Smart Card Adoption Model: Social and Ethical Perspectives

Hamed Taherdoost¹, Shamsul Sahibuddin², Meysam Namayandeh³, Neda Jalaliyoon¹, Alaeddin Kalantari², and Saman Shojae Chaeikar⁴

¹Faculty of Computer Science and Information System, Islamic Azad University, Semnan Branch, Semnan, Iran
²Advanced Informatics School, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
³Faculty of Computer Science and Information System, Islamic Azad University, Isfahan Branch, Tehran, Iran
⁴Faculty of Computer Science and Information System, Islamic Azad University, Khorramabad Branch, Khorramabad, Iran

Email: hamed.taherdoost@gmail.com

Abstract – In the current growth of information technology (IT), without realizing, smart cards have been brought as an ideal device for any transaction such as transportation, healthcare, e-commerce, telecommunication, banking and many other applications. Smart card improved the quality of services in terms of security and customization for users. Recognition of aspects which affect on smart card usage is crucial for sophisticated consumer with respect to ethical action and reaction, where knowing the customers ethical and behavioral intention to employ smart cards should be the main part in any decision-making procedure. In this study, a short review on ethical scenarios are introduced to identify personal understanding of ethical circumstances by using smart cards and furthermore, an adoption model is developed from the ethical and social perspective based on previous acceptance models, ethical frameworks and ethical scenarios.

Keywords – Smart Card, Adoption, Computer Ethics, Technology Acceptance, Intention to Use, Attitude toward Usage, Customer Satisfaction

1. Introduction

Smart card is called ‘smart’ because it contains a computer chip. Indeed, smart card is often referred to as ‘chip card’ or ‘integrated circuit card’ [34]. Smart card is a simple plastic card just as a size of credit cards that provides maximum security and convenience, and also data portability. It makes possible sophisticated 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 [35].

Smart cards are secure devices that enable positive user identification and they are multi-functional, cost effective devices that can be easily adapted for both physical and logical access. Logical access control concerns such familiar principles as password checking or the more sophisticated cryptographic mechanisms for authentication such as windows logon, virtual private network (VPN) access, network authentication, biometric storage and others. Physical access control relates to ID badges and building access control. Importantly, smart cards technology includes a wide range of applications and additional physical forms, than just plastic cards [34].

Over the past century, it is undeniable that social constructivist and information technology has achieved a bright technological development for us. It has facilitated the globally interdependent technology in which we use, has altered our sense of our place in the universe [28]. Using smart card is emerging day by day throughout daily advertisement, posters and social programs.

To ensure successful effect of information technology, various controls and measures is implemented, current policies, smart card application and guidelines between information technology developers are the most useful examples of information technology (IT) growth [36]. An interesting point of analysis on these topics is on ethical issues which remain the heart of this study in order to develop and suggest a model to realize problems and complicated concern on smart card adoption and related ethical behavior.

For novel technology development in any educated society, acceptance measurement is more significant rather than relevant advantages and usefulness. In fact, user acceptance is considerable and ongoing progress that likely be made in improving the human-computer interface where public use of smart cards may root from educational basis to ethical behavior of end user under the certain circumstances of information and telecommunication technology [36].

As with so many other subjects, ethics is best understood when its principles are applicable in real life situations, and bridging the gap between theory and practice would be one of the biggest challenges of scholars. For that reason, while developing a social model based on our research we have developed a learning approach to supplement the suggested model and relevant social models. The scenario themes are based on experiences and observations during our previous research on computer ethics and smart card technology acceptance. However, lack of appropriate awareness and planning in undeveloped courtiers would be the current difficulty of many researchers and scholars [38]. From ethical point of view [28] and smart card adoption model [24], people prefer to use smart card due to following reasons stated as follows: ease of use, usefulness, transaction speed,
mobility and security. On the other hand, the concerns which force end user unmotivated to be away from this technology innovation may focus on fraud, misuse, duplication and unethical behavior of consumers.

In this paper, the authors suggested social acceptance model for future successful use of smart card with respect of ethical scenarios and reviewed models.

2. Social Models Perspective

In this part, some of the previous acceptance and ethics models such as PAPA, Moral Model, Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) are studied, in order to clarify aspect of smart card technology adoption model from ethical perspective detail.

2.1. PAPA

According to [19] decision makers place such a high value on information that they will often invade someone's privacy to get it. It contains four elements which are: privacy, accuracy, property and accessibility. Manson stated, these four elements are general human weaknesses that cannot be a part of their ethical behavior. Furthermore, he mentioned that the ethical issues involved personal behavior and professional practice.

