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Single Phase Prepaid Smart Energy Meter System Using an RFID AND Arduino Nano

Shubam Gabane[2], Sanchit Kulkarni[4], Payal Gandhi[1], Alpesh Ramteke[3], Monica Rajurkar5
[1, 2, 3, 4, 5]*Student, Dept. of Electrical Engineering, G H Raisoni Institue of Engineering And Technology, Nagpur, Maharashtra, India*

Abstract: ***In the present day scenario, the energy consumption awareness plays an important role as its demand is growing day by day. Huge differences in energy production and consumption urges the need to reduce the power wastage. The prepaid electricity system proposed in this paper aims at reducing the wastage of power due to its theft and control its usage on the consumer side. This increases the overall efficiency of the power system. The RFID card enables a consumer to utilize the energy for which he has paid. A microcontroller continuously checks if his balance is within the threshold limit and he is notified when his balance goes below the limits. Once it exceeds the threshold value, the supply is automatically cut off. The user can then recharge by making an online payment whenever necessary. The LCD continuously shows the units of energy consumed.***

Keywords: Prepaid, Wastage, Billing System, Threshold limit, RFID Card, Arduino Nano, Relay, Software

I. INTRODUCTION

Every month we can see a person standing in front of our house from Electricity board, whose duty is to read the energy meter and handover the bills to the owner of that house. According to that reading we have to pay the bills. The main drawback of this system is that person has to go area by area and he has to read the meter of every house and handover the bills. The present billing system is minimally able to detect power theft and even when it does it is at the end of the month. Also, the distribution company is facing many problems in terms of losses. The distribution company is unable to keep track of the changing maximum demand for domestic consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers load on a timely basis, which will help assure accurate billing, track maximum demand, and detect online theft. These are all the features to be taken into account for designing an efficient energy billing system. The main motive of this system is pay before use. The main objective is to minimize the illegal usage of electricity, reduce power wastage due to its theft and to control the usage of power on the consumer side and thus increase the overall efficiency of power system. The conventional energy meters have not been replaced, but a small modification on the already installed meters can change the existing meters into prepaid meters, so these meters are very cheap

II. PREPAID ENERGY METERS

The main components of this system are Microcontroller Arduino Nano, RFID Card and card reader, relay driver circuit, energy meter and optocoupler, OLED , a buzzer and a regulated power supply. The figure -1 shows the block diagram of a prepaid electricity system.

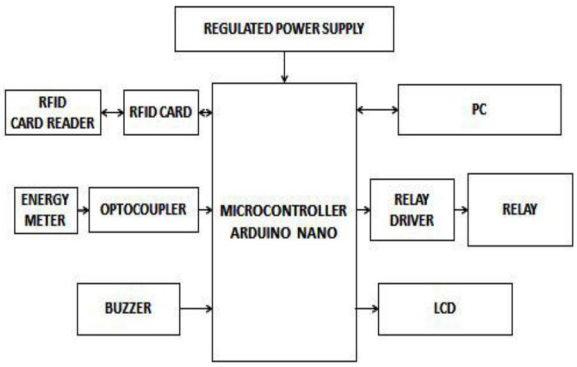


FIG 1: Block Diagram

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The proposed system consists of two sections-a hardware section installed at the consumer side and a software section installed at the utility side. The software section is coded in Python and it enables two modes- recharge mode and reading mode. The simulation of the system is done in Proteus. The regulated power supply system block consists of a step down transformer, rectifier and filter and a voltage regulator. The 230V supply is first stepped down to 12V and is the then rectified using a bridge rectifier. It is then filtered using an inductor-capacitor unit. The voltage regulator limits it to 5V .This is given as the input power to microcontroller and other units. The RFID card is given a default amount of Rs.5.The threshold amount is stored in the microcontroller .The load is connected to the hardware section and the program coded in Python is run. The RFID card is swiped in the card reader. The amount credited in the card is read and is then passed on to the microcontroller. It checks if the amount is within the limits and if true then the consumer can consume energy. The pulses consumed are read by the energy meter and using an optocoupler it is coupled to the microcontroller. The OLED connected to the microcontroller displays the pulses and the amount being consumed. For each pulse consumed Rs.0.5 is deducted from the main balance and is always cross checked with the threshold value. Once it goes below the limit the relay coil is de-ignited and the supply is International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072 © 2018, IRJET | Impact Factor value: 6.171 | ISO 9001:2008 Certified Journal | Page 3682 cut off, thereby opens the circuit. So the supply is cut off. In order to recharge the information is passed on to the utility section. Using the recharge mode in the software the card is again recharged for the required amount. The time interval between two successive readings are taken as a month. The maximum limit for a month is fixed to be Rs.50.If there is a balance amount at the end of a month then this amount will be credited to the next month with pulses being set again to zero. The buzzer is provided when the recharge amount is about to be over.



Fig -2: RFID card and card reader

III. RESULT

The objective to set up a prepaid electricity meter was successfully achieved. The connections are done as shown in the figure 3 and the program is loaded on to the Arduino Nano. Power supply was provided to the Nano. The RFID card was swiped in the card reader with a particular recharge amount. The consumer consumes the units for the recharged amount. The LCD displays the pulses and the balance amount. The figure 3 gives the hardware set up installed at the consumer end.

