User Requirement Analysis for the Design of a Gamified Ambient Assisted Living Application

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Abstract. Most countries of the world are heading towards an ageing society. At the same time, newer technologies are constantly created, while the advances in networks and wireless communications allow other technologies like mobile and cloud computing to become ubiquitous. This leads to a problem that we are identifying and confronting, to make the use of modern technology easier for older adults, since it is in principle more easily perceivable by younger people. This paper presents a questionnaire study that took place during the design of a gamified mobile application that targets older people. In total 133 older adults answered the questionnaire consisting of 41 questions, providing an insightful view of their attitude towards modern technology, their health, physical activity tracking, playing games and social interaction using technology. The results provide useful insights to researchers and developers who target this age group for their human-centric applications and services.

Keywords: Ambient Assisted Living · Mobile applications · Senior citizens · Survey · User requirements

1 Introduction

We are heading towards an ageing society and the median age of the population has been rising during the last decades, due to declining fertility rates and/or rising of life expectancy [1]. Although the European population is currently the

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most aged around the world and is projected to remain so, every other continent has been experiencing the same demographic transition [2]. This shift is likely to be of major significance during the coming decades, transforming the age pyramid and leading to a much older population structure.

There is, however, an age technology gap and the ageing population shift is expected to deteriorate it. Older adults often lack awareness of many technologies and are less likely to use them [3]. Elderlies are also less confident with new technologies in general [4], have different concerns and needs than younger technology users and may not be attracted by the latest technological advances [5].

EDLAH2 (Enhanced Daily Living and Health 2) is a European Ambient Assisted Living (AAL) project that plans to make the usage of smart technology easy and to promote wellbeing and health among older people. The goal of the project is to create an easy to use gamified tablet application that includes games, social and health tracking features. The content and the features of the app can be remotely managed via a web interface.

The functionality of the app includes an easy to manage photo library with photos sent by family members, integrated video/audio communication with Skype, an e-mail system, a web browser with an easy way to set bookmarks, calendar functionality with reminders and a number of tablet games. Moreover, the platform includes a way to record health data, such as weight, blood pressure, blood sugar, etc., a plan for health improvement including exercise and weight, and finally a wearable device that will monitor health parameters, such as the number of steps and the amount of sleep. This set of features is manageable and the extracted data are visible to family members and others that have permission via the aforementioned web interface.

The rest of the paper is organised as follows. In Sect. 2 we describe related works, both surveys and applications, that have targeted older populations. The experimental setup and the motivation for carrying out this user requirements study are described in Sect. 3. In Sect. 4 we present and discuss the results that we have obtained and make the relevant recommendations. Finally, we conclude our work with Sect. 5.

2 Related Work

Due to the ageing society, there has been a rapid surge in the developed AAL tools and applications. These promote independent and safe living and aim to reduce the cost of healthcare as well as the caregiver burden [6]. AAL has emerged into a multi-disciplinary field that promotes the advancements of communication and information technologies to be used by older adults. Over the last years, there has been a plethora of AAL systems, platforms, frameworks, standards, and technologies [7]. Each one of those aims to fulfil different needs of the end users [8], but all technologies undeniably target to contribute to the overall wellbeing of older adults [9].

There have been many studies about the perception of technology by people and in our case, by older ones. In principle, the acceptance of a technology

depends on its perceived usefulness, its ease of use, the attitude and the intention of the users to actually use it, as well as the actual usage of the system [10]. There has been an implicit assumption that information technologies are of great use throughout all sectors of society, but older adults prove to be more ambivalent towards using such technologies in their day-to-day lives [11].

The use of gamification, that is the application of game-design elements in non-game contexts, proves to be a way to promote the use of technology, encourage a specific behaviour, improve the user experience and reduce the getting used time. In our case, the whole use of the tablet application will be gamified. There have been works that apply gamification techniques to improve older peoples' aspects of wellbeing, either by engaging elderly in telemedicine [12], or by supporting their efforts to maintain good physical activity routines [13].

Designing an application for older adults is a demanding task. In principle, they encounter several constraints when dealing with computer-based technologies [14]. Their attitude towards technology and their learning rate differ when compared to younger adults, but with proper encouragement and explanations, elders prove to be equally effective [15] and may form and participate in online communities [16]. Specific design methodologies should be followed when developing applications that target older adults [17]. With our work, we are pursuing to comprehend how older people think about several aspects of technology, what are their needs and how their wellbeing can be enhanced when developing a platform that satisfies their requirements.

