

The use of smart cards and their implications on the society

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Abstract

The new commerce era is a fact, it's the e-commerce. There is already a tremendous expansion and use of e-commerce worldwide and especially in USA and Europe. Almost everybody knows that many transactions take place through internet, like simple exchanges among people (P2P, peer2peer) or commercial transactions among enterprises and end-customers (B2C, business2customers) or among companies (B2B, business2business).

Many applications in several fields. Among them one with special importance and implication in our lives, the banking application, the so called e-banking. More or less most of us have experienced some kind of e-banking.

The simplest application is the use of credit cards where the transactions take place from special terminals placed somewhere outside the banks. But the most important applications are the transactions between banks, public and private business or between public and private companies or even among private companies. In these applications the payments take place through internet transactions and the money transfer is completely digital.

An important and very anxious factor in e-banking is the insurance of transactions especially from intervention and fraud use. To prevent these problems we use special precaution means. One very progressive and effective tool is the smart card. Smart card is a European invention with a worldwide impact and use. It offers a very safe exchange environment and that's why its use is increasing impressively.

In our research we will examine the use of smart cards in the Greek environment and their acceptance by several users (public sector, business, people, etc). Also our investigations will examine the implications of smart card's use on the society and the emotional consequences to users.

Keywords: e-commerce, e-banking, Internet safety, smart cards.

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Introduction

The trend in computing over recent years has been toward small machines and "distributed processing". Simply put, that means delegating tasks to many small computers rather than having everything done in large, centralized machines. Over time, smart cards will put personal computing power into the hands of every one of us.

Smart card is a European invention. The chip card was invented by German rocket scientist Helmut Gröttrup and his colleague Jürgen Dethloff in 1968; the patent was finally approved in 1982. The first mass use of the cards was for payment in French pay phones, starting in 1983 (*Télécarte*).

Roland Moreno actually patented his first concept of the memory card in 1974. In 1977, Michel Ugon from Honeywell Bull invented the first microprocessor smart card. In 1978, Bull patented the SPOM (Self Programmable One-chip Microcomputer) that defines the necessary architecture to auto-program the chip. Three years later, the very first "CP8" based on this patent was produced by Motorola. Today, Bull has 1200 patents related to smart cards.

The major boom in smart card use came in the 1990s, with the introduction of the smart-card-based SIM used in GSM mobile phone equipment in Europe. With the ubiquity of mobile phones in Europe, smart cards have become very common.

The international payment brands MasterCard, Visa, and Europay agreed in 1993 to work together to develop the specifications for the use of smart cards in payment cards used as either a debit or a credit card. The first version of the EMV system was released in 1994. In 1998 a stable release of the specifications was available. EMVco, the company responsible for the long-term maintenance of the system, upgraded the specification in 2000 and most recently in 2004. The goal of EMVco is to assure the various financial institutions and retailers that the specifications retain backward compatibility with the 1998 version.

At the beginning smart cards were used for storing data, mainly monetary values which the user could spend in pay phone, retail vending, transportation, retail transaction and etc. By the time, the smart card technology has matured and its use is not only storage data but mainly processing information.

Imagine a cashless society, where you can use smart cards to do many interesting things. This is becoming a reality and smart cards are making people's lives much easier. Smart cards are used for transportation systems, to store important medical information, and even to purchase items from vending machines like the examples mentioned in (Zoreda and Oton, 1994:139-163). Smart cards are even taking advantage of the Internet. A smart card reader can be plugged into the back of a personal computer (PC) and items can be purchased over the Internet making use of smart card security.

More complicated cards also exist. American Telephone and Telegraph Company has a Smart Card and System division. According to William Bulkeley in the Wall Street journal, they are demonstrating a security-conscious card that works with cash machines.

The smart card is expected to be used in many applications and especially in personal security related applications such as access control, computer logon, secure email sending and retrieving services.

The reason for this growth lies in the smart card's portability and security characteristics. In addition, as the recent growth of palmtop computers shows, people are looking for smaller and smaller devices for carrying their data with them. Smart card provides a good solution for many applications.

In this paper, we shall briefly describe what smart card is and how it can be used in different applications. The aim of this study is to provide an executive overview to those who wish to learn about smart card era. More specific applications and uses will be examined for the Greek environment.

SMART CARD BASIC

Think of the smart card as a tiny personal computer—minus screen and keyboard—and you have some idea of its potential power. No bigger than a typical credit card, each smart card contains an integrated circuit on a computer microchip capable of processing and storing thousands of bytes of electronic data. Given their size and portability, smart cards represent the ultimate today in personal computers.



Many people carry wallets thickened with cards from banks, stores, airlines, insurance companies and the like. On plastic or on paper, each card identifies the issuer and cardholder, but the real record is not the card but a file housed in a computer, perhaps hundreds or thousands of miles away. To draw cash using an automated teller machine, make a purchase or pay a medical bill, the bank, store or hospital needs to verify the accuracy of the card through a central computer. So, today's plastic and paper cards merely represent a record; they are not the record itself.

Created by a computer, but carried by an individual, the smart card is itself an electronic record. Information in the microchip can immediately verify the cardholder's identity and any privileges to which the card entitles that person. Withdrawals, sales, bills—all the information can be processed electronically on the spot; later on, if necessary, those records can be transmitted to a central computer to update its files.

