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Elderly Healthcare Assistance Application using Mobile Phone

Andreas Handojo, Tioe Julio Adrian Sutiono, Anita Nathania Purbowo

Informatics Engineering Department
Industrial Technology Faculty
Petra Christian University
Email: handojo@petra.ac.id

Abstract—As people become older, people generally will experience a health decline such as becomes weak, susceptible to disease, decreased vision ability, etc. Therefore, special health attention is needed for the elderly people, especially from the family member or personal doctors / nurses. On the other hand, the number of elderly people in the world is rapidly increase so there's more people will need special attention. Therefore, this research try to develop an application on mobile phone that could help elderly people and their family member to supervise and monitor the health of the elderly. This application has feature to monitor the location of the elderly, remainder to take the medication, doctor appointment remainder, medical record records, emergency phone to family number or personal doctor, etc. From the experimental results of the application to the participant and the test with the questionnaire on the prospective users, 94% of respondents feel the application is very useful and can run well as needed.

Keywords—Elderly; Healthcare; Android; Google Cloud Messaging; Google Maps

I. INTRODUCTION

With the increasing level of human health factor, human life is getting longer. Statistical data in various countries shows a trend of increasing the number population of elderly people. For example in the United States, it is predicted that by 2030 the number of elderly population (65 years and above) will reach 20% of the total population [1]. Also in Canada, is it predicted that on 2021 the number of elderly population has exceeded the number population of children aged 14 and younger people [2]. The Organization for Economic Co-operation and Development (OECD) reported that the percentage of elderly people population in various countries during 2010-2014 continues to increase for example like Finland (up 0.033% per year), France (up 0.015% per year) , Italy (up 0.012% per year), Japan (up 0.025% per year) [3]. In terms of number percentage of elderly people to the total population, the number percentage of elderly people is very big for example by the data of 2014 in Finland the number percentage of elderly is 19.93% of the total population, while in Australia 14.71%, America 14.51%, Italy 21.25%, especially on Japan (as a country with the largest number of elderly people in the world) reached 25.06%.

Unfortunately, when the age become older is identic with deterioration of health quality. Starting from decreased body endurance, decreased eye sight, decreased hearing function, decreased memory function, and more limited body movement, etc. Therefore, elderly people often need more attention. So with the growing number of elderly people, the need for attention to the elderly people also increases significantly.

On the other hand, with the increasing number of users of mobile phone (especially on Android-based operating system) as well as with the rapid development of mobile phone technology. This create great opportunity to use mobile phone to help elderly people in daily life activity, especially in terms of healthcare monitoring.

