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DemeAssist - Dementia Assist Mobile Application

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***Abstract*- Dementia is a syndrome in which there is deterioration in memory, thinking and behavior and the ability to perform day to day activities. This paper addresses the importance of providing support to the dementia patients through a mobile application which improves their life expectancy. This study focuses on providing comfort for dementia patients and their caretakers or family members. The application keeps track of patient's medical history and personal information. It tracks the location of patient and notifies caretaker or family member if the patient wanders beyond a specific limit from home. It alerts patient to take medicines at the right time and displaying pictures and videos of family members to retain memory and to provide comfort for them. It is hoped that this application helps in improving cognition of older adults suffering from dementia and related diseases**

Keywords— dementia, mobile application, patient, flutter, android, ios, location tracking, medicine remainder

I. INTRODUCTION

Dementia is a group of symptoms affecting memory, thinking and social abilities severely enough to interfere with daily life. It deteriorates cognitive function beyond what might be expected from the usual consequences of biological ageing. The signs and symptoms linked to dementia are, forgetfulness, losing track of the time, becoming lost in familiar places, becoming forgetful of recent events and people's names, experiencing behaviour changes, including wandering and repeated questioning. Dementia has physical, psychological, social and economic impacts, not only for people living with dementia, but also for their care takers, families and society at large. There is no treatment currently available to cure dementia or to alter its progressive course. However, much can be offered to support and improve the lives of people with dementia and their caretakers and families.

Dementia Assist Application is designed to assist the dementia patient and their caretaker or family members by multiple means. The application is developed using Flutter. The Flutter framework has a single code base. It supports both iOS

and Android platforms. The application runs perfectly on Android versions 7.0 and above. For backend, Firebase's Firestore is used, which is a NOSQL database.

This paper is intended to support the caretaker's community, the patient and the family members of the patient through mobile application. The end deliverable of this paper is a mobile application and is completely menu driven and user friendly. This application serves as a potential solution to meet the difficulties endured by the dementia patients and their caretakers. The users are provided with login credentials, only through which they can get the services.

II. EXISTING WORK

The existing systems (assistive technology) for therapeutic treatment of individuals with chronic illness mainly focuses on only one aspect, either by providing engaging activities for such people or monitoring their medical history and daily life. Since there is currently no treatment is available for dementia and constrained caring abilities of caretakers, further sophisticated strategies must be created to increase the quality of life of the individuals. Patients' lives in house require additional care and supervision, which has a significant impact on the quality of life of caretakers. The fact that technology can assist in healthcare is obvious, but choosing the appropriate application for dementia healthcare is challenging.

III. PROPOSED WORK

This paper proposes a mobile application focuses on bringing both health and safety monitoring along with Cognitive thinking under the same roof. This mobile application is developed using Flutter. The goal of this project is to develop an application that supports the caretaker's community, which also provides comfort and care to the patients. Existing research literatures confirmed that smartphones or tablets are the viable options for meeting the needs of dementia patients by offering simple interactive

characteristics such as a touch screen, motion detection utilising sensors and speech recognition. It is also believed that through using such apps, dementia patients' self-management abilities will improve.

IV. System Environment

The following are the hardware and software specifications used in this application.

A. *Hardware Configuration*

Processor	: Pentium IV 2.8-GHz
RAM	: 8 GB (Recommended)
Hard Disk Capacity	: 4 GB

B. *Software Configuration*

Operating System	: Windows 7 or later
IDE	: Android Studio
SDK	: Flutter
Minimum SDK Version	: Android API Level 21

C. *Android Studio*

Android Studio is the official integrated development environment (IDE) for Google's Android operating system. It is the fastest development tools to develop state-of-the-art apps and speed up performance. In the current stable version, the following characteristics are available.:

- Flexible build system powered by Gradle.
- Create rich experiences. Get rid of strenuous tasks. Create the best code.
- Template-based wizards to create common Android designs and components
- Maven repository to store multiple jar files as project and plugin jar files
- A visual layout editor that permits users to drag-and-drop UI widgets, choice to sneak layouts on different screen configurations.
- Intelligent code editor

D. *Flutter*

Flutter is an open-source framework to create high quality, high performance mobile applications across mobile operating systems - Android and iOS. It provides a simple, powerful, efficient and easy to understand SDK to write mobile application in Google's own language, Dart. Flutter comes with beautiful and customizable widgets for high performance and outstanding mobile application. It fulfils all the custom needs and requirements.

