CARECONNECT: AI-POWERED COMPANION FOR THE ELDERLY

BY

TAN WEN PANG

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ABSTRACT

This project presents the design and development of a mobile application aimed at supporting elderly users by enhancing safety, independence, and memory health. The system integrates several core features into a single platform, including medication management, AI-powered chatbot assistance, emergency alert and caregiver connectivity, and facial recognition for memory recall. The medication module provides timely reminders with user-friendly options, while the chatbot enables natural language interaction to add, find, and manage medical records. The emergency module ensures safety by triggering alerts through a countdown system and automatically notifying registered caregivers with location details if no response is received. In addition, the facial recognition module assists elderly users in identifying familiar faces and allows new samples to be added to improve accuracy.

The application was developed in Android Studio using Room Database for local data storage and OpenAI API for chatbot interaction, with emphasis on usability and accessibility through large buttons, intuitive navigation, and clear alerts. System evaluation confirmed that all modules functioned effectively, with alarms triggering reliably, chatbot responses processed correctly, emergency notifications reaching caregivers, and facial recognition performing with satisfactory accuracy. Overall, the project demonstrates the potential of integrating AI technologies into a user-centric mobile application to promote elderly safety, strengthen caregiver connectivity, and improve quality of life.

Area of Study (Minimum 1 and Maximum 2): Mobile Application Development, Artificial Intelligence in Elderly Care

Keywords (Minimum 5 and Maximum 10): AI Chatbot, Emergency Alert, Medication Management, Facial Recognition, Caregiver Connectivity, Elderly Safety, User-Centric Design, Memory Support

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
NLP	Natural Language Processing
HIPAA	Health Insurance Portability and Accountability Act
API	Application Programming Interface
DB	Database
IOT	Internet of Things
GDPR	General Data Protection Regulation
SMS	Short Message Service

Chapter 1
Introduction

The rapid aging of the world's population has accelerated the need for technological innovation to meet the special needs of older people [1]. The elderly population in Malaysia is defined as people aged 65 and above. From 2018 to 2019, the elderly population grew from 2.12 million to 2.21 million in less than a year. The population of Malaysians aged 65 and above is estimated to reach 7% in 2020. It is expected that the population will grow to 15% in 2040 [2]. As people are aging, it comes with increasing health risks and conditions [3]. Seniors often struggle with maintaining independence, adhering to medication schedules, remembering appointments, and staying socially engaged. At the same time, caregivers and families are seeking tools to ensure the safety and well-being of their elderly loved ones. These challenges underscore the need for innovative, technology-driven solutions that bridge the gap between caregiving and independence. The **Elderly Companion Application** has been conceptualized to meet this need.

The proposed application integrates advanced Artificial Intelligence (AI) technologies with user-friendly interfaces to create a holistic support system for seniors. By combining AI-powered tools such as chatbots, image recognition [4], cognitive engagement features, and emergency detection systems, this app addresses the core concerns of elderly care. The chatbot assists in managing medication schedules, recording medicine usage times, and providing reminders for medical appointments. Leveraging AI-based image recognition, the application ensures accuracy in tracking medication and appointments by analyzing physical records, such as pill bottles or appointment cards. In addition, real-time notifications sent to caregivers enable them to stay informed and intervene if necessary.

Safety and emergency response are paramount features of the application. Using advanced AI, the app detects unusual sounds or events, such as shouting, phone dropping, or falls, and prompts the user to confirm their situation. If no response is detected, it automatically alerts designated caregivers or emergency services with the

user's location. To ensure constant availability, an offline emergency button is prominently displayed in the interface, allowing users to send alerts with ease, even in the absence of an internet connection.

1.1 Problem Statement and Motivation

The increasing aging population worldwide has brought significant challenges in maintaining seniors' independence, safety, and mental well-being. Seniors often face difficulties such as remembering medication schedules, recognizing familiar faces, and responding to emergencies, especially when living alone without immediate support [5].

Despite the availability of technological solutions, many existing mobile applications focus only on isolated features, lacking a holistic, integrated approach. This segmentation increases complexity for elderly users and reduces the practicality and adoption of such tools [6]. Furthermore, most current solutions fail to address key needs like simple interfaces, offline emergency access and memory reinforcement. Without addressing these critical usability factors, these tools often become impractical for their intended users, resulting in low adoption rates and underutilization of their potential benefits [7].

The lack of engaging and supportive features worsens social isolation and cognitive decline among seniors, leaving both elderly individuals and caregivers underserved. There is a clear need for a comprehensive, technology-driven solution that combines medication management, emergency detection and facial recognition into a single, user-friendly platform. Such a system can improve seniors' quality of life, reduce caregiver burden, and promote active aging.

Motivated by these gaps, this project aims to develop an AI-powered mobile application that provides holistic support to elderly users. By integrating key features into one unified platform, the solution seeks to empower seniors to maintain independence, ensure safety, and enhance memory health, setting a new standard for technology-assisted elderly care.

1.2 Objectives

To design and develop an Elderly Companion Application that integrates AI technologies to enhance safety, independence, and enhance memory health for elderly users. The application aims to provide a unified platform featuring medication management, emergency detection, facial recognition, and caregiver connectivity. It focuses on delivering a user-friendly interface tailored for seniors, with real-time notifications and offline emergency support.

1. **To develop an AI-powered chatbot** that assists elderly users in managing their medication schedules and appointment reminders.

2. **To enhance memory recall by implementing facial recognition** to assist elderly users in identifying familiar faces

3. **To promote caregiver connectivity** by sending notifications and updates regarding the user's emergency situations.

4. **To ensure user-friendly design and accessibility** by creating a simple interface with large buttons and intuitive navigation, tailored specifically for elderly users.

1.3 Project Scope and Direction

To design and develop an Elderly Companion Application that integrates AI technologies to support elderly users in managing medications, appointments, memory recall, and emergency situations. The application features an AI-powered chatbot for managing medication, a facial recognition system to assist memory recall, sensor-based emergency detection, and brain-stimulating cognitive games. It aims to provide a simple, user-friendly interface with offline emergency support and real-time caregiver notifications to enhance safety, independence, and cognitive engagement for elderly users.

1.4 Contributions

To design and develop an Elderly Companion Application that applies AI-powered technologies for enhancing elderly care. The application integrates multiple intelligent systems such as medication management, medication reminders, emergency detection, and facial recognition. Using ChatGPT API, the AI chatbot can assist users in managing medication schedules, reminding medication time, and answering health-related queries through simple conversations. Additionally, the app enables users to scan information on medical zip lock bag using image recognition APIs to ensure accurate and effortless record keeping.

To implement a facial recognition feature that assists elderly users with memory recall and emotional connectivity. The system matches real-time camera input with uploaded photos of family members or caregivers, helping users to recognize familiar faces and retrieve associated memories. This feature aims to support cognitive health and strengthen emotional bonds.

To enhance caregiver connectivity by providing real-time notifications and emergency alerts. The application monitors sensor data, such as sudden movements, and detects emergencies like falls. If no response is received from the user, it automatically sends alerts, location details, and emergency messages to registered caregivers through SMS notifications, ensuring rapid response during critical moments. To evaluate the application to ensure it is reliable, user-friendly, and accessible for elderly users.

Usability testing and real-world simulations will be conducted to verify that the system meets project objectives. Test cases will ensure that the medical record is correct and functionable, AI chatbot correctly manages simple tasks, emergency detection is timely and accurate, and facial recognition supports memory recall effectively. Feedback will be used to identify necessary improvements, particularly focusing on system simplicity, accuracy, and response time to optimize the elderly user experience.

1.5 Report Organization

This report is organized into 6 chapters: Chapter 1 Introduction, Chapter 2 Literature Review, Chapter 3 System Design, Chapter 4 System Implementation and Testing, Chapter 5 System Outcome and Discussion, Chapter 6 Conclusion. The first chapter is the introduction of this project which includes problem statement, project background and motivation, project scope, project objectives, project contribution, highlights of project achievements, and report organization. Chapter two, a literature review is conducted on existing mobile applications, AI chatbots, emergency detection systems and facial recognition technologies, highlighting their strengths, limitations, and areas for improvement. Chapter three outlines the project scope and objectives, detailing the proposed solutions and the specific goals aimed at enhancing elderly care through AI-driven technologies. Chapter four describes the methods and technologies involved in the development process, including the Rapid Application Development (RAD) methodology, system design, and workflow integration. Finally, Chapter five provides the conclusion of the project, summarizing the key findings, discussing limitations encountered during the development, and offering suggestions for future work. The appendix section includes all references cited throughout the report for further reading and validation.

Chapter 2
Literature Review

2.1 Previous Work on real life mobile applications

Real-life mobile applications play a vital role in addressing the healthcare and daily assistance needs of various demographics, particularly older adults. These applications utilize advanced technologies like AI and machine learning to enhance medication management, cognitive engagement, and social connectivity. The following sections review notable applications such as AgeWiser, Medisafe, and MyTherapy, focusing on their features, advantages, and limitations in providing comprehensive and accessible solutions for health and well-being.

2.1.1 AgeWiser

A real life application AgeWiser app exemplifies the integration of AI technology into senior care, addressing key challenges faced by older adults in maintaining independence, health, and social connectivity. The app incorporates a range of features [8] designed to improve physical, cognitive, and emotional well-being. Mobility support is provided through guided exercise videos, including Tai Chi and chair exercises, aimed at enhancing strength, balance, and fall prevention. Its AI-driven fall detection system monitors irregular movements to identify potential risks, enabling timely intervention and personalized care adjustments.

