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User acceptance of ATM biometric authentication

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Abstract

Malaysia is amongst one of the first countries in the world to use biometrics as a standard in its identification cards and automatic teller machines (ATMs). Currently, there is a lack of studies in Malaysia and around the world that studied the user acceptance of ATM biometric authentication technology. All previous studies tended to overlook the user acceptance of ATM biometrics authentication which is an increasingly important mechanism to verify user identity in banking industry. Therefore, this study is carried out to examine the key factors of user acceptance of ATM biometric authentication technology in Malaysian banks. The target population of this study was customers of commercial banks in the central region of Malaysia. The participants were randomly selected. The questionnaire was distributed to 200 bank customers who have at least 1-year experience in using ATM biometric authentication. The items in the questionnaire were derived from the extensive survey of relevant literature and oral interview. The findings show that both the performance expectancy and social influence have significant effects on user adoption of ATM biometric authentication.

Keywords: ATM, behavioural intention to use, biometrics, performance expectancy, social influence.

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1. Introduction

Malaysia is amongst one of the first countries in the world to use biometrics as a standard in its identification (ID) cards and automatic teller machines (ATMs). Traditional ATM systems authenticate user identity using a card (credit, debit or smart) and a password or PIN, in which no doubt has some defects (Amurthy & Redddy, 2012). The prevailing techniques of user authentication, which involves the use of either passwords, user IDs or PINs (personal identification numbers), suffer from several limitations (Connell & Bolle, 2001). The conventional systems can easily be breached by others, and the ID cards and passwords can be lost, stolen or duplicated (Richard & Alemayehu, 2006). On top of that, unimodal authentication that uses single user trait for recognition purposes suffers a several practical problems such as unacceptable error rate, failure-to-enrol and spoof attacks (Reddy, Kumar, Rahman & Mundra, 2008; Richard & Alemayehu, 2006).

As a result, Malaysian banks are about to place additional biometric authentication at the ATMs. Biometric techniques are fused together for bank customer authentication to improve the security level at ATMs. At the time of the ATM transaction, the user's biometric images can be captured at the ATM terminal using a high-resolution scanner (Onyesolu & Ezeani, 2012; Sheeba & Bernard, 2012). These images can be developed and then encrypted using 128-bit private key algorithm (Onyesolu & Ezeani, 2012; Sheeba & Bernard, 2012). The encrypted figure print image can then be transmitted to the banks' central server via a protected channel. At the ATM, the biometric images can then be decrypted, and matching can be done to verify that the biometric images are belonging to the bank customer (Onyesolu & Ezeani, 2012; Sheeba & Bernard, 2012). The biometric ATM authentication system makes use of the user's biometric traits simultaneously to authenticate a person's identity. Robustness and high security of authentication can be achieved by using the ATM biometric system (Onyesolu & Ezeani, 2012; Ratha, Connell & Bolle, 2001; Sheeba & Bernard, 2012).

There is a lack of studies in Malaysia and around the world that studied the user acceptance of ATM biometric authentication technology. In the previous literature, Gao and Deng (2012) empirically investigated the determinant of Chinese users' acceptance of mobile e-books, Yamin and Lee (2010) studied Malaysian students' acceptance of e-mail system and Birch and Irvine (2009) examined the influence of effort expectancy on Canadian teachers' acceptance of e-learning portal. All these studies seem to overlook the user acceptance of ATM biometric authentication which is an increasingly important mechanism to verify user identity in banking industry.

2. Objective of the study

This study is carried out to examine the key factors of the user acceptance of ATM biometric authentication technology in Malaysian banks.

3. Literature review

3.1. Automatic teller machine biometric authentication

There are two major categories of ATM biometric authentication techniques (Deane, Henderson, Barrelle, Saliba & Mahar, 1995; Sheeba & Bernard, 2012):

1. Physiological (fingerprint verification and iris analysis).
2. Behavioural (handwritten signature verification).

Deane et al. (1995) found that behaviour-based systems were perceived as less acceptable than those based on physiological characteristics. Of the physiological techniques, the most commonly utilised authentication technique is fingerprint scanning. The ATM biometric authentication is restricted in the past due to its high cost and lack of social acceptance. However, it is now

experiencing a higher level of acceptance not in high security applications such as banks and governmental facilities.

3.2. Behavioural intention to use ATM biometric authentication

Behavioural intentions to accept a new technology have been seen as an effective way to evaluate the potential success of the system (Arekete, Ifinedo & Akinnuwesi, 2014). The behavioural intention to use ATM biometric authentication is not limiting to the often seen 'intention to accept' in this study but also expanding to behavioural intention to continue using ATM biometric authentication in the future. The influence of factors, such as social influence, attitude, performance expectancy, effort expectancy and anxiety, on behavioural intention to use ATM biometric authentication technology has been under-researched until now. There is a lack of explanatory models on this research area. Therefore, this study sheds some light on this area of research by testing the following hypothesis:

H1—Social influence affects behavioural intention to use ATM biometric authentication.