Firebase and Google Cloud Platform's Cloud Firestore is a scalable, adaptable database for mobile, web, and server applications. Like Firebase, through real-time listeners, Real-time Database keeps our data in sync across client apps and provides offline support for mobile and web, allowing responsive apps to be designed that run independent of network delay or Internet connectivity. Cloud Firestore also integrates well with other Firebase and Google Cloud Platform products, including Cloud Functions. Like Real-time Database, Cloud Firestore uses data synchronization to update data on any connected device. It's a NoSQL database stored in the cloud that iOS, Android, and web apps may invoke straightaway using native SDKs.

V. Application Design

The interface design illustrates how the software communicates within itself and with the systems that interoperate with it.

A. *UML Diagram*

Caretaker registers themselves as a user of the applications and registers patient details. The application notifies location of the patient to the caretaker and alerts the patients using pre-recorded voice message of caretakers to take medicine during the scheduled time.

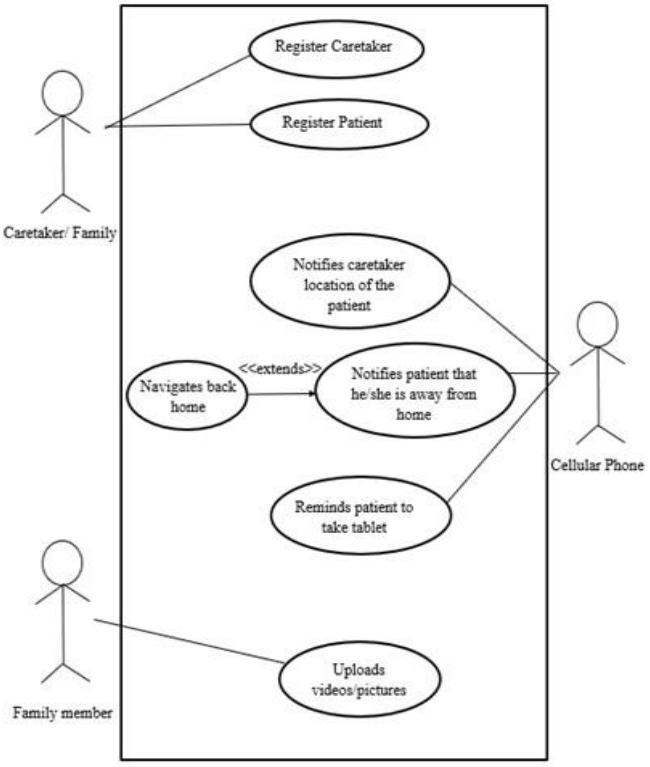

Figure 1. UML Diagram

B. *Flow Diagram*

The caretaker can create their profile and also register the patient and link the patient's profile to theirs. User can set medicine remainders, tracks patient's location and add media files. On the other hand, patients can view the photos, and alerted with change in location, medicine remainder. Application also gives the alert message in the pre-recorded voice message of caretakers so that patients can recognize it and it results in retaining of memory.

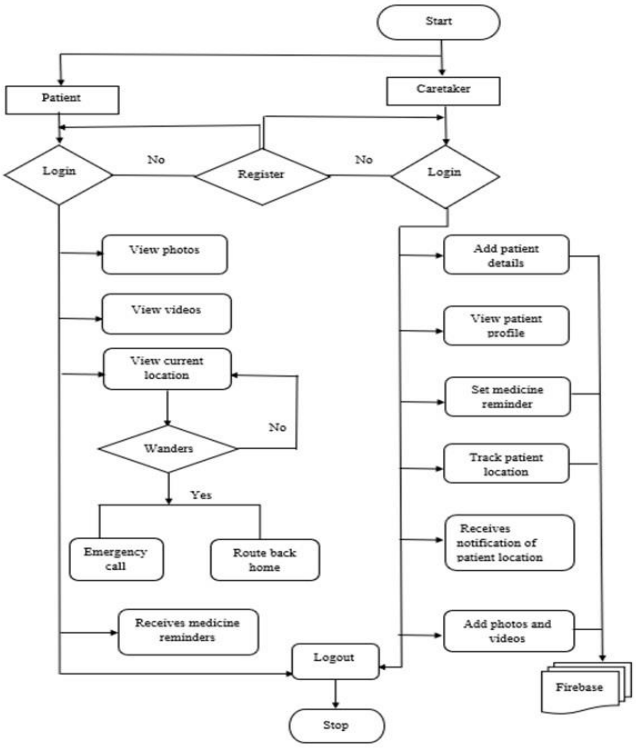

Figure 2. Flow Diagram

VI. IMPLEMENTATION

There are four different modules in Dementia Assist Application and they are as follows:

