Intelligent M-Government: Application of Personalisation and Location Awareness Techniques

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Abstract

This paper proposes the use of personalisation and location awareness techniques to efficiently select then deliver the appropriate M-Government services to the desired users who most benefit from the services according to their geographical location. A logical architecture for provisioning governmental location-based services to citizens is suggested which will ease the creation of Intelligent M-Government Services that can match the best options to the targeted user in order to better serve the government's constituents.

Key words*: Personalisation, location, mobile, services*

1. Introduction

In order to cope with the information explosion, personalisation techniques have been developed, the effectiveness of which is related to the information customisation conjecture which holds that information filtering technology will be able to keep up with the amount of relevant information (Berghel et al. 1998). The goal of personalisation is streamlined access to, and absorption of, needed information by users. Berghel et al (1998) state that information personalisation can be done by humans for other humans (information brokerage) and the future of information personalisation lies not only in automation but also in location-based personalisation. The latter is possible because the kind of information related to or obtained by the person is related to her/his location e.g. the nearest hospital to a person's residential address. Location-based personalisation is one of the latest tools in the evolutionary chain of digital information handling technologies for information storage, transfer, distribution, acquisition, agency, and brokerage. Nonetheless, information overload remains an issue for end-user and Berghel et al (1998) posit that the optimal solution should be highly interactive and borderless on the client-side. Al Shibly et al (2004a) suggest personalisation is the antidote for unwanted information overload problems, however, Berghel et al (1998) believe that, in most cases, there will always be the risk that the Information and Communication Technologies (ICT) will send more information than the end-users can consume. In this paper, the authors discuss how the techniques of personalisation and location awareness technologies may be applied to Mobile Government (M-Government) architecture.

This deployment should result in creating Intelligent M-Government Services that can match the best options to the targeted user in order to better serve the government's constituents.

The paper is organised as follows: Section two provides the background to mobile government services and section three sets out the methodology. Section four defines personalisation, outlines its techniques, and sets out their potential use in M-Government context. Section five describes how location awareness provides real-time location-based services. The conclusions and directions for future research are found in section six.

2. Background

Wireless mobile communication infrastructure advances are pushing governments to think seriously about utilising this technology to better deliver their services and provide more constituent satisfaction. Governments that utilise these advances effectively are the prime movers of the next stage of e-government adding benefits to those governments (such as cost reductions and greater work efficiency and effectiveness), and to their constituents (such as faster access to public services anytime, anywhere). Thus Mobile Government (M-Government) may be defined as "the use of mobile and wireless communication technology within the government administration and in its delivery of services and information to citizens and firms" (Östberg 2003). Mobile communications and Internet technologies are enabling ubiquitous access to new eGovernment services.

Today, M-Government has become the centre for wide range of activities, transactions, services and information exchange. M-Government has the potential of delivering information on demand, performing transactions, but most significantly, using communications to satisfy citizens needs and wants. Therefore, in the pursuit of a better reaction to citizens' anticipations, governments start to shift toward the stage of service transformation. Government proactively anticipates the nature of services that citizens need then provides them with the appropriate services in a timely manner instead of simply waiting for requests and then reacting to them.

A new study showing more people surfing the Web via the cellphone suggests that the PC may soon lose its dominance in Internet access (Tan 2006). Therefore, the benefits of e-government can be improved by M-Government through which citizens gain easy access anywhere, anytime to governmental information via the available wireless Internet. However, accessing Internet via handheld devices can be hindered by the limitations of such devices. For example, mobiles have limited memory and storage capacities, low resolution screens, and keyboard restrictions (W3C 2006). These limitations cause users to demand higher quality of information delivery from government. Therefore, providing high quality information is an important success factor for M-Government. Without an understanding of the various dimensions of information delivery in mobile government, it is difficult to provide effective guidelines to mobile government (Kim & Albers 2001).

3. Methodology

This paper follows on from previous studies on mobile government undertaken by the researchers from 2005 (Al-khamayseh & Lawrence 2005, 2006a, 2006b). The researchers are using a triangulation strategy (i.e. more than one method) to study mobile government services namely a literature review, surveys and case studies (ReCAPP Research Glossary 2006). This paper reports on an exploratory study on the use of personalisation and location awareness techniques to efficiently select then deliver the appropriate M-Government services to the appropriate users who most benefit from the services according to their geographical location. Sekaran (1992) is

reported as saying that exploratory studies are useful when researchers do not know much about the situation at hand. Exploratory research is conducted into an issue when there are very few earlier studies that can provide information about this issue (Denzin & Lincoln, 1994). In such research, the focus is on gaining insights and familiarity with the research area for more rigorous investigation at a later stage. This research was approached in several phases. First, a literature review was undertaken to understand and draw out the critical success factors associated with mobile government. These include the citizens' perception and governments' acceptance of the mobile government technologies and applications. Secondly an analysis of promising mobile technologies and applications was conducted to ascertain which of these could be adapted to mobile government services. The literature review and subsequent analysis of the issues and synergies drawn from the literature led to the development of the following research question: Will personalisation and location provide an impetus to spread M-Government to the citizenry?