Although there is a lot of research on AAL tools, each work usually targets a relatively narrow aspect of older adults perceptions and needs. With our work, we are pursuing to comprehend how older people think about several aspects of technology and we are examining ways gamification techniques may result in different engagement levels. This survey was conducted in order to understand the users' needs and how their wellbeing can be enhanced when developing a platform that satisfies their requirements.

3 Methodology

The goal of the project is to develop a platform and a set of tablet applications that are easy to use by older adults. In order to do so, one should first understand the needs and requirements of the users of the platform, the elderly. This is the reason why this questionnaire took place, in order to understand the expectations, the needs and the attitude of the users towards physical activity tracking, playing games, gamification and social interaction using a tablet. By understanding how older people feel about technology, their health and social inclusion, then we can apply all the results in the design of the tablet application and gamify the whole experience. Therefore, the goal of the presented work is to understand our target group, in order to design the platform and further orient the development of our project that could motivate people to improve their wellbeing by using a tablet app.

All the consortium partners of the project participated in the creation and the grouping of the questionnaire. The questions were developed in English so that all consortium partners could contribute with suggestions and thoughts. Each partner proposed questions trying to understand how the contribution for every aspect and feature of the project should be done. In total 41 questions were developed and categorised into thematic areas about games in general, computer games, competition, social background, health and technology acceptance. All questions were closed-ended ones with predefined responses.

The survey was carried out in Switzerland and in the United Kingdom (UK). The originally developed questionnaire was used in the UK, while a translated version of it in German was used in the German-speaking part of Switzerland. The survey was created and completed using the Drupal Webform module. The participants were recruited from the partners' existing user base and contacts, from end users of other projects and activities and from newsletters, e-mails and phone calls in order to diversify the sample with previously unknown participants.

In total 133 people completed the questionnaire ($N = 133$). Among them, 59% were Swiss and 39% were British. There were also 2 Germans and 1 Italian. There was an almost equal amount of women and men that participated, with 68 women and 65 men, while the majority of the participants, that is 66%, were from 65 up to 79 years old. 16% were less than 65 and 17% were more than 79 years old.

Half of the interviewees (52%) have obtained higher education qualifications and a quarter of them (24%) have a work based background. The majority of the participants (84%) live in their own home. In fact, all of the participants from Switzerland live in their own home, while all users living in a care village come from the United Kingdom. Most interviewees have no mobility impairments. At least three quarters of the participants walk unaided, drive a vehicle, be it a car, motorbike or bicycle and more than half of them (55%) use public transportation.

Most of the participants (71%) can still live on their own, without the need of any domestic support. Although memory failure problems increase with age, the majority of our sample claims either to not have any memory problems (20%) or to have some, but not frequently (66%). Most participants (59%) do not suffer from either anxiety or depression, while 32% of them rarely do so. A quarter takes no medication, while the rest ought to take at least one type of drug.

4 Results and Recommendations

4.1 Games in General and Computer Games

It is very crucial for our project to understand the attitude of the users towards games, both physical and computer ones. Considering that the goal of the project is to motivate people to use the tablet application and to improve their wellbeing by using gamification techniques, understanding their perception is important before promoting healthier lifestyles with games.

Most of the participants (80%) play games regularly. Only 11% of them do not play at all, while 16% of them are playing daily. Classic board games like dominoes, card games, crosswords, scrabble and bingo, do not seem to be very popular among our target group since the distribution is skewed (towards the "several times a year" and "never" responses). 17% of the participants never play such board games.

The main reasons behind not playing games more frequently are lack of inspiration (30%), lack of time (27%) and lack of partners to play with (21%). On the other hand, for the people playing games, the main reasons for doing so are for fun (60%), for practising the brain (56%) and for social inclusion (40%). Since our platform will include multiplayer features like a leaderboard, we have also asked about the users' experience with multiplayer games and about the type of such games they like. 32% are playing games in pairs, 28% in a team and 27% with lots of others individuals. A lot (38%) would prefer playing on their own and 12% do not like playing multiplayer games.

It seems that just over half (54%) of the users would play video games either on a computer or a tablet. Comparing this result to the previous one of 80% of people playing games in general, we can already highlight the gap that exists between older people and technology. 27% would prefer to play a single player game, while those that would happily play multiplayer games would prefer to do so with people they already know, either with friends (56%), or relatives (39%), or acquaintances (23%).

More than two thirds (69%) are not interested in competing against others and only a quarter of them (26%) would be interested in getting a prize from the game they play on the tablet. Regarding the prize, most (43%) seem to be indifferent to it, while the ones that would happily earn one would rather prefer something physical, either cash and discount vouchers (26%), or a free cup of tea (13%), to some kind of digital reward, since every such reward was ranging between 2% and 8%.

