

Prepaid Energy Meter System

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Abstract: The aim of this paper is to propose an alternative approach for calculating, measuring and billing of the energy consumed rather than the traditional approach. Here a new method is followed for controlling and analysing energy consumed. It is possible to get the electricity recharge done through this system. It also continuously reads the energy meter readings and automatically sends some updates like low- balance alert, zero-balance alert, recharge alert when necessary to the registered number through GSM modem. This paper presents a prepaid energy meter to facilitate energy consumption measurement and to know consumer's maximum demand. Electricity has become one of the basic requirements for people and widely used for domestic, industrial and agricultural purposes. The energy billing system used nowadays are labour and time consuming. Errors are inevitable at every stage of billing, some are human errors while noting down the meter readings, errors while processing the paid bills and the due bills. There is no proper way to know the consumer's maximum demand, usage details. This paper demonstrates the use of prepaid energy meter system. If we use this system it will be beneficial for the consumer to manage power. It is easy to operate and cost effective. Another advantage of the prepaid system is that the human errors in taking meter readings and processing bills can be reduced to a large extent.

Index Term: Calculating, Measuring, Billing, Electricity recharge, GSM modem, Electricity, Energy Meter System.

I. INTRODUCTION

The development of electric metering instruments has come a long way from what it was more than 100 years ago. In addition to developing features and requirements, there have been many developments from the original bulky meters with heavy magnets and coils, which have resulted in size & weight reduction. Over the years the meter's resolution and accuracy have seen significant changes. The optical meter, beginning with Voltmeters & Ammeters, has dominated the entire range of measuring instruments due to its advantages such as ease of reading, better resolution and robust construction. The implementation of an Electronic Energy Meter in the

mid-eighties is of particular significance. Thanks to the large gap in energy output and use, energy use and energy distribution have become a major subject for debate nowadays. Power users face too many problems in this regard due to the regular power failures; another important explanation for power cuts is due to the limitless energy consumption of rich people. In this respect, in order to reduce the power cuts and allocate the energy equally to all regions, there should be certain restrictions on the power usage of each and every energy user and accordingly, the government should introduce a policy by implementing Autonomous Energy Meters in the domestic sector everywhere. Therefore, on that side, the need has come to think and a solution has to emerge.

The new billing system is minimally capable of detecting diversion of power and only at the end of the month when it does. The distribution company still faces other loss-related issues. The distribution business can't keep track of the increasing overall domestic market demand. The customer faces issues such as getting unpaid bills for already paid bills, as well as low reliability of energy supply and efficiency even though bills are regularly paid. The solution for all of these problems is to keep track of customer load on a timely basis, which will help to ensure accurate billing and monitor maximum demand. Here are all of the features to consider when developing an effective energy billing program. The new "Prepaid Light Meter Program" project integrates these technologies to resolve problems faced by customers and delivery companies alike. The project deals mainly with a prepaid energy meter that uses the functionality of the embedded device, which is the combination of hardware and software to incorporate the desired function. The project also addresses the use of GSM Modem to implement the idea of prepaid. Using a GSM modem, with the aid of a smartphone one can recharge the energy meter. The quantity left for use will also be shown continuously on the LCD and if the quantity falls below a certain minimum value then it can be indicated with the aid of the warning notification. It project aims to track and manage Domestic Energy meter remotely. This device helps the Electricity Department to periodically read the meter readings without getting the person visiting every building. It can be accomplished by using a

Microcontroller device which continuously monitors and records the readings of the Energy Meter at its permanent location. This device also makes use of a GSM modem to track and manage the Energy Meter remotely. The Microcontroller- based device records the readings continuously, and the reading of the live meter can be sent on request to the Electricity Department. In case of non- payment, this device can also be used to disconnect the power supply to the building.

II. LITERATURE REVIEW

During the last few years the need of prepaid billing for energy meters has emerged as a highly accurate, where efficiency can be implemented.

Smart Prepaid Energy Meter using GSM and Arduino[1] Surveyed not only automating but managing of energy consumed which result in efficient usage of power. GSM module is used for this purpose along with different components which are controlled by ATmega328P microcontroller.

