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## Android Based Assistive Toolkit For Alzheimer

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### Abstract

The aim of the paper is building an application that could ease the everyday life of a person affected by Alzheimer's disease. This application provides various functionalities such as tracking movements of the patient through GPS, providing medicine and food timing notifications, daily routine tracker and quiz to increase cognitive functioning of the patient. The main objective of this project is to make people suffering from Alzheimer's as independent as possible. So this project is not only about creating an application but also address the problem of increased dependency of Alzheimer patients on caregivers.

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### 1. Introduction

In 2010, there are 3.7 million Indians with dementia and the total societal cost is about 14,700 crores. While the numbers are expected to double by 2030, costs would increase three times. While in 2010, there were between 21 and 35 million people worldwide with AD. It most often begins in people over 65 years of age, although 4% to 5% of cases are early-onset Alzheimer's which begin before this. It affects about 6% of people 65 years and older. In 2010, dementia resulted in about 486,000 deaths. Alzheimer's disease (AD), also known as Alzheimer disease, or just Alzheimer's, accounts for 60% to 70% of cases of dementia. It is a chronic neurodegenerative disease that usually starts slowly and gets worse over time. The most common early symptom is difficulty in remembering recent events (short-term memory loss) <sup>1</sup>.

As we can see Alzheimer patients have short term memory so they face some common problems like wandering off, forget to have food, forget faces/names of family members are the most common one. To solve all this problem

Alzheimer patient's have a caretaker with them, who takes care of them and help them in day to day chores.

What if there is an application which will take care of the patient instead of the real care-taker, which helps the patient to remember faces/names of family members, gives reminder to have medicine, helps them to follow full schedule, etc. It also helps the patients to estimate his/ her progress by progress report which will be generated by playing games. Solving problem games which will help him/her to stimulate brain functioning. The purpose of this project is to make patients independent as much as possible.

## 2. Literature Survey

It affects memory. Alzheimer's disease (AD) is the most popular dementia in elderly people worldwide. Its expectation is 1 in 85 people will be affected by 2050 and the number of affected people is double in the next 20 years <sup>2</sup>.

There are 3 phases of AD: A) Early stage B) Moderate stage C) Severe stage

A) Early stage: - In the early stages of Alzheimer's, a person may function independently. He or she may still drive, work and be part of social activities. Despite this, the person may feel as if he or she is having memory lapses, such as forgetting familiar words or the location of everyday objects.

Common difficulties include:

- Memory loss that disrupts daily life.
- Challenges in planning or solving problems.
- Confusion with time or place.
- Decreased or poor judgment.

B) Moderate stage: - Moderate Alzheimer's is typically the longest stage and can last for many years. As the disease progresses, the person with Alzheimer's will require a greater level of care.

Common difficulties include:

- Forgetfulness of events or about one's own personal history.
- Confusion about where they are or what day it is.
- Changes in sleep patterns, such as sleeping during the day and becoming restless at night.
- An increased risk of wandering and becoming lost.

C) Severe stage: - In the final stage of this disease, individuals lose the ability to respond to their environment, to carry on a conversation and, eventually, to control movement. They may still say words or phrases, but communicating pain becomes difficult. As memory and cognitive skills continue to worsen, personality changes may take place and individuals need extensive help with daily activities <sup>3</sup>.

Common difficulties include:

- Require full-time, around-the-clock assistance with daily personal care.
- Lose awareness of recent experiences as well as of their surroundings.
- Experience changes in physical abilities, including the ability to walk, sit and, eventually, swallow.
- Have increasing difficulty communicating.

Assistive technology refers to devices or systems that support a person to maintain or improve their independence, safety and wellbeing. Many assistive technology devices are electronic, but the term does not just refer to high-tech devices. However, devices such as smartphones and tablets, coupled with widespread internet coverage, are making technology more accessible for everyone in ways that we couldn't predict just a few years ago. Technologies and 'apps' (applications or programs for smartphones and tablets) that have been developed for the general public are increasingly being used by people with dementia as well. Over time these mainstream technologies will probably replace many of the products that were developed specifically for people with Alzheimer disease <sup>4</sup>.

