



Automatic Energy Consumption and Cost Monitoring System with GSM

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ABSTRACT: 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. In this paper, an automatic energy and cost monitoring system has been proposed. This unit displays the value of supply voltage, current, units and cost of consumption. The main component of the system is an arduino controller. If we use this system it will be beneficial for the consumer to manage the power. The main aim of this is to know, how much unit is obtained and the total amount of rupees has to be paid. This will help both the inspector and the owner of the place where the meter is placed, we can simply view the unit and the total money that we have to pay and also send to our cell phone as well as the EB contact number using GSM technology.

KEYWORDS: prepaid meter, post paid meter, gsm, arduino, rtc.

I. INTRODUCTION

From the time of invention, till day, energy meters have undergone several advancements, from electromechanical meters to more sophisticated and accurate digital and electronic meters. Electric energy meters, the direct billing interface between utilities and consumers plays significant role in power system. Hence, the development of these meters is very important. The conventional electromechanical meters are being replaced by new electronic meters to improve accuracy in meter reading. Still, the Indian power sector faces a serious problem of lean revenue collection for the actual electric energy supplied owing to energy thefts and network losses. One of the prime reasons is the traditional billing system which is inaccurate many times, slow, costly, and lack in flexibility as well as reliability. Therefore, attempts are being made to automate the billing systems. Even though more accurate and faster meter readings have been introduced, bill payment is still based on a traditional procedure. They require an individual/agent to personally come down to customer place and note the meter readings and report the amount one has to pay to the household/office.

In this paper, an automatic energy and cost monitoring system has been proposed. This is actually an individual unit that could be installed by the consumer or which could be adopted by the electricity board for meter reading. The main feature of this system is that it aims at economical as well as better utilisation of available energy by the consumer. The system design is done using one of the most advanced controller Arduino, which replaces the PIC and microcontrollers. The implementation of this paper will help in better energy management, conservation of energy and also eliminates the problems on unnecessary hassles over incorrect billing. The automated billing system will keep track of the real time consumption and will leave little scope for disagreement.

II.SYSTEM ARCHITECTURE

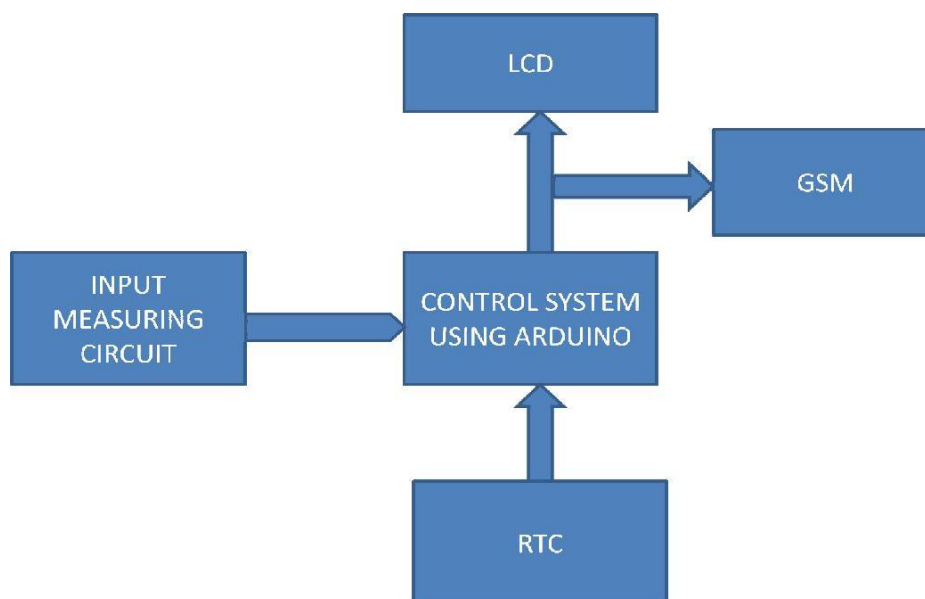


Fig.1 Block diagram of proposed system

The proposed system consists of input measurement circuit, control system using ARDUINO, RTC, LCD display module and GSM (global system for mobile communication). Input measurement circuit consists of current transformer, potential transformer and a pulse generator circuit. This unit measures the value of supply voltage, current drawn by the load. The pulse generator circuit generates the pulses as per energy consumption. The major part of the proposed system is an arduino controller. The measured voltage and current are fed to the controller. The controller converts the outputs of current transformer and potential transformer into actual values by multiplying with transformation ratios of transformers and ADC resolution factor. The controller controls the overall functions of the system. The amount of energy consumption and cost of consumption are calculated in the control section by using tariff rates. The arduino board is interfaced with RTC DS1307, GSM and LCD module. RTC means that real time clock, provides seconds, minutes, hours, day, date, month and year information. LCD module displays the voltage, current, consumed units, cost of consumption and calendar information. GSM module is used for the communication between the server and client. In this system the amount and cost of energy consumption can be automatically send to our cell phone as well as the electricity board contact number using GSM technology at the end of two months. We can also receive the same whenever a message is sent from our cell phone to the GSM module. The main highlight in using GSM technology is that this eliminates the requirement of an individual/agent to personally come down to customer place and note the meter readings and report the amount one has to pay to the household/office. Since the consumer receives message on the cost of consumption, it creates an awareness on the daily electricity usage in the household and industry.

