What Seniors Want in a Mobile Help-on-Demand Service

A user needs analysis in the MobileSage project

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***Abstract*— Ambient assisted living can greatly assist seniors in pursuing an active and healthy lifestyle. MobileSage is an Ambient Assisted Living Joint Programme supported project that develops a cloud enabled smartphone based help-on-demand service for seniors providing appropriate "just-in-time" assistance through an individualized adaptive and multimodal user interface. This paper details the results from a user needs analysis conducted with seniors to help determine the design of MobileSage. Six focus groups in three countries were held to illicit the information. The user input is structured under the following themes: Multimodality: Input & Output; Navigation (wayfinding); Personalization; Help material – content; Help-on-demand; and Privacy, trust and security concerns. The MobileSage system will have its first iteration of user testing late Fall 2012.**

Keywords: user needs analysis; Help-on-demand; seniors; smartphone; multimodality; ambient assisted living.

I. INTRODUCTION

In the modern self-service and technology-saturated society, we find ourselves increasingly in situations in which we need access to information and perhaps assistance to be able to cope and manage successfully. It may be when adopting Internet banking, when using a ticket vending machine, when using an automated supermarket checkout system, or when checking in electronically at the airport. We may also need assistance when having acquired electronic domestic appliances that for various reasons have deficient or inappropriate operating instructions and manuals, e.g., being overly technical, or using a minute font size etc.

The information and assistance needs to be presented in a manner that the user prefers and finds accessible and easy to use. It also needs to be available when required and arrive in a timely fashion. Given their somewhat slower uptake of technology, seniors especially may benefit greatly from having access to user-friendly low threshold information and assistance services. This may assist seniors in pursuing active and healthy lifestyles, and is in accordance with an active ageing paradigm.

The MobileSage (MS) R&D-project develops such a help-on-demand (HOD) service for seniors. MS is partly funded by the European Commission through the Ambient Assisted Living Joint Programme (REF. AAL-2010-3-050). The participating countries are Norway, Spain, Romania and the UK.

MS involves the development of a cloud enabled smartphone based HOD service for seniors providing appropriate "just-in-time" assistance through an individualized adaptive and multimodal user interface. The front end consists of an application (app) installed on an Android phone. Advanced software on a server including a database populated with the HOD media in the form of text and multimedia files comprise the back end of the system. The content in the database is generated through a Content Management System (CMS). An overview of the MS architecture is provided in Figure 1.

The system can be applied to an abundance of situations and contexts in which seniors require assistance to conduct everyday tasks. Two brief examples will suffice.

Mr. Tweed is faced with a ticket machine when wanting to catch the train to his granddaughter. He is unsure on how to operate the machine. He sees that the ticket machine is MS enabled. He starts up the MS app on his smartphone (Figure 2), and brings the phone in close proximity to the ticket machine. The Near Field Communication (NFC) reader on the phone scans the NFC tag on the machine, and the unique code helps identify the ticket machine. The machines ID is used when the MS app contacts the MS server, and downloads the appropriate support material to the smartphone. Mr. Tweed's MS profile indicates that he prefers video instructions, and a brief video on how to use the ticket machine is shown on the smartphone.

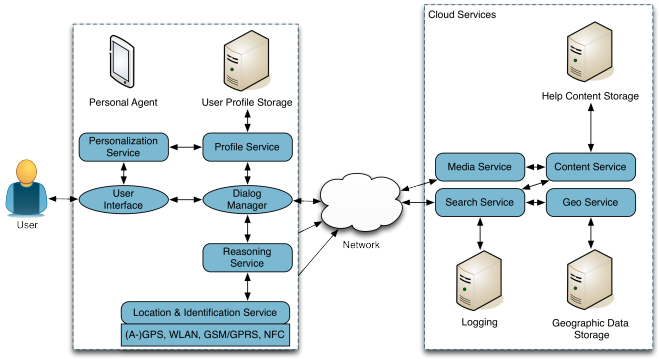

Figure 1. The MobileSage architecture.

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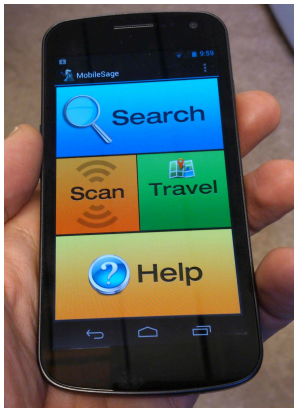

Figure 2. The MobileSage smartphone application.

