
GSM BASED PREPAID ENERGY METER WITH THEFT CONTROL FOR DOMESTIC PURPOSE

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ABSTRACT:

As we are aware that electrical energy is spine for the industry and needed for day to day life. The tremendous demand of electricity has also increased the power theft to a large extent. The data collection of energy distribution for billing and monitoring of the distribution system are very important part in the research of energy visualization and analysis. The main objective of this paper is to propose the method to automate the electric billing system. Our objective can be achieved by incorporating a microcontroller with energy meter and interface it through Global System for Mobile Communications (GSM) module. Along with it two current transformers are used to measure the reading of electricity one is for measurement of phase current and the other is to measure the turning back or neutral current. Those signals fed to micro controller through the bridge rectifier, Microcontroller will compare both signals. Depend on the comparison made, the microcontroller decides whether theft is going on the energy meter or not and the message will be sent to notify the authorized power vendor using GSM for that energymeter.

Keywords: GSM smart billing system, theft detection system, Tamper notification, Arduino, GSM.

INTRODUCTION

The technology of Electrical metering instrument has seen various changes and travelled a miles in its long way journey and now it has new incarnation from what it was more than 100 years ago. From the world of 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. It was observed that this system has faced several problems including incompetent monitoring of consumption, wrong meter reading, unproductive revenue collection and useless energy use. By keeping this in mind, to minimize the power cuts and to distribute the energy equally to all areas, some restriction should imposed over the power consumption on each and every energy consumer, and government should introduce policies over the coming years for introducing Autonomous Energy Meters every where in domestic sector. Hence, the need has come to think on this line and a solution has to be emerged out. Prepaid Systems are progressively more popular in the delivery of urban services, particularly for electricity and water. The use of prepayment system is irregular, with some countries dynamically seeking the use of prepayment, while others are apprehensively making steps to wards the adoption of this system [4]. Prepayment is presented as a suitable mean to improve the effectiveness of utility billing for low income customers without a balanced income, where there may be low rate of literacy, high levels of utility pilfering, isolate or unbalanced settlement and an insufficient street address system and / or postal service [9]. Prepayment system upgrades technology from mechanical disc rotating meter to advanced intelligent metering system [10]. To collect the consumed energy data of a particular energy consumer through wireless communication system (without going to consumer house), the system can be called as automatic meter reading (AMR) system. The Automatic Meter reading system uses communication system to remotely collect the meter readings of a locality,

without persons physically going and reading the meters visually. On addition to that an electricity theft monitoring system has been generated. It's not only saves time but also help to maximize profit margin for utility company working in electrical distribution Network. Utility Company can keep a constant eye on its customer. This project provides an overview of GSM based efficient and effective Power Management

Nowadays the problem of electricity theft has increased in rural areas and in industrial parks. Also, these thefts are quite noticeable in urban houses too. This project adds a new security measure to such type of electricity theft control. The design is compact enough to setup this system in houses [2].

EASE OF USE

This project enables consumer to pre pay their electricity bills within few seconds from their mobile phones and provide monitoring over the total usage of electricity and balance in their account. The GSM that we used here is providing the monitoring information to the consumer through SMS and the theft control system used here gives the information about the tampering in the meters through alarm as well. The distributor will also know about the theft through GSM.

SYSTEM ARCHITECTURE:

The system designing of shrewd imperativeness meter is showed up in figure 1. It involves Arduinouno, essentialness meter, opt coupler, exchange, LCD show and GSM modem.

ARDUINOUNO

Arduino is a versatile programmable gear arrange. The Arduino programming change condition is successfully available in web. It is a microcontroller board in perspective of the ATmega328P. It has fourteen mechanized information/yield pins, six straight forward wellsprings of data, a sixteen-megahertz quartz jewel, a Universal serial bus (USB) affiliation, an energy jack, an In-circuit Serial Programming (ICSP) header and a reset get. Arduino is a physical programmable circuit board (PCB) and a touch of programming called Arduino Integrated Development Environment (IDE) that continues running on PC, used to make and exchange PC code to the board. The Arduino IDE uses an improved type of C, making it less requesting to make sense of how to program. Arduino gives a standard casing factor that breaks out the components of the littler scale controller into a more open package. The Arduino Uno is a standout amongst the most well-known sheets in the Arduino family what's more, a magnificent choice for novices [3].

GSM MODEM:

GSM modem operates over a subscription to a mobile operator. Here theft detection information and meter over load information is intimated to the service and consumer provider end through GSM modem to the particular mobile number register for that meter device [5].