Millions of us already use these smart cards. For example, many college students purchase cards that operate soda, photocopy, or laundry machines. In Europe, many phone booths require smart cards. The idea behind these cards is simple. We buy €10 worth of electronic money from a machine or a sales clerk. This €10 is stored on a plastic card and is electronically diminished every time we purchase something. In other words, the card has a memory.

At a hospital emergency room, for example, the card could identify the person's health-insurance carrier and transfer all necessary information from the microchip to an admittance sheet. Tests, treatment, billing and prescriptions could be processed more quickly using the card. Major clinical findings could be added to the medical information section within the microchip.

Smart cards typically hold 2,000 to 8,000 electronic bytes of data—roughly several pages of information. Because those bytes can be coded electronically, the effective storage capacity of each card is significantly greater than a few pages. Magnetic-stripe cards, such as those issued by banks and credit-card companies, lack the security of microchips but are cheaper to use as single-purpose cards. As a carrier of multiple records for multiple purposes, however, the smart card is superior.

Due to the high security level of smart cards and its off-line nature, it is extremely difficult to "hack" the value off a card, or otherwise put unauthorized information on the card. Because it is hard to get the data without authorization, and because it fits in one's pocket, a smart card is uniquely appropriate for secure and convenient data storage. Without permission of the card holder, data could not be captured or modified. Therefore, smart card could further enhance the data privacy of user.

WHAT IS A SMART CARD

A **smart card**, **chip card**, or **integrated circuit card (ICC)**, is defined as any pocket-sized card with embedded integrated circuits which can process information. This implies that it can receive input which is processed - by way of the ICC applications - and delivered as an output. There are two broad categories of ICCs. Memory cards contain only non-volatile memory storage components, and perhaps some specific security logic. Microprocessor cards contain volatile memory and microprocessor components. The card is made of plastic.

In the article “Smart cards: A primer” (DiGiorgio1997a), the smart card is defined as a “credit card” with a “brain” on it, the brain being a small embedded computer chip. Because of this “embedded brain”, smart card is also known as chip or integrated circuit (IC) card. Some types of smart card may have a microprocessor embedded, while others may only have a non-volatile memory content included. In general, a plastic card with a chip embedded inside can be considered as a smart card.



In either type of smart card, the storage capacity of its memory content is much larger than that in magnetic stripe cards. The total storage capacity of a magnetic stripe card is 125 bytes while the typical storage capacity of a smart card ranges from 1K bytes to 64K bytes. In other words, the memory content of a large capacity smart card can hold the data content of more than 500 magnetic stripe cards.

Obviously, large storage capacity is one of the advantages in using smart card, but the single-most important feature of smart card consists of the fact that their stored data can be protected against unauthorized access and tampering. Inside a smart card, access to the memory content is controlled by a secure logic circuit within the chip. As access to data can only be performed via a serial interface supervised by the operating system and the secure logic system, confidential data written onto the card is prevented from unauthorized external access. This secret data can only be processed internally by the microprocessor.

Therefore, smart card is not only a data store, but also programmable, portable, tamper-resistant memory storage. Microsoft considers smart card as an extension of a personal computer and the key component of the public-key infrastructure in Microsoft Windows

The important thing about smart cards is that they are everyday objects that people can carry in their pockets, yet they have the capacity to retain and protect critical information stored in electronic form.

TYPES OF SMART CARDS

Basically, based on their physical characteristics, IC cards can be categorized into 4 main types, memory card, contact CPU card, contactless card and combi card.

1. Memory Cards

A memory card is a card with only memory and access logic onboard. Similar to the magnetic stripe card, a memory card can only be used for data storage. No data processing capability should be expected. Without the on-board CPU, memory cards use a synchronous communication mechanism between the reader and the card where the communication channel is always under the direct control of the card reader. Data stored on the card can be retrieved with an appropriate command to the card.

In traditional memory cards, no security control logic is included. Therefore, unauthorized access to the memory content on the card could not be prevented. While in current memory cards, with the security control logic programmed on the card, access to the protection zone is restricted to users with the proper password only.

2. Contact smart card

Contact smart cards have a small gold chip about 1cm square on the front. When inserted into a reader, the chip makes contact with electrical connectors that can read information from the chip and write information back. The contact interface requires the card to be inserted into a card reader so that the reader can establish a direct electrical contact with the chip. Contact cards are generally used for a wide variety of applications, including financial transactions and logical access control. Contact cards have certain limitations. With age, these contacts get worn out. Electrostatic discharges, due to improper contact may damage the circuits. Cardholders some times pull out the cards from the reader before the transaction is completed, leading to what is known as Card Tearing. Rough handling and stresses during card insertion lead to damage of the card.

3. Contactless Cards

Even though contact CPU smart card is more secure than memory card, it may not be suitable for all kinds of applications, especially where massive transactions are involved, such as transportation uses. Because in public transport uses, personal data must be captured by the reader within a short period of time, contact smart card which requires the user to insert the card to the reader before the data can be captured from the card would not be a suitable choice. With the use of radio frequency, the contactless smart card can transmit user data from a fairly long distance within a short activation period. The card holder would not have to insert the card into the reader. The whole transaction process could be performed without removing the card from the user's wallet.

Contactless smart cards use a technology that enables card readers to provide power for transactions and communications without making physical contact with the cards. Usually electromagnetic signal is used for communication between the card and the reader. The power necessary to run the chip on the card could either be supplied by the battery embedded in the card or transmitted at microwave frequencies from the reader onto the card.

