CMPE 491

PROJECT ANALYSIS REPORT

Project Name: MemorEase

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1. Introduction

Alzheimer's disease is a degenerative neurological disorder that mostly impairs memory, thinking, and behavior. It is a rising global challenge, with millions of patients and families trying to cope with its consequences. Memory loss is a key symptom, and as the disease advances, patients frequently lose touch with their past experiences, which can have a significant influence on their quality of life. Caregivers, frequently family members, encounter considerable emotional and practical hurdles when delivering efficient care.

This project addresses these issues by developing a unique Flutter-based mobile application specifically for Alzheimer's sufferers and their families. The program makes use of personal memories to increase cognitive engagement and retain ties to previous events. The software allows family members to add personalized material such as images, text, and videos, facilitating meaningful engagement between patients and their memories.

To increase engagement, the app employs gamification techniques, transforming memory recall exercises into an exciting and rewarding pastime. Patients answer questions based on uploaded content, earning points for correct responses and compete for leaderboard positions. This not only encourages continuing use, but also fosters family interaction, resulting in a sense of community.

Beyond involvement, the app includes a vital analytical component. By detecting trends in patient answers, it creates detailed reports that show regions of memory strength and decrease. These insights are linked to specific brain regions, giving caretakers and medical experts important information about the patient's cognitive health. Such reports can assist identify early indicators of cognitive decline and modify care efforts accordingly.

The suggested application is a comprehensive solution that integrates memory stimulation, family interaction, gamification, and analytical insights into a single platform. It is intended to improve the quality of life for both patients and caregivers, making it an important addition to Alzheimer's care.

2. Current System

Current Alzheimer's care systems frequently rely on generic cognitive activities like puzzles or memory games, which lack personal connection and fail to engage patients fully. While some apps allow you to share photographs or memories, they are generally

passive repositories rather than interactive memory recall aids, which limits their effectiveness in terms of cognitive stimulation.

Furthermore, most accessible technologies do not provide extensive feedback or insights into how memory patterns relate to brain function, creating a huge vacuum in understanding cognitive health trends. The lack of gamification aspects further diminishes their appeal, as they lack motivational components such as prizes or competition. This highlights the need for a solution that combines individualized memory engagement, analytical feedback, and gamified components in an entertaining and user-friendly manner.

3. Proposed System

3.1 Overview

The suggested system will:

- Allow family members to add personal information (pictures, text, and videos) related to certain memories.
- Provide patients with interactive quizzes based on their provided data.
- Gamify the experience by giving out points for right responses and tracking leaderboard positions.
- Create reports that link performance trends to suspected neurological disorders, providing insights into the afflicted brain regions.

3.2 Functional Requirements

Data Upload & Management: Family members can tag photographs, text, or videos with memory descriptions.

Quiz functionality: The software creates tailored questions, such as "Where was this photo taken?" Indeed, "Who is in this photo?"

Gamification:

- Patients can receive points for correct answers.
- Users can keep track of their leaderboard positions.

Statistical Reports:

- Determine memory trends and places with consistent errors.
- Generate neurological insights that indicate which brain regions are likely to be affected.

User Roles:

- Patient: Participates in quizzes and games.
- Family member: uploads data and monitors progress.

3.3 Nonfunctional Requirements

- Performance: In order to provide a seamless user experience, the app must quickly manage real-time interactions.
- Scalability: Designed to handle an increasing number of users and data.
- Security: Use strong encryption to protect sensitive data including patient information and personal recollections.
- Accessibility: The user interface will adhere to accessibility guidelines in order to accommodate senior users who have visual or cognitive problems.

3.4 Pseudo Requirements

- The app should work on both the Android and iOS platforms.
- Data synchronization requires internet connectivity.
- Compatibility with text-to-speech functionality for visually impaired users.

3.5 System Models

3.5.1 Scenarios

- **Image-based questions:**

A family member posts a photo from a vacation to New York, tags it with "Central Park," and adds a brief caption, such as "Our walk in Central Park, 2015." The patient later views the photo and asks, "Where was this photo taken?" They get points for answering correctly. If not, the right answer is presented, and the response is saved for further study.

- **Text-based Questions:**

A family member uploads a brief remembrance remark, such as "Your favorite childhood hobby was painting with watercolors." The app creates questions such as, "What was your favorite childhood hobby?" The patient responds by selecting one of several options or by typing their response.

- **Audio-based Questions:**

A family member records a voice note that reads, "This was your favorite song in high school," or uploads an audio clip of a song. The app inquires, "Who is the artist of this song?" such as "When did you listen to this song most often?" This contact adds another sensory dimension to engagement.

- **Video-based Questions:**

A family member uploads a video clip from a family celebration or vacation and includes metadata such as "This was taken during our family trip to Hawaii in 2017." The software plays the video and inquires, "Where was this video taken?" and "Which year does this memory belong to?"