In the research, we tried to develop an application on android-based mobile phone that can be used to help monitoring healthcare for the elderly (assistive technologies). This application will help elderly in terms of self-health monitoring such as remainder that remind them to take their medication or visit doctor, record personal medical records, provide emergency assistance directly through emergency calls either to the mobile phone family member or personal doctor, and find out Position of the elderly from the position of mobile phone and search the nearest hospital and pharmacy using GPS facilities (Global Positioning System and Google Maps) on mobile phone. With this application, the family member or the elderly health doctor/nurse could helped to monitor their parents or their patient.
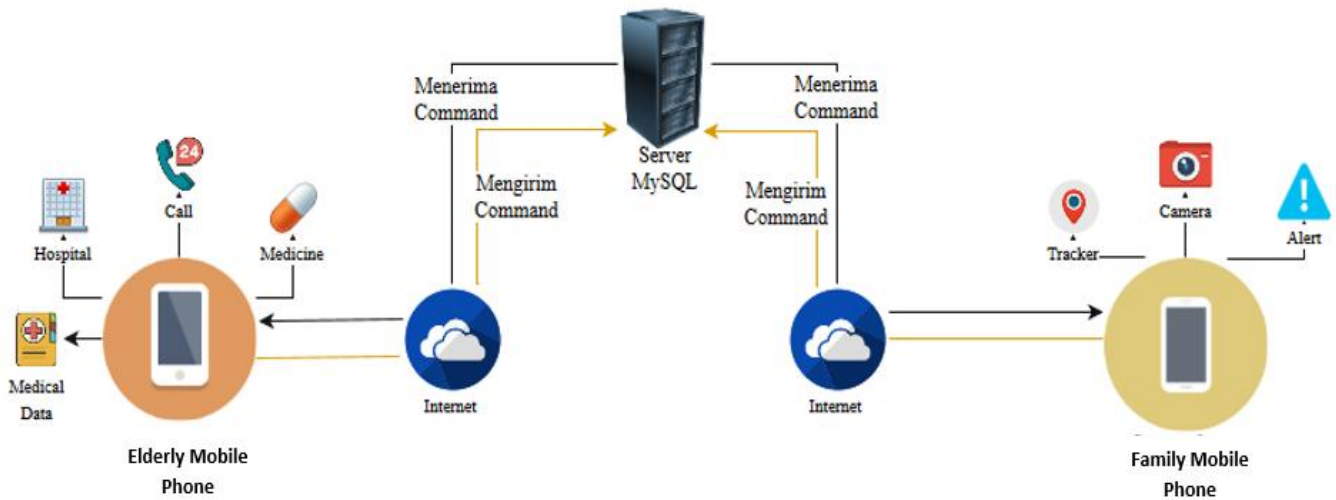
Figure 1.   Elderly Healthcare Assistance Application System

II.   RELATED WORKS

Elderly people or senior people is often defined as someone who has age above 60-65 years [1] [3] [4]. With the decline in physical health of the elderly people, such as vision problems, hearing problem, memory, muscle and other organs. The elderly people would need attention from others people around it [5] such as family, nurses, doctors, nursing homes, etc.

The efforts to improve healthcare for elderly people using mobile device devices have been widely practiced. For example Kuo et al. [5] conducted research improving elderly home care service by utilizing information and mobile devices. This research could be used by home care service, but this service not from the personal side of elderly or the family member. Kiat and Chen [6] conducted research to provide facilities for seniors to be able to send messages on their mobile devices. This application comes with shortcut feature on contact phone number, big font size, group chat, etc. Meanwhile, Cota et al. [7] researches how to make games on mobile phones exclusively for the elderly. This study is intended to train the cognitive abilities of the elderly. Also, Teixeira et al. [8] that trying to find important components in helping seniors in the use of computer technology such as font size, touch, gesture, sound, etc. From the efforts of these studies it appears that ideas have emerged to use mobile phones to help health services for elderly people.

III.   DESIGN AND IMPLEMENTATION

This research is aims to help the elderly people (self-help) and family members (or personal doctors / nurses) to be able to monitor the health from elderly people. The applications will be divided into two parts: applications that will be used privately by the elderly people (on the next explanation we called it elderly application) and applications for the elderly family/doctor or nurse (on the next explanation we called it family application). The application design system could be seen in Fig. 1.

Both parts of this application will connect through the server. So the users of family apps could give commands on elderly application like auto call activation and activated the sound / light and send text that appears automatically on the elder mobile phone (Fig. 2). This feature is intended to facilitate the emergency condition where the elderly people could not take their mobile phone to answer the call. Or in simple conditions, such as forgot where they put their mobile phone. This sound activation could also be done even if the elderly mobile phone is in silent mode condition.
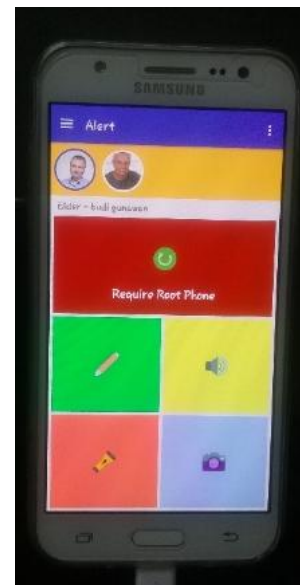

Figure 2.   Features Alert, Text, Take Image, and Mobile Phone Reboot

For sending text, the user from family applications must input what text will be sent. The application will then send the text to elderly mobile phone using Google Cloud Messaging (GCM) technology [9]. This family application is also have

mobile phone reboot feature that could restart elderly mobile phone without touch the elderly mobile phone. This feature could be used when an error occurs in an elderly mobile phone and need to reboot. So after the restart process, the mobile phone is expected could running well again.