Contactless card is highly suitable for large quantity of card access and data transaction. However, contactless smart card has not been standardized. There are about 16 different contactless card technologies and card types in the market. Each of these cards has its specific advantages, but they may not be compatible with each other. Nevertheless, because of its high production cost and the technology is relatively new, this type of cards has not been widely adopted.

4. Combi-Card

At the current stage, contact and contactless smart cards are using two different communication protocols and development processes. Both cards have their advantages and disadvantages. Contact smart cards have higher level of security and readily-available infrastructure, while contactless smart cards provide a more efficient and convenient transaction environment. In order to provide customers with the advantages of these two cards, two methods could be employed. The first method is to build a hybrid card reader, which could understand the protocols of both types of cards. The second method is to create a card that combines the contact functions with the contactless functions. Because the manufacturing cost of the hybrid reader is very expensive, the later solution is usually chosen.

Sometimes, the term “combi card” is being misused by manufacturers. In general, there are two types of combined contact-contactless smart cards, namely the hybrid card and the combi card. Both cards have contact and contactless parts embedded together in the plastic card. However, in the hybrid card, the contact IC chip and contactless chip are separate modules. No electrical connections have been included for communications between the two chips. These two modules can be considered as separate but co-existing chips on the same card. While in the combi card, the contact and contactless chips could communicate between themselves, thus giving the combi card the capability to talk with external environment via either the contact or contactless method.

As the combi card possesses the advantages of both contact and contactless cards, the only reason that is hindering its acceptance is cost. When the cost and technical obstacles are overcome, combi cards will become a popular smart card solution.

CURRENT SMART CARDS APPLICATIONS

With the rapid expansion of Internet technology and electronic commerce, smart cards are now more widely accepted in the commercial market as stored-value and secure storage cards. Moreover, it has also been widely used as an identity card. For instance, in City University of Hong Kong, the old student/staff cards have been replaced by the hybrid-card based identity cards. This identity card can be used for normal access control as well as electronic payment.

The smart card has also been used in transportation such as the Octopus card which has replaced the old Magnetic stripe card. Medical record can also be stored in the smart card. This enables critical information of the patient to be retrieved whenever it is required. With the help of smart card technology, many secure data such as the computer login name and password can also be kept, so user need not remember a large number of passwords.

In the next chapter, we shall briefly describe some current applications of smart cards. These applications can be classified into 6 main categories: Electronic Payment, Security and Authentication, Transportation, Telecommunications, Loyalty Program and Health Care Applications.

I. Smart cards applications worldwide

Electronic payment Applications

Smart cards as electronic purses

A smart card can function as a cash replacement by holding an euro value which is reduced each time the card is presented to obtain goods or services. These are known as stored value cards'. The service provider keeps a record of the transactions and is reimbursed at regular intervals by the system controller. The service provider does not have to know the identity of the card holder. Cards may be disposable or rechargeable. Rechargeable cards can be topped up by paying cash over the counter or by transferring funds from a bank account. There are also card systems which allow for an automatic top-up of funds when the value in the card reaches a specified minimum amount. Details of recent transactions (usually up to ten) are recorded in the card's memory.

Electronic purses have the potential to operate simply as a substitute for cash by allowing completely anonymous transactions (like the today hard money notes) provided that information about the card holder or the card itself (such as a serial number) is not transferred from the card. However, the introduction of an electronic purse that allows a card holder to transfer money to the card from another bank account or identifies the holder at the time of the transaction (to reduce fraud if the card is lost or stolen), has the potential to reduce the anonymity of the traditional cash transaction (Lokan, CWI CAFE, Dawson, Gaskell, Mewett & Russell).

Stored Value Cards

Another use of smart cards in electronic commerce is Electronic token. It is an example of the stored-value card. The principle is that some memory in the smart card is set aside to store electronic tokens or electronic tickets. A smart card can store tokens for different services and each of the tokens can be refilled, depending on the types of the memory card. This allows the cost to be distributed over a number of services and over a much longer life span.

For example, the card could be used to pay for gas and instead of putting coins in a parking meter. Consumers load up the card from a vending machine. The card can then be used to operate the meters. One advantage of this system is that collections of coins would no longer be necessary. This would reduce the operation overhead and eliminate theft. This would also benefit the consumer as tokens could be bought and stored in the card in advance so it is not necessary to carry many heavy coins around. It is also possible that the card could monitor patterns of use and return the information to the merchant as well as the consumer, so better shopping model could be derived (McCrinkle1990).

Security and Authentication Applications

Cryptographic uses

From the point-of-view of the supplier and system operator, the main requirement of almost all machine-readable card systems is to ensure that the card presented is valid and the cardholder is indeed the person entitled to use that particular card. To verify the cardholder's identity, users are required to enter their PIN code (personal identification number). This PIN code is kept in the card rather than on the terminals or host machines.

Identification and authentication procedures take place at the card terminal. One of the problems is to ensure that the card furnishes some sort of machine-readable authenticity criterion. This can be solved by the use of encrypted communications between the card and terminal. It is well known that encryption can be used to ensure secrecy of messages sent and also to authenticate messages.

In order to perform the encryption procedure, the cryptographic smart cards must have the following properties:

- The cards must have sufficient computational power to run the cryptographic algorithms.
- The cryptographic algorithms must be theoretically secure. This means that it is not possible to derive the secret key from the corresponding texts.
- The smart cards must be physically secure. It should not be possible to extract the secret key from the card's memory.

Provided these conditions are met, and with advances in card microcontroller technology, the microprocessor-based smart card can be made to meet the required security level (Chaum1989).

