Validating Tam With Odour Interface In Atm Machines

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Abstract- **Many studies were and still are carried out to discover the user acceptance technology acceptance that mostly depends on ease of use and usefulness. Biometrics in general has the characteristics needed for acceptance such as easiness and usefulness. In this paper we introduce a new biometric interface for ATM machines, using human odour biometric for authentication. We validate TAM in the Portuguese culture in term of new interface acceptance (using odour in ATM machine). Results show that perceived easiness has significant effect with intention to use. However, perceived usefulness has not significant effect with intention to use. In addition results show that security issues should be embedded within TAM.**

Keywords-Biometrics, biometrics technology, Authentication, odour, smell sense, Banking, Recognition, interface.

I. INTRODUCTION

Human–computer interaction tools are often used cross-culturally before being tested for suitability and validity. As new tools emerge, they must be cross-culturally validated to ensure that they work with all audiences (Oshlyansky et al., 2008), not just those in the country in which they were developed.

Day by day, the number of online banking customers is continuously growing. This demands more research, focusing on security issues relevant to the clients' side of online banking systems. Security is vital in banking and financial sectors, where users use their identity to transfer property and security is controlled by owning a particular artifact or tool (Coventry et al., 2003) and (Rashed & Santos, 2010b).

IT tools made the daily life much easier, but not secure (Sukhai, 2008). IT tools evolving everyday and the information overloading makes it difficult for individuals to recall their user names and passwords within all those technological artifacts. Moreover, users select easier passwords that they can easily remember (Coventry et al., 2003), which is considered a security tradeoff. Biometric techniques can be used as a solution for these problems: users can confirm their personal identities without being asked for their tokens or PINs and without a requirement to remember anything (Coventry et al., 2003). There are three types of authentication (Bala, 2008): 1

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something that you know, like a PIN; 2) something you know, like a PIN; 2) something you have, like a passport, A driver's license, an ID card, or an ATM card; 3) something that you are (Biometrics), like fingerprints, signature, ear shape, odour, keystroke, voice, finger geometry, iris, retina, DNA, hand geometry (Prashanth et al., 2009) or odour (Rashed & Santos, 2010a).

Dogs use their noses to recognize things via odour (Wikipedia, 2009). When they search they can use their memory, since smell sense is linked to memory and emotion (Brewster et al., 2006).

Human beings smell is not used with such accuracy. The reasons may be summarized in the lacking of research and the IT tools to enable these devices to work (Brewster et al., 2006). Moreover, this field is under development (Korotkaya, 2009) and so it is much less well understood with comparison with image based or voice recognition (Brewster et al., 2006).

The first mechanical cash issuer was removed after six months due to the lack of customer acceptance (MIT, 2003). For that reason, Technology Acceptance Model (TAM), figure 1, (or any suitable model) should be used to measure the acceptance of such machines. We validate TAM in term of odour acceptance as user interface in the ATM machines OTM).
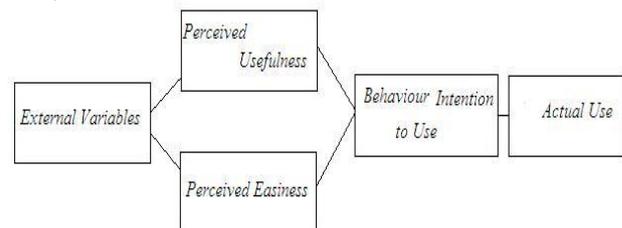
Fig. 1: Technology Acceptance Model (Rashed & Santos, 2010b)

This paper is organised as following: in section 2 we demonstrate the literature review. We present the problem statement and our approach in sections 3 and 4, respectively. In section 5 some conclusions are presented.

II. LITERATURE REVIEW

Some studies discussed the security within the banking sector and the technological solutions used. (Mao & Palvia, 2006) extended a US based research model and applied it to Chinese culture, contacting by e-mail 30 organisations. They compared their findings with the existing studies and found that their findings supported previous US studies. Moreover, they confirmed the suitability and applicability of TAM, TRA and IDT to study IT acceptance in Chinese culture.