Mrs. Wool has just bought a new blood pressure monitor, but is unable to use it as the instructions are in very small print, and Mrs. Wool has poor vision. By reading a Quick Response (QR) code, the MS app provides Mrs. Wool with a simple instruction manual in large print text retrieved from the MS server.

To ensure that the MS service is in accordance with the needs and wishes of real seniors, a thorough user needs analysis was conducted. In this paper the methods used and findings from this user needs analysis are summarized and discussed. A brief conclusion is provided along with a description of further planned work.

II. RELATED WORKS

The MobileSage project encompasses a plethora of technologies and domains including Help on Demand & Assistance "just-in-time", Multimodality, Adaptive and adaptable user interfaces, Context & location sensitive services, Reasoning agents and Profiles & personalization. Given the breadth of topics, a comprehensive summary of related works is not possible. A selection of relevant works is mentioned primarily limited to larger European R&D activities.

In the ongoing APSIS4ALL-project [1] the focus is on using the mobile phone in personalizing interaction with Public Digital Terminals (PDT) such as cash dispensing machines and ticket vending machines. Key elements covered in [1] are digital interaction with the mobile phone, profiles and personalization, adaptive user interfaces and multimodality. The end users targeted are people with disabilities, the elderly and novice Information and Communication Technology (ICT) users.

The completed ASK-IT project [2] had a similar scope as MS in terms of providing real-time information and being of assistance, but dealt primarily with travelling although work and leisure contexts were also addressed. The WayFiS, Mediate and Access2all projects [3, 4, 5] all deal with accessibility and transport or travelling. They share some attributes with MS, be it in a more domain specific manner. Similarly, [6] is concerned with context-based adaptation of ubiquitous web applications focusing on tourism and travel.

Soprano [7] had a similar scope to MS, but was more centred on independent living and a smart home environment. OASIS [8] also includes many elements of MS, but is a much larger project encompassing a wider number of topics. It is further preoccupied with architecture and platform development. INHOME [9] is also concerned with an architecture platform and ways of providing intelligent ICT based services for assisting independent living of elderly people in the home environment.

The ongoing MyUI-project [10] focuses on the mainstreaming of accessible and highly individualized ICT products. As with MS the need for adaptive personalized interfaces is of paramount importance. This was also a key feature of the Diadem project [11], which focused primarily on web interfaces.

Other scientific undertakings are narrower in scope and touch on certain elements in MS. In terms of user interface research SNAPI [12] and GoldUI [13] are of interest, whereas the HAPTIMAP project [14] is interesting in terms of multimodality and mobile location based services. Mapped [15] and HMFM [16] deal with multimodality and also cover similar ideas as MS. There are also a number of other major and more general international R&D activities that touches upon topics covered in MS [17, 18, 19].

Thorough user needs analysis were important parts of many of the projects mentioned above as well, but for reasons of brevity we cannot elaborate on these. We will draw the attention to one piece of academic work that did focus entirely on user needs in the related topic of location aware mobile services [20]. The author presents user needs separated in five main themes, which are not too dissimilar to the topics chosen in MS.

A review of current ongoing and past projects and initiatives shows that although there are a number of activities that touches upon similar topics, no other project is identical. Thus, MS is as such unique and innovative in its scope. It complements a number of other relevant R&D activities, and adds new knowledge and technology in a number of areas.

III. METHOD AND DESCRIPTION OF PARTICIPANTS

A. Method

We used a qualitative approach utilizing focus groups to elicit the information for the user needs analysis. Six focus groups were conducted, with two groups each in Spain, Norway, and Romania. There were some local variations in the inclusion criteria between the groups, but key criteria were actual mobile phone ownership and being a senior. The informants also completed a short questionnaire regarding demographics, mobile phone ownership and usage. The groups varied in size from four to eight persons. Each group was presented with two scenarios in which MS was used – one involving travel and the other use of a domestic appliance with some variation in scenarios used in each

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country. The scenarios were discussed based on a theme guide.

The required ethical issues were covered, especially through the informed consent form signed by each focus group participant, and the provisions related to personal data protection.

Transcripts were made from the recordings, and based on these summary reports for each group was made on a national level. A qualitative thematic meta-summary for the whole project based on the national reports was made.

B. Description of the participants

In total 39 informants took part. The vast majority was 60 years or older. In total the material comprised a wide variety of users in terms of functional capacity and impairments potentially impeding on ICT usage. It includes both the "average healthy" senior and persons with specific health issues including sensory impairments and mild cognitive impairments. The participants are described in Table I.

