

Use of a Smart TV as a Platform for Social Engagement for Senior Citizens

Elona Dika and Arianit Kurti^{1,2}

¹ Faculty of Technology, Linnaeus University, Växjö, Sweden
dika.elona@gmail.com, arianit.kurti@lnu.se

² Interactive Institute Swedish ICT, Norrköping, Sweden
arianit.kurti@tii.se

Abstract. The number of studies investigating computer use or other technologies used by senior citizens has progressively increased in the last twenty years. The interest stems from a diverse range of research disciplines including human computer interaction, education, and many others. Senior citizens generally have a positive attitude towards technology, and they are willing to use the product if they need it. Positive attitudes are also more likely to be expressed towards devices used every day at home, such as the television, microwave etc. Even if those devices are now typically digital, senior citizens are familiar and comfortable with them. These characteristics drive us to offer a solution by re-thinking the use of some existing technologies and making them more affordable and accessible to older people. It is offered on a TV, something that senior citizens are familiar and comfortable with and which most of them have it at home. On this research we report our experience on developing a prototype service using smart TV application specifically tailored for the senior citizens needs and requirements. Based on the findings, we can conclude that there was great acceptance from senior citizens for the support of daily living and the ability to control their daily activities provided by this service.

Keywords: Senior citizens (and/or elderly people), human computer interaction, Smart TV, social engagement, system design, interaction, video communication

1 Introduction

The increased portability and wide adoption of social media services and mobile devices have resulted in the fact that they are not anymore perceived as distinct technological objects but more as integrated tools to support our everyday activities [12]. In these emerging social web applications and services, socializing of people has become one of the main activities. Rennie and Zorpettet [13] suggested that: “*Socializing is something that people used to do on the web; gradually is becoming the web*”. The main idea behind this view is the fact that peoples are actively engaged by contributing with digital content on the Internet through the use of different social media applications (such as Youtube, Flickr, Twitter, Facebook etc.) and devices. All these

development trends have resulted in new ways for people to create, share, manage everyday life, and communicate with their friends and family.

Nevertheless all these popular social media services developed so far have been designed and implemented taking into the consideration primarily the requirements and needs of younger generation. This fact can be clearly seen from the demographics of the social media users¹. Today, in the developed world we are experiencing the increased life expectancy trends [14]. In Sweden currently the life expectancy is 82 years for women and 77 for men. Moreover the total number of senior citizens (65+) is almost 20% of the overall population and the predictions are that this number will continue to grow in the years to come [8]. The demographic trends of population and the fast development of social media applications have created the so call “*generation gap*” on how the ICT tools are used among people [10]. Currently we have only 2% of the social media users that are 65+ years old². This paradigm created the landscape that senior citizens perceive the social media services as far too complicated for them to use. One of the aspects that that has become a cumbersome for wide adoption of social media services by senior citizens, is the fact that they are developed for diverse device usage, such as computer, smartphones and handheld tablets. The inappropriate design, small buttons, fiddly controls and unnecessarily complicated interfaces of social media application have brought a high level of complexity for the senior citizens, thus limiting them from active use.³

Different ICT devices have been around for different period of years. Telephone has been around for more the 100 years, TV for around 80 years, personal computers for around 30 years, while smartphones and handheld tablets for less then 10 years. All this is also reflected in the way that senior citizens have adopted them. Telephone and TV sets have been more pervasive in current senior citizens life almost from their birth or early childhood. Recent developments especially in the TV technologies turned them to become a new platform for interacting with peoples [15]. The Smart TV and Net TV initiatives are gradually gaining the pace between the TV set producers. All this combined with the advancements of Internet based telephony systems bring new opportunities for leveraging social media services especially tailored for senior citizens. Research in this field is in the initial stages and the main challenge remaining is to utilize the smart TV platform for social engagement of users (especially senior citizens) [16].

Therefore the research problem that is investigated in this paper is formulated as follows: *How can interactive media devices be used as assistive devices to help senior citizens for a better social engagement?*

In the next section we provide a state-of-the-art overview of the related research, followed with a requirements identified. This is followed with a prototype design, implementation and the assessment of the prototype usefulness. In the end we report our conclusion and pave the way for the future research work.

¹ <http://royal.pingdom.com/2012/08/21/report-social-network-demographics-in-2012/>

² <http://royal.pingdom.com/2012/08/21/report-social-network-demographics-in-2012/>

³ <http://www.independentage.org/media/9425/gulbenkiannewreport.pdf>

2 Related work

According to [5], the key success for conducting a research project was planning, understanding the obtainable information, maintaining that information, and extracting information from useful sources. In this aspect a very important tool is state of the art survey of the related research work to enable to position our research efforts within the already existing body of knowledge in this field. To achieve this, we have followed the Literature Survey Protocol [7]. This approach was chosen as it provided us with the possibility to create a good understanding of the area based on existing research. Below we provide the details regarding the keyword choice, search query and the scope of the literature survey.