- **Relationship-based Questions:**

A family member posts a group photo and tags people, like "John (brother), Sarah (daughter)." The app inquires, "Who is John in this photo?". Alternatively, "Which one of these people is your daughter?"

- **Event-Based Questions:**

A family member uploads a memory of a special event, such as “Your 60th birthday was celebrated at a beach resort.” The app then asks, “Where was your 60th birthday celebrated?” or “What did we celebrate on this day?”

- **Error Pattern Analysis Scenario:**

  After a few sessions, the system recognizes patterns. For example, the patient constantly struggles to recognize family members in photos or react to event-related inquiries. The software generates a report indicating probable memory decline in specific areas of the brain, such as the temporal lobe (which is responsible for facial recognition and memory recall).

3.5.2 Use Case Model

Actors :

1. **Patient**: An Alzheimer's patient interacting with the system to play quizzes and view memories.
2. **Family Member**: A caregiver or family member uploading personal memories, monitoring progress, and managing data.
3. **System**: The application providing the interactive, gamified, and analytical functionalities.

Family Member

1. **Upload Memory Content**
   a. **Goal**: Add personalized memory content (images, text, audio, video).
   b. **Steps**:
      i. Family member logs in.
      ii. Selects the type of content to upload.
      iii. Tags the content with metadata (e.g., location, event description, relationships).
      iv. Saves the content for use in quizzes.
   c. **Precondition**: Family member must be logged in.
   d. **Postcondition**: Memory content is stored and linked to the patient's account.
2. **Monitor Patient Progress**
   a. **Goal**: View detailed reports and insights about patient memory recall trends.
   b. **Steps**:

i. Family member accesses the "Reports" section.
ii. Reviews graphical and textual insights (e.g., memory trends, leaderboard scores, error patterns).
iii. Adjusts content or care strategies as needed.

c. **Precondition**: Memory data must be available for analysis.
d. **Postcondition**: Updated strategies for care are informed.

Patient

3. **Participate in Quizzes**
    a. **Goal**: Engage with memory recall quizzes based on uploaded content.
    b. **Steps**:
        i. Patient opens the quiz section.
        ii. Views personalized questions (e.g., image, audio, or text-based).
        iii. Provides answers (e.g., multiple-choice, typed responses).
        iv. Receives feedback and points for correct answers.
    c. **Precondition**: Memory content must be available.
    d. **Postcondition**: Quiz results are saved for analysis.

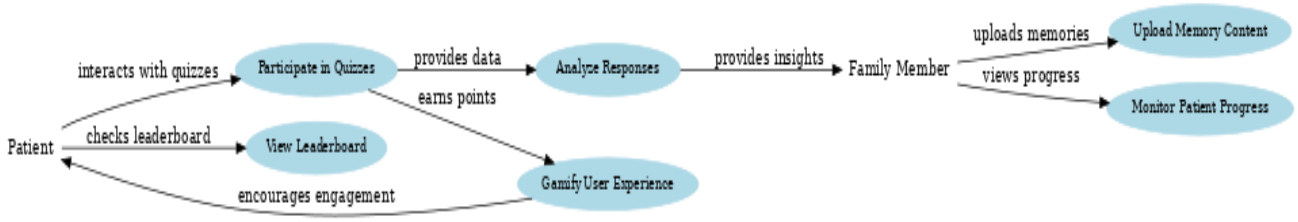
4. **View Leaderboard**
    a. **Goal**: Check personal performance and compete with themselves.
    b. **Steps**:
        i. Patient navigates to the leaderboard.
        ii. Views points and rankings.
    c. **Precondition**: Patient has participated in quizzes.
    d. **Postcondition**: Motivational feedback is provided.

System

5. **Analyze Responses**
    a. **Goal**: Generate detailed reports on patient memory trends.
    b. **Steps**:
        i. System records patient answers.
        ii. Identifies consistent errors or areas of strength.
        iii. Links trends to cognitive functions (e.g., temporal lobe, event recall).
        iv. Outputs a comprehensive report for caregivers.
    c. **Precondition**: Quiz participation data must be available.
    d. **Postcondition**: Report is generated and saved.

6. **Gamify User Experience**
    a. **Goal**: Enhance engagement through gamification.
    b. **Steps**:
        i. Assigns points for correct answers.
        ii. Updates leaderboard based on scores.
    c. **Precondition**: Patient interacts with quizzes.
    d. **Postcondition**: Leaderboard is updated.

Use Case Model:



3.5.3 Object and Class Model

Patient :

Attributes:

name (String): The patient's name.

age (Integer): The patient's age.

id (String): A unique identifier for the patient.

Methods:

`participateInQuiz()`: Allows the patient to engage in quizzes.