The groups are heterogeneous in terms of the type of mobile they use, and the types of functionality and services they utilize. It appears that the group in total comprises both advanced and basic mobile phone users, as well as the average senior mobile phone user. An overview of their mobile phone ownership and usage pattern is provided in Table II.

TABLE I. CHARACTERISTICS OF THE INFORMANTS.

Country:	Total #:	Gender (f/m):	Age range:	Comments:
Norway	12	5/7	48-81	Two groups of six in each. One group consisted of persons born outside of Norway.
Spain	11	8/3	62-75	Two groups.
Romania	16	11/5	67-86	One group consisted of persons with mild sensory impairment, the other group of persons with mild cognitive impairment.
TOTAL	39	24/15	48-86	

TABLE II. MOBILE PHONE OWNERSHIP AND USAGE PATTERN.

Country:	Type of mobile:	Usage pattern:	Comments:
Norway	Almost 1/2 had smartphones,. Majority used basic phone functions.	2/3 used calling, texting, MMS and photos. Some used e-mail and apps.	The group of persons not born in Norway had more basic phones, and used mainly basic functions, compared to the other group.
Spain	9 had basic phones and 2 had smart phones.	Calling, texting, MMS, photos and calendar, apps	Use of MMS, photos and calendar quite common. Few advanced functions.
Romania	All had standard basic phones.	All for talking and 50% for texting	Only one used phone for other things than talking and texting None used computers.

IV. RESULTS

A thematic summary of the findings from the focus groups is provided below. The themes reflect the main issues covered in MobileSage, and formed the basis for the scenarios and theme guides used in the focus groups. The themes are Multimodality: Input & Output; Navigation (wayfinding); Personalization; Help material – content; Help-on-demand; and Privacy, trust and security concerns.

A. Multimodality

In general this relates to the provision of output in various modalities, adapted to the user's needs and preferences, e.g., text, video, audio etc., as well as different ways of operating the device, e.g., touch, voice, physical keyboard input etc.

The interest in voice input varied from enthusiasm to seemingly polite interest; some did not prefer voice input at all compared to keyboard or -pad input. It was pointed out in several of the groups that voice input would be both easier and faster compared to keyboard usage, and it would be especially beneficial for persons with visual or movement disorders. The problems using on-screen touch keyboards were mentioned.

Several of the informants had had first-hand negative experiences using voice input. Their experience was that voice input was difficult to use because of poor speech recognition software. The need for a high quality voice input feature was mentioned as a prerequisite for implementation. It was also pointed out by several participants that a voice input feature must be context sensitive, i.e. must only receive and process input and execute something when intended to by the user to avoid unintentional execution of commands and actions.

There was almost universal interest in multimodal output, with few exceptions. Audio output such as text-to-speech is viewed as an important adjunct to visual text output in many situations, and especially for persons with visual impairments. There are also certain situations in which audio output is preferable to visual, e.g., when driving. Several informants mentioned that it is important to facilitate connectivity between the phone and hearing aids to ensure that the audio is available for users of hearing aids and other assistive hearing devices.

It was raised, though, by a number of participants, that audio output is not suitable in all contexts and for all information due to reason of privacy and safety. Although, many were positive to having text messages read aloud, some were reserved about this due to the potential private nature of the content.

The use of video for demonstrations and tutorials was universally applauded. It was also pointed out that audio equivalents must be available to ensure that those with visual impairments do not miss out. It was highlighted that the video sequences must not be too long, and needed to provide step-by-step instructions to avoid information overload.

Overall there was a genuine interest in multimodal solutions. Some had concerns for their usage in certain situations, and it was argued by some that it must be very easy to switch between the different modalities. Few had

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much experience with vibration/haptics as a modality. It was also mentioned that it was essential to have fall back modalities available if required due, for instance, to changes in environmental conditions, e.g., persistent loud noise which means that voice output need to have a visual alternative. Having a large screen was deemed important.

B. Navigation (wayfinding)

In general this was related to provision of support for both in- and outdoor navigation, but also to automatic detection of objects and the provision of location aware information.

All groups were interested in using a mobile phone as a device for in- and outdoor navigation. Voice navigation was especially appealing. A handful of the Norwegian respondents reported to have first hand experience with using the phone as a navigation device. In addition to getting assistance with findings one's way, it would also make them feel safe. Possible uses for indoor navigation could be to find one's way around shopping centres, as well as locating exhibits in museums and the like. Some concern was raised, however, with the cost of using map-based services in terms of downloading data over cellular networks.

There were some who raised the issues that a mobile phone screen is small for maps, and that it only shows a small area of the map. This could cause problems, especially for getting an overview of an area. Another point was that mobile maps are sometimes not up to date, and that this could cause problems. Further, some pointed that that they did not want to get too dependent on the phone for navigation purposes, and preferred paper maps.

