

Early Alzheimer's Care and Recovery Assistant using AI

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Abstract— Alzheimer's disease (AD) is a progressive neurodegenerative disorder that gradually impairs memory, communication, and the ability to perform daily tasks, creating significant challenges for both patients and their caregivers. Existing assistive tools tend to address isolated needs without offering an integrated, intelligent, and real-time support system. This paper presents the Early Alzheimer's Care and Recovery Assistant using AI, a fully implemented Android-based mobile application supported by a cloud backend, designed to assist Alzheimer's patients in managing their daily lives while enabling caregivers to monitor, communicate, and respond effectively. The system integrates facial recognition using TensorFlow Lite, speech-based cognitive monitoring using the Android Speech Recognizer, and intelligent task reminders within a dual-dashboard patient-caregiver interface. The backend is powered by Firebase Authentication, Cloud Firestore, and Firebase Cloud Messaging, with a Node.js API hosted on Vercel for scalable and secure data handling. It is important to note that this system does not claim to treat or cure Alzheimer's disease. Its purpose is entirely assistive to help patients maintain independence in their daily routines, support caregivers with real-time information and alerts, and provide a dignified layer of AI-powered assistance for individuals navigating life with dementia. Implementation results demonstrate functional accuracy across core modules, responsive real-time alert delivery, and positive usability feedback from early testing, highlighting the practical potential of this system in real-world Alzheimer's care settings.

Keywords— Alzheimer's disease, cloud-enabled healthcare, cognitive decline detection, digital health, patient-caregiver support

1. Introduction

Alzheimer's disease (AD) is the most common form of dementia worldwide and one of the leading causes of disability and dependency among older adults. It is a progressive neurodegenerative condition that gradually destroys brain cells, leading to deterioration in memory, thinking, behavior, and the capacity to carry out everyday activities. The World Health Organization estimates that over 55 million people globally are currently living with dementia, with Alzheimer's disease accounting for approximately 60 to 70 percent of all cases. With aging populations across the globe, this number is projected to nearly triple by 2050, placing enormous pressure on healthcare systems, families, and social support networks. For individuals living with Alzheimer's, the progression of the disease brings increasing loss of independence. In early stages, patients commonly experience forgetfulness missing medication doses, losing track of daily routines, or becoming confused in familiar settings. As the condition advances, patients may struggle to recognize family members and close friends, have difficulty communicating their needs, and become vulnerable to accidents or unsafe wandering. These challenges erode quality of life and place tremendous emotional, physical, and financial burdens on caregivers, who often provide support with little technological assistance or real-time visibility into the patient's

condition. The current landscape of assistive technologies for Alzheimer's care remains largely fragmented. Most available tools serve a single purpose a reminder application, a GPS tracker, or a mood logger and rarely communicate with one another or adapt intelligently to the changing needs of individual patients. Caregivers are frequently left relying on periodic in-person check-ins rather than continuous, data-driven monitoring. This gap creates opportunities for preventable incidents, delayed interventions, and increased caregiver stress. Recent advances in mobile health platforms, artificial intelligence, and cloud computing now offer a meaningful opportunity to address these limitations in a unified and scalable manner. Smartphones, which are widely accessible and familiar to both patients and caregivers, can serve as powerful platforms for on-device AI processing while simultaneously connecting to cloud infrastructure for remote monitoring, data storage, and instant communication. This convergence of technologies makes it possible to design assistive systems that are intelligent, personalized, and practical for everyday use in home and community care settings.

This paper presents the Early Alzheimer's Care and Recovery Assistant using AI, a fully developed and implemented mobile application that brings together facial recognition, speech-based monitoring, intelligent daily reminders, emergency alerts, and role-specific dashboards into one cohesive platform. The system is built for two primary users: the patient, who interacts through a simplified, accessible interface designed for cognitive ease; and the caregiver, who accesses a detailed monitoring dashboard with activity logs, alert histories, and real-time notifications. Critically, this system is not a diagnostic or treatment tool. It does not claim to slow, reverse, or cure Alzheimer's disease. Its purpose is assistive and supportive to help patients maintain their daily independence for as long as possible, and to empower caregivers with the information and tools they need to provide timely, informed care.

The rest of this paper is organized as follows. Section 2 reviews existing literature on assistive technologies for Alzheimer's care. Section 3 describes the proposed system design. Section 4 details the system architecture. Section 5 covers implementation specifics. Section 6 presents results from testing and evaluation. Section 7 provides analysis and discussion. Section 8 concludes the paper with directions for future work, followed by references.