4. Mobile information personalisation

According to Jørstad & Thanh (2006) "Personalisation is the process where services are adapted to fit each individual user's requirements (needs and preferences)". Personalisation, at this point, is an information technology-supported process of adapting and filtering an information flow and giving feedback interactively in real-time, according to the individual's preferences or chrematistics (Al Shibly, Aisbett & Pires 2004b). It might also be seen as an interactive process whereby information interactively and in real time is filtered and sent to the target user. According to Jørstad, Thanh & Dustdar (2005), this process entails the following steps:

- Collecting information about the user to build services preference profile. These preferences could be gathered by subscription process or user-rating mechanism.
- Storing and keeping regular updates for this information.
- Recommending personalised services to a targeted user.

Figure 1 illustrates the mentioned personalisation process.

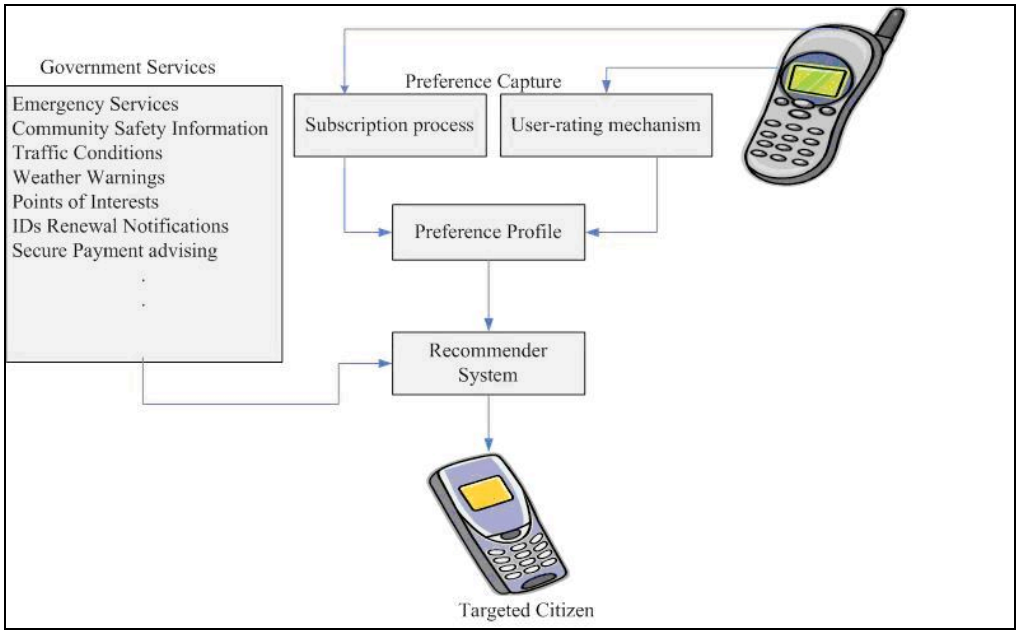

Figure 1 Process of Personalisation

Recommender systems are one of the most popular applications of personalisation techniques (Adomavicius & Tuzhilin 2005). Basically, the aim of the recommender system is to suggest interesting items to the users automatically based on their preferences. Many e-commerce sites have successfully utilised different types of recommending systems as a means to offer personalised customer service and to improve the online shopping experience (Prassas, Pramataris & Papaemmanouil 2001). Recently, recommender systems have been adopted in mobile commerce (m-commerce) applications (Zenebe, Ozok & F. Norcio 2005).

According to Adomavicius & Tuzhilin (2005) and Choice stream (2004) the goals of any personalisation system is to:

- Provide precise and related content, based on each user's preferences.
- Provide user satisfaction: by understanding the user needs and try to meet them successfully.
- Determine users' preferences with minimal involvement from them.
- Recommend in real time; so users can react immediately which is more likely lead to increase the user loyalty and encourage them to re-use the offered services.

These goals correspond to the M-Government vision "to contribute to providing easier and faster access to governmental information and services anytime, anywhere in order to improve citizens' life quality" (Al-khamayseh & Lawrence 2005). Based on the literature review, the existing personalisation techniques can be classified into the following categories (Sarwar et al. 2001; Zeng, Xing & Zhou 2004).