Technology can be used in a variety of ways, and for a variety of purposes. It can support people in carrying out everyday tasks and activities, enhance a person's safety, support their social participation, and monitor their health.

Assistive technology can help people who have problems with:

- Hearing and eyesight
- Finding their way around
- Memory and cognition (thinking and understanding)

Although the onset of Alzheimer's disease cannot yet be stopped or reversed but by using assistive technology like mobile application it can make the patients independent and improve the quality of life of patients with AD or dementia. By considering symptoms in various stages, technology can be used for the patients in mild stage <sup>5</sup>.

Advances in mobile phone technology have paved the way for exciting new applications. Smartphones can be used as medical devices for measuring blood pressure, measuring Glucose levels, performing portable ultrasounds, and even testing for STDs <sup>6</sup>.

The focus of our work is to improve people's abilities to perform activities of daily living and hence to promote independence and participation in social activities. Our work also aims for reducing the burden on caregivers by increasing the AD patients sense of competence and ability to handle behaviour problems.

Following features such as GPS tracker, Routine tracker, Reminder, Flashcards, SOS, etc. can be included in the application that can help in stimulating the patient brain, decreasing the depression and also reducing the symptoms of AD. The primary aim of the current project is to offer persons with mild AD an assistive presence <sup>7</sup>.

GPS tracking is the surveillance of location through use of the Global Positioning System (GPS) to track the location of an entity or object remotely. The technology can pinpoint longitude, latitude, ground speed, and course direction of the target. GPS location tracking feature in an application can be used to track location of patients suffering from AD <sup>8</sup>.

Reminder is a feature in an application that allows users to set notifications for themselves and create lists. It remind its users to take the correct medicines on time and record the in-take schedules for later review by the caregiver. It can alert the patients about potential drug-drug/drug-food interactions through push notification or alarms. It will issue an alert approximately 5 – 15 minutes before the scheduled time to take certain medicine. The alert will be issued repetitively until it is cancelled by the user. It will record the time at which its user cancels an in-take alert and regard that at the time that specific medicine was taken. These medicine in-take records can be stored on board and synchronize with the database <sup>9</sup>.

Personal emergency notification system is an important tool for personal security and safety .There are two kinds of common emergency notification systems. One is designed to allow the user wearing a designed button with a connection to the device host at home. Another is specially designed single-function phone (the phone for elders) whose back has an SOS button. Users can quickly push the designed SOS button for help via sending (short) messages or phone calls to default emergency corresponding people (caregiver) <sup>10</sup>.

### 3. Existing System

#### 3.1 Alzheimer's Daily Companion. <sup>11</sup>

The features of the existing system called "Alzheimer's daily companion" are as follows:

- Free and immediate advice and tips for dealing with Alzheimer's and dementia behaviours and situation.
- 24-hour care giving assistance via toll free phone number or email submission.
- Access to free Alzheimer's and other dementias caregiver resources and training materials.
- No internet connectivity required.

Drawbacks of the "Alzheimer's daily companion" are as follows:

- It does not provide GPS tracking or any other mechanism to solve the wandering problem of the patient.
- It does not make the patient independent instead it requires a human caretaker to use this application and tend to the needs of the patient.

#### 3.2 Alzheimer Caregiver Buddy. <sup>12</sup>

The features of “Alzheimer caregiver buddy” are:

- Get instant caregiver help and advice.
- Teaches caregiver to deal with wandering, bathing, meals.

Drawbacks of this system are:

- It is again caretaker oriented.
- It does not track movement of the patient.

### 3.3 Alzheimer’s Disease Pocketcard.<sup>13</sup>

The features of “Alzheimer Disease Pocketcard” are as follows:

- Display latest information on detection, diagnosis and management of Alzheimer’s disease.
- Interactive tools to assess cognition and function.
- Education/support PDF’s that can be mailed directly to patients and caregiver.