For cognitive health, AgeWiser includes brain games designed to boost memory and mental acuity. Additionally, the app features medication management tools that assist users in adhering to their prescribed schedules and detecting potential medication conflicts, ensuring better health outcomes. Social connectivity is a core focus, offering a platform for communication with family and friends, helping to combat loneliness and isolation. One of its standout features is the AI companion "Jen," an interactive avatar that provides personalized engagement, fostering a sense of companionship and support.

AgeWiser prioritizes user accessibility with a simple, intuitive interface designed for older adults. Available on Android and iOS platforms, the app ensures data privacy and security by encrypting user information during transmission. Despite its innovative

features, further research could explore its real-world efficacy in enhancing the quality of life for diverse elderly populations and addressing specific limitations like technological familiarity among older adults. Overall, AgeWiser demonstrates the potential of AI-powered applications in transforming elderly care through comprehensive and user-friendly solutions.

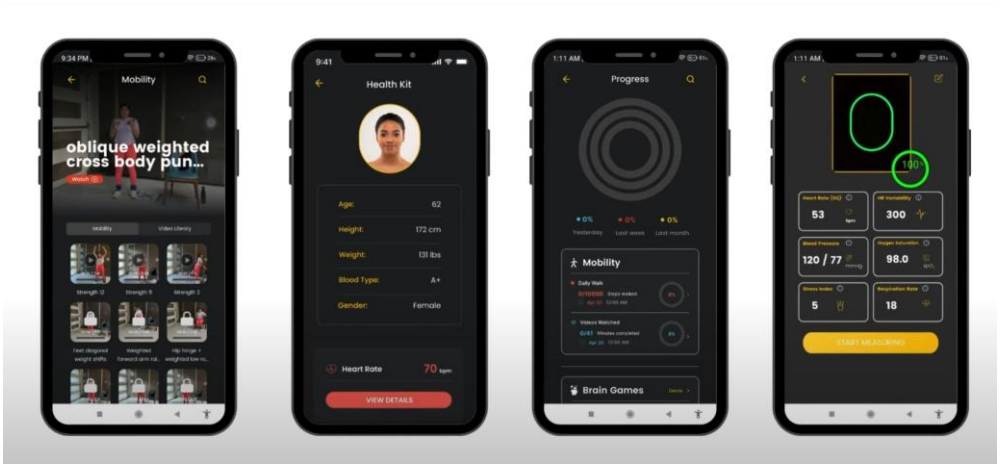


Figure 2.1 AgeWiser Application: Mobility

Figure 2.2 AgeWiser Application: Brain game & Pill Mangement

2.1.2 Medisafe

Medisafe is a widely recognized medication management application designed to enhance adherence to prescribed regimens and support overall health tracking [9]. It is particularly beneficial for individuals managing complex medication schedules, as it offers customizable reminders and detailed dosing schedules. The app integrates advanced features such as drug interaction warnings, which notify users of potential conflicts between medications, ensuring safe usage. Additionally, Medisafe includes a caregiver support system called "Medfriends," allowing family members or caregivers

to receive notifications when a dose is missed, fostering a collaborative approach to medication adherence.

The application also supports health tracking by monitoring metrics like blood pressure, glucose levels, and weight, enabling users to gain a holistic view of their health. Medisafe emphasizes data security, adhering to HIPAA standards, and employs 256-bit encryption to protect sensitive user information [10]. Its user-friendly interface includes visual representations of medications, such as pill images and clear scheduling, which simplify navigation and usage for all demographics, particularly older adults [10].

While Medisafe offers comprehensive features, some limitations exist. Tthe absence of web-based access limits its usability to mobile devices. Despite these drawbacks, Medisafe demonstrates significant potential as an accessible and effective tool for medication management. Its integration of reminders, health tracking, and caregiver support addresses critical challenges in medication adherence, making it an asset in personal and clinical healthcare management. Future improvements could focus on expanding accessibility and introducing features for a broader range of health conditions.

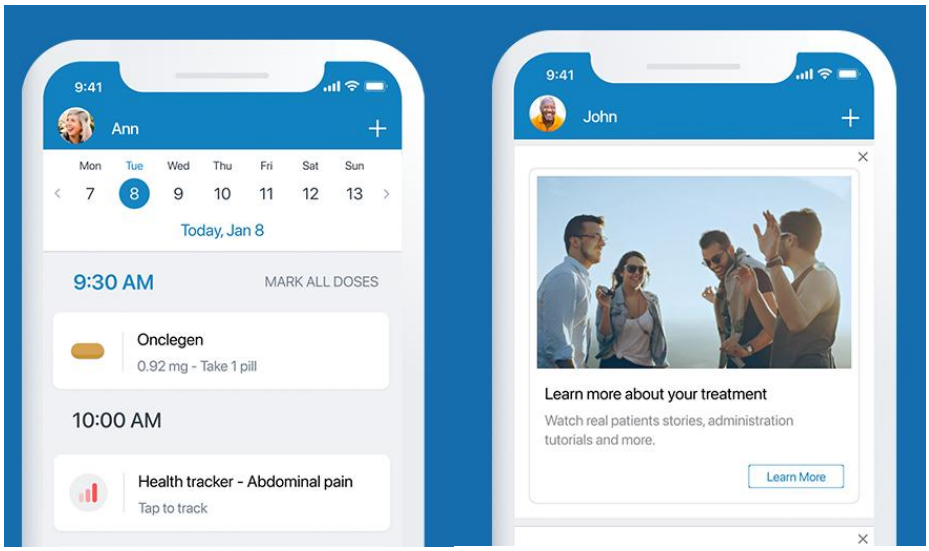


Figure 2.3 Medisafe Application

2.1.3 MyTherepy

The MyTherapy app is a comprehensive health management tool designed to support medication adherence and overall well-being [11]. It combines medication reminders with features for tracking symptoms, monitoring health metrics such as blood pressure, glucose levels, and weight, and logging physical activities [12]. By offering personalized reminders, the app ensures timely adherence to prescribed medication schedules, catering to users managing complex regimens. Additionally, the app generates detailed health reports based on logged data, which can be shared with healthcare providers to facilitate more informed clinical consultations.

One of MyTherapy's strengths is its user-friendly interface [12], which is designed to be accessible to individuals across different age groups. It supports multiple languages and includes accessibility features like Android's TalkBack and iOS's VoiceOver, ensuring inclusivity for visually impaired users. The app also prioritizes data privacy, complying with stringent European regulations to safeguard personal information and preventing unauthorized third-party data access.

In addition to the previously mentioned limitations, some users have reported that the MyTherapy app may experience notification issues, particularly when battery-saving modes are enabled on their devices [13]. This can result in reminders not functioning as intended, potentially affecting medication adherence.

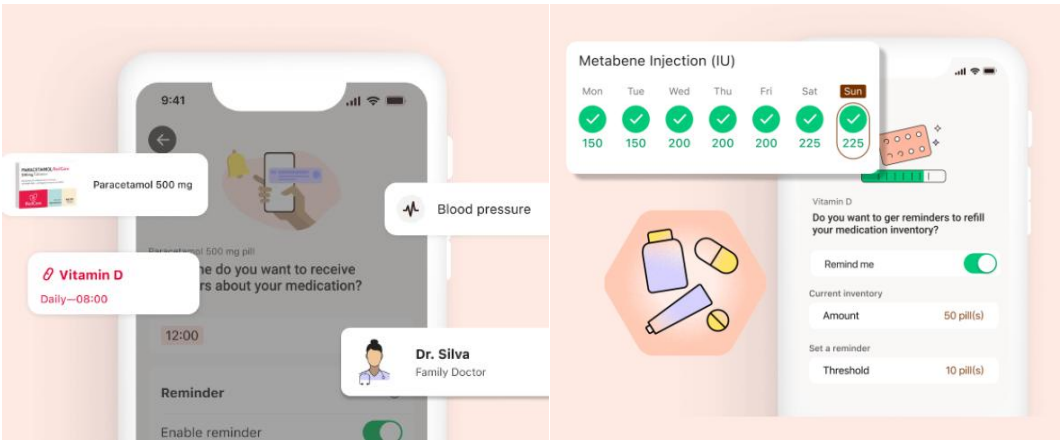


Figure 2.4 MyTheraphy Application

Table 2.1 Between Three Mobile Applications

Application	App Features	Advantages	Limitation
AgeWiser [8]	- Fall prevention - Cognitive games - Medication tracking - AI companion "Jen" - Social connectivity	- User-friendly interface - Drug interaction alerts - Caregiver integration - Adheres to strict privacy laws	- Lacks offline access - Initial setup may be tedious for some users
Medisafe [9]	- Medication reminders - Caregiver notifications (Medfriends) - Drug interaction warnings - Health tracking	- Comprehensive health management - Accessible interface - Multiple language support - Shareable health reports	- Time-consuming setup for extensive medications - Occasional notification issues with battery-saving modes
MyTheraphy [11]	- Medication reminders - Health tracking (blood pressure, glucose, weight) - Symptom tracking - Activity logging	- Combines mobility, cognitive health, and social engagement - Real-time fall detection - Personalized care	- Some features may require constant internet access for optimal performance

2.2 Previous Work on Chatbot/ Voice Assistant

Chatbots and voice assistants have become essential tools for improving interaction between humans and machines. They use technologies like Natural Language Processing (NLP) and speech recognition to perform tasks, provide information, and enhance accessibility. Various studies have explored their applications in fields such as healthcare, education, and daily assistance, highlighting their potential and areas for improvement.

