Share&Care: A Senior-Friendly Family Interaction Application

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Abstract—Seniors, or older adults, living alone often experience loneliness and face technical challenges when using mobile applications to interact with their families. We first performed a user study on older adults' family interaction and their mobile phone usage through in-person interviews with 12 older adults and an online survey for 28 people aged ranging from 16 to 35. Then we proposed and designed Share&Care, a senior-friendly communication application that aims to improve the seniors' experience with the mobile application and promote family interaction to reduce senior loneliness. This solution integrates senior-friendly user interfaces, multi-language voice interaction, senior managers, and multiple databases to increase the seniors' comfortability and trust in our application. Interested readers might watch a YouTube video introducing the Share&Care app at https://youtu.be/KeDxeV-5_Rk.

Keywords—*Senior Communication, Loneliness, Remote Management, Mobile Application*

I. INTRODUCTION

According to the 2016 American Community Survey (ACS) report [1], 9% of the world population aged 65 or older, which is about 617.1 million people. It is expected that the senior population will increase to 12% by 2030. The 2010 U.S. Census Bureau report [2] also shows that 28% of the U.S. senior population in 2010 are living alone, which is about 11 million seniors. We would like to note here it is surprisingly hard to find a good term for people age 65 or older - seniors, older adults, elderly, elderly people, etc. [1]-[14], we use these two most used terms – seniors and older adults - interchangeably wherever the contexts fit.

Research [3]-[6] has shown that physically living alone often leads to loneliness and various health problems, such as depression, poor cognitive function, dementia, etc. This often results in higher medical costs for this group of seniors. The National Health Expenditure (NHE) reported that the average of health care expenses for seniors was $19,098 in 2014, while the cost for children under 18 and the working-age adults were only $3,749 and $7,153, respectively [7].

A number of technologies have been developed to help old adults curb loneliness through communication with virtual robots [8]-[10]. However, these applications often are too expensive yet have not provided real human interaction. Older adults also experience many challenges in using existing communication apps due to the lack of familiarity with technical products and declination in their hand dexterity as they age.

Fig. 1. Share&Care: basic and special features

In this paper, we propose Share&Care, an iOS communication application with a senior-friendly and voice user interface to assist older adults to fight against social isolation and loneliness by promoting family interaction regardless of physical location and technology familiarity. The features of the app are shown in Fig. 1 and will be detailed in the paper: the basic features include phone call/FaceTime, real-time chatting, managing posts and contacts, while the special features include a voice user interface, a senior manager, and senior-friendly chat interface. The key contributions in this work include: (1) A comprehensive user study of older adults (seniors) and their younger generations on their smartphone usage and family interaction, (2) A voice user interface that allows seniors to navigate the app through voice commands, and (3) A senior manager feature that enables a family member to remotely manage a senior's account with the senior's permission.

This paper is organized as followed. The existing applications to reduce senior loneliness are discussed in Section 2. Next, the result of the user study is provided in Section 3. The system design and implementation of the Share&Care are presented in Section 4. Last, Section 5 concludes the works and discusses a few future directions.

II. RELATED WORK

A few studies [8, 11] have shown that animal interaction can effectively provide companionship for lonely people and improve their mental well-being. In particular, puppy and kitty can bring many joys to the owners regardless of age. However, older adults often cannot take care of a real pet; thus, many

robotic pets were invented to help them fight against social isolation and loneliness. For example, Joy for All robotic therapy pets [9], which are furry robotic pets with a vibrating heartbeat and can respond to actions, like petting, hugging and speaking. It aims to provide seniors with realistic pet interactions. Besides the robotic pets, there are also virtual pet apps, such as GeriJoy [10], designed to have compassionate conversations with seniors through an animated dog or cat. The existing robotic and virtual pets could help older adults ease the feeling of being lonely; however, they are usually expensive and cannot fully assist them to curb the loneliness since these products only provide artificial interactions. Our approach focused on providing a mobile app for real human interactions, especially the interactions within the family to help seniors reduce loneliness and feel the love from others.

There exist many chatting apps and photo sharing apps, such as Messenger, Google Duo, WeChat, 23Snap, etc. These applications have many great features for family communications but are difficult for older adults to use, especially for those who are new to mobile devices, since these apps' design and functionalities are more targeted for younger users who are familiar with technical products. To enhance seniors' experiences with communication apps, our solution incorporates a voice interaction system to minimize the requirement of touching the screen and a senior-friendly graphical interface to help seniors easily find the person/photo they would like to communicate/see.

