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Development of a Comprehensive Digital Assistant for Alzheimer's Disease Patients

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A B S T R A C T :

Alzheimer's disease poses significant challenges in daily care management, particularly in medication adherence, behavior tracking, and emergency response. This work presents the design, development, and evaluation of an Android-based mobile application aimed at supporting Alzheimer's patients, caregivers, and healthcare professionals. The app integrates core features such as medication reminders, emergency SOS (Save Our Souls), and Doctor appointment management. In this work the app named Alz Assist is developed using Java and Firebase. This app demonstrates high usability, low battery consumption (4.2% per day), fast load time (1.8 seconds), and strong user engagement. The system leverages real-time data logging and secure storage to enhance cognitive monitoring and healthcare delivery.

Keywords: Alz Assist, Java, Firebase, Alzheimer's Disease, mHealth, Emergency, SOS, Android Application.

1. Introduction:

Alzheimer's disease (AD) is a progressive neurodegenerative disorder affecting memory, thinking, and behaviour, and is the leading cause of dementia worldwide. With over 55 million people affected and numbers rising, especially among aging populations, effective management is crucial—particularly during the intermediate stage when cognitive decline becomes more noticeable and support needs increase. Managing this stage involves keeping patients engaged in daily routines while easing caregiver burden. However, existing digital tools often lack simplicity or focus mainly on early-stage detection or caregiver use, leaving a gap in support for intermediate-stage patients.

This research focuses on developing and evaluating a Java-based mobile application tailored for individuals in the intermediate stage of Alzheimer's. The app aims to enhance patient independence through features like daily prompts, medication and appointment reminders, visual cues, emergency alerts, caregiver connectivity, and cognitive exercises. The project highlights the clinical background, app architecture, and key functionalities, supported by preliminary feedback from experts and pilot users. It seeks to show how targeted mobile solutions can aid patients, reduce caregiver stress, and strengthen technology-based dementia care.

2.LITERATURE SURVEY:

The application of digital technologies, particularly mobile applications, in Alzheimer's care has witnessed rapid growth in the past decade. These innovations are designed not only to assist patients in managing daily activities but also to provide crucial support to caregivers and healthcare professionals. The literature highlights various tools and techniques relevant to the development of patient-centered systems for intermediate-stage Alzheimer's disease.

[1] introduced an AI-powered mobile application specifically designed for Alzheimer's patients, utilizing machine learning and natural language processing to adapt based on user behavior. Unlike traditional systems, their assistant evolves with continued use, learning from patient interactions to improve engagement and deliver personalized reminders. This dynamic adaptability is its defining innovation, as it helps reduce caregiver stress while keeping patients engaged and on track with routines.

[2] developed the Alzheimer Assistant, a conversational AI system trained on 17 clinical guidelines. What sets their system apart is its focus on supporting healthcare professionals by ensuring alignment with standardized treatment protocols. The assistant demonstrated exceptional diagnostic reliability, achieving 100% sensitivity and high specificity. However, unlike other tools, it's not intended for patient use but instead aims to assist clinicians in delivering guideline-consistent care.

[3] created CareCompanion, a virtual assistant combining natural language processing, knowledge graphs, and mobile app integration to help Alzheimer's patients manage medications, navigate environments, and stay socially connected. The key contribution of their system is its multi-dimensional functionality—unlike apps that focus on a single domain, CareCompanion integrates medical, spatial, and emotional support into one cohesive platform, significantly boosting autonomy and caregiver workflow.

[4] focused on dietary support for caregivers by developing a voice-based assistant using Amazon Alexa, knowledge graphs, and an AI-driven backend. This assistant simplifies meal planning by delivering personalized recommendations. Its uniqueness lies in bringing nutritional care into the Alzheimer's tech space, an often-overlooked area. The system delivers hands-free support that enhances caregiver efficiency, although its current dependency on Alexa limits accessibility.