It was mentioned that automatic detection of objects in one's surroundings could be useful – especially to regain one's bearings if lost. Many liked the idea of automatic location aware information, whereas others wanted manual settings for this. The access to a variety of Points of Interest (POI) for both tourist and practical purposes was mentioned as desirable. The possibility of being able to locate other persons through the phone was also mentioned in a couple of the groups, especially in the context of persons who were vulnerable, e.g., those with mild memory impairments.

C. Personalization

This is to be understood as the provision of support that is adapted to the specific, personal needs and preferences of the individual user. This theme is closely related to multimodality.

By and large there was universal agreement that a phone that can be personalized to individual needs was very positive and very useful. It was pointed out that not only must the in- and output be able to be personalized, but also the functionality and complexity of the device and services. It was for instance said that functionality not required by a certain person, should be hidden in the menus so it would not complicate or confuse the user. It should also be possible to change the complexity level to individual needs. This was especially important for persons with cognitive and memory issues. It is vital that the most important functions and controls are easily and readily accessible – including an emergency button to alert others in potentially dangerous or vulnerable situations.

It was also pointed out that a person's needs may change over time, and that this was important to take into account in a flexible set up. Suitable translations in terms of language are a must, and it was also mentioned that multiple languages should be available if this was preferred.

There was also a concern about who should assist the user with making changes to the set up of the smartphone when required. This is a pertinent point that needs addressing. Personalization also raised concerns from a privacy and security perspective. This was because personalization could mean that information about personal characteristics and potential vulnerabilities such as cognitive or visual challenges would be stored on the phone.

D. Help material – content

This pertains to the type of content provided as help material. Various types of content were suggested, such as:

- Maps and directions for orientation and navigation – both in- and outdoors.
- Travel information, and points of interest, including sights and services like ATMs.
- Tourist information about services and practical information including emergency information.
- Manuals, demos and tutorials – preferably step-by-step guides on for instance self-service machines, domestic appliances, recipes etc.

The modality and delivery should be personalized. Suitable modalities were video, audio and text. Adequate help materials – and access to training in using the equipment – were also emphasized.

E. Help-on-demand

Pertaining to provision of help "just-in-time", when needed. Many in the groups were positive to automaticity in the timing of help or assistance when needed. It was, however pointed out that for some persons and in certain situations this would not be appropriate. It could be distressing and disturbing. For others, like persons with cognitive challenges, help "just-in-time" would be very advantageous in a number of situations and for a number of reasons. Though, it is essential that a manual override is available, and that one has a choice in switching the type of mode on and off.

F. Privacy, trust and security concerns

This theme deals with issues pertaining to privacy, trust and security that MobileSage may evoke. These issues were raised in all groups, and seemed to be important for all. It was essential to trust the services and the information that was provided. The trustworthiness in the content would partially depend on who the content contributors were, and who were allowed to provide content. The ability to switch different services on and off depending on how much trust the user may place in one or another service, was framed as a possibility.

Privacy was a prime concern, and the protection of personal sensitive information such as health-related data

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was raised by many informants as a very serious concern. Of particular concern were the potential consequences of losing the device. The use of PIN codes and content protecting was suggested. The problem of having to remember (and possibly forgetting) the PIN was also raised as an issue. Privacy issues around logging of, for instance geographical and activity information were also forwarded as an issue that needed to be addressed. As well as the use of tracking of oneself or other people.

The issue of becoming overly dependent on the phone for vital functions and assistance was also raised as a safety concern. What would one do if there were no mobile coverage, or the battery went flat etc.? The need for the user to be in control and be informed about the various aspects pertaining to security, privacy and safety was suggested as being of paramount importance.

G. *Miscellaneous issues raised*

Below are a number of miscellaneous issues that emerged in the focus groups mentioned. They are all thought to have significance for the development of MS app. The cost of device/service was mentioned by a number of informants as an important issue. It cannot be too costly, as this will place it beyond the reach on many potential users, as well as being discriminatory.

It was also emphasized that smartphones should have physical buttons to assist operation. They should be large. The screen should also be sufficiently large to make it easy to see the content and easy to operate the device. Adequate training in use of the system is for many of utmost importance. Further, motivation to use MS was forwarded as a key issue for success. It was suggested that if the design provides an easy to use interface that makes it easy to navigate and operate MS, the motivation to use the device would hopefully be higher.

