Mobile Based Healthcare Application for Elderly

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Abstract— Recently, Thailand is now approaching to become an aging society. The healthcare is becoming a main issue and most concerns for elderly citizen. Many people are paying more attention to their healthiness with care in diet, exercise, and daily life activities. Regarding demands of healthcare services are increasing and the high cost comes with it. A workload in service is also another issue that can impact the performance of care takers. Therefore, the aim of this proposed study will be an alternative and supportive way to the high demand of healthcare services and supplement of works for the care takers for doing their job effectively. The integration of the AR technology, healthcare knowledge and related information in mobile-based application is proposed to support the collaboration between the elderly persons who need help to support their living and the care takers who need assistance for more effective work to provide for healthcare services**.**

Keywords— Aging, AR, Mobile Application, Healthcare

I. INTRODUCTION

Nowadays, Thai people have more concerns of their healthy life. Whether it is food or diet, exercise or taking care of themselves regularly, as a result, people can live longer life expand. In these recent years, the number of elderly people increases in society and another issue to it is how elderly people understand the basic information and knowledge of healthcare for themselves. More elderly people are visiting hospital and healthcare centers for having services. To access information related to healthcare is lessen and difficult for elderly people which makes more researchers interested in developing more mobile base applications. But the simplicity of utilizing application should be the main feature for the elderly people to have on their smartphone with ease of getting over for benefits.

In this paper the proposed work has the aim of collecting relevant information on how to develop the mobile applications related to healthcare in the elderly. The specific media technology, Augmented Reality known as AR, is applied in this work that could be a very friendly way to provide much information for the elderly persons to get educated and learn about the healthcare that is necessary for them to understand and follow all steps to change for better healthy living and improved lifestyle in terms of more healthcare concerns and longer life span.

There is the knowledgeable information of how to take care of the elderly's healthiness, which may involve with some basic measurement and acquisition of the body's health related signals such as blood pressure level, heart-rate count, blood oxygen volume or blood sugar accumulated rate. All mentioned self-monitoring and measuring of body responsive signs are required care takers who have well trained to do all these kinds of measurements. Some other concerns with elderly would also involve the schedule of taking medication and some emergency calls to contact the family members in case of accidents. Therefore, the application that we have designed has to answer all mentioned issues for the proper solution on application and can accompany the elderly to get over for what in need. Moreover, the elderly's measured body signals will transferred to a doctor for closed monitoring to access a record of elderly patients who need more attention from doctor on their health situation. In this work of attempting to develop the mobile application that can assist all elderly persons, the research information gathering, and related data analysis are carried out with careful designed and supervised by expert in a field for improvement of application.

The following sections of paper are outlined by, first the basic information on mobile applications for healthcare elderly is described. Section 2 shows the related principles and theories. Section 3 describes the procedure in detail of how the application works. Section 4 presents the results from study. Finally, section 5 summarizes and shows future work.

II. BACKGROUND

In this section, a brief overview of elderly, the healthcare application using with android-based smartphone, and using augmented reality to the elderly are described.

A. ELDERLY

Elderly person is a person who is over 60 years old. It is the edge of our final aging range that we human will have come to the end of our life. Therefore, the problems of the elderly in all aspects, especially in public health and society, are different from those of other ages. Nowadays, the elderly population are rapidly increasing both in Thailand and around the world. The government and foreigners are aware of the importance of this matter, so there is an effort and many campaigns for people to understand and ready to tackle the issue [1]. The elderly persons are the ones that require the special care because they are deteriorated and have regression in many areas, both physically and mentally. They may have chronic illness, such as high blood pressure, diabetes, dementia, etc., as well as mental and emotional changes that some elderly people may not be able to cope with. Therefore, the purpose of caring for the elderly is to enable them to live happier for the rest of their life and more independent, and able to rely on themselves as much they can [2]. Therefore, an application has been developed to help take care of the elderly' s health. Within the application, there is an AR technology system to explain and provide information about health problems and answer any concern questions. This

includes advice on exercise methods that are suitable for health problems. In order for the elderly or those caring for them to understand more about such health problems, AR technology will play a role in the conversation with the doctor. To make the elderly feel like having a conversation directly with the doctor. The application will have many other functions, such as medication reminders and record of the body's responsive health data and emergency calls. All these functions will help facilitate the daily life of the elderly better.