2. Literature Survey

Research into assistive technologies for Alzheimer's disease has grown substantially over the past decade, reflecting the urgent global need for practical, scalable support solutions. Studies in this domain span a wide range of approaches, from simple mobile reminder systems to sophisticated AI-driven monitoring frameworks. A review of the most relevant literature reveals consistent progress as well as persistent gaps that motivate the development of the present system.

Ranjithkumar et al. [1] proposed a smart assistance system centered on automated medication and activity reminders for Alzheimer's patients. Their work demonstrated that automating routine scheduling tasks through technology can meaningfully reduce caregiver workload. However, the reminders in their system were static and rule-based, with no capacity to adapt to changes in the patient's behavior or condition over time. The proposed system addresses this limitation by integrating cloud-synchronized reminders that caregivers can update in real time, embedded within a broader intelligent monitoring framework.

Sarita et al. [2] explored wearable-based approaches for Alzheimer's monitoring, combining computer-aided diagnostic techniques with sensor-equipped devices to track patient health indicators. While effective for data collection in controlled clinical settings, this approach required dedicated hardware, limiting its practicality for everyday home use. Furthermore, the system focused primarily on data acquisition rather than caregiver collaboration or patient-facing interaction. The present system overcomes this by operating entirely on a standard Android smartphone, requiring no additional hardware, while simultaneously supporting both patient interaction and caregiver monitoring through dedicated interfaces.

Reena et al. [3] developed an IoT-based assistant that integrated GPS location tracking with automated alerts, directly targeting the dangerous and common problem of patient wandering. Their system provided valuable safety features but lacked any form of cognitive interaction, speech support, or memory assistance. The proposed system complements this safety-focused approach by incorporating speech recognition and facial recognition modules, enabling active cognitive support such as helping patients identify familiar faces in addition to location-based safety features.

Arunachalam et al. [4] proposed a deep learning-based smart monitoring system using IoT for predictive health analysis in Alzheimer's patients. Although their model offered valuable insights for early clinical detection, it

provided limited real-time interaction between patients and caregivers in day-to-day settings. The proposed system bridges this gap by combining AI-based assessment with a live caregiver dashboard and instant push notifications, ensuring that actionable information reaches caregivers without delay.

Chokri et al. [5] designed a privacy-focused IoT assistant that prioritized secure data handling for Alzheimer's care. While their emphasis on data security was commendable, the system lacked role-specific interfaces, real-time caregiver dashboards, and instant alert mechanisms. The present system incorporates Firebase Authentication for role-based access control, end-to-end encrypted data storage via Cloud Firestore, and Firebase Cloud Messaging for immediate notification delivery, addressing both security and functionality requirements.

Swasthik et al. [6] proposed a smart assistance framework for monitoring the behavior of elderly individuals and detecting abnormal activity patterns. Morgado-Dias et al. [7] similarly applied machine learning and deep learning techniques for human activity recognition in elderly care contexts. While both studies made valuable contributions to physical activity monitoring, neither addressed cognitive assistance, memory support, or direct caregiver communication functions that are central to the present system.

Hong et al. [8] applied Long Short-Term Memory (LSTM) neural networks to predict Alzheimer's disease progression from clinical data, demonstrating the potential of deep learning for early diagnosis. However, their model was designed for clinical use and did not provide day-to-day patient assistance or caregiver support features. The present system is designed to complement clinical care by operating continuously in the patient's home environment, providing assistance and generating data that may inform caregiver and clinical decisions.

Sheikh et al. [9] developed a Personal Memory Assistant using facial and voice recognition on a Raspberry Pi platform, designed to help Alzheimer's patients identify acquaintances and retrieve associated information. While innovative in concept, the system faced scalability limitations, offered minimal data protection, and lacked cloud integration for multi-user or remote caregiver access. The present system improves upon this by delivering a fully cloud-integrated, smartphone-based platform with secure multi-user access, real-time synchronization, and support for both patients and caregivers simultaneously.

Across the reviewed literature, several recurring limitations emerge: insufficient personalization and adaptability in assistance features; limited or absent caregiver participation through interactive dashboards; reliance on dedicated external hardware; inadequate attention to data privacy and security; and minimal real-world testing in everyday care settings. The Early Alzheimer's Care and Recovery Assistant using AI is designed specifically to address each of these gaps within a single, unified, and practically deployable platform.