4.1 Collaborative Filtering (CF) personalisation

Collaborative Filtering (CF) personalisation is one of the most popular personalisation techniques due to its simplicity. It has been very successful in both commercial applications and academic research (Zeng, Xing & Zhou 2004). As a result, it has been used by many Websites and e-commerce applications and portals such as amazon.com. Basically, collaborative filtering systems use pattern matching techniques to produce personal recommendations based on correlations among users' choices. The following two sections explain the main types of CF which are User-based CF and Item-based CF and illustrate how they can be applied to mobile government services.

4.1.2 User-based collaborative filtering

In User-Based Collaborative Filtering, the recommendation is based on identifying a group of similar users by comparing a target user's choice of a particular service with choices of other users. Once this group is formed, user-based CF system recommends the services that are selected by a group of like-minded users to the target user. M-Government could benefit from this technique by sending SMS informing citizens of available services of interest to them based on recommendation by the system which found that other citizens of similar criteria such as interests, demographic information; age range whom have subscribed to the service. For example, if user A has subscribed for weather warnings service, s/he will be compared with other users who have already subscribed to the weather warnings service as well as services such as traffic warnings, and emergency warnings. The system will then recommend the traffic and emergency warnings services to user A.

4.1.3 Item-based collaborative filtering

Similar to user-based CF approach, item-based collaborative filtering has the advantage of lower computation cost. The main difference between them is that user-based CF systems recognise patterns of similarity between users' choices, while the item-based CF systems recognise patterns of similarity between the items themselves. In other words, item-based CF systems use a list of items that has previously been chosen by the target user in order to suggest similar items to same user. Item-based CF has roots within business context and e-commerce applications. Since government provide services we will refer to item-based CF as service-based CF. In this scenario, if user A has subscribed to the weather warnings service, the system will recommend other services of the same nature or category such as traffic warnings and emergency warnings services.

5. User-profile based personalisation

Many Websites require users to register in order to start using their different services. During registration process, users provide some personal information such as name, gender, postal code, date of birth, and content preferences such as preferred language to build their profile. Using these profiles, the service provider can offer personalised services. For example, using profiles based on the date of birth and gender NSW Department of Health could disseminate personalised advice to women aged 40+. The advice "It is recommended that you have a free screening mammogram every 2 years through Breast Screen Australia. Contact BreastScreen on 13 20 50", which is published on NSW Department of Health Website (Multicultural Health Communication Service 2005) can be sent using SMS messages. By utilising this simple technique, NSW Health Department can ensure that the appropriate service will target the desired group of citizens. Privacy and security issues would need to be addressed for such health warning messages and the authors recommend an 'Opt-In' system.

5.1 Location-based personalisation

One of the main goals of any government is to deliver its services by using all available means to the largest possible number of citizens especially in emergency situations such as the approach of a Tsunami or a cyclone. For citizens with mobile handhelds, it is possible that the kind of information they want to obtain is related to the location of the person who is receiving that kind of information e.g. the nearest hospital to person's residential address. Thus, in order to deliver personalised services in the form of relevant information, the citizen's location should be determined. Schmandt and Marmasse (2004) have demonstrated that geographic information can be personalised based on its relevance to the user with their prototypes such as comMotion which tracks a user's path via Global Position System (GPS) and maintains 'to do' lists for select locations, or Watchme that allows users share their position information with family members or selected persons. Therefore, as part of the intelligent government we introduce the use of location-based techniques to deliver personalised services to citizens.

5.2 Location Awareness

Positioning techniques or Location Determination Technologies (LDT) are used to estimate the geographical position of the mobile devices. Several competing position technologies have emerged, each offering different accuracy levels (Boertien & Middelkoop 2002). Generally, they can be categorised into two classes (Feng & Law 2002): the first class utilises the continuous signals that are sent by a mobile phone to its base station. Mobile Location Centre (MLC) at the

Wireless Network Operator uses one or more positioning techniques e.g. Cell of Origin (COO), Angel of Arrival (AOA), or Enhanced Observed Time Difference (EOTD), to estimate the location of that mobile based on received signals. The second uses Global Positioning System (GPS) or equivalent technologies e.g. Galileo, GLONASS, with mobile phones equipped with GPS receivers to calculate the geographical location of the mobile. GPS systems are the most accurate option already achieving levels of 10m (Boertien & Middelkoop 2002). However, since most mobile phones are not equipped with GPS receivers a major success factor for the intelligent M-Government is its partnership with private Mobile Operators as they are able to locate citizens using Mobile Location Centres from signals sent from mobile devices. The United States Federal Communications Commission has declared that 95% of mobile phones must be traceable to within 50 to 300 metres by the end of 2005 and wireless service providers must disclose this location information to emergency call responders (Schmandt & Marmasse 2004).