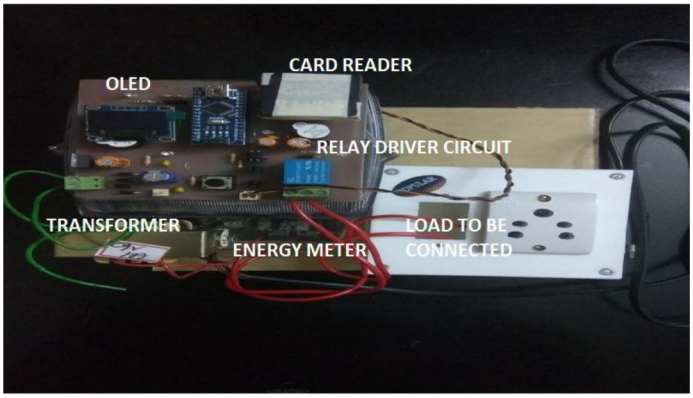


Fig 3: Hardware setup

IV. CONCLUSION

This paper identifies the key benefits of Prepaid Electricity system. This system can control the usage of electricity on consumer side to avoid wastage of power it proves to be a boon in the power sector. The major drawback of a postpaid system is that there is no control of usage from the consumer's side. There is a lot of wastage of power due to the consumers lack of planning of electrical consumption in an efficient way. Since the supply of power is limited, as a responsible citizen, there is a need to utilize electricity in a better and efficient way. The importance of the electricity power leads the researchers to find new technologies to get a better utilization of electrical power and reduce the waste. One of these technologies is the prepaid metering system. There are many methods for recharging the credit and for communication with the server. The proposed prototype electricity prepaid metering system used RFID technology as recharging method.

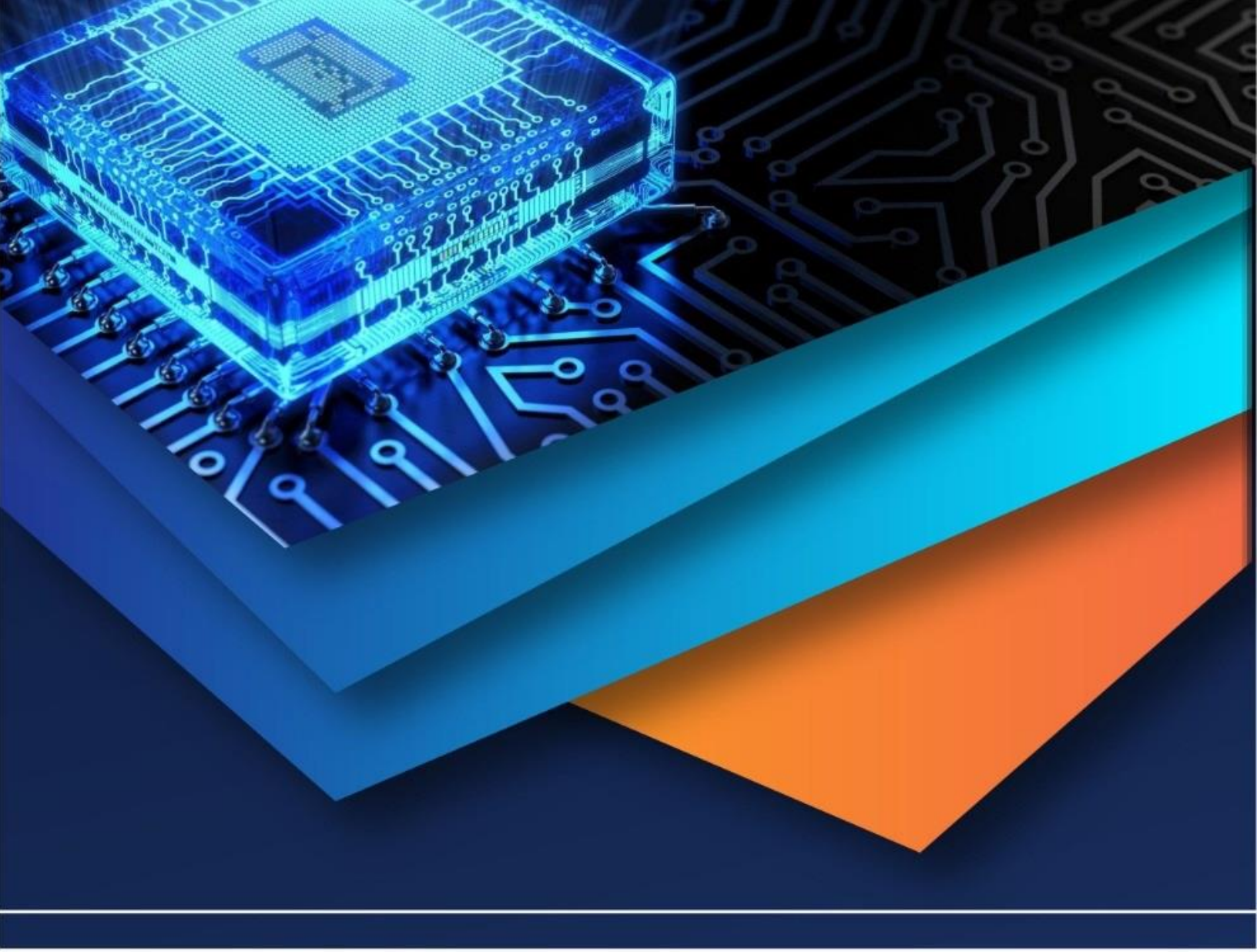
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