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GSM BASED REMOTE PREPAID ENERGY METER

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Abstract: - *The aim of this paper is to develop a billing solution for energy consumption just like pre-paid taxi, mobile phone, petro card etc. The major drawback by using postpaid system is, there is no control of usage from the consumer's side and lot of wastage of power due to the consumer's lack of planning in electrical consumption. Since the supply of power is limited, there is a need to utilize electricity in efficient way. To overcome this, we are using pre-paid energy meter billing which deals with GSM for domestic power billing and transaction. In this project GSM technology is used for reading power consumption and updating the consumed units and available units at consumer point. In this the current is measured through an analog sensing circuit. The output of the sensing circuit is given to a combination of analog and digital circuitry whose output is given to the ARM7 Microcontroller LPC2138. The total number of units consumed is displayed on LCD Screen. By using RFID Tags we can also recharge the units required and complete the units till power gets disconnect. At the same time consumer will receive message if the units decrease below 10. And the power will be disconnected automatically.*

Keyword:-*Freytag, Prepaid power meter, GSM Technology, Prepaid card, LCD, Microcontroller.*

I. INTRODUCTION

So many years have passed since electricity has been there in our country and there is the same structure of supply of electricity even today. In many of the cities and villages in our country there is problem of load shading to save electricity for future consumptions. But which is of no use because electricity is still being wasted. People don't even have idea of how much electricity they make use of every month they never think of it. And even manual work is more in the present structure of electricity supply MSEB member has to visit every month to record the details of the units used by every house due to which privacy of the house is disturbed and even time of that person is wasted in recording the units. Every month we need to visit the nearby electricity office to pay electricity bill by taking out some time from are important schedule otherwise extra charges are applied on the bill .To overcome all these problems faced by our people we have taken out a solution to it by designing a system named "GSM BASED REMOTE PREPAID ENERGY METER". This system consists of many new technologies such as nowadays we have our mobile phones and Set top box of TV etc. This system is RFID based which uses RFID tags for recharging regularly and also a RFID Reader is there to read this cards. After our recharged units reach a minimum value a message is sent to our mobile phone through GSM. And we will have to recharge it otherwise the power will be disconnected. Due to the introduction of prepaid system, the problem likes overcharging, over billing and paying bills in queue will be removed automatically. Also we have used electronic meter so the problem related stability and accuracy due to temperature changes is solved. It is designed for customer

II. METHODOLOGY

We are designing a system named "GSM BASED REMOTE PREPARED ENERGY METER". RFID tag, Energy meter, ARM, Relay, GSM Modem, Power supply are the important components used in the system. All this components play a vital role in the building of the project. The RFID tags are used for recharging the units we require. ARM 7 is the main control unit of all these components of the project. Relay is used for switching ON and OFF the power supply whenever units are fully used and when it is again recharged respectively. We will be receiving a message on our mobile phone whenever power is cut through the GSM system which is also connected to ARM 7. We have initialize ARM7, Energy meter and GSM modem in the system. It gives a missed call to the authenticated number in GSM modem through mobile phone. Once the number gets registered through GSM modem to the electricity board office, the conformation message is sent to the mobile phone. If the authorized number is authenticated then it shows on LCD screen as "recharge your pre-paid account to attain the corresponding units". Once the recharge is done according to the amount recharged the available units are displayed on LCD screen simultaneously and the message is sent to the authenticated number. When the power consumption is takes place, the available units are decremented. The decremented units are known as "consumed units". When it reaches the limited units, then it is activated & sends an alert message to authenticated number as "your recharge amount is very low, so please recharge your account to retain the units". If the units are totally

consumed, the relay gets activated & then the power supply turns OFF. Alternatively, if the overvoltage occurs, then the microcontroller activates the relay circuit so that the particular device (load) turns OFF. After the processing of activation of relay simultaneously, the required information is displayed on LCD screen as well as it sends an SMS to the authenticated number. If the above all process is not done accordingly to the authenticated number, then the system remains in stand-by-mode. The process gets finished.

III. BLOCK DIAGRAM

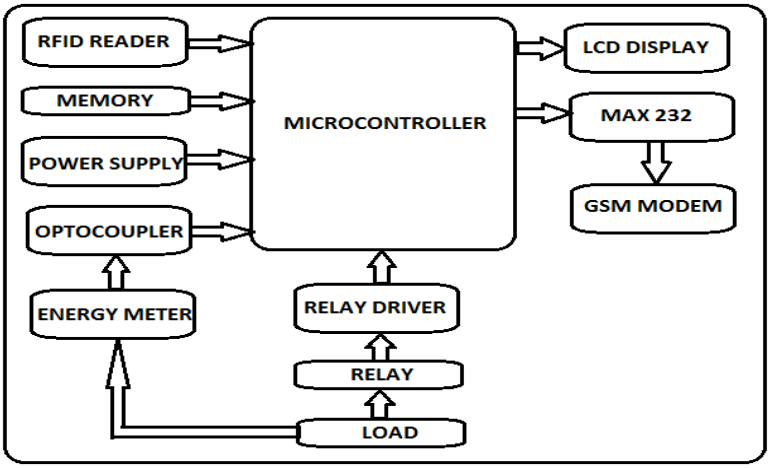

Fig.3 Block diagram of GSM based remote prepaid energy meter [6].