2.2.1 NLP based AI Voice Assistant

In [14] the "NLP-based AI Voice Assistant" paper highlights the role of AI systems in human-machine interaction, focusing on voice assistants and their applications. It references a variety of methodologies, such as acoustic analysis, decision tree algorithms, and NLP techniques, while also discussing practical uses like accessibility for visually impaired users and automation of daily tasks. However, the review primarily lists studies without critical comparison or analysis. It does not explicitly identify gaps in the literature, and the discussion is fragmented, lacking synthesis of findings. Challenges like data bias and variability in accents are mentioned indirectly but not explored in depth. Overall, while the review provides technical insights, it could benefit from a clearer structure, critical evaluation of prior work, and identification of research gaps to better justify the proposed system.

2.2.2 Artificial Intelligence-based Voice Assistant

IN [15], the authors have proposed an AI-based voice assistant designed to perform a variety of user commands using Python and Google Text-to-Speech (gTTS). The voice assistant captures user inputs through a microphone, processes them into text, and executes specific tasks such as playing music, retrieving weather updates, conducting Google searches, taking screenshots, and translating text into different languages. The processed responses are then converted into audio using the Playsound library to provide seamless interaction.

The core of the proposed system relies on **Automatic Speech Recognition (ASR)**, which incorporates Acoustic Analysis to process speech waveforms. The ASR breaks down speech into three modelling levels: **acoustic modelling** to identify speech elements, pronunciation modelling to account for variations like accents, and language modelling to establish contextual probabilities. This layered approach enables the assistant to handle diverse linguistic inputs and provide accurate responses.

The system includes additional features like customizable assistant names, session-specific memory, and emergency alert capabilities, making it adaptable to various user needs. The authors also highlight the assistant's ability to automate repetitive tasks and integrate with everyday applications, enhancing accessibility and convenience. Implemented using Python's flexible programming environment, the assistant is

scalable for further enhancements, such as improved dialogue recognition and task automation.

Figure 2.5 Process of ASR

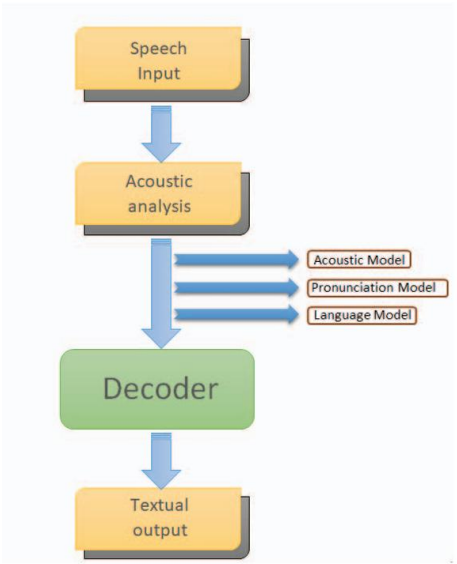


Figure 2.6 Acoustic Analysis

2.2.3 Enhancing College Chat Bot Assistant with the Help of Richer Human Computer Interaction and Speech Recognition

Chatbots have gained significant attention over the last decade, being widely adopted across various domains such as e-commerce platforms, college websites, and customer service. An advanced college chatbot has designed to address the challenges faced by students and parents during the admission process [16]. The chatbot supports both text and voice interaction, offering a more engaging and user-friendly experience. It aims to reduce manual effort, eliminate queues at help desks, and provide 24/7 support for admission-related queries.

The authors review previous work in chatbot development, highlighting pattern-matching approaches using relational databases, stemming techniques for keyword

extraction, and machine learning models for natural language understanding. Examples include Bayu Setiaji and Ferry Wahyu Wibowo's database-driven chatbot and Dungeon Lee et al.'s emotionally responsive chatbot for counselling [11]. However, the authors note that existing chatbots often fail to bridge the gap between human-like interactions and system responses, leading to suboptimal user experiences.

The proposed system leverages Natural Language Processing (NLP) and Automatic Speech Recognition (ASR) for improved conversational abilities. It employs MongoDB for backend storage and RESTful APIs for robust communication. The chatbot classifies queries into FAQs and transactional questions, dynamically adapting responses based on context. Features like error correction, fallback questions, and multilingual capabilities enhance its usability.

Despite its innovative design, the chatbot faces challenges in handling ambiguous queries, misinterpretation of commands, and grammar errors. The authors emphasize the need for advanced NLP techniques and suggest future enhancements such as multilingual support and local language integration to make the system more inclusive and realistic. This research contributes to the growing field of intelligent virtual assistants, emphasizing the importance of seamless human-computer interaction.

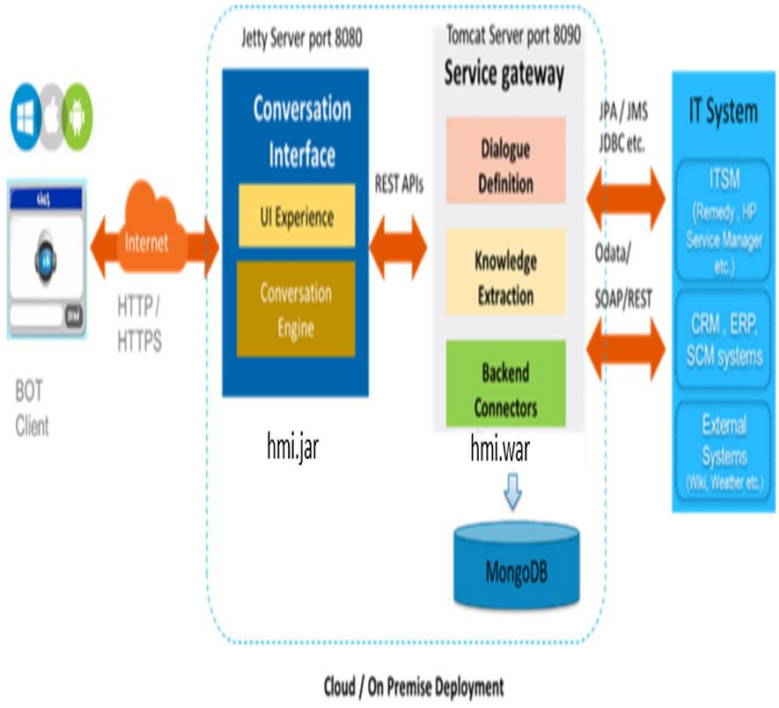


Figure 2.7 Cloud/ On premise Deployment Architecture

2.2.4 Chatbot Using A Knowledge in Database

The authors in [17] propose a chatbot framework that utilizes relational database management systems (RDBMS) to manage knowledge for human-to-machine conversations. The authors describe a pattern-matching approach where user input sentences are compared with stored patterns in the database, and responses are generated based on similarity scores. The bigram model is used for similarity calculations, dividing sentences into overlapping two-character sequences to handle misspellings and syntax errors effectively.

The chatbot's core relies on a database storing patterns, templates, and conversation logs, with normalization functions to correct misspellings and punctuation errors. The authors implemented the chatbot interface using Pascal and Java, enabling a user-friendly interaction platform. SQL-based stored procedures and functions are used for pattern matching, ensuring easy integration and customization.

The authors highlight the practical applications of the chatbot in handling natural language queries, particularly in Indonesian, and emphasize the flexibility of the RDBMS-based approach for updating knowledge and supporting multi-language implementation.

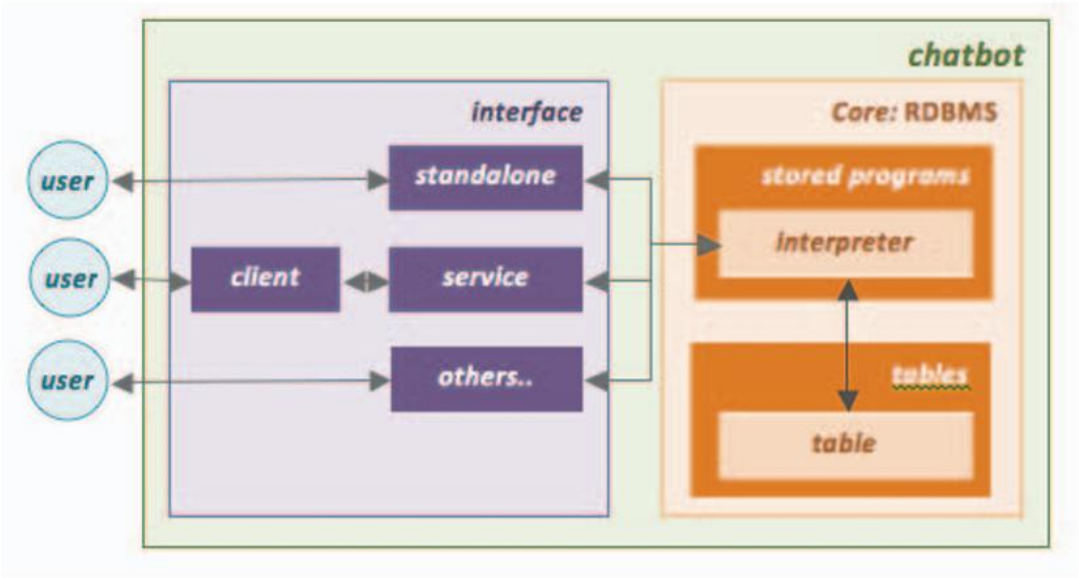


Figure 2.8 Global Design of Chatbot

2.2.5 Benefits of, Barriers to, and Needs for an Artificial Intelligence–Powered Medication Information Voice Chatbot for Older Adults: Interview Study With Geriatrics Experts

The author propose an AI-powered medication information voice chatbot to assist older adults in managing their complex medication regimens [18]. The authors emphasize that the chatbot leverages voice-based technology to address common challenges faced by older adults, such as diminished vision, reduced dexterity, and cognitive burdens. By providing features like medication reminders, instructions, and side effect information, the chatbot aims to improve adherence and support overall health. It also facilitates communication by connecting users with pharmacies, healthcare providers, and caregivers, thereby reducing the dependency on manual record-keeping and enhancing medication management. The authors highlight the chatbot's potential to make health management more accessible through its ease of use and voice-based interaction.