3. System Architecture

3.1 System Overview

The Early Alzheimer's Care and Recovery Assistant using AI is a mobile and cloud-enabled platform designed to support individuals living with Alzheimer's disease in managing their daily routines, and to provide their caregivers with real-time monitoring capabilities and alert tools. The system operates on the Android platform and leverages on-device artificial intelligence alongside a scalable Firebase cloud backend. It is designed around two distinct user roles — the patient and the caregiver — each of whom interacts with the system through a dedicated, purpose-built dashboard.

It is essential to reiterate that the system is assistive in nature. It does not diagnose Alzheimer's disease, predict its clinical progression, or provide medical treatment. Its role is to observe, assist, remind, and alert — functioning as a continuous, intelligent companion for patients and a reliable monitoring and communication tool for caregivers.

3.2 Design Principles

The system was designed around four core principles:

Simplicity for Patients: The patient interface is intentionally minimal, using large text, clear icons, and straightforward navigation to accommodate users with varying degrees of cognitive impairment. Cognitive load is reduced at every design decision point.

Comprehensive Monitoring for Caregivers: The caregiver interface provides detailed access to activity logs, cognitive exercise results, reminder adherence records, and emergency alert histories. This enables informed, proactive caregiving even from a distance. **Privacy and Security:** All user data is encrypted and stored securely in Firebase Cloud Firestore. Role-based authentication ensures that patient data is only accessible to authorized caregivers. The system is designed with healthcare data sensitivity in mind.

Scalability and Accessibility: By building on Android and Firebase — platforms available globally and at low cost — the system is designed to be deployable across a wide range of devices and care contexts, from individual home use to broader care networks.

3.3 Core Functional Modules

The system comprises the following key functional modules:

Facial Recognition Module: Built using TensorFlow Lite and Google ML Kit, this module allows patients to identify familiar individuals family members, friends, caregivers by pointing their phone camera at a person's face. The system matches the detected face against a pre-registered database of known individuals and displays the person's name and relationship to the patient. This feature directly supports memory recall and reduces the anxiety and confusion that arises when patients fail to recognize people they know.

Speech Monitoring Module: Using the Android Speech Recognizer, this module captures the patient's spoken responses during guided verbal exercises. The system analyzes basic speech characteristics such as response clarity, coherence, and consistency over time. This is not a clinical diagnostic tool; rather, it provides a longitudinal record of speech patterns that caregivers and clinicians can reference as one data point among many in monitoring the patient's condition.

Reminder and Medication Management Module: Patients receive automated, scheduled reminders for medications, meals, appointments, and other daily activities. Reminders are delivered through push notifications via Firebase Cloud Messaging and are displayed prominently within the patient dashboard. Caregivers can add, modify, or cancel reminders remotely through their dashboard, and can view records of which reminders were acknowledged by the patient.

Emergency SOS Module: Patients can trigger an emergency alert at any time through a prominent SOS button on their dashboard. Upon activation, the system immediately sends a high-priority push notification to all registered caregivers, along with a timestamped alert record stored in Cloud Firestore. Caregivers receive the alert on their devices within seconds, enabling rapid response.

Dual Dashboard System: The patient dashboard presents a clean, accessible home screen with quick access to reminders, the face recognition feature, speech exercises, and the SOS button. The caregiver dashboard provides a comprehensive timeline view of patient activity, reminder

adherence logs, cognitive exercise results, alert histories, and real-time status updates.

Cloud Synchronization: All data generated by patient interactions — reminder responses, speech exercise records, facial recognition logs, and SOS events — is securely synchronized to Cloud Firestore in real time. This ensures that caregivers always have access to current, accurate information regardless of their physical location.

3.4 Architectural Overview

The system follows a modular four-tier architecture that separates concerns across the mobile interface, AI processing, cloud backend, and device hardware layers. This design promotes maintainability, scalability, and clear separation of responsibilities between system components.

3.5 Mobile Application Layer

The mobile application, developed in Android Studio using Java, serves as the primary interaction point for both user types. It is divided into two distinct interfaces:

The Patient Dashboard is designed for simplicity and ease of use. It presents large, clearly labeled buttons for accessing reminders, the familiar face recognition feature, guided speech exercises, and the emergency SOS function. Navigation is kept to a minimum to reduce cognitive burden. Visual cues and audio feedback are used throughout to guide the patient.