IV. WORKING OPERATION

The energy metering system consists of Energy Meter, Microcontroller, Voltage and Current controlling unit, RFID TAGS, Relay and Liquid Crystal Display (LCD). Energy Meter IC generally produces electrical pulses proportional to the power consumed by the consumer and the power supply of microcontroller. Microcontroller calculates the energy consumed by the consumer utilizing the output of Energy Meter and programs loaded on the microcontroller. Voltage and Current controlling unit feeds the actual current and voltage of load connected to consumer side to the Energy Meter. RFID interfaces with the microcontroller unit in which the number of units recharged by the consumer are written. Relay mainly performs the opening and closing of a connection between energy meter and load through supply mains depending upon the number of units present in the RFID Tag at a moment. Liquid Crystal Display shows the energy consumption, number of unit recharged by the consumer, rest of the unit and maximum demand. The server unit sets number of units in the RFID Tags according to the consumer's demand. The tariff rates are already programmed in the PC of energy billing system and the system will only load the number of units into the RFID.

V. RFID BASED SYSTEM

Radio-frequency identification (RFID) is a technology to record the presence of an object using radio signals. It is used for inventory control or timing sporting events. RFID is not a replacement for the barcoding, but a complement for distant reading of codes. The technology is used for automatically identifying a person, a package or an item. To do this, it relies on RFIDtags.Thesearesmalltransponders (combined radio receiver and transmitter) that will transmit identity information over a short distance, when asked. The other piece to make use of RFID tags is an RFID tag reader.

This paper helps in developing a prototype of a prepaid energy meter employing RFID technology. In the current RFID energy meters, many have used "read" types of RFID technology to activate the meter and supply electricity to the consumers. One can only program the credit by a given code in the RFID card. The code cannot be changed. Therefore ,to top up different credits in the RFID card , one should use different RFID cards instead of one. For example, if the user wants to top up RM 10 , RM 20 and RM 30 on the RFID energy meter, he has to use three cards with different credits hold . This scenario causes users having to buy more RFID cards for different amount of credits used.

The RFID reader can be connected to the computer using USB cable. When the RFID card placed on the reader, the data can be transferred to the computer or from the computer to the RFID card.

There is connection between computer and RFID device as shown in figure 2. In the figure, it is shown that the RFID device is interfaced with the computer. The implementation shown in Figure is mainly for top up the credit into the RFID card. The communication between the device and a computer is via a connection to the microcontroller and MAX232 IC.

The MAX232 regulates the voltage level between the output of the arrows shown in figure indicate the direction flows of data. The communication between the device and the computer is in duplex or bi-direction.

The working principle of the RFID energy meter begins from the external supply given through the adapter to the microcontroller. The capacitor actually acts as filter which removes the ripple content in the dc. With voltage regulator connect across at the output of capacitor the dc voltage is regulated down into 5V. The 5V is then used by microcontroller, relay, MAX232 IC and LCD display.

When the RFID reader is activated or read the correct RFID card, the data from the cards is transferred to the microcontroller. He microcontroller will compute the power.

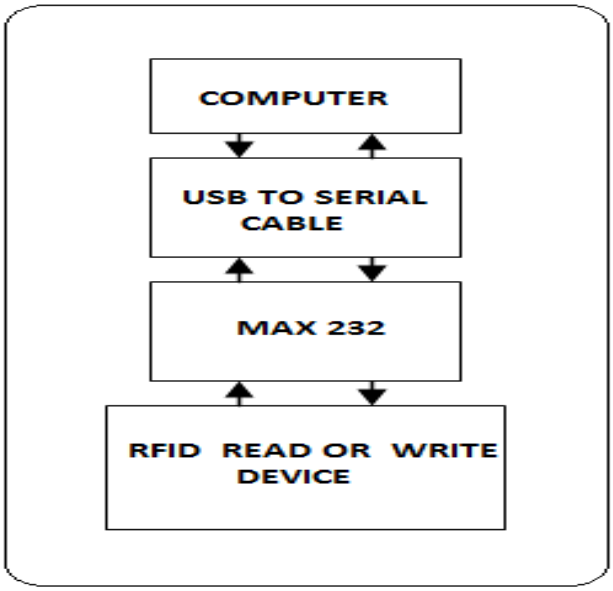

Fig.2 Connection or top up the credit in the RFID card [1].

Credit and trigger the relay so that the load is connected to the AC source. Both the power and credit are displayed in the LCD screen. As the credit is low, SMS message will send out to the hand phone through GSM modem.

LCD acts as an interface between the user and the Energy meter during the LCD interface with the microcontroller. The LCD displays the character corresponding to the information received from the microcontroller. If the data entered is correct, then the data is transmitted to the electricity board station by the GSM Modem through serial communication. If the data entered is incorrect, message is an invalid displayed on the LCD.