Despite its advantages, the authors identify barriers to the adoption of this technology, particularly among older adults aged 75 and above or those from lower socioeconomic backgrounds, who may struggle with technology familiarity. Privacy and security concerns also emerged as significant issues, as some older adults are wary of data misuse or breaches. Additionally, usability challenges, such as complex interfaces, troubleshooting difficulties, and voice recognition accuracy, were noted as areas needing refinement. The authors suggest that these barriers could be mitigated through the design of an affordable, user-friendly chatbot with clear language, native language support, and technical assistance.

The author further proposes that integrating the chatbot with existing technologies, such as smart speakers or patient portals, could enhance its adoption and usability. They argue that the system should be designed to cater to diverse user needs, including personalized interactions and seamless integration with caregivers and healthcare providers. The proposed chatbot represents a significant step toward improving medication adherence and overall health management for older adults, but the authors stress the importance of addressing barriers like cost, privacy, and usability to achieve widespread adoption. Future research should involve diverse populations and real-world testing to validate the chatbot's effectiveness and refine its design.

2.2.6 Assisting Personalized Healthcare of Elderly People: Developing a Rule-Based Virtual Caregiver System Using Mobile Chatbot

This [19] article focuses on creating a virtual caregiver system to address the personalized healthcare needs of elderly individuals. The proposed system integrates a rule-based "mind monitoring" service with mobile chatbot technology to encourage dialogue-based interaction, allowing elderly users to express their mental and physical states. Unlike traditional health monitoring approaches that rely on external sensors, this system prioritizes internal expressions such as emotions, thoughts, and feelings.

The chatbot engages users by asking daily questions, which are answered through simple "yes" or "no" responses or via speech recognition. These responses are quantified, visualized as graphs, and used to generate personalized summaries and advice. The aim is to enhance self-reflection and promote better self-care among elderly users. The study demonstrated the system's feasibility through a 14-month experiment involving elderly and younger participants, showing a response rate above 80% and reflecting real-life events like stress from COVID-19 restrictions.

Despite its effectiveness in usability and interaction, the authors highlight challenges such as the lack of gamification and the repetitive nature of questions, which could lead to boredom. They suggest integrating sensor-based technologies and gamification to improve engagement and functionality. The study underscores the potential of mobile chatbots as virtual caregivers, emphasizing their cost-effectiveness and scalability compared to physical care robots.

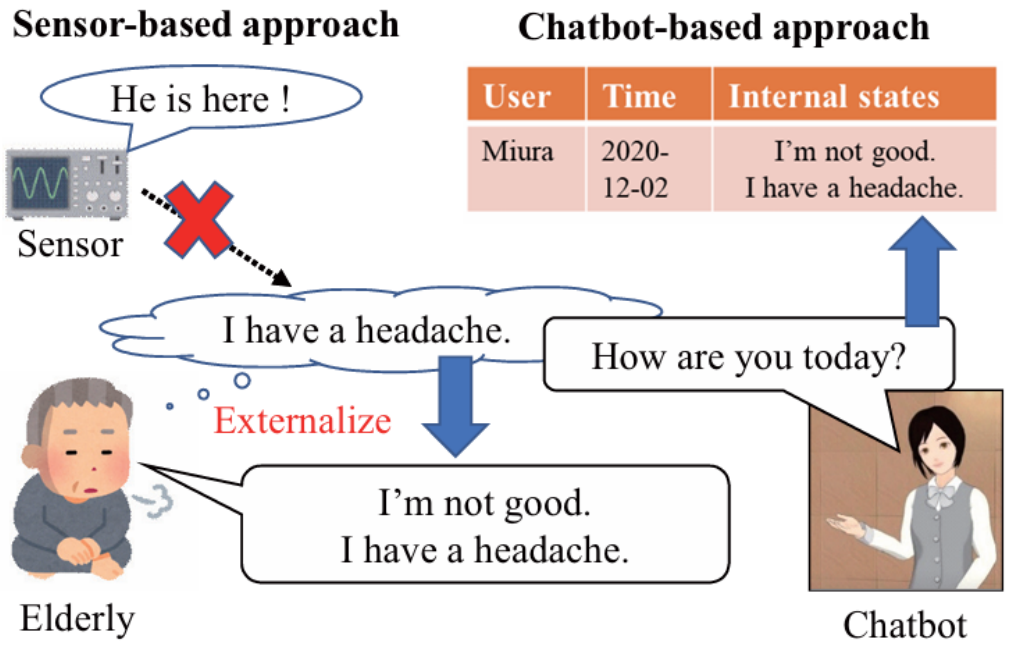


Figure 2.9 Sensor-based And Chatbot-based Approach For Elderly People

2.3 Previous Work on Elderly Tracking And Emergency Detection Mobile Applications

Elderly tracking and emergency detection applications use advanced technologies like accelerometers, machine learning, and real-time monitoring to ensure the safety and well-being of older adults. These systems focus on detecting critical events, such as falls, and providing timely alerts to caregivers, improving the quality of life for elderly individuals. The following sections summarize notable advancements, practical applications, and limitations in this domain.

2.3.1 Mobile applications for elderly healthcare: A systematic mapping

The study categorizes mobile health interventions using the World Health Organization's (WHO) Digital Health Initiatives framework, finding that most applications focus on Personal Health Tracking for independent elderly users. These apps emphasize monitoring vital signs, medication adherence, and scheduling medical appointments [20]. Despite advancements, the study identifies a significant gap in applications targeting dependent elderly users and public health system management, revealing an opportunity for research and innovation.

The analysis also highlights the spatiotemporal distribution of research, showing that most studies originate from developed countries, with the United States leading the publication count. In terms of validation techniques, controlled experiments and usability evaluations dominate, reflecting a focus on ensuring app effectiveness and user satisfaction. However, the study notes a lack of robust evaluation methods in many papers, leaving room for methodological improvement.

2.3.2 Development of Smart Elderly Care Mobile Application for Health Management System

Nowadays, elderly care faces numerous challenges, particularly in managing health effectively for both the elderly and their caregivers. Mobile applications like SECA are designed to address these health management challenges, especially in Malaysia, where the elderly population is rapidly increasing, necessitating systematic solutions to overcome inefficiencies in traditional methods [21]. SECA simplifies and streamlines health management with five core features: Medical Appointment, Medication, Daily Health Data, Health Summary, and Elderly Profile. These features allow users to manage appointments, track medication, monitor health parameters, and maintain comprehensive health records efficiently.

The application employs Firebase for secure and stable data storage, ensuring information remains accessible even in case of device malfunctions. Built using Android Studio, SECA minimizes development and maintenance costs, offering a cost-effective solution for elderly care. The authors emphasize the app's user-friendly design, making it intuitive and accessible for both elderly users and their caregivers. Additional features, such as a COVID-19 vaccination record and personal profile management, further enhance usability.

The study acknowledges limitations in existing mobile health applications like Pill Monitor and BookDoc, which suffer from instability, restricted usability, and narrow scopes. SECA addresses these gaps by offering a comprehensive suite of features tailored to elderly health management needs. The authors propose future improvements, such as multi-language support, healthcare facility directories, and media upload options, to make the app more versatile and inclusive. SECA demonstrates the transformative potential of mobile technology to revolutionize elderly care by

improving health management, fostering independence, and enhancing caregiver coordination.

2.3.3 Design of a Wearable Healthcare Emergency Detection Device for Elder Persons

Due to the high prevalence of falls as a leading cause of severe injuries and mortality among older adults, particularly those with dementia or metabolic disorders, the authors introduce a wearable system for detecting falls to improve safety and quality of life [22]. The proposed system employs a neural network embedded on an Arduino Nano 33 BLE Sense board for real-time movement detection, recognizing activities such as walking, running, and falling. Alerts are sent via Bluetooth to a connected smartphone, which notifies healthcare professionals if no response is received within 60 seconds, including the user's location and activity data to enhance emergency response efficiency.

The wearable device is portable, low-cost, and suitable for both indoor and outdoor use. Designed as a single wrist-mounted device, it minimizes complexity and enhances user comfort. The study validates its performance using pre-existing datasets and real-world testing, achieving an activity recognition accuracy of 78%. Battery consumption is reduced by processing data locally on the device instead of streaming it to external systems.

Despite its potential, the authors acknowledge limitations, including the system's modest accuracy improvement compared to chest-mounted sensors and the simplified neural network model that may restrict its ability to classify complex activities. Future directions involve expanding detectable activities, integrating speech recognition for comprehensive emergency detection, and applying advanced privacy and security measures. This work demonstrates a significant step forward in developing accessible and efficient fall detection technologies for elderly care.

2.3.4 Fall Detection Using Accelerometer-Based Smartphones: Where Do We Go From Here?

Falls are the second leading cause of unintentional injury deaths worldwide, according to the World Health Organization [22]. More than 37 million falls each year are severe enough to require medical attention [22]. The author reviews solutions for fall detection

using smartphone accelerometers, addressing falls as a critical health issue among older adults [23]. The study screened 267 articles, focusing on 15 that utilized either threshold-based algorithms or machine learning techniques for fall detection. Machine learning methods included decision trees, k-nearest neighbors, boosting, and neural networks, demonstrating sensitivity ranging from 60.4% to 99.3% and specificity from 74.6% to 100%.