III.SYSTEM DESIGN

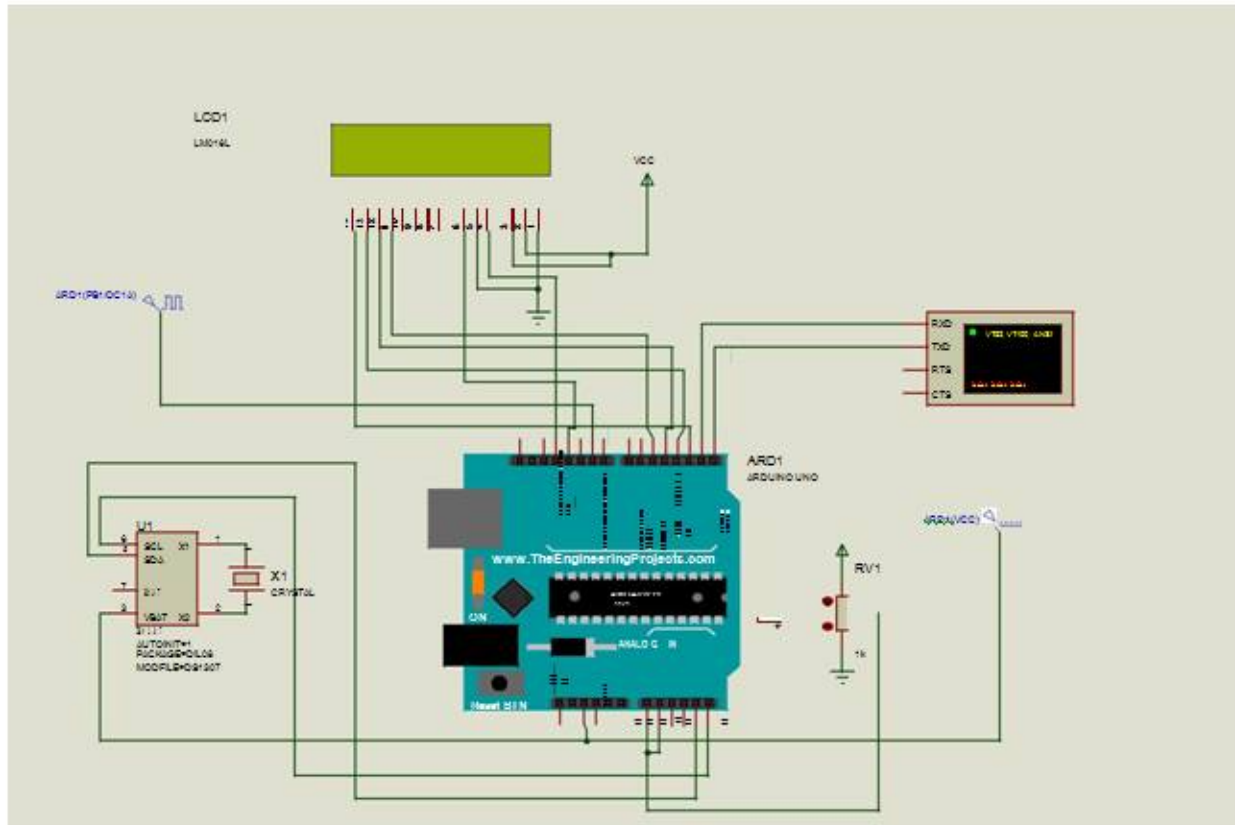


Fig.2 Simulation model of proposed system

DESCRIPTION

The main component of the system is an arduino controller. The Arduino platform consists of a microcontroller board and the associated IDE (Integrated Development Environment). Microcontrollers are small computers that are much easier to interface with the physical world than regular computers. Microcontrollers have been around for a long time finding diverse applications. The arduino IDE comes with many libraries and makes it easy to write arduino programs or sketches, as they are known in the world of arduino. Arduino is not one-size-fits-all and a range of arduino boards is available for different applications. Here the arduino uno series is used. The parts of arduino uno board are power connector, TX and RX LEDs, USB Port, reset Button, digital Input/Output, Power LED ,On-board LED microcontroller and analog Input. Power connector is used to power the Arduino when it is not plugged into a USB port for power. The power connector can accept voltages from 7 to 12 volts, so the standard 9-volt battery is good enough for powering the board and TX and RX LEDs indicates the communication between computer and arduino. The USB port connects your arduino to a computer and it is used for powering the arduino as well as uploading sketches to it and the reset button is used to reset the on-board microcontroller. Digital input/output pins are the primary way to interface the arduino board with external components and systems. These pins are used to read as well as write digital data using digitalRead() and digitalWrite() functions. The power LED indicates that the arduino is getting power or not.

