

Implementation of Smart Prepaid Energy Meter Using IoT

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Abstract: This paper explores the design and assemble of smart prepaid energy meter system, which help in minimizing the queue at the electricity billing counters and to restrict the usage of electricity automatically, if the bill is not paid. The project also enables the consumer to buy the required amount of energy and provides Information about their credit balance. It aims at proposing a system which overcomes the whole problems associated with the present metering, billing and collection of dues. The project aims at reducing the loss of power and revenue due to power thefts and will make the consumer more conscious about the usage of electricity. The system model adopts a totally new concept of “Prepaid Electricity”. It uses the IoT based concept so that continuous monitoring of power consumption is possible and when the minimum threshold is reached it will automatically alert the consumer to recharge their account either through smart meter or internet. The model uses Arduino microcontroller to control and monitor the entire system. This technology is mainly applicable to all electricity distribution companies, private communities, IT parks and self-containing housing projects. The implementation of the project aims at better energy management, conservation of energy and also in dealing with the unnecessary problems over incorrect billing. The energy system will automatically keep track of the real time consumption and alert consumers with usage of electricity.

The prepaid energy system uses an advanced Arduino microcontroller unit that continuously monitors and records the Energy Meter readings that is stored in its permanent (non-volatile) memory location. This system model uses a GSM kit for automatically monitoring, reading and controlling the prepaid Energy Meter from a remote server using the existing GSM networks for cellular phones. The GSM modem make use of GSM network that has national wide coverage to retrieve and send the power consumption notification from individual houses and flats using the short message service (SMS) back to the energy provider wirelessly. In prepaid energy system consumer will always be conscious about the remaining credit and thus prevent the wastage of electricity.

II. METHODS AND MATERIALS

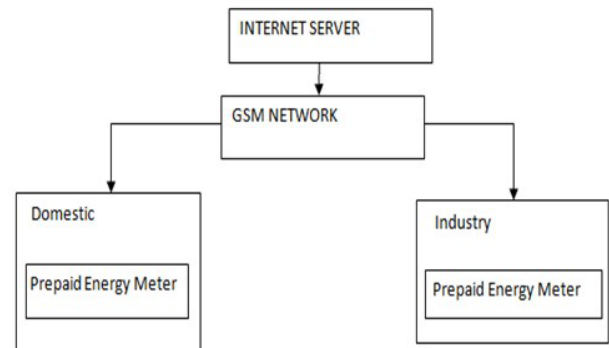


Fig 1. Basic Layout

Keywords: Prepaid Electricity; Arduino Controller; Constant Update through GSM and Internet.

I. INTRODUCTION

The Existing system uses AT89S52 microcontroller for metering and billing which will consume more power. All the existing system uses post-paid metering system to measure the electricity and it will be sent to the distributor. It is a periodic process and monthly power bill for consumers is calculated. This project proposes a prepaid energy system for effective means of data collection that allow considerable amount of saving through the reduction of meter re-read, energy conservation, enables frequent reading, improved billing and customer service and better management of human involvement.

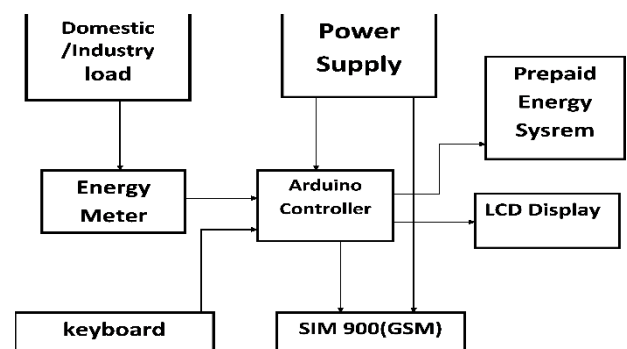


Fig 2. Block Diagram of the working

The description is as follows.

A. Domestic /Industry Load:

Domestic or industrial usage of electric energy .

B. Energy Meter:

A device to measure the amount of electric energy consumed by the domestic /industry load.