III. User Study

To obtain first-hand information on seniors' thoughts on the existing mobile communication apps and their needs on communicating with their family members, we conducted in-person interviews with 12 older adults (aged 65 or older) and 3 staff members from 3 senior centers. We also created online surveys for younger people to collect their interaction frequency with their senior family members and their thoughts on seniors' technology usage.

A. Smart Phone Usage by Older Adults

Pew Research Center has a continuous study on American mobile phone usage started in 2011 [12]. Based on their survey results, the percentage of U.S. adults (age 18 and above) owning the smartphone has increased from 35% in 2011 to 81% in 2019. This large increase in smartphone ownership also existed in the senior population, their ownership had increased from 11% in 2011 to 51% in 2019 [13]. Our survey result and interview result also confirmed these statistics.

From the 28 younger people (ages between 16 to 35) we surveyed, 44.9% of their senior family members are actively using the smartphone. Out of the 12 old adults we interviewed, 50% of them are using smartphones and the rest are using cell phones. As the smartphone ownership increased, the problem will not be owning a smartphone, but how to make it easily accessible and safe for seniors to use, as most of the older adults we interviewed mentioned that they have experienced difficulty in using most of the existing mobile applications.

One of the major concerns that most older adults have is the security of their personal information, this problem can range from prompting for basic personal information when registering an account in any application to the sensitive information, such as ID numbers or SSNs. For most of the seniors, they are not familiar with the functionalities of the application and might accidentally press on some buttons, which often leads to the request of credit/debit card information or other pages that seniors often don't know how to close or deal with. As some applications promote ads while users using the apps, it increases the difficulty for seniors and leads to poor user experience with the app.

B. Family Interaction

From the survey group of 28 younger family members, 76% of them are not living with their seniors, and none of the seniors we interviewed are living with their family members except their spouses. As discussed above, more and more seniors experience social isolation, the distance separation between seniors and their family members have been the common problem that many seniors are facing. With the availability of cellphones and smartphones, phone calls and messaging have been the most practical communication tools for the seniors, in addition to the in-person communication. As shown in Table 1, over half of the surveyed young population contact their senior family member only a few times per year.

TABLE I. Survey Result: The communication frequency between young people and their senior family members

Daily	Weekly	Monthly	Yearly
16.9%	18.6%	13.6%	50.8%

Most of the interviewed older adults do not use any social media apps, either due to the lack of access to smartphones/tablets, or they feel these apps are not personal and have too many distractions from ads and/or irrelevant information. However, they do feel that it is a good idea to have communication apps, as the younger generation is more active in social media apps than phone calls. According to the three staff members at the three senior centers we contacted, they all offer technology classes to teach seniors to use computers and smartphones, and most seniors are eager to learn. But the common problem is the complexity in most apps which makes it harder for seniors to use.

IV. Share&Care Design and Implementation

Share&Care is a multi-language iOS application that provides a secure and private communication platform for families and friends with a senior-friendly interface. Our application aims to better assist seniors to interact with their families and friends, so we distinguish the interfaces for senior users from ordinary users. To improve the senior's experience with our application, we incorporate voice control and feedback to minimize the need of touching the screen, use text-to-speech as the visual aid, and provide a simpler interface for seniors without any distraction from ads or pop-up message. Most importantly, we allow seniors to select a manager to remotely help them manage their accounts, such as adding or removing people from their contacts.

Fig. 2. Share&Care tech stack

Data privacy has been a huge concern based on the feedback from the user study. To ensure the security of our user data, we separately stored user's data into three different locations as shown in Fig. 2. All the chatting messages are stored in the Firebase Realtime Database for real-time performance without users' identities, all the images and audio messages are stored in the AWS S3 cloud storage for its capacity and also without showing the users' identities, other user information will be stored in the AWS DynamoDB with encryption. Our application will not request any sensitive information from users. Users can successfully register and use our application by providing a valid phone number.