In PAPA model, privacy is defined as the claim of individuals to determine when, to whom, and to what extent individually identified data about them is communicated or used. Also, accuracy represents the legitimacy, precision and authenticity with which information is rendered [35]. Because of the pervasiveness of information about individuals and organizations contained in information systems, special care must be taken to guard against errors and to correct known mistakes. Another element of the PAPA model is property which is one of the more controversial areas of information technology and ethics concerns the intellectual property rights connected with smart card ownership. Finally, accessibility means the information that a person or organization has a rights or privilege to obtain with which level of access and safeguards.

2.2. Moral Model

Related research [22] stated that, the heart of interest of any ethical situation and development is morality of end user. As Fig. 1 shows, Melissa [22] argued this an important factor of ethical issues from educational point of view where different ethical guidelines have been introduced in order to evaluate and educate of beneficial ethical opportunities.

In this model, researchers wanted to create educational opportunities that allow students to examine their existing beliefs regarding ethical and technical issues and in relation to existing technical, professional, legal, and cultural solutions [22].

2.3. Theory of Reasoned Action

Drawn from social psychology, Theory of Reasoned Action is one of the most fundamental and influential theories of human behavior, derived from previous research that started out as the Theory of Attitude [18], which lead to the study of attitude and behavior. It has been used to predict a wide range of behaviors [8].

As it is shown in Fig. 3, TRA defines relationships between beliefs, attitudes, norms, intentions, and behavior. According to this theory, an individual's behavior (e.g., use or rejection of technology) is specified by one’s intention to perform the behavior, and individual’s attitude toward performing the behavior and subjective norm influence the intention, specified as “the person’s perception that many persons who are important to her think she should or should not perform the behavior in question [8].

![Figure 2. Theory of Reasoned Action [8].](image)

2.4. Theory of Planned Behavior

While the Theory of Reasoned Action (TRA) has been the most widely used theory for examining user acceptance, other theoretical perspectives have also been used. The Theory of Planned Behavior (TPB) [2] is a descendant of TRA and adds a third antecedent of intention, perceived behavioral control, to the TRA model. Perceived behavioral control is determined by the availability of skills, resources, and opportunities, as well as the perceived importance of those skills, resources, and opportunities to achieve outcomes. Perceived behavioral control has been viewed to be close to self-efficacy belief concept [2].

This theory postulates three dimension of intention: a) attitude towards behavior and degree to which a person has favorable or unfavorable evaluation of behavior b) the social factor, or subjective norm is to perform or not to perform the behavior; and c) the last determinant is the difficulty of performing the behavior based upon prior experience and anticipated action [1][35][37].

These are indications of how hard people are willing to try and how much effort is exerted in order to perform the behavior [31]. Fig. 3 illustrates TPB model. This theory...
postulates three dimension of intention:

- Attitude towards behavior which is defined as an individual’s positive or negative feelings (evaluative affect) about performing the target behavior.
- The social factor or subjective norm is an individual’s perception of whether people important to the individual think the behavior should be performed.
- The last determinant is the difficulty of performing the behavior based upon prior experience and anticipated action [1]. In other words, it was defined as perceptions of internal and external constraints on behavior.

This theory provides a framework to study attitudes toward behaviors. According to the theory, the most important determinant of a person’s behavior is behavior intent. The individual's intention to perform a behavior is a combination of attitude toward performing the behavior and subjective norm. The individual's attitude toward the behavior includes: Behavioral belief, evaluations of behavioral outcome, subjective norm, normative beliefs, and the motivation to comply [37].

Theory of Planned Behavior has been successfully applied to the understanding of individual acceptance and usage of many different technologies [20] [29] and also other situations in predicting the performance of behavior and intentions, such as predicting user intentions to use new software [20].

![Theory of Planned Behavior](image)

TRAs and TPBs have many similarities. Both theories assume that human beings are basically rational and make systematic use of information available to them when making decisions. But the point is that, by considering control-related factors, TRA assumes that the behavior being studied is under total volitional control of the performer. However, TBP expands the boundary conditions of TRA to more goal-directed actions [2]. PBC is included as an external variable that has both a direct effect on actual behavior and an indirect effect on actual behavior through intentions.

3. Scenario Method

Using scenarios allows contributors to learn about the relevance and challenges of ethical decision making by resolving of dilemmas that arise in ‘real life’ situations. Participants can feel into personal understanding and have the opportunity to consider others’ perspectives through discussion and role play. In doing so, they can develop an understanding of the need and the ability to stand in another’s shoes - a critical component of developing sensitivity to ethical issues on smart card technology.

The scenarios present dilemmas to be resolved amidst multiple, often competing, considerations and interests, and raise the kinds of issues and internal and external pressures with which many participants could identify. The point of the exercise is not to arrive at any one ‘right’ resolution to the dilemmas, but instead to:

- Appoint in challenging their own and understanding others’ perspectives
- Recognize that reality is usually a better way to resolve a dilemma ethically, depending on the different factors with smart card technology and behavior considered.

At this point, three real scenarios are reviewed as examples.