The outputs of current transformer and potential transformer are fed to the ADC(analog to digital converter) pins of arduino .Arduino converts the outputs of PT and CT into actual voltage and current by multiplying it with ADC resolution factor and transformation ratios of transformers.

Here we are using a 16x2 LCD DISPLAY to display the supply voltage, current drawn by the load system, date ,hour, minute, seconds ,year,energy consumption and cost of consumption.The RTC module is used to give an information about calendar details.The end of the month date is automatically adjusted for months with fewer than 31 days,including corrections for leap year.The clock operates in either the 24-hour or 12-hour format with AM/PM indicator.The DS1307 has a built-in power sense circuit that detects power failures and automatically switches to the back up supply.Time keeping operation continues while the part operates from the back up supply.Another most important part of system is GSM.GSM modem is a data oriented GSM transceiver that uses a network provider to connect and transfer data.It is reliable ,easy to use and have wide coverage area.The wireless modem sends and receives data through radio waves.Like a GSM mobile phone ,a GSM modem requires a SIM card from a wireless carrier in order to operate.AECCMS uses SIM 900.GSM operates at 4 different frequencies, the modem is known as quad band modem.

IV.SIMULATION RESULTS

The proposed system circuitry has been set up in the proteus and the program for the system is written on the Arduino IDE (Integrated Development Environment).After the compilation of the program a hex file is generated. This hex file is virtually burned on the arduino IC. After the simulation ,LCD unit displays the date ,time,supply voltage ,current drawn by the load system, energy consumption and cost of consumption and the gsm module automatically sent the amount and cost of energy consumption to our cell phone as well as the electricity board contact number with in a finite time interval.

V.HARDWARE IMPLEMENTATION

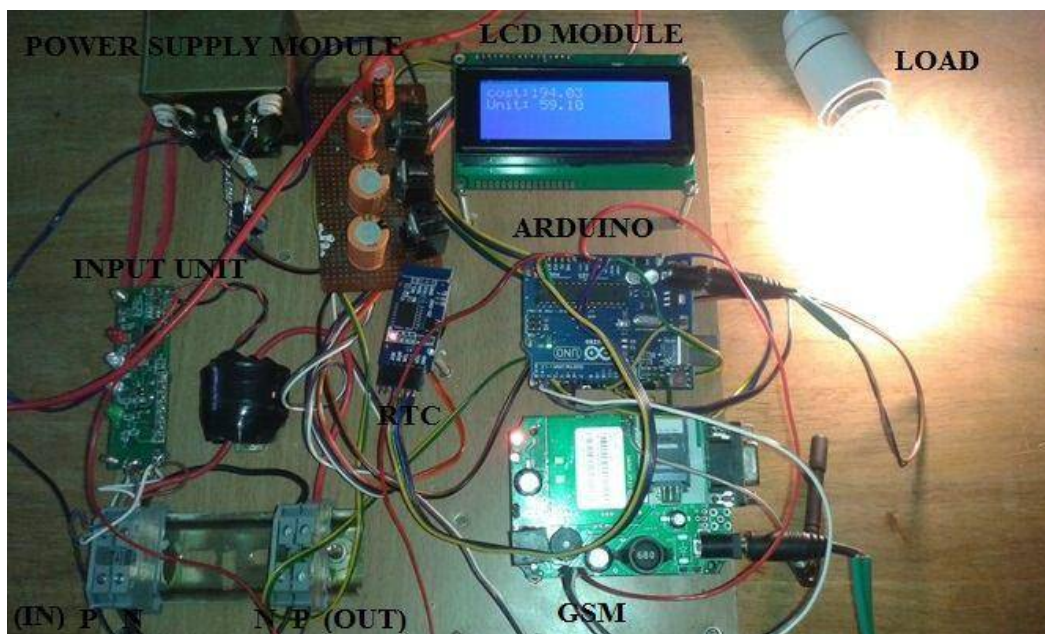


Fig.3 Circuit prototype of proposed system

VI.FUTURE SCOPE

The proposed system can be further modified by attaching bank account so that the electricity bill will be automatically deducted from the account in 2 months interval. Also, message will be send to the consumer after the transaction is done.Since,the proposed system is experimentally set up on short term basis,the present tariff rate is used for cost



estimation. So, while considering the system for long term usage, we could connect it to the internet for regular updates of tariff rates.

VII .CONCLUSION

The automatic energy and cost monitoring system is designed and experimented for better and economical utilization of generated power. The proposed system displays the value of supply voltage, current, units and cost of consumption. Also, by the usage of GSM, the electricity bill will be automatically send to the consumer's cell phone as well as to the electricity board contact number in an interval of 2 months. The paper also aims in creating an awareness among consumer on energy conservation. It also rectifies main drawbacks of our present metering system.

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