Drawbacks of this system are as follows:

- No progress reports to view progress of cognitive functioning.
- Alzheimer patients may find user interface difficult to use.
- No patient tracking functionality.

## 4. Our Approach

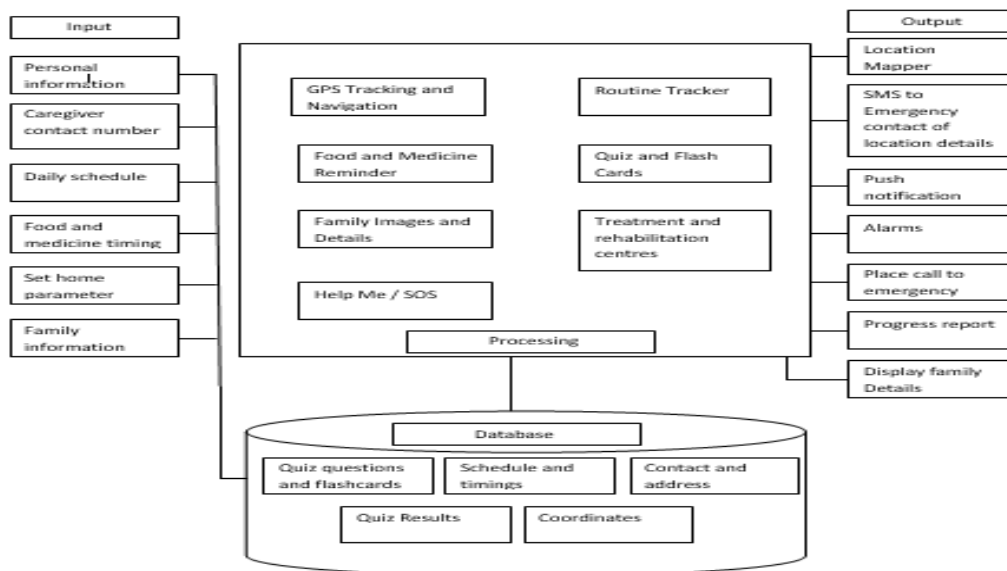


Fig1: Block Diagram of Alzheimer Application System

The features of assistive toolkit can be briefly summarized as follows:

- Personal Information: The user name, age, address and contact number of caregiver all of this will be stored in the database.
- Daily Schedule: This will include schedule for all the daily chores performed by the user starting from morning to night. Like meal timings, reading books or newspaper, medicine timings and so on. This schedule will be again stored in the database for easy retrieval.
- Family Information: Initially user have to provide his/her family member images along with the details of each member like the relationship between the user and the member.
- GPS Tracking and Navigation: Initially home parameters is provided as input by the caregiver. Location

mapping will begin using GPS and navigation feature as soon as the user will leave from home parameters. And if the user forgets the returning route to reach to the source then the coordinates which will be saved in the database using GPS, will help the user to map the route for returning back.

- Food and Medicine Reminder: User will be reminded about their food and medicine timing through push notification or through alarms.
- SOS Button: User in need of any help or in an emergency can press this featured button which automatically sends a message which will include the user's current location to the person whose details is mentioned prior in personal information.
- Quiz and Flashcards: It will include certain kind of games which will stimulate the user's brain and the overall performance will be recorded in the progress report.
- Treatment and Rehabilitation Centre: It will include the list of medicine, the exercise to be performed by the user suffering from AD and also information about the rehabilitation centre.

## 5. Implementation

### 5.1 Setup

The following screenshots of the application specifies the information that has to be provided by the user at the beginning.

1. Patient personal information(Fig 2.a)

At the beginning, user has to provide basic information of the patient such as name, age and contact number.