Similar to many existing communication applications, Share&Care also provides basic communication features, including real-time chatting, create/like/dislike of photo posts, manage contacts, edit user profile, etc. On top of these basic functionalities, our app also provides voice interaction to enhance the seniors' experience with navigating through the app, senior managers to help seniors manage their contacts to save seniors from the complex operations of adding/removing/editing family members, multi-language feature to serve users from different countries, and photo grouping to allow users easily find the post/photo they want to view.

A. Voice User Interface

As seniors' hand dexterity decrease with their age increase, they might experience difficulties in touching the screen. To minimize the requirement of the screen interaction for seniors, we incorporate voice navigation in our application. When seniors login to the app, the voice navigation feature will be automatically turned on, and they can use voice commands to navigate through the family posts and photos. For example, saying commands "scroll up" and "scroll down" will scroll the screen to the previous or next post. As they are using the voice commands, voice feedback will be provided to let them know which action the app will be performed, this can increase the seniors' confidence and comfortability when using our app and not be surprised by the changes that appeared in the screen.

Currently, our application supports dual languages – English and Chinese (Mandarin). As the grammar for English and Chinese has a huge difference, we developed the word extraction algorithm to better detect the command words from the user's voice input and used in voice navigation. To provide more visual aid for seniors, not only did we increase the sizes of the text and buttons, but also provide a text-to-speech feature. Text-to-speech is available for users to hear the description of each photo post and the chatting messages from other users.

B. Senior Manager

Setting up the contacts is a tedious task for seniors, as it involves complex commands and the risk of mistakenly adding strangers. To save them from these complex operations, our app allows seniors to select a family member as their manager to help them deal with these tedious commands. The managers can remotely manage their assigned seniors' contacts, with the ability to add and remove members from the seniors' contact page. Additionally, they can edit the nickname and relationship of each contact for the seniors. With this feature, managers can remotely set up the contact page for their seniors, so seniors can just easily start to communicate with their families.
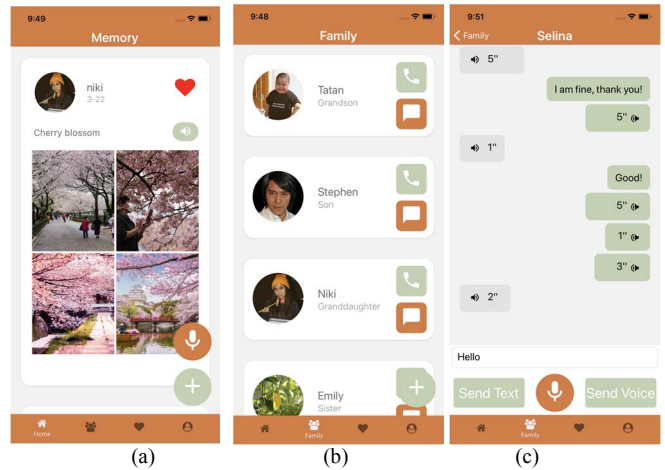

Fig. 3. Share&Care app interfaces, (a) the home screen, (b) the contact screen, (c) the chat screen

C. User Interfaces

A simple user interface is essential for seniors to increase their comfort with technology. To further reduce any confusion that our app could bring to our users, we greatly simplify our user interface and enhance the accessibility for users while still maintaining all essential features. Fig. 3 shows the three main screens of our app. All family's posts will be displayed on the home screen (Fig. 3 (a)) with voice navigation available when the voice button turns to orange. Users can say different voice commands to navigate through the posts without touching the screen, such as "open post", "swipe left", "go back", and "like post". As users like a post, the liked post will appear on the favorite page, which allows users to easily find their favorite special moments. In each post, there is an audio button available to play the recorded audio or a text-to-speech of the post description. Under the voice button is the plus button that allows users to create a new post by selecting photos from the photo library or taking the new photo with the camera; the audio aid is also available for creating post description.

The contact screen (Fig. 3 (b)) contains all the user contacts with their profile image, user-defined nickname, and relationship with the user. Pressing any contact card will open

the selected person's post screen, which contains all posts created by that person. By pressing the phone button on the right of the contact card, a popup window will be displayed for the user to choose either make a phone call or a FaceTime call with the selected person. On the other hand, pressing on the message button will open a private chat screen (Fig. 3 (c)). To free seniors from typing, we have the audio button in the chat screen, that allows users to send the recorded audio or text from voice recognition. As voice recognition is active, the recognized text will be displayed in the text field while the user is talking, and users can feel free to edit the text before sending the message.

