Understanding User Acceptance of Mobile Alerting Systems

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ABSTRACT

Even though the adoption of emergency alerting systems may improve the safety and security of individuals, participation in existing systems that utilize mobile alerting in universities in USA varies and does not match the high adoption rate of mobile phone technology itself (Sullivan, Häkkinen & Piechocinski 2009; Wu, 2009). As the adoption of mobile alerting system (MAS) can be viewed as a critical life safety benefit, there is motivation to better understand factors that affect the acceptance of MAS. Among the possible, alternative methods of implementing mobile alerting, an opt-in type of system can enable the alerting process to be executed in a way that is more suitable and useful for a diverse community of individuals. As a result of this study, a refined version of technology acceptance model (TAM) is proposed, extended with factors of perceived trust and perceived financial cost to better interpret the acceptance of MAS. This model is being evaluated in ongoing research on MAS in a university and community context.

Keywords

Mobile alerting system, technology acceptance model, perceived trust, perceived cost.

INTRODUCTION

The importance of effective early warning system has been generally acknowledged. However, we continue to witness situations where, for various reasons, alarms have failed to fulfill their purpose. In general, warnings must reach those, and preferably only those, who are affected by an incident, in a timely manner, providing individuals clear, understandable and reliable information and instructions. To improve the level of emergency alerting, actors ranging from universities to various countries have started to utilize or contemplate utilizing mobile phones as a way to reach people in threatening situations. The Mobile Alerting System, or MAS, is defined to be a system or service used for presenting time critical emergency information to recipients, the recipients being individuals with a mobile phone.

Arguably the greatest improvement mobile alerting can provide for emergency notification is in reaching the stakeholders in time and targeting the alert to those who are most directly affected by the incident. However, there are also shortcomings in utilizing mobile phones for disseminating emergency information. For example, network congestion can cause delay in message delivery when there are many to be contacted. Limitations in message size, such as an SMS and Cell Broadcast character limits, can cause difficulties in drafting understandable and comprehensive messages (Latimer, 2008). In addition, typical of innovations in general, MAS cannot have the desired effect of improving the reach of emergency alerting if it is not adopted by the potential beneficiaries of the alert. If the authorities, whose task it is to disseminate and produce emergency alerts, are to be able to influence the positive acceptance of MAS, it is necessary to find out what affects user acceptance of such systems and gain data on how to improve the motivation of individuals to adopt and participate in MAS.

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TECHNOLOGY ACCEPTANCE

Technology and innovation acceptance has been the interest of a number of studies across different disciplines. Consequently, there are also several models and theories that deal with the subject. Well known and used models in information systems are, for example, the theory of reasoned action (TRA) by Fishbein and Ajzen (1975), the theory of planned behavior (TPB) by Ajzen (1991) and the unified theory of acceptance and use of technology (UTAUT) by Venkatesh, Morris, Davis and Davis (2003). However, arguably, the two most well known models and theories used in the field of information systems are the innovation diffusion theory (IDT) by Rogers (2003) and the technology acceptance model (TAM) by Davis (1989).

In IDT diffusion is defined as the "*process in which an innovation is communicated through certain channels over time among the members of a social system*" (Rogers, 2003). According to Rogers, individually, adopters go through a five step innovation decision process starting from gaining knowledge about an innovation, continuing to form an opinion towards the innovation, making a decision whether to adopt or reject the innovation, and finally, in the last stage, confirming the formed opinion. Davis (1989) developed TAM to specifically address why users accept or reject innovations, especially in the area of information technology within organizations. Three relationships capture the main concept of TAM. The intention to use information technology is affected primarily by the perceived usefulness, "*the degree to which a person believes that using a particular system would enhance his or her job performance*", and secondly by the perceived ease of use, defined as*" the degree to which a person believes that using a particular system would be free from effort*" (Davis, 1989). Third, perceived ease of use is regarded as having influence on the perceived usefulness. The relationship from perceived ease of use to perceived usefulness is natural because the easier the use of a technology is, the more useful it will become (Davis, Bagozzi & Warshaw, 1989).

In terms of innovation characteristics, perceived usefulness and perceived ease of use are often included in acceptance models. Studies that have used these two basic constructs of TAM have successfully predicted and explained acceptance of various technologies and perceived usefulness has been shown to explain and predict the acceptance of many innovations (see e.g. Davis et al., 1989; Moore and Benbasat, 1991).

