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Share&Care: A Family Interaction Application for Older Adults Living Alone

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Abstract

Loneliness is a common problem that many older adults experience when they are living alone. Family interaction through telecommunication using mobile applications brings many technical challenges to older adults due to their lack of technological familiarity: many mobile applications are not designed to be senior-friendly. In our work, a user study was conducted on older adults' family interaction and their mobile phone usage through in-person interviews with 12 older adults and an online survey for 28 young people age from 16 to 35. By analyzing the survey results, we propose a senior-friendly communication application, Share&Care, which aims to reduce older adults' loneliness by promoting real-life family interaction and improving their experience with the mobile communication application between them and their family members. The solution integrates senior-friendly user interfaces such as voice navigation, remote family management, and multi-layer security to increase the older adults' comfortability and trust in our application. Interested readers can watch a YouTube video introducing the Share&Care app at https://youtu.be/KeDxeV-5_Rk.

Keywords

Senior-Friendly, User Study, Family Communication, Voice Navigation, Remote Management

Introduction

The population aged 65 and older is growing at an unprecedented rate with the increasing global life expectancy and is expected to increase from 9% of the world population in 2016 to 12% by 2030 (Roberts et al., 2018). Older adults usually have poorer health conditions, such as hypertension, dementia, heart failure, etc. (Marengoni et al., 2008), and as such they will need more attention and care from their families. However, there are many barriers for young people to take care of their parents or grandparents, such as the physical distances of their living places. Over a quarter of the U.S. population over age 65 live alone in 2010 (West et al., 2014).

Many programs had formed to create better life quality for older adults by keep them healthy, active, happy, and stay connected with people. Among them, Active Assisted Living Programme (AAL) is a European funding program supported by 19 member countries and the European Commission (AAL Programme, 2020). It focuses on overcoming three challenges that older adults face: retirement, loneliness, and chronic disease. Since 2008, it had funded over 220 projects and over 10% of the funded projects are already on the markets. Such programs show the governments' care and effort to draw public attention to improve older adults' life quality, which is also our goal of this paper.

Applications have been developed to help monitor older adults' health conditions (Pavlakis et al., 2012; Gao and Koronios, 2010; Sukmana et al., 2019) usually included features like reminders, emergency buttons, and setting up connections to caregivers. These applications can help older adults with their physical conditions, however, research (Cacioppo and Cacioppo, 2014; Jennifer Yeh and Lo, 2014; Taylor et al., 2018) also show that physically living alone often leads to many mental health problems, such as loneliness and depression. There are limited applications designed for caring about older adults' mental health.

A few studies (Banks and William, 2002; Cacioppo et al., 2014) show that animal interaction can effectively provide companionship for lonely people and improve their mental well-being. Robotic pets (e.g., Tombot Puppy and Joy for All) and virtual pet apps (e.g., GeriJoy) were invented to help older adults curb their loneliness. These products help older adults combat loneliness to some degree, but they are usually expensive and only provide artificial interactions that cannot fully assist older adults in curbing the loneliness. Many existing communication applications (e.g., WeChat, Messenger, Google Duo, etc.) provide great functionalities for social interaction. However, these apps are mainly designed for younger users. These app's extensive features increase their user interface complexity and bring many challenges to older adults since many of them are new to mobile applications.

In this paper, we propose Share&Care, a senior-friendly communication application incorporating voice interaction and remote management to enhance the older adults' experience and accessibility with the mobile application and closely connect them with their families. The key contributions in this work include:

(1) A comprehensive user study on older adults' smartphone usage and family interaction from both younger and older generation's perspectives;

(2) A multi-language iOS application that provides a secure and private communication platform for older adults and their families and friends with a senior-friendly user interface; and

(3) A dual user interface design especially with a senior manager feature, which enables family members to remotely manage older adults' accounts and set up notifications with their permission.

Methods and Results

User Study

To understand older adults' thoughts and needs on family communication through mobile applications, we conducted in-person interviews with 12 older adults and 3 staff members from 3 senior centers. We also surveyed 28 younger people (ages between 16 to 35) to collect the younger generation's feelings and thoughts on communication with their older family members.

Older Adults Smart Phone Usage

Out of the 12 older adults we interviewed, 6 of them used smartphones and others used cell phones. From the 28 younger people we surveyed, 50% of their 58 older family members reported owning a smartphone. Out of the older adults who own smartphones, 56.4% use the iOS system and 43.6% use the Android system.