Choice of keywords. Social engagement of senior citizens, accessibility, interaction, user acceptance, and assistive technology

Search string. ((Title: social OR Title: engagement OR Title: elderly OR Title: citizens OR (Abstract: social OR Abstract: engagement OR Abstract: elderly OR Abstract: Citizens))

Search Scope and Strategy. In this research, two dimensions are defined: time and space. In time, the dimension included papers that were published from January 2010 until January 2013. The year 2010 is used as the start time because of the trends and novelties that Smart TV as a technology offered around that time. This time dimension was chosen because of the technology-driven society in which we are living. Principal research databases consulted in the literature survey were the Association for Computing Machinery's, or ACM's, digital library of major publications, and the Institute of Electrical and Electronics Engineers, also known as IEEE, which delivers the world's highest quality on the latest technical research.

Inclusion Criteria. Beside the criteria of time and space mentioned above, we had some additional criteria:

- The paper must be related to engaging senior citizens with social media or their ability to use and access those media.
- We included only papers that provided evidence and assessment methods to prove their claims. The assessment may be in the form of an example application, simulation and evaluation, or survey analysis, we include these type of papers because we need examples that are similar to what we need to research and as a conclusion come up with a product. Papers with insufficient amount of information, or papers with vague analytics discussion were excluded.
- Papers that focused on explaining their methods and research for increasing senior citizens' social relationships through TV-based services, devices that can make TV

more seemly for supporting interaction amongst older adults were included. Papers that provided concrete recommendations and solution.

- We only included papers which were submitted in English language.
- The papers should adhere to the problem definition of this paper. It should be able to address the research question (s). Otherwise papers that do not tackle the research question were excluded.

Exclusion Criteria.

- Papers that did not provide enough evidence for their claims.
- Papers that deal with assistive devices for seniors related to health or education were not used in this process, since in this phase we wanted to focus more on social engagement of senior citizens.
- Duplicate papers

With these parameters, we retrieved 48 papers. After applying the inclusion and exclusion criteria, 25 final papers remained for processing. The summary of these papers and findings is presented in the following state of the art section.

State of the Art. The complexity of new technologies of today lead to what is known as “the digital divide”, where senior citizens find it challenging to access technology and interact with it. Besides complexity, design is also a difficult challenge for senior citizens, because it must be simple to use, affordable, and easily integrated in the home environment. Different papers, journals and conferences have raised ideas on developing and building something for senior citizens with more adequate user interfacing approaches and greater ease of use. Based on the literature survey, we have divided the papers based on their content and the solutions offered, e.g. the technological aspect, social/ loneliness concerns, physical constrains, etc. The key lessons derived from the research are used to label the sub-sections of the literature survey outcomes found below.

TV as most suitable for the senior citizens. This issue was covered from a project about doing a genuine case study of the assistive living ecosystem. Mainly, the focus was about TV and phones in daily life activities. They found that media, like phones or television, do not disturb senior citizens. This is because they already have some daily activities connected with these devices. In [11] conclusions, they have given the reason why the TV makes a suitable device for this study's purpose:

“Among the enormous variety of devices, TVs are the most suitable for the senior citizens. Senior citizens can use these devices without written instructions. They can use them easily. They want services that can be navigated with remote, and give them the feeling that they control it” [11].

Loneliness, an Important Issue of Senior Citizens' Daily Lives. Another important issue in the daily lives of elderly people and why this project may have the advantage

is loneliness. This was tackled and noticed from the researchers that went to the majority of peoples in the senior housing. This observation was also noted in the Ticket to Talk Television Project [9].

Physical Constraints. Chou and colleagues [4] indicate in their research that they have noticed that older populations, due to age related problems, tend to face physical weakness. Also, sometimes it is not only their willingness to learn and using new things but also the approach of environment, the development, and the design that can restrict seniors' technological aptitude. Thus, it is desirable to offer a solution without physical constraints that can be smoothly become part of the media with which they are already familiar.

Seniors with less knowledge on computers and Internet are excluded and neglected from using these technologies. From the results of the research done for the TAGlab project [2], we learned that now some of elders use Skype to stay in touch with their family. Knowing that current technology can be used as a bridge for physical and social distance, this project intends to fill these gaps and make this connection stronger for senior citizens.

There are some other similar projects analyzed, but not covered in this paper, since they were on-going or in their initial phase of development (when the literature survey was conducted), for example FoSIBLE [1].