(Kllopping& McKiinney, 2004) studied consumer e-commerce as a technology adoption process and evaluated the suitability of Task-Technology Fit (TTF) and TAM. They discussed the use of the TAM to predict online shopping activity, both the intention to shop online and actual purchases. They suggested two alterations to the use of TAM—perceived ease of use was not linked to perceived usefulness, and perceived usefulness is directly linked to actual use. Moreover, they found that the (TTF) model is a valuable addition to TAM for online shopping tasks.

(Tibenderana & Ogao, 2008) studied the acceptance and use of digital library services by the library end-users in Ugandan universities. They suggested modifying The Unified Theory of Acceptance and Use of Technology (UTAUT) by replacing —effort expectancy" and —voluntariness" with "relevancy", —awareness" and —benefits" factors. They developed the Service Oriented UTAUT (SOUTAUT) model whose dependent constructs predict users' acceptance and use of e-library services. Their study found that relevancy moderated by awareness plays a major factor in acceptance and use of e-library services.

(De Magalhães et al., 2006) focused on user authenticating as a complex problem. They discussed the ethical issues for many times authentication and thought that they must be done without the collaboration of the authenticated user. They introduced keystroke dynamics biometrical technology as solution and difficult of intrusive issues, when used in collaborative mode.

(AlZomai et al., 2008) discussed the authentication problems of security in online banking of using SMS for transactions. They stated that online banking security should be enhanced focusing on usability more than security technical and mechanisms. They suggested the SMS authorization scheme. Their experiment aimed to simulate the online bank using website to do the transactions. They attacked their approach to make sure that it would work properly. Their attack succeeded in 21%. They justified that as user should have more experience.

(Singh et al., 2008) presented a shared family accounts framework. Their experiment consisted of sixteen families that included eight who used individual profiles at home, and eight who shared a single profile. They concluded that it is necessary to bridge the gap between authentication systems and social practice leads to a weakening of overall security. In addition, they stated that could lead to a lessening of the security of digital banking systems by having a security design that takes into account the importance of social and cultural practice.

(Hao et al., 2009) discussed the two problems of online banking: first problem online security lacked to the attention and research that should focus on the security issues related to the client side. The second problem related to the huge number of security product that would increase the difficult level to test the category and standards of the security. They presented a scheme to design a compliance testing system for the security of online banking. The presented scheme aimed to obtain suggestions from testers that might help to design security testing and identify potential vulnerabilities in current online banking systems.

(Heckle et al., 2007) studied the biometrics acceptance. 24 participants were asked to participate in a role play to evaluate the use of fingerprint in online book purchasing. Their findings showed that respondents were comfortable after perceiving the benefit of using that biometrics. They suggested explaining obvious benefits would lead to more perception of usability and higher rate in acceptance.

(Coventry et al., 2003) discussed consumer-driven usability and user acceptance of biometrics tools. They focused on using iris as ATM interface. The applied qualitative, laboratory and field based studies. Their results showed that 90% were satisfied with iris verification method and they would select it over signatures or PINs.

(Saadé et al., 2007) studied the viability of TAM in multimedia. They conducted a comparative study consisting of 362 students. Results showed that TAM was a solid theoretical model where its validity could extend to the multimedia and e-learning context. They concluded that the multimedia learning system users is an important step towards a better understanding of the user behavior on the system and a multimedia acceptance model.(Rashed & Santos, 2010a) studied the acceptance of odour in authentication systems among youth users in the Arab countries. They found that presenting the tool in acceptable form would accelerate the acceptance and adoption of this tool.Technology continues to evolve and improve, so more work is required to address the usability issues which will be a key to successful implementation of biometrics within a general public application such as banking. Three patents related to odour machines are registered (Fukui et al., 1989), (Kao et al., 1999) and (Friedli & Gaussmann, 2005). Moreover (Korotkaya, 2009) introduced the electronic noses (ENoses) model as an odour recognition as shown in figure 1. Now the question is would users accept to use odour in ATM machines?