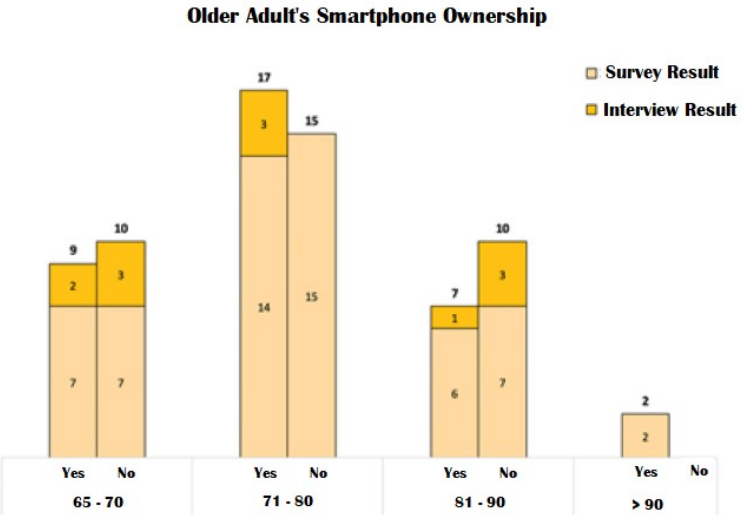


Fig. 1. Older Adults' Smartphone Ownership from the 12 Interviewed Older Adults and 58 Older Family Members of the 28 Survey Respondents.

This data also confirmed by the Pew Research Center study on American mobile phone usage. As shown in "Demographics of Mobile Device Ownership and Adoption in the United States", older adults' smartphone ownership increased from 11% in 2011 to 53% in 2019.

Besides that, older adults' social media usage also increased from 11% in 2010 to 35% in 2015 (Perrin, 2015). With the increase in older adults' smartphone ownership and social media usage, the focus will be on making the applications easily accessible and safe for older adults to use. Many of the older adults we interviewed mentioned that they experienced difficulty in using most mobile applications. Among various issues, such as confusion with button functionalities, hard time with reading small text and clicking on small buttons, and the distraction from irrelevant information, one of their major concerns is personal information security. When older adults register an app account independently, they might accidentally press the wrong button causing unexpected things to pop up and might even request sensitive information (e.g., credit card or ID number). The application complexity, distraction from ads or pop-up, and the risk of losing personal information contributed to the poor user experience and difficulty that older adults have to deal with in many existing applications.

Family Communication Methods

The distance separation between older adults and their family members is a common problem many older adults face, as many younger individuals live in other states or countries away from their older family members for their education or careers. This problem has become severer due to the COVID-19 with strict limitations on travel. Among the 28 younger people we surveyed, 76% of the respondents did not live with their older family members. All the older adults we interviewed either live only with their spouses or alone by themselves.

