A NOVEL APPROACH FOR SMART ENERGY METER USING 89C51 MICROCONTROLLER

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ABSTRACT:

It is the new concept in the world of electricity measurement. This concept is not only beneficial for electricity measurement but also has the capabilities to prevent power theft and misuses of electricity which is based on *"Pay first..Then use it.."*. The concept of PEM (Prepaid Energy Meter) is very similar to prepaid mobile system, you recharge and spend accordingly. When the purchased units are used up by the consumer the meter disconnects the power supply until the next recharge is done. The system will automatically notify the consumer to recharge before zero balance, unit recharge will be done by the service provider. In India, presently distribution companies are collecting revenues from theirconsumers by metering and billing which is very long process. The expenses for metering, billing, and collecting dues became difficult as electricity is supplied to large number of consumers located in remote areas, resulted in high cost per unit. To solve these problems, distribution companies can have an automated prepaidsmart card energy meter, which overwhelms the whole problems associated with the present billing system and will make the consumer more conscious about usage of electricity. The purpose of this project is to design and develop an intelligent energy metering system that can capably control the amount of electricity consumed by the user. Electricity users can buy definite amount of energy to use it only when they desired.This is achieved by interfacing energy meter with smart card technology. A

prototype of the system has been developed with the state-of-the-art digital and information technology and proven to be stable, reliable, low cost, and easy maintenance.

KEYWORDS:

ATMEL 89C51 Microcontroller, smart card reader, smart cards, energy meter, optocoupler, LCD, crystal oscillator, etc.

INTRODUCTION:

Electricity is a major foundation of energy in the world and used in every urbane country for household, industrial and business purpose. Recently owing to raise in number of new housing, business-related and trade developments in India, the number of clients of electricity been improved in the network distribution. The monthly power bill for clients is calculated from post-paid meter reading based on the electricity consumption. But the disadvantage of this process is that device readers are needed to visit every door to door to read the device for billing purposes. This is a tedious, prolonged and error prone process. Additionally, there is a chance for consumers as well as meter readers to do the corruption.


Fig: Electromechanical meter

The current conventional billing system have many problems like problem of payment collection, power thefts etc. due to which the usual billing system is sluggish, expensive and untrustworthy[1]. The current billing system has chances of blunder and it is also time or labour consuming. A paper suggests a digital energy measuring device for improved metering and billing scheme [2]. Poly-phase prepaid energy metering structure has also been projected and developed based on confined prepayment and card reader [3]. An added paper suggests prepaid energy mater using a microcontroller from microchip technology. In PIC family, used due to little cost of microcontrollers [4]. So it is essential to expand a billing system which solves the problem of billing by hand and also reduces the manpower. In post-paid scheme [5], the monthly bill sent to the client by mail at the end of the month and all the clients often need to gather in a long queue to pay the bills. This practice is tedious and time consuming. In this paper, a smartcard is used which is available in a variety of ranges (i.e. Rs. 50, Rs. 100, Rs. 200 etc.) and the energy meter to which the no. of recharge units has to be loaded[6]. Suppose a customer buys a recharge for Rs. 100 he/she can introduce this amount through the

keypad so that the smart energy meter will be activated. According to the power utilization the amount will be reduced. A LDR circuit is used to calculate the amount of energy consumed and an LCD is used to show the meter readings. When the smart card amount is zero the relay will automatically shut up down the whole structure. In this project we also have provision to give an alarm using buzzer to the customer before the whole amount run down [7]. Introduced a GSM based structure, where GSM technology had taken place instead of Bluetooth, here the readings were send to remote location by using Short-messaging-service and bill is developed and send to consumer mobile using GSM modem. Drawback of this technique is the cost of Short-messaging-service and network congestion [8]. EB card was introduced in this structure which will resemble as top-up cards for cell phones. According to usage of power we can pay for the card. Then we can enter the undisclosed number in the card and send to server with help of ZigBee network. Amount for usage will detected by the server and it will credit the quantity if there is balance. Thus we can pay the bills from home.[9].