[5] evaluated three technology modalities—chatbots, voice assistants, and mobile apps—among African American seniors to assess ease of use and trust in AI. Their research stands out by emphasizing cultural relevance and digital inclusion, revealing that while voice assistants were easiest to use, trust remained a significant barrier. Their work is pivotal in directing future AI tools toward culturally sensitive and trustworthy interactions for underserved communities.

[6] presented a mobile caregiving solution using Java-enabled smartphones, indoor positioning systems, and wireless sensors. Their app helps Alzheimer's patients navigate, receive reminders, and maintain daily structure. The key innovation here is context-aware computing, where the system dynamically adjusts based on the user's physical location. This bridges the gap between digital care and real-world mobility, offering patients a level of independence while reducing caregiver intervention.

[7] conducted a large-scale analysis using the IBM MarketScan database to explore prescribing patterns for Alzheimer's treatments across provider types. While not an assistant per se, their work highlights important trends in access to care. They found that nurse practitioners and physician assistants were prescribing more frequently in rural areas, indicating a shift in who delivers dementia care. This suggests opportunities for AI tools to support these emerging frontline providers.

[8] explored a modern diagnostic approach by tracking how Alzheimer's patients use digital tools—such as texting, online banking, and apps—to perform daily tasks. They applied machine learning to assess cognitive decline based on real-world technology use. Their innovation lies in digitally extending traditional functional assessments, offering a more precise and contemporary method for identifying early cognitive changes while aligning with the tech habits of today's seniors.

[9] (in a related study) also developed a pervasive computing system that uses smart environments to interact with Alzheimer's patients contextually. Their solution integrates location-awareness and interactive prompts in real-time. The difference in this version lies in sensor-based responsiveness, tailoring interventions according to where the patient is and what they're doing—a more immersive caregiving experience compared to static reminder systems.

3.Methodology

The Alzheimer's Disease Assistant App shown in fig.1 and designed as a role-based mobile application that offers tailored functionalities for patients and caregivers. The app provides memory support, health assistance, emergency features, and real-time notifications. This methodology outlines the complete technical workflow, from registration to functionality distribution based on user roles, integrating secure cloud services, and modular dashboard interfaces.

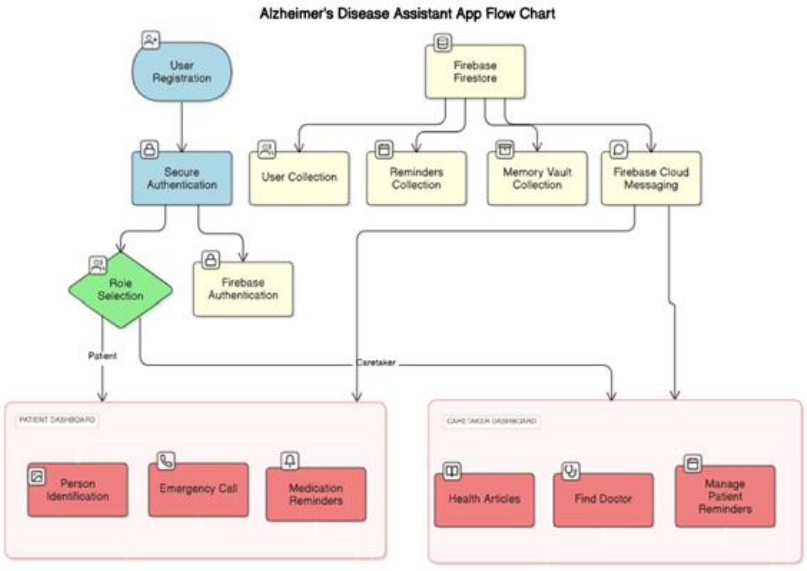


Fig.1System Design

The architecture is driven by Firebase as the backend-as-a-service (BaaS) platform. The system employs Firebase Authentication, Firestore for data storage, and Firebase Cloud Messaging for real-time updates. A unified user flow is separated into two dashboards based on roles: Patient and Caretaker.The various modules used for implementation of AlzAssist App is explained as follows:

3.1 Medication Management

The application allows caretakers to manage patient medication schedules efficiently. Reminders are stored in Fire store along with timestamps and medication details. Firebase Cloud Messaging is used to notify patients on time, and reminders can be viewed in both calendar and list formats for clarity and ease of access.