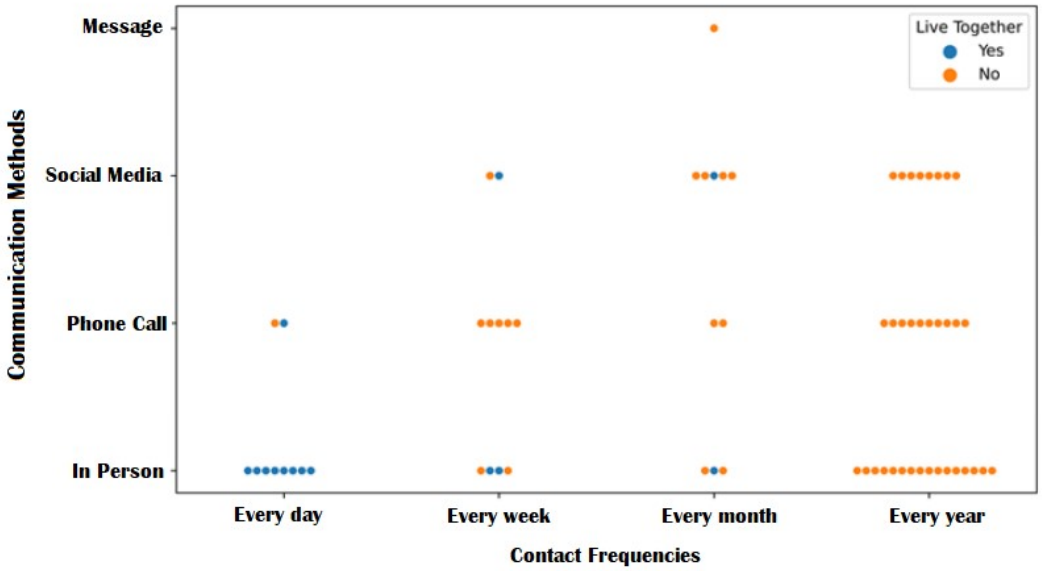


Fig. 2. Young People's Contact Frequencies and Communication Methods with Older Adults.

Face-to-face communication and phone calls are the two most common communication methods between older adults and their younger family members. With the distance barrier, young people would communicate with older adults more often if they live with older adults. Over half of the survey respondents only contact their older family members a few times a year (Fig. 2), and this group of people did not live with older adults. However, if older adults can better use smartphones and social media apps, it would allow them to stay closely connected with younger people to better combat their loneliness.

One of the advantages of communicating through social media apps is not requiring immediate responses and it is easy for long-distance communication. Many survey respondents are more likely to increase their communication frequencies with older adults through social media apps. However, most of the interviewed older adults are not actively using social media apps, either due to the lack of access to smartphones or feel that the apps are not personal and distractions from irrelevant information (e.g., promote posts on Facebook). According to the staff members at three senior centers, they all offered technology classes to teach older adults to use

computers and smartphones. Older adults are eager to learn new technologies, such as using simple apps to generate videos and share with their families. However, older adults and young people have different needs in mobile applications and most developers often fail to recognize and incorporate older adult's needs when they develop the apps. For example, existing of many small buttons and distraction interfaces due to fancy features that older adults are not going to use, and these ever-increasing app complexities discourage older adults from learning and using the apps.

To minimize these problems, our application focuses on providing a simple and secure communication platform for older adults while maintaining necessary functionalities to engage young people to not only share their lives with older adults but also to help them manage their accounts through a *dual user interface* design – with customized user interfaces to different users and for different functions.

Share&Care Design and Implementation

Share&Care is a multi-language iOS application that provides a secure and private communication platform for older adults and their families and friends with a senior-friendly user interface. It is built with React Native, since React Native is cross-platform and can be easily integrated to serve in both iOS and Android devices. Based on our user study, more older adults are using iOS devices, thus the app is currently developed in the iOS system, but we will expand to Android in the future after more evaluations and tests.

Share&Care provides *basic* communication features as many existing communication applications are offered, including real-time chatting, sharing posts and photos, managing contact lists and user profiles, etc. On top of these basic functionalities, the app also provides *special* features to assist older adults better in interacting with their families and friends. First, to address

the older users' major concerns, the app takes special care of users' data security and privacy. Second, the app incorporates voice input and output with a senior-friendly user interface to enhance the older adults' user experience with navigating through the app. Third, the app offers a dual user interface to minimize the unnecessary features for older adults and keep it to attract younger users. The app also offers a multi-language feature to serve users from different countries. Finally, the app allows family members to remotely manage older adults' accounts through permission to free older adults from complex operations and increase family interactions.

Data Security and Privacy

Data privacy is the major concern based on the feedback from the user study. We have found that many older adults don't fully trust mobile applications, either due to massive reports of personal information get misused by applications or experience of personal information get stolen. To ensure user data security and privacy, we add multiple security layers between the app, web services, and databases (Fig. 3). AWS Cognito is used to validate the users' phone numbers and login credentials. Once the login credential is verified, our web service will generate a randomly customized token based on the users' credentials and send to the app. The token is required when the app requests or sends the data to the web service. It will be automatically refreshed, which minimizes the risk of unauthorized access to the web service from external applications.

