DESIGN A TALKING ENERGY METER BASED ON MICROCONTROLLER

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Abstract - *In recent years, the demand for electricity has increased in households with the use of different appliances. This raises a concern to many developed and developing nations with the demand in immediate increase of electricity. People are unaware of energy consumed by various appliances. An electricity meter is a device that measures the amount of electric energy consumed by various electrical appliances. The main drawback of previously used traditional meters is that they do not provide information to the consumers, which is accomplished with the help of Talking Energy Meter. As power consumption is increasing day by day there should be more focus on understanding consumption patterns. Traditional electromechanical energy meters are now replaced by electronic meters in domestic as well as commercial applications. This project is aims to design a circuit which helps the consumer in taking care of the electrical energy consumption. This system helps the users by alerting them about the billing status and unit consumption. The "Talking Energy Meter" using ATMEGA328 Microcontroller is an exclusive system which is used to help the deaf and dumb people to announce their requirements using voice module aPR33A3. This aims to provide a user friendly interaction.*

Key words: ATMEGA328 Microcontroller, Energy Meter, Power Consumption, Threshold Limit, Unit Consumption, Voice Module

1. INTRODUCTION

In the early phase of household technology, delivery of electricity is completely depended on traditional energy meters. These meters play a key role in measuring the consumption of electrical energy in individual households. The usage of these meters has been slowly declining with the improvement in technology as fast changes has been made to encounter the problems occurred by the traditional meters. The major problem arises when habitants are unaware of their daily behavior. Monthly feedback given to the consumers is not sufficient as the consumers will not have knowledge on how much energy does the individual appliances consume. To overcome the problems of traditional electricity meters, electronic meter or static energy meter comes in picture. Now a day's, technology is developing rapidly. High automated and secured systems are preferred in all fields including electricity distribution. Electrical energy is universally accepted as an essential commodity for human beings. Energy is the prime mover of economic growth and is vital to the sustenance of modern economy. Future economic growth crucially depends on the long term availability of energy from its sources.

The Microcontroller based "Talking Energy Meter" mainly aims at the middle class and the lower class family to bring their electricity bill down with the help of the power consumption alert system. It benefits the government as it is helps in reducing the power consumption and succeedingly can reduce the unusual power usage. Energy meters being deployed at homes are used for reading the power that is being consumed. Each consumer may fix a customized threshold value (unit). If the value reaches above the threshold, it will alert to the consumer by voice module. This system may install at any place where the energy consumption should be regularly monitored and controlled. The consumers can fix their own threshold budget values and can be easily customized based on their requirements. This is used to continuously monitor the meter reading and give monthly information about the number of units consumed along with its cost to the consumer. It also alerts the user if someone tries to steal the electricity from meter by using IR sensor and cut the line and inform the Electricity Board by mobile application.

Major components used in this system are Microcontroller ATMEGA 328, Energy Meter, GSM module, Voice Module aPR33A3, IR Sensor. Microcontroller is the central unit of this system and is connected to GSM module, Voice Module aPR33A3 and energy meter through various ports.

Microcontroller drives the voice module to play the voice messages based on the energy meter readings. The typical voice alerts are like "threshold limit is reached", "pay electricity bill" etc. This system also consists of a LCD display that continuously displays the energy meter readings in real time. This can be achieved by the use of microcontroller ATMEGA 328 unit that is used to monitor and records the energy usage readings in its memory. The microcontroller that we use here is ATMEGA 328.

2. LITERATURE SURVEY

In order to design this project, literature review has been made from various sources like journal, books, article and others. This chapter includes all important studies which have been done previously by other research work. It is importance to do the literature review before doing the project. The review of the work is given as follows:

In Power Consumption Alert System [2], they design a circuit which helps the consumer in taking care of the electrical energy consumption, to make the consumer aware and to control the excess power consumption. This system will inform the consumer about their usage rate via SMS. Once the maximum threshold value is reached, power is cut off with a prior notification to the consumer. Due to this, customer feels inconveniency in emergency condition. This system gives the alert to the consumer via SMS only.