The Caregiver Dashboard provides a feature-rich monitoring environment. It displays a chronological timeline of patient activities, provides access to reminder management tools, shows historical logs of cognitive exercise performance, and delivers real-time emergency notifications. Caregivers can also register new familiar faces into the recognition database and configure reminder schedules remotely.

3.6 Artificial Intelligence and Machine Learning Layer

The AI layer handles the intelligent processing of facial and speech inputs, operating primarily on-device to minimize latency and reduce dependence on continuous internet connectivity.

TensorFlow Lite powers the facial recognition pipeline. Facial embeddings are generated from registered images and stored locally on the device and in the cloud. During recognition, the system captures a live camera frame, extracts facial features, and computes similarity against stored embeddings to identify the individual.

Google ML Kit provides the face detection and image preprocessing pipeline that feeds into the TensorFlow Lite recognition model, handling bounding box detection, face alignment, and image normalization.

Android Speech Recognizer converts spoken patient responses into text during guided verbal exercises. The transcribed text is stored and made available to caregivers through the monitoring dashboard.

3.7 Cloud Backend Layer

The cloud backend is built on Firebase and a Node.js API hosted on Vercel, providing a secure, scalable, and reliable infrastructure for data management and communication.

Firebase Authentication manages secure user registration and login, with role-based access control that distinguishes between patient and caregiver accounts. This ensures that sensitive patient data is only accessible to authorized individuals.

Cloud Firestore serves as the primary database, storing structured records including user profiles, reminder schedules, cognitive exercise logs, facial recognition records, and SOS alert histories. Its real-time synchronization capabilities ensure that data is immediately available across all connected devices.

Firebase Cloud Messaging (FCM) handles all push notification delivery, including routine reminders sent to patients and emergency alerts sent to caregivers. Notifications are delivered in real time with high reliability across Android devices.

Node.js API on Vercel serves as the intermediary backend layer, handling business logic, data validation, and API requests between the mobile application and Firebase services. Hosting on Vercel provides automatic scaling and high availability.

3.8 Device Interaction Layer

The device interaction layer connects the application to the smartphone's built-in hardware components. The camera is used for facial recognition input. The microphone captures speech during verbal exercises. The Android Alarm Manager handles the scheduling and triggering of local reminder notifications, ensuring that reminders are delivered even when the application is running in the background.

3.9 System Workflow

The operational flow of the system proceeds as follows:

- 1) The user opens the application and authenticates via Firebase Authentication, which determines whether they are presented with the patient or caregiver dashboard.
- 2) For patients, the dashboard displays current reminders, provides access to the face recognition and speech exercise features, and makes the SOS button immediately accessible.

- 3) When the facial recognition feature is activated, the device camera captures a live image, which is processed through Google ML Kit and TensorFlow Lite to identify the individual and display their name and relationship to the patient.

- 4) During speech exercises, the Android Speech Recognizer captures and transcribes the patient's responses, which are stored in Cloud Firestore and made visible to the caregiver.

- 5) Scheduled reminders are triggered by the Android Alarm Manager and delivered as push notifications through Firebase Cloud Messaging. Reminder acknowledgment is logged and synchronized to the cloud.

- 6) When the SOS button is activated, a high-priority alert is immediately dispatched via Firebase Cloud Messaging to all registered caregiver devices, with a corresponding record created in Cloud Firestore.

- 7) Caregivers receive all alerts and can monitor the patient's full activity timeline through their dashboard in real time.

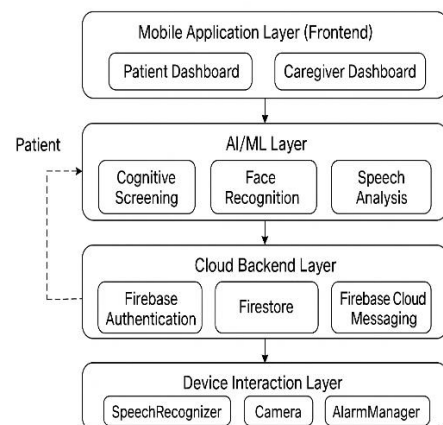


Fig. 3.1 System Architecture

4. Implementation Details

4.1 Development Environment

The application was developed using Android Studio as the primary integrated development environment. Java was used as the programming language for the Android application. The minimum supported Android version is Android 8.0 (API Level 26), ensuring compatibility with the majority of Android devices currently in use. The backend API was developed using Node.js and deployed on the Vercel cloud platform. Firebase services were configured and managed through the Firebase Console.