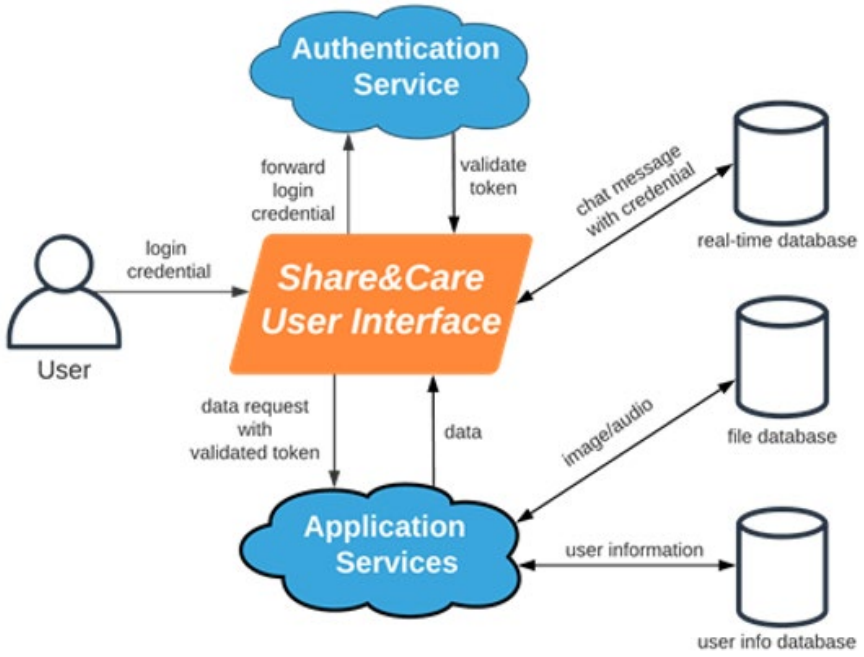


Fig. 3. Share&Care Data Flow Diagram.

To further increase the security of users' data, data are separately stored into three different databases. Firebase is used to handle and store the chat messages for its real-time performance, the app can directly access it with validated credentials. Images and audio files are stored in the Amazon Simple Storage Service (Amazon S3) for its capacity and scalability. Both Firebase and Amazon S3 do not contain users' identities. AWS DynamoDB is used to store user information for its low-latency performance and built-in security; user information will be encrypted through the web service before being stored in the database. Users can successfully register an account only with a valid phone number and the app will not request more sensitive information from older adults. With integrated multi-layer security and multi-databases, our app provides a safe platform for users to be confident in using without worrying about personal information leakage.

Remote Management

Most applications required multiple steps to search and add users, which involves complex commands and the risk of mistakenly adding strangers. Thus, setting up contact lists is a tedious and challenging task for older adults, and they usually need help from younger people, which is difficult as they are living alone. To solve this problem, our app allows older adults to select a family member as their senior manager to remotely manage their accounts with limited authorization. As the privacy concern of the older adults, the senior managers cannot view the older adults' chat messages or directly delete the contact without older adults' permissions (Fig. 4 (a)).