For instance, Verisign and Schlumberger have developed the use of Cryptoflex smart card for carrying a Verisign Class 1 Digital ID (Verisign9701). Cryptoflex card is the first cryptographic smart card in the industry, which is designed based on the PC/SC specifications. This enables the use of smart card for portable Internet access with Microsoft Internet Explorer 3.0 at all sites accepting Verisign Digital IDs.

In Michigan University, the Cyberflex card has been used for storing Kerberos keys in a secure login project (Michigan9701).

Identity card

The identification of an individual is one of the most complex processes in the field of Information Technology. It requires both the individual to identify himself and for the system to recognize the incoming connection is generated by a legal user. The system then accepts responsibility for allowing all subsequent actions, sage in the knowledge that the user has authorization to do whatever he is asking of the system.

If a smart card is used, the information stored on the card can be verified locally against a 'password' or PIN before connection is made to the host. This prevents the password from being eavesdropped by perpetrators on the Internet.

Some of the smart cards will have personal data stored on the card. For example, the cardholder's name, ID number, and date of birth (Devargas1992).

Access control card

The most common devices used to control access to private areas where sensitive work is being carried out or where data is held, are keys, badges and magnetic cards. These all have the same basic disadvantages: they can easily be duplicated and when stolen or passed on, they can allow entry by an unauthorized person. The smart card overcomes these weaknesses by being very difficult to be reproduced and capable of storing digitized personal characteristics. With suitable verification equipment, this data can be used at the point of entry to identify whether the user is the authorized cardholder. The card can also be individually personalized to allow access to limited facilities, depending on the holder's security clearance. A log of the holder's movements, through a security system, can be stored on the card as a security audit trail (McCrindle1990).

The card could contain information on the user's privileges (i.e. access to secure areas of the building, automatic vehicle identification at entrances to company car parks, etc.) and time restrictions. All information are checked on the card itself. Access to different areas of the building can be distinguished by different PINs. Furthermore it can also track the user's movement around the building (Devargas1992).

Computer login

Access to the Computer room and its services can be controlled by the smart card. In terms of network access, smart card can authenticate the user to the host.

Furthermore, depending on the environment being protected the network access card can also perform the following functions:

- Manipulation of different authentication codes for different levels of security.
- Use of biometric techniques as an added security measure.
- Maintaining an audit trail of failures and attempted violations.

Meanwhile, in terms of access to the computer room itself, PIN checking can be done on the card without the need for hard wiring the access points to a central computer.

The identification of a user is usually done by means of a (Personal Identification Number) PIN. The PIN is verified by the microcomputer of the card with the PIN stored in its RAM. If the comparison is negative, the CPU will refuse to work. The chip also keeps tack of the number of consecutive wrong PIN entries. If this number reaches a pre-set threshold, the card blocks itself against any further use.

2. Transportation uses

Ticketing and Tollway systems

The smart card can act for a car park fee system, for ticketing or as electronic money for car drivers who would need to pay a fee before being able to use a road or tunnel.

SMARTPARK - a car park fee system

In the heart of the Melbourne central business district smart cards are being used to set car park fees depending on whether the driver has shopped in the associated shopping center's retail outlets. Introduced in 1993, the SMARTPARK system, works on the basis of an EPROM smart card in which the data is stored until the transaction is completed, at which time the data is erased and the card is re-issued to another driver.

SMARTPARK works like this:

- The car enters the car park where the driver is issued with a smart card and a pamphlet explaining how the SMARTPARK system operates.
- The card records the entry point for the car and the time and date of entry.
- The driver then enters the Melbourne Centre Shopping Centre.
- Each time the consumer makes a purchase at one of the retail outlets in the Melbourne Centre he or she hands over the smart card to the assistant. The assistant uses a reader to record the time, date and amount of purchase on the driver's smart card.
- When the driver exits the car park, the driver hands the card to the car park attendant. The card is inserted into a reader which calculates the parking fee on the basis of the amount of money spent by the driver in the shopping centre and the time spent in the car park. The card is retained by the car park attendant.
- The (anonymous) consumer habit information contained on the card is down-loaded onto the shopping centre's data base, before the information on the card is erased and the card re-issued to another customer.

A central feature of the SMARTPARK system is that the consumer is not identified individually or by car registration. However, the consumer's purchasing habits are recorded which enables the Centre's management to make decisions about the location of stores, opening hours and so on.

Designers of the system estimate that the card can be re-issued up to 10,000 times which makes it more cost effective than other card types.

The SMARTPARK system is an example of an anonymous smart card system in which personal information about the consumer is not known. At no stage during the transaction is the name of the consumer known, nor details of their car registration or demographic information (age, gender etc). However, given that there are commercial incentives for collecting and storing this information, particularly if it can be linked with purchasing habits, the system such as this one could be gradually expanded to incorporate loyalty schemes or other applications which identify an individual.

Hong Kong - ticketing system

A consortium in Hong Kong called Creative Star is establishing a ticketing system for the city's public transport system that includes trains, buses, trams and ferries. The contactless card will allow commuters to pass through the turnstiles without the need to insert the card into a reader. Instead, the commuter needs only take a wallet out and pass it near the reader which will then debit the amount of the fare from the card; the card holder need never take the card out of his or her wallet.

Commuters will be able to top up the value on the card by:

- taking the card to a Mass Transit Railway Corporation window and paying cash;
- establishing a direct debit arrangement with a savings account so that when the card reaches a certain minimum level, additional funds are added to the card; or
- placing the card in an automatic teller machine (ATM) and transferring funds.
- commuters will have the option of using an anonymous card or a personalised card which will contain details of the commuter's name, date of birth, Hong Kong identification number and eligibility for discounts (as a student etc).