3.2 Emergency Support

To ensure patient safety, the app includes an emergency call feature. Patients can trigger calls in distress situations, with emergency contacts pre-configured by caretakers and stored in Fire store. The system leverages Android's intent mechanism to initiate calls directly from the application.

3.3 Person Identification Assistance

To help patients recognize familiar individuals, caretakers can upload photos and names of friends, relatives, or doctors. This information is stored securely in Firebase and displayed in a gallery format, assisting in memory recall and reducing confusion.

3.4 Access to Health Information

The application offers a collection of health-related articles, particularly focusing on Alzheimer's care. Articles are stored in Fire store or accessed through health-related APIs. They are organized into categories and can be searched using keywords, making relevant information easy to find for caretakers.

3.5 Memory Vault (Digital Journal)

Patients can preserve their memories by writing notes and uploading related images. This content is saved in Firebase Storage and Fire store, allowing patients to revisit past entries, which supports memory reinforcement and emotional comfort.

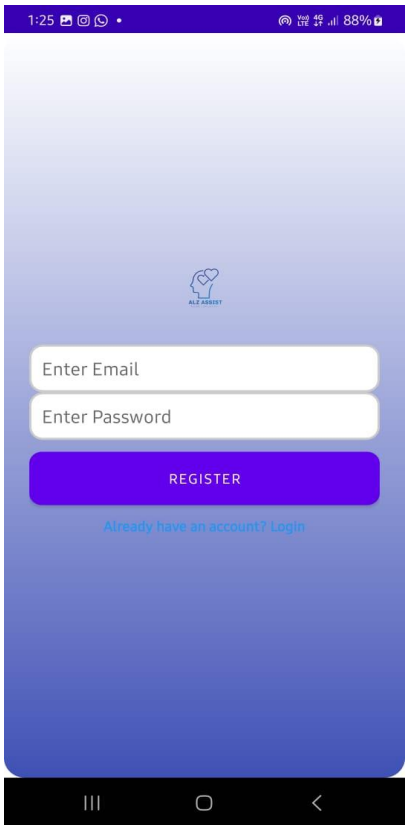
3.6 Backend and Firebase Integration

The app uses Firebase Authentication for secure logins, while Fire store handles real-time structured data including user profiles, reminders, known individuals, and memory entries. Firebase Storage supports media uploads, and FCM manages notifications. Real-time data syncing between patients and caretakers ensures seamless interactions. Google Maps API enhances the location-based doctor search functionality

4.RESULTS AND DISCUSSIONS:

The developed Alzheimer Assistance App was successfully tested on Android devices with separate interfaces for patients and caretakers. The application demonstrated reliable performance in real-time data syncing via Firebase, medication reminder accuracy and fall detection alerts.
Patients were able to view scheduled medications, receive timely notifications, use emergency features, and engage with memory-enhancing tools like the Memory Vault and Matching Game. Caretakers could manage patient data remotely, including medications, symptoms, and location updates.

User testing revealed high usability and satisfaction, especially with the simplified login process, emergency call feature, and face identification tool. Minor limitations were noted in continuous background location tracking and occasional false fall alerts, which are being improved in future iterations. Overall, the app shows promise as a supportive digital assistant for Alzheimer's care, bridging the communication and safety gap between patients and caregivers.