POWER SUPPLY:

Power supply is a primary requirement for the project work for this we have to use center tapped secondary of 12v-0-12v (step down) transformer and current transformer is used to measure the alternating current. Here semi-conductor diodes are used as a rectifier to convert alternating current (AC) to direct current (DC). The rectified output is filtered for smoothing the DC, for this purpose capacitor is used.

A. Theft Detection:

Here we have used two current transformers one is at the source end

(current transformer-1) and other is at load end (current transformer-2). If the power difference between these transformers is exceed the threshold level then there is a theft is detected.

The buzzer driver indicates the theft by raise the buzzer and relay activates the switch mechanism. Theft detection result is intimated by the company side and consumer side from the web page or to the Particular mobile number registered for that meter device.

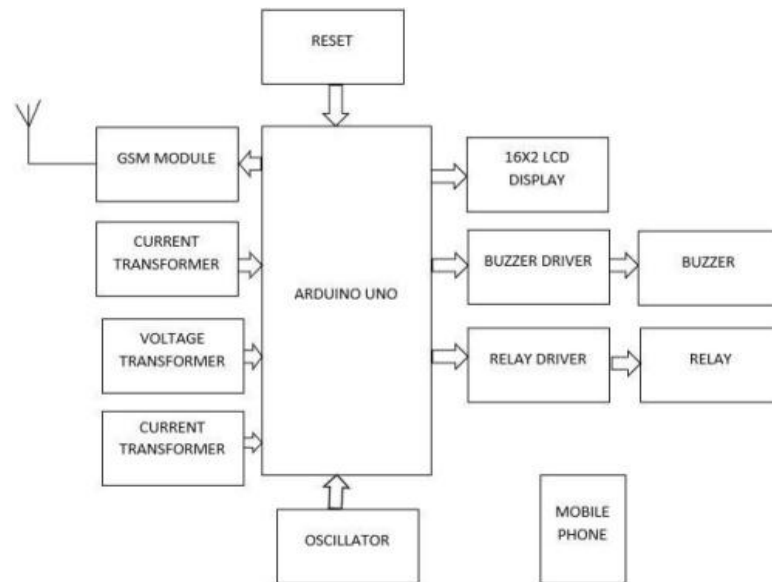


Fig 1: Block diagram of smart Energy Meter

LCD DISPLAY:

A 16*2 LCD demonstrates contains two lines likewise; there are 16 characters for each line. Each character is appeared by 5x7 pixel lattice. This LCD includes two registers, specifically, Order and Data. The charge select extra the charge bearing that are given to the LCD. A charge is a rule given to LCD to do a predefined errand like presenting it, clears its screen, sets the cursor position, controls show et cetera. The data enroll saves the data to be appeared on the LCD[2].

METHODOLOGY

The imperativeness meter is interfaced with the Arduino using an interfacing Oscillator. The beats from the imperativeness meter are recognized by an Oscillator and it changes over the beats to electrical signs going about as clock beats for the Arduino. In bona fide system 1 unit = 3200 beats yet here in this paper considering 1 unit = 10 pulses for comfort. An LCD indicates is related with microcontroller to show the used units and cost. Around the complete of consistently the data containing the ate up units and cost is shared to a database from the distributor office to the customer through GSM. All the interfaced data are escaped in a database at the premises of pro association, which can be made by MySQL. MySQL is a high-performance fundamental database structure and is much confounding to set up and control than greater systems [5].

$$\text{Energy} = \text{power} \times \text{seconds} \quad (1)$$

Equation 1 shows that at a specific time, server energizes the relay; supply will be given to load. The energy meter will measure power on supply side. This power will be converted to energy, by multiplying with seconds.

The programming of energy meter is done in such a way that seconds will continue to be incremented until relay is de-energized. The programming language used to program the meter is Arduino IDE.

ENERGY THEFT ACKNOWLEDGMENT:

Another important feature is theft detection. Normally, electricity theft is done by meter tampering. In this project, meter tampering situation has been created by by-passing the relay.