M-Government could greatly benefit from the recent advancements of LDTs to better serve its constituents be it Government to Government (G2G), Government to Businesses (G2B) and Government to Citizens (G2C). The authors propose the provisioning of Location-Based Services according to the geographical location of the constituent. Once the location is determined by any of the available positioning techniques the M-Government source (be it local, state or federal government) could offer services and information according to the location.

The value of such service could be foreseen specially in the case of emergencies and critical situations where a need arises to coordinate disaster management activities with location-awareness activities. In the case of disasters and emergencies government become responsible for disseminating real-time information to its citizens by using all available broadcasting media such as radio and TV. However, mobile services like SMS text messages have the ability to reach people while other media fails to do so. For example, the civil protection agency in Italy has successfully used SMS messages to send information for residents located in the capital Rome after a massive power failure in September 2003 (Povoledo 2003).

Location-based services can automatically be triggered when a citizen is at a specific location (Schnicke 2002). Different geographical areas can be subjected to different governmental services. A Web-based example can be found at The Australian Broadcasting Corporation (ABC) Website where ABC provides customisable “counter disaster information” based on the geographical location of the requestor (ABC 2005). While it is necessary for users to have Internet to browse ABC website in order to check the latest and updated weather warnings, M-Government can disseminate SMS messages to citizens in a particular region once updates are released. SMS has the advantage of reaching a larger number of people in less time, hence, increasing citizens' awareness to present and potential hazards and risks.

The value of such services can be foreseen in situations such as natural disasters. In March 2006, cyclone Larry devastated parts Queensland. Centrelink,-“government agency delivering a range of Commonwealth services to the Australian community” (Centrelink 2006), announced it would have staff on the ground in several communities to answer questions from farmers, residents and local businesses about Australian Government relief assistance and services as part of the recovery efforts. Centrelink also announced staff would be available in specific Centrelink Customer Service Centres and community recovery centres (Centrelink 2006). Location-based M-Government services could boost Centrelink assistance efforts by sending updated SMS messages about latest weather warnings based on the location of mobile users. Bulk SMS messages can be sent to inform larger number of citizens about the nearest community recovery centres, their working hours and contact numbers.

In figure 2, a logical architecture for provisioning governmental location-based services to citizens is suggested. The main components are:

1- Content Server: A government agency registers its new service or updates existing ones by contacting the content server on the government portal. The content server as the common service registry will allow agencies to manage their services or search for others based on standard predefined policies.

2- Application Sever: This hosts various government applications which are exposed to citizens through the use of Web-based products. The content is exposed in the form of HTML pages or other Web-capable files through a Web server which can be a part of the application server itself or as a separate server.

3- Gateway: Transform emails or any Web-based content such as HTML to SMS text messages.

4- Mobile Location Centre: Specialised gateway used by the carrier to determine the location of the user.

