

Analyzing and Implementing a Mobile Reminder System for Alzheimer's Patients

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Abstract - Recently, M-health or mobile health has been receiving a lot of attention worldwide from healthcare professionals, patients, network service providers, application developers and researchers. Mobile phone software applications or apps are available for a variety of useful healthcare tasks such as psycho-education, symptom assessment, resource location, and tracking of treatment progress. This study focused on creating an application for smart phones with android system. The main aim of the proposed system is to help an important category of the society which is the alzheimer's patients, this system gives them the ability to have small memory which can help them to remember all tasks to live, which may contribute to the prevention of progression of the disease rapidly, the technology provides the best care because it is not susceptible to forgetfulness or damage. The design of the proposed system presented in this study includes reminding them of their families through memories and family photos and information, and the dates of their medications, the amount of medicine and hospital appointments.

Key Words: Mobile Technologies, Alzheimer's Patients, M-health, Reminder System.

1. Introduction

Alzheimer's Disease is a chronic neurodegenerative disease that affects 44 million people worldwide. As a result of the illness, Alzheimer's patients experience difficulties with their memory, which interferes greatly with their daily lives. Unlike other chronic illnesses, Alzheimer's disease prevalence is on the rise with 160 million globally projected to suffer from the disease by 2050. Not only does the disease affect the patient, but also caregivers, including families, friends and care professionals [1-3]. People affected by Alzheimer disease suffer from various problems such as inability to think, communicate, and make decisions, recall memory. They lose the track of what they are thinking and not know what to speak. Communication challenges are common in such patients. Behavioural symptoms such as depression, anxiety, and sleep disorder also occur as the disease progresses. Changes in mood and personality, less social participation, distress from work all these symptoms drastically affect their livings [1, 4].

Alzheimer's disease has become a very significant problem in the current era and it is very likely to worsen due to increasing life expectancy. rapid expansion of mobile information and communications technologies (ict) within health service delivery and public health systems has created a range of new opportunities to deliver new forms of interactive health services to patients, clinicians, and caregivers [5-7]. The enormous potential of smart mobile devices has attracted researchers and medical practitioners to develop and provide m-health solutions for Alzheimer's [8].

Samsung created the "Memory Recaller," an innovation that gives meaning back to an Alzheimer patient's life. The easy-to-use mobile application was developed in consultation with dementia specialists at praram9 hospital to help bring patients back from the isolation caused by memory lost. The application detects the person standing in front of the patient by utilizing facial recognition technology and the mobile camera. It then informs the patient of their relationship and the person's name using auto-speech as well as 'recognizing' people for the patient through "memory recaller," the application has an "activity recaller" function, which helps the patient keep track of completed activities, eliminating unnecessary repetition [9].

Choon In [10] developed an android application for helping people with Alzheimer's patients in their daily life, which provides an audio reminder that can help them to do their everyday activities on time. Moreover, this application allows caregivers to have remote access to the Alzheimer's patient's smartphone on which the app is installed to check the history of the performed activities. Pirani et al. in [11] also developed an android-based assistive application for Alzheimer's patients. In this case, the application provides a facility to track the movements of patients through GPS. It also gives medicine and food timing notifications. In addition, it has a daily routine tracker and quiz to increase the cognitive functioning of people with Alzheimer's. figure 8 shows a snapshot of the application developed by Pirani et al. [11].

Duque et al. in [12] developed a mobile application for detecting Alzheimer's patients' movement patterns through data provided by accelerometers. The goal of this application was to explore the relationship between these patterns and the stage of alzheimer's disease. The application was developed based on neural network classifiers and was applied in a case study involving 35 patients. The proposed application achieved a success rate of up to 83%.

The technological revolution influenced everything [13-32], even the methods of marketing, business, educational and mobile applications for the real world business issues. today, the use of artificial intelligence (AI) algorithms is expansive, particularly in providing solution to challenging problems including image segmentation [13, 14, 24, 33-39], nurse rostering problem [40], analysis of medical image [41-45], patterns recognition and retrieval of information [46-62], learning management system [63-88], healthcare monitoring system [27, 89], as well as prediction of river flow [90-92]. accordingly, the combination of human and artificial intelligence have been utilized to design and implement a reminder system to help the patients with Alzheimer’s disease and to assist home care to the elderly people [93-95].

