

Prepaid Energy Meter Using Microcontroller and Smart Card

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Abstract —

The present billing system is very time and labor consuming and also chances of error. Taking meter reading, bill distributing, payment collection etc. are very difficult for supplier for people who living in isolated areas. That's why present billing system is slow, costly and unreliable. The current issue about present billing system is nothing but power and energy theft. This problem is reduces by prepaid energy meter. Prepaid means "pay before use" this concept is similar to prepaid mobile. In this paper microcontroller has been introduce with smart card which is use for recharge purpose. Smart card is nothing but a memory card (EEPROM IC) available at various ranges (i.e. Rs.50, Rs. 100, Rs.200 etc.). when consumer insert smart card into reader then card reader will read the stored information and delete information from smart card so that the card cannot be used by other. As power consumption increases amount will decreases. the unit of energy consumed are detected by the digital energy meter which shows the amount of power consumed in form of energy unit and display remaining amount on LCD. When recharge amount is nil the relay will automatically power off the whole system. A buzzer is used as an alarm which gives sound before hole amount is reduce.

Key Words — AT89S52 microcontroller, AT24C02 microcontroller, ULN2003, smart card, card reader, energy meter

I. INTRODUCTION

The Prepaid energy with smart card can improve the cash flow management in energy utilities. Solve problem related with present billing system and reduces manpower required for taking meter reading. Energy meter uses two Atmel ICs AT89S52 and AT24C02. In this paper recharge is done by smart card (which is nothing but EEPROM). Available in various ranges. As soon as microcontroller AT89S52 get signal then we have to insert smart card into reader for recharge. Reader will read the recharge related information from smart card. And information is deleted from smart card so that card cannot be again used by other customer. As soon as recharge is done energy meter is activated. As power consumption increases the amount will decreases. The units of energy consumed are detected by electronic meter. Electronic meter consists of current and voltage sensors which sense the amount of current and voltage consumed. ADCs used to sample analog signal and convert into digital form. The digital signal processed using microcontroller which then display the amount of power

consumed in the form of energy units. And display remaining amount on LCD or LED. When the amount is over, the relay will automatically power off the whole system. As power consumed the reading in single phase energy meter increased and the units in LCD is decreased by Rs.1. when amount reaches to its minimum value, buzzer start indicating so the consumer will aware that she/he needs to recharge meter soon.

II. LITERATURE REVIEW

The present traditional billing system have many problems like problem of payment collection, energy thefts etc. due to which the traditional billing system is slow, costly and unreliable[1]. The present billing system has chances of error and it is also time or labor consuming. A paper suggests a design of digital energy meter for improved metering and billing system [2]. Poly-phase prepaid energy metering system has also been proposed and developed based on local prepayment and card reader [3]. Another paper suggests prepaid energy meter using a microcontroller from microchip technology Inc. PIC family, used due to low cost of microcontrollers[4]. The prolonged discussion clearly defines the architecture of smart metering system. The architecture proposed in this study is a multifunctional approach to read the energy meters located at the consumer sites. This report states that out of total energy generated only 55% is billed and only 41% is realized [5]. Each customer equipment provides the energy consumption to the MCIC that keeps the details of individual users. The meter tampering is easily detected by this approach. But the implementation cost is high. This paper discusses simulations and models based on data from pre-paid meters in order to determine the feasibility and method of Operation for remote check meter. The resolution of illegal consumers detected depends on the deviation of the losses and the connected time of the check meter. This report gives only the simulation result. It would be the better method for minimum amount of users. The further improvements to detect the electricity theft lead to grouping of customers by means of Support Vector Machine (SVM) [7]. This methodology insists data processing and data mining methods to detect the customers with abnormal consumption of electricity. It involves many complicated mathematical calculations that may provide erroneous results and can detect only 60% fraudulent customers. The previous methodologies are apt for the traditional power systems. Sudarshan K.

Vallurup[8]. proposed the design and assemble of low cost prepaid smart card Energy Meter. This will reduce the energy wastage and save lot of energy for future use. Even this is an advanced technology it cannot cover the remote area. In order to check out the wide area real time investigation is needed [9]. This paper defines the spot monitoring of the energy meters to verify whether the electricity theft has happened or not. It continuously compares the determined meter reading with the traditional meter reading to avoid relaying of the values. The above mentioned methodology doesn't give the exact theft detection criteria. Better analysis of about technical and nontechnical losses will provide the electricity theft measures [10]. This paper implements black tracking algorithm to determine the power deviation between the meter data and delivered power data. In this idea, the malfunctioned consumer's power supply will be turned off. The detection of exact theft location is somewhat harder when we talk about the previous methods; to overcome the drawbacks. Ashna.K and Sudhish N.George [6] proposed GSM based automatic energy meter reading system. This method is valid for the highly equipped distribution line and is not applicable for the rural areas. To expand the coverage area GPRS based electricity stealing prevention method is proposed. Here an electricity user that uses GPRS communication software will reduce the electricity losses.

