Prepaid Energy Meter Using GSM Technology

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Abstract: The project's objectives are to shorten lines at energy meter billing counters and automatically lower use of energy meters in the event that bills are not paid. The project also aims to offer a remedy that would reduce power and revenue losses brought on by theft of power and other illegal actions. The "Prepaid Energy Meter" is a brand-new concept used by the workplace system. Utilizing GSM technology, the user is alerted to power usage (measured in watts) and is immediately prompted to recharge if it drops below a certain threshold. All power distribution companies, private communities, computer parks, and multi-unit housing developments can use this technology.

The adoption of this project will aid in better energy management, energy saving, and the elimination of unneeded head aches associated with inaccurate billing.The automatic billing system will track realtime use and allow minimal room f or argument over consumption and invoicing. The metering and billing system has been identified as one of the proble matic subsystems leading to the massive revenue loss in the Nigerian power sector.

The prepaid card communicates with the power company through the GSM network. The latching Relay disconnects the consumer load from the utility supply when the prepaid card is out of balance (contactor). Through GSM/SMS mode, the electricity supplier may remotely top off the prepaid card based on user demand. The results obtained imply that the process works effectively. Delinquent bills and human error in meter readings are certain to be reduced by prior billing, ensuring the utility justified revenue.

Keywords: Prepaid, Energy Meter, GSM module, Relay, Microcontroller, LCD display

I. INTRODUCTION

Technology for electrical metering instruments has advanced since more than a generation ago has considerably improved. From the indigenous enormous metres with heavy magnets and coils, several advancements have resulted in reductions in size and weight as well as increases in features and specifications.

The decision and correctness of the metre have greatly increased throughout time. It way electrical characteristics are measured has entirely altered with the advent of the digital metre in the latter half of the 20th century. Due to its benefits including ease of reading, greater resolution, and durable construction, digital metres have swept the whole range of measuring devices, beginning with Voltmeters and Ammeters.

The usage of energy and its distribution have recently been a major topic of debate because of the enormous variations in consumption and production of energy. As a consequence of frequent power outages, which are also largely due to affluent people's irrational energy use, energy consumers confront a number of problems.

II. LITERATURESURVEY

[1] Sourav Choubey,KapishawarMishra, Ajaysinh Chauhan, Feni Faldu, and Vishal Devaliya are among the cast members. This study presents a new idea of an energy metre in which the maximum energy demand of a customer is shown in the metre used by the consumer. When the maximum is reached, the metre and the connection are spontaneous unplugged via an integrated technology built within the metre.The suggested system is primarily concerned with customer electricity use. When the consumer's consumption of power approaches its limit, the system restricts it. The system has been configured with a consumption restriction, which may be adjusted as needed.

[2] Sandip Zade, Mitalee Nagvekar, and Megha Mane. In this article, the authors examine the idea that the customer's bill may be calculated and sent to them via an Android app, with the metre reading being shown on a VB application for

the service provider.This method allows the user to simply verify the monthly readings via the Android application and receive SMS notifications of the monthly charge.The application-based bill payment feature is not supported by this system.There are separate applications for customers and service providers on the system.

[3] Avinash Kumar, Annapurna Mishra, Ravi Kumar, Chetan Chaturvedi, and Gautam Kamran (2018). In this study, the authors focused on the GSM modem, which uses the GSM network to send the Arduino the identicalpart unit for the renew amount pay and alerts the user when the balance is low. In this arrangement, a relay turns off the power supply if the balance goes below the threshold amount.

[4] VIVEK K. SEHGAL The notion of a postpaid energy metre that automatically measures the energy spent in the house and disconnects the power connection when it reaches a number that is initially supplied into the hardware was originally proposed under the phrase "Electronic Energy Meter with Instant Billing." The gadget contains a user interface that enables people who will interact with the hardware to set values.