Singapore - electronic road pricing

A trial involving contactless smart cards is being conducted in Singapore to replace manual tollway gates. A smart card mounted on the windscreen of the car is automatically debited by card readers mounted over the road as the car passes a toll station at speeds up to 120 kilometres per hour. The remaining balance on the card is visible to the driver through a liquid crystal display incorporated in the card. Unlike many of the models in Europe, the Singapore system does not identify individual cars or drivers.

The sensitivity of identified information about people's movements was illustrated in Hong Kong, where a system was proposed that would identify cars so that the owners would be billed each month for toll charges. Consumer fears about invasion of privacy, and the anticipated costs, forced the project to be abandoned.

Telecommunication Applications

Telecommunication is one of the largest markets for smart card applications. In 1997, payphone cards occupy the largest share of the smart card market. Over 70% of the smart cards are issued as payphone cards (Card-Tech1997) and this will continue to be the largest market in at least the next 3 years.

Since 1988, smart card has become an essential component in cellular phone systems. Network data, subscriber's information and all mobile network critical data are kept inside the card. With this card, subscribers could make calls from any portable telephone. Moreover, through the IC card, any calls through the mobile phone could be encrypted, and thus ensure privacy. In the future, more and more value-added services, such as electronic banking, could be supported by using this microprocessor card.

3. HealthCare Applications

Due to the level of security provided for data storage, smart cards offer a new perspective for healthcare applications. Medical applications of smart cards can be used for storing information including personal data, insurance policy, emergency medical information, hospital admission data and recent medical records. Numerous national hospitals in France, Germany and even Hong Kong have already started to implement this kind of healthcare card.

With the microcontroller on-board, smart cards could be used for managing the levels of information authorized for different users similar to a workflow control system. Doctors would be able to access the medical record from the patient's card, while chemists could make use of the prescription information stored on the card for preparing the medical treatment. Emergency data kept on the patient's card, which includes the cardholder's identity, persons to contact in case of accident and special illness details, can be used for saving the patient's life. In some countries, medical insurance is required for hospital payment. With the insurance records stored in the patient's card, the administrative procedures are simplified.

Health Passport

The health passport is a "smart card" that puts important health related information at the fingertips of parents, guardians and their children eligible for health programs.

Information for several different health care providers is kept securely in one place and can be read only when the cardholder authorizes its use. As a result a patient's health record will be more complete and accurate. The health passport allows cardholders to keep track of important information such as recent exam results, health related-contacts, immunization records, appointments, approved food benefits and much more.

It stores current and accurate personal information like address and phone number, contact information like providers' name and phone numbers and health information like height, weight and immunizations.

This information helps avoid duplication of tests and records. Participants can also use the card to keep track of appointments and referrals and other public health services for which they may be eligible.

Information on the card can be read or updated by using card readers located at participating health care providers. Cardholders can also read their cards at kiosks like this one located throughout the community.

4. Loyalty Applications

Loyalty program is another important application of smart cards in the shopping model. The preferred customer status together with detailed information on shopping habits is stored and processed on the smart card. With this information, merchants could derive better shopping model or tailor-make personalized customer shopping profiles. In addition, this shopping habit profile is kept in the customer's card; therefore, his/her shopping record could be kept confidential from unauthorized access.

As an extension to the loyalty application, stored value functions could be added. In current pay television systems, users' preferences are kept together with the electronic payment scheme. Users would not have to set their preferences each time they use the television system. As this card will also be used as the key to the television, users would not be permitted to use the television box unless they have paid their television fee. So sufficient security and convenient television usage could be guaranteed.

Smart cards applications in Greek society

1. Digital money-Electronic purse

According to a Greek daily newspaper smart cards intended to replace coins in a considerable number of our daily transactions. It regards the use of “intelligent” cards (Smart Cards) containing a chip and thus working like a small computer offering to cardholders the ability to do several daily transactions, purchases, etc without connecting a reader terminal or asking approval from the bank. Purchases and shopping of small value goods from super markets, even use of urban transport can be carried out with a simple “passage of” the card on a special appliance (card reader) that will be installed in the point of sale. Automatically, as soon as the card comes in contact with the reader the enclosed chip is activated and the value of the bought good or the amount of the transaction is subtracted from the credit amount of the card. Another function can be to add the amount in the card to the bank account of the cardholder.

As executives of MasterCard report, the technology called “Pay Pass” is already used in many European countries with great success and it is a question of time to be introduced in the Greek market. Moreover, the bigger Greek banks replace old credit cards with new “intelligent” (Smart Cards) that include an incorporated chip in order to create the appropriate condition for the new services. Related to the safety of the transactions, the Smart Cards do not require the use of password and contains a limited amount for daily transactions. In case the card is lost or stolen the damage will not be bigger than that of a loss of a wallet with a small amount inside.

2. Safe smart cards

Safe credit cards with intelligent chips including special codes are used in electronic transactions in order to solve the problems of safety in these transactions.

The most recent example constitutes the credit card Blue of American Express that is circulated in Greece by Alpha Bank. The particular card incorporates an intelligent chip, an advantage for the cardholder to undertake electronic transactions with increased safety. Beyond the factor of safety, in the advantages of the particular credit card are the consumer’s choices of maximum or minimum payment and dates of payments, as well as the support of complex reward programs.