- Caretaker and Patient Registration
- Medicine Reminder
- Tracking Location
- Upload and view photos and videos

A. Caretaker and Patient Registration

When the user starts the application, he/she has to provide email id and password for registering themselves. The authentication is carried out by Firebase Authentication. Only registered users can access the services of the application. The caretaker can create their profile and also register the patient and link the patient's profile to theirs.

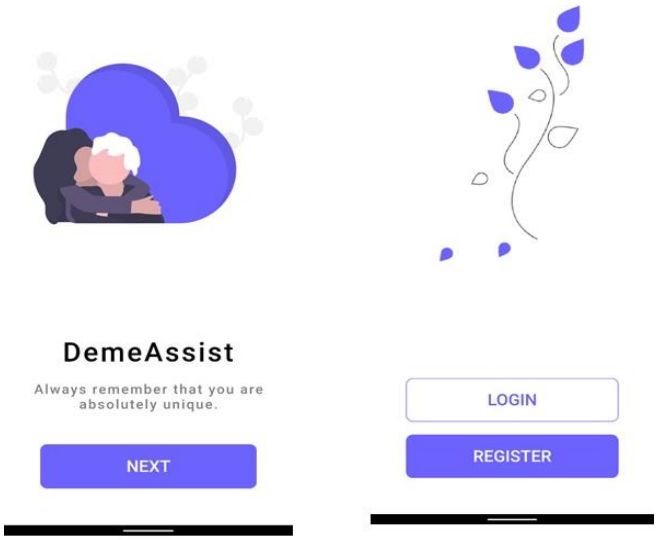

Figure 3. Login and Registration screen

When a user fills the form and clicks on the Register button, they will receive a verification email. This email includes a link to verify the user's account. Upon successful verification of the account, the user can login

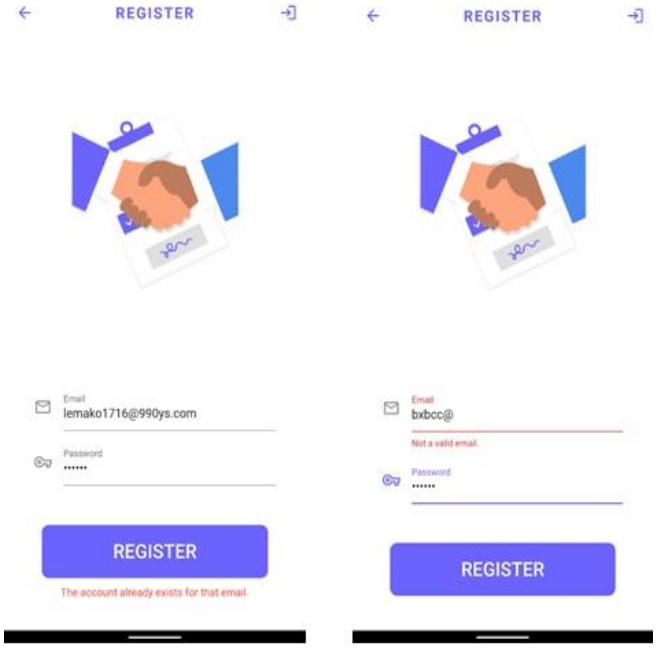

Figure 4. Registration screen

After email verification and upon signing in, the caretaker can add his/her details and these are in turn stored in the Cloud Firestore. The caretaker can also add the patient details by using patient's email address. This way the caretaker and patient's profile are linked

