

Design and Implementation of Smart Energy Meter for Residential Purpose

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Abstract:

Measuring the energy consumed is one of most important aspect of these modern days. Without keeping track of energy consumed by the customer there won't be efficient utilization of electricity. So, this project presents the Design and Development of Smart Energy Meter for Residential Purpose. The smart energy meter introduced here, makes use of GSM and IoT, measures the voltage, current, frequency, energy consumed and generates the bill for the usage of energy. The measured parameters will be sent to the authorities through GSM and WiFi for analysis and to take action accordingly. The customer can get the information of energy consumed and hence, can limit the usage of energy and either prepay or postpay. This meter can also cut off the power, if the bill is not paid on or before the due date. Once the bill is paid the authorities will send control signal to the meter to reconnect the supply to load.

Keywords — Arduino, WiFi module, GSM, Voltage and Current Sensor

I. INTRODUCTION

This project focuses on developing a smart energy meter which eases the work of human. In early days this metering technology was fully analog. Due to rapid technological developments nowadays it has become digital but not fully automatic it too needed a huge human work force. The above mentioned two techniques have a lot of drawbacks like erroneous and needed a lot of time for repair, gives faulty unit readings, the second one gives readings digitally with some accuracy but cannot be sent to the customer. It needed a lot of human work force regularly to take readings. Electricity has become a vital role in our everyday life. It is impossible to

imagine a world and human life without electricity. But the vitality of electricity has meant that individuals consume huge amounts of energy unmindfully and carelessly. Present-day, energy metering system measured from electromechanical and somewhere digital energy meter has poor accuracy and lack of configurability and additionally consumes longer and labor. But this project is designed and to implement Smart Energy Meter where it is used to measure the consumer's power consumption. The energy consumption is calculated using the measurement of voltage and current. The calculations of power and energy are executed by Arduino programming and message will be sent to the corresponding consumer regarding units consumption and the bill amount.

This project we are using GSM for customer notification uses and for bill payment part. And IoT for Controlling of the connection and disconnection of power to load (consumer).

Today the energy meter is placed in the domestic or commercial sites and collects the data of the energy consumed and displays it on either a number dial or digital display. At the end of every billing cycle the person from the service provider has to visit the place where the meter is placed to get the reading and to note it down for further bill generation. The present system of energy charge is fallible and also long. The underlying aim of each technology is to ease human efforts as so much as attainable, thus therewith objective in mind; we tend to depart to realize another such goal.

An energy meter in easy terms would be a tool that measures the quantity of electrical energy consumed by a residence, business centers, or electrically powered devices or appliances. Electricity meters are generally calibrated in billing units. Periodic readings of electrical meters establish billing cycles and energy used throughout a cycle, the cycle typically extending for a month the current system of energy metering uses electromechanical and somewhere digital energy meter has poor accuracy and lack of configurability and additionally consumes longer and labour. The traditional electromechanical meters are being replaced by new electronic meters to enhance accuracy in meter reading. One of the prime reasons is the traditional billing system that is inaccurate repeatedly, slow, costly, and lack of flexibility in addition to responsibility. Still, accuracy can't be secured as there may be errors in human reading. It is an advanced metering technology involving inserting intelligent meters to scan, method and feedback the information to customers. It measures energy consumption. The smart metering system uses the advanced metering infrastructure system technology for higher performance. Modems are utilized in these smart meters to facilitate communication systems like bill system using IOT communications. Another advantage of smart metering is GSM module for customer notification.

II. IMPLYMENTATION OF PROPOSED SYSTEM

The proposed smart energy meter with billing system is a device, to make electricity billing user friendly and much more readable to the common man and provides a lots of advantages. Our main aim in this project is to calculate the power consumption using sensor and display unit on LCD. User will get the SMS using GSM module once consumption unit reaches a threshold limit value. If user did not pay the bill within due date, the power is cut off automatically using IoT. Once the user pays the bill, power house office will connect the supply to load can continue the power supply using IoT access and relay. Figure 1 shows the block diagram implementation of the presented Smart Energy Meter.

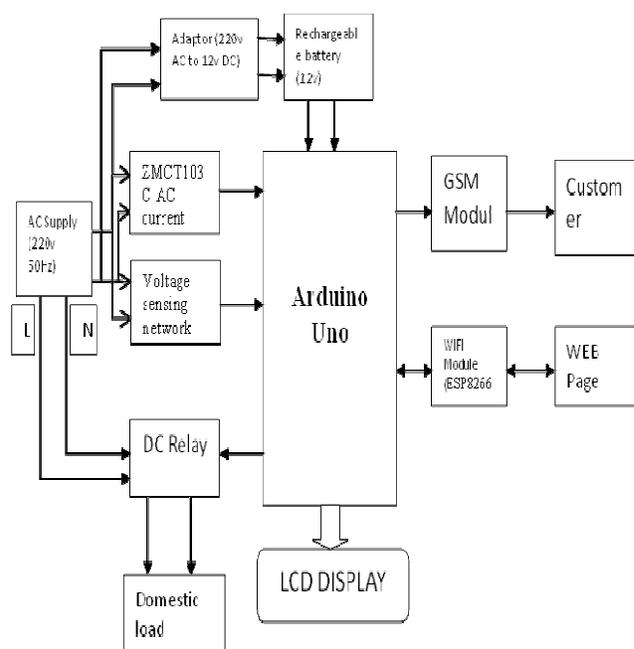


Figure 1: Block diagram

III. RESULT

The project of Smart Energy Meter Reading system has been executed by the hardware prototype. In this hardware, the lamp load is used. so once load is turned on, the sensors will sense it and will update to microcontroller. Based

on the code, microcontroller will display the voltage, power consumed and the bill amount on the LCD. GSM is initialized and sends SMS once consumption unit limit is crossed. The power to consumer is disconnected remotely if the user didn't pay bill within due date. The power is cut using IoT and relay. And power will be connected after payment of bill, the power house people will make it continues using IoT platform. The figure 2 shows the flow chart of the working of the Smart energy meter.