User from family application could also set up speed dial contacts that can be displayed in elderly application. This speed dial contact (Fig. 3) will contain the names, phone numbers, and photos from important contacts person such as family member, doctor, nurse, pharmacy, etc. So the elderly people could make calls quickly without opening the contact person application which generally found on the mobile phone application. With this feature the elderly people do not need to be bothered with other applications that may be exist in their mobile phone. This set up speed dial contacts could be made by family application user without have to access / touch elderly mobile phone. So the changes could be done anytime and from far away without have to make physical contact with the elderly mobile phone.
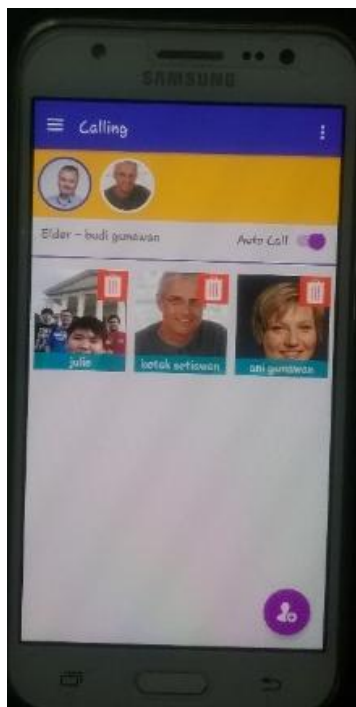

Figure 3. Quick Call Contact feature

Family apps can also enable take a picture directly from an elderly mobile phone. The captured images will be sent to the server computer and family app. This feature is intended to take a snap shoot to check the condition of the elderly that could be used either in emergency or not.

On the elderly apps side (Fig. 4), the application could make a phone call through an available speed dial contact. The application would immediately activated the existing phone call feature on mobile phone equipment and make phone calls on the contact person who has been selected. For emergency condition, elderly could send emergency (SOS) message only by pressing SOS button in the application. This emergency call will be sent directly to all existing speed dial contacts. This feature is intended to anticipate when emergency situation occur that cause elderly could not make phone calls to the family member (or doctor / nurse).

Figure 4. Elderly Application Features

Both of these applications could perform medication data input (Fig. 5) along with the schedule time to consume it. This information will be store in the elderly application. The same thing could be done on doctor check-up time remainder. This all remainder will be sent via GCM technology to elderly phone.
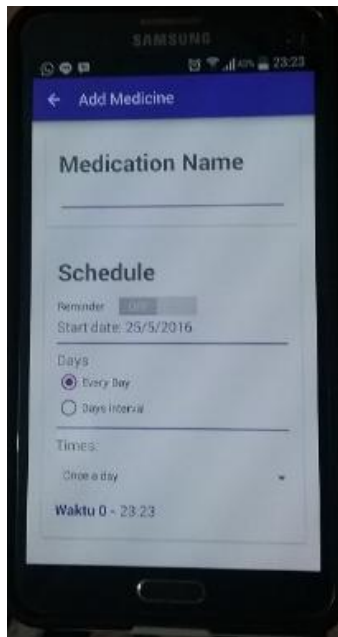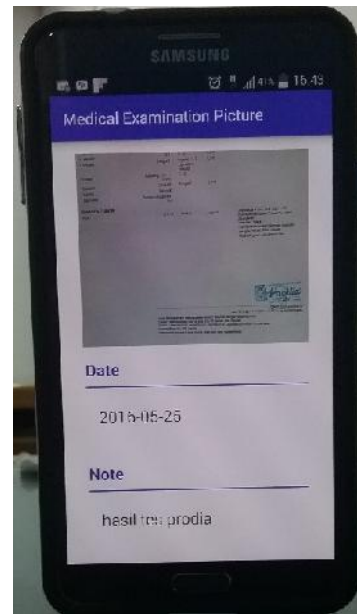
Figure 5.   Features Medication Remainder