3 Identifying requirements

Besides having a good understanding of the existing body of knowledge regarding the senior citizens and assistive technologies, the literature survey helped us also to identify the gaps and requirements of the senior citizens. The state of the art section gives us clear pictures about what senior citizens want and what is more or less acceptable and adaptable to them. In the study performed by Carrasco et al. [3], they state that 98.3% of senior citizens from aged 60 years and over possess and regularly use a TV set. For this reason, we feel reasonable to choose the TV and consider it a suitable technological platform for our purposes in this thesis. Also, we have summarized both the requirements that this solution should fulfill and the conditions that a technology needs to meet. One of the key requirements identified by [9] is the need of avoiding loneliness. Furthermore in the T-Seniority project [11] brings the importance of familiar and simplified ways of interactions and use of large icons and avoiding double clicks and moving texts and use of large fonts.

4 Design and Implementation

The interface of this application is expressly adapted to senior citizens' needs and requirements. It was designed for the familiar TV set, but the architecture that we have developed is also compatible with PCs and tablets. From the system design per-

spective, we have considered concept of extensibility where we leave space in the implementation to consider future growth. This process of development allows for numerous other possibilities for this platform, such as how the same platform can be utilized in tablets without any modifications.

Working environment. After deciding that TV is the device to be used, to hide the complexity of PCs, we plan on using an additional device that will convert the normal TV into a SmartTV. By comparing some devices, we chose MinixNeo X5 as a leading device that fulfilled our needs. This device had Android as its operating system.

Prototype components. This solution presents a mashup of 5 components in which 4 of them work in parallel to create an interface and the 5th is included for authentication and authorization. Prototype components are depicted in Figure 1.

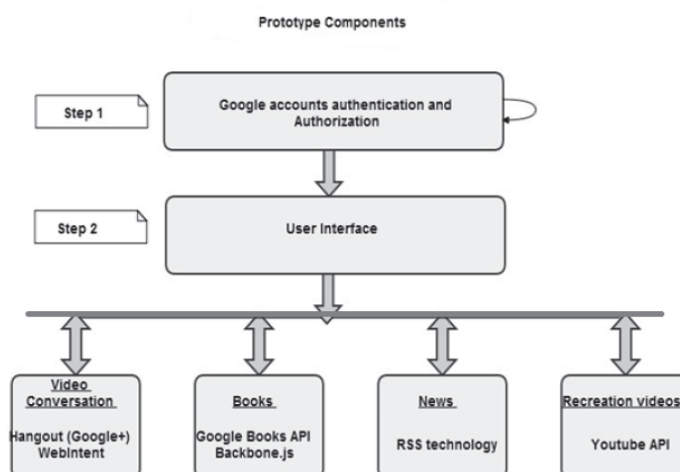


Fig. 1. Prototype Components

Technology overview. Comparing the requirements and services we want to offer with all the advantages and disadvantages inherent to each of the three types of apps (Native vs. Hybrid. Web), we can say that hybrid is the one that can serve us best in delivering our solution in the proper manner and with all the functionalities mentioned until now.

Implementation. The first feature implemented in the project is the ability of users to log in with Google Authentication. This feature gives the platform more security and makes it easier for users to use their Google accounts to use the platform.

Google authentication. To ensure that user data is not abused, we have used Google Account for certain activities. Access control consists of two components: authentication and authorization. This login involves a sequence of interactions between our solution, Google's login authentication service, and the end user.

Video Conference. For this part Hangout is used. Since it has some limitations for ARM architecture we tried to find a way of accessing hangout. One way is using as hybrid application, which offers the possibility of using Hangout as a native application. While developing the hybrid app, Intent was used as an abstract description of an operation to be performed. Web Intents is a framework for client-side service discovery and inter-application communication. Applications request to start an action and the system will find the appropriate service for the user to use (in this case Hangout).

Google Books API. Having the possibility to login to the application through Google gives us the possibility to choose from a wide range of services that Google offers. One such service is the Google Books API, which has a mission to digitize the world's book content and make it accessible on the web. The positive effect is that people can read every book wherever and whenever they want.

RSS News. For this part, we have used RSS (Rich Site Summary). It is a format for delivering regularly changing web content. This enables us to take different information and be updated with news from Swedish newspapers (or other). It retrieves the latest content from the site. The main advantage of RSS is that it lets us tune out mainstream media and tune into alternative and personal media.

Recreation Videos. The fourth functionality of this solution was based on Aktiv Senior⁴, which is an independent network of active seniors. Based on their research, we found out that the priorities of senior citizens regarding social engagement are: House or Gardening, Hunting, Exercise and Cooking. This is achieved by using the public YouTube API, which offers a full range of possibilities. By using this API, it is possible to create customized platforms based on YouTube.

Interface design. Once we had accounted for all of the above-mentioned requirements regarding the design and functionalities, we had our first User interface for the system.