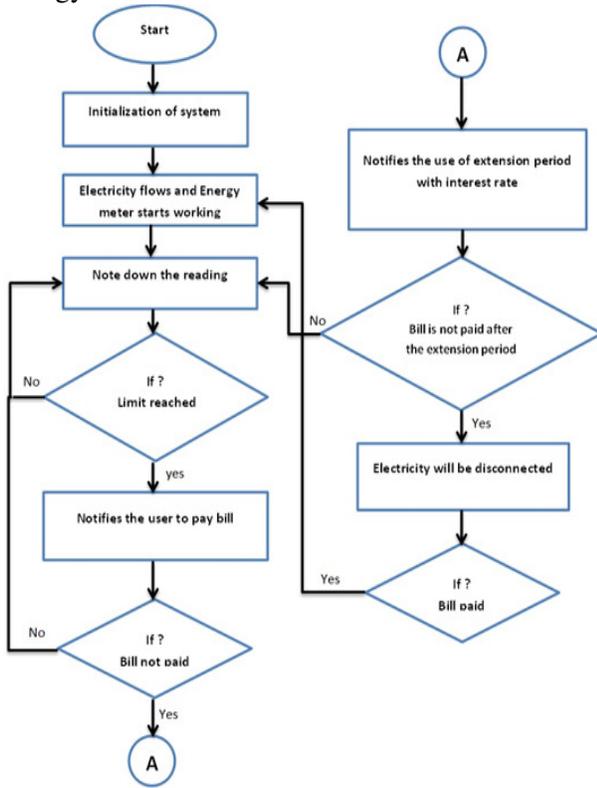


Figure 2: Flow Chart working of the smart energy meter.

Step1: Smart energy meter is turned ON.



Figure 3: Result image1

Step2: Starts noting down the reading and the values are displayed on the LCD screen as shown Figure 4.

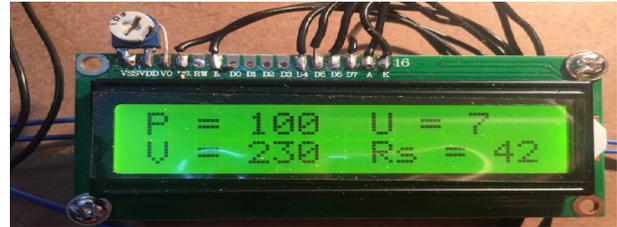


Figure 4: Result image2

Step3: Sends the notification of the electricity consumed via text message.

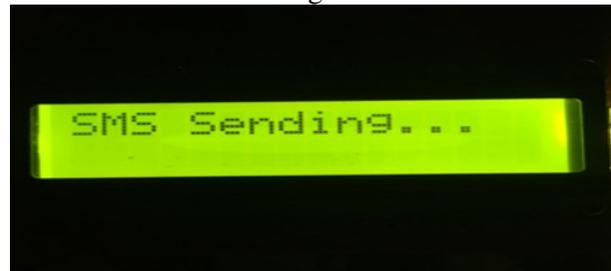


Figure 5: Result image



Figure 6: SMS sent to consumer for bill payment

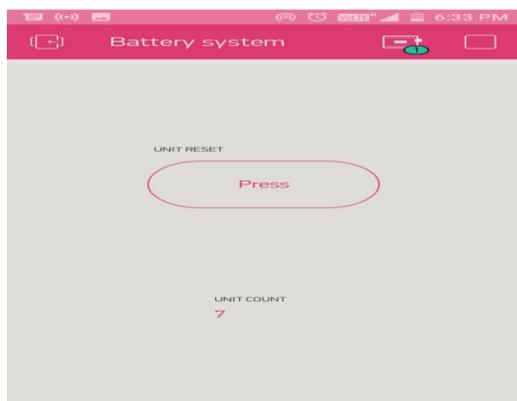


Figure 7:IoT control

The presented smart energy meter has the following advantages:

- No bill reading people required.
- Automatic power connection and disconnection.
- IOT and GSM access.
- More reliable.
- Less power consumption.
- LCD Display for Live monitoring.
- On time notification.

IV. CONCLUSIONS

The advancement in the power distribution system is a non-stop process and new technology is always in progress. In this project, an Arduino, GSM and IOT based smart energy meter has been proposed. The units using GSM technology for customer notification. Arduino based Power measurement is an advanced method of determining power. Energy consumed is measured in real time, stored in data base and displayed on LCD display also the changes are sent to consumer through text message. The power house people will be able to access the details using IoT. And if the user fails to pay the bill, electricity will be disconnected.

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