DEVELOPMENT OF AN ADOPTION MODEL TO ASSESS SMART CARD
TECHNOLOGY ACCEPTANCE

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ABSTRACT

Smart card technology is one of the most recent computer revolutions, and among the fast growing usage of new technologies, smart card technology has an outstanding growth and making its way worldwide into the hands and wallets of everyone. Today smart cards are used all over the world as personal identification cards, corporate building security systems, personal computer equipment access control and etc. Governments, financial services, transportation, telecommunication, healthcare, education, retail, and many other industries are planning to or already using smart cards as a means of providing better security and improved services to its customers and users. In fact, smart cards greatly improve the comfort and security of any transaction. It is important to note that consumer acceptance and confidence are vital for the further development of smart card technology or in the other word, acceptance has been viewed as a function of user involvement in smart card systems development. Understanding the factors that influence user acceptance of information technology is of interest to researchers in a variety of fields as well as procurers of technology for large organizations. The purpose of this study is to present a general overview of smart cards, its characteristics, features, and applications, and develop an adoption model to evaluate the user acceptance of smart card technology in Iran. In order to obtain this goal, the online survey will be conducted and it will be introduced among the five private universities' students in Iran and ask about their acceptance of smart cards based on the factors included in the propose model.

ABSTRAK

Teknologi kad pintar adalah salah satu daripada revolusi komputer terkini yang pesat penggunaannya. Perkembangan kad pintar yang pantas dan meluas membolehkan setiap orang memilikinya. Pada masa kini, kad pintar digunakan di serata dunia sebagai kad pengenalan diri, sistem keselamatan bangunan korporat, kawalan capaian peralatan komputer peribadi dan lain-lain lagi. Sektor-sektor kerajaan, perkhidmatan, kewangan, pengangkutan, telekomunikasi, kesihatan, pendidikan, peruncitan dan lain-lain industri telah atau sedang merancang untuk mengguna pakai kad pintar sebagai satu kaedah penyediaan keselamatan yang baik dan menambahbaik perkhidmatan kepada pelanggan dan penggunanya. Malah, kad pintar juga telah meningkatkan keselesaan dan keselamatan sebarang transaksi yang dijalankan. Penerimaan dan keyakinan pelanggan adalah sangat penting untuk dipertimbangkan bagi pembangunan teknologi kad pintar seterusnya, atau dengan lain perkataan penerimaan dilihat sebagai satu fungsi penglibatan pengguna dalam pembangunan sistem kad pintar. Kefahaman terhadap faktor-faktor yang mempengaruhi penerimaan pengguna terhadap teknologi maklumat telah menarik perhatian sebahagian besar penyelidik dalam pelbagai bidang, juga para pemeroleh teknologi dari organisasi-organisasi besar. Matlamat kajian ini adalah untuk membentang secara umum gambaran keseluruhan kad pintar, ciri-ciri dan aplikasinya, dan membangunkan satu model penerimaan untuk menilai penerimaan pengguna terhadap teknologi kad pintar di Iran. Untuk mencapai matlamat ini, kaji selidik dalam talian dilaksana dan diperkenalkan kepada pelajar-pelajar di lima buah universiti di Iran bagi mendapatkan maklumbalas tentang penerimaan mereka terhadap kad pintar, berdasarkan faktor-faktor yang terangkum dalam model cadangan.

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CHAPTER 1

INTRODUCTION

In this beginning chapter, a brief introduction to this study and an insight to the research area are given. This begins by discussing the background of smart card technology and its fast growing applications. The background of the problem to be solved is described. Then, the problem statement, objective, scope, and significant of the study are described respectively. In this study acceptance and adoption terms are used interchangeably.

1.1 Introduction

Smart card is a simple plastic card, just at the size of a credit card, with a microprocessor and memory chip embedded inside a smart card. The chip holds data with appropriate security. This data is associated with either value or information or both and is stored and processed within the card's chip, either a memory or microprocessor. Beside its tiny little structure it can has many functions such as storing data, making calculations, processing data, managing files, and executing encryption algorithms.

Smart cards provide maximum security and convenience, and also data portability. It makes possible sophisticated and portable data processing applications, and has proven to be more reliable than magnetic strip cards. The interest in smart card technologies worldwide is driven by several factors, including security against identity theft, web fraud, efficiency of service delivery and user convenience.

Governments, financial services, transportation, telecommunication, healthcare, education, retail, and many other industries are planning to or already using smart cards as a means of providing better security and improved services to its customers and users. In fact smart cards greatly improve the comfort and security of any transaction.

With the advancement in the smart card technology and the common technology, the smart cards will be replacing cash, identification cards, Passports, airline tickets, licenses, medical records for patients, credit cards. This all is achievable due to increased memory capacity and better security using data encryption (Al-Alawi and Al-Amer, 2006).

