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# Android App using Machine Learning for Assisting Alzheimer's & Dementia Patients

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**ABSTRACT :** The main purpose of this research is to assist Alzheimer's patients in the early and middle stages of this condition by making it easier for them to remain involved in society than was previously the case, sending daily tasks reminders, providing a tracking mechanism, and increasing their confidence to remember each member of their family. In addition, the families do not need to worry as the application can help to monitor and support the Alzheimer's patients' movements. The main objective of the proposed application is to enhance the quality of Alzheimer patients' lives so as to make it easier for them and those around them to live with the condition. It also sets out how to prevent the onset of isolation or loneliness by using machine learning face recognition technology for communicating and remembering people's faces around them. Not only will these features improve the daily lives of those with Alzheimer's, but also of their caregivers, in multiple different ways.

**KEYWORDS:** Alzheimer's disease; dementia; mobile application; face recognition; machine learning; caregiving; daily task reminders; tracking mechanism; memory games; cognitive stimulation; digital diary; GPS tracking; caregiver support; user-friendly design; Alzheimer's care; technology-assisted care.

## I. INTRODUCTION

Alzheimer's disease is a neurodegenerative disease that causes progressive memory loss, thinking impairment, and behavioral changes. It is the most common cause of dementia, and there is no cure.

Face recognition is a machine learning technique that can be used to identify people's faces. It has several real-world applications, such as identity verification and security.

We propose to develop a mobile app that uses face recognition to help Alzheimer's patients and their families. The app would allow patients to recognize their family members' faces and names, as well as establish the nature of their relationship with them. It would also help patients to remember important tasks and appointments, and to find their way home if they get lost.

The app would have a positive impact on the lives of Alzheimer's patients and their families by:

- Reducing social isolation
- Improving quality of life
- Reducing anxiety and stress
- Improving cognitive function

We believe that our app has the potential to make a real difference in the lives of people with Alzheimer's disease and their loved ones.

## II. RELATED WORK

There are a number of mobile apps that have been developed to assist Alzheimer's patients. Some of the most popular include:



- It's done: helps users to manage their daily tasks and appointments
- **MindMate:** provides games and other mentally invigorating activities to help improve cognitive function
- **Alzheimer's Helper:** allows users to store and access personal information about family and friends
- **AngelSense:** uses GPS tracking to help locate and protect patients from wandering off

Our proposed app differs from these in a number of ways. First, it uses face recognition to help patients identify people, even if they have forgotten their names. Second, it includes features to help patients find their way home if they get lost. Third, it provides a quiz and games section to help patients improve their memory and cognitive function.

Our proposed mobile app uses face recognition and other machine learning techniques to assist Alzheimer's patients and their families. It includes features to help patients identify people, find their way home, and improve their cognitive function. Our app differs from existing apps in that it provides specific features to address the unique needs of dementia patients.

Table1. Comparison analysis of application

Applications	Face Recognition	Digital Diary Clock	Audio & Text notes	Multiple Interface	Adding pictures	GPS tracking
AngelSense (2019)				✓		✓
MindMate (2019)		✓				
Alzheimer's Helper (2019)					✓	
It's done (2019)		✓				
<b>Dementia Assistant</b>	✓	✓	✓	✓	✓	✓



Table2. Comparison analysis of application

Applications	Video Diary	Quiz & Flashcards	Brain Exercise games	Reminders	Adding pictures	Music Playlist
AngelSense (2019)						
MindMate (2019)				✓		
Alzheimer’s Helper (2019)						
It’s done (2019)				✓		
<b>Dementia Assistant</b>	✓	✓	✓	✓	✓	✓

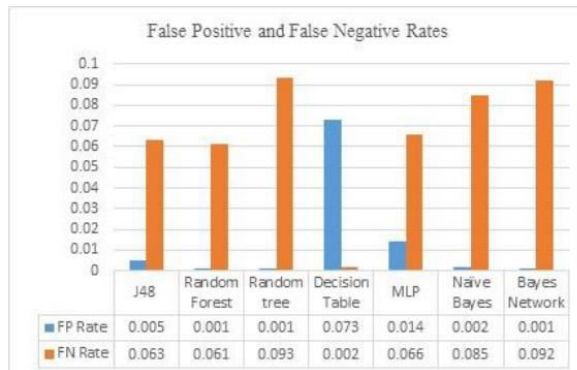
Based on the above comparison between the related work and the proposed application, there are some differences between them. The proposed application incorporates tracking, audio-text notes, memory games, quiz-flashcards, video-diary, digital diary clock and face recognition to help and support Dementia's patients

Below are the tables and fig where we compared the machine learning classifiers tp rate, precision, false negative & positive rate, accuracy for choosing the best classifier for our application.