C. Keyboard:

Keyboard is a device which uses an arrangement of buttons or keys to act as a mechanical lever or electronic switch. Keyboard is used to enter the user id and password.

D. Power Supply:

A electric supply is given both to the arduino controller and the SIM 900 to able their working.

E. Arduino Controller:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software(IDE), Processing.



Fig 3. Arduino micro controller.

F. SIM 900:

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular

time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of rates.



Fig 4. SIM 900

G. Prepaid Energy System:

When the user enters the user id and password to recharge a certain amount, that will be reduced and the new amount will be updated in the internet.

III. PROPOSED SOLUTION:

The arduino controller is programmed in such a way that the input is the electric power that is been consumed by the domestic or industrial load which is captured by the energy meter .Once the input is given the arduino it calculates the number of units used and the cost of the units. Power supply is given both to the entire system.The SIM900 (operates over a GSM network) sends alert messages to the consumer when the usage of power crosses a certain limit.The limit for each costumer can also be programmed for into the controller. The number of units used and the cost is displayed onto the LCD screen(16 bit LCD screen).

At the time of registration of a costumer ,the details of costumer like name ,address, bank details are collected ,these details are stored in the web portal (prepaid energy system) which is designed using HTML and J2EE. Once the registration is done each customer receives a unique identification code(user id) and a initial password(which can be later changed by the customer).This user id and password is given through the keyboard which is connected to the controller is used to recharge amount to the account.

IV. HARDWARE IMPLEMENTATION:

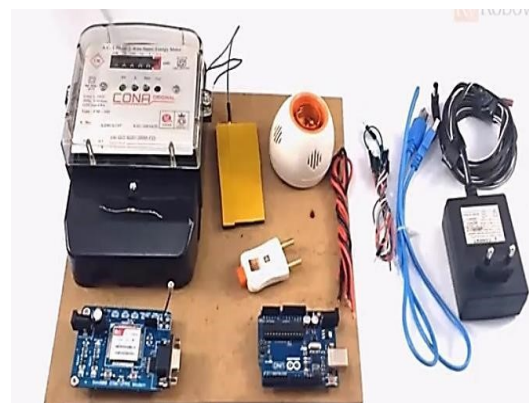


Fig 5. Hardware implementation

The image shows the hardware implementations used in the system.

V. RESULTS AND DISCUSSION

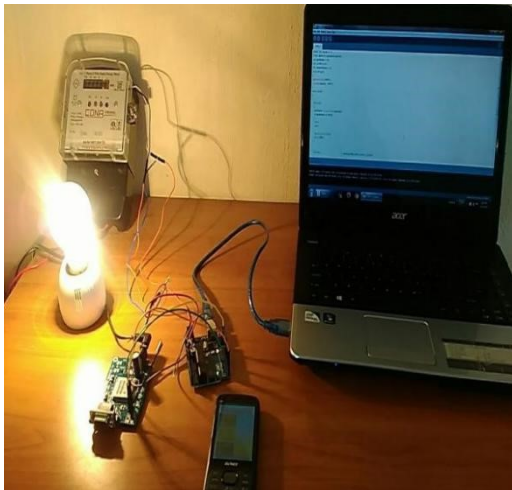


Fig 6. Hardware Results

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VI. CONCLUSION

The IoT based Prepaid Electricity helps the consumers to pay for the electricity before its consumption. It minimizes the human intervention in meter reading and bill calculation. The consumers hold control of credit and then use the electricity until the credit is exhausted. When the available credit is exhausted then the electricity supply is automatically cutoff by a relay. GSM communication is used to alert the user when the credit goes below a minimum threshold. This system ultimately reduces many problems associated with the post paid billing system.

Since a microcontroller based system is being designed, the readings can be continuously monitored and recorded. This increases the efficiency in calculation of bills for electricity consumed. Smart prepaid energy meters will result in automatic control of energy meter and prevent wastage of power. This system provides automation of billing system and prevent tedious human labour.

VII. FUTURE WORK:

In future electricity Board can alert the consumers for their power consumption.

The average power consumption can be calculated for the future days, thus the power generation and supply can be planned before hand, in turn reducing power cuts.

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