B. THE HEALTHCARE APPLICATIONS WITH ANDROID

The healthcare industry is challenged, unique, complicated, and intransigent. It deals with the most important asset of life that individual has one's health. We are distressed when we lose our health due to illness, accidents, or getting old, and we are happy and thankful when we are relieved from pain, illness, or loneliness [3]. Depending on the rapid development of technology in our lives and the era of mobile health applications, our work that is proposed is the development of an android application to provide the health care services for elderly persons at home. The reason of Android platforms selected is that the cost of Android mobile is reasonably cheap and can be used by everyone with all ages [4].

C. APPLYING AUGMENTED REALITY TO THE ELDERLY

The advances in medical and assistive technologies have prolonged the age of human beings. The aging population is increasing, by 2030 the global population of those aged above 60 years is projected to grow by 56% and double in size by 2050. We are seeing attendant challenges in elderly population such as loneliness, social isolation and increasing depression rates as the elderly population rise. Several reasons of this are a lost sense of purpose in life, a lack of confidence in dealing with physical or mentally decline, and the refusal to be a burden to others. Almost one third of the elderly have reported experiencing loneliness, and the loneliness is also linked to higher risks of illness. Many believe that to live longer is not the ultimate goal if without living well. Research had shown that we need to continue learning and work out to be both physically and mentally healthy. Many initiatives and research works had been done by involving innovative uses of technologies to help the elderly. However, there are comparatively less studies on using augmented reality to stimulates the cognitive or psychomotor skills of the elderly such as paying attention, visual-motor coordination, logical spatial reasoning, visual perception, spatial orientation, and creativity [5].

III. APPROACH

This section provides detailed information about application design, goals of study and ways to enable us to get older people interested in healthcare and exercise.

A. APPLICATION DESIGN GOALS

This mobile based healthcare application in elderly is an application that is designed for the elderly to use, and for their caregivers as well. Therefore, the application should be easy to use. Colors in application are not too blinding within the application which consists of many different systems essential

to the daily use for the elderly, such as a medication reminder system. Body record system, emergency call system, and the information of the registrant will be stored in the database system. Therefore, when logging back in again, the information of the old person within the application will remain. Every system that has been built in the application is to promote the well-being of the elderly and their caregivers to have a better well-being

B. AUGMENTED REALITY FOR APPLICATION

To encourage the elderly to pay more attention and care about their own physical health, we have created function on application to provide information about diseases that the elderly persons often have. By within the application, it will consist of Augmented Reality that helps the elderly to be interested in viewing the illness/disease information function and follow the animated AR exercises that are performed in sequence starting from a warm-up to a full exercise. Once the exercise steps completed, the application will take the user back to the exercise main menu page. For the most part, the AR animation is responsive and will take a user to the next page of AR to explore more and to show the situation according to the question that the user chooses.

IV. METHOD

In this section, we first share information and instructions on how to make the application. We then provide the demographic data of the participants, reviewing the tools used in study, and the process of study.

A. DESIGNING THE SYSTEM STRUCTURE WITH APPLICATION

The first step of using the application is the registering for an account. If user registered successfully, then users can fill in personal information such as names, weights, heights, congenital diseases, illness, and regular medication that needs to be taken. Therefore, when a new caregiver comes to take over, it can make the process of caring for the elderly uninterrupted. There are five functions on the main page, which will be subdivided into several health pages. Recording the results of the physical examination, reminding for medication, emergency calls, and exercise page which all are shown in Figure 1.