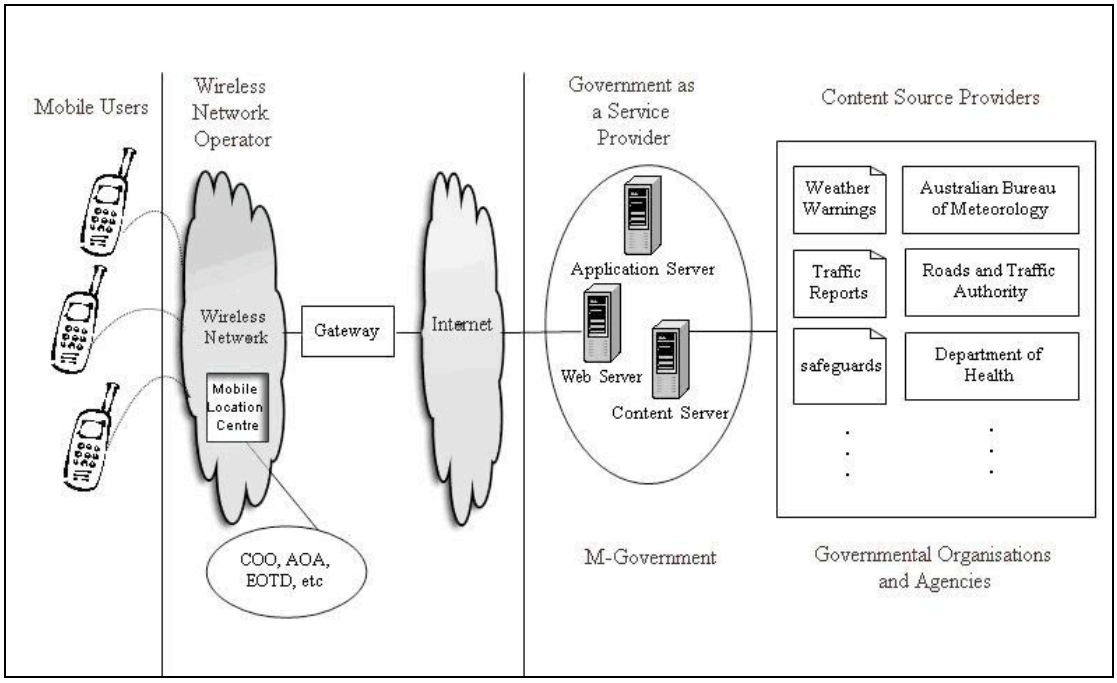

Figure 2 Proposed M-Government Service Logical Architecture

5.3 Use Case example

The Australian Bureau of Meteorology (BOM) (Bureau of Meteorology 2006) provides updated weather reports and warnings at their website. The value of such reports could be highly appreciated if such information could be broadcast to citizens at specific areas before a major natural or weather hazard. BOM as a governmental agency needs first to register its "weather warning" service at the central government content server. The agency will update its service information regularly. In the case of potential natural events like cyclones or floods at a specific area, the application server handles BOM requests to broadcast such reports to citizens. M-Government contacts carriers to locate all mobiles at the targeted location using their Mobile Location Centres. SMS text messages will then be disseminated to all mobiles within that area.

Malta has launched many M-Services through (SMS) notification such as: notification of acknowledgements and status change of customer complaints, notification of court deferrals, notification for license-renewal to the holders of licenses, notification of exams results, and notification for Direct Credit Payments from the Department of Social Security (Ministry of Information Technology and Investment 2003). Citizens in Malta wishing to use M-Government services have to register through a dedicated online website as a first step. Once the government system validates the citizen's information it triggers the M-Government infrastructure which in turn sends a notification to the citizen's mobile service provider which sends it as an SMS to a registered citizen (Ministry of Information Technology and Investment 2003). Figure 3 depicts the mobile interaction between the citizen and the government.

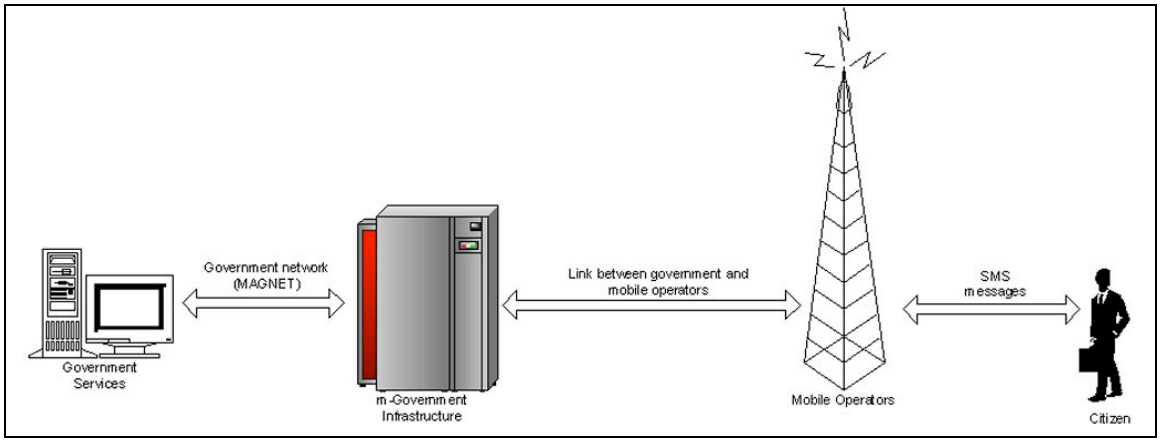

Figure 3 Citizen's interaction with M-Government in Malta, source: (Ministry of Information Technology and Investment 2003)

6. Conclusion

The authors have examined location-based personalisation and customisation as possible methods to help improve M-Government services. Personalisation and location awareness techniques have the advantages of delivering the right service to the desired users who most benefit from it. Thus, personalisation and location awareness techniques should be added to the M-Government architecture as it improves it by helping delivering the services to the appropriate people efficiently and effectively in short time through SMS. Our next step is to investigate the impact of personalisation and location awareness techniques on M-Government implementations in developing and developed countries as well as examining applications that make use of more sophisticated mobile standards such as WAP 2.0.

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