III. PREPAID ENERGY METER

Prepaid energy meter based on concept of "pay before use it". It not only reduces the manpower but also make billing system reliable.

IT IS USEFUL- BECAUSE

- No bill production
- No bill distribution
- Pay before use
- Reduce manpower
- System becomes reliable
- No bill
- No bill error
- Show money left
- Show true cost of consumption Save time
- Customer is responsible for disconnection

A. BLOCK DIAGRAM OF PREPAID ENERGY METER

Fig .1 shows the block diagram of prepaid energy meter using smart card. It consists of card reader,

microcontroller AT89S52, AT24C02, ULN2003, relay, LCD and relay.

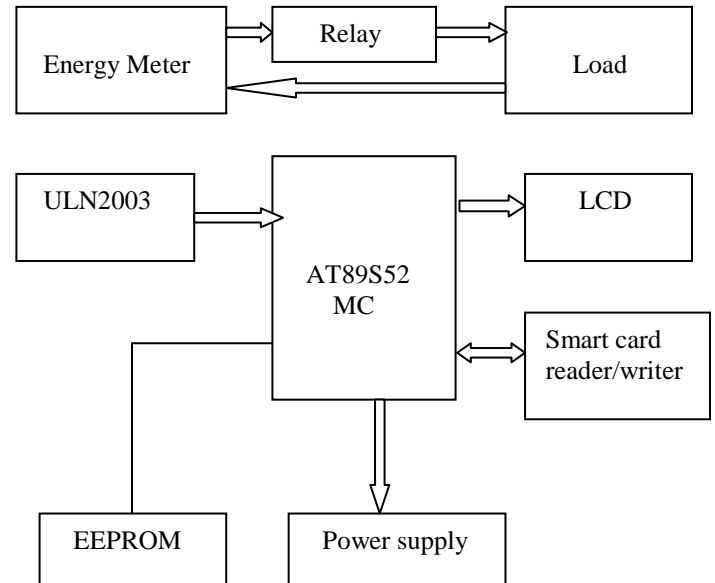


Fig.1 block diagram of prepaid energy meter using smart card

B. COMPONENT DISCRPTION

1. IC AT89S52

It is CMOS 8-bit microcontroller IC. it use ISP (i.e. in system programing) on chip flash memory of 8KB .this IC is used because it required low power and its performance is also high. This device uses nonvolatile memory (permanent memory). Program memory can be reprogrammed in-system because of on chip flash. This 40 IC is similar to IC 80C51 instead of it is from ATMEL family.

2. SMART CARD & CARD READER

Smart card is nothing but a memory card (i.e. EEPROM IC) use for recharge. It is available in various ranges (i.e. Rs50, RS100 etc.). Reader is used to read the information of smart card.

3. IC AT24C02

It is an electrically erasable and programmable random access memory with 2Kbit of memory size. Memory arranged in 32 pages of 8 byte each. In one byte each 256 words are there. It is 8pin IC.

4. ULN2003 IC

It is Darlington array IC with high voltage and high current. It used with common emitter having seven open corrector Darlington pair. This IC is basically used to drive the load (relay, buzzer, display etc.). Each pair is rated at 500mA.

Then digital output of ADC is processed using microcontroller. 1unit means 1kilo watt hour energy consumed. 1000 watt of electric energy is required for 1kwh. The Microcontroller AT89S52 produce only 10ma current which is not able to drive load, so IC ULN2003 is used which convert 10ma current of microcontroller into 80ma so that relay will switch on. As soon as reading in single phase energy meter increases amount is decreases by Rs.1 in LCD. When balance remains 10rs then buzzer give indication so that customer will aware that he/she needs to recharge soon. And when recharge is totally nil then relay will automatically switch off the whole system and so now there is no flow of electricity.

C. WORKING AND CIRCUIT DISCRPTION

Fig.2 show the circuit diagram of prepaid energy meter using smart card. In this step down transformer is used which convert 230v-12v supply. Then rectifier circuit is used to convert AC into DC. At the output of rectifier 12v DC generated but this circuit work on 5v supply so regulator IC 7805 is used, which convert 12v DC to 5v DC. So as per our requirement we get 12v or 5v from input and output of regulator. As soon as microcontroller AT89S52 get signal then we have to insert smart card into reader for recharge. Reader will read the recharge related information from smart card. And information is deleted from smart card so that card cannot be again used by other customer. As soon as recharge is done energy meter is activated. Recharger unit is saving in IC AT24C02 which is nothing but EEPROM, nonvolatile memory. Recharge unit is display with some message "recharge is successful" on LCD (i.e. Liquid crystal display). Amount is decreases as the power consumption increases. Electronic meter detect how much amount of power is consumed and energy unit. And display remaining amount on LCD. Electronic meter is consisting of current and voltage sensors. They sense amount of current and voltage consumed. After those ADCs is used to sample and digitizes the analog signal.