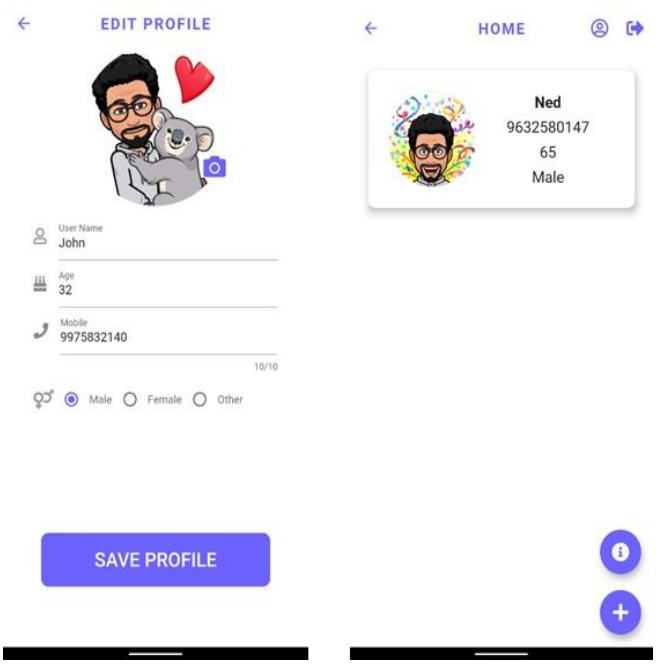

Figure 5. Caretaker and Patient profile

B. Medicine Reminder

The caretaker can set medicine reminders for the patient by providing the medicine name, medicine type, dosage to be consumed, the time to take the medicine, and days in which the medicine has to be taken by the patient. Once reminder is set, the application triggers a notification to the caretaker as well as the patient, at the specified time along with the medicine details to be consumed.

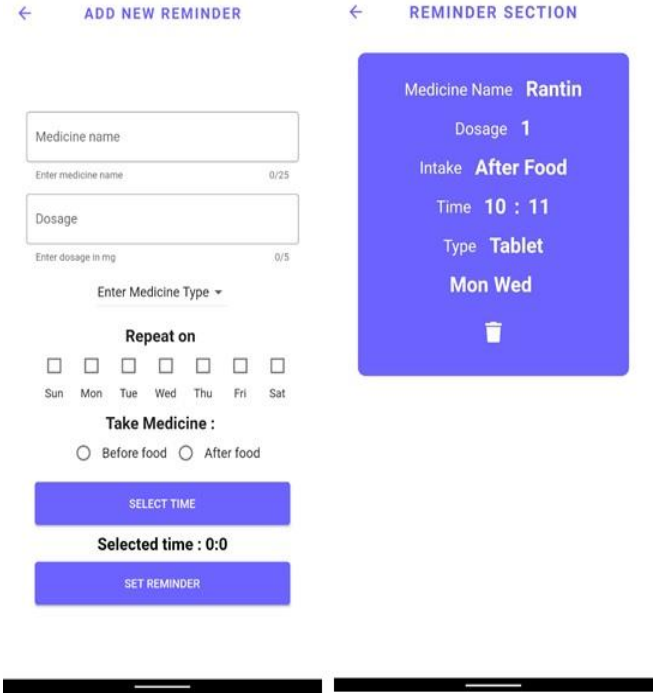

Figure 6. Medicine remainder set up

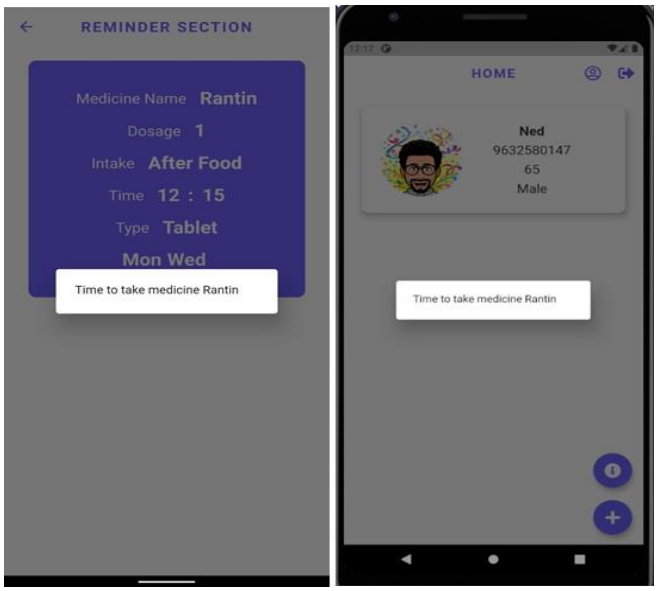

Figure 7. Notify Caretaker and patient

C. Tracking Location

The application tracks the location of the patient if he/she wanders away from home beyond a specified limit. The location has to be enabled in the patient's phone for the feature to work accurately. The application fetches, stores and monitors the location of patient. If patient wanders beyond a certain specified limit, the application alerts the patient that he/she is lost and provides with two options: "Take me home" – which navigates the user back home and "Emergency call" – which helps the patient alert the family member/ caretaker that they are lost in a place. If patient fails to respond to the above two options, then notifications are sent to the caretaker and they can view the location of the patient and track them.