`viewLeaderboard()`: Enables the patient to view their rank.

Family Member :

Attributes:

name (String): Family member's name.

`email` (String): Their email address.

`id` (String): A unique identifier for the family member.

Methods:

`uploadMemory()`: Enables adding memory content.

`monitorProgress()`: Allows tracking the patient's progress.

Memory Content :

Attributes:

`id` (String): Unique identifier for the memory.

`type` (String): Type of memory content (image, text, video, audio).

`description` (String): Descriptive metadata about the content.

`data` (File): The memory content itself.

Methods:

`attachMetadata()`: Adds metadata to the memory content.

`getMemory()`: Retrieves memory details.

Quiz :

Attributes:

`id` (String): Unique identifier for the quiz.

`question` (String): The question for the quiz.

`correctAnswer` (String): The answer to the quiz question.

`points` (Integer): Points awarded for correct answers.

Methods:

`generateQuiz()`: Creates personalized quiz questions.

`evaluateResponse()`: Checks the user's answer.

Leaderboard :

Attributes:

`rankings` (List): The leaderboard rankings.

Methods:

`updateLeaderboard()`: Updates the leaderboard after a quiz.

`viewRankings()`: Displays current rankings.

Report :

Attributes:

`id` (String): Unique identifier for the report.

`trends` (Map): Memory trends observed.

`insights` (String): Cognitive health insights.

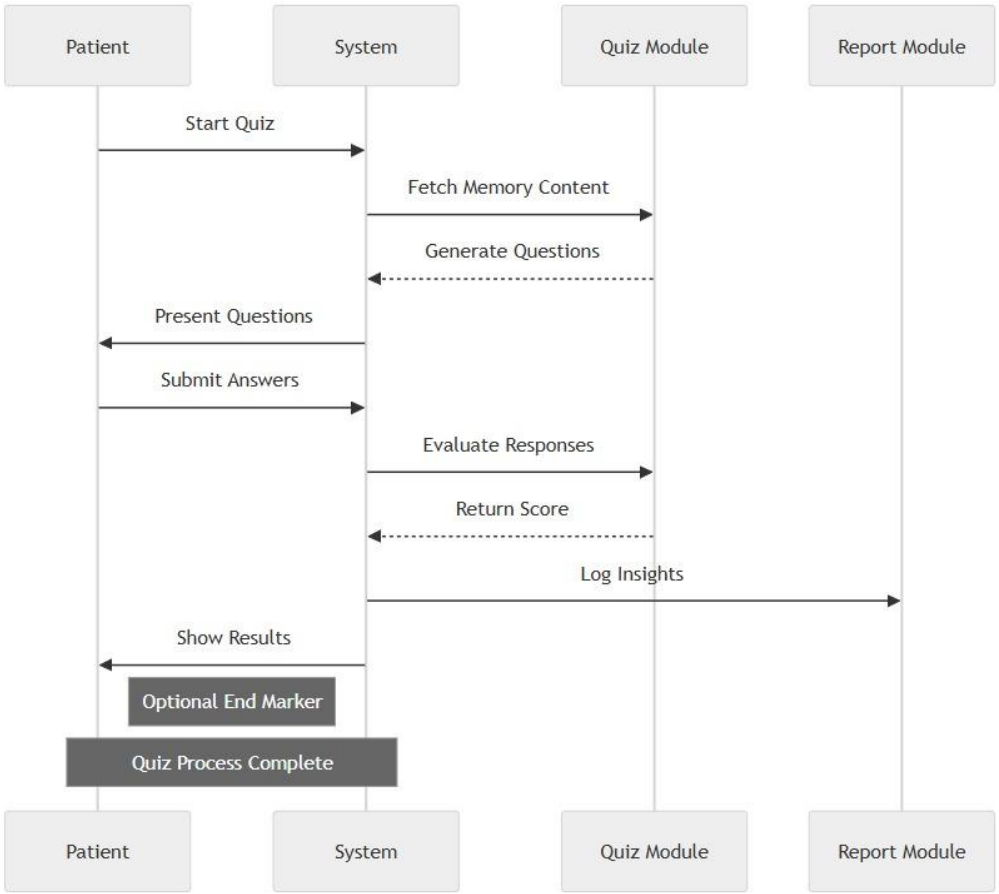
Methods:

`generateReport()`: Generates progress reports.