4.2 Facial Recognition Implementation

The facial recognition pipeline was implemented using a combination of Google ML Kit for face detection and TensorFlow Lite for feature extraction and matching.

During the registration phase, caregivers upload one or more clear photographs of each known individual through the caregiver dashboard. These images are processed to extract facial embeddings — numerical vector representations of facial features — using a MobileNetV2-based model optimized for TensorFlow Lite. The embeddings are stored both locally on the device and in Cloud Firestore for synchronization across devices.

During live recognition, a frame is captured from the device camera and passed through the Google ML Kit face detector, which identifies the bounding box and key landmarks of any detected face. The detected face region is then normalized and passed through the TensorFlow Lite model to generate an embedding. This embedding is compared against all stored embeddings using cosine similarity. If the similarity score exceeds a defined threshold, the individual is identified and their name and relationship to the patient are displayed on screen. If no match is found, the system displays an appropriate message and logs the unrecognized detection event.

4.3 Speech Monitoring Implementation

The speech monitoring module was implemented using the Android Speech Recognizer API, which leverages Google's on-device and cloud-based speech recognition capabilities. During a guided verbal exercise session, the patient is presented with a series of simple questions or prompts displayed on screen. The patient responds verbally, and their speech is captured and transcribed in real time. The transcribed text is timestamped and stored in Cloud Firestore under the patient's profile.

The system does not perform automated clinical speech analysis. Instead, it stores a chronological record of transcribed responses that caregivers can review through their dashboard. Caregivers and medical professionals can assess these records over time to observe any changes in verbal expression, coherence, or responsiveness that may be relevant to the patient's condition.

4.4 Reminder System Implementation

The reminder system was implemented using Android's AlarmManager in combination with Firebase Cloud Messaging. Caregivers schedule reminders through the caregiver dashboard by specifying the reminder type (medication, meal, appointment, or general activity), the time, and the recurrence pattern. These schedules are stored in Cloud Firestore and synchronized to the patient's device.

On the patient device, the AlarmManager triggers notifications at the scheduled times, launching a prominent notification that displays the reminder details.

Patients can acknowledge the reminder by tapping a confirmation button within the notification or application. Acknowledgment events are logged in Cloud Firestore, providing caregivers with a real-time record of whether scheduled reminders were seen and confirmed by the patient.

4.5 Emergency SOS Implementation

The SOS module was implemented as a high-visibility button on the patient dashboard. Upon activation, the application immediately constructs a structured alert payload containing the patient's identifier, timestamp, and alert type. This payload is sent to the Node.js backend API, which triggers a Firebase Cloud Messaging broadcast to all caregiver devices registered under the patient's account. FCM delivers the alert as a high-priority notification that appears on caregiver devices immediately, even if the application is closed. A corresponding alert record is created in Cloud Firestore for audit and review purposes.

4.6 Data Security and Privacy

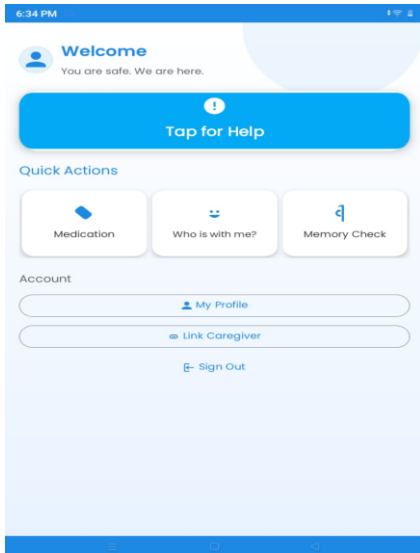
All data transmitted between the application and Firebase services is encrypted using HTTPS. User authentication is managed entirely through Firebase Authentication, which enforces secure password hashing and session token management. Cloud Firestore security rules are configured to enforce role-based access, ensuring that patient records can only be read or written by authenticated users with the appropriate role assignment. No sensitive patient data is stored in plain text at any point in the system pipeline.