V. BRIEF DISCUSSION

We will in this section briefly discuss some of the results, as well as scrutinize the method used. The groups appeared to be positive to the MS system. Many seemed to realize that it could be of real help to them. This was interesting as few seniors own smartphones [21], with subsequent low usage of the types of services that smartphones can offer. Some research indicates that seniors are getting increasingly interested in smartphones and that the adoption rate is on the increase [22]. A survey into types of different mobile services showed that many seniors are interested in using services similar to those offered in MS [22].

Voice input was one of the major talking points in terms of input modality. Touch was also mentioned, but too a much smaller extent. This is interesting given that the use of voice as an input modality is really in its infancy in terms of mobile phones. The introduction of Siri on the iOS platform and similar attempts on Android phones may of course in time change all that. We would have thought that using touch as an input method given its ubiquitousness in the smartphone world would be something the informants would like to discuss to a larger extent. This may be because few of the participants had phones with a touch based user interface. It may well also be that the theme guide specifically mentioned voice input as a modality, and that the groups became preoccupied with this as a result.

It was raised that a touch user interface was problematic for some, and the need for physical buttons was also highlighted. Physical buttons are increasingly omitted from smartphones. This trend goes against the wishes of the focus groups. Touch only user interfaces with few or no physical buttons may be difficult to use for a number of groups, amongst them people with motor disabilities like hand tremors, as well as people with visual problems.

The wish for simple and easy to understand user interfaces with little complexity is one of the key messages from the focus groups. This echoes previous research, that seniors would like little complexity in their mobiles [23]. Attempts to accommodate this in smartphones are also seen elsewhere. Doro [24] has for instance recently launched a senior friendly user interface on an Android based device.

It was also suggested by the informants that it should be possible to increase and decrease the complexity of the MS system depending on personal needs. This could be especially useful for persons with cognitive issues. Fraunhofer Portugal [25] offers this feature in a tracking and navigation app for persons with dementia.

It is noteworthy to observe the focus that the informants had on security and privacy in terms of the MS system. As it came out from the discussions, despite their low smartphone ownership many of the informants are well aware of various privacy and security risks when using smartphones. This echoes findings from other user studies with actual smartphone users [26]. It is also interesting to note that multimodality, e.g., using audio to have information read out, was perceived as a security or privacy risk too.

The wide variety of HOD content mentioned by the informants covered many types of domains and activities. The majority of content did however focus on travel and tourism. This may be explained by the emphasis made on the first scenario that is a travel scenario. This may have influenced their answers and discussions. The MS system can offer HOD in virtually all contexts and settings, but this did perhaps not become evident amongst all the participants.

The issue of cost was raised. The costs are related to the cost of a smartphone as well as whatever the cost (if any) the MS system will be to the consumer. This is a very important issue, especially as we currently are having a financial crisis in many European countries. It is also an important factor that many seniors are on low incomes. It should be pointed out that the MS service can be used with relatively cheap smartphones. However, one may not be able to access all features such as NFC. NFC is usually only incorporated in the more expensive high-end phones, but is increasingly found in less more affordable handsets.

There are a number of methodological issues that may have influenced the results. Firstly, using a qualitative approach one is always open to different biases and interpretive issues. We have tried to be as open, objective and transparent as possible to combat this, but the results will always be a matter of the subjective influence by the researchers.

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The informants were very heterogeneous in terms of ICT and mobile phone experience, nationality, and functional capacity, to mention but a few characteristics. This may be viewed as a methodological weakness, i.e. the generalizations made in the results section only apply to some or certain of the participants or sub-groups. We choose to look at it as strength, however. By getting input from a group with a wide variety of user requirements, we were able to collect a wide range of user needs. As the potential users of MS possess an equally wide range of user needs, this may prove an asset rather than a liability. One should bear in mind, however, that there were very few participants in Spain and Romania that had smartphone experience. This fact will more than likely to have a bearing on the results, and needs to be taken into account when interpreting the results.

VI. BRIEF CONCLUSION AND FUTURE WORK

The focus groups provided a wealth of useful and relevant information. It shows a breadth in both user needs and requirements, as well as in the different users' familiarity with ICT and mobile technology. Further, it confirms many of the assumptions underpinning the MS project, as well as adding important commentary and input which will be invaluable when implementing MS.

Ideally all products and services should be designed in a manner that follows the principles of universal design, so that everyone can use or access them. This may be the case in a remote future. Meanwhile, there is a need for systems like MS. This need is likely to persist for a long time to come.

The MS project is conducting user testing of the first prototypes of the HOD and CMS in late Fall 2012. Several additional iterations are planned. The projects concludes in 2013

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