[5] Ashna's "GSM K's Based Automatic Energy Meter Reading System with Instant Invoicing" proposes the building of a simple, low-cost wireless GSM energy metre and its associated wave interface for the aim of automating billing and handling the obtained data on a global scale.Ms. Sunita D. Giri, Ms. Prajakta B. Murmude, and Mr. Sachin G. Jagdale, proposed the development of a GSM-based remote energy metre with data logging, consumption authority control, workforce reduction, power theft prevention, and automatic billing and payment in electricity distribution and regulation.

[6] Gopal,Brijesh Kumar Dubey, and Devendra Kumar Pandey. The Global System for Mobile (GSM) technology is described by the authors in this study. According to this technology, the customer receives signals about their power consumption (measured in watts), and if it reaches a certain threshold, they are immediately advised to recharge in order to continue using the device. There is some area for discussion over use and pricing with this automatic billing system for smart energy meters.

III.   EXISTNG METHODOLOGY

A prepaid card, similar to a mobile SIM card, that is used as part of a GSM-based energy recharging interface. The GSM network is utilised to communicate between the prepaid card and the electrical business.Once the prepaid card is out of balance, the latching Relay disconnects the consumer load from the utility supply (contactor).

To measure use in the current system, either an electronic energy metre or an electro-mechanical metre is put in the building**.**The only unit of measurement available to the metres in use right now is the kWh.Nevertheless, monthly on-foot metre readings of the kWh units utilised must still be completed.

A business specialising in metre reading must process the recorded data.In order to process the metre reading, the firm must first associate each record of power use with a specific account holder before calculating the amount owing using the applicable rate.

IV.   PROPOSED METHODOLOGY

The work system utilises a brand-new "Prepaid Energy Meter" idea. TheUser would receive alerts concerning power usage thanks to the GSM technology (in watts).When the battery level drops below the required amount, it will entirely notify the user to recharge.

The consumers must pay for the power through this technique before using it. Users utilise the power in this way while holding credit, up until the credit runs out. The electrical supply is shut off by a relay if the credit line is exhausted.

V.   BLOCK DIAGRAM

The microcontroller-based system used in this project records the measurements continually, and it may send the live metre reading to the electricity department upon

request. In the event of unpaid electricity bills, this tool can also be utilized to disconnect the home's electricity source . Each energy metre must have its own GSM modem and SIM card.
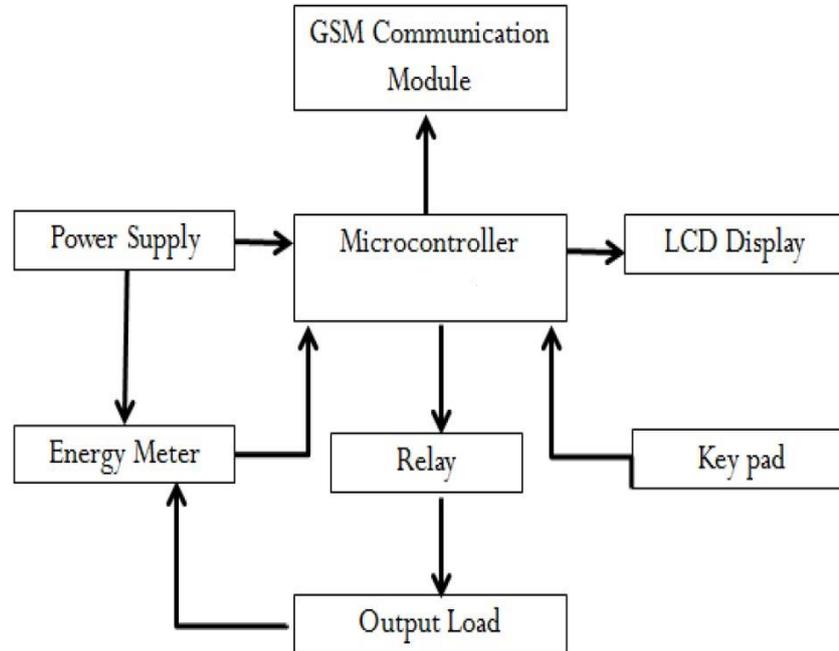

Fig. No: 1. Block diagram of Proposed system

VI.   WORKING

The PIC micro controller serves as the central processing unit in the suggested concept. The PIC micro controller is used to interconnect the entire system.