The first option helps the patient call his/her caretaker and to let them know that they are lost. On clicking the first option, it automatically opens the phone feature with the caretaker's number. The second option helps the patient navigate back home from the current location to home. This feature has been implemented using Google Maps.

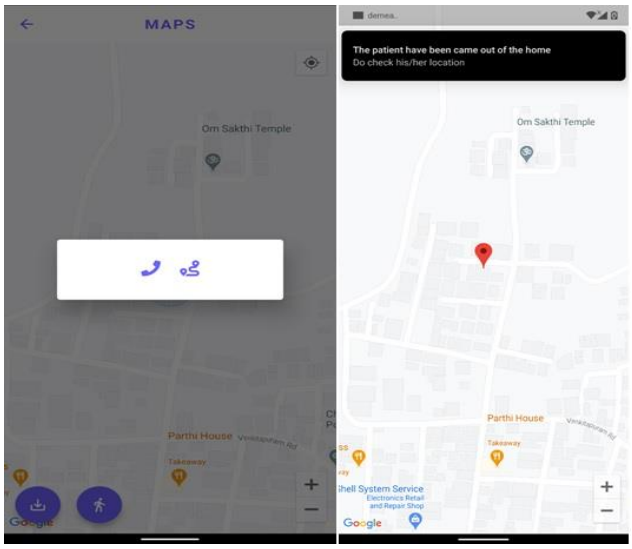

Figure 8. Live location tracking and Emergency call

D. Upload and View photos and videos

The family member of the patient can upload photos of close friends and family for the patient to view. This is to help the patient retain memory. The family member can also upload pre-recorded audio/ videos for the patient. This helps to provide comfort for the patient when the family members are away.

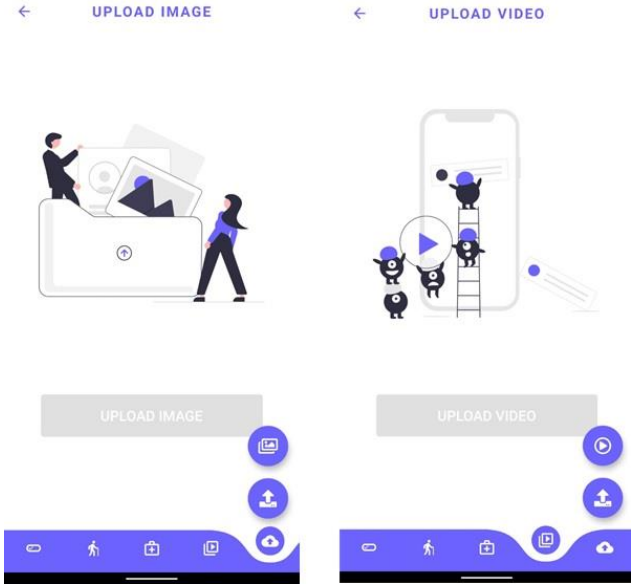

Figure 9. Upload Media Files

VII. TESTING

The testing process focuses on the logical internals of the software assuring that all the statements have been tested and also on the functional externals by conducting tests to uncover errors.

The below table illustrates the testing carried out on the application and its result.

Table 1. Test Cases & Report

Functionality	Result
All graphic elements, texts and animations have high resolution	Pass
Check the ability to return to previous screen from any screen	Pass
Check that scroll/swipe is working in app	Pass
Check Error Messages are displayed correctly	Pass
Check if the app gets current latitude and longitude coordinates of user	Pass
Proper permissions declared to request location	Pass
Able to retrieve last known location of user	Pass
Access location in background	Pass
Check if position coordinates are stored in and retrieved from Firebase	Pass
Calculating distance and triggers notification if distance specified is exceeded	Pass
Check user login screen and functionality	Pass
Check registration functionality	Pass

VIII.CONCLUSION

In a nutshell, this work is a humble venture to satisfy the needs of Dementia patients and their caretaker. Taking into consideration all the difficulties endured by the patient and the caretaker, this application is intended to comfort them and improvise their day-to-day activities. The programming techniques used in the design of the application provide a scope for further expansion and features like, fall detection, Memory games for cognitive development of the patient can be implemented.

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