Also another considerable number of “intelligent” credit cards with microchip (Smart Cards), that will ensure the safety of electronic transactions will come to the Greek banking market. Visa cards circulated to cover the increased needs at the duration of Olympic Games. In 2004 in the Greek market they were more than 25.000 “intelligent” cards that guaranteed the safety of transactions.

3. Digital payment in toll

Toll -way gate payment has changed the more at the beginning of 2004. According to the new system, the drivers buy or rent (with the proportional compensation) from certain shops a special card (a smart card). The card is mounted on the windscreen of the car and is automatically debited by card readers mounted over the road at the toll station as the car passes, without necessary reducing its speed.

The antenna that is installed at the toll stations, will record each car and the amount will be removed from the banking account of the driver. A similar system is applied already in Attica Road and in the Regional Avenue Hymettus (Manwlas).

4. Driving Licenses

The new European driving licenses will include a special microchip, similar to the passports, including all the necessary information. In Greece their use is expected to start from June 2008 (Ntelezos).

5. “Intelligent” cards in the investors

Smart cards are being given to all investors who wish to check their portfolio via special machines placed at the beginning of the roads Aioloy, Pasmazogloy and Sofokleoy in Athens and the road Katoyni 16-18 in Thessaloniki. In the near future this will also be possible via the ATM's of banks and the Internet. Already a pilot project runs with 2000 investors during 2004. If a smart card is used, the information stored on the card can be verified locally against a ‘password’ or PIN before connection is made to the host. This prevents the password from being infringed by perpetrators on the ATM or the Internet.

The smart card will hold personal data stored on it such as the cardholder’s name, ID number, date of birth, etc. These cards will contain identification information of an individual and therefore they can be something like “electronic identity”.

The investors may later use the smart cards as identities in public registration for obtaining shares. At the same time the transactions will be updated and viewed with the use of a PC. The smart card can authenticate the identity of the shares’ holder in the general assembly of the company. According to the schedule of the exchange company during 2005 leaflets and questionnaires will be sent to the investors. In these questionnaires the investors will declare whether they wish to receive the AXIAcard (smart card) or not for their exchange transactions (Stergiou).

6. Smart cards with microchip in the urban transport

Soon the “intelligent” tickets, the “intelligent” family-weekly cards and the “intelligent” unlimited route cards (ie smart cards) will be available in the urban transport of Athens. The ministry of Transports and Communications and the Organizations of Urban Transport Athens (OASA) decided to go ahead in the application of new system of Automatic Collection of Fare for the urban transport of Athens (Athens Automated Fare Col-

lection System - AFC). The new system will cover all the transportation means that is in use today or they will be activated in the future and more specifically will comprise: the blue buses, the trolleybuses, the electric railway, the Underground, the tram and the suburban railway.

The minister of Transports and Communications Christos Berelis announced yesterday that the project will be executed in two stages. In the first stage (it will be in 2004) foreseen that will take place the replacement by “intelligent cards” (Smart Cards) of the paper monthly cards, the annual cards of unlimited route and the paper cards of free transportation. Also it is forecasted the creation of new “intelligent” card (Smart Card) of multiple routes that will be used in all means of mass transport. The paper ticket for a “simple route” will remain as it is today. Also, is foreseen that will be done the development and maintenance of the required infrastructures (editorial, abrogative, back office, network infrastructure, management of cards) that are necessary for the support of new system.

The second stage is related with the replacement of the simple paper ticket with the “intelligent ticket” (Smart Card). The passenger will travel with this ticket in all means of mass transport. Each time that he will pass it through the checking machines the ticket fare will be reduced from the amount stored in the card. As soon as the amount of card is diminished there will be available refilling machines in stations and in appropriate points. The refilling machines will be special tools called “ATIM” (like the ATMs of the banks). The same cards might be used for the payment of tolls, for the shopping in markets, for the payment of parking and for the calls from the phone tolls of the GREEK TELECOM (OTE). The budget of the first phase of the project amounts to 16,1 billions drachmas (47,2 millions of Euros).

IMPLICATIONS OF SMART CARDS

The world is undergoing a revolution to a digital economy, with pronounced implications for corporate strategy, marketing, operations, information systems, customer services, global supply-chain management, and products.

In looking at the information available on smart cards, it is apparent that there are compelling reasons to use this technology to provide new solutions to some electronic payment problems, social situations, every day's problems and others.

Internationally accepted smart cards, such as those being developed by Visa and its member financial institutions, will be increasingly available over the next several years. In fact, many parts of the world already use them.

Technological advances in smart card development have the potential to change the face of modern society, not least in the banking environment. Such advances can radically change the way that consumers and service providers interact and exchange services, offering the development of new channels of distribution (Plouffe et al 2001a). Thus, smart cards are seen as critical to the modernization of the economy and the development of the Information Society (ICTSB Project Team 2000, eEurope Smart Cards 2002).

Smart cards are set to experience a boost in the marketplace over the next few years, with the potential to be in common use within the next 5 years. Europe is a leader in the smart card industry; the main innovations for smart card techniques and applications have been made in Europe since the 1970s and there is a concentration of expertise in all smart card related areas (Ankri 1999, Longo and Stapleton 2002). Indeed, Europeans use smart cards on a regular basis for a diverse range of applications, including stored value cards (e.g. pay-phone cards), health data storage and e-purse (Longo and Stapleton 2002). In 1998 approximately 90% of worldwide smart card production was in Europe, and, during 2000, 2390 million smart cards were produced by European manufacturers (CEN 2000).