The authors identify challenges in developing fall detection systems, such as limited participant diversity, small datasets, and artificial experimental setups that may not reflect real-world conditions. Most studies rely on simulated falls by young individuals, raising concerns about the algorithms' validity for elderly users. The review also highlights gaps in evaluation methods, including the lack of standardized testing and real-world validation. To address these issues, the authors recommend expanding the scope of studies, improving data science methodologies, and adopting advanced machine learning techniques like deep learning.

This research emphasizes the potential of smartphone-based fall detection applications as affordable and accessible tools to enhance elderly safety. It calls for the inclusion of more diverse datasets, rigorous validation processes, and sophisticated algorithms to improve the reliability and practicality of these systems in real-world settings.

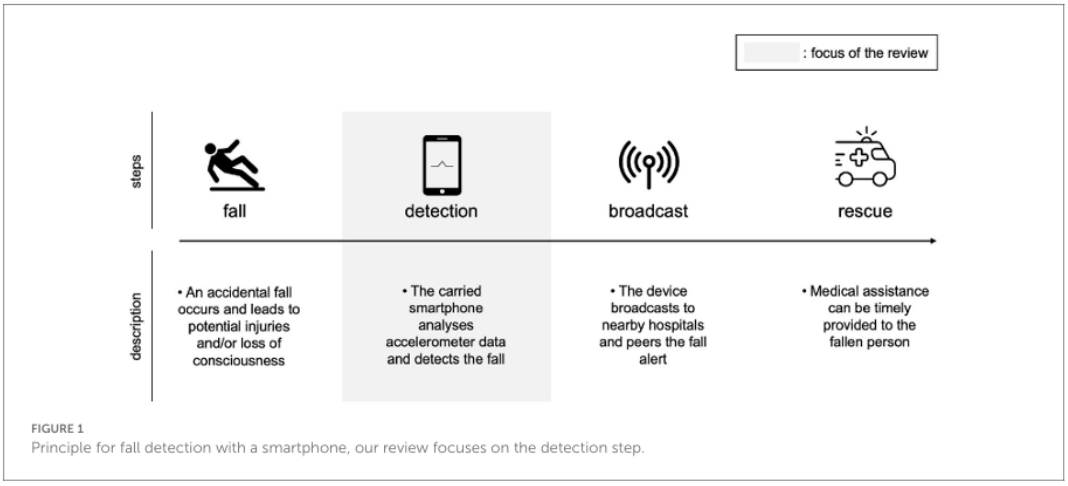


FIGURE 1
Principle for fall detection with a smartphone, our review focuses on the detection step.

Figure 2.10 Principle For Fall Detection

2.3.5 The Application of Machine Learning on the Sensors of Smartphones to Detect Falls in Real-Time

Falls are a significant global public health issue, ranking as the second leading cause of accidental fatalities after motor accidents, with approximately 684,000 deaths annually. Over 80% of these fatal falls occur in developing and middle-income nations, with individuals over 60 experiencing the highest death rates. Even non-fatal falls are a major concern, with more than 37.3 million falls each year severe enough to require medical attention [24]. To address this issue, the study [25] focuses on developing a smartphone-based fall detection system leveraging machine learning to enhance safety for the elderly. By utilizing accelerometer sensors embedded in smartphones, the proposed system provides real-time monitoring to categorize activities as "fall" or "not fall" using machine learning classifiers like Support Vector Machines (SVM) and k-Nearest Neighbors (KNN).

Data from smartphone accelerometers, recording x, y, and z-axis activity, is processed using MATLAB to identify patterns indicative of falls. A web-based platform connects the smartphone to MATLAB for real-time monitoring and emergency notifications, offering an efficient method for fall detection. The system's dataset includes diverse activities and fall scenarios, ensuring comprehensive training and testing. Results highlight the superior performance of the KNN model, achieving over 99.6% accuracy, sensitivity, specificity, and F1-score, with fewer misclassifications compared to SVM. The study emphasizes the system's effectiveness as a cost-effective and accessible solution, particularly beneficial for elderly individuals living independently.

Despite its potential, the authors recognize limitations, such as high energy consumption and the need for continuous signal processing. They propose optimizing energy efficiency by reducing data collection during inactivity. This work contributes to the field of wearable technology, showcasing the potential of machine learning-driven solutions to improve elderly care and safety.

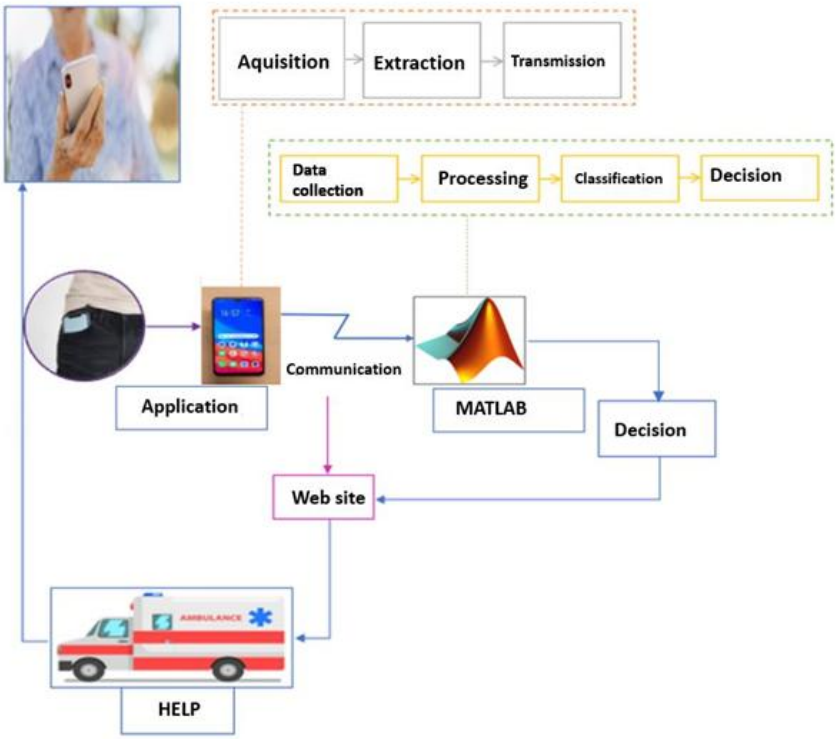


Figure 2.11 Falls Remote Monitoring System architecture

2.4 Previous Work on Cognitive Engagement

Cognitive engagement is essential for maintaining mental health, memory, and overall well-being, particularly among elderly individuals. Gamification has emerged as an effective tool to foster cognitive engagement by integrating game elements such as rewards, progress tracking, and interactive challenges into digital applications. These technologies aim to enhance user motivation, memory retention, problem-solving skills, and social interaction. The following sections explore notable studies and applications that leverage gamification to address cognitive decline and promote mental health, focusing on their features, benefits, and limitations.

2.4.1 Developing and Refining a Multifunctional Facial Recognition System for Older Adults with Cognitive Impairments

In [26], the "Developing and Refining a Multifunctional Facial Recognition System for Older Adults with Cognitive Impairments" paper explores the design and evaluation of a facial recognition-based assistive system intended to enhance memory recall and daily communication among elderly individuals with cognitive impairments. The system integrates facial recognition with supplementary features

like photo capturing and voice memo recording, offering a multi-modal approach to memory support. It highlights the emotional and social challenges faced by Alzheimer's patients, such as loneliness and frustration from not recognizing familiar people, and positions technological interventions as a means to address these issues. While the study successfully demonstrates the potential of using AI-driven face recognition to assist cognitive recall, the literature review portion mainly discusses existing face recognition technologies like dlib, FaceNet, and DeepFace without deeply analyzing their suitability for elderly users specifically. The paper could further benefit from a critical comparison of prior work in memory assistive technology and an exploration of human factors such as technology acceptance among seniors. Moreover, although the multifunctional design is emphasized, there is limited discussion on user testing results or longitudinal evaluation to validate its effectiveness in real-world daily use. Overall, the paper presents a strong foundation for AI-driven memory assistance but leaves room for deeper evaluation and user-centric studies.

2.4.2 Automatic Reminiscence Therapy for Dementia

In [27], the paper "Automatic Reminiscence Therapy for Dementia" presents an AI-driven solution to support reminiscence therapy for individuals with dementia by automating memory-stimulating conversations through photo-based prompts. The system, called Elisabot, uses deep learning techniques to generate personalized questions about users' uploaded photos, aiming to evoke memories related to people, places, and experiences. Unlike traditional image-based Q&A systems, the AI is designed to require prior personal knowledge, thus actively exercising the user's memory rather than simply describing the image content. The approach leverages multimodal architectures involving a Visual Question Generator (VQG) and conversational AI to create engaging dialogue, potentially expanding the accessibility of therapy beyond clinical environments to smartphones and home settings.

While the system shows strong potential in making reminiscence therapy more scalable and accessible, the literature review primarily focuses on the technological components of chatbot development and multi-modal AI, rather than deeply analyzing previous human-centered therapy research. Additionally, there is limited discussion on long-term cognitive outcomes or emotional effects of automated reminiscence sessions compared to traditional, therapist-led approaches. Nonetheless, the study effectively

bridges artificial intelligence and dementia care, offering a promising new pathway for supporting memory health in aging populations through intuitive and personalized interaction.