Assume a student at a university may use the university identification card (ID card) as a basic form of identification to gain access to the university's facilities, using university library, purchase meals or decrease value from a meal plan, purchase materials and supplies from the university store, or use university's vending machines. Additionally, some cards may also be used to access the university's computer systems, network and intranet or internet. In this situation, likelihood the contactless reader cannot detect the smart card.

The use of multiple technologies or multi-application on a single ID card can reduce card issuance and administrative costs and provide users with the convenience of a single access ID credential. One example of a multi-application card is the student campus ID card. But the point is that, the students should accept the new technology otherwise developing new technology will not be successful.

It is important to note that consumer acceptance and confidence are vital for the further development of smart card technology or we can say that acceptance has been viewed as a function of user involvement in smart card systems development.

Generally, acceptance is defined as an antagonism to the term refusal and means the positive decision to use an innovation (Simon, 2001). Several researches developed theories and models to describe and analyze user acceptance and each of

these models determines different factors to explain user acceptance. This study is going to combine previous studies and develop a model to investigate the user acceptance of smart card technology.

1.2   Background of the Problem

Take a look in Iranian wallet and what will be found? Notes, coins, driving license, a library card, paper identity card and other cards will be found. All these documents could be replaced by just two or three smart cards because they can store and protect relatively large amounts of data. Smart cards are being used in a number of ways around the world, replacing a wallet's content bit by bit (Fancher, 1997). By adopting smart card technology one card can be used for all.

Smart cards greatly improve the comfort and security of any transaction. They protect against a full range of security threats, from careless storage of user passwords to sophisticated system hacks. There are a lot of advantages to use of smart cards for wide variety of daily tasks like; Stored Value, Securing Information and Physical Assets, e-Commerce, Personal Finance, Health Care, Network Security, and Physical Access.

Assume person X is working in a large company. Then each of the employees has access permission to different facilities and different physical places. And also he/she needs to access the servers inside the company for various purposes like sending mail and accessing the databases of the company. Now, if there is one lock for each door and just one password for each server and some money in his/her pocket to buy things from the local restaurant, so he/she needs to carry a lot of things and memorize many passwords, but actually he/she could use only one smart card for all these.

In order to reduce the number of vehicles stuck in congestion, especially for stop and go traffic at toll plazas, the establishment of smart card systems has been a hot issue and dominant trend in many countries. Faced with annually increasing

demand for travel and transport of goods, transportation systems are reaching the limits of their existing capacity. Heavy highway congestion has become one of most serious urban problems for Iran.

By using the smart cards banks have been able to replace their current cards (ATM, debit, credit account, and travel and entertainment cheque) with one card. Beside that smart cards are also being used in quite a few countries as electronic purses (such as Singapore). On the other hand, many retailers have started using smart cards as loyalty card (Haddad, 2005).

Nowadays the main trend is the use of multiple application cards. A multiple application card is a smart card that can support different types of applications on the card itself thereby reducing the number of cards in the wallet. The big scale use for this card is a national e-ID for the citizens (such as Malaysian identity card) (Al-Alawi and Al-Amer 2006). A quickly growing application is in digital identification cards. In this application, the cards are used for authentication of identity. National identity schemes are used in over a hundred nations, and may combine the functions of social security cards, driver's licenses, immigration documents, and other identification documents.

Smart card implementation must be clear to the users or cardholders, or at least have minimal impact on them. Although the technology used to implement a smart card program is important, educating and supporting the end users is also significant. Technology should be introduced to people and they have to be aware of its characteristics, features, and advantages. Also user awareness is a key to act against fraud and identity theft. The users need to understand what the card is doing; sometimes users do not know how they should use their cards and even what are the advantages of using them, and how they can benefit users. As we know, different applications involve different user behavior so they should be aware of the usage and application of smart cards.

Cultural differences that exist between different countries may affect on user understanding and utilization of technology. On the other hand, there are some habits which are so difficult to change due to these cultural differences.

Both practitioners and researchers have a strong interest in understanding why people accept information technology so that better methods for designing, evaluating, and predicting how users will respond to new technology can be developed (Dillon and Morris, 1996). Acceptance has been viewed as a function of user involvement in systems development as a measure of the political climate in an organization (Dillon and Morris, 1996).

1.3   Statement of the Problem

A smart card is a plastic card with an embedded microprocessor chip (usually small gold-colored metal module), capable of storing a significant amount of data and performing basic computing operations. Most smart cards resemble the size of a standard credit card (Rankl and Effing, 2003).

User acceptance is very important to the successful implementation of a smartcard. Being user-friendly and ease of use are the main factors to achieve the user's acceptance. In all applications, the training of the user is a key element that you need to integrate in any kind of smart card deployment. An application's features play an important role in determining whether individuals involved in an activity will use it or not (Venkatesh. et al, 2003). The user needs to understand what the card is doing, how he needs to protect the card and why he needs to protect the card.