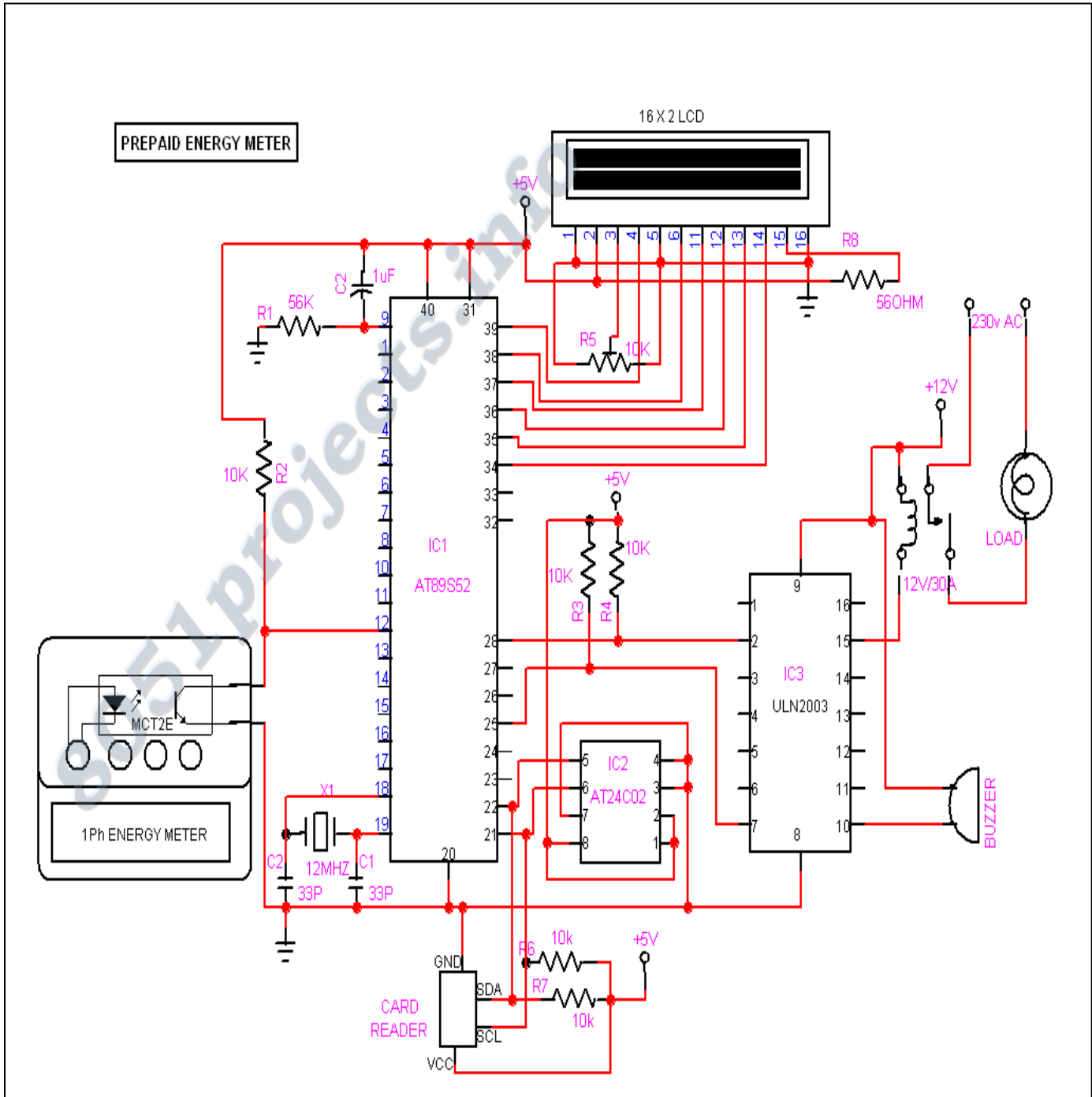


Fig.2 prepaid energy meter using smart card

AUTHOR'S PROFILE

III. CONCLUSION

The paper gives an overall view of prepaid energy meter using smart card. It is a concept to avoid wastage of power and minimize the electricity theft in a cost effective manner.

- User has to pay according to their requirement. Do not have to pay excess amount.
- Reduce manpower for taking meter reading and bill distributing.
- The prepaid energy meter is less costly, more reliable and error free.

From overview of all this, it can conclude that if prepaid energy meter is implemented then it will be very beneficial.

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