2.4.3 Exploring Photo-Based Dialogue Between Elderly Individuals and Generative AI Agents

In [28], the study "Exploring Photo-Based Dialogue Between Elderly Individuals and Generative AI Agents" examines the potential of combining photo prompts with conversational AI to support cognitive and emotional well-being among older adults. The project involves elderly participants interacting with AI agents that use personal or general photos as conversation starters, aiming to stimulate storytelling, memory recall, and emotional expression. Leveraging technologies such as computer vision and large language models like GPT-3.5, the system generates questions and comments to maintain natural and engaging dialogue. The study highlights how the use of familiar visual stimuli, combined with responsive AI conversation, can foster a greater sense of connection and cognitive engagement among seniors. While the research effectively demonstrates the benefits of using photo-based dialogue to enhance memory recall and emotional well-being, the literature review component primarily focuses on technical system design and general AI dialogue systems. There is limited critical comparison with existing human-led reminiscence therapies or studies examining the nuances of elderly user acceptance and emotional sensitivity. Nevertheless, the work represents an important advancement by showcasing how AI can be tailored to create personalized and meaningful interactions that could potentially delay cognitive decline and improve the quality of life for older adults.

2.4.4 Cognitive Benefits of Photo Reminiscence Therapy for Dementia Patients

In [29], the article "Cognitive Benefits of Photo Reminiscence Therapy for Dementia Patients" investigates the impact of photo-based reminiscence therapy (pRT) on cognitive function, emotional well-being, and social connection among elderly individuals living with dementia. Conducted as a pilot project across several senior living communities, the study paired dementia patients with trained university students who used personal and stock photographs to engage residents in memory-focused conversations. Findings suggest that photo reminiscence therapy can significantly

reduce social isolation, enhance emotional resilience, and support cognitive performance by stimulating memory retrieval through meaningful, familiar imagery.

Although the research provides encouraging evidence of the benefits of photo-based engagement, the literature review mainly emphasizes the therapeutic impact without a deep comparative analysis of other cognitive stimulation methods. Additionally, while the narrative highlights emotional improvements, it lacks detailed longitudinal data on sustained cognitive enhancement over time. Nevertheless, the study successfully positions photo reminiscence as a low-cost, non-pharmacological intervention that can meaningfully enrich the quality of life for individuals with memory impairments. It reinforces the idea that visual memory prompts, especially when tied to personal history, play a crucial role in preserving identity and mental function among older adults.

2.5 Limitation of Previous Studies

Previous studies highlight various limitations in existing systems and proposed solutions. The limitation of AgeWiser app [8] include the potential dependence on constant internet access for optimal functionality of certain features. These limitations highlight areas for improvement in each app to better cater to user needs and provide a more seamless experience. Next, the limitations of the Medisafe app [9] include the lack of offline access, and a potentially tedious initial setup process for users with extensive medication regimens. Last, the MyTherapy app [11] faces limitations such as the time-consuming setup process for entering a large number of medications and occasional notification issues, particularly when battery-saving modes are enabled on devices. In [15], the authors note that the system's dialogue recognition quality needs improvement to handle more complex user interactions. They also emphasize the limited features of the voice assistant, suggesting the need for advanced functionalities and better interaction capabilities. The authors in [18] point out challenges with technology familiarity among older adults, particularly those aged 75+ or from lower socioeconomic backgrounds, who may struggle to adopt digital tools. Privacy concerns regarding data usage, usability issues like voice recognition errors, and complex interfaces further hinder adoption. Additionally, the reliance on geriatrics experts rather than older adults limits the generalizability of the findings. They recommend addressing these issues with affordable, user-friendly designs, strong privacy measures, and studies

involving diverse populations. The mobile application discussed in [19] also has limitations, including the repetitive nature of chatbot questions, which may lead to user boredom and reduced engagement over time. The system lacks gamification elements that could improve user motivation and interaction. While the chatbot effectively collects self-reported mental and physical states, the absence of sensor-based technologies restricts its ability to provide comprehensive health monitoring, such as detecting physical activities or environmental factors. Similarly, in [25], the proposed system is noted for high energy consumption due to continuous data collection and signal processing, which impacts device battery life. The system's reliance on MATLAB and a web-based platform limits its standalone functionality in real-world scenarios, while potential delays in signal transmission could affect its reliability during critical moments.

2.6 Proposed Solutions

The proposed Elderly Care mobile application aims to overcome the limitations of existing systems by integrating AI-powered assistance, cognitive engagement features, and robust emergency response tools to improve the safety, independence, and well-being of elderly users. At the core of the system is an image recognition technology, the system ensures accurate recording of medication schedules and notifies caregivers of missed doses or changes, promoting seamless coordination between the user and their support network. Combined with AI chatbot that supports users in managing their medications, providing timely reminders and allowing updates through natural language input. Additionally, a facial recognition module assists users in identifying familiar faces and recalling memories through associated photos or prompts, fostering both memory support and emotional connection. For emergency response, the app integrates sound detection capabilities to identify critical events such as shouting or falls. If the user fails to respond to a safety prompt, the system automatically sends alerts, including calls and location details, to caregivers or emergency services. An offline emergency button is also provided to ensure that users can request help even without internet connectivity. Accessibility remains a key design principle, with the interface featuring large buttons, simplified navigation, and clear visual cues to ensure ease of use for elderly individuals, including those with limited technological experience. By combining these innovative features, the application delivers a

comprehensive, reliable, and user-friendly solution that enhances elderly users' independence, safety, and quality of life, while simultaneously supporting caregivers in providing timely assistance.

Chapter 3

System Methodology/Approach OR System Model and System Design

Proposed Method/Approach

The development of the Elderly Companion Application followed the **Rapid Application Development** (RAD) methodology, which emphasizes fast prototyping, iterative design, and incremental delivery. The processes were categorized into four distinct phases: Requirement Planning, Prototyping, Development and Integration, and Testing and Refinement.

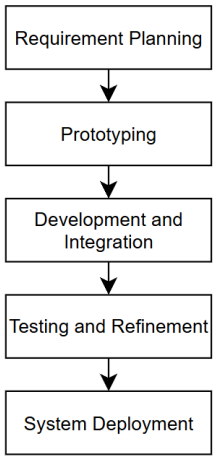


Figure 3.1 Overall Development Phase

3.1 Rapid Application Development method:

3.1.1 **Requirement Planning:**

This phase focused on identifying the key features of the application, such as medication and appointment management, emergency detection, and gamified brain activities. Tools and technologies like Android Studio, Firebase, and TensorFlow Lite

were selected to meet the functional and technical requirements. The aim was to create a clear roadmap for the development process.

3.1.2 **Prototyping:**

In this phase, prototypes of core features were developed to test functionality and feasibility. Prototypes included an AI-powered chatbot for medication management, sensor-based emergency detection, and facial recognition. These prototypes were internally tested and refined to ensure they met basic requirements and were ready for integration.

3.1.3 **Development and Integration:**

The refined prototypes were converted into fully functional modules and integrated into a single system. AI models for image recognition and emergency detection were trained, Room Database was used for storage. The user interface was designed to ensure accessibility and ease of use for elderly users.

3.1.4 **Testing and Refinement:**

The application underwent rigorous testing to ensure reliability and usability. Unit testing was performed for individual modules, and integration testing ensured all components worked seamlessly together. Feedback, if available, was incorporated to refine the application and address any issues.