GSM based talking energy meter [5] is used to monitor and alert the consumer of their power usage. But the hardware required for this system is very complex.

In our system, we have covered all the drawbacks of existing system. Basically talking energy meter based on microcontroller is used to give the alert of energy usage if the set limit get exceeds, billing status etc. The microcontroller which we have used here is ATMEGA 328, it has 32K of flash memory, 1K of EEPROM and 2K of internal SRAM (Static Random Access Memory).

3. SYSTEM DESCRIPTION

The different literatures are studied which helped in designing a new system for monitoring and giving the alerts to the consumers.

3.1 Drawbacks of Existing System

a) Manual Interference

Traditional meter reading of electricity consumption is done my human operator by visiting one place to another in every month. This takes more time to collect the data from each and every user and also requires more human operator. Due to human interference, error may occur in reading and results error in billing too.

b) Electricity usage is not monitored

There is no knowledge of electricity usage because in existing system only monthly bill comes so consumers not get aware about their daily usage.

c) No Provision for energy stealing

In previous meter, if energy gets theft by the other people, owner not gets information about the stealing of their energy meter. And owner get suffer from this.

3.2 Proposed System

In proposed system, all the drawbacks of existing system are overcome. Talking Energy Meter based on microcontroller is design to give voice alert and monitor the energy usage. Voice can be in any language so that it easy to understand for common people. It is more convenient to physically disabled people.

4. WORKING OF TALKING ENERGY METER BASED ON MICROCONTROLLER

The purpose behind this system is to design a circuit which aware the consumer about their energy usage by giving the voice alert when consumed energy get exceeds the threshold limit which is set by the user according to their requirement. It also helps to monitor the electrical energy usage and protect the meter if someone tries to theft the electricity by cutting the line of meter with prior SMS to the electricity board. The block diagram of Talking Energy Meter based on Microcontroller is shown in fig. 4.

An AC source is given to the electric energy meter and from this; the load is connected to the meter via a relay switch. The fourth LED of the energy meter is given to one of the digital pins of microcontroller ATMEGA 328 at port C as shown in fig. 4. The microcontroller is connected to the voice module and the GSM module. The GSM module is used to send and receive messages via a mobile network to give daily alerts. The energy values once taken from the energy meter are digitized and processed with the help of a microcontroller ATMEGA 328. The billing of the corresponding energy usage is determined and per unit rate of consumption is set at the time of programming. The threshold unit value is set for which the consumption level increase is notified to the user. And the user can change that threshold limit according to the requirement by using dome switch.

A relay switch is connected with the microcontroller and the load which is used to cut the supply if someone tries to steal the electricity. It is used as protection purpose. Voice Module is used to give the alert when consumption of units exceeds the set limit by user. As soon as the limit exceeds, the voice alert occur and SMS get send on registered mobile number.

