A Ubiquitous Photo Frame to Provide Reminders to Older Adults

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***Abstract*— Over the years people tend to forget activities that take place every day, and particularly those ones that are not carried out frequently. Forgetting activities is a common problem in various older adults. Information and Communication Technologies can help elder people to manage this problem, but these people may not feel confident or comfortable to use a software application or a device. Therefore, we propose the use of common and ordinary objects to provide reminders that will allow preventing the forgetfulness of carrying out daily activities. As a first attempt, the current proposal consists of using a photo frame to provide these reminders. The developed prototype, using mobile devices, has been evaluated applying case study research. The results showed that the proposed idea was well received by the participants. Moreover, the participants suggested that other older adults could use our proposal to receive reminders easily and ubiquitously trying to prevent them from forgetting what they should/need/must do.**

Keywords— Older adults, reminders, photo frame, mobile devices.

I. INTRODUCTION

One problem that older adults experience over the years is the deterioration of their cognitive abilities. These capabilities allow remembering events, dates, personal information, etc. that particularly seniors might forget. In addition, these people may, in some cases, forget to do everyday activities such as taking medicine, eating, or watching a TV show. Family members and/or caregivers may help older adults remember to perform these activities. However, many older people may prefer to live alone and carry out their tasks/activities on their own. Therefore, there is a need to explore or develop new tools/solutions based on Information and Communication Technologies that will help older adults to manage this situation.

Various software applications and devices can provide important support to older adults in their day, particularly with the aim of providing reminders. Devices such as a first-aid kit [1], a "smart" pill dispenser [2] or a screen [3] can help improve medication intake. To this end, the devices display announcements or alerts to older adults at the exact time that the medication must be taken according to a schedule previously configured depending on doctor's prescription. Similar support can be obtained using mobile applications [4] [5]. Applications of this type can not only alert seniors when they should take their medicine; they can also issue alerts when medicines are running out [6] and even offer other benefits such as helping in cognitive training [7]. The use of robots is also an option to consider helping older adults remember everyday activities. Robots could, in addition to helping to remember "something", serve as personal assistants [8], but their cost could still be an obstacle in many cases. In addition, the possibility of using non-interactive objects that could be found in most houses, such as a window [9] or a plant [10], have been explored recent years. Proposals such as the latter could offer interesting benefits for older adults to be used as mechanisms for issuing notifications or reminders, but other options need to be explored.

Precisely, one of the options that could be used to give reminders to older people is a picture frame. The authors, during their experience, have observed that, in most homes where older adults live, one or more photo frames are placed on the walls. These people usually have photos of their relatives, landscapes, animals, plants, etc. to beautify their house, which implies that they usually appreciate those pictures with certain frequency. This idea has been taken as inspiration for this work; that is, we propose the use of a digital photo frame, which can be placed on a wall like a conventional photo frame, with the ability to emit reminders that were previously configured, for example, by a family member. These reminders could include activities such as taking medication, preparing for a medical appointment, watching a television program, or even doing a particular task (for example, watering a plant).

To evaluate this proposal, we designed a prototype (Section 2) capable of issuing various types of reminders, and then, we conducted case studies using it. In these cases, the reception that the proposal could have was analyzed with the participation of older adults. The obtained results (Section 3) were positive, providing evidence that the picture frame could effectively serve as a ubiquitous device to help older adults remember every day activities.

II. MATERIALS AND METHODS

We carried out a case study research [11] in order to analyze whether the proposal to use a photo frame placed on the wall could serve as a ubiquitous device to help older people remember to carry out their day-to-day activities. Four cases were studied trying to ascertaining people's opinion of the proposal, their acceptance and recommendations for possible improvements in new versions.

Before executing the study, the corresponding prototype was designed. This prototype, illustrated in figure 1, consists of a tablet (of seven inches and resolution of 1024 x 600 pixels), a smartphone and a speaker. The tablet was used as a screen to display the photo(s) that could be shown in a conventional photo frame. Moreover, it was used to

978-1-7281-3764-3/19/$31.00 ©2019 IEEE

incorporate classical background music as a way of relaxing and/or stimulating people. In addition, this tablet was connected through Bluetooth to an external speaker that allowed to improve the quality and intensity of the music reproduced.