3.2 System Design Diagram

3.2.1 System Flowchart

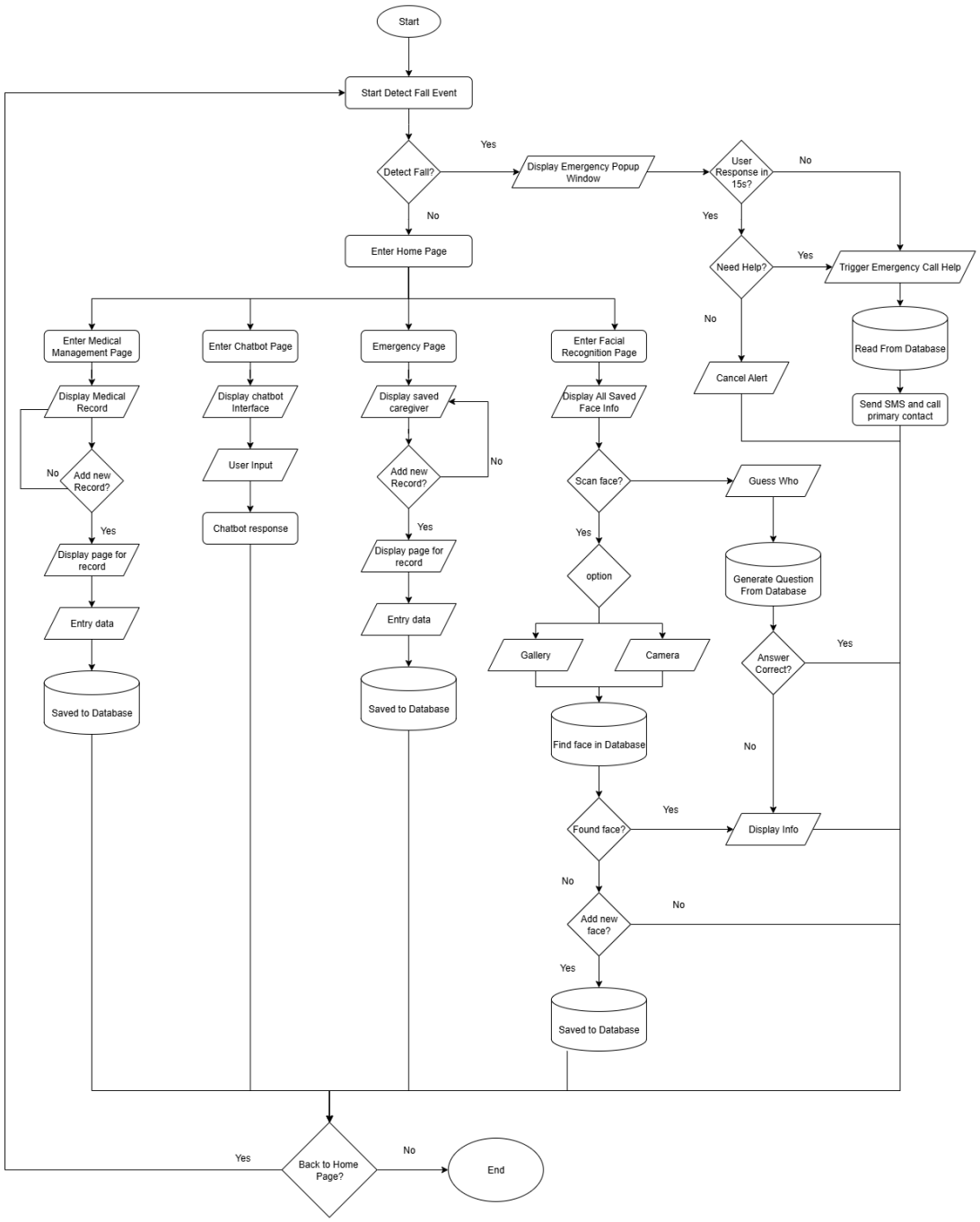


Figure 3.2 Flowchart

The flowchart illustrates the overall workflow of the Elderly Companion Application, starting with the fall detection mechanism. When a fall event is detected, the system immediately displays an emergency popup window and waits for the user's response within 15 seconds. If the user does not respond in time, the system

automatically triggers emergency assistance by retrieving caregiver information from the database and sending an SMS or call to the primary contact. If the user responds, they can either cancel the alert by confirming they are safe or request help to notify their caregiver. In cases where no fall is detected, the user is directed to the home page, which provides access to four main features: medical management, chatbot interaction, emergency information, and facial recognition. Within the medical management module, users can view previously saved medical records and add new entries, which are then stored in the Room Database. The chatbot module presents a conversational interface where users can enter queries, receive responses, and save relevant information if necessary. The emergency module displays stored caregiver details and allows users to add new caregiver contacts for quick access in urgent situations. The facial recognition module enables users to view saved face profiles, scan new faces using the camera or gallery, and verify them against the database. If a match is found, the system displays the related information, whereas unmatched faces can be saved as new entries. Additionally, a “Guess Who” feature leverages stored questions from the database to assist users in recalling individuals. At the end of any interaction, users are given the option to return to the home page or end the session, ensuring the application provides a complete yet straightforward flow tailored to elderly users’ needs.

3.2.2 Use Case Diagram

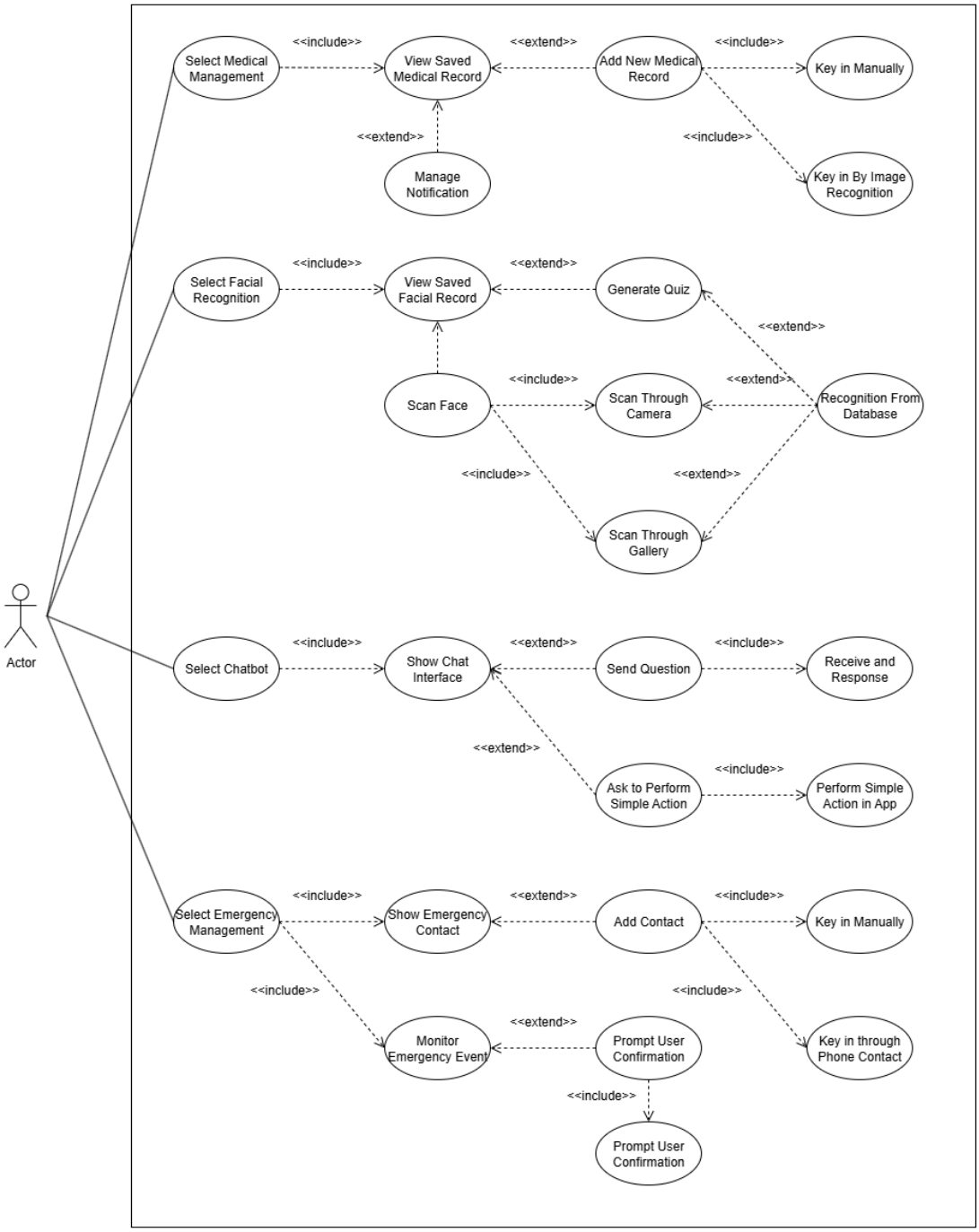


Figure 3.3 Use case diagram

The use case diagram illustrates the main functionalities available to the user in the Elderly Companion Application. The user can select four primary features: medical management, facial recognition, chatbot interaction, and emergency management. In the medical management module, the user can view saved medical records, manage

notifications, or add new medical records either manually or through text recognition. In the facial recognition module, the user can view saved faces, guess saved faces and scan new faces using the camera or gallery, with the system either displaying recognized information or allowing new face registration. Through the chatbot feature, users can access a chat interface, send health-related questions, and receive responses generated by the OpenAI API, user also can ask chatbot to perform simple action in the app like add new medical or modify medical. The emergency management feature allows users to modify caregiver, view emergency details, monitor emergency events, prompt for user confirmation during critical situations, and send alerts to caregivers if needed. Each use case represents how the system responds to the user's actions to provide a supportive and interactive experience.