The rest of the paper is organized as follows; unified modeling language (UML) will be described in section 2, the prototype design of the proposed system will be illustrated in section 3. Results will be discussed in section 4. Finally, the conclusion is presented in section 5.

2. The Unified Modeling Language

Unified Modeling Manguage (UML) is a common language for business analysts, software architects and developers used to describe, specify, design, and document existing or new business processes, structure and behavior of artefacts of software systems. UML can be applied to diverse application domains (e.g., banking, finance, internet, aerospace, healthcare, etc.) it can be used with all major object and component software development methods and for various implementation platforms (e.g., J2EE, .net). The UML was utilized mainly to design the proposed system. The use-case diagram and the class diagram are addressed below.

2.1 Use Case Diagram

A use case is a kind of behavior classifier that specifies a [complete] unit of [useful] functionality performed by [one or more] subjects to which the use case applies in collaboration with one or more actors, and which [for complete use cases] yields an observable result that is of some value to those actors [or other stakeholders] of each subject. Figure 1 shows the use case diagram for the proposed system. Mainly 4 actors (admin, caregiver, family member and patient) will be interacting with the proposed system; each one can do the following:

- **Admin:**
 - ✓ Admin can update system
 - ✓ Admin can manage firebase

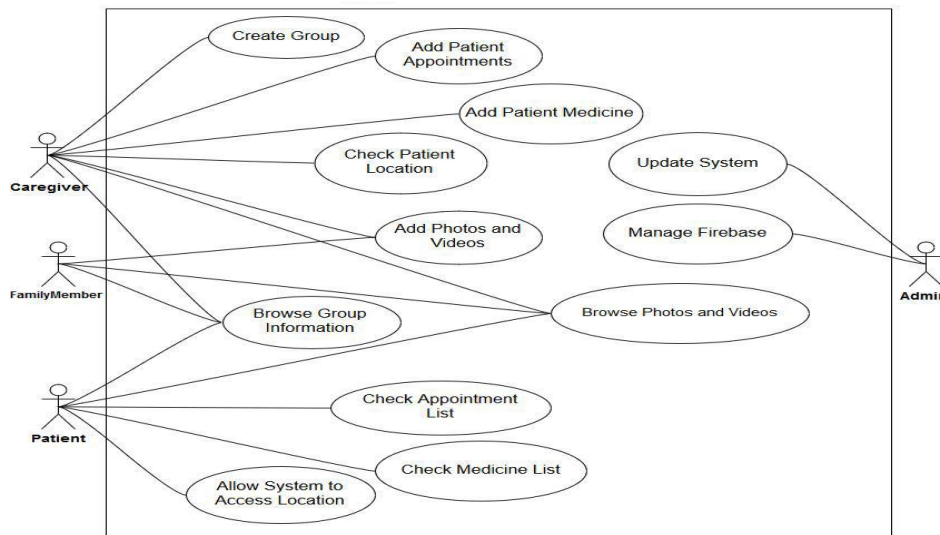


Figure -1: Use case diagram for the proposed system

- **Caregiver:**
 - ✓ Caregiver can create group
 - ✓ Caregiver can add patient appointments
 - ✓ Caregiver can add patient medicine
 - ✓ Caregiver can check patient location
 - ✓ Caregiver can add photos and videos
 - ✓ Caregiver can browse group information

- **Family Member:**
 - ✓ Caregiver can add photos and videos
 - ✓ Caregiver can browse photos and videos
 - ✓ Caregiver can browse group information
- **Patient :**
 - ✓ Patient can browse group information
 - ✓ Patient can check appointment list
 - ✓ Patient can check medicine list
 - ✓ Patient can allow system to access location

2.2 Class Diagram

Class diagram is UML structure diagram which shows structure of the designed system at the level of classes and interfaces, their features, constraints and relationships - associations, generalizations, dependencies, etc. Figure 2 shows the proposed system entities, such as Caregiver, Family member and Media file, etc.