4.1 Components Used

4.1.1   Hardware Requirements

a) Energy Meter

b) Microcontroller ATMEGA 328

c) LCD

d) GSM Module

e) Relay

f) DS1307 RTC

g) Voltage Regulator IC 7805

h) IR Sensor

i) Voice Module

4.1.2   Software Requirement
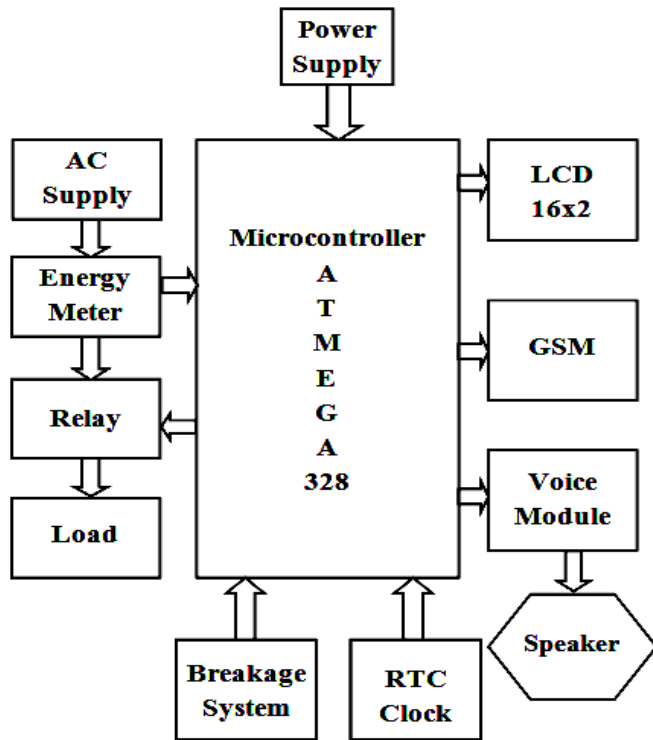
a) Arduino IDE

Fig. 4: Block Diagram of Talking Energy Meter based on Microcontroller

5. RESULT

The project "Design a Talking Energy Meter based on Microcontroller" is design such that whenever the usage of energy exceeds the threshold value which is set by user, it announces an alert message which was already predefined in the voice circuit. The SMS of monthly billing status is also sends on user's mobile number which is mentioned in program. The snapshot of SMS is shown in fig. 5.
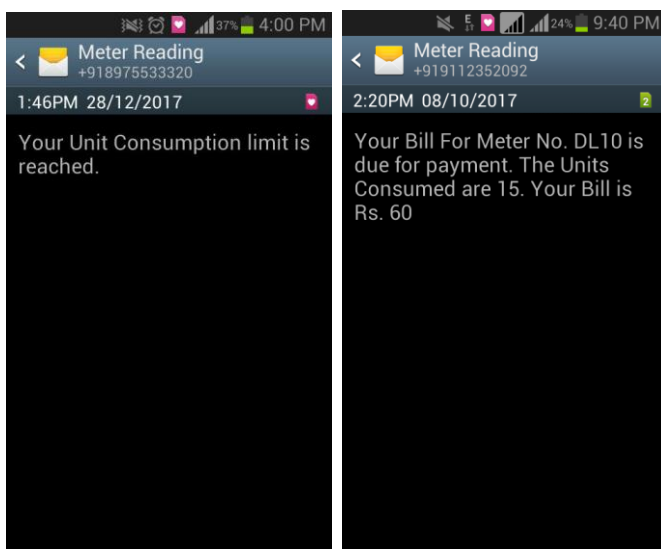

Fig. 5: Snapshot of Received Message of Billing Status and Energy Usage Status

6. CONCLUSION

The Talking Energy Meter based on Microcontroller is used to alert the user whenever the usage of energy exceeds the threshold value which can be set by user by using dome switch, it announces a voice message which is already predefined in the voice module. This helps in saving electricity and also keeping the electricity bills under limits. It not only benefits the consumer, but also benefits the government as it is capable of reducing the power consumption and subsequently can reduce the unusual power usage. By using this meter, customer can manage their energy consumption.

A small module consisting of the Microcontroller ATMEGA 328, Voice Module aPR33A3, IR Sensor, GSM Module and RTC DS 1307 can be installed with energy meter to make the electricity consumption smarter. In this system, the use of GSM and voice module provides numerous advantages over the methods that have been previously used.

7. FUTURE SCOPE

Our project "Design a Talking Energy Meter based on Microcontroller" is mainly intended to get a voice alert if usage goes beyond a set value. This system used a voice module into which a predefined alert voice messages are stored. And also it sends the SMS to user of billing status and when preset limit is exceeds.

The size of this project can be compact by using advanced processor. It can be modified to detect the faulty condition like over voltage, over current, earthing fault etc.

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