Figure 2: E-Nose (Korotkaya, 2009)
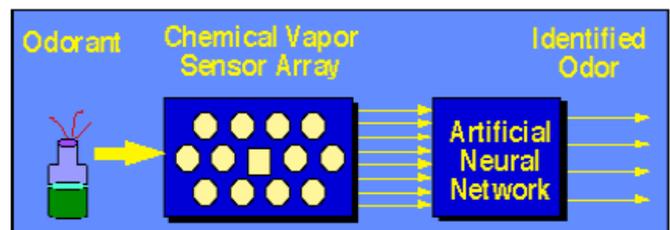
III. DISCUSSION

Aiming to answer our research question, a questionnaire was distributed via website to a local university community. We selected e-mail as the target technology (postgraduate students in the department).

The constructs used existing scales from previous studies. Questionnaire contained 11 statements and fully anchored 5-point Likert scales were used with end points being for one —extremely disagree" and five —extremely agree". The instrument was developed in English. We received 48 responses. The main findings are:

i. Age of the respondents was within the interval [20-30] that represents youth people as shown in figure 3.

15-19	20-30	31-39	More than 40
8	22	17	1

Figure 3: ages of the respondents

ii. Education level: most of the respondents obtained high education as shown in Figure 4.
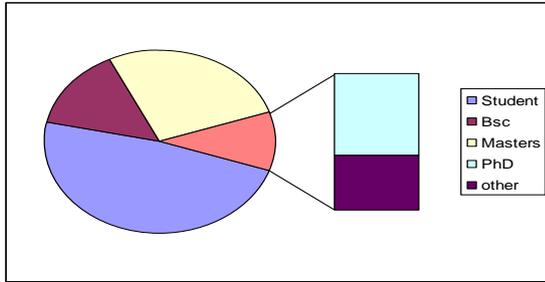
Fig. 4: Education level of the education

iii. The specialization of the sample is shown in figure 5 (the context is a technological university department).
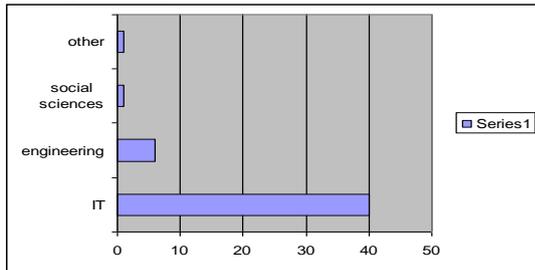
Fig. 5: specialization of the sample

iv. 19 participants (40%) believe it would be easy to use odour as an authentication technique in ATM machine, whereas only 8 (25%) think it would not be easy (see Figure 6).
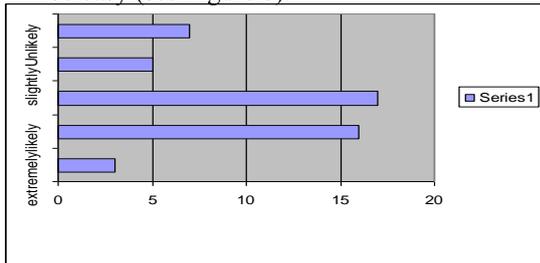
Fig. 6: easiness of odour in ATM machine

v. In contrast of the expected hypothesis, 15 respondents (31%) found odour for authentication in ATM machine would not improve their performance and 14 (29%) thought that it would improve their performance.

vi. 21 respondents (44%) intended to use odour as ATM authentication system and 15 respondents (31%) did not decide.

vii. The majority, 22 respondents (46%), point that using odour in ATM machines would be good idea.

viii. The majority of the respondents had not used odour in ATM machines.