There is a correlation between the frequency of playing games and the interest of a person to play video games on a tablet. So given this, a developer should properly design video games and give enough motivation to the users in order to expect high engagement.

4.2 Social Background

Another goal of the application is to enhance the social life of its users. They will be able to receive e-mails, photos and phone/video calls within our platform. Hence the importance of understanding their social background first.

The majority of the participants (82%) think that social contact is important, three quarters of them (77%) have regular contact with their family through phone calls and visits at most on a weekly basis, but only 40% can imagine engaging with more people using technology. So it seems that older people are not fully aware of the capabilities of technology and how it can be used for communication. Although people willing to socialise want to use technology as a means of socialising, they do not feel able to do so. Only a minority of them

do not go out that often (7%) and do not see people often (11%). All the rest do so at most on a weekly basis.

Providing that we are creating a platform that monitors and collects data about different aspects of behaviour and wellbeing, it is of crucial importance for the end users to know how their data are being treated and who is able to view them. Regarding privacy concerns, given that the users know exactly who and which data are shared, permission would have been granted by more than half of the interviewees to certain members of the family (56%), as well as to certain healthcare professionals (59%). Around 24% would not share their data with others. There was, however, a respectable number of participants that were not entirely sure what data sharing means, so attention and careful clarifications should be given by app developers.

4.3 Technology Acceptance

The target application runs on a tablet and addresses many aspects, some even new-found for our target group. As previously discussed, there is a technology-age gap and thus, it is important to understand the older adults' view on several aspects of technology, understand their previous experience and evaluate their technology acceptance.

More than three quarters (76%) have an internet connection, either at home or a data plan on their phone and often use a computer, tablet or smartphone. 18% of them do not have an internet connection and 15% do not own any aforementioned device. Most of the people not using a tablet yet would be interested to learn to do so, either by exploring and learning it themselves (35%) or with some practical help (18%) or by written instructions (15%). People that do not use technology, either do not understand it (6%), or do not see the need (3%), or do not trust technological devices (2%). This target group is an undoubtedly challenging one to convince to use our platform.

The most prevalent reasons for using technology is staying in touch with people (75%), staying up-to-date with the world (72%) by reading news or checking the weather forecast, learning new things (50%) and maintaining a hobby (37%). Regarding data security, some people are not worried at all (30%) since they show trust in the platform they use, while more are worried, but would happily use the platform (40%) or would first ask family advice before (16%).

It seems that among older people, there are different age subgroups in terms of familiarity and interest towards technology. We noticed that as the age goes up, the frequency as well as the interest in learning to use modern portable devices decreases. This is why it is important to motivate users of all ages to overcome the initial fear of using technology and then to properly communicate all possibilities that open.

4.4 Health

A big part of the project is about proposing ways to improve one's health through gamification. Several health-related metrics will be monitored and shared with

predefined members of the family or healthcare professionals. Health tracking devices are also planned to be utilised by the platform.

It is clear that most older adults would like to improve their fitness level (83%) and would enjoy mental exercise (84%). It is not clear though, whether they would like some encouragement from others in order to do so, with 53% of them liking this idea and 42% not.

Regarding wearing a measuring device, the results are again split, with 54% interested to try to use one and 43% not. The blood pressure monitor (45%), the clip-on pedometer (41%), the panic alarm (35%) and the steps measuring bracelet (32%) seem to be the most popular options.

Our target group would not freely share health-related information with certain family members, with 52% of them voting for this. 38% would like to be able to see a health report on the tablet and 35% would not. It is noteworthy that 20% do not really know if they would be interested in this feature, fact that we can most probably attribute to the technology-generation gap.

Regarding the most appealing aspects of health improvement training, getting a clear goal on what should be done (36%) and training with other people (29%), i.e. enhancing their social life, seem to be the most popular ones. Notably, only one participant would be interested in being able to compete with others and only 9% of them would be interested in receiving some sort of achievement for every successful exercise.

People already familiar with computer, tablets or smartphones are naturally more willing to try new types of devices and applications. But the big number of people not replying to such questions possibly demonstrate once more that the older adults are not up-to-date with the current trends in technology.

5 Conclusion

Our work provides an insight into how older adults perceive technologies, health monitoring and tracking, games and social interaction, in support of researchers and developers who design applications for this target group. Designers should create human-computer interactions that allow seniors to remain active members of their family and the society while pursuing their interests. In general older adults seem to be interested in exploring technology, although sometimes they are unaware of its capabilities. This is why it is crucial to approach older people with proper encouragement and clear explanations when presenting new applications to them.

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