As Agarwal and Prasad (1998) have indentified, most acceptance models have included the construct of intention to use an innovation as a step before the actual use of a technology. Although the intention to use does not always automatically lead into actual usage of the system, the connection between these two constructs has been shown to be significant for example by Taylor and Todd (1995). Because existing MAS have appear to have acceptance limitations, our research is undertaking an approach that seeks to better understand the factors that influence the intention to use MAS as a foundation for the design and evaluation of a new, mobile alerting application.

In general, influences that are included in acceptance models and studies often contain elements of (1) innovation characteristics and (2) individual characteristics. In addition, (3) the surrounding environment can play a role in acceptance, for example in terms of social influence, communication channels, norms and support within a social system. As Rogers (2003) has identified, most research have concentrated on innovation characteristics in explaining and predicting individuals' intention to use and adopt innovations. To simplify the developed model, this research also adopts the same approach and excludes further analysis of the impact of individual characteristics and surrounding environment to the acceptance at this stage.

POTENTIAL ACCEPTANCE FACTORS OF MAS

In addition to TAM's general popularity, Wu's (2009) study concerning the acceptance of mobile emergency alerting system and Von Watzdorf's and Michahelles's (2009) similar study on user acceptance of mobile phones as risk information providers have used and included factors of TAM for explaining the user acceptance. Therefore, TAM has been selected as the basis for our research framework. As Nysveen, Pedersen and Thorbjørnsen (2005) point out, that while TAM is a useful model for explaining the acceptance of mobile services, extensions to the model may have to be developed in order to get a more comprehensive view of the acceptance factors of a certain innovation. Bouwman, Carlsson, Molina-Castillo and Walden (2007) concluded in their research concerning the adoption of mobile services that understanding the acceptance of a certain innovation is only possible when the specific characteristics of an innovation have been taken into account. Since TAM was not originally developed to measure the acceptance of MAS, we propose and incorporate extensions to the original TAM.

Perceived Usefulness

Innovations are usually developed for a certain purpose and need, with the intention that the innovation will fulfil the need better than any precursors. This relates to the concept of perceived usefulness as Moore and

Benbasat (1991) state. Our research regards the purpose of mobile alert systems as being in line with the objectives of emergency management, to ensure safety and provide sense of safety to individuals. Thus, perceived usefulness of the system can be regarded as *how much the potential adopter feels that the use of the system would increase their personal safety.*

The mobility aspect can be regarded to have influence on the perceived usefulness of MAS in at least two different ways. *First*, mobile phones follow individuals throughout the day and therefore mobile services are usually available everywhere, and at all times (Bouwman et al., 2007; Kaasinen, 2005). Thus, the advantage MAS offers, compared to traditional methods such as sirens or broadcast media, consists of reaching people directly and with the ability to present timely information. *Second*, mobile phones can identify the location of the user and utilize this information in providing location based services. Therefore, the alerting process can be executed based on the location of the recipient. In the emergency context this is appropriate because specific alerting information can be targeted only to those at risk in a specific geographic area.

Users generally want to receive information that is personally relevant to them (Kaasinen, 2005). What is considered as relevant information by some might be irrelevant to others. The mobile phone is personal device and therefore, mobile services can be offered in a personalized way. Personalization capabilities inherent in mobile phones enable the users not only to define areas of interest but also to some extent, the format and style in which notifications are presented, such as language. Kaasinen (2005) described, in general, that personalization and controllability are components of perceived usefulness or perceived value of mobile services. Also, in the context of alerting services, Watzdorf and Michahelles (2009) saw that the relevancy of information is actually a result of the user being able to personally select the topics or incidents the user wants to be alerted about, and this has an effect on perceived usefulness.

Perceived Ease of Use

Perceived ease of use of the system in this context can be defined as *how easy the potential adopters evaluate the ease of using MAS*. In general, the mobility of a service does not offer the only advantages. As Funk (2004) states, there is a trade-off between the portability of the service and various limitations concerning mobile phones. Physical limitations in the user interface, such as display size, as well as limits in message size and content, may result in applications that are easy to use and understandable for some, but otherwise difficult or impossible to use or comprehend by those with sensory, cognitive or physical limitations. These limitations can disproportionally impact those in the aging population. Regardless of this as Sullivan et al. (2009) point out, alarms should be accessible and usable for all.

Wu (2009) stated that controllability and personalization of MAS can have an impact on perceived ease of use because it could avoid irrelevant alerts from being sent to the recipient. However, being able to control the service can also have a negative influence to the perceived ease of use. In order to enjoy the benefits of personalization, the user must also take the responsibility to enable the personalization set-up for the service. This subject relates to the factor of perceived ease of adoption proposed by Kaasinen (2005). Therefore, it is relevant to investigate the relationship between controllability of the service and perceived ease of use.

