

**A Study on Improving Energy Metering System And Energy Monitoring.****Smart Energy Meter Home Surveillance System**Moksha Patel¹, Azba Clipwala², Parth Bhatt³¹Electrical Engineering, Vadodara Institute of Engineering²Electrical Engineering, Vadodara Institute of Engineering³Electrical Engineering, Vadodara Institute of Engineering

Abstract: *The invention relates to building an electricity meter which is user friendly and helps the customer to monitor his/her energy consumption. The main feature is prepaid electricity system. This system will allow the user to recharge for the amount of electricity to be used as per the tariff rates. This will allow the distribution company to keep a data track on future load demand. The meter will send the notifications to the registered consumer mobile number through the GSM module. Secondly this meter will help the user to keep a track on his/her 24 hour energy consumption. The user can get information about the power consumption of the major loads in the house such as TV, fridge, AC, etc. The meter will alert them if such appliances consume more energy than their ratings and thus the user can know about the faults in the appliances. Thus we can do the entire surveillance of the energy consumption using this meter. This can lead a way to energy conservation.*

Keywords - *electricity meter, prepaid system, energy consumption monitoring*

I. INTRODUCTION

The energy conservation is one of the major problem world is facing today. Most of the energy is consumed in the form of electrical energy. So it is necessary to built systems that can help the domestic, commercial and industrial electricity consumers to conserve electricity. Along with this we also need a metering system that is user friendly, that is, can be understood easily by everyone. So we have developed one such system that shows the energy consumption in terms of the money and also alerts when the high power rating equipments consumes more than their rated energy.

Recently two separate systems i.e **prepaid energy meter** and **energy monitoring system** are existing separately. So one needs to install two different systems, which will not be feasible in terms of cost for majority of the domestic consumer. So here we introduce a system that works as energy meter as well as does the surveillance of energy consumption of the whole house.

It is an Arduino controller (Arduino UNO R3) based system. Arduino is interfaced with the GSM module. Consumer can recharge his/her account through mobile phone. The units will be calculated according to the tariff rates of the respective DISCOMs'. These data would be stored in the memory of Arduino. Voltage and current are measured and energy is calculated in Arduino. The units consumed would be deducted from the total units and the remaining units and balance would be displayed on the LCD. (it would be similar to the prepaid mobile system). When the balance would get low, consumer would be alerted by sending alert message to his/her registered mobile number. After the total balance gets over, consumer would be able to use few units in negative balance and after that load will automatically gets cut off through relay. The system can be restarted only when consumer will recharge again. All these functioning would be secured and can only be operated by DISCOMs. These will reduce the theft of electricity.

II. ENERGY CONSUMPTION SURVEILLANCE

For the surveillance of the energy consumption of house, the total load of the house is divided into two parts, major loads (high power equipments like T.V, A.C, Motors etc...) and minor loads (lightning loads). The energy consumption of each major load is measured separately by measuring their current separately and is continuously compared with their rated values. Arduino will display a notifying message on LCD if any of these loads starts consuming more than a predefined value of energy on the basis of the load ratings. This will help the consumer to manage his/her energy

consumption. The energy consumption of lightning loads is done separately. The total units consumed are displayed on LCD.

III. FIGURES

3.1 Block Diagram:

Below block diagram shows an Arduino based metering system in which the units are credited by the DISCOM through GSM in accordance with recharge made by the user. This system is password secured so that only DISCOM authority can access it. The information of individual load (Major loads) and total energy consumption and remaining balance is displayed on the LCD. Notification messages are sent to the registered mobile number of the user by Arduino through GSM module. Relay module is used to cut off supply when balance becomes NIL.