Table3. True Positive Rate and Precision Ratios

Machine Learning Classifiers	TP Rate	Precision
j48	0.931	0.989
Random Forest	0.938	0.991
Random tree	0.906	0.992
Decision table	0.924	0.944
MLP	0.919	0.978
Naive Bayes	0.912	0.988
Bayes Network	0.907	0.992

Table4.. False Positive & Negative Rates



**Table5. Average Accuracy Rate**

Machine Learning Classifiers	Correctly classified Instances	Incorrectly classified Instances	Accuracy Rate
j48	55865	4135	93.10%
Random Forest	56265	3735	93.77%
Random tree	55345	5655	90.57%
Decision table	55464	4536	92.44%
MLP	55141	4859	91.90%
Naive Bayes	54741	5259	91.23%
Bayes Network	54439	5561	90.73%

### III. PROPOSED ALGORITHM

To overcome the limitations of above systems, we propose this mobile application for assisting dementia patients based on android technology. The methodology for this application has been specifically designed to achieve the application objective. Therefore, the phases involved are data collection, application design including the interface and the database, implementation and testing. Each phase is described below.

#### 1. Data collection

For the purposes of this study, an online questionnaire was designed and disseminated to gather data from the caregivers of those living with Alzheimer's, who are the primary target audience for this application. The questionnaire specifically sought to compile data on technology as an aid for Alzheimer's patients and family members. The survey was developed using Google Forms and was subsequently disseminated to facebook groups of caregivers using group messages, with the ultimate aim of reaching a caregiver. We also interviewed a specialist in neurology at a mental health hospital in India, who helped us to determine patient needs from a medical perspective. The interview format devised comprised ten questions, which elicited information on patient abilities, as well as identifying what technology might have to offer to both patients and their families.

#### 2. Functional requirements

The functional requirements set out the tasks a system should be capable of performing Essentially, they outline how a system should perform, in particular circumstances

The application should display a list of related pictures, along with background information on their relationship to the patient.

The application should remind and notify the patient of important tasks that need to be carried out.

The application should notify the patient's caregiver when a signal received from the tracking bracelet indicates that the patient has crossed a predefined safe zone.

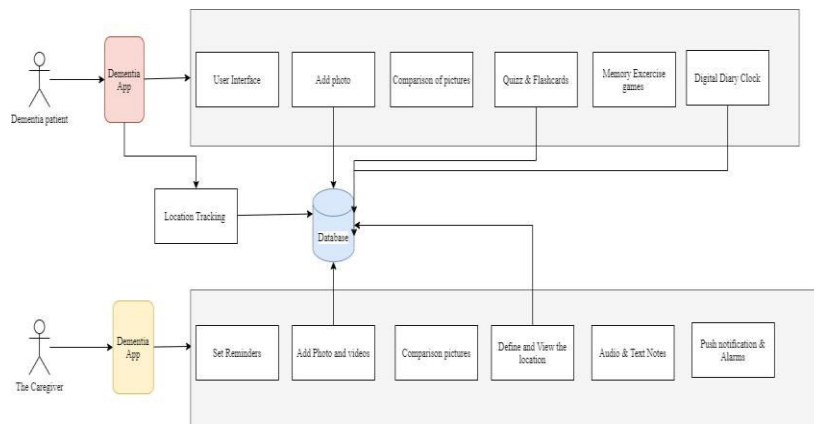
#### 3. Non-functional requirements

Non-functional requirements specify the criteria through which the system will be appraised, coupled with the limitations associated with its Key non-functional requirements include

- Usability: The application is easy to use and learn for beginners
- Accessibility: The application is easy to navigate, and it provides menus on each page to help the users access the sections they need easily
- Performance: The application has a fast response time of approximately one to two seconds when the users are navigating it.

#### 4. The Architecture

The architecture shows the correspondence between the requirements and the constructed system. Thus, Figure 1 presents the architecture of the proposed application. The architecture has two different parts for the patient and the caregiver. From the patient perspective, the application has the user interface components for capturing the photo; add the photo and comparison of photo. The photos are kept in a central database that can be retrieved by other components. From the caregiver perspective, the application has set reminder, add photo, comparison of pictures and define and view the location.



#### 5. Application design

The design phase supports the process by drawing on the requirements specified in the analysis phase and capturing them in an architecture chart.. Thus, the overall goal of the design phase is to facilitate the construction of an interface, which enables the systems and its various functions to operate effectively.