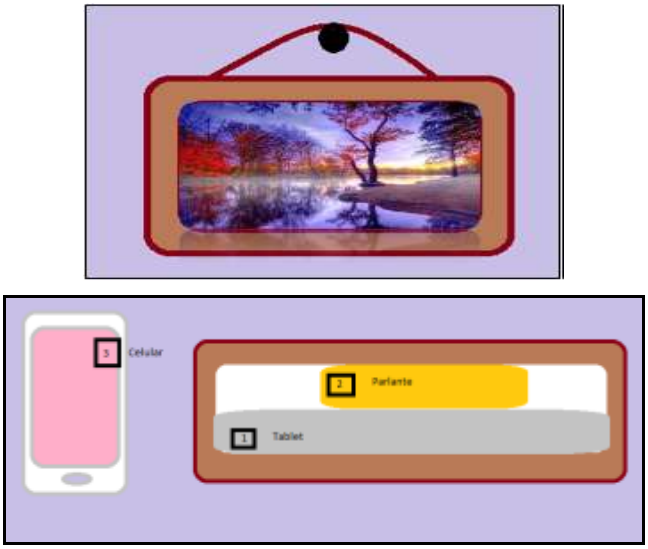

Fig. 1. Prototype of the photo frame used in the case studies.

The considered reminders were issued in the form of audios reproduced in random order. These reminders were previously set up using a cell phone and then reproduced in the tablet. Five types of reminders were included: medication intake, medical appointment, household chores, birthday of a family member and leisure/recreation activity. For each of them, the audio corresponding to a voice was played pointing to the respective reminder. For example, "it is time to take the blood pressure pill" or "today is your son's birthday, 'Pepito', call him".

Participants were recruited after designing the prototype and evaluating it in a pilot test to check its correct operation. Participants were aged between 70–84 years, and all were without medical conditions that could interfere the study. Also, all participants were of Ecuadorian nationality and, they consider themselves to belong to the middle social class. All of them had some slight deterioration in their cognitive abilities and an acceptable visual ability at certain distances (for example, to look at a wall). These data were provided by the psychologist at the health center where the participants receive care. The participants also stated that they had little or no experience with the use of technological tools/devices. Additionally, it should be noted that all the older adults who participated lived alone at the time of the study; also, they did not have any different abilities. Table I shows these ones and other participants' characteristics.

The study itself was carried out at the homes of each of the participants, trying to make them feel more comfortable and to make the study more "realistic". After explaining the objective of the project, one of the researchers explained the procedure to be followed. At the same time, the photo frame was placed on a wall (containing no object) and two chairs were positioned approximately two meters away from the wall. The chairs were placed in such a way that the participant could see the picture frontally without any inconvenience. In addition, each participant signed an informed consent authorizing his or her desire to collaborate in the study.

TABLE I. CHARACTERISTICS OF THE PARTICIPANTS.

ID	Age	Educational level	Live alone	Visual limitation	Cognitive limitation
1	70	PS	Yes	2	2
2	80	PS	Yes	3	3
3	84	PS	Yes	3	3
4	75	HS	Yes	2	2

Notation: PS = Primary school; HS = High school. Limitations: 1 = low; 5 = high.

Once all the necessary elements were in the right place, one of the researchers engaged in a conversation with each participant. In this conversation, topics from the general life of each participant were discussed in order to make them feel comfortable. As the conversation progressed, the prototype emitted reminders at different time intervals. The conversation lasted approximately ten minutes. During this time notes were taken as deemed necessary and the entire conversation was saved for further analysis.

At the end of the conversation, the researcher collected data through an interview with each participant. This interview was focused on knowing if:

- Participants understood the goal or use of the proposal.
- The proposal could help older people in their daily lives.
- The proposal caught participants' attention, positively or negatively
- Participants think the photo frame is intrusive or causes some discomfort.
- Participants would recommend the use of the proposal.

In addition, the participants answered questions concerning demographic aspects.

III. RESULTS AND DISCUSSION

On the basis of the notes and recordings, the corresponding results were obtained. The most important aspects gained in each of the cases are described below. At the end of this section there is also an interpretation/discussion of them.