An integrated prepaid energy meter using GSM[2] Identified efficient power meter sending, usage verification and consumers maximum demand using GSM network GSM modem utilizes the GSM network GSM model utilizes the GSM network to send equivalent unit for the recharged amount to microcontroller. The microcontroller acts as data processing and transmission system.

Prepaid Energy Meter Using GSM Technology[3] Focus on building an automatic system using Arduino and GSM module where recharge for electricity balance can be done through this system by sending SMS Arduino ATmega328 microcontroller is used. GSM modem is used to send and receive message.

Modelling of Arduino-based Prepaid Energy Meter using GSM Technology[4] Propose work intended to gather information about data which is consumed energy of specific user as consumer through a wireless communication system called as AMR(Automatic Meter Reading). The system remotely accumulates the meter readings of a local using a relating remote wireless system comprising of GSM and Arduino

Prepaid Energy Meter with GSM Technology[5] Presents a system which aims at reducing less of power of revenue due to power thefts and other illegal activities. GSM technology is used so that consumer would receive message about consumption of power.

III. PROPOSED SYSTEM ADVANTAGES

- Eliminating manual meter reading

Traditional meter systems forced the employees to visit each meter individually and take the meter reading to find out the number of units by a particular meter connection and then calculate the amount to be paid accordingly. The proposed system proves superior in this aspect than these traditional methods as it immediately assigns the units according to the amount of recharge done and then, also indicates the units consumed.

- Monitoring the electric system more quickly

The proposed system helps in efficient monitoring of the entire energy system as it knocks out various traditional methods and has solutions to it more conveniently and efficiently.

- Making it possible to use power resources more efficiently

The usage statistics help in help in to know the consumption of electricity. Based on the stats of the usage done, it turns out to be a golden possibility to use the power resources efficiently.

- Providing real-time data useful for balancing electric loads and reducing power outages (blackouts)

It can provide an overall consumption of electricity in a particular area depending on which necessary actions regarding balancing electric loads can be taken. In case of over use of electricity in a particular area, it can lead to extensive load for which electricity can be balanced to avoid unnecessary outages.

- Offering more detailed feedback on energy use

Users are provided with a quick process of applying a feedback for their use of electricity. It thoroughly eliminates the hectic process of visiting the respective administration for lodging a complaint or giving a feedback with the help of doing it online.

- Enabling them to adjust their habits to lower electric bills

The usage statistics actually enables users to keep a track on their respective electricity consumption.

IV. SYSTEM ARCHITECTURE

A system architecture or architecture of systems is the conceptual model which defines a system's structure, behaviour and more views. A description of architecture is a systematic description and representation of a system, structured in a manner that facilitates thinking about system mechanisms and behaviours.

A system architecture can consist of system components and defined sub-systems which will work together to implement the overall system. Efforts have been made to formalize languages to explain machine architecture; collectively these are called languages for architecture description (ADLs). Systems Architecture is a standard practice called "systems" for managing entities (existing or to be created), in a way that facilitates thinking about the structural properties of such entities. System

Architecture is an response to the philosophical and practical problems of defining and constructing complex systems.

Our system includes different components like the hardware, web portal and mobile application. The hardware consists of an actual prepaid energy meter along with an arduino, gsm module, relay and a current sensor which are interconnected with each other to form a circuit. The web portal is provided for web site monitoring. And the mobile application is provided along with a dummy payment gateway for end user. All this system together is bound by the internet network.