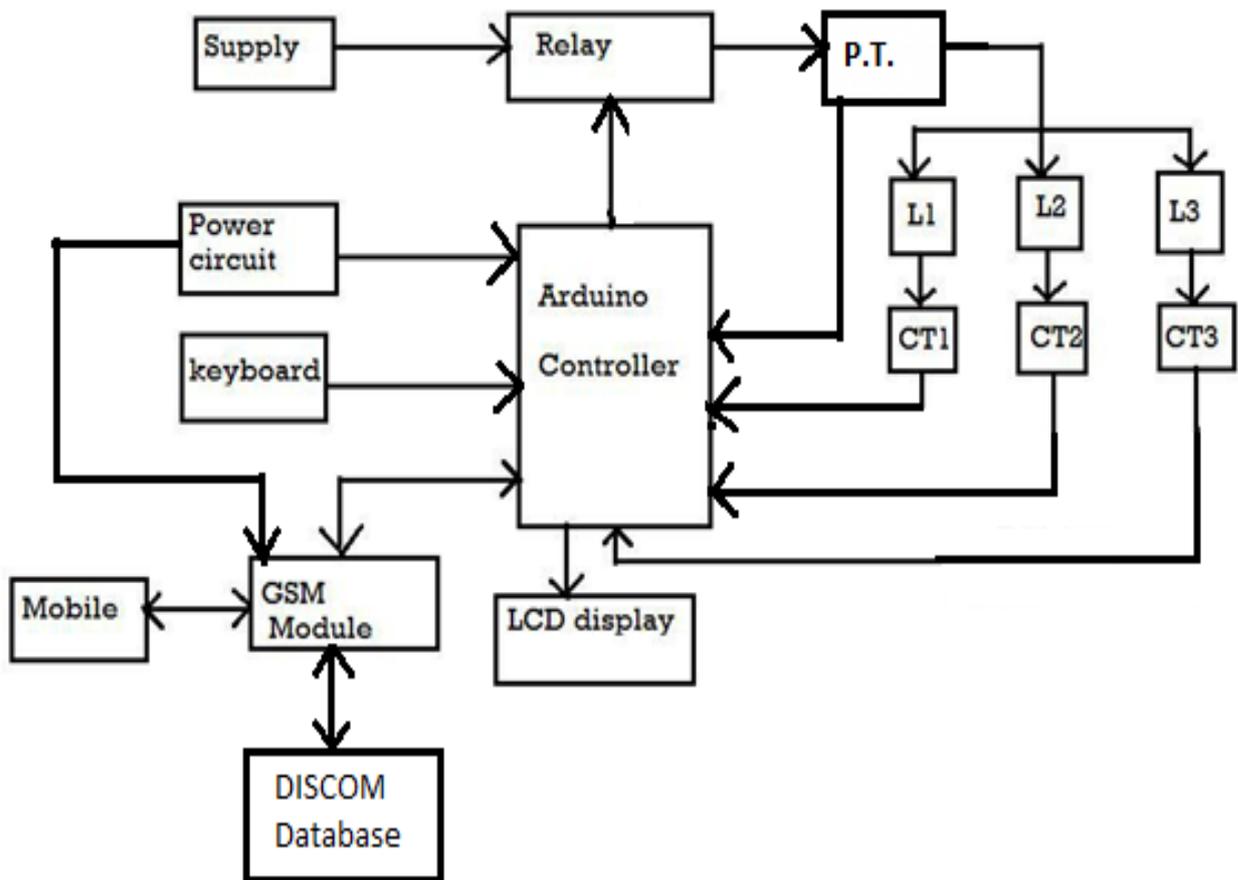


Fig. 1 Block diagram of the system

3.2 Flow Chart:

The figure below shows the flow chart for the programming of Arduino controller.

