Elderly Companion App
Comprehensive System Report

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1 Introduction

Elderly Companion App is a cross-platform mobile application designed to serve elderly users and their caretakers. It provides health tracking, medication reminders, emergency assistance, cognitive trainings, and simple communication between elderly users and their family members. Built with React Native (Expo) as the frontend and Node.js/Express as the backend, the system employs contemporary cloud facilities for storage, reminders, and real-time updating.

The app addresses the most critical problems in geriatric care with an integrated system that brings together health monitoring, drug adherence, emergency calls, mental stimulation, and family communication. The app is designed with accessibility as a core value, such as voice-over commands, large touch target areas, and simple navigation to accommodate the elderly.

2 System Architecture

2.1 Frontend Technology Stack

- Framework: React Native with Expo SDK 51
- State Management: React Context for managing authentication, medication, notification, and theme
- Navigation: React Navigation with stack and tab navigators
- UI Components: MaterialCommunityIcons, React Native Paper, and themed components
- Notifications: Expo Notifications for local and push notifications
- Media Handling: Expo AV for audio recording, Expo ImagePicker for profile picture
- Storage: AsyncStorage for local data storage

2.2 Backend Technology Stack

- Framework: Node.js with Express.js

- Database: PostgreSQL (hosted on Supabase)
- Storage: Supabase Storage for audio and image files
- Authentication: JWT tokens with secure middleware
- External Services: Twilio for SMS notifications, AssemblyAI for audio transcription
- APIs: RESTful endpoints for all core functionality
- Deployment: Docker containerization with PM2 process management

3 Core Features and Functionality

3.1 Authentication and User Management

The app includes a secure authentication system with role-based access control. Users can be signed up as elderly users or caregivers, with different sets of features based on their role. The site has:

- Email signup and login via email verification, secured
- Reset password
- Upload of images to Supabase Storage and handling of profiles
- Session handling via JWT token
- Role-based navigation and access to features

3.2 Health Tracking Module

The health tracking module provides elderly users with day-by-day wellness records:

- Daily health check-in with configurable parameters
- Health trend tracking history
- Health recommendation and health insight
- Check-in reminder for health
- Data visualization of health trends

3.3 Medication Management System

Complete medication management system for accurate medication adherence:

- Add, edit, and delete medications with full details
- Medication reminders with frequency customizable
- Adherence tracking and medication history
- Push and local notification of medication reminder
- Integration of voice assistant for voice query of medication

3.4 Emergency Assistance System

Emergency system for the purpose of seeking instant assistance whenever necessary:

- SOS button to send instant emergency notifications
- Emergency contact management of multi-contact type
- Storage and quick access to medical records
- Sharing the location in case of an emergency
- SMS and email notifications to emergency contacts
- Integration of Twilio for emergency calling

3.5 Cognitive Training Platform

Brain training cognitive games for the purpose of ensuring cognitive processes:

- Different types of games: memory, logic, attention
- Progressive increase in the level of difficulty
- Monitoring of score and performance
- Morning and evening brain training reminders
- Visualization of achievements and progress

3.6 Voice Assistant Integration

Hands-free voice commands:

- Audio processing and voice recording
- Speech-to-text integration with AssemblyAI
- Reminders for medicine, emergency calls, and assistance through voice commands
- Management of audio files and storage
- Natural language processing for command interpretation

3.7 Family and Caregiver Dashboard

System to monitor and control caregivers:

- Invitation system and family member management
- Real-time monitoring of elderly health and medication
- Location tracking and geofencing capabilities
- Permission and access control
- Family coordination communication functionality
- Health and safety alert system

4 User Experience and Interface Design

4.1 Accessibility Features

The app is built with the elderly in mind, such as:

- High contrast theme and big touch targets and font
- Voice navigation and command
- Clear visual hierarchy and simplified navigation
- Error prevention and recovery functionality
- Offline support for default capabilities

4.2 Cross-Platform Compatibility

The React Native release offers:

- Responsive UI for multiple screen sizes
- Platform-specific optimization when needed
- Shared codebase for easy maintenance

5 Security and Data Privacy

5.1 Security Features

- JWT authentication and safe token storage
- Securing API endpoints with authentication middleware
- Input validation and sanitization
- Safe file upload with type and size restrictions
- HTTPS encryption of data transfer
- Regular security audits and updates

5.2 Privacy Protection

- GDPR-compliant data processing procedures
- User consent management for data collection
- Data export and deletion functionality
- Storage of personal data encrypted
- Privacy settings and user control over data sharing
- Audit logs of data access and modification

6 Technical Implementation Details

6.1 API Structure

The backend exposes RESTful APIs organized in logical modules:

- Login, registration, and token-related authentication endpoints
- Image and detail upload user profile management
- Check-in and history health tracking API
- CRUD and reminder medication management
- Contact and alert emergency management
- Elderly-caregiver relationship family management
- Audio upload and transcriptions voice processing

6.2 Database Design

The PostgreSQL database is optimized with normalized tables for:

- User accounts and authentication information
- Health records and check-in history
- Medication information and schedules
- Emergency contacts and health info
- Family relationships and permissions
- Brain training progress and scores
- Notification settings and logs

7 Testing and Quality Assurance

7.1 Development Testing

- Extensive logging inside the app
- Postman collections for testing and documentation of APIs
- Unit tests for main business logic
- Integration tests for API endpoints
- Manual testing scripts for ensuring user experience

7.2 Error Handling and Monitoring

- Graceful error handling with kind messages
- Retries and error handling for network errors

- Performance optimization and monitoring
- Crash reporting and analytics
- Automated system problem alerting

7.3 Maintenance and Updates

- Regular security patches and updates
- Monitoring and optimization of performance
- User feedback collection and feature updates
- Database maintenance and optimization
- Third-party service integration updates

8 Conclusion

The Elderly Companion App is an all-encompassing system of care for the elderly and interconnection of family members. The modularity of the system, security strength, and ease of the design all complement one another in making the system an effective tool to improve the quality of life of the elderly user with caregivers' peace of mind.

The combination of modern web technologies, cloud computing, and access-oriented design gives birth to a system that is powerful yet easy to use. The ability of the application to marshals together health monitoring, drug reminders, emergency calls, and brain training into a single, one-stop interface corrects the complicated needs of geriatric care in the modern cyber age.

Future development on the roadmap includes additional AI-driven features, wearable device support, and stronger family communication features in order to further expand the elder care experience.