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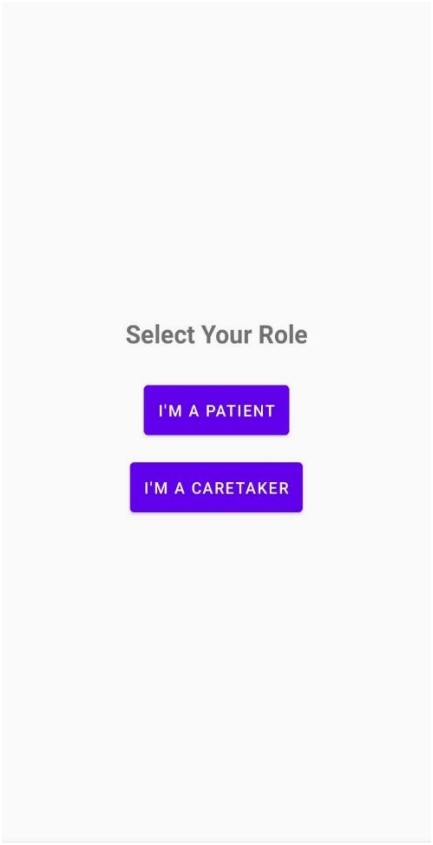

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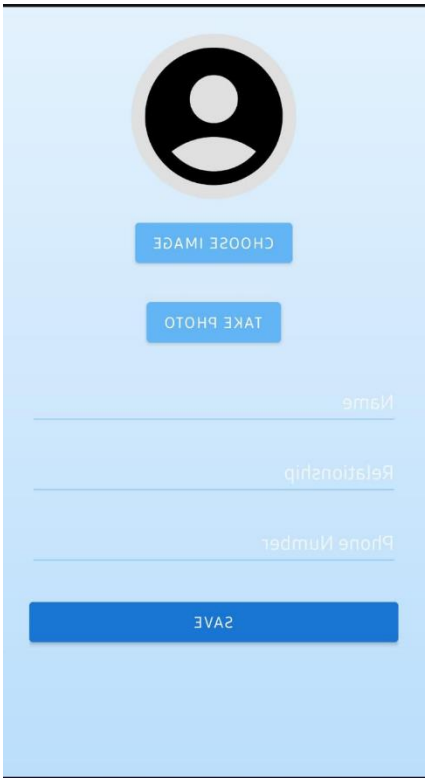

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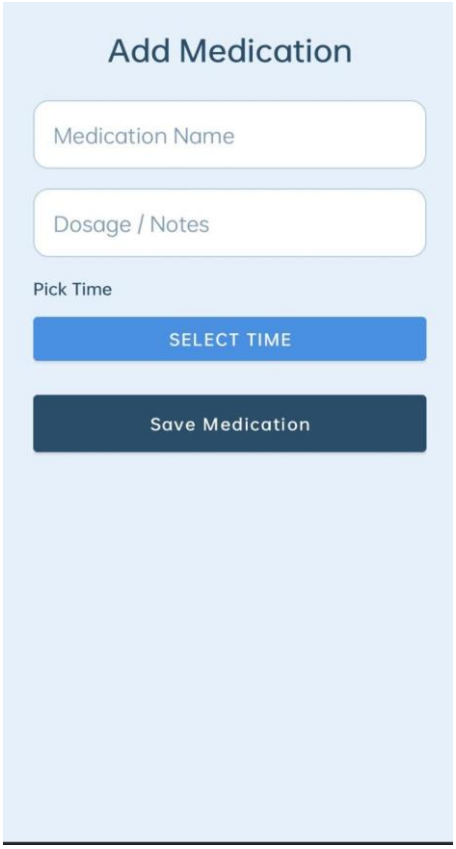
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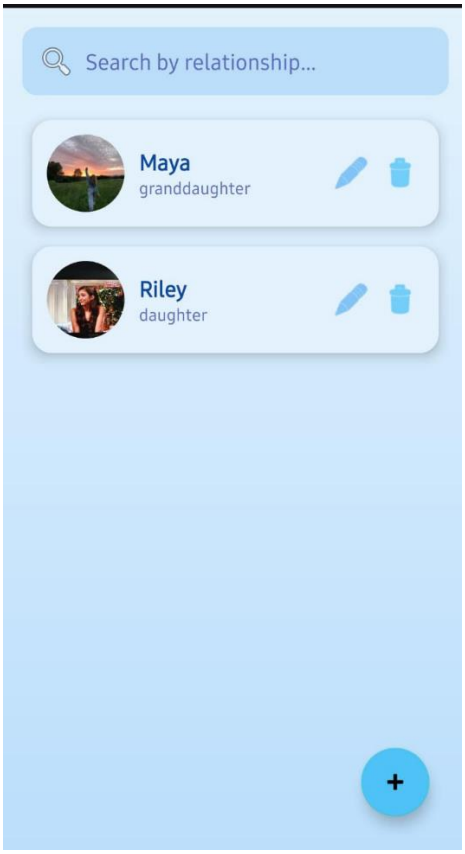
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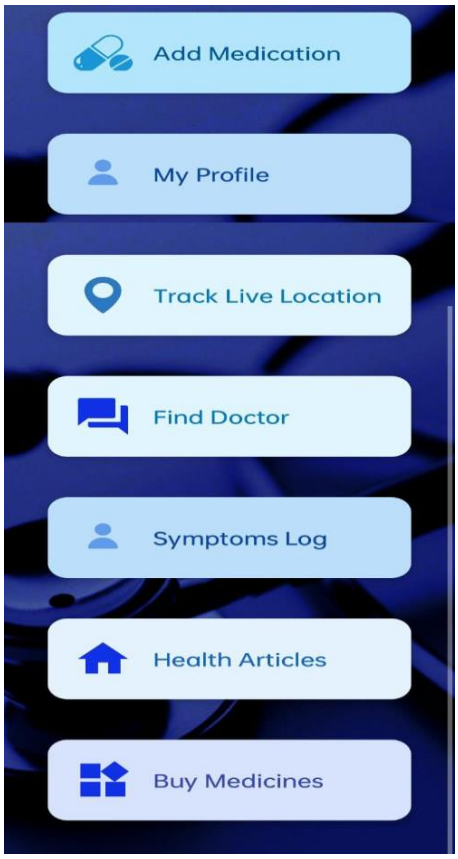