PROPOSED WORK:

Smart card based prepaid electricity is a exceptional and new concept which saves lot of time and power for electricity department. User can recharge the card whenever the power is essential. People now can buy electricity in advance, using the so-called prepaid electricity cards in the form of smart cards. The proposed prepaid smart card can also be used to manage electricity use in a hotel room. Thus, people can get through only as much power as they really need. Prepaid energy meter is system which is cost competent and can shrink problems associated with billing and also reduces deployment of manpower for taking meter readings. In this paper, a prepaid metering (PPM) system has been proposed. Each consumer has to install digitally planned prepaid electricity meter along with smart card in their home, office or industry. Based on the electricity use, the credit will be deducted automatically from the smart card. When the credit goes below the threshold value, the meter gives warning icon and if credit reach to zero the meter will automatically cut off the power supply. The consumer has to go to the transaction station with the smart card and money to buy electricity. In the vending station, user can get the credit to his smart card by paying the money. Then the consumer will insert the smart card to the meter and the meter will be re-energized. In prepaid billing system, the consumer will be always conscious about the left over credit and thus try to use electricity carefully and stop its misuse. Furthermore, in contrast with post-paid billing, the consumer can acquire credit at any time in the month from the transaction station.
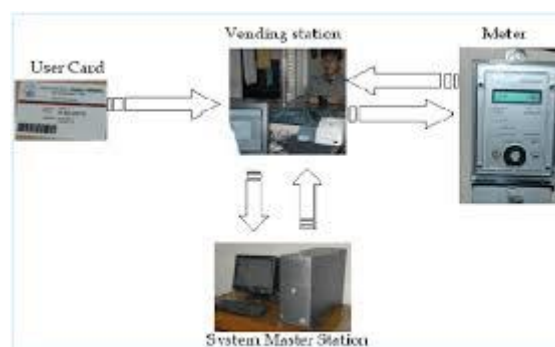
BLOCK DIAGRAM OF PROPOSED SYSTEM:
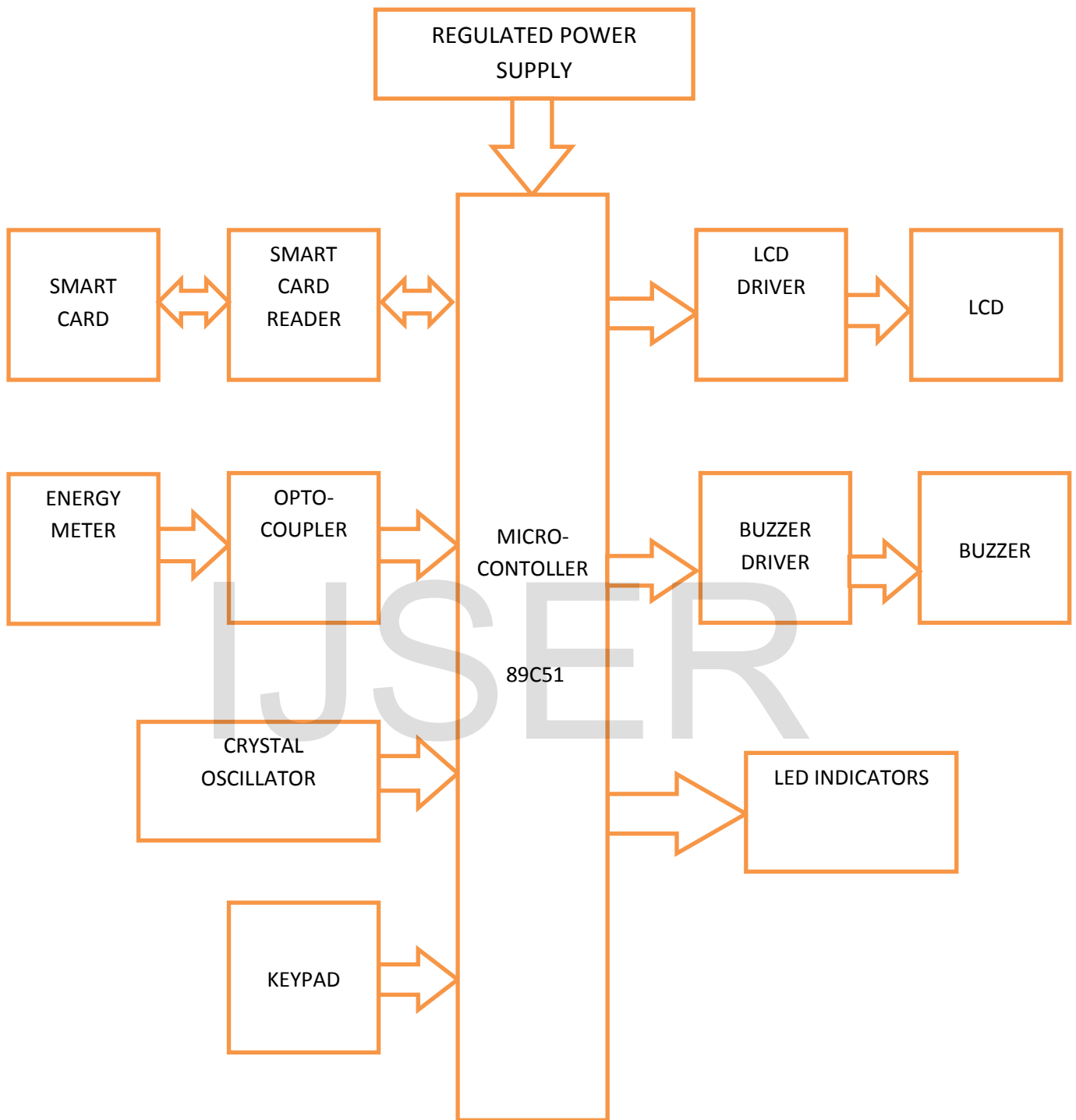
The system with magnetic strip card reader interfaced with microcontroller is set up .The microcontroller 89C51 is used for interfacing of various devices such as keypad, card reader, LCD driver and buzzer. The regulated dc power supply is provided to the microcontroller. When the user swipes the magnetic card ,three options will be displayed on LCD display. Options to check the balance, to recharge and to do payment. Use will have to select appropriate option as per requirement and the operation will be performed. Every magnetic card will have its unique number which contains the information like name, contact number, balance amount can be saved. As per operation performed the balance will be updated. After payments amount will be deducted or credited after recharge. Energy meter is interfaced with microcontroller with the help of optocoupler because high amount of current can damage the microcontroller. Here optocoupler acts as a switch which make or break the circuit. In the diagram as shown crystal oscillator is used to provide frequency pulses to microcontroller of about 12MHz,without which microcontroller do not perform any operation. Control operation will be performed by microcontroller in such a way that electricity will be used only when it is prepaid. When there will be no balance in the customer ID, buzzer and LED will operate.LCD drivers and buzzer driver are used for excessing the current from microcontroller because LCD and buzzers operate on current in Amperes, while microcontroller operate on mA.In this way this system can be used to save electricity.