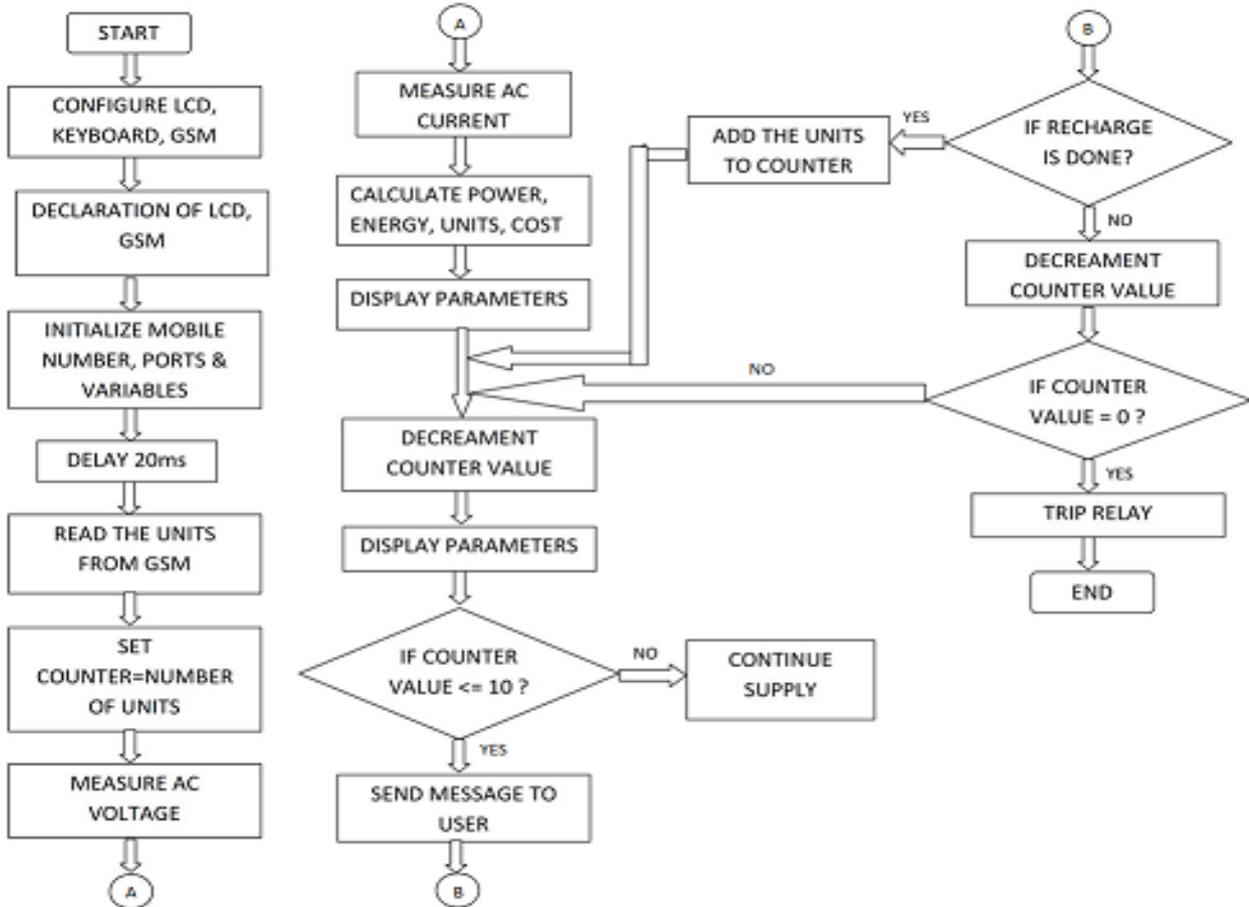


Fig. 2 Flow Chart for programming

IV. FUTURE SCOPE

As stated by **Yashraj Khaitan. et al. [1]** in their patent **Power Management Device and System**, the system is interfaced with the utility grid which reduces the risk of theft. An efficient anti-theft surveillance system can be built up using the data obtained.

In the system of energy monitoring, we can also include the concept of home and building automation as stated by **Robert Osann, Jr. [2]** in their patent **Energy monitoring system and method**. It can lead to saving of money if energy costs are higher, security, surveillance, remote care, interaction of monitoring with automated and manual control. This may help the users to have their lights and appliances controlled automatically through GSM.