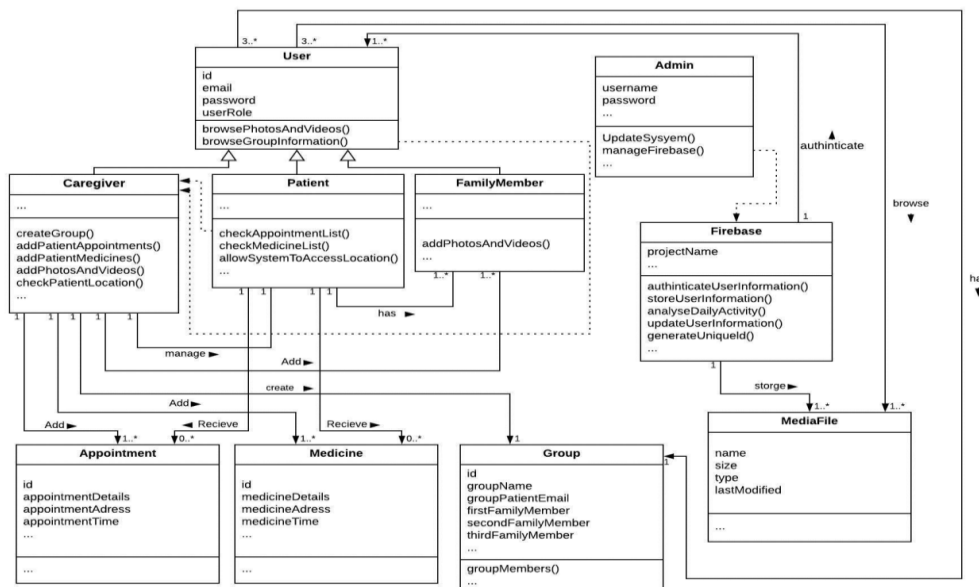


Figure -2: The class diagram of the proposed system

2.3 Entity Relationship (ER) Diagram

An entity-relationship diagram (ERD) is a data modeling technique that graphically illustrates an information system’s entities and the relationships between those entities. An ERD is a conceptual and representational model of data used to represent the entity framework infrastructure. Figure 4 shows the ER diagram for the proposed system.

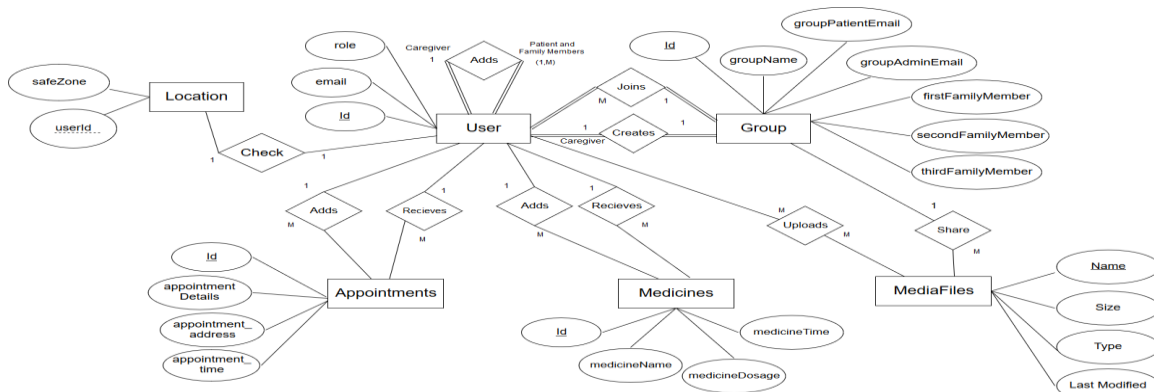


Figure -3: ER diagram for the proposed system

3. Proposed System Prototype Design

This study focused on creating an application for smart phones with android system. The main aim of the proposed system is to help an important category of the society which is the Alzheimer’s patients, this system gives them the ability to have small memory can help them to remember all tasks to live, which may contribute to the prevention of progression of the disease rapidly, and the technology is best care because it is not susceptible to forget or damage. The design of the proposed system presented in this study includes reminding them of their families through memories and family photos and information, and the dates of their medications, the amount of medicine and hospital appointments. The figures below are examples of the implemented interfaces.

