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Modelling of Arduino Based Pre-Paid Energy Meter Using GSM Technology

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***Abstract*- This project presents the design and modelling of Energy recharge system for Prepaid metering. The present system for energy building 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 and processing errors. The aim of this project is to minimize the error by introducing a new system of Pre-paid energy metering. This will enable the user to recharge his/her electricity amount from or any place by using a GSM Module. We can easily implement many add-ons such as energy demand prediction, real time tariff as a function of demand and so on.**

***Keywords*- Prepaid energy system, GSM Module, Metering, Demand prediction.**

I. INTRODUCTION

In the present time of 21st Century we have no space for errors or faults either in any technical system or in general application. Prepaid energy meter is an advantage concept. It facilitates the exemption from electricity bills. Electricity coupons will be available at a nearby stores.

The word prepaid means “pay before use” one of the advantageous features of this concept. Prepaid energy meter is used to pre-pay the ongoing supply of electricity to offices, homes, schools etc. the main objective of this project is to reduce the manpower and increase the accuracy of meter reading and avoid more consumption of electricity.

The major components required in this project is GSM modem for remote communication, digital energy meter, LCD display, regulated power supply, electromagnetic relay microcontroller. The design representation of this project was inspired for todays need for an automatic energy meter reading since system manual reading of thousands of household energy meter regularly is a tedious job especially when the climate conditions are not favorable to human sustaining limits.

With this solution the meter reading can be done from anywhere in the world with use of GSM technology. This solution may be a little expensive in terms of initial costs but it saves a lot of expenses in longer period of time.

II. PROPOSED SYSTEM

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

The proposed system gives the information about the Energy consumption on daily basis, billing and payment through IOT, pre-intimation of shut down details, alert systems when the energy consumption exceeds beyond the critical limit and the disconnection of power through a message when the residential are out of station to prevent the wastage of energy.

III. HARDWARE DESCRIPTION

In this system, a unique ID is given for each energy meter. This unique ID number is interlinked with the customer mobile ID number. It constantly monitors the energy meter. The energy consumption from each house is sent to the control station through the web server and the billing and power cut details are sent from the control station to the residential energy meter.

1. Energy Consumption on Daily Basis:
In the existing energy meter, the meter shows the energy consumed from the date of installation. In this system, the daily energy consumed is calculated using the Arduinomicro controller and it is displayed in the LCD. It is also communicated to the consumer mobile using Arduino and GSM Module.

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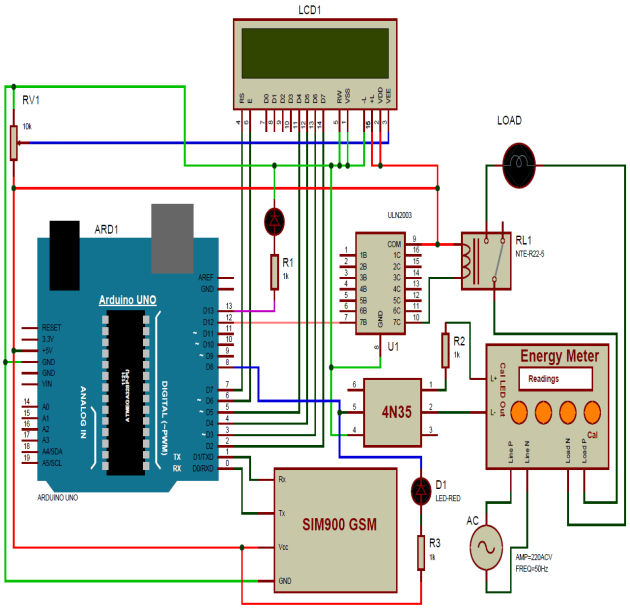

Fig 1. Prepaid energy meter diagram.

2. Billing and Payment:
The billing detail for the energy consumed is communicated to the consumer monthly as a message through the GSM module. The payment can also be made through the web server. This helps in eliminating the manual dependency to collect the reading.

3. Alert systems:
Our electricity billing system has a format that when the energy is consumed beyond the certain limit, double charges are collected i.e, they are charged twice the normal rate. In order to create awareness to the public, an alarm will be provided when the energy consumed by the consumer reaches a nearer value of critical limit. The message is also displayed in the LCD display. It is also displayed in the LCD. It is a time saving process and it helps to eliminate the human interference.

IV. SOFTWARE DESCRIPTION

This project is implemented by using following software.

1. Express PCB:
Breadboards are great for prototyping equipment as it allows great flexibility to modify a design when needed; however, the final product of a project, ideally should have a neat PCB, few cables, and survive a shake test. Not only is a proper PCB neater but it is also more durable as there are no cables which can yank loose.

2. PIC Compiler:
PIC complier is softwareused where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. PIC compiler also supports C language code.

It's important that you know C language for microcontroller which is commonly known as Embedded C. As we are going to use PIC Compiler, hence we also call it PIC C. The PCB, PCM, and PCH are separate compilers. PCB is for 12-bit opcodes, PCM is for 14-bitopcodes, and PCH is for 16-bit opcode PIC microcontrollers. Due to many similarities, all three compilers are covered in this reference manual. Features and limitations that apply to only specific microcontrollers are indicated within.

3. Proteus 7:
Proteus is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed.

This microcontroller has a program in it written in such a way that it accepts the hex file from the pic compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply circuit designed and connected to the microcontroller in proteus. The program which is to be dumped in to the microcontroller is edited in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller using a dumper.

IV. FIGURES

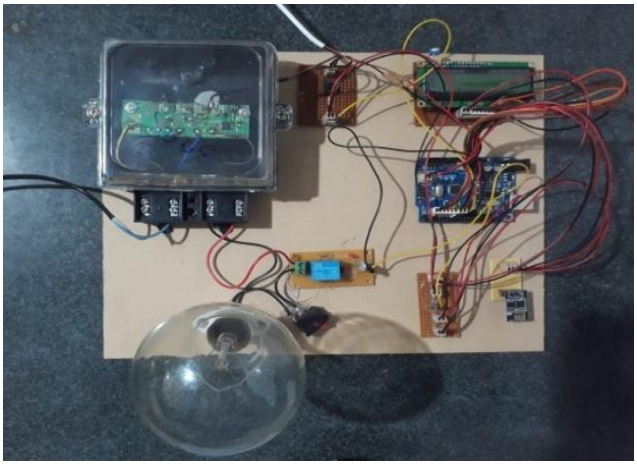

Fig 2. Final Kit

A picture of the kit made by the Students of EEE, which helps us understand quite how the final output functioning would work. This project has been made by keeping in mind and considering the human errors caused sometimes during the calculation of electricity bills every month,

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since it is totally a well-executed prototype of a household energy meter.

Fig. 3: Programming the Arduino.

V. CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly,using highly advanced ICs with the help of growing technology, the project has been successfully implemented. Thus,the project has been successfully designed and tested.

VI. FUTURE SCOPE

Our project "Modelling of Arduino based prepaid energy using GSM Technology" is mainly intended to design a system which helps in continuous monitoring of energy meter reading and to alert when meter reading goes beyond a set level. This system has an energy meter, load, LCD and GSM Modem interfaced to the microcontroller.

The microcontroller is programmed in such a way that the energy meter always gives the meter reading to the controller which is displayed on the LCD. The system also alerts through Texts by using GSM Modem. Which would be very useful since India plans to replace all the current Energy meters of all the Indian households by 2022.

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