B. USER LOGIN PRINCIPLE

Elderly healthcare application collects information such as registration information. Data on the profile, the body data, and emergency call numbers stored in Firebase, one of Google's products. Firebase is a collection of tools for managing back-end or server-side. This makes it possible to build mobile applications efficiently. It also reduces time and costs as well.
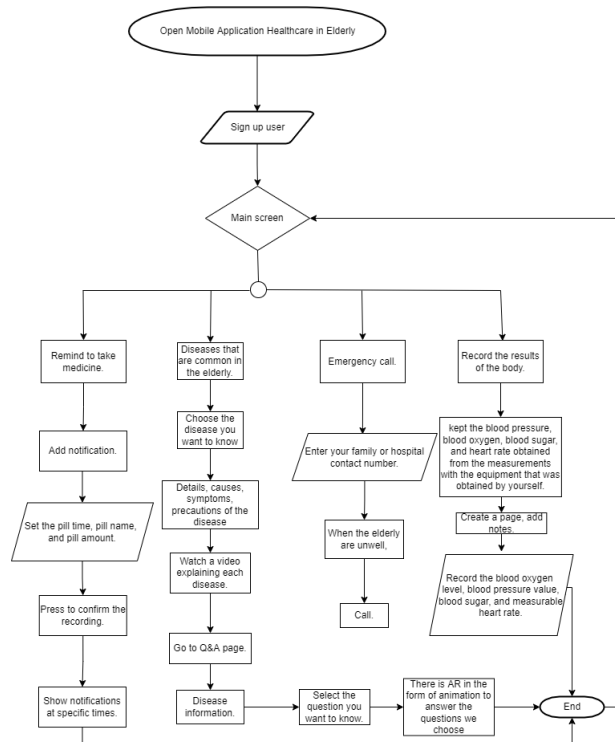
Fig. 1.   Workflow of a whole study

C. PARTICIPANT

We have ten elderly persons with ages from 60 to 80 years, and ten elderly caregivers with irrespective of genders and ages. To test the performance of our mobile based healthcare application, three experts in application development and another three in medical knowledge have tested and commented on the application for improvement.

D. TOOL FOR DATA COLLECTION

Questionnaire is made with the questions based on a chosen format that cover all areas related to healthcare for elderly. When asking questions and take them into account with considerations, such as making it clear for questions, asking straightforward to the point, using simple words in question, and avoiding any difficult technical terminology. The other tools used in this study are a satisfaction assessment form, a medical knowledge assessment form, and an application quality assessment form.

V.   PROCEDURE

As mentioned above, users first must register for an account with application. When user logged in, it will go to the main menu page where users can choose which function to use. If entering the health page, it will go directly to the disease that the elderly is prone to. Inside this selection, there will be animations to explain the information of disease instead of too much text display on screen. User can skip parts of animation by pressing a button on screen to a next page of question/answer section that is an AR doctor to meet. In the similar way for the exercise page, there is also another AR animation to make various gestures to make it look cute and attractive. A calling system will be linked to a mobile phone in case of emergency. Within the application,

there will be a page to record physical results. If a caregiver or an elderly person takes measurements, they can record the collected data within the application for a doctor when having an appointment at hospital. Another important function is a medication reminder system that works like an alarm clock to remind the elderly to take a medicine on time as well.

VI.   RESULT AND DISCUSSION

For evaluation and satisfaction survey, on our proposed mobile based healthcare application in elderly, we have two sample groups who are 10 elderly persons and another 10 care takers with irrespective of genders and ages. Our mobile application was assessed in 4 main aspects comprising of a design of characters and texts, audio and sound effect in application, systems in application, and motion graphic in AR and video.