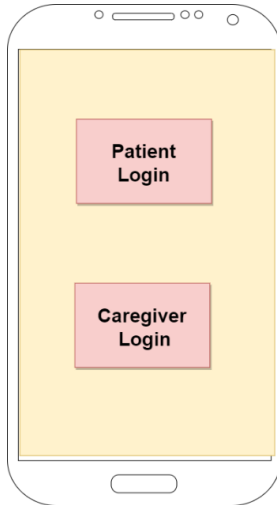


Fig.1 Login page

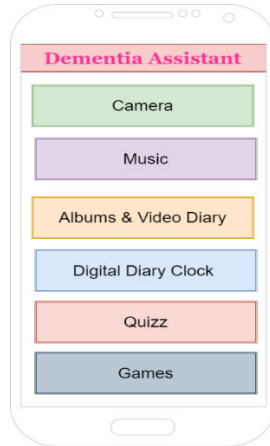


Fig.2 Patient Interface 1

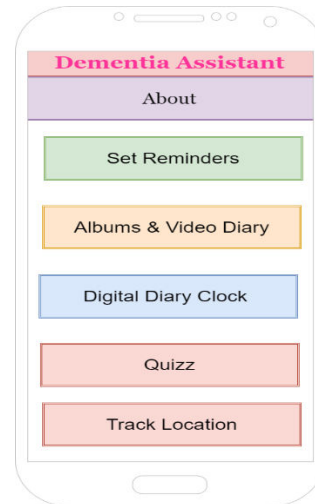


Fig.3 Cargiver Interface 1

- There will be 2 login page one for dementia patients and the other one for caregivers
- The first step in the registration page (sign up) requires the caregiver to add his or her name, password, phone number, email, and address,
- The second step in the registration page (sign in) requests the adding of an email address and password;

This in the homepage for dementia patients where they can use following features: (Refer Fig2)

1. **Camera** – It operates through the front camera, where the application takes 20 pictures of the same person at slightly different angles to become familiar with the person’s features, and then saves the image to the album. Having added a photo of the same person that had been previously saved, the user will automatically recognize the person and store it in his folder in the album. If the patient meets a person that he or she did not recognize, he or she can photograph them through the camera.
2. **Music** –In music page there will be playlist of devotional, meditation, sleep, classical etc. where patients can hear the one they want.
3. **Albums & video diary** – This page contains all the key people whose photos have been uploaded and saved to the application and they can subsequently be identified using facial recognition. Everyone has their own dedicated, named folder and all their images are contained within this folder. And same for videos.
4. **Digital Diary Clock** – This feature will work as clock on the patients phone.
  - The patient can see the daily scheduled task like taking pills
  - Dementia Diary will display up to the next three appointments from your web calendar, occurring either today or tomorrow (configurable) and a current "all day" event.
  - It displays the date, day and time in bold and different fonts with images used to recognize whether it is a morning, afternoon, evening or night.
  - Photos stored on the device of Google Drive can be used to turn patinets device into a photo or memory album including an option for a dynamic slideshow.

5. **Quiz & Flashcards** – The quiz will include the questions like choosing the image which contains their family members in it. And also, there will be questions like what’s their son’s name etc. Slideshow mode or selecting the “Next question”.
6. **Games** - This feature helps stimulate the brain with fun & interactive games. The games are designed to challenge the four core cognitive areas: problem-solving, speed, memory, and attention.
  - Matching pairs – This game will include the images of family members which the patients have to match.
  - Puzzles – Word puzzle for guessing their family members, friends names and many more. Jigsaw puzzles of family images.
  - Candy Crush
  - Bubble Shooter

This in the homepage for Caregiver patients where they can use following features: (Refer Fig3)

1. **Reminders** – Caregiver can set time and date of reminder for medicines recommended by the doctor. Caregiver can also update reminder, modify medications, add medications, dosages, timings, can delete and view it. Caregiver can add audio and text notes and send as a reminder for taking medication and food. The patient will get a voice note plus text notification.
2. **Album & Video Diary** - In this feature the caregiver can upload a photo so as to identify the person in it and add it to the photo album in the correct folder so that the patient can view it and same with the video.
3. **Digital Diary Clock-**
  - Dementia Diary/Clock provides a digital / analog clock display and a live and remotely configurable shared calendar facility.
  - The caregiver can schedule daily task and add images or remove it.
4. **Quiz** – The caregiver can modify the quiz and add as many question as they want according to their convenience.
5. **Track Location** - This feature is only available on the caregiver’s interface if the tracking is connected to the application. The caregiver can track the patient’s location, and also identify if the patient has traveled outside a specified geographical area, where it then sends an alert to the caregiver.
6. **Resources used in this application**

In order to implement the face recognition features, we conducted an android resources research required in order to find the suitable for our application. There are several libraries dealing with the complex process of facial recognition and this indicate that the development of these libraries are becoming demanding in the market . The result of the research has indicated the following libraries for android resources for face recognitio