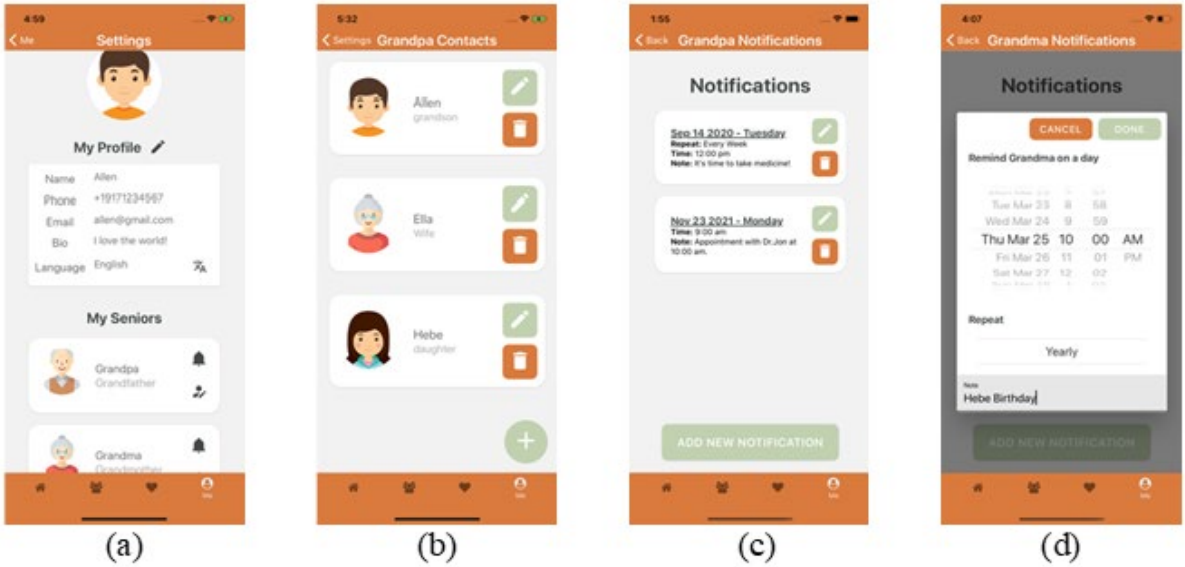


Fig. 4. (a) Senior Manager Setting Screen; (b) Contact Manage Screen; (c) Senior Notification Manage Screen; (d) Set-up Notification Screen.

A senior manager of an older adult can remotely add people to the older adult's contacts, edit the nickname and relationship for each contact, and send a remove contact request that requires approval from the older adult (Fig. 4 (b)). With the contacts set up by the manager, older adults can directly communicate with their families without struggling to search and add people.

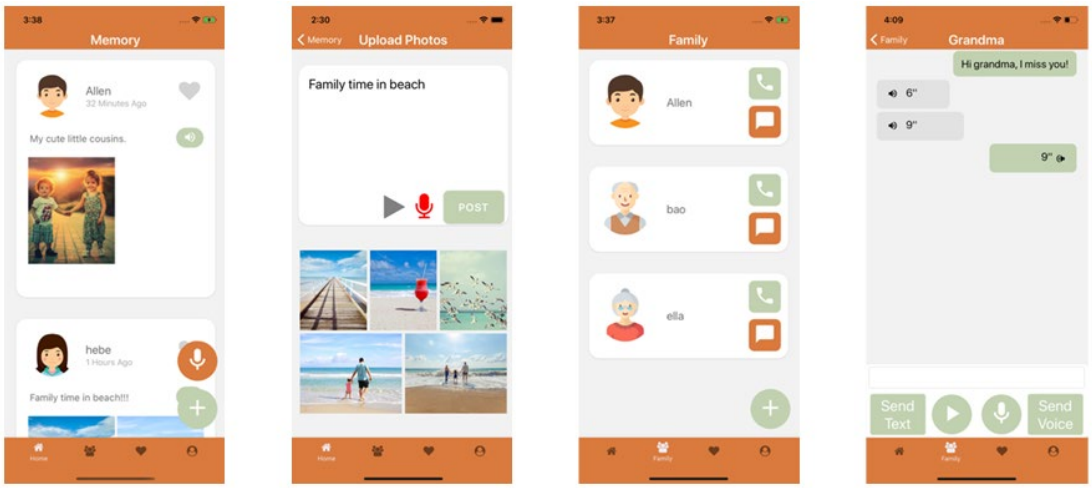
Friendly reminders are extremely helpful for older adults, as they are not very good at remembering things. To remind older adults about important events, senior managers can set up notifications for older adults through our app (Fig. 4 (c) and Fig. 4 (d)), such as a doctor's appointment, the time to take a medicine, etc. This notification feature will closely connect the senior manager with the older adults and make older adults feel the care from their families.

Senior-friendly User Interface

Other common problems older adults experience with mobile applications are the size and location of the buttons and relying on younger people for customizing operations (Kurniawan, 2008). Therefore, a simple but unique user interface is essential for older adults to be comfortable and successful in using the application. Our app dramatically simplifies the user interface and incorporates voice interaction to minimize the required screen interaction.

The app is designed with two primary colors and big buttons that can vary by size based on feature priority and large text suggested by Gao and Koronios (2010) to provide better visual aids and reduce distraction. Besides that, voice navigation will be automatically turned on when the older adult logs into the app, to help older adults who have a hard time controlling the screen and allow them to use voice command to navigate through the family posts and photos on the home screen (Fig. 5 (a)). Voice feedback will be provided to notify them the actions will be performed, so it will not surprise them if any changes appeared on the screen. For example, commands like "scroll up" or "swipe left" will navigate between pages; "play audio" will either play the recorded audio or activate text-to-speech; "like post" will add a post to their favorite screen. Creating a new post is also simple; users can select the photos from the photo library or take them from the camera, then users can use the audio aid to generate the post description, so they do not need to type any words. Audio playback is also available by pressing the play button,

which allows users to be confident with the recorded messages and redo the recording if they encounter any unwanted voice (Fig. 5 (b)). All these features are built to increase older adult's comfortability of viewing and sharing their thoughts with their families or friends through our app.