Smart cards offer a clear advantage to card issuers, merchants and customers. They reduce cash handling expenses, reduce losses due to fraud, expedite customer transactions and enhance customer safety and convenience. In addition, new services will begin to evolve, or payment mechanisms for existing services will start to change. For example, through the use of smart cards, software could be paid for on a per use basis instead of through a license fee. Journalism could be bought by the article much more easily than today. Many companies would be able to set-up an on-line business and begin to receive revenue.

This European evolution in the use of smart cards is natural to affect the Greek market too, and regarding the applications referred in chapter 4 it is logical to be some positive and negative implications in the exchanges of citizens with banks, merchants, service providers etc and in life generally.

I. Implications from the complicated uses of smart cards

With the use of credit cards which incorporate microchip, apart from the traditional transactions, complex and multiple applications can be executed improving our daily life and saving important time .

As an example, an intelligent credit card could support an electronic wallet of predefined amount for the small daily transactions with the property to be “reloaded” in the ATM of banks or in the terminals of transactions of cards. Also can be used in POS(Point Of Sale) of the shops helping customers in their transactions with shops, merchants and etc.

Another application with vital consequences on the citizens’ life is the use of smart card in health by storing medical information of the holders so that it can be used in an emergency case. Moreover the smart card can function as credit or debit card of a connected bank account via ATM, making our transactions safer.

Last but not least smart card holders can easily access internet with increased safety(Papaioannou 2003).

2. Electronic payment affects Greek lifestyle

Electronic payments with new “pay pass” smart cards are coming soon in the Greek market changing the shopping habits of Greeks; only with their demonstration in the cashier the transaction will be automatically executed and the customer will take receipt.

Smart cards “pay pass” are intended for daily use, for fast and small valued transactions, as in fast-food and etc. Their technology is analogous to the appliances used in the automatic payment of road tolls. And if this appears a scientific imagination, cards in the size of a key ring have already appeared in Turkey, while MasterCard in collaboration with Nokia try a new mobile phone which will be a credit card simultaneously. These are the results of the development of the chip card technology. These chip smart cards have already entered in the Greek market, have memory and function as microcomputers. They provide big safety as they cannot be copied, while they do not need to be placed in the classic parallelogram plastic which is used today in the credit cards. These chips can also be put in glasses, in earrings and etc. As Mrs Ozlem Imece explained, general director of office of MasterCard for Turkey and the SE Europe, the markets of Greece, Israel and Balkans are demanding markets. They want cards in order to make their transactions easier, faster and safer, targets that can be succeeded by “pay pass” smart cards. They also want credit cards designed to be practical in the daily use and in their carriage, characteristics that the new cards offer without corners, in key ring shape. As she said this is one of the reasons that MasterCard will open in Greece new office for the region Greece-Turkey and ES Europe to import such products.

The new credit cards will not require password and special approval of transactions. Only with the demonstration of the cards, transaction will automatically be executed and the customer will take receipt.



3. The use of electronic payment facilitates and improves the Greeks' financial habits

Finally, the Greeks will say good buy to small coins [psila] in a line of daily transactions, as in 2007 is expected to come in the country the first "intelligent cards" (smart cards) that they will replace the payment by cash [metrita]. Purchases in kiosks, entry in the Underground and in the means of mass transport, payment parking and a lot of other daily transactions that today are processed with coins, might also be realised via the new generation of Smart Cards that are expected to be in use at early of this year. These cards will be already charged with the payments of purchases or services and will be renewed via ATM or they will add up the cost of transactions and the cardholder will receive monthly account in his house. It will be something analogous to credit cards, with the difference that will not be required signature or typing of special code. This will reduce the minimal time that is required for the transactions. Already Greek banks and enterprises discuss with Visa and MasterCard (which posses the international know-how) to develop and apply this technology in the range of their products. Moreover such transactions are already realised in pilot level in Britain and in France, and if the experiment achieves, they will also be extended at an early date in remainder Europe (Pefanis 2006).

4. Guaranteed safety with smart cards

The smart cards with the incorporation of microchip, combine increased safety of transactions and management of "intelligent" customer's services. Contrary to the existing credit cards that are published today with "magnetic strap" and have limited storage capacity, the main characteristic of this new card is the embedded microprocessor of capacity from 4 until 64 Kbytes, which provides the possibility of storage of data related to the consuming habits of holders. The banks, having access and capability of treatment of this information, can develop and manage complex programs of customer's services, like programs of rewarding customers, something that it is a long-term objective of the banks.

With the "intelligent" credit cards the banks will have the possibility of further breaking their portfolio and consequently the creation of flexible products. As a result they will extend considerably the range of provided products and the specialised services fulfilling special needs of their customers. An additional advantage of smart cards with microchip is the reduction in the telecommunications' costs of electronic transactions through terminals, since theses cards can work autonomous without the approval of the transaction from a central system.

Furthermore they offer increased safety, and consequently problems due to wretched use of factitious cards (lost or stolen) are expected to be reduced considerably. This safety is guaranteed due to encryption of personal details and private data which are saved in the chip of the smart cards. (G.Papaioannou 2003)

5. Negative implications from the use of smart cards in driving licenses and vehicles identification cards

The ministry of Public Order and the ministry of Transports of Greece will cause additional annoy and discomfort to the citizens because they will have to queue for long time in order to obtain their driving licences and vehicle identification cards! The minister of Transports Michalis Liapis, and the minister of Public Order Byron Polydoros, announced yesterday that from the next year the driving licences change form. The current

pink driving licences and the green vehicle identification cards will be replaced by “intelligent cards” with embedded microchip which will contain all data of drivers and vehicles.