(c) Medical Data Image

Figure 6.   Medical Data Features

Both applications can also input medical data (Fig. 6) as a personal note as a medical data assistant that has been performed such as blood pressure data, blood sugar data, and cholesterol levels, etc.

The app can also search the location of elderly mobile phone (tracker) using GPS and Google Maps technology, as can be seen on Fig. 7. Also search the nearest hospital and pharmacy based on the current user location using Google Maps technology. The app will display a map containing the location of this user along with the location (marker) of the hospital and the nearest pharmacy. Hospital search will using Google Places API by inputting latitude and longitude from user location, distance radius, and the place name. The hospital and pharmacy data shown is using the official data of Google Maps.

(a) Medical Data Menu

(b) Medical Data Graphic

Figure 7. Elderly Features Mobile Phone Tracker

IV. SYSTEM TESTING USING USER PARTICIPANT AND QUESTIONNAIRE

After the application is build and implemented, we tested it with 5 elder participant (age range 67-72) and 3 elder family participant (age range 35-50). From elder participant group input, we redesign our application GUI (Graphic User Interface) by use big button rather than just a small icon, add SOS button to send emergency situation to all contact person, add sound activation to find the mobile phone location just in case the elder forget where to put their mobile phone.

From family participant input, we add a reboot system to elder mobile phone just in case there's an error occur on the mobile phone operating system, add medical data graphic chart to show the medical data record achievement such as weight, blood pressure, etc. Family participant also ask to add map information feature for hospital and pharmacy close by.

We also try this application using questionnaire to 20 elder and 12 family member from the elder. We found that 22% respondent said that information that give by the application is very good and 78% respondent said that this good. In terms of ease of use of the application, we found that 63% respondent said it is very easy to use and 38% respondent said the application easy to use. In terms of the benefits of the application, this application obtained 88% respondent said that this application is very useful and 12% respondent answer useful. In the last question about the overall application, we got that 94% respondent said that this application is good. From this questionnaire can be concluded that this application is enough to provide benefits and can be used easily both the family side and the elderly.

V. CONCLUSION

In this research, we try to build elderly healthcare assistant application that run on android-based mobile phones operating system. This application is divided into two parts: application for the elderly and applications for family member / personal doctor/nurse. The family application have the ability to send alert such as sound and text. Users also could arrange the elderly application speed dial contact setting, consumption of drugs schedule remainder and the health checkup (doctor appointment meeting) remainder on elder mobile phone remotely without have to touch the elder mobile device. This, of course, will make it easier for the elder because there is no need to make changes themselves and also make family member easier to manage elder mobile phone.

There is also a feature to find the location of elder mobile phone by utilizing GPS and Google Map API. This feature can be used when the elder gets lost somewhere and forgets the return direction. This application also have feature to locate nearby hospitals and pharmacies from the user's position using the Google Map.

There are a few technical limitation for this application. For example to perform the reboot function on mobile phone then mobile phone condition must be in root condition. Permission on android to use automated telephone answering it is only work starting from lollipop android version (CALL_PRIVILEGED).

Another system limitation was this research had only small participant (8 participant) and 32 respondents. There are still a lot of possibility to have a diverse opinion because the spread of the age and computer / mobile phone literacy differences from each user.

For further development, this application could may combine with hardware such as heat sensors, blood pressure sensor, glucose sensor, etc. to improve elder health information especially on dangerous condition.

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