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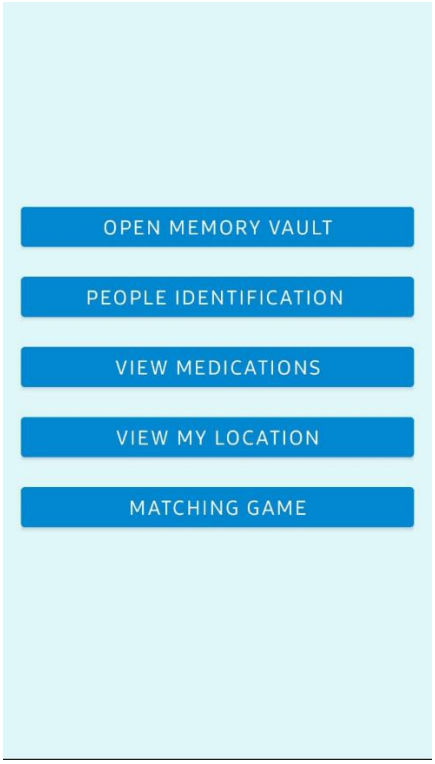

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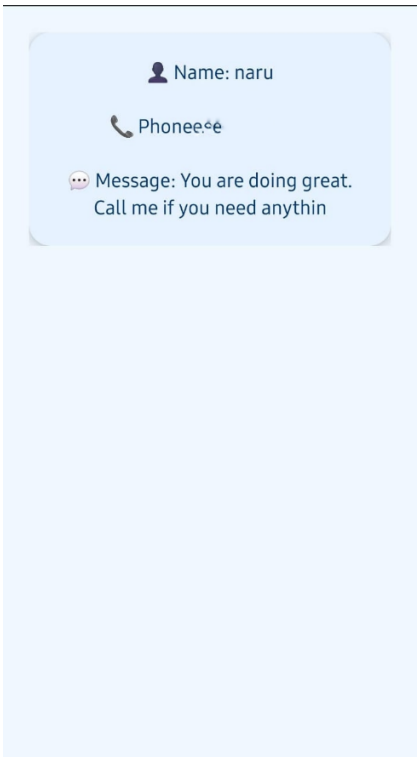