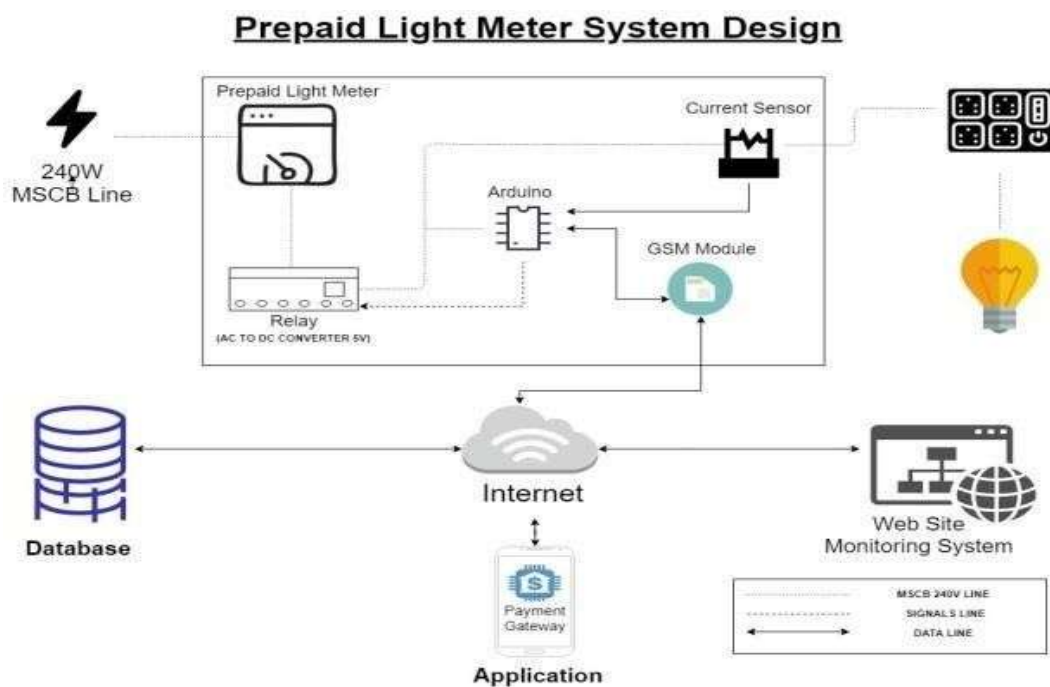


Figure 1: System Architecture of Prepaid Energy Meter System

V. METHODOLOGY

The energy that is the current flow is the reference to the meter network and will be then a reference to the relay. The relay requires contractor through which the current moves. The contractor is also linked to arduino which takes feedback from arduino to notify the relay to decide the current flow allowance. Now, the relay makes current flow to the charge through it. The current sensor is positioned between relay and charging. The current sensor will give the arduino its output with respect to the amount

of electricity transferred. The arduino updates this consumption to the database via GSM module. According to the remaining recharge the arduino must tell about the least amount of electricity available. When the recharge is fully exhausted, the contractor will then be told to stop the electricity flow via relay.

Along with the hardware setup the two other vital parts of this system are the following:-

- A) Web Portal
- B) Android Application
- C) Firebase

A) Web Portal:

The web portal will be governed by the admin to have control over the entire system. The admin will be in charge of monitoring and handling the entire system. The web portal will be the tasks of admin to view customer details, recharge facility, handling the creation & deletion of customers, history of recharge.

B) Android Application:

The android application will enable user to login into the application and use the various features. The main motto of the application is to help customer to do recharge just sitting at home without have to be waiting for queue. It can help user to do the recharge prior to actual consumption.

C) Firebase:

The firebase is like the connecting link between web portal and android application. It deals with the connecting of portal and application to avoid data redundancy & enhance quick updating in the database.

VI. CONCLUSION

The problem of load shedding can be dealt with effectively by placing a full stop at the waste of electricity. Half of India is said to still not get electricity that will no longer be valid. Man power will be restricted, as there will be no need to visit each and every electricity meter personally as it was in the previous days. The Asian market for the monopolistic transfer of resources is slowly becoming a dynamic marketplace. Price differentiation would be the main strategic driver for increasing market share in prepaid meters in the deregulated power markets, with their advantages over traditional meters likely to help power distributors differentiate and deliver value-added services to customers. Encouraging customers to willingly opt for prepaid meters and providing tariff or non-tariff discounts to those customers who are paying their power adjustments in advance will help utilities enforce this scheme.

Smart Energy meter architecture using GSM technology will allow users to pay for energy before using it. Consumers, therefore, hold credit, then use the energy until the credit is expended. If the available credit is exhausted then a relay cut-offs the electricity supply. An agreement is also made to intimate the user when their credit in their balance is poor, with the aid of the GSM contact module. This system was suggested as an innovative solution to the affordability problem in the Utilities sector. Since a device based on a microcontroller is being developed, the readings can be registered continuously. It decreases human labour, thus increasing the efficiency of measuring bills for using energy. Smart energy meters will offer awareness- raising solutions for wasteful power wastage, which will help to rising electricity wastage. This module will reduce the strain of delivering energy by easily establishing the link, and no power theft will occur.

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