



Swedish College of Engineering & Technology

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Project Proposal

Department of Electrical (Power) Engineering



Project Title	Smart Card Based Prepaid Energy Meter
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Abstract

Over the past several years, smart cards have achieved a growing acceptance as a powerful tool for security, identification, and authorization. Financial card issuers are moving to replace magnetic stripe cards with chip cards to reduce counterfeiting and fraud. The increasing computational power placed on the chip along with advances in cryptography has made the smart card a very powerful tool for identification. The advent of multi-application smart card operating systems for both contact and contact less applications has put smart cards on the edge of information technology. This paper introduces a 3-tier smart card secure solution for prepaid electricity. The proposed system uses an IP-based controller in addition to a power meter, providing efficient online control of the amount of electricity consumed by the user. The user can use the card to log in to the service provider company, as well as topping up his smart card for additional power needed.

Introduction

In the last decade, smart cards evolved from basic memory cards to complex systems on chips with expanding processing power. This has opened the avenue to many applications such as financial transactions, e-commerce, physical access control, health, and transportation services. The smart card, an intelligent token, is a credit card sized plastic card embedded with an integrated circuit chip. It provides not only memory capacity, but computational capability as well. A smart card usually consists of a ROM or flash memory, EEPROM and a CPU. Access to data stored on the card is under the control of the smart card operating system. The card operating system not only makes the smart card secure for access control, but can also store a private key for a public key infrastructure system. Lately, the industry has come up with 32-bit smart card processors having more than 400Kbytes of EEPROM, and a memory management and protection unit serving as a hardware firewall. This hardware firewall enables secure separation of adjacent applications, as well as being the basis for secure downloading of applications. The self-containment of smart card makes it resistant to attack as it does not need to depend upon potentially vulnerable external resources. Because of this characteristic, smart cards are often used in several applications which require strong security protection and authentication. In addition to information security, smart cards achieve greater physical security of services and equipments, because a smart card restricts access to all but authorized users.

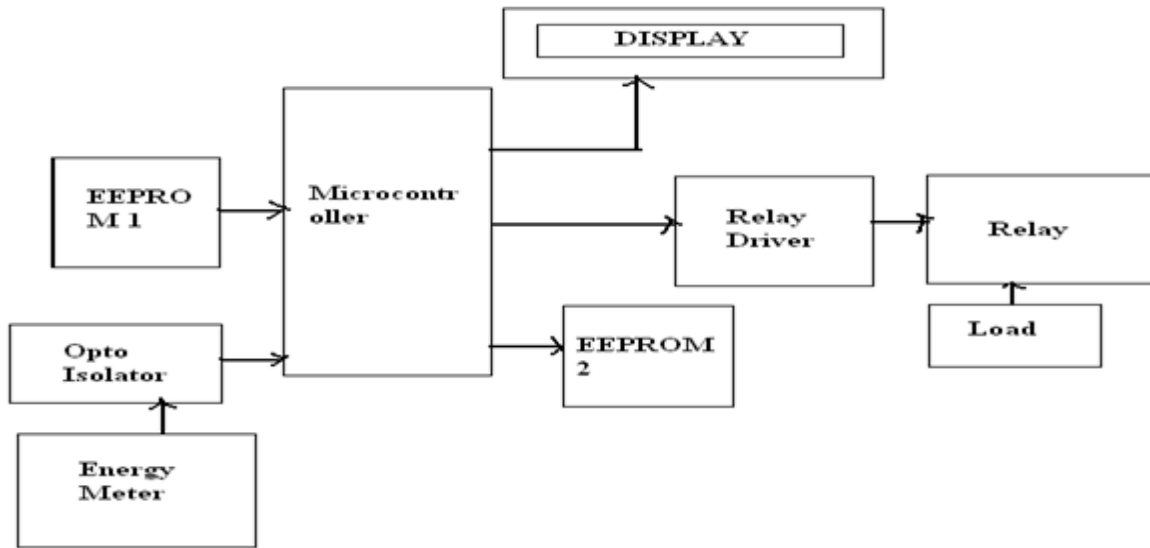
One of the most valuable applications is in using the smart card to buy energy. Domestic consumers could for instance buy energy, at a price based on their previous consumption pattern, from any supplier wherever and whenever they choose. When the customer wants to top up their gas or electricity credit they visit a vending machine which uses the consumption data stored on their card to allocate a tariff and calculates how much energy to offer the consumer for their money.

Prepaid Electricity

Since the last decades of the past century, scientists, researchers and public people have been worried about energy conservation. People spend much more power than what they actually need and that results in a huge loss of energy. Moreover, the continuous increase in the universal energy prices has resulted in a huge economical loss. Thus we are proposing a prepaid electricity smart card based system so people can buy specific amount of energy to use it only when then need. People can register for this service and charge their accounts through the Internet. The proposed system is based on an IP-based controller called TINY, and a WATTNODE type power meter which interrupts the controller at a regular interval based on the consumption of electricity to update the balance based on a certain tariff. The power meter we used, interrupts the controller at a rate of 0.75Wph, so based on the particular tariff used and the amount of power consumption needed, the correct amount of money to be loaded into the card can be easily calculated and programmed into the chip. The unique feature about this system is that the electric utility in the home environment can be accessed remotely from the supplier server due to the fact that the controller is IP-based, without the need for a PC on site, which reduces the cost of the system drastically. People now can buy electricity in advance, using the so-called prepaid electricity cards. The proposed prepaid smart card can also be used to manage electricity consumption in a hotel room, as well as accessing the room itself. Thus, people can consume only as much power as they really need. The main role of the smart card is summarized in two things

- Authenticating the user or log in
- Updating the balance in the card based on the given tariff and the electricity consumption profile of the user stored in the smart card

Block Diagram



Conclusion

A secure smart card based system for e-payment, implemented on prepaid electricity over the internet, was proposed. The smart card system has been designed and implemented successfully using a three tier model client-server system, which was shown to be superior over the two tier client-server system model. The proposed system has the benefit of using a secure smart card to log in to the network, and control the amount of money needed to be spent for the required electricity consumption based on the user profile stored on the card. The proposed system has also the unique feature of using an IP-based controller which provides remote access to company server without the additional cost of a PC. Work is ongoing for shifting to a true open platform multiplication smart card environment.