**Scenario one:** Assume person X receive physical access card in order to use for interior building facilities. Prior to using the access card, a friend of person X who is person Y (Consider as an unauthorized person), needs to use the access card too, so person X shares his/her smart card. As earlier mentioned, ethically this behavior is an invasion to intellectual property rule and regulation where the only responsible person is person X to hold security of entire building [35].

**Scenario two:** Imagine a senior security officer who has recently resigned from his/her previous company. Nevertheless, still he/she is aware of smart card authentication process which has not been change yet and he/she would access the private information [35]. On the other hand, his/her friend, suggesting him/her to publish the dishonesty among the employees and management in order to aware stockholder and society to prevent from further corruptions.

**Scenario three:** Suppose a university student, who is technical assistant of his /her supervisor, has already received a smart card as an access and credit card, which might be useful for other student. Also, as a developer he/she was assigned the task of developing software to control the number of print out pages in order to charge students for the facility expenses. While, he/she is acting in both the character (Student and teacher assistant) will it be an ethical behavior if he/she can share the free username and password for his/her friend [35].

Obviously, all these three scenarios can be covered by two elements of PAPA model which are accessibility and property. Therefore, having an educational fundamental including PAPA factors and making users aware about the smart card technology might be valuable to prevent misuse, fraud, unauthorized access and consequently increase the level of users’ acceptance.

4. Research Framework

We have developed a social model with respect to smart card acceptance and ethical perspective, base on the PAPA, Theory of Planned Behavior, Reasoned Action and Moral Model. Fig. 3 shows the schematic view of research model. The further discussion, monitor the proposed model from different dimension such as education, awareness, and PAPA.
The most imperative factor in effective ethical awareness is people’s actions, attitudes, and their sense of right and wrong [16]. Whoever uses information technology and in any forms, they should understand the threats and related vulnerabilities. The issue of ethics has fallen into the gray area that have avoided for fear that too little knowledge could be hazardous and too much could be dangerous [11].

Many organizations and educational centers acknowledge the need for awareness, but at the same time, it may be more significant, and far more successful to address the issue of ethics as an attitude rather than a technology.

On the other hand, it is about revealing beneficial aspect of technology which are morally controversial but people are facing a weak point of it due to lack of ethical awareness throughout social public.

If individuals will be through awareness, education and subject to norms towards technology development, hence, transitions into future will touch smoother and an ongoing process [7]. On the other point of view, several studies have reported that higher levels of education are positively related to favorable computer attitudes [27] [17] [15].

Educational points have been discussed on two major aspects which are attitude and morality [24]. The earlier model [22] examines morality where failure in previous research [21] found few changes in students’ opinion regarding unauthorized usage and duplication that shows lack of adequate attitudes towards ethical analysis. Also, there was no significant correlation between students attitudes and their religious believes or lack thereof.

According to Mason’s [19] new ethical concern are created and acting wrongly becomes easier. These ethical issues must be addressed for a unique opportunity to help and educate technology users in order to make the best moral decision under ethical or unethical situations.

According to Bailey and Pearson [5] satisfaction is defined as the sum of users weighted reaction to a set of criteria. From the list of satisfaction factors which are reported by [5], According to Igbaria and Parasuraman [17] satisfaction is directly effect on usage. Oliver [26] postulated that user’s satisfaction of a system leads to continuance intention whereas dissatisfaction leads to discontinue subsequent use.

Wolfinbarger and Gilly [32] identified a positive link between reliability and customer satisfaction. They also stated that reliability is the first dimension that explains satisfaction of end user. Besides, previous studies [10] [23] argued that reliability has the direct and positive impact on user satisfaction. Kim et al. [18] found that customer satisfaction is strongly relay on reliability for repeat users that Yoon [33] also found that technology satisfaction is positively related to intention to use.

An individual's behavior (e.g., use or rejection of technology) is specified by one’s intention to perform the behavior, and individual’s attitude toward performing the behavior and subjective norm influence the intention, [8]. Moreover, adoption may be facilitated if the use of the innovation improves the image of the user, so as prestige and other valued attributes to culture in relation to the use of the innovation that are directly related to the adoption rate [3].

5. Conclusion and Future Work

Even though from technical point of view, implementing of smart card system is important but, educating and awareness of the end users is also significant factor of social and behavioral modeling.

Technology should bring up to people and they have to be aware of its benefits, features, and attributes. Being aware of the technology will improve users’ judgment and their ability in using the system in ethical behavior manner [2]. With elements of social factors, awareness, ethical analysis and user adoption a framework was develop as main heart of this research.

On the other hand, education which is based on the PAPA model will help and instruct end users towards a better understanding of smart cards and its benefits. In order to pre-evaluation of suggested model real life scenario was introduced and it might be applicable as future tools and further research. This research is still on progress and for future work the proposed model need to be evaluated and tested for further development by using statistical tools and techniques.

References


