Prepaid Smart Meter with GSM

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Abstract—this paper presents the design and modelling 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 labour 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.

Keywords: Energy meter, GSM technology, Microcontroller AT89S52, Prepaid Card, Relay, Putty Software

I. INTRODUCTION

The evolution of electric metering instruments has come a long way from their origins more than a century ago. Initially, meters were large, bulky devices with heavy magnets and coils. Over time, numerous innovations have led to reductions in size and weight, as well as improvements in functionality and specifications. The accuracy and precision of these meters have also seen significant advancements. The introduction of digital meters in the late 20th century revolutionized the way electrical parameters are measured. Starting with voltmeters and ammeters, digital meters have now dominated the entire range of measurement devices due to their advantages, including ease of reading, higher resolution, and durable construction. One of the key milestones was the development of the electronic power meter in the mid- 1980s. Today, power consumption and distribution have become major topics of concern, given the significant imbalance between electricity production and consumption. In this context, consumers are facing many challenges due to frequent power outages, with one major cause being the excessive energy consumption by affluent individuals. To address this issue and ensure a more equitable distribution of electricity, it is essential to impose limits on energy consumption for all users. Consequently, governments must enforce policies by introducing autonomous power meters in residential areas. As a result, the need for such solutions has arisen, and it is time to consider and implement effective strategies. In traditional electricity billing methods, managing the billing process for each consumer is a time- consuming task for the distribution grid. Additionally, consumers can intentionally consume more power than necessary and avoid paying the corresponding bill, making it difficult to regulate electricity usage. This paper focuses on the development of a Smart Energy Meter (SEM) utilizing GSM Technology for residential consumers. The SEM encourages consumers to use electricity.

II. OBJECTIVE

The proposed smart energy meter with an advanced prepaid billing system is designed to simplify electricity billing, making it more accessible and understandable for the average consumer, while offering several key benefits:

- Promotes energy conservation.
- Allows users to recharge the desired number of units through a prepaid system.
- Saves significant time and resources for the electricity department.
- Enables automatic control of the energy meter.
- Utilizes non-volatile memory to store energy consumption data.
- Implements a prepaid billing model that raises consumer awareness of energy usage, encouraging more cost-effective consumption.
- Automates the billing process, reducing human intervention and improving accuracy.
- Offers time-of-day billing, which discourages electricity consumption during peak hours, helping to lower energy generation costs.

- Encourages consumers to track and manage their energy consumption.

III. PROBLEM STATEMENT

The Energy metering instrument technology has come a long way from what it was more than 100 years ago. From the original bulky meters with heavy magnets and coils, there have been many innovations that have resulted in size & weight reduction in addition to improvement in features and specifications. Resolution and accuracy of the meter have seen substantial improvements over the years. Introduction of the digital meter in the later part of last century has completely changed the way Electrical parameters are measured. Starting with Voltmeters & Ammeters, the digital meter has conquered the entire spectrum of measuring instruments due to their advantages like ease of reading, better resolution and rugged construction. Of particular significance is the introduction of the Electronic Energy Meter in the mid-eighties. Now a day, the Prepaid Energy Meter using GSM Module Energy consumption and energy distribution has become a big subject for discussion because of huge difference in energy production and consumption. In this regard, energy consumers are facing so many problems due to the frequent power failures; another important reason for power cuts is due to the un-limited energy consumption of rich people. In this aspect, to minimize the power cuts and to distribute the energy equally to all areas, some restriction should have over the power consumption of each and every energy consumer, and according to that the Government should implement a policy, by introducing Autonomous Energy Meters everywhere in domestic sector. Hence, the need has come to think on this line and a solution has to be emerged out.