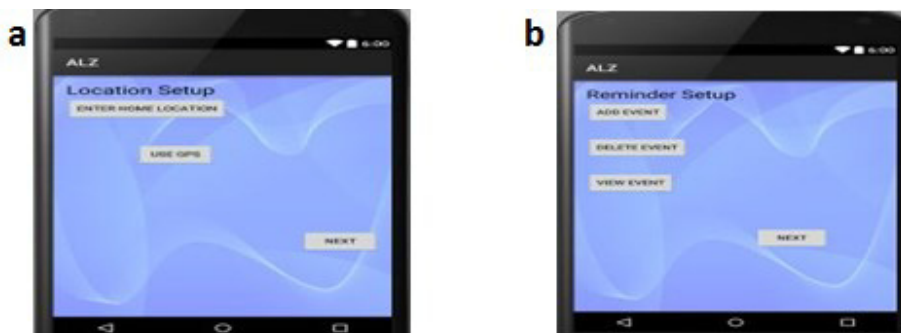


Fig 2.(a) Patient personal information; (b) Caregiver personal information

2. Caregiver personal information(Fig 2.b)

User has to provide basic information such as name, contact no. and email id of the person who will be taking care of the patient.

3. Location setup(Fig 3.a)

User has to provide proper coordinates of patient's home location.

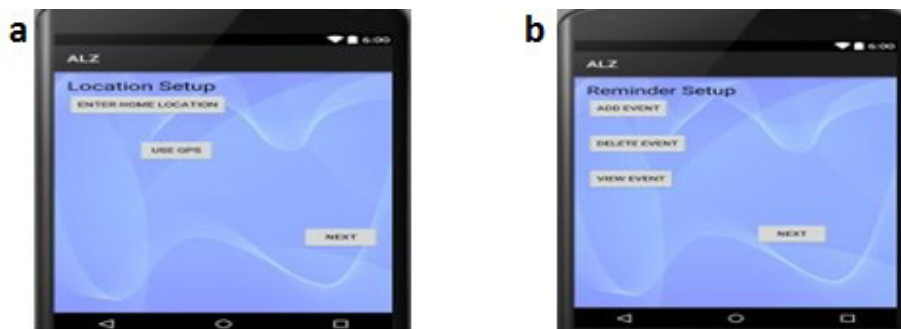


Fig 3. (a) Location setup; (b) Reminder setup

## 4. Reminder setup(Fig 3.b)

User can set new event by using “add event” button, can delete the existing event by using “delete event” button and can view all the events which he had included before by using “view event” button.

## 5.2 Main Page

The following screenshots specifies the important features of the overall application.

## 5. Home(Fig 4.a)

This page includes following buttons such as navigation, schedule, reminder, gallery, quiz and help me button which will help the user to tackle some of his daily problems.

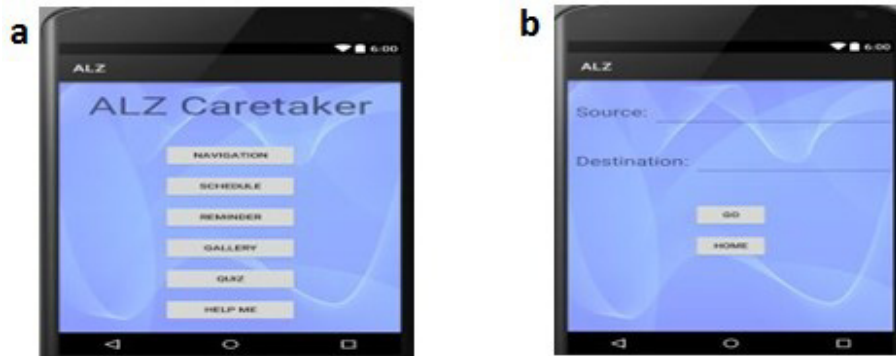


Fig 4. (a) Home; (b) Location tracker

## 6. Location tracker(Fig 4.b)

User just need to specify his source and destination. Location mapping will begin using GPS and navigation feature as soon as the user will leave from home parameters. And if the user forgets the returning route to reach to the source then the coordinates which will be saved in the database using GPS, will help the user to map the route for returning back.