The results from our questionnaire are shown in Table I. Most users are very satisfied, and its total satisfaction was calculated. First, the design of characters and texts in the application has a high level of satisfaction with a mean of 4.45 and a S.D. of 0.62. Second, the audio in application shows a high level of satisfaction for mean of 4.48 and S.D. of 0.70. Third, the systems in application also show the highest level of satisfaction for mean of 4.63 and S.D. of 0.46. Finally, the motion graphic in AR and video reveals the highest level of satisfaction with mean value of 4.60 and S.D. value of 0.51. Finally, the total mean value is found at 4.54 and S.D. for 0.57 and the sample groups show the highest level with the application.

The results of quality based on three experts evaluating in four same aspects of application that was mentioned before are shown in Table II. Scores show that each subject had their quality levels and total quality levels are calculated. Mean and S.D. values were found at 4.50 and 0.63 for the design of characters and texts in the application with the highest level of quality levels. The audio in application shows a high level of quality with a mean of 4.44 and S.D. of 0.58. The systems in application have a high level of quality with a mean of 4.33 and S.D. of 0.69. The motion graphic in AR and video shows the highest level of quality with a mean of 4.55 and S.D. of 0.39. Finally, the total mean was found at 4.46 and S.D. at 0.57. The process quality of application is at a high level.

The evaluation results on the content of mobile application with three detail experts in the same aspects are shown in Table III. Each subject has their quality level and total quality level calculated. First, the design of characters and texts in the application shows the highest level of quality with mean of 4.56 and S.D. of 0.58. Second, the animation shows the highest quality level with mean of 4.50 and zero S.D. Finally, the total mean of 4.53 and S.D. of 0.29 were found and the content evaluation results reveal the highest level with application. In the aspect of application design, the evaluation results from three knowledge experts can be concluded that the overall quality was assessed at a level that passed the standard in all aspects and its quality is at a highest level with mean of 4.53 and S.D. of 0.29. The assessment results can be concluded that the overall quality passed the standard level in all aspects and its quality is at a high level with mean of 4.46 and S.D. of 0.57. Based on the satisfaction results collected from 20 participants,

it can be concluded that the overall satisfaction of the sample group is at the highest level with total mean value of 4.53 and S.D. of 0.53.

The content that was prepared represents the knowledge and understanding about health problems, illnesses, or diseases that the elderly persons have normally, such as heart disease, diabetes, high blood pressure, dementia and osteoarthritis that are concise and easy to understand by elderly. Design the organizer has designed the characters of the doctor and the elderly, including 2-D animated videos that are cute, bright, and based on different situations to be able to feel the action. Facial expressions and character gestures include recognition of information and knowledge that we want to communicate correctly, completely, and easily to understand. This corresponds to the results of the assessment by experts with expertise in health care in terms of animation, and the quality with the highest level. In accordance with the results of the evaluation by experts in media and technology in terms of design, it shows that the quality is at the highest and consistent with the satisfaction obtained from the sample group for the design with a high level of satisfaction.

The audio and sound effect were found to be interesting, proper loudness and fit to the situation within the application This corresponds in terms of sound quality with a high level and the satisfaction of the sample group in terms of sound satisfaction at a high level. The systems in application have been designed for the usage, and proper placement of buttons so that users can easily control the application. This corresponds to the results of the evaluation in terms of the system quality with a high level and consistent with the satisfaction of the sample group with the highest level of satisfaction. The motion graphics in terms of both characters and illustrations are smooth and uninterrupted, appropriate to the application not too much or too less for users to perceive the movement. This corresponds to the results of the evaluation in motion graphics with the highest quality level and consistent with the highest level of satisfaction by sample group.

VII. CONCLUSION

In this study, it has brought together knowledge of technology and medical knowledge for development of application that can facilitate the elderly, caregivers, or related people with interest of healthcare and related services. Data record can be made for medical information for the doctor appointment at hospital. An emergency call number in case when the user wants to make will go to the telephone page with a number of 1669, which is an emergency number for the elderly and the caretaker can call immediately.

In next phase of development of the proposed application such as the doctor's appointment function or connecting the application to the hospital for examination and diagnosis, also an online doctor's consultation system will be considered and developed.

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