Using MAX232, the data will be received and transmitted from/to the microcontroller using the GSM Modem.
An optocoupler interfacing occurs, when one unit of electricity is consumed, an interrupt is given to the microcontroller using an optocoupler. When one interrupt is received by controller, it decreased the recharged amount equals to one unit of the electricity.

Interfacing of relay and relay driver where relay is an electrically operating switch. When the recharged amount reaches below 10 units, user will get warning message to recharge the remote meter. When the recharged amount gets finished, the relay will be used to cut off the house hold power supply. The relay driver is useful to drive relay at 12V and also it is used to prevent the back current from the relay to microcontroller [3].

Microcontrollers are based on a 16 or 32-bit ARM7 TDMI-S CPU with real-time emulation and embedded trace supports that combine the microcontroller with 16kb, 32 kb, 64 kb, 128 kb, 256 kb and 512 kb of embedded high-speed flash memory. Microcontrollers are most important part of the circuit. Due to their smaller size and low consumption of power, these microcontrollers are ideal for application where make small version is a key requirement, such as access control and point-of-sale with wide limit of the serial communication interface and on-chip SRAM. It is in system programming or in application programming via on chip boot loader software.

Power supply is a mention to a source of electrical power. A device or instruments which supplies electricity or other types of energy to an output load or all loads which are put together is called a power supply unit (PSU). The term most times applied to electrical energy supplies, less applied to mechanical ones, and rarely to others. The available

voltage signal from mains is 230v/50 Hz which is an ac voltage, but dc voltage is required with the amplitude of +5v or +12v or both for various application

VI. MODULE OF GSM BASED REMOTE PREPAID ENERGY METER.

VII. FLOW CHART

From the algorithm, there are two input-output ports configurations, one is for the LCD display and other is for microcontroller. The I/O ports configuration is very important to read and write the data. Once the microcontroller knows the I/O ports and where the data flows, the next algorithm is read the RFID card from the RFID reader. The microcontroller computes the credit deduction, displays the power and the credit, and makes decision or comparison to trigger the relay and GSM modem to send the SMS message. The algorithm is then repeated from the beginning when the power is cut off. By referring to Figure, there is a feedback path connected at the load. This feedback is used to determine the current in the AC circuit. In other words, feedback is actually a current sensing circuit [1].

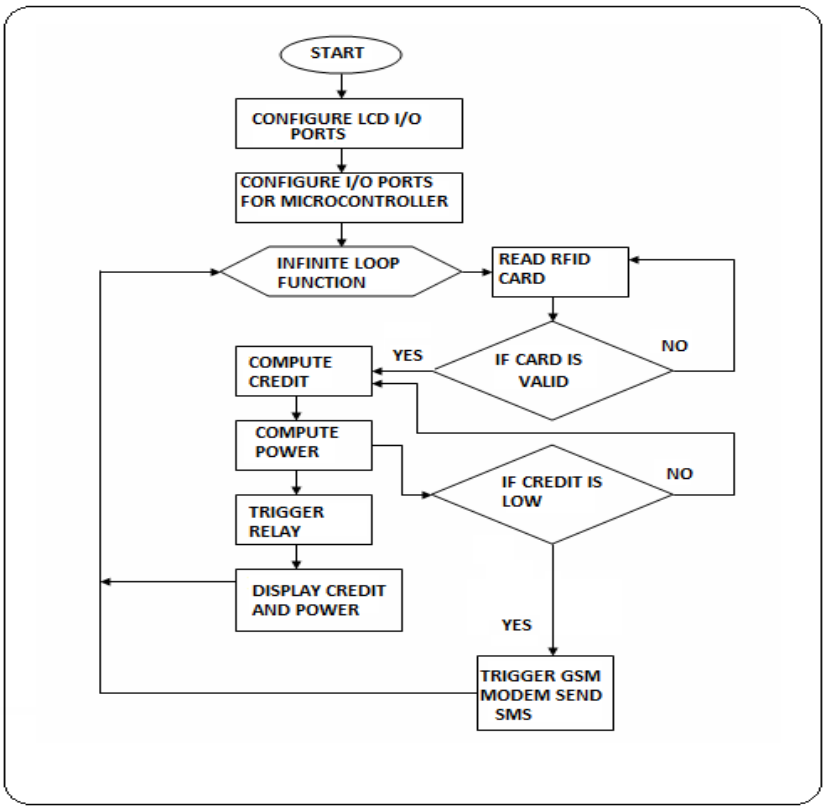

Fig. 4 System algorithm design for the microcontroller works in the RFID energy meter [1].

VIII. CONCLUSION

The project titled "GSM Based Remote Prepaid Energy Meter" is a model for prepaid Energy Meter including GSM for communication purpose and RFID system for recharging purpose. This system can solve many problems faced by the electricity consumers in present usage such as there will be no need of visiting the MSEB office every month for paying bills, there will be limited use of electricity, we will be having idea of how much electricity we are using and many more. We have completed the project as per the requirements of our project. Finally the aim of the project is successfully achieved.

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