## 7. Schedule(Fig 5.a)

User will include schedule for all the daily chores starting from morning to night like meal timings, reading books or newspaper, medicine timings and so on. User can also delete and view the schedule by using “delete” and “view” buttons.



Fig 6. (a) Schedule; (b) Gallery

## 8. Gallery(Fig 5.b)

This will show the images along with the names of the patient’s relatives.

## 9. Quiz(Fig 6.a)

It will include certain kind of games which will stimulate the user’s brain and the overall performance will

be recorded in the progress report.

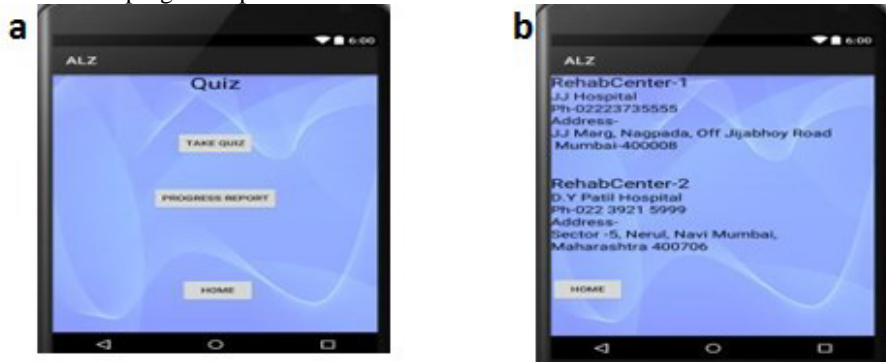


Fig 7. (a) Quiz; (b) Rehabilitation center

10. Rehabilitation Centre(Fig 6.b)

It will include the list of information such as address and phone no. of the rehabilitation centre.

6. Testing

The testing conducted with respect to the application and in comparison with the existing systems yielded the following results. This survey was conducted on survey monkey site <sup>14</sup> which consisted of following questions:

6.1 Usability and Evaluation

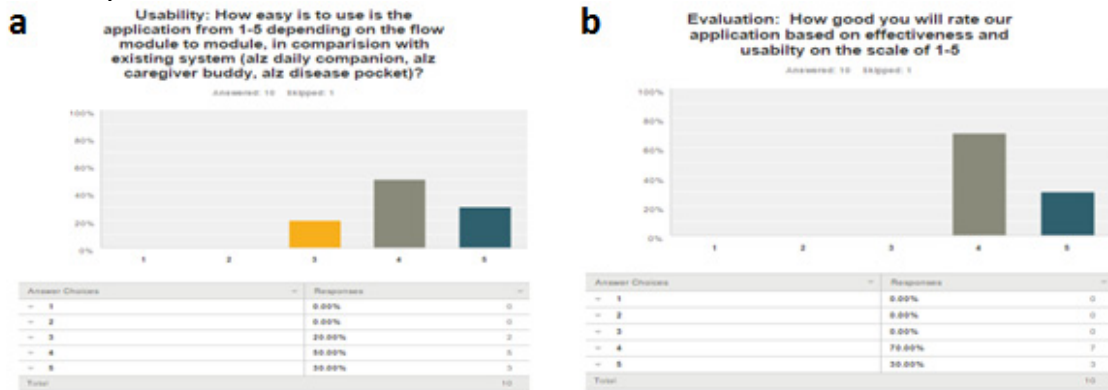


Fig 8 (a) Question on usability ; (b) Question on evaluation

Analysis of Usability: The above question asks the users to compare the current application with the previously existing systems with respect to the Usability and the flow of every feature present on the scale of 1 to 5. The reviewing users have given a ‘Good’ response for the Usability of the app which accounts to an average of 4 units out of total 5.

Analysis of Evaluation: The above question requests users to state how often they can use the current Alzheimer caregiver application and how comfortable it would be for them to use it during the course of the day. Given the test results, the application is very comfortable for a daylong use and that no improvements have been requested by the users.