H2—Attitude affects behavioural intention to use ATM biometric authentication.

H3—Performance expectancy affects behavioural intention to use ATM biometric authentication.

H4—Effort expectancy affects behavioural intention to use ATM biometric authentication.

H5—Anxiety affects behavioural intention to use ATM biometric authentication.

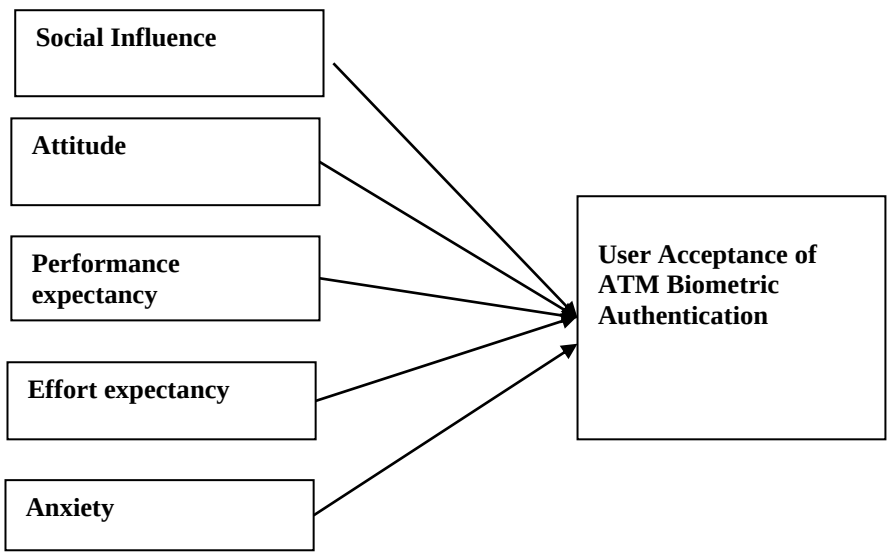

Figure 1. Research framework

4. Methodology

The target population of this study was customers of commercial banks in the central region of Malaysia. The participants were randomly selected. The questionnaire was distributed to 200 bank customers who have at least 1-year experience in using ATM biometric authentication. The instrument used for this study was a 16-item questionnaire developed by the researchers. The items in the questionnaire were derived from the extensive survey of relevant literature and oral interview. The instrument has two sections. The first section deals with participants' profile. The second section deals with participants' use and reliability of ATM biometric authentication. Of the 200 copies of the

questionnaire administered, 139 complete questionnaires were collected and analysed by using statistical software.

5. Findings

Table 1 shows that 51.1% of the survey respondents are females, whereas 48.9% are males.

Table 1. Gender

	Frequency	Percentage	Valid percentage	Cumulative percentage
Male	68	48.9	48.9	48.9
Female	71	51.1	51.1	100.0
Total	139	100.0	100.0	

Table 2 shows that 69.8% of the respondents are young adolescents under the age of 30 years old, whereas 21% of the respondents are middle-age adults under the age of 31–40 years old.

Table 2. Age

	Frequency	Percentage	Valid percentage	Cumulative percentage
Under 21 years	39	28.1	28.1	28.1
21–30 years	58	41.7	41.7	69.8
31–40 years	33	23.7	23.7	93.5
41–50 years	9	6.5	6.5	100.0
Total	139	100.0	100.0	

Table 3 shows that gait (mean ratings = 6.78) is ranked as the most important ATM biometric authentication method by the respondents. Palm is ranked as the second most biometric authentication method (mean ratings = 4.06), voice is ranked as the third important biometric authentication method (mean ratings = 3.98) and signature is ranked as the fourth important biometric authentication method (mean ratings = 3.94).

Table 3. Biometric measures

	n	Minimum	Maximum	Mean	Std. deviation
Fingerprint	109	1	9	1.82	1.770
Voice	51	1	8	3.98	2.005
Palm	48	1	8	4.06	1.850
Face	67	1	8	2.99	2.114
Retina	49	1	7	2.29	1.581
Iris	54	1	8	3.31	2.126
Signature	65	1	8	3.94	2.627
Gait	40	1	8	6.78	1.954

Table 4 shows that the performance expectancy is ranked as the most important factor affecting the user acceptance of ATM biometric authentication (standardised beta coefficient = 0.285). Social influence is ranked as the second most important factor affecting the user acceptance of ATM biometric authentication (standardised beta coefficient = 0.208). Both factors account for 49.1% of the variance in user behavioural intention to use ATM biometric authentication in the near future.