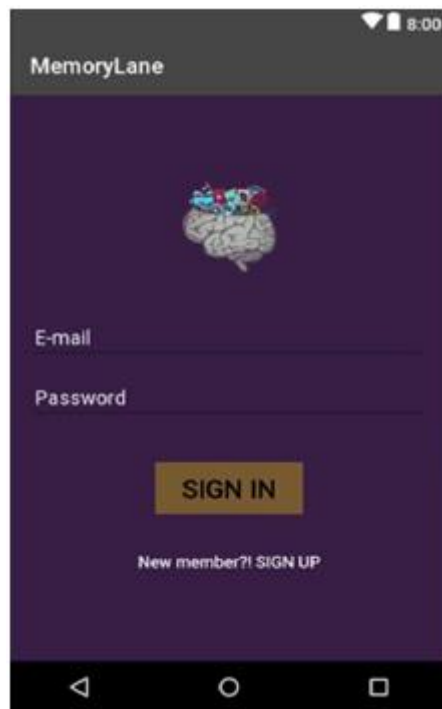


Figure -4: Login Interface

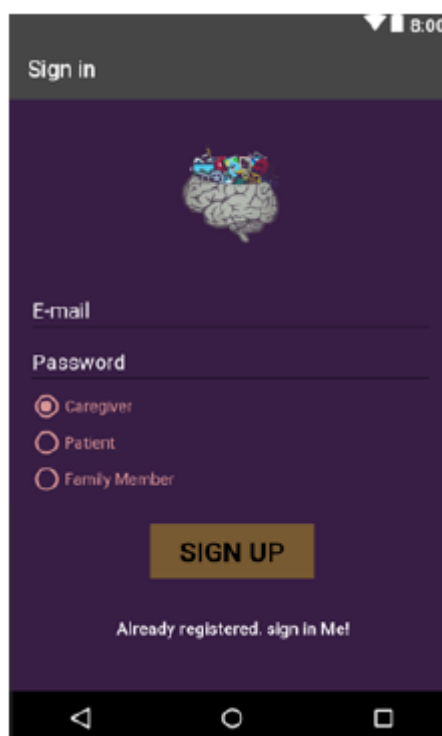


Figure -5: Sign up interface



Figure -6: Caregiver home page



Figure -7: Location interface

4. Results And Discussion

The proposed system has been tested in order to measure its usability, where the proposed system was tested by operating using android studio. Twenty students evaluated the system prototype from Imam Abdulrahman Bin Faisal University (IAU). After given a brief explanations about how to use the system, the students have been tested the proposed system and answer the survey questionnaire (contains 10 questions measured by 5-point Likert scale). The aim of the proposed survey is to measure the user satisfaction about the proposed system and prove its usability. The results obtained shows a high percentage of the students approve that the proposed system is usable, useful and achieved the main project target (see table 1).

Table -1: Results of data collected from the 20 students

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Strongly Disagree										
Disagree										
Neutral	3	4	3	2	2	3	4	8	4	3
Agree	7	10	8	8	8	7	12	8	12	11
Strongly Agree	10	6	9	10	10	10	4	4	4	6

5. Conclusion

A smart phone application with android system was developed in this work. The main aim of the proposed smart phone application is to help an important category of the society which is the Alzheimer's patients, this proposed system gives them the ability to have small memory can help them to remember all tasks to live, which may contribute to the prevention of progression of the disease rapidly, and the technology is the best care because it is not susceptible to forget or damage. The proposed system reminds the Alzheimer's patients of their families through memories and family photos and information, and the dates of their medications, the amount of medicine and hospital appointments.

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