The GSM modem is serially attached to the controller, which serves as the primary communication interface between the user and the provider.

The GSM transfers information through its own network. When utilising a hardware programmer and the MP-LAB IDE software, special embedded C code is utilised to programme PIC micro controllers. To turn off and on the power source, the relay functions as a switching device.The LCD is connected to the micro controller through a parallel port connection.

 Its micro controller collects an SMS that was delivered to the phone, decodes it, finds the mobile number, and then activates the relays that are linked to its port to run the appliances . When an operation is successful, the controller replies by sending an SMS to the user's mobile device.

The prominence of the coding is on the fact that it decreases human labour while increasing the accuracy of the computation of power bills.

VII. HARDWARE REQUIREMENT

GSM Module:

GSM is a circuit-switched system in which each 200 kHz channel is divided into eight 25 kHz time slots. In most regions of the world, GSM works on the mobile communication bands 900 MHz and 1800 MHz. GSM works in the 850 and 1900 MHz frequency bands in the United States.

Fig.No.2 - GSM Module

Microcontroller

A single function inside an embedded system is controlled by a tiny integrated circuit. A typical microcontroller contains a CPU, memory, and input/output (I/O) peripherals on a single chip. The energy metre is controlled by the PIC Microcontroller.

The PIC Microcontroller-based control section regulates and synchronises all operations, including reading the credit from the card reading device, generating and updating the net credit, and showing the net credit on the LCD Display.

Fig.No.3 - Microcontroller.Electricity Energy Meter

A device that tracks the amount of electrical energy utilised is called an electric metre, often known as an energy metre.The most used unit of measurement for electricity is the kilowatt hour (kWh), which represents the energy expended by a load that use kilowatt hour for one hour.

Fig.No.4 - Digital Energy Meter

16x2 LCD Display:

A 16x2 LCD has two lines with a capacity for 16 characters each.On this LCD, each character is shown as a 5x7 pixel matrix. The clever alphanumeric dot matrix display can display 224 different characters and symbols and has a resolution of 16 x 2. Command and Data registers are present on this LCD.

Fig.No.5 - LCD Display

Relay:

An electrical switch of this kind is a relay. It consists of an operational contact terminal and an input terminal for one or more control signals. The switch may have an infinite number of connections in different contact kinds, including combinations, create contacts, and break contacts.

Fig.No.6 - Relay

Keyboard:

A computer keyboard is a type of peripheral input device modelled after a typewriter keyboard. It utilizes a variety of buttons or keys that function as mechanical levers or electrical switches. Since the 1970s, teleprinter-style keyboards have been the preeminent input method for computers, replacing previous punched card and paper tape technologies. The computer mouse has been a complement since the 1980s.

Fig.No.7 - Keyboard

Power Supply Unit:

This power supply unit (PSU) transforms mains AC voltage and converts it to DC voltage supply.And variable DC to variable AC can be converted through rectifier circuit. In AC voltage 230V to convert DC voltage 12v 10A power supply. It application for a computer's internal electronics components and industrial motors controller. Switched-mode power supply are used in all electrical and electronics equipments. Variable frequency drive (VFD) is the power supply unit used for industrial purpose.

Fig.No.8 - Power Supply Unit

VII.   CONCLUSION

The market for prepaid energy metres is already developed. The government is allowing people to use this in their homes. As a result, it was this technology that originally inspired us to rebuild. Then we planned to incorporate some new fixtures into the project. We ended up developing a method that allows people to recharge their metres using a pin code. And may see the metre reading through SMS. If the metre needs to be recharged, the user will be notified. If the user does not recharge in a timely manner. It will bring the system to a halt. And it will restart when it is recharged again.

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