Table 4. Multiple linear regression

Model	Unstandardised coefficients		Standardised coefficients	*t*	*p*-value	R^2
	B	Std. drror	Beta			
Constant	0.626	0.463		1.353	0.178	
Social influence	0.241	0.097	0.208	2.493	0.014	0.491
Attitude	0.018	0.115	0.015	0.161	0.873	

Anxiety	0.085	0.083	0.081	1.035	0.303
Effort expectancy	0.106	0.112	0.087	0.948	0.345
Performance expectancy	0.326	09.108	0.285	3.011	0.003

Dependent variable: Behavioural intention to use ATM biometric authentication.

6. Discussion

Respondents in this study would prefer to be identified and authenticated through their gaits, palms, voices and signatures. Therefore, the system developer should develop a biometric ATM system that would be able to validate an ATM user's identity by comparing the captured gait, palm, voice and signature data with the user's gait, palm, voice and signature template stored system database. Besides gait, palm, voice and signature data, the system developer should develop a system that requires a user to key in personal identification number, user name and smart card number so that a one-to-one comparison was performed to determine whether the biometric data belong the genuine ATM user. Identity verification is used to prevent multiple people from using the same identity. Besides identity verification, the system developer should also develop a sophisticated ATM system that can perform the identity identification to conduct a one-to-many comparison in the biometric system database to establish an individual's identity to prevent a single person from using multiple identities.

The performance expectancy is the most important factor affecting the user acceptance of ATM biometric authentication. Performance expectancy refers to the degree of utilising an ATM biometric authentication which will provide the benefits to the users. The higher the perceived relative advantages, the greater behavioural intention to adopt ATM biometric authentication. Therefore, when banks develop ATM authentication technology functions, they need to consider user expectations towards these functions. Banks can improve their biometric authentication technology based on users' suggestions so that the authentication technology will better be aligned with users' performance expectations. Besides, the banks need to run marketing campaigns to enhance users' knowledge about ATM biometric authentication technology and key benefits in using ATM biometric authentication.

Social influence is the second important factor affecting the user acceptance of ATM biometric authentication. Social influence refers to the extent, to which ATM users perceive the importance of family and friends' believe that they should utilise biometric technology (Venkatesh, Morris, Davis & Davis, 2003). This finding implies that the social pressures would drive the individual to adopt ATM biometric authentication technology. The effect of social influence, therefore, deserves further attention from the marketing practitioners. Marketing practitioners can take advantage of earlier adopters of ATM biometric technology, whose opinions and reviews may generate positive word-of-mouth effects on subsequent adoption behaviour (Wiedemann, Haunstetter & Pousttchi, 2008). They could publish the positive comments of early ATM biometric authentication adopters or obtain celebrity endorsements to help promote greater user adoption on ATM biometric authentication.

Effort expectancy is not an important factor that affects the user acceptance of ATM biometric authentication. This finding reaffirms Sumak, Polancic and Hericko (2010) study that student behavioural intention to adopt e-learning was not influenced by effort expectancy. Furthermore, the insignificant influence of effort expectancy on behavioural intention was found in Yu's (2012) study on location-based service and mobile banking in China and Taiwan, respectively. Perhaps, respondents in this study are comfortable with the current usable and easy-to-use ATM banking interfaces, and they do not foresee any difficulty in using ATM biometric authentication. Similarly, anxiety is also not an important factor that affects user acceptance of ATM biometric authentication. This finding further

confirms that users are very confident about their ability of using ATM biometric authentication technology.

Respondents in this study does not view attitude as an important factor affecting the user acceptance of ATM biometric authentication. This implies that they are more concerned about the perceived benefits of the technology compared to the perceived enjoyment of the biometric authentication technology. Therefore, bankers should ensure that the benefits of ATM biometric authentication are clearly communicated to the users via advertisements, online FAQs or interpersonal consultation at bank counters.

7. Conclusion and Recommendations

From a practical perspective, this research shows that both performance expectancy and social influence have significant effects on user adoption of ATM biometric authentication. Therefore, ATM service providers need to improve mobile users' technology perceptions such as performance expectancy by providing different authentication techniques to meet different user group's task demands so as to improve the user adoption of ATM biometric authentication.

From a theoretical perspective, this research integrates key factors, such as social influence, attitude, performance expectancy, effort expectancy and anxiety, to explain user adoption of ATM biometric authentication. This study discovered that besides performance expectancy, social influence also has a significant effect on user adoption. This contributes to the knowledge base that when examining the factors affecting ATM biometric authentication users' adoption, the researchers need to not only be concerned with technology perceptions but also pay attention to the effect of human factor on the technology acceptance. Thus, the future research can combine both perspectives to examine the user adoption of other banking services such as electronic fund transfer and online banking.

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