V. Conclusion and Discussion

In this paper, we propose the Share&Care app that aims to increase senior's comfortability with mobile communication and promote distance family interaction. Our major contributions are the development of the dual-language voice user interface and design the app for all people regardless of their technology familiarities. More importantly, the senior manager feature closely connects the seniors with their families and saves seniors from performing complex commands.

Due to the COVID-19, we are unable to test the usability of Share&Care with seniors and their family members, even though our IRB approval is ready. However, we did test the app informally with a few older friends. Overall, they provided very positive feedbacks, e.g., senior manager feature, large font size, and text-to-audio aid. But they also suggested changes in improving app performance, such as adding chat notification and group chats functionality. Interested readers might watch a short YouTube Video introducing the main functions of the Share&Care app at https://youtu.be/KeDxeV-5_Rk.

After this crisis is over, we plan to evaluate the functionality and usability of our app with seniors and their families by separating the senior participants in our experiment into three groups based on their technology familiarities through interview and pre-test survey. The goals of the *functionality tests* include: 1) the evaluation of the voice navigation efficiency and our word extraction algorithm, through comparison of the time that seniors from each group needed to navigate between posts or photos with screen touching and voice navigation; and 2) the evaluation of the ease of usage in our core functionalities, e.g. locating and viewing a user's photos, locating and contacting a user through messaging/calling, and selecting a user to remotely help them manage their accounts.

The *usability experiments* aim to evaluate users' experiences with our app interface and features for family communication. Each participant will take the user experience survey at the end of the experiment. We will analyze all the collected data and feedback to improve our application.

In the future, we would like to expand the senior-friendly features by making our app totally touch-free and incorporating more voice feedbacks to make the seniors feel more confident in using our application. As it could be difficult for seniors to find our application from the app store, we plan to compress our app into QR code and allow users to scan for download. We would also expand the multi-language feature to make it available for more languages.

References

[1] A.W. Roberts, S. U. Ogunwole, L. Blakeslee, and M.A. Rabe. "The Population 65 Years and Older in the United States: 2016" *Census Bureau*, Oct. 2018.

[2] L.A. West, S. Cole, D. Goodkind, and W. He. "65+ in the United States: 2010", Census Bureau, P23-212, Jun. 2014.

[3] J.T. Cacioppo and S. Cacioppo. Older adults reporting social isolation or loneliness show poorer cognitive function 4 years later. *Evidence-based nursing*, 17(2):59-60, 2014.

[4] S. C. Jennifer Yeh and S. K. Lo. Living alone, social support, and feeling lonely among the elderly. *Social Behavior and Personality: an international journal*, 32(2):129-138, 2004.

[5] "Social isolation, loneliness in older people pose health risks." *National Institute on Aging*, 23-Apr-2019.

[6] H. O. Taylor, Y. Wang, and N. Morrow-Howell. Loneliness in senior housing communities. *Journal of gerontological social work*, 61(6):623-639, 2018.

[7] "NHE Fact Sheet" *CMS,* 24-Mar-2020. [Online]. Available: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet. [Accessed: 30-April-2020]

[8] M. R. Banks and W. A. Banks. The effects of animal-assisted therapy on loneliness in an elderly population in long-term care facilities. *The journals of gerontology series A: biological sciences and medical sciences*, 57(7):M428-M432, 2002.

[9] "Lifelike Robotic Pets for Seniors - Joy for All" *Ageless Innovation LLC.* [Online]. Available: https://joyforall.com/. [Accessed: 5-Aug-2020].

[10] "Care and Companionship for Seniors" *GeriJoy Inc.* [Online]. Available: https://www.gerijoy.com/. [Accessed: 05-Aug-2020].

[11] S. Cacioppo, J. P. Capitanio, and J. T. Cacioppo. Toward a neurology of loneliness. *Psychological bulletin*, 140(6):1464, 2014.

[12] A. Smith, "Smartphone Adoption and Usage" *Pew Research Center: Internet, Science & Tech,* 11-Jul-2019.

[13] "Demographics of Mobile Device Ownership and Adoption in the United States," *Pew Research Center: Internet, Science & Tech*, 12-Jun-2019.

[14] J. Pinsker, When Does Someone Become 'Old'? The Atlantic, Jan 27, 2020