Fig: Proposed System

FLOWCHART:
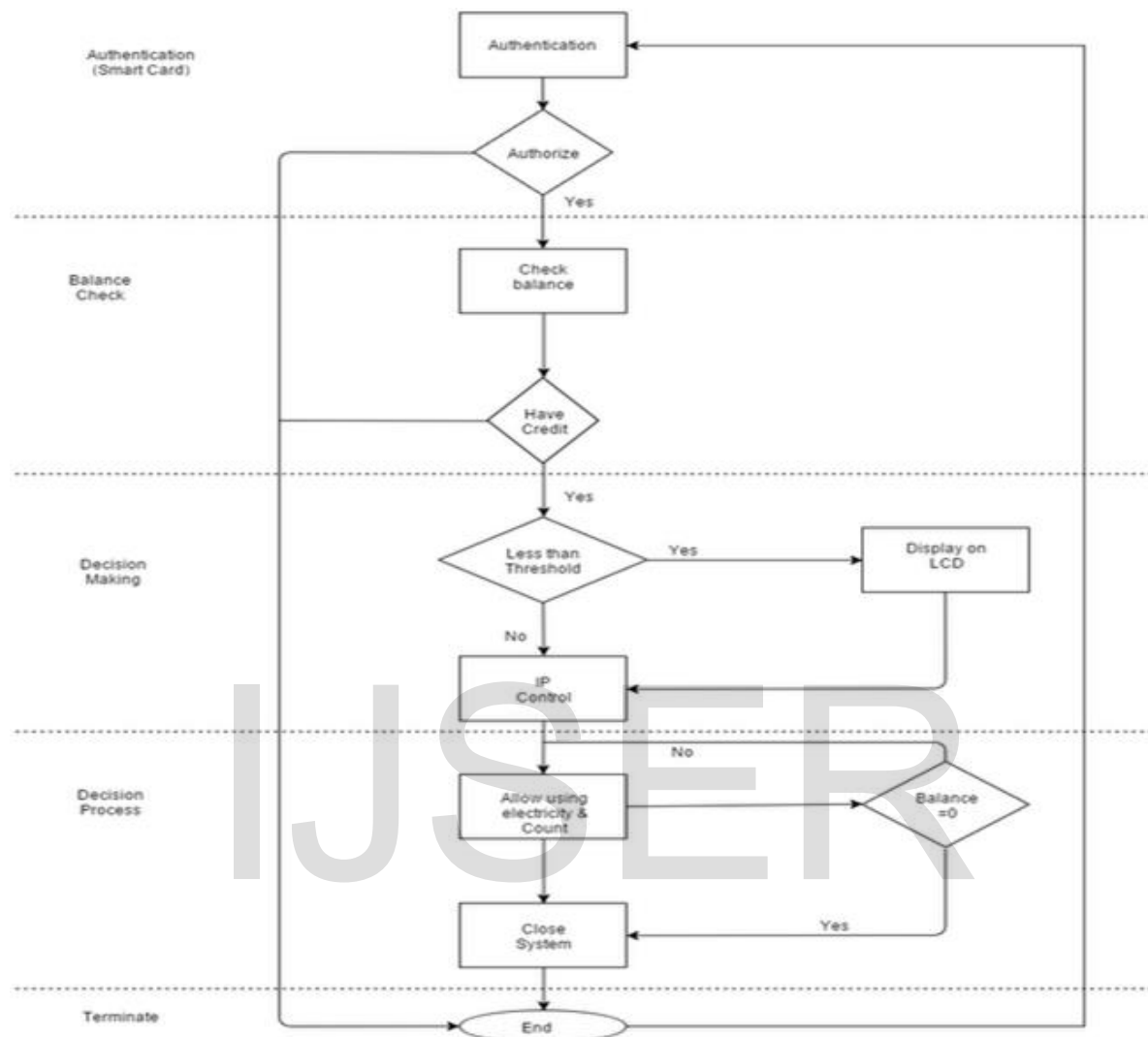
The flow chart for smart energy meter using smart card is shown in figure above. The first step is to authentication of user that means authentication of smart card. For that user should insert the card into an energy meter. If the card is unauthorized then the process will end and the display of the meter will show message "UNAUTHORIZED". If the card is authorized then the controller will check the balance from the card if the card don't have credit it will again stop process "BALANCE NIL". If the card have balance the controller will compare credit with reference value mentioned in the program. If the card have less than threshold value then it will be displayed on the LCD screen. After performing IP control it will allow the usage of electricity. If customer fail to increase credit controller will close system by displaying message "BALANCE ZERO". The controller continuously decreases the credit according to electricity usages and also check the balance.

ADVANTAGES:

CONSUMER'S POINT OF VIEW:

1) Flexible payment solution.
2) Pay to suit your income status.
3) Show true cost of consumption and money left.
4) Reduce waste – conserve energy.
5) No bills.
6) No billing errors.
7) Increased responsible usage by consumers.
8) Reduction of power theft.
9) Easy transaction.

OPERATOR'S POINT OF VIEW:

1) Pay before use.
2) No bill production.
3) No bill distribution.
4) No further actions such as disconnections.
5) Social acceptability.
6) Customer responsible for disconnection.
7) This system is of great advantage for the electricity department as this unit can be utilized effectively for preventing power theft, non-payment of electricity bills etc
8) The whole process of billing can be centralized.
9) Cost of manpower for billing / collection is reduced.

CONCLUSION:

In the present situation all customers are using manual communication. To reduce the manual efforts and human errors, we need to have some kind of automated system checking all the parameters and functioning of the connections between the customer and electricity board. Also by implementing this system we can control the usage of electricity on consumer side to avoid wastage of power.This paper describes theoverviews of different technologies used for overcomingthe problems and at last come up to this level. New technologies and methodologies which are already used toimprove applications of AMR have been discussed in this paper. Till now Bluetooth, Smart meters, EB Cards, GSM/GPRSare used in Automatic meter reading system. Since there is need to utilize energy in better and efficient way this pre-paid meter proves to be a boon in the power sector. In this system to save time of consumer, the consumed energy corresponding price is displayed for the consumer benefits. By the implementation of this system overall efficiency in operations of the electric board will improve. An attempt is made in this work to develop a system, which when interfaced with static electronic energy meter is avoided where in complexity of the circuit is reduced and cost also gets reduced of the meter.

APPLICATIONS:

1) Household electrical systems.
2) Hotels and short term residential houses.
3) Industrial power consumers.
4) Shopping Malls
5) Employee quarters

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