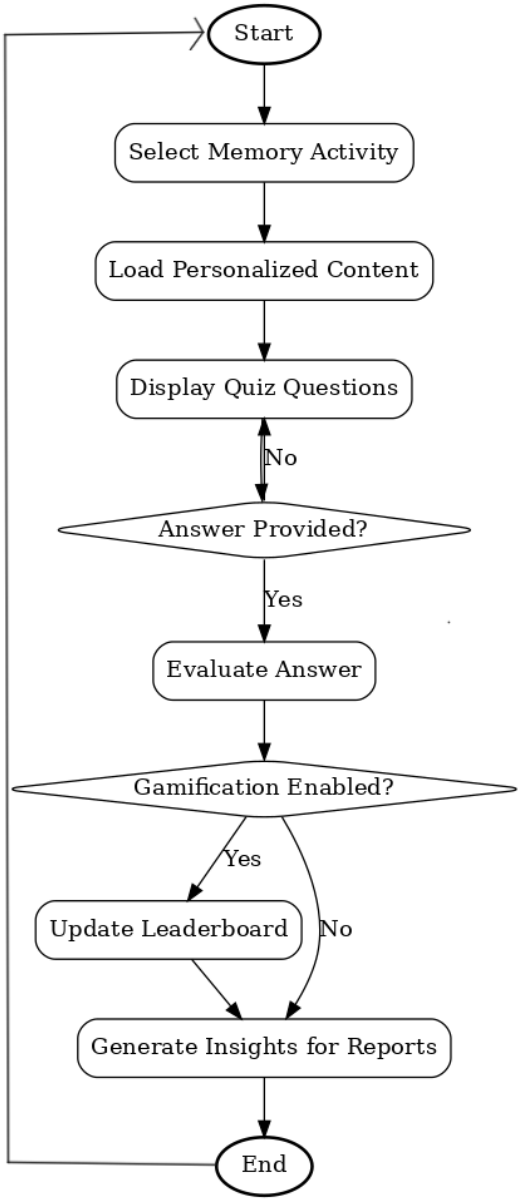
`linkToBrainRegions()`: Links trends to specific brain regions.

3.5.4 Dynamic models

3.5.4.1 Sequence Diagram:



3.5.4.2 Flow Chart Diagram:



3.5.5 User Interface - Navigational paths and Screen Mock-ups

MemorEase

Login

E-mail

Password

Sign-In

or Sign-Up

Name Surname

E-mail

Password

Sign-Up

HOME

20120

#1023

MEMORIES

Upload Memory

Review Memory

MEMORIES

Review Memory

11.22.2020

11.27.2020

12.03.2020

12.11.2020

What is your favorite food?

01.09.2021


Question
02
Question
What is your favorite food?
Burger
Buffalo Wings
Mac and Cheese
Clam Chowder
Question
02
Question
Where was this photo taken?
France
Italy
Turkey
England
Question
02
Question
Who is this man?
John - my uncle
Adam - my husband
Robert - my son
Sheldon - my brother
25 × 29


Question
02
Question
Whose voice is this?
Michael- my grandson
Emily- my daughter
Olivia - my friend
James - my husband
REPORT
text
voices
family relatives
personal question
places
The patient has answered visual questions incorrectly 50% of the time, indicating potential impacts on the frontal region of the brain.

4. Glossary

- **Alzheimer's Disease**

Definition: A gradual neurological condition that results in behavioral abnormalities, cognitive decline, and memory loss.

- **App (Application)**

Definition: A software application made specifically to operate on portable electronics like tablets and smartphones. In our project, this covers only smartphones.

- **AI (Artificial Intelligence)**

Definition: Defined as the process by which computers, particularly computer systems, mimic human intellectual functions such as learning, reasoning, and problem-solving.

- **Gamification**

Definition: Process of applying concepts and features of game design to non-gaming environments in order to boost user engagement.

- **Memory Recall**

Definition: Defined as the process of bringing up memories or knowledge from the past; it's frequently utilized in tests or activities within your app. This term is basically the heart of our project.

- **Metadata**

Definition: Information about other information, like tags or descriptions appended to images and movies.

- **NLP (Natural Language Processing)**

Definition: It is the area of artificial intelligence that gives computers the ability to comprehend, interpret, and react to human language.

- **Patient Profile**

Definition: A collection of information and preferences specific to a patient, such as their quiz results and uploaded memories.

- **Quiz Functionality**

Definition: An app feature that uses uploaded data (text, audio, video, or images) to create interactive questions.

- **UI (User Interface)**

Definition: Refers to the area where people and computers interact, with an emphasis on accessibility, layout, and navigation.

- **UX (User Experience)**

Definition: Defined as the totality of an individual's interaction with an application, including how user-friendly and enjoyable it is.

- **Visual Accessibility**

Definition: Features like text-to-speech capabilities, huge letter sizes, and high contrast colors that are intended to assist users who are visually impaired.

- **Neurological Insights**

Definition: Analytical data produced by the application that uses memory recall performance to spot patterns and potential neurological problems.

- **Tagging**

Definition: Process of adding pertinent information (people, place, event, etc.) to images, videos, or text.

- **Temporal Lobe**

  Definition: A part of the brain linked to facial recognition, language understanding, and memory processing.

5. References

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