- **OpenCV Face Recognizer** - OpenCV (Open Source Computer Vision Library) is a free library under a BSD license which includes hundreds of computer vision algorithms
- **Rekognition** - Substitute to Face.com, Rekognition can make facial detection, crawling, facial recognition and scene understanding. It can be automatically trained using images and tags just like on Facebook;
- **CERT** (Computer Expression Recognition Toolbox) - is a fully automated system for recognizing facial expression that operates in real time;
- **FaceRect** - is a powerful and free API for face detection. It finds faces (both front and profile) on the image specified by a URL or uploaded as a file and is able to find multiple faces in a single shot, the result being provided in JSON format with a bounding box for each face which is found



- **Face++** - uses the latest technology of computer vision and data mining to provide three basic services (detection, recognition and analysis). This API provides detection and Landmark analysis;
- **FaceReader** - is a tool that is able to automatically analyse facial expressions, giving users an objective assessment of a person's emotions;
- **Realtime face recognizer** - demonstrates real-time face recognition on Android. The application is based on the FaceNet.

After the comprehensive investigation and review the advantages and disadvantages of these libraries, we decided the best choice and most suitable for our application is Realtime face recognizer. The code can recognize people faces and allow adding new person using photo.

We used the Realtime face recognizer library and linked it with the database, where we built in two methods by which to add pictures of family or friends.

1. Firstly, this was through the photo album, where the user uploads the image to the application and saves the features of the person's face, and then saves them in the album.
2. Secondly, it operates through the front camera, where the application takes 20 pictures of the same person at slightly different angles to become familiar with the person's features, and then saves the image to the album. Having added a photo of the same person that had been previously saved, the user will automatically recognize the person and store it in his folder in the album. If the patient meets a person that he or she did not recognize, he or she can photograph them through the camera.
3. The tracking feature, which tracks the location of the patient. Initially, we decided to work on a virtual clock, and import Google maps API to our application.
4. For creating games in android, we will be using Eclipse IDE, Java, C/C++, and Kotlin.
5. Firebase\_ML KIT aims to make machine learning more accessible, by providing a range of pre-trained models that can use in the iOS and Android apps. Let's use ML Kit's Face Detection API which will identify faces in photos. By the end of this article, we'll have an app that can identify faces in an image, and then display information about these faces, such as whether the person is smiling, or has their eyes closed with wonderful GUI.
6. Database – Firebase, Mysq

#### IV. SIMULATION RESULTS

Data analysis This section describes the data analysis process, as well as presenting the results of applying the proposed application. We conducted an online survey specifically to understand the needs of Alzheimer's patients and caregivers. Tables 4 and 5 below show the demographic data of caregivers and Alzheimer's patients, respectively. We also took data analysis based on the research paper for getting the proper result.



Table 6. Distribution of caregiver demographic data

	Number	%
<b>Distribution of caregivers by gender</b>		
Female	143	81%
Male	34	19%
Total	177	100%
<b>Distribution of caregivers by age group</b>		
20 or younger	8	51%
21-25	20	11%
26-30	38	21%
31-35	34	19%
36-40	29	16%
41-45	17	10%
46-50	14	8%
51 or greater	17	10%
Total	177	100%
<b>Distribution of caregivers by education</b>		
High school	9	5%
Bachelor's	129	73%
Master's Degree	14	8%
Doctrate	7	4%
Other	18	10%
Total	177	100%

Table 7. Distribution of patient demographic data

	Number	%
<b>Distribution of dementia/Alzheimer patients by gender</b>		
Female	117	66%
Male	60	34%
Total	177	100%
<b>Distribution of dementia/Alzheimer patients by age group</b>		
41-50	6	3%



51-60	13	7%
61-70	34	19%
71-80	66	37%
81-90	45	26%
91 or greater	13	7%
Total	177	100%
<b>Distribution of dementia/Alzheimer patients by education</b>		
First	36	20%
Second	72	41%
Third	69	39%
Total	177	100%

## V. CONCLUSION AND FUTURE WORK

This Report discuss about dementia and Alzheimer's patients and their caretakers. It discusses what are the problem they are facing. It moves forward with what are the current technologies are available and their features and their limitations. It compares with existing work on the subject and our work. Then the report has our proposed solution for the problem using face detection by machine learning with architecture. The solution offered by this project is an Android app using face recognition for Alzheimer's and Dementia patients. It also involves features like video diary, game, quizzes, gps tracking, multiple reminders. The Advancement in Man-made reasoning and figuring will be the foundation to help improve the lives, however this should be finished with record to regard to the human existence and their privileges. The utilization of innovation to help dementia patients what's more, overseers in day by day life as demonstrated to be a powerful and valuable instrument that is doesn't include drug. The utilization of this product application as an Assistive Innovation for dementia patient will help increment the opportunity and reduction the disgrace that dementia patients endure not having the option to recollect essential things and uncover to their overseers about what they disregarded something fundamental. Project can be updated in near future as and when requirement for the same arises, as it is very flexible in terms of expansion. It will be surely helpful to people who are currently suffering from Alzheimer's and dementia.

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