It is important to note that consumer acceptance and confidence are crucial for the further development of smart card technology as the underlying issues which demand more control, security, privacy, flexibility and ease of use (Rankers et al., 2001; Powell, 1999; Argy and Bollen, 1999).

User support is a major factor in the success of a smart card implementation and has stressed the importance of ensuring proper communication, education, and functional support. Smart card implementation must be clear to the users (i.e., cardholders), or at least have minimal impact on them. The technology used to implement a smart card program is important and also educating and supporting the end users is important.

User's awareness about smart card can assist them to understand the technology, for instance, contactless card adopters must be aware of the probability of slow transactions or business logic problems when more than one card enters the radio frequency field (for example, if a cardholder has two in a wallet), or where the reader must deal with more than one modulation scheme. Cardholder education is needed to deal with the first problem, and in the second case, it is highly preferable to choose a single modulation scheme.

Smart cards are multi-functional, cost effective devices that can be easily adapted for both physical and logical access. For example, think that you are working in a large company. Then each of the employees has access permission to different facilities and different physical places. And also you need to access the servers inside the company for various purposes like sending mail and accessing the databases of the company. Now, if there is one lock for each door and just one password for each server and some money in your pocket to buy things from the local restaurant, so you need to carry a lot of things and memorize many passwords, but actually you could use only one smart card for all these.

The general question of this study is:

> *What is the attitude of Iranian towards the adoption of smart card?*

In order to be able to answer this question, a set of research questions that address the problem in detail are defined as follows:

- ➢ What is smart card and how is it deployed?
- ➢ What are the smart card applications?
- ➢ How they can benefit users?
- ➢ What are the advantages of smart card?
- ➢ What are the different types of smart card?
- ➢ How is the security of smart card?
- ➢ What are the technology acceptance models?
- ➢ What functions can affect on user acceptance?
- ➢ What is the model to determine smart card acceptance in Iran?

1.4   Objectives of the Study

The aim of this project is to investigate the adoption of smart card technology in Iran. The research objectives would be as follows:

I.   To identify the characteristics, application and technology of smart card

II.   To develop an adoption model

III.   To assess the smart card technology acceptance in Iran

1.5   Scope of the Study

This study is going to develop a model to investigate the user acceptance and the questionnaire will be distributed. This study only focuses on the factors which are included in proposed model to investigate user acceptance in Iran. The respondents for this research are 900 students from five private universities in Iran.

The five universities in Iran which have been selected as case study are listed below:

- ❖ Tehran Islamic Azad University
- ❖ Damavand Islamic Azad University
- ❖ Karaj Islamic Azad University
- ❖ Shahriyar Islamic Azad University
- ❖ Bandar Abbas Islamic Azad University

1.6 Significance of the Study

Right now, in most of the countries, inside the people's wallet, they probably have a couple of credit cards, an identification card, an automatic machine teller card (ATM card), and maybe a few other plastic cards. Without realizing it, these plastic cards have become a very important part of their life.

The applications of smart cards include their use as credit or ATM cards, in a fuel card, SIMs for mobile phones, authorization cards for pay television, high-security identification and access-control cards, and public transport and public phone payment cards (Haneberg, et al. 2007). Lack of user acceptance is a significant impediment to the success of new information technology system. In fact, users are often unwilling to use information systems which, if used, would result in impressive performance gains. Therefore, user acceptance has been viewed as the pivotal factor in determining the success or failure of any information system project (Davis, 1986).

Adoption of smart card technologies should not be made simple, knowing the customers perception of and behavioral intention to use technology should be the key in the decision-making process. Smart card technology is not well defined in Iran and therefore it is not used in a large scale. As an example we can mention to ATM machines which are available in Iran but some of the people prefer to carry cash instead of using smart card.

Findings of this study could be used by policy makers and stakeholders. The literature review revealed no existing studies investigating smart card acceptance related to Iran. Hence, this study will contribute new information to the body of knowledge in this field. It will also serve as a benchmark study to guide future actions, as well as to put the Iran on the map of e-health and information and communication technology users, attracting attention of international funding bodies to support the process of e-health adoption.

The current literature, which specifically addresses acceptance of smart card technology, and their usage and implementation, is somewhat sketchy. Most of the literature focuses on specific case studies. Yet, there is very little literature about the concept and ideas on the philosophical and practical implications of smart cards in Iran. This study (outlines the basic concepts of smart cards) provides a brief description of what a smart card technology is and how it can be used in different applications. It is the intent of this study to provide important information that will present a backbone for future study into the problems surrounding the acceptance of information technology and especially smart card technology in Iran.

User acceptance is the one of the most critical factors. Rajiv Chaudhry quotes that "you can design the best process in the world, and back it with the latest and greatest technology, but if your people don't buy into the project, it will not work."

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