Participant 1: The first person who participated had no difficulty in understanding the objective of the proposed picture frame, although she was indifferent in wanting to incorporate it into her daily life. This person stated that the device could be moderately useful, but for other people; in her particular case, she considers that she does not need it. Her response was based on the fact that she leads a lifestyle that is "quite" active for her age because she spends most of her time in outdoor activities such as taking care of her animals and planting and watering plants. She also indicated that the device is "good" in the proposed form and it does not

need to be improved. In conclusion, this person indicated that she would prefer not to use the device but she thinks it could help other older people.

Participant 2: The second participant was excited and fully convinced of the usefulness of a device of the proposed type. This persona indicated that the reminders were "ideal" and that this device could make a significant contribution to daily her life. The provided justification was: "I always forget the things I have to do, especially turning off the lights". In fact, upon hearing the reminder to turn off the lights, she suggested pausing to go to the bedroom to turn off the light she had forgotten on. In terms of design, this participant said she liked the device in its current form, particularly because it allows enjoying landscapes and listening to music at the same time. Ultimately, the second person gave positive feedback on the proposal, also considering that it could be useful for other older people like her.

Participant 3: In this case, the person was "indifferent" during the evaluation of the proposed prototype. Although she emphasized that the device might be useful for her and other older adults, she said she felt "a little uncomfortable because it is not easy to her to get acquainted with technology". Finally, and in a similar way to the other cases, this person considered that it was not necessary to add anything else to the proposed frame of photos.

Participant 4: The last participant showed a behavior similar to that of the second participant; she manifested a total acceptance of the proposed picture frame. First, she pointed out that this device can help her remember "that which (she) is overlooked", allowing her to avoid having to worry about certain aspects because it would be helping her remember them. It should also be noted that the lady welcomed the proposal in spite of considering "not handling the technology" in comparison to the third participant. This is complemented by the view that the device may also be beneficial for other older adults. Referring to the design, this participant said she would not add anything to the prototype, but she preferred to go a little further in her response commenting that "she would like to have several objects inside her home that allow her to remember the 'things' she should/must do every day".

These results provide evidence of device acceptance. Only one of the older people who participated was not convinced of this acceptance, but she argued that it was a particular case due to her lifestyle. The other participants showed their acceptance of the device and said that it would help them in their daily lives. Also, all participants understood how the device worked, and indicated that it caught their attention by the way the reminders were delivered. In addition, all indicated that it did not cause them any discomfort and recommended the use of this device. The only possible exception was a participant who stated that the reminders emitted by the frame should have a lower volume because "if you are watching TV or having a conversation with someone, it would be annoying to hear the reminder". All in all, and in general terms, the participants responded positively during the study, they did not present any problem and, they expressed that it would be very useful for older people.

IV. Conclusions and Future Work

Given that the older population is being "technologically excluded", a significant amount of effort has been made to deal with this situation. While some older adults may resist this change, ubiquitous solutions can be implemented in homes to support these people in everyday activities. Precisely with the aim of helping to this segment of the population, a first attempt has been made in this work to use common and ordinary objects to provide reminders that will allow preventing the forgetfulness of carrying out daily activities.

To this end, the design and evaluation of a prototype photo frame to provide reminders to older adults are described in this article. During the evaluation, the prototype provided reminders about activities related to medical, social/family, household chores and entertainment aspects. The results obtained from case studies with older adults suggest that the proposal is a feasible solution for providing reminders to the type of people of interest. Devices like this can help remember the things older adults should/must do during a normal day and usually forget.

In spite of the favorable evaluation, and in accordance with the opinion of the participants, it is necessary to go beyond this proposal. The possibility of using other objects (e.g., a chair or a flower vase) for the same purpose, individually and/or together, should be examined. It may also include the use of sensors to verify the execution of tasks or to detect dangerous circumstances such as a stove or iron on. This may be complemented by the use of a mobile application that allows sending information to a family member, caregiver or physician as needed.

ACKNOWLEDGMENTS

This work received funding from XXXXXXXXXXX XXXXXXXX 2018-2019 (XXXXXXXXX XXXXXXXX, XXXXXXXXXXX).

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