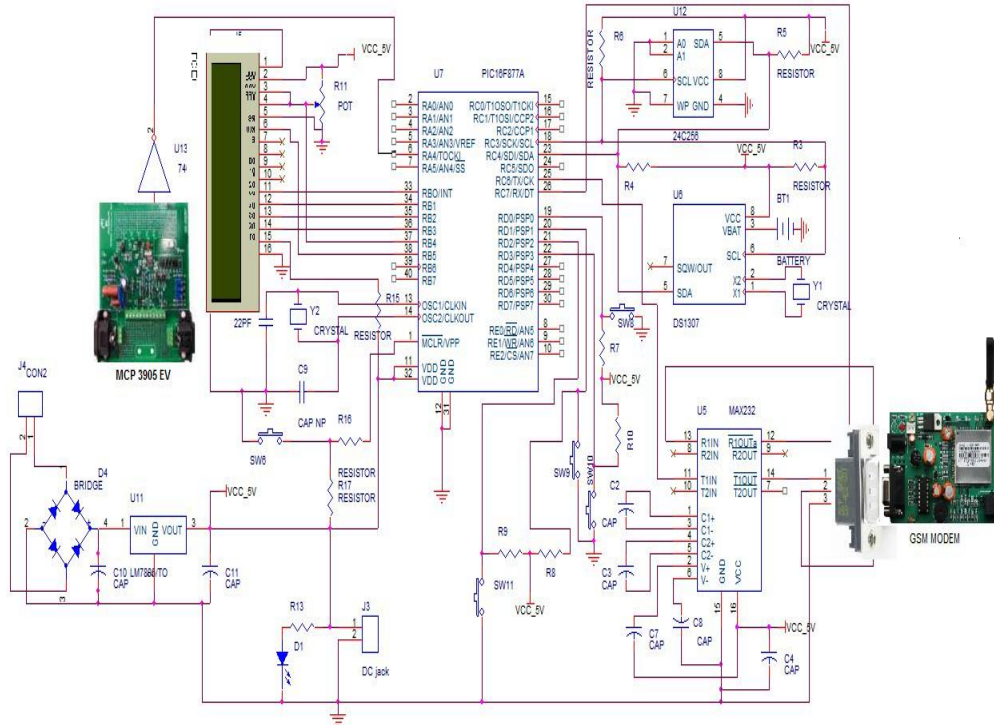


Fig 2: Circuit diagram of system

2.2 CIRCUIT DESCRIPTION

The pre-paid functionality can be implemented using an electronic meter, which consists of LED, which blinks according to the power consumption. If the consumption is more, then LED will blink with a faster rate for which over voltage is detected and the power gets off due to excess amount of load given and if the consumption is less then LED will blink with slower rate. The LED blink receives train of pulses which is applied to one of the interrupt pin of controller. The counter is activated at the interrupt pin, which counts the number of pulses that controller while receiving and thus controller measure the amount of energy consumed in the household. With the help of GSM modem one can recharge energy meter through mobile by SMS which can load the recharge amount in one of the register of controller.

For each pulses received at interrupt pin, the controller decrement the content of the register which is equivalent to the recharged amount left. If the content of the register falls below some level the controller activate the buzzer which indicate that amount left in the meter is low. If the contents of the register becomes zero then with the help of relay driver controller drive the relay which will disconnect the supply from the household.

On recharging the meter the controller connect the supply to the load with the help of relays. Thus, prepaid remote energy meter controls the power supplied to the household on the basis of amount recharged. The display shows the remaining amount and consumed unit.

2.3 CIRCUIT DESIGN COMPONENT

1. Global System For Mobile Communication (GSM)
2. Microcontroller
3. Energy Meter
4. Power Supply Unit
5. Relay
6. Step Down Transformer
7. Rectifier Unit
8. Filter Circuit
9. LCD

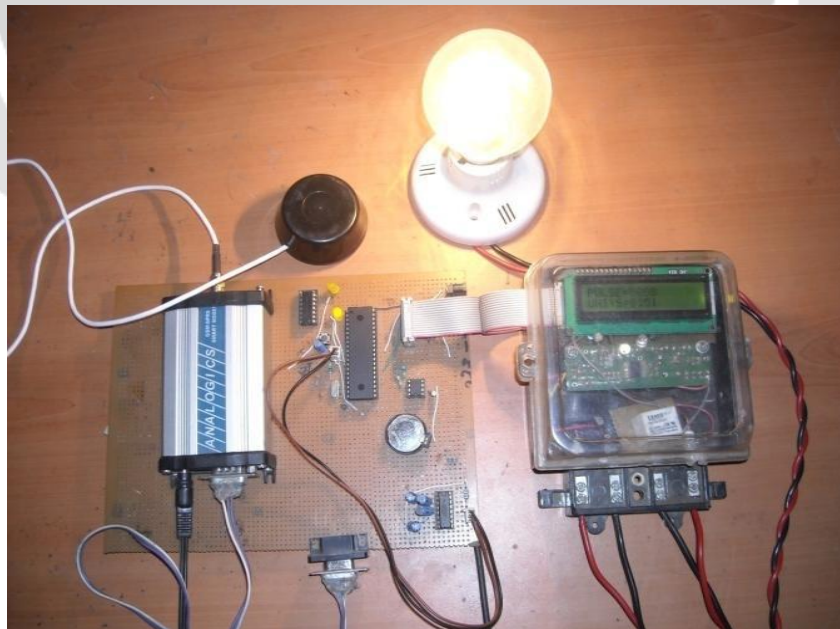


Fig 3: Final prototype project image.