(a) (b) (c) (d)

Fig. 5. (a) Home Screen; (b) Create Post Screen; (c) Family Contact Screen; (d) Chat Screen.

React-native voice recognition library is used to recognize the users' voice. The customized word extraction method detects the command words for every sentence the user spoke, where punctuation characters separate the sentences. Once a command word is detected, the app will temporarily stop receiving the voice input until the voice feedback and action are performed.

The contact screen in Fig. 5 (c) contains all the contact profile images that allow older adults to identify their contacts easily. Users can view a person's posts by pressing the person's contact card and making a phone call or video call with that person by pressing the phone button. The message button will lead to a private chat screen (Fig. 5 (d)) with the selected person. An audio button is available on the chat screen to free older adults from typing. Users can send either recorded audio or voice recognized text, in which users can then edit the recognized text if

they encounter any mistakes in voice recognition. Besides that, when users click on any text message, the text-to-speech feature is available to play for the selected message. This feature serves as the visual aid for older adults who have difficulty in reading the text.

Evaluation

Due to COVID-19, we don't have the opportunity to visit senior centers in person and have our app tested by older users to receive feedback even though our IRB approval is ready. In the meantime, we did manage to have the app tested informally by a few older friends at home. Overall, they gave positive feedback on the senior-friendly interface. They also found the senior manager feature extremely useful as this functionality doesn't exist in common social media applications, and they felt comfortable letting someone they trust set up their account. But they did not find the voice navigation feature very useful as they've already had some experiences in using mobile applications and have no problem with performing simple gestures of swiping and pressing on the screen. With this feedback, we added new features to allow users to terminate the voice navigation through voice commands or simply turn off by press the voice button. Users can also keep the voice navigation on while using the screen interaction. We also received feedback suggesting new features, such as adding group chat and automatically cleaning chat messages after a selected time period. We aim to implement these functions to make our app comparable with the existing social media apps.

However, these feedbacks were from an informal study with a few users, therefore it does not hold statistical significance. We plan to conduct a formal study when the pandemic is over on having older adults and their family members test out and evaluate our application. We will first interview and conduct a pre-test survey with each older participant to understand their familiarity and former experiences with mobile applications and put them into three groups based on their

technology familiarity. We plan to evaluate the usability of our app, particularly the voice navigation and senior manager feature. To evaluate the voice navigation efficiency and our word extraction method, we will analyze and compare the time an older user is required to navigate between posts through screen touching and voice navigation. We will also have the older participants try out the core functionalities and evaluate the difficulty of performing the tasks, e.g., locating and viewing a user's posts, messaging, and calling a user, and selecting a user as their manager. Furthermore, we will let the family members try out the senior manager interface to help their older family members set up contacts and reminders. At the end of the experiment, each participant will take the user experience survey to compare the experience on our app with the common communication methods or apps that they actively use. We will analyze all the collected feedback to improve our app design and features in the future.

Conclusion

The Share&Care app aims to increase older adults' comfortability with mobile communication and promote distanced family interaction. The UI and UX designs (Yun, 2016) of the app are tailored to older adults to increase their comfort in using our app and provide incentives for older adults who do not use mobile apps due to unfamiliarity or discomfort with technology to engage with our app. In particular, voice navigation and senior manager features were designed and implemented to ease older users' usage. By providing voice navigation with simple voice commands, we attempt to solve the problems that older users have in using touchscreen efficiently due to decreased hand dexterity. By providing the senior manager feature, which lets the older users designate someone they trust to manage their account, we attempt to save older users from complex operations on the app and closely connect them with their

families. Furthermore, the managers can set up reminders for them remotely, either send one-time or periodic notifications to their phones to help them remember important dates or tasks.

In the future, we would like to further expand the senior-friendly features, by making our app totally hands-free and incorporating more voice feedbacks to make the older adults feel more confident in using our application; but this will be decided after the formal study if the voice interface is the best choice. As it could be difficult for older adults to find our application from the app store, we plan to compress our app into QR code and allow users to scan for downloading. We would also expand our multi-language feature to make it available for more languages.

Acknowledgments

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