6.2 Future improvements and User Friendliness



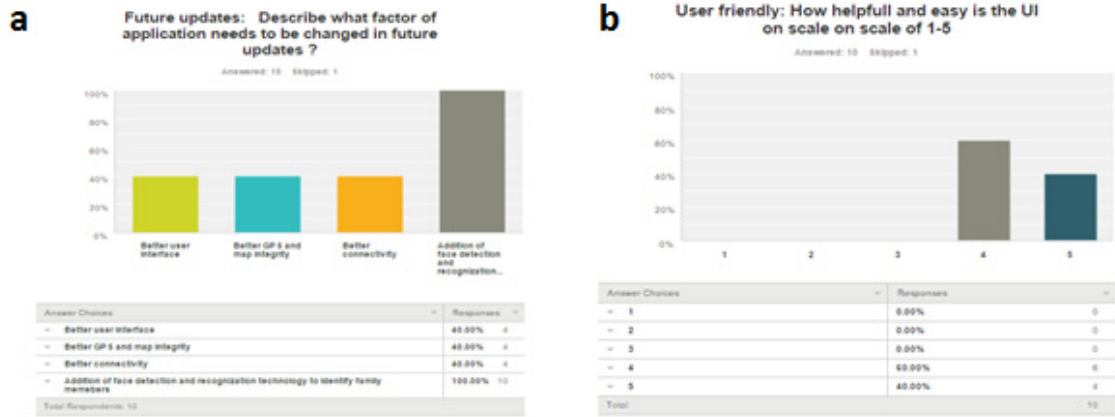


Fig 9 (a) Question on future improvements; (b) Questions on user friendliness

Analysis on future improvements: Every android application has a particular technology after which it gets outdated in order to keep the users from preferring another and an improved version of a similar technology. So we need to update our application with some new technologies to keep our self in the competition with other competitors.

Analysis on user friendliness: Every android application has a particular user interface to make our application famous and user friendly we need our user interface to be simple efficient and how helpful it is. So our user interface score is 4 units which quite good.

6.3 Reminder and scheduling effectiveness and GPS efficiency

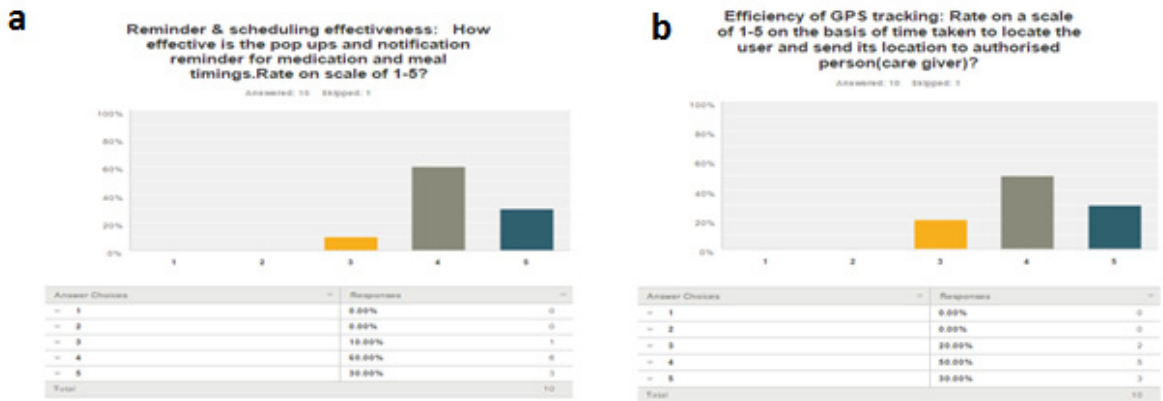


Fig 10 (a) Question on reminder and scheduling; (b) Question on GPS efficiency

Analysis on Reminder and Scheduling: the objective was to find the effectiveness of popups and notification reminders for meal and medicine timings.

Analysis on GPS efficiency: Every android application has many technologies which is highlight of the application. To see how efficient a specific technology is we asked the question of efficiency of GPS. On average we got a score of 4 units, so GPS technology of our application is efficient.

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