The new driving licences and vehicle identification cards will not be issued by the Transport Authorities of prefectures, as it happens up to now, but by special authority of Public Order ministry. For this purpose all prefectures of the country will forward the necessary documents to this authority. More specifically, the prefectures will hold the examinations of the candidate drivers, but the succeeded drivers will receive their driving licences from the ministry of Public Order. Executives of ministry of Transports characterize “the procedure extraordinary which will cause new enormous problems of discomfort and annoy in citizens”. It is remarkable that each year in Greece are granted roughly 300.000 new driving licences and roughly 450.000 vehicle identification cards.

Today the issue of new driving licences and vehicles identification cards takes roughly 4-5 days, while the replacements of driving licences is done on the same day. The same executives point out and add that with the new process, the new driving licences and vehicle identification cards will delay much longer, as it happens today with the passports’ issue. They say “If the process is also applied to those who they possess already driving licences- they are roughly 8 millions – and replace as well the vehicles identification cards - roughly 6 millions - then it will become a real chaos”(Ntelezos 2006).

6. Negative implications on life of students and citizen

The “intelligent cards” affect also the children life because they are used in the schools to follow-up the kids, to know where they are each moment, what they eat and which books are rented by the library. The same time the government plans to use a new system of biometric cards of identity, where various biometric elements - as finger imprints and eye-iridoskopisis - will be retrieved from a base of data with personal elements.

The commissioner of Information, who is approved by the government but he refers to the Parliament for subjects of personal data, proposed the performance of a public dialogue in order to examine what is acceptable and what not.

At the same time he accepts that surveillance of the society helps in solving some serious problems like the fighting of terrorism and crime.

He mentioned that “I would like a more comprehensive discussion so that the citizen will consider of what will happen in the future if the cameras are also equipped with microphones and if satellites spy and check each driving mile of our cars”. He pointed out that it is necessary for the politicians to establish clear borders of control which the police and other law authorities cannot exceed (Angelopoulos 2002).

Conclusion

Modern society needs an enormous amount of information to function. Computers give us the means to process this information. Smart cards give us a way of individualizing the handling and control of this information.

Smart cards are set to revolutionize transactional systems over the next few years by offering security and trustworthy systems for European citizens that will boost electronic and mobile commerce.

Greece as a member of European Union has to follow and utilize several European programs and projects regarding the development and application of Smart Cards. Such a major program is the eEUROPE framework of eEUROPE SMART CARD initiatives which ultimately seeks to utilize Smart Cards on the direction of enhancing public services for all European citizens.

The eEurope vision is to make an information society reality, and the eEurope Smart Cards initiative has a major role to play in realizing this vision.

Managers need to take a close look at their markets and their products to determine what their best strategy is, regarding electronic card systems. In the long run, you can count on mass acceptance of electronic card payment systems. However, managers need to ask themselves many questions. Does our current payment handling system offer the level of service our customers expect? Is the electronic card payment industry heading in a direction that best suits our business? If not, should we get involved in the standardization effort to ensure our interests are considered? Would it be advantageous to implement our own electronic payment system before a multifunctional card is widely accepted? If we develop our own electronic payment handling system, do we adhere to the developing standard? The answer to such questions can help companies in the development of smart cards strategy.

Following the culmination of the eEurope Smart Cards two-year plan, EUROSMART RESET (September 2002) will act as a 'roadmap project' to investigate future research needs for smart card technology focusing on communication and network protocols, systems and software, interface technologies, peripherals, subsystems and Microsystems, high end cryptography, tamper-proof and security technologies, microelectronics. This project will be a valuable source of information regarding smart card development over the next few years.

Smart cards represent a core enabling technology for the advancement of transactional systems within Europe, with the ability to enhance transactional security, to underpin consumer confidence in such transactions, and, increase convenience and mobility for the consumer. The eEurope Smart Cards Initiative focuses on:

- The need for a legislative framework ensuring a smooth operation and management of smart card schemes across Europe.
- The development of standards and certification processes to promote interoperability amongst smart card schemes, working towards a consensus amongst interested parties about the key directions for smart card development. The main foci of which are identification processes, multi-application cards, a generic card reader and contactless technology;
- The development of proactive business strategic plans to promote the success of electronic and mobile commerce, including the promotion of an atmosphere of 'co-competition';

- Gaining a better understanding of the consumer issues that affect adoption of smart card innovations (including relative advantage, compatibility and user perceptions of power and privacy, security and trust) and the specific user requirements for the user-system interface;
- Development of ways forward for enhancing public services utilizing smart card technology.

The eEurope Smart Card Initiative will make a significant contribution to the advancement of smart card development, addressing many major barriers.

The challenge will be to combine the emergent research and development strands into a coherent whole that will inform the next generation of smart card innovations and facilitate electronic and mobile commerce. These exciting developments will take place within a dynamic environment characterized by increasing demands from consumers, merchants and financial institutions with regard to faster, more efficient services; where it is envisaged that interactive TV with chip card reader for set top boxes, PCs with chip card readers and dual-chip/two-slot mobile phones will be commonplace (Jones 1999).

Eventually smart cards have the potential to influence the way that we shop, see the doctor, use the telephone, and enjoy leisure activities. The use of smart cards technology will benefit the individual and increase the quality of life.

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