ix. In comparison with other authentication mediums like iris, finger print, retina, and ear shaped, the respondents ranked odour as shown in figure 7.
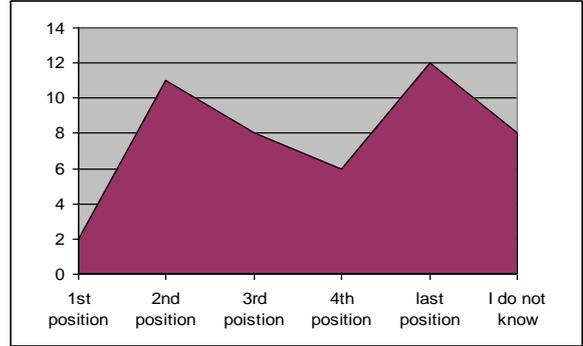
Figure 7: ranking odour with comparison with other biometrics

x. The main comments submitted by the sample were the following:
1) Is it secure? Using odour as an authentication method in Bank ATM? Odour is easier to be copied and this makes the system absolutely insecure.
2) Odour seems to be easy to be hijacked; I don't think that it is safe.
3) Odour is an innovative idea, but attention to its security. Otherwise it can be used for other less sensitive fields.

The standard deviations were calculated and mostly equal for all study parameters that showed it was consistent and significant ….

IV. PROPOSED SOLUTION

Odour automated teller machine (OTM), as discussed here, is a computerised telecommunications device that provides the customers of a financial institution access to the financial transactions in public places without the need for a human clerk or bank teller. Customers are identified by their odour.We assume that OTM would have its own shape as it would allow only one customer to use it at the same time and be alone with some special cabinet. The overall OTM system can be described by the following:

i. A place for only one person.
ii. Thermal system that help to extract the odour from users and for detecting living bodies.
iii. Odour sensors to detect the smell and the associated module for improved authentication.
iv. Another solution is that users who need to authenticate themselves should carry their e-citizen cards.
v. This card should obtain (or provide?) both:
  1) Microprocessor that can compare the extracted odour and the biometrics stored information; and
  2) Stored biometrics: encrypted digitized format stored in the card.
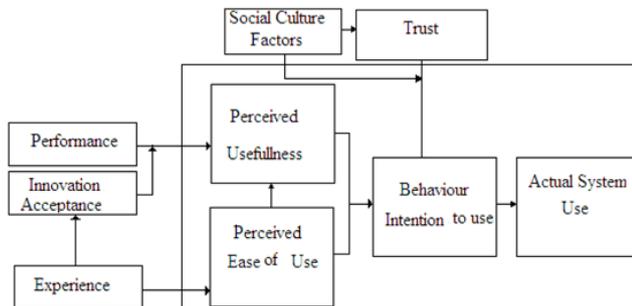
Figure 8: modified TAM

For the functional and non-functional requirements; Authors believe that they will be the same as traditional ATM in (Mylopoulos et al., 2007).

V. CONCLUSION AND FUTURE WORK

Most of the respondents were youth and they found it good idea and easy to use odour as an interface in authentication system and useful. Moreover they reported they would use it frequently if it would be available. The majority of the respondents thought that it would not improve the performance. The biometric technologies create the challenge of avoiding attacks before they take place (De Magalhães et al., 2006). Results show that perceived the usefulness does not have a significant effect on intention to use. However, there is significant effect between easiness of use and intension to use. Moreover, due to the type of the technology and risk that might affect; security is still first element for the users (figure 8), so we suggest adding user concerns to the model. The reason is that user would prefer difficult tool if it is secure.It is concluded that the problem is how we could present the odour to usersIt is a challenge to apply this approach due to:

i. Acceptance by the customers due to its simplicity: customers have to do nothing whereas people used to apply very complicated authentication depending on the importance of that issue.
ii. Many people might be worries (comments of the respondents) that this approach might be hijacked easily (smell of odour on clothes) and needs to be strengthened with another approach that enhances it is performance.

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