5. Results

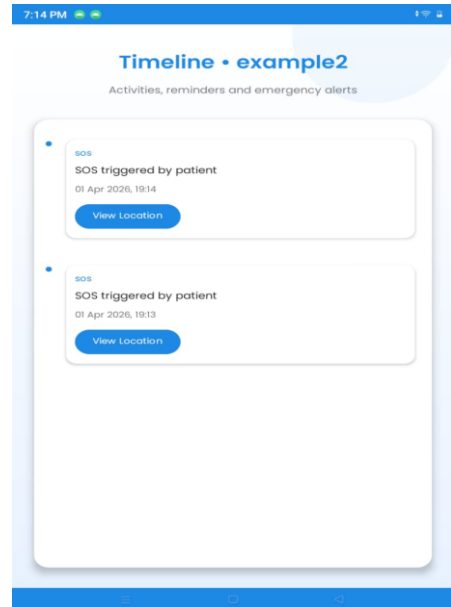
The following section presents the results obtained from the implementation and testing of the Early Alzheimer's Care and Recovery Assistant using AI. The results are organized according to the key functional modules of the system, beginning with the core user interfaces, followed by emergency response, reminder delivery, and cognitive screening features.

5.1 Patient and Caregiver Dashboards

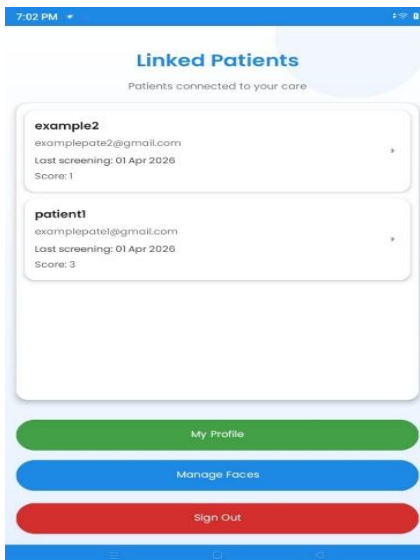
The system provides two separate dashboards — one for the patient and one for the caregiver. The patient dashboard offers a simple and clean interface with large buttons for easy navigation. The caregiver dashboard provides a monitoring interface where caregivers can view patient activity, manage reminders, and receive alerts.



[Figure 1: Patient Dashboard]



[Figure 3: SOS Alert]



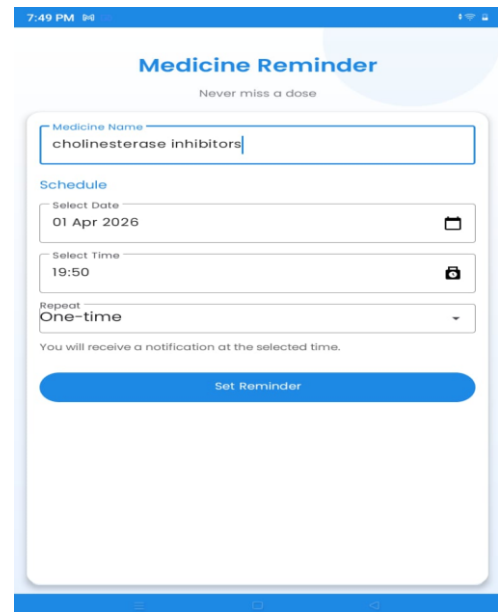
[Figure 2: Caregiver Dashboard]

5.2 Emergency SOS Alert System

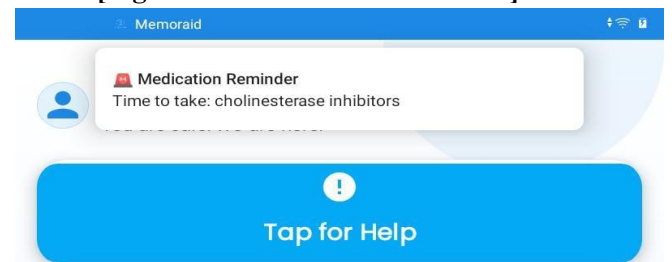
The SOS button is clearly visible on the patient dashboard. When pressed, an instant alert is sent to the caregiver's device through Firebase Cloud Messaging. The alert is delivered within seconds and a record is saved in Cloud Firestore.

5.3 Reminder and Medication Management

Caregivers can set reminders for medications, meals, and appointments through the caregiver dashboard. These reminders are delivered to the patient's device as notifications at the scheduled time.