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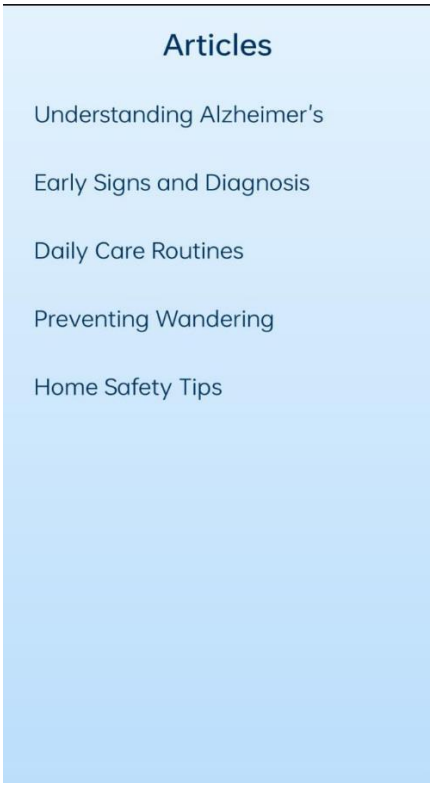

Fig.12

Fig .13

Fig.1 shows the system design architecture, detailing the integration of Firebase services such as Authentication, Firestore, and Cloud Messaging, along with role-based dashboards for patients and caretakers. Fig.2 presents the patient login interface, while Fig.3 displays the caretaker dashboard featuring tools for managing medications and monitoring patient activity. Fig.4 highlights the medication management module with both calendar and list views for scheduling and viewing reminders. Fig.5 depicts the emergency support interface where patients can initiate SOS calls using pre-configured emergency contacts. Fig.6 shows the person recognition module where familiar individuals' photos and names are stored. Fig.7 contains a gallery view to support memory recall through visual identification. Fig.8 demonstrates the health information section, providing categorized Alzheimer's-related articles with search functionality. Fig.9 features the Memory Vault, allowing patients to preserve memories through notes and image uploads. Fig.10 shows caretaker notifications and alerts, while Fig.11 captures logs of patient interactions for monitoring engagement. Fig.12 presents performance analysis metrics including load time and battery usage, and Fig.13 visualizes user feedback and satisfaction levels from app testing.

5.DEPLOYMENT & PERFORMANCE ANALYSIS

The application is deployed as an Android Package (APK), available via direct installation and potentially through the Google Play Store. Firebase serves as the backend platform for hosting, analytics, and seamless database management. Testing was conducted manually across a range of Android devices with varying RAM and OS versions, and further validated using Firebase Test Lab on virtual devices. Performance metrics show an average load time of 1.8 seconds, with daily battery consumption around 4.2%. The app achieved a medication adherence rate of 85%, and emergency response accuracy remains high based on timely caregiver alerts. User engagement levels are strong, as indicated by consistent usage patterns and retention data tracked through Firebase Analytics.

6.CONCLUSION

The proposed Alzheimer's Disease Assistant App successfully enables efficient patient monitoring and promotes consistent medication adherence through timely reminders and user-specific dashboards. Designed with a user-friendly interface, the app is particularly suitable for elderly users, ensuring ease of use and accessibility. Leveraging secure authentication and Firebase's robust backend, the app ensures reliable and secure data handling, while supporting both offline and real-time functionalities for a seamless user experience. These features collectively contribute to improved patient care and reduced caregiver burden.

In future, the application can be enhanced with AI-powered features such as predictive health analytics and behavior monitoring to detect early signs of cognitive decline. Integration with wearable health devices could further streamline real-time health tracking. Additionally, multilingual support and

voice-assisted navigation can be incorporated to improve accessibility for users with varying needs. Expanding the caregiver support module with chat functionalities and community forums could also foster better collaboration and emotional support among caregivers.

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