5 Assessing the benefits of the prototype

USE questionnaire served as instrument to validate its usefulness and importance. The motivation behind using this type of questionnaire was the study suggestion. Users

⁴ <http://www.aktivsenior.se/cm1v/default.asp>

evaluated the prototype primarily using three dimensions: usefulness, satisfaction and ease of use. These are the parameters found in USE questionnaire [6]. Before utilizing the USE questionnaires, we did four scenarios that will be performed by them. Each of the users performed one or two of the scenarios in order to understand the application and see how it works. A basic explanation was given on how everything works, how can you access it, and what is provided. The environment for the usability assessment consisted of the TV, Minix Neo X5, remote control, and the camera. Each of the users had to perform two of the scenarios which, depending on the user took approximately 5-7 minutes to complete including the time for clarification if something was not clear. After the scenario, they had to fill out the USE questionnaire, which took between 40 and 45 minutes, including the answers and discussions as necessary during this time. Questionnaire consisted of 30 questions divided into four categories.

Subjects. The participants, 4 males and 6 females, were people ranging in age from 55 to 73 (in different places aging starts either from 55 or 60, as stated in the introduction part). Participants were from Macedonia, Kosovo and Serbia. They differed widely in their level of computer or other technology (excluding TV) experience. 30% had used a computer for communicating with family members, and 40% had experience with computers but only with the help of someone else. The rest had never used a PC or other device to communicate (excluding the telephone). All of them (100%) had used a TV in their everyday life to watch the news or movies, and some were even regular visitors of the Discovery Channel, which is mostly known for its documentaries. Only 2 of the participants had not completed primary studies (only 4 years), while the others had completed their primary studies, and 4 had accomplished university studies.

Materials. Participants were given printed questionnaires along with written and spoken instructions describing how to complete the questionnaire. When a question was not clear, additional explanation was given.

Procedure. The questionnaire distribution took place during our visits to the participants' homes. As we entered, we mounted the device that we would be using to their TVs and asked if they wanted to try to use it. All of them accepted, because I had informed them prior for the visit regarding my project and how they can "play" around. Meanwhile, we discussed that we would be trying to take notes based on their face expressions, body language, etc.

Instruments. The participants' TVs were used along with our remote control, which can be used much like a simple mouse for a computer, so participants could point to what they wanted by moving the remote. There was always one person from the project with them while they used these instruments.

The first thing that we noticed was that the results was different for users with close family members abroad and those that live with someone. Users communicate an

average of 1.75 times, which means once or twice per week. And with our application we expect growth to 2.75 or 3.75. This assumption is based on three of the participants that had the application at their houses for 1 week. More than 80-90% of participants found this solution useful, easy to use, and easy to navigate. Satisfaction and ease of learning received more positive grades. A major part of this success was the simplicity offered in the steps that the user should take to execute a task. The vast majority of the responses showed that users were highly satisfied with their experience with various aspects of this solution. However, all this feedback was used as a guide for the ultimate implementation that will lead in high-quality service and educational resources, as well support the research question stated in the beginning.

6 Conclusion and further work

Improving the social engagement of senior citizens has increasingly been the concern of different research groups and companies in recent years. New trends in Smart TV technology have opened new possibilities to provide better ways of interaction and engagement. The system in this project is developed with senior citizens in mind and for senior citizens. We provided them with services that fulfill their needs in their everyday life. Based on the assessments, the senior acceptance rate was high due to the user-friendly interface, appropriate content, the easy way of interacting, and the easy to use environment.

First, we made a literature survey based on rules and standards to find the existing solutions on the market and their limitations and disadvantages. We studied those solutions to find the gaps. The state of the art section can be used as part of a research foundation for studies in the same academic field or area as well.

Second, based on our findings, we built a solution designed for TVs to make them 'smart' that can also be used on different devices with different screens sizes and carried out an assessment which details the users' experiences and their feelings regarding the system etc. On a general level, the conceptual design, development, and evaluation of the portal prototype have shown that the majority of senior citizens enjoy using it. Furthermore, the evaluation results suggest that various aspects of the portal prototype meet the needs of a senior citizen in terms of interaction design and social engagement. Nevertheless, the importance of this research was also that the solution is provided with a technology, which is easy set-up, reduces access barriers, and is a relief for family members. Even that the time span for the evaluation was limited the insights gained study show some interesting trends on the use of Smart TV as a solution for senior citizen engagement. Finally, all the advantages of having an assistive device for better social engagement and e-participation may encourage family members to enrich the lives of their parents, grandparents by introducing suitable service for their daily live activities. Since the system is based on HTML5 and native app, maybe in the future we can consider developing this solution with minor changes for mobile devices. They are more ubiquitous and have a large deployment in nowadays market, which will also give us the possibility to extend to different scenarios. Taking into consideration that this idea will need to be developed and adapted in the future, we may consider having our own device for exposing this solution, unlike the TV

solution offered in this phase. As a conclusion, we can say using a Smart TV to enable social engagement for senior citizens is promising when they, their behavior, and their needs are well analyzed. In future different services, possibility of customization and interaction should be considered.

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