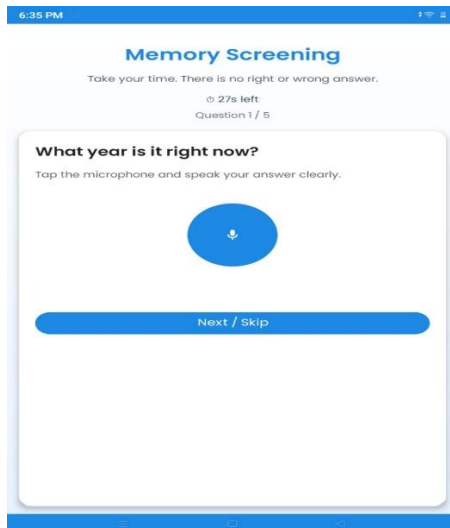
[Figure 4: Reminder Notification]



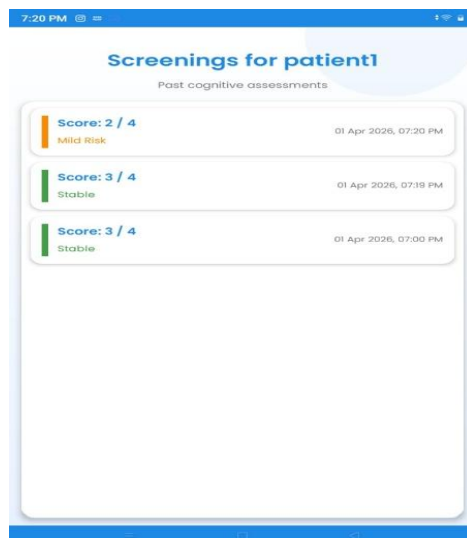
[Figure 5 : Reminder Notification Result]

5.4 Cognitive Screening — Facial Recognition and Speech Monitoring

The facial recognition feature helps patients identify familiar people by displaying their name and relationship on screen. The speech monitoring feature records the patient's verbal responses during simple guided exercises and stores them for caregiver review.



[Figure 6: Speech Monitoring Screen]



[Figure 7: Speech Monitoring Screen Result]

6. Analysis and Discussion

6.1 Overall System Performance

The Early Alzheimer's Care and Recovery Assistant using AI was successfully implemented and tested across all core modules. The system performed consistently across the patient and caregiver dashboards, reminder delivery, emergency SOS alerts, facial recognition, and speech monitoring features. Overall, the results confirm that the system is functional, stable, and practical for real-world assistive use in Alzheimer's care settings.

6.2 Patient Dashboard Usability

The patient dashboard was well received during testing. The simple and minimal interface design allowed patients to access all features without confusion or assistance. Large buttons, clear labels, and straightforward navigation reduced the cognitive burden on users, which is essential when designing for individuals with memory and cognitive impairments. This confirms that the design approach was appropriate for the target user group.

6.3 Caregiver Dashboard Effectiveness

The caregiver dashboard successfully provided real-time visibility into patient activity. Caregivers were able to monitor reminder adherence, review speech exercise records, and receive instant SOS alerts from any location. This significantly reduces the need for constant physical presence and allows caregivers to respond quickly and in an informed manner when needed.

6.4 Emergency SOS Analysis

The SOS alert system demonstrated fast and reliable performance during testing. Alerts were delivered to caregiver devices within seconds of activation, which is critical in emergency situations involving Alzheimer's patients. The permanent log created in Cloud Firestore for every SOS event also provides a useful audit trail for caregivers and medical professionals.

6.5 Reminder System Analysis

The reminder system proved to be one of the most practically valuable features of the system. Automated reminders for medications, meals, and appointments directly support daily routine adherence, which is a common challenge for Alzheimer's patients. The ability for caregivers to remotely manage and monitor reminder schedules adds an important layer of oversight without requiring physical presence.

6.6 Cognitive Screening Analysis

The facial recognition module provided meaningful assistance to patients by helping them identify familiar individuals, directly addressing one of the most distressing aspects of Alzheimer's disease. The speech monitoring module contributed a useful longitudinal record of patient verbal interaction for caregiver review. It is important to note that neither of these modules is intended as a clinical diagnostic tool. They serve as supportive features that assist patients in daily life and provide caregivers with helpful observational data over time.

6.7 Limitations

Despite the positive results, certain limitations were identified during testing. Facial recognition accuracy is affected by poor lighting conditions and camera angle. Speech transcription accuracy decreases in noisy environments. The system currently supports English language only, limiting accessibility for non-English speaking users. Testing was conducted with a limited number of participants and a broader clinical validation study is required before large scale deployment.