3. WORKING

The proposed model has the PIC microcontroller as Central Processing Unit. The whole system is interfaced with PIC microcontroller. The GSM modem is serially connected with the controller which is the major communication module between User and provider. The GSM uses its own network for the transfer of information. Special coding in embedded c is used for programming PIC microcontroller using programmer Hardware along with MP-LAB IDE software. The relay acts as switching device to cut off and restore power supply. The LCD is interfaced to microcontroller using parallel port connection. In this project the Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter. The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile no. and then switches on the relays attached to its port to control the appliances. After successful operation, controller sends back the acknowledgement to the user's mobile through SMS. The coding emphasizes the fact that it reduces human labor but increases the efficiency in calculation of bills for used electricity. The user will have a universal number and they can recharge outlets of electricity board. The acknowledgement of recharged coupon detail will come to notice of the consumer and also will get displayed in LCD module. So this process will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place. The LCD display will display the used amount and balance amount that can be used.

The tariff structure is also introduced in our project, for night time it is one rupees per unit and for day time it is two rupees per unit which helps to generation side for preparing their next schedule so that it is economical for both generation and consumption side.

3.1 FLOWCHART

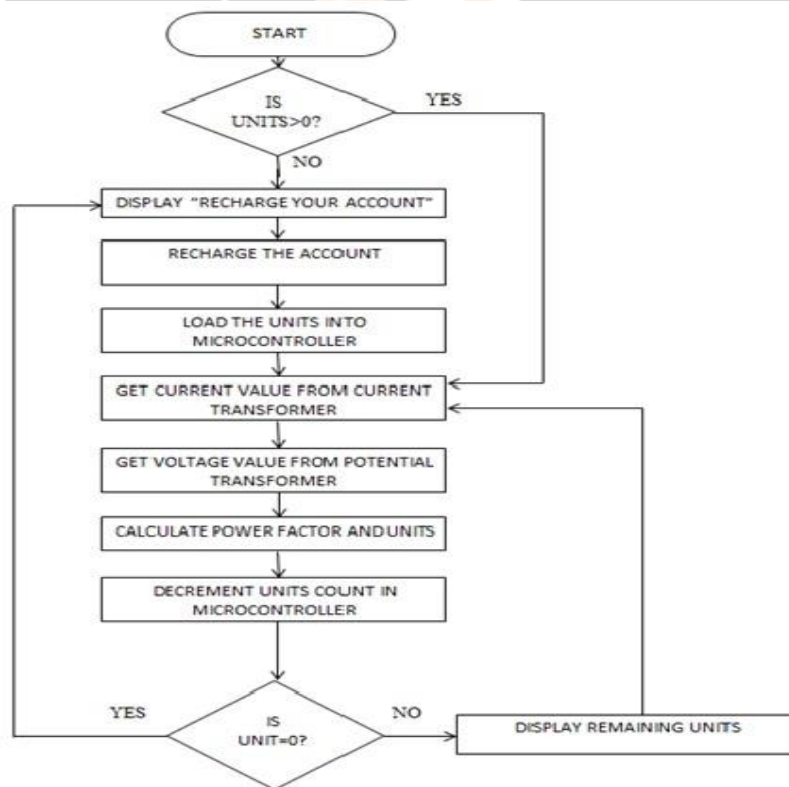


Fig 4: Flowchart for controller program.

4. CONCLUSIONS

The proper guidance of project head and the sincere efforts of our group have lead to the successfully accomplishment of our concerned projects.

The project based on “**G.S.M.BASED AUTOMATIC PREPAID ENERGY METER WITH TARIFF STRUCTURE.**” was interesting to work on and was also gained in this project work. This knowledge of project will definitely be helpful in our future. So we must maintain that this final year project was an essential part of our engineering education enhancing our technical knowledge and practical skill.

The design of Smart Energy meter using GSM technology can make the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. This reduces human labor and at the same time increases the efficiency in calculation of bills for used electricity. Smart energy meters will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place. This paper work exposes the purpose of energy monitoring and controlling by implementing prepaid system. It is hoped that this work helps the consumers for better energy management and its utility in the distribution system for economic liability of the Electrical Boards.

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