IV. METHODOLOGY

The electrical metering device generation has come a long way from what it turned into more than one hundred years ago. From the authentic bulky meters with heavy magnets and coils, there had been many innovations which have led to size & weight loss in addition to development in functions and specs. Decision and accuracy of the meter have seen giant enhancements over the years. Advent of the virtual meter in the later a part of final century has completely changed the way electrical parameters are measured. Beginning with voltmeters & ammeters, the virtual meter has conquered the entire spectrum of measuring contraptions due to their blessings like ease of analyzing, higher decision and rugged production. Of specific importance is the creation of the electronic energy meter inside the mid-Eighties. Now a days, the electricity consumption and energy distribution has come to be a big problem for dialogue because of huge distinction in power manufacturing and intake. Fig(1) shows the old version of self-reliant strength meter, power clients are dealing with so many issues due to the common electricity disasters; every other crucial motive for power cuts is due to the un-restrained power intake of rich humans. In this component, to reduce the power cuts and to distribute the strength similarly to all regions, some limit have to have over the electricity intake of each and each electricity customer, and according to that the government should put in force a policy, with the aid of introducing autonomous power meters anywhere in home quarter. Consequently, the want has come to assume on this line and an answer must be emerged out The most common unit of measurement on the electricity measurement is that the kilowatt-hour [kWh], which is adequate to the quantity of energy employed by a load of 1 kilowatt-hour over one hour. Energy meter systems are designed in such a manner to ease or to meet your specific requirements. Usage of energy meter not only beneficial for power supply companies but also to the common man who can count the accurate amount of unit consumed and pay the amount for it respectively.

V. BLOCK DIAGRAM

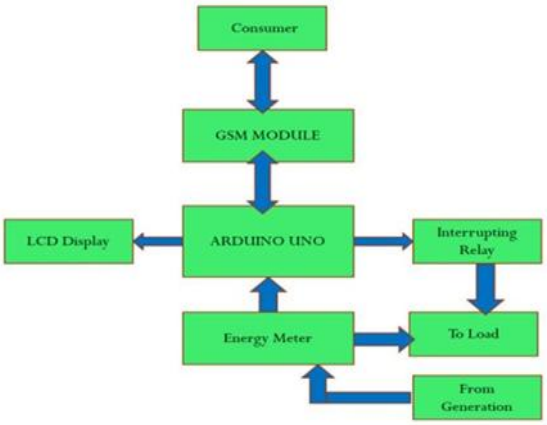

Fig1. Block Diagram of Prepaid Energy Meter

VI. WORKING

Prepaid Energy Meter with GSM Modem using pic microcontroller: The interfacing of prepaid energy meter with GSM (Global system for mobile) modem is very credible for both consumer and energy Supply Company. Basically, this is the concept of electronic energy meter for records the consumer billing, the minimization of energy theft and reducing the energy losses as compared to the conventional electromechanical energy meter. In this prepaid energy meter system, the consumer can pay the home billing through smart card or any other electronic resource such as mobile phone and save the time. Here we would be interface the energy meter with GSM module for prepaid energy meter billing, sending or receiving the massages or data to the supply company automatically. This interfacing system would be made with the help microcontroller 18 F452 belongs to pic family, energy meter, LCD display and GSM modem for sending or receiving the message or data automatically through mobile.

VII. ADVANTAGES

1. Cost-effective and easy to install.
2. Reduces manual meter reading and billing errors.
3. Enables remote management and quick response to issues.
4. Promotes energy conservation.

VIII. SCOPE and FEATURES

In the present time of 21st century we have no space for errors or faults either in any technical system or in general applications. Prepaid energy meter is an advantages concept for the further. It's facilitates the exemption from electricity bills. Electricity coupons will be available at nearby shops.

Features:

1. Prepaid billing system that requires users to pay in advance for electricity usage.
2. GSM communication for remote data transfer and control.
3. Real-time monitoring of energy consumption.
4. Automated deduction of units based on usage.
5. Alerts and notification system for low balance, outages, or abnormal usage.

User-friendly interface for recharging and managing accounts remotely.

IX. CONCLUSION

The power utility can recharge the prepaid card remotely through GSM/SMS mode base on customer requests. The results obtained shows good system performance. A prior billing is bound to do away with the problems of unpaid bills and human error in meter readings, thereby ensuring justified revenue for the utility. In conclusion, we had found that the majority of people who are using the prepaid electricity meter are satisfied with the system as they are more alert and well informed of their electric usage; thus encourage them to be more preserved in their energy as well as financial practice. They would also encourage other people to adopt the prepaid electric meter into their homes as it may prevent outstanding debts to the government.

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