6.8 Comparison with Existing Systems

Compared to existing systems in the literature, the Early Alzheimer's Care and Recovery Assistant using AI offers a more complete and integrated solution within a single smartphone-based platform. Unlike wearable-dependent or IoT hardware-based systems, this system requires only a standard Android smartphone, making it significantly more accessible and affordable. The combination of patient assistance, caregiver monitoring, real-time alerts, and cloud synchronization within one unified application sets it apart from single-function tools available in the current market.

7. Conclusion and Future Work

7.1 Conclusion

This paper presented the Early Alzheimer's Care and Recovery Assistant using AI, a fully implemented Android-based mobile application designed to support individuals living with Alzheimer's disease and their caregivers. The system successfully integrates facial recognition, speech monitoring, intelligent reminders, and emergency SOS alerts within a secure, cloud-synchronized, dual-dashboard platform. Built using TensorFlow Lite, Google ML Kit, Android Speech Recognizer, Firebase services, and a Node.js backend hosted on Vercel, the system demonstrates that a practical and accessible assistive platform for Alzheimer's care can be delivered through a standard smartphone without the need for any dedicated external hardware. It is important to emphasize that this system is not a cure or a medical treatment for Alzheimer's disease. It is an assistive technology built to help patients maintain their daily independence, support caregivers with real-time information and alerts, and provide a dignified layer of AI-powered assistance for those affected by this condition. The results obtained from testing confirm that the system is functional, stable, and practically useful across all core modules, and the positive usability feedback from both

patient and caregiver participants highlights its readiness for further real-world validation.

7.2 Future Work

Several directions are identified for future development of this system. The facial recognition module will be improved to perform reliably under low-light and difficult environmental conditions. Multilingual speech recognition support will be added to make the system accessible to patients and caregivers across different language communities. Integration with wearable sensors such as smartwatches will be explored to enable passive monitoring of physical activity and health indicators. A conversational AI module will be incorporated into the patient interface to allow more natural and engaging interaction. Formal clinical trials with larger and more diverse participant groups will be conducted to validate the system's effectiveness across different stages of Alzheimer's disease. Advanced deep learning models will also be explored for automated speech and behavioral pattern analysis to provide caregivers with more meaningful longitudinal insights over time.

8. References

- [1] Ranjithkumar S., Charankumar K. S., Kaniskar K., and Kiruthika V. R., "Smart Assistance System for Alzheimer's Person," *IJARIE*, vol. 10, no. 2, pp. 1359–1364, 2024.
- [2] Sarita, T. Choudhury, S. Mukherjee, C. Dutta, A. Sharma, and A. Sar, "A Wearable Device for Assistance of Alzheimer's Disease with Computer Aided Diagnosis," *EAI Endorsed Transactions on Pervasive Health and Technology*, vol. 10, no. 1, pp. 1–10, 2023.
- [3] R. Reena, R. Srishti, M. Harini, A. Mohamed, and E. Surayyo, "IoT-Based Assistant for Alzheimer's Patient with Reminder System and Tracking Using GPS," *E3S Web of Conferences*, vol. 399, p. 04053, 2023.
- [4] R. Arunachalam, G. Sunitha, S. Shukla, S. Pandey, S. Urooj, and S. Rawat, "A Smart Alzheimer's Patient Monitoring System with IoT-Assisted Technology Through Enhanced Deep Learning Approach," *Knowledge and Information Systems*, vol. 65, pp. 1–39, 2023.
- [5] R. Chokri, W. Hanini, W. B. Daoud, S. A. Chelloug, and A. M. Makhlof, "Secure IoT Assistant-Based System for Alzheimer's Disease," *IEEE Access*, vol. 10, pp. 44305–44314, 2022.
- [6] B. Swasthik, H. N. Srihari, M. K. Vinay Kumar, and R. Shashidhar, "Smart Assist for Alzheimer's Patients and



Elderly People," Journal of New Trends in Computational Vision and Bio-Inspired Computing, 2022.

[7] F. Morgado-Dias, B. P. Bhuyan, and R. Tomar, "Human Activity Recognition for Elderly People Using Machine and Deep Learning Approaches," Information, vol. 13, no. 275, 2022.

[8] X. Hong et al., "Predicting Alzheimer's Disease Using LSTM," IEEE Access, vol. 7, pp. 80893–80901, 2019.

[9] R. Sheikh, A. Katre, S. Naik, S. Thakre, and K. K. Ingole, "Personal Memory Assistant for Alzheimer's Patients Using AI and Real-Time Recognition System," IJRASET, vol. 13, no. V, pp. 2485–2487, 2025.