Also this system can be expanded to an auto-switching system where a solar panel can be installed at the roof top of the building and as the balance becomes NIL, the relay may auto-switch to the solar panel system for further consumption. Information of this can be sent to DISCOM as notification.

V. RELATED WORK

5.1 Requirement Of Energy Monitoring

As per the research made by **Patrick A. Rada et al. [3]** in their patent **Automatic Detection of Appliances**, it is stated that around 15% of energy can be saved, if a consumer is aware of his /her energy consumption and its total costing.

They have proposed these methods for the monitoring and controlling of energy usage:

- Energy monitoring of each power outlet points in the house.
- Energy usage monitoring at each circuit breaker point.
- Manual control of energy usage of the devices.
- Controlling energy usage of device by program.

In the patent **System and Method for ON Line Monitoring and Billing of Power Consumption** by **Swartztrallber et al. [4]** methods related to monitoring of energy drawn by the power lines have been developed. It is a metering system which has microcontroller and memory for storing the data about the usage of energy. The metering system will receive the data and accordingly transmit the power.

5.2 Security Parameters

An intelligent user side power management device has been developed by **Yashraj Khaitan et al. [1]** in their patent **Power Management Device and System** that consists of an optional energy storage unit. It can interface with the utility grid to eliminate power theft and provide clean energy to the user. Also it helps the grid to manage the demand response smartly and efficiently.

5.3 Prepaid system

A metering system has been developed by **Kevin J. Gilmore et al. [5]** in their patent **Prepaid Commodity System** which is card activated for the sale of utility service of electricity. The distributors sell a card of information to the consumers. It has information related to the amount of utility which can be consumed by the user. It is a magnetic stripped card. The consumer can swipe the card in the meter to feed the information to the meter for the use of electricity or any other utility.

A similar meter consisting power relay and microprocessor controlled is developed by **Jess R. Bateman et al. [6]** in their patent **Intelligent Electric Utility Meter**. Here units are predetermined and credited in the users card. Accordingly, the sensors will allow the power to be supplied to the consumer. It will give alerts if the credit goes low.

5.4 User friendly meter

Recently the electricity meters used are installed at the main supply point, mostly located outside the house. This meter is reviewed only once in a month by the officer of DISCOM company for the billing purpose. Because of its location, it is not easily accessible by the user on the regular basis. Besides only KWH are displayed on them. This gives no idea about the total costing and where the energy consumption is more. As stated by **Patrick A. Rada et al. [3]** in their patent **Automatic Detection of Appliances**, it is necessary that the meter should be installed on a convenient place so that user can monitor it regularly. The facts that can help the user to manage his/her usage must be available in the meter and they must be understandable by everyone.

VI. CONCLUSION

This system discloses a prepaid electricity meter that also monitors the energy usage of the house and helps the user to manage his/her energy consumption. It is an Arduino controlled system that interfaces with GSM module and relay system. Energy consumption of individual load and remaining balance are displayed on LCD which aware user about the each major load consumption of the house. System also notifies the user through GSM about the status of the meter.

VII. REFERENCES

- [1] Yashraj Khaitan, Jacob Dickinson, US PATENTS, US20130035802A1,2013
- [2] Robert Osann, Jr, US PATENTS, US8265776B2, 2012
- [3] Patrick A. Rada , John H. Magnasco, US PATENTS, US20110251807A1,2009
- [4] Sayre Swartztrallber, Doron Shafir, Stanley Lo, Michael Newsome, Eric Jacobson, US PATENTS, US20030158677A1,2003
- [5] Kevin J. Gilmore, Andrew H. Marrinson, William A. Jahnke, US PATENTS, US4795892A, 1989
- [6] Jess R. Bateman, Robert L. Carpenter, Ross K. Smith, US PATENTS, US4240030A, 1980