Perceived Trust

In examining the perceived trust an individual must have concerning the adoption and usage of MAS, three aspects of uncertainty can be identified. *First*, as George (2002) states, trust can be seen as individual's belief and desire to be dependent on the trustee. In this case the trustee or counterparty is the provider of the system. As Gefen, Gaharanna and Straub (2003) found in their research concerning the acceptance of electronic commerce applications, trust towards the service provider has a significant effect on the acceptance. Trust must be examined beyond the traditional public authority or media providers, as commercial firms, such as insurance companies, can be regarded as potential service providers of MAS. Therefore, the impact of trust towards these different service providers of MAS is included in our research.

Second, users must have trust towards the used technology. The significance of trust towards the technology itself has been identified, for example, by Kaasinen (2005). *Third*, as Wang (2002) argued, the perceived credibility towards mobile services is affected by an individual's belief that the use of mobile service is free of security and privacy threats. Kaasinen (2005) refers to the same subject and states that user trust in mobile services includes user's confidence that the service will not misuse personal data. As MAS can be considered to be a location-based service, the location data obtained of the user is among the privacy data that needs to be handled properly. In addition, information related to language, and any accommodations for support of disability are also considered as private data Therefore we can propose that the perceived trust of MAS is also affected by the willingness to give and allow personal details such as positioning data to be collected to provide the service.

In general, people need to be able to rely on the information and the overall functionality of the method through which emergency information is presented. The more that users can depend on the overall reliability the system, the more useful the system is assumed to be.

Perceived Financial Cost

Perceived cost can be regarded as a relevant factor to the acceptance of commercially offered innovations (Mallenius, Rossi & Tuunanen, 2007). Wu (2008) suggested perceived financial cost of receiving emergency messages could also influence motivation to adopt emergency alert systems. The public sector's lack of funds has been acknowledged as an obstacle for the implementation and development of MAS in Finland and also, mobile operators in Finland have not identified commercial potential concerning the implementation of MAS (Ministry of Transport and Communication, 2009). However, end-users may be willing to pay for MAS as von Watzdorff and Michahellis (2009) observed. By exploring the willingness of end-users to pay for the service and the impact of perceived cost, information concerning the motivation to implement MAS from the third-party service provider's point of view is obtained simultaneously.

The proposed research framework

Based on the introduced factors a research framework is proposed for understanding the acceptance and, more specifically, the intention to use MAS. The framework is presented in Figure 1. Every arrow in the model describes a positive relation between the factors except arrows starting from perceived financial cost which has a negative impact on perceived usefulness and intention to use.
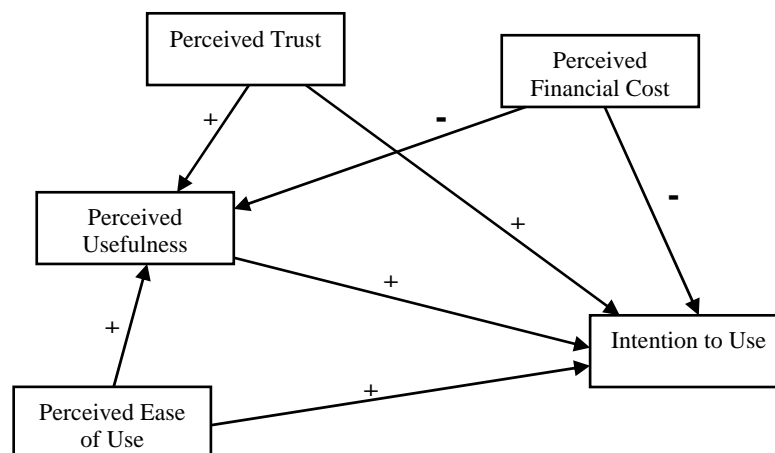

Figure 1 Research framework for studying the intention to use MAS

CONCLUSION

Because one type of alert, or alerting channel, is not suitable for all individuals, a personalized, mobile alerting system can offer advantages for a diverse user population. To succeed in the goal of improving personal safety, systems that provide understandable and comprehensive alerting information needs to be adopted by the potential users. In our research, we propose an extended version of TAM to explain the acceptance of MAS by adding factors of perceived trust and perceived financial cost. Ongoing research is testing the proposed model and will assist in validating whether these factors can help in understanding user acceptance of MAS, and lead to the design of more effective mobile alerting applications.

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