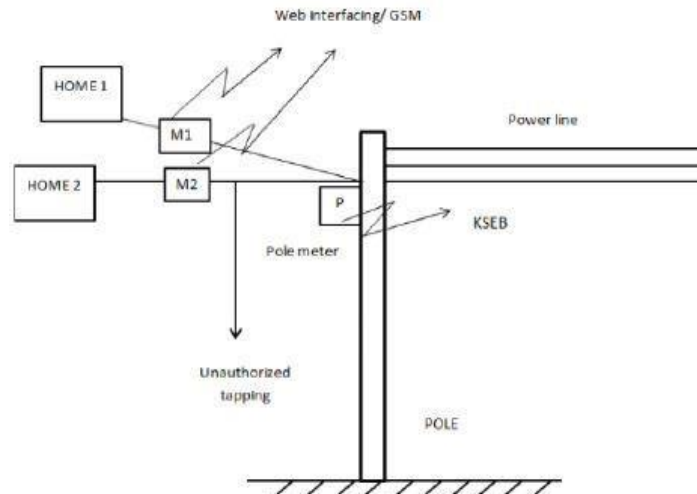


Fig 2. Method for power theft detection

Two separate electronic essentialness meters can be used for control theft acknowledgment; one meter is presented at customer side and the other is presented at a pole-based structure. Customer side imperativeness meter measures the energy ate up by stack over a period. Shaft based meter is talented to gage the energy movement over each line related with that pole. Directly the Arduino in the pole-based meter has two readings: one is signifying control circled by the post itself and another is control eaten up by the customer [3]. In normal cases the reading of both the energy meter is same which means there is no theft detection. In tampering condition, there is a difference between the readings. The pole-based meter shows the reading higher than the home based. The difference between the readings is directly observed by the Arduino which gives the information to the distributor office through the GSM[9].

Following mathematical comparison occurs in the comparison unit of the theft detection system.

$$\sum P_{sent} = \sum P_{consumed} + Loss \quad \text{No Energy Theft} \quad \sum P_{sent} \neq \sum P_{consumed} + Loss \quad \text{Energy Theft Occurs}$$

Where, P_{sent} = Meter data of the power delivered to the customer \square

$P_{consumed}$ = Meter data of the power consumed by a customer On every occasion the input power passes from supplier to the consumer and the total amount of power receives by the receiver are not equal indicates a possibility of theft of power.

RESULTS AND DISCUSSIONS:

Around the complete of consistently the energy charge sent to the distributor office and customer through GSM module. An enlisted SIM number is given in the GSM module. A database is made in the distributor office which records the bill purposes of enthusiasm of each home. All the webinter faced

data are escaped in a data base at the premises of authority association, which can be made by MySQL. The electricity fee per unit is set to 2 rupees in this project. On the application of the power supply initially reset the microcontroller. The process started by registering the mobile number of the user with the help of GSM. If the account linked to the registered mobile number doesn't have enough money then the recharging of account is done with the help of GSM. By accepting the input signal by "GSM" Arduino will send "THANKS FOR PAYMENT" message to consumer mobile. In the sameway, other messages will be sent to consumer's mobile through "GSM" Arduino. The AC load is connected that can be controlled with the help of relay. The 16*2 LCD continuously displays the processing information. Electric supply can be given to load only when relay is energized. In other words, without any payment, electric supply to load cannot besupplied.

When the imperativeness use is more than the farthest point regard the staggering weights in the home circuit will thus lyfaltered off using exchanges. A message sent to the customer to careful about the over imperativeness usage than the edge regard. In the event that there is any tapping done on the appropriation lines, instantly a message sent to the energy office. Then there will be immediate action will take place and a penalty will be charged for the respective consumer. This penalty will be cut off from the recharged amount of the consumer and if there are fewer amounts in the consumer's account then a message will be displayed showing "RECHARGE IMMEDIATELY" for recharge of the account through GSM. After successful completion of recharging the consumer is now able to again use the electricity and is supplied by the distributor.

CONCLUSION:

The monopolistic power distribution market in Asia is gradual transforming into a competitive marketplace. Differentiation in service is going to be the key competitive factor to the improve market share in the deregulated power markets prepaid meters with their advantages over conventional ones are likely to help power distributors to differentiate and offer value –added services to consumers. Encourage consumers to opt for prepaid meters on a voluntary basis and offering tariff or non-tariff incentives to those consumers who prepaid their power changes would help the utilities to implement this system. This system also urges the customers to think about their essentialness use. The information is transmitted to the energy board office using GSM modem on GSM sort out and through web generation of database. It can moreover bind the imperativeness use by demonstrating the over essentialness use. The proposed system keeps up a vital separation from control theft to broad degree and impacts the essentialness to meter precisely planned. This meter extends the pay of the Government by perceiving the unapproved changing in the electrical links. The proposed technique can be stretched out for customized control cutting if the bill isn't paid. The primary preferred standpoint of our undertaking is that electric supply organization gets most extreme income for the power gave by this innovation and robbery location is likewise conceivable. Accordingly, this innovation ought to be actualized in such countries where income gathering and power theft are significant issues.

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