3.2.3 Activity Diagram

Medical Management Activity

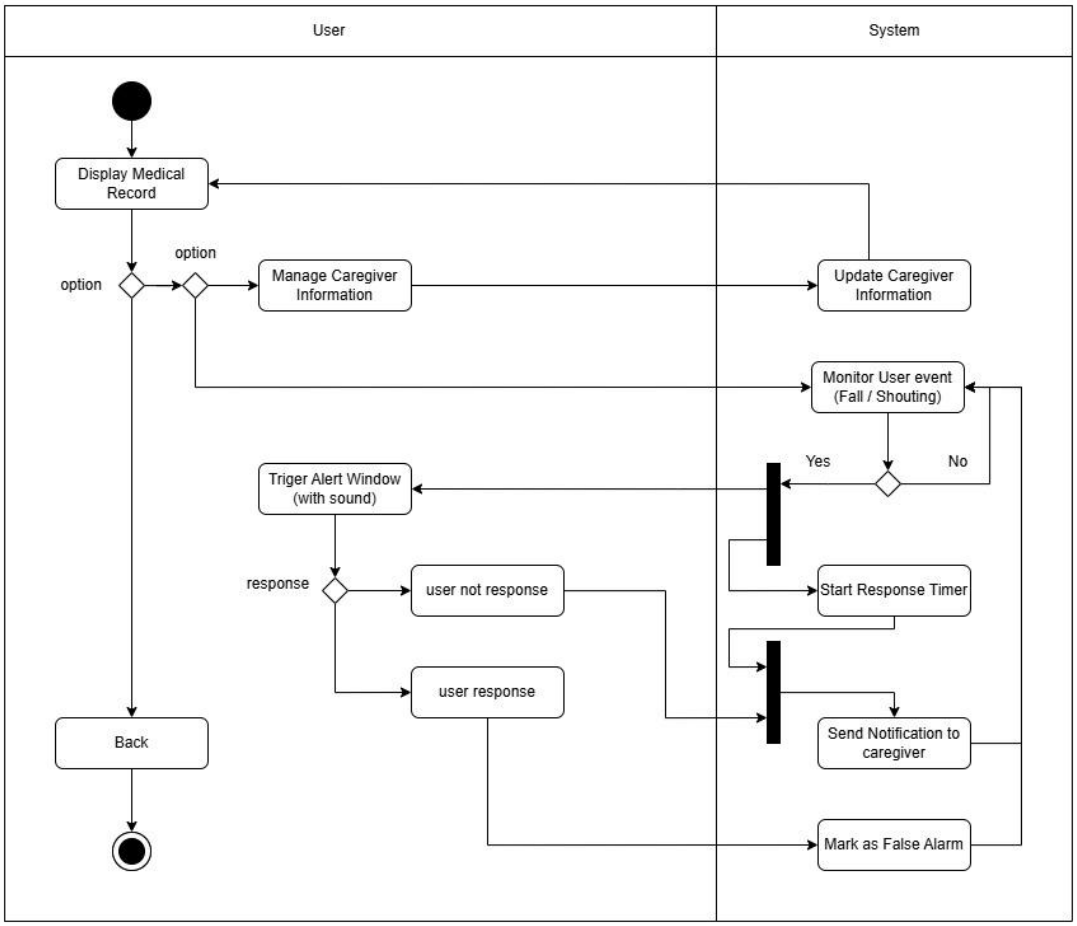


Figure 3.4 Medical Activity

This diagram shows how a user manages their medical records. After viewing the records, the user can either manage notification settings or choose to add a new medication record. For new records, users can input the information manually or use text recognition. After confirming the input, the system saves the data into the Room Database, and the user is returned to the main interface.

Chatbot activity

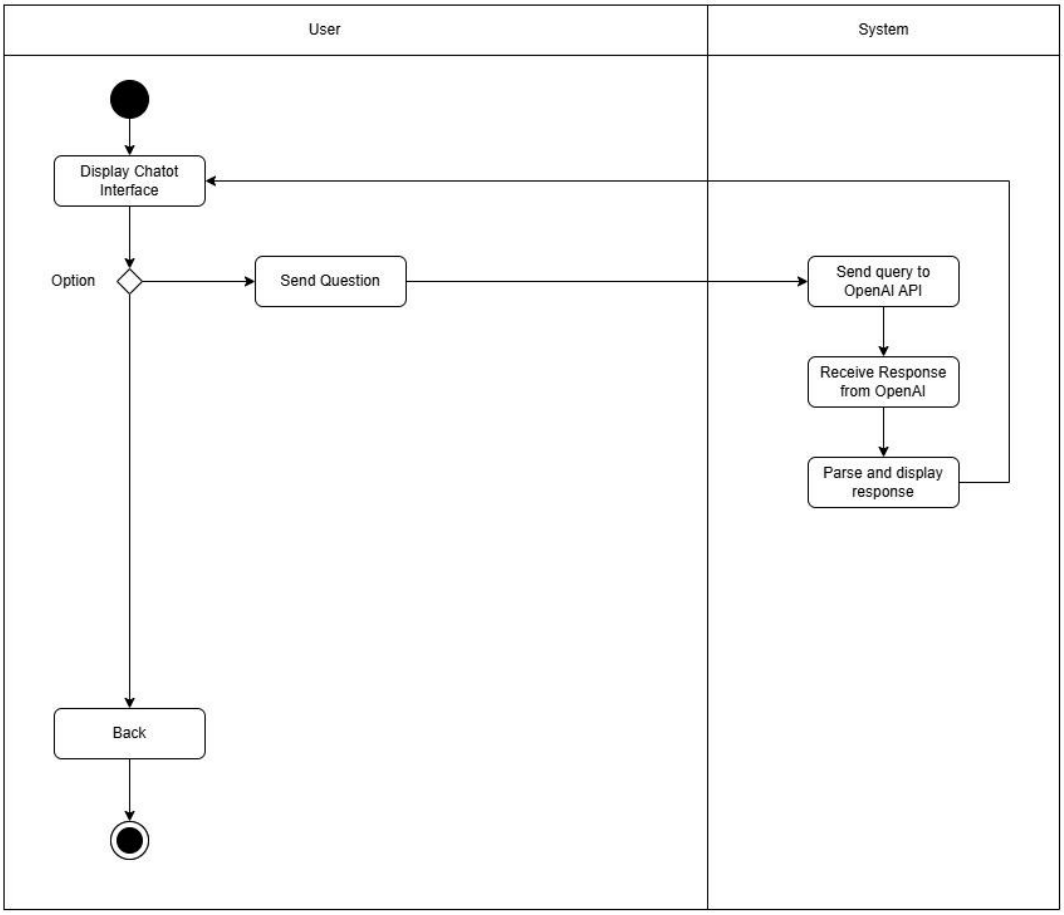


Figure 3.5 Chatbot activity

This diagram shows how a user interacts with the chatbot system. The chatbot interface lets users easily communicate with the system to obtain health-related information or perform simple tasks. When the user enters the chatbot page, a chat interface is displayed, allowing them to type their queries. These inputs are then processed through the integrated AI service, which generates relevant and supportive responses to guide the user. The chatbot not only answers health or daily life questions but can also be extended to perform simple in-app actions, such as displaying reminders or retrieving saved records.

Facial Recognition Activity

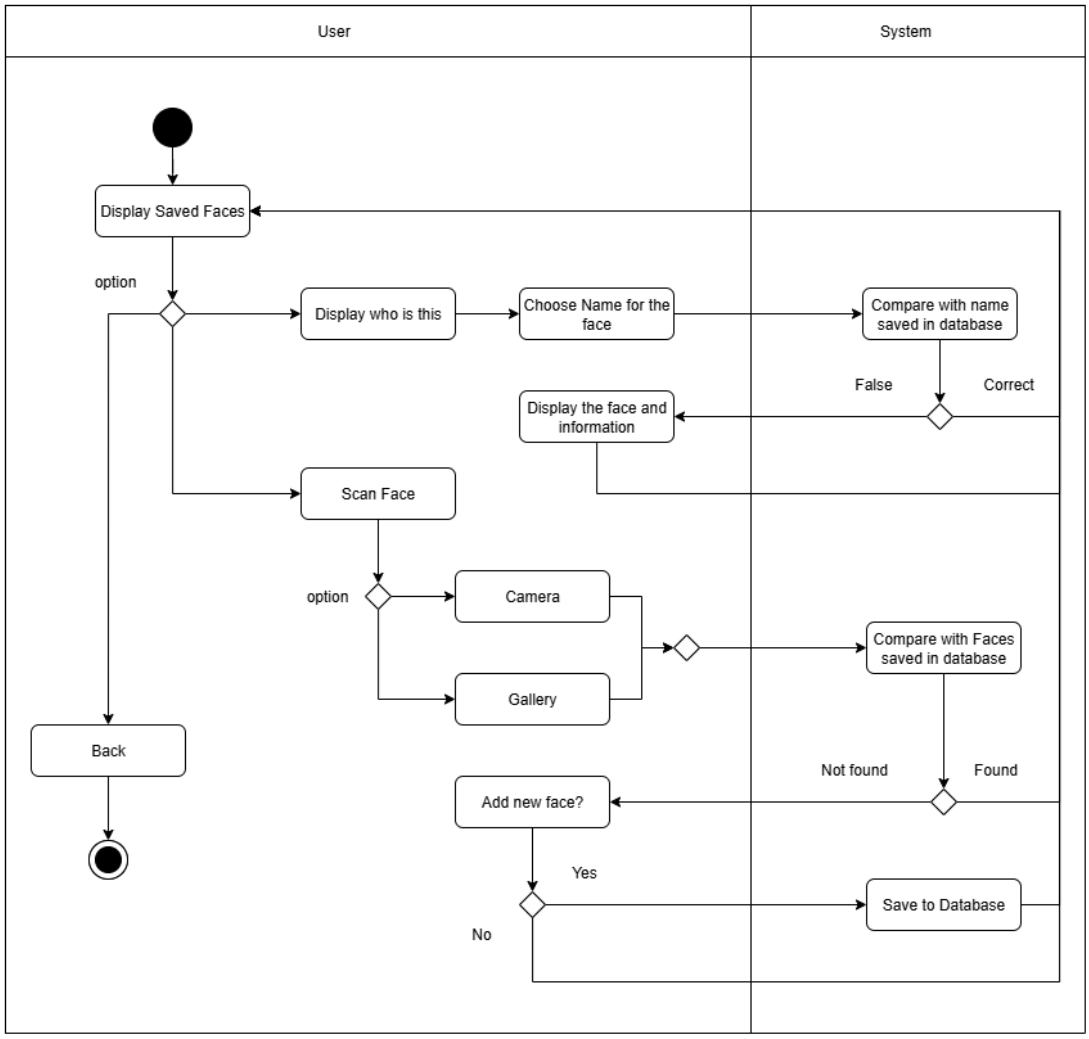


Figure 3.6 Facial Recognition Activity

This diagram describes the facial recognition flow. The process begins with the option to view saved facial records. Users may also engage in a “Who is this?” quiz, which serves as a memory aid by presenting stored profiles in a question-and-answer format. Alternatively, the user can scan a new face either through the device camera or by selecting an image from the gallery. Once the face is captured, the system compares it against the existing database to determine if a match is found. If the face already exists, the corresponding information is displayed to the user; if no match is found, the system prompts the user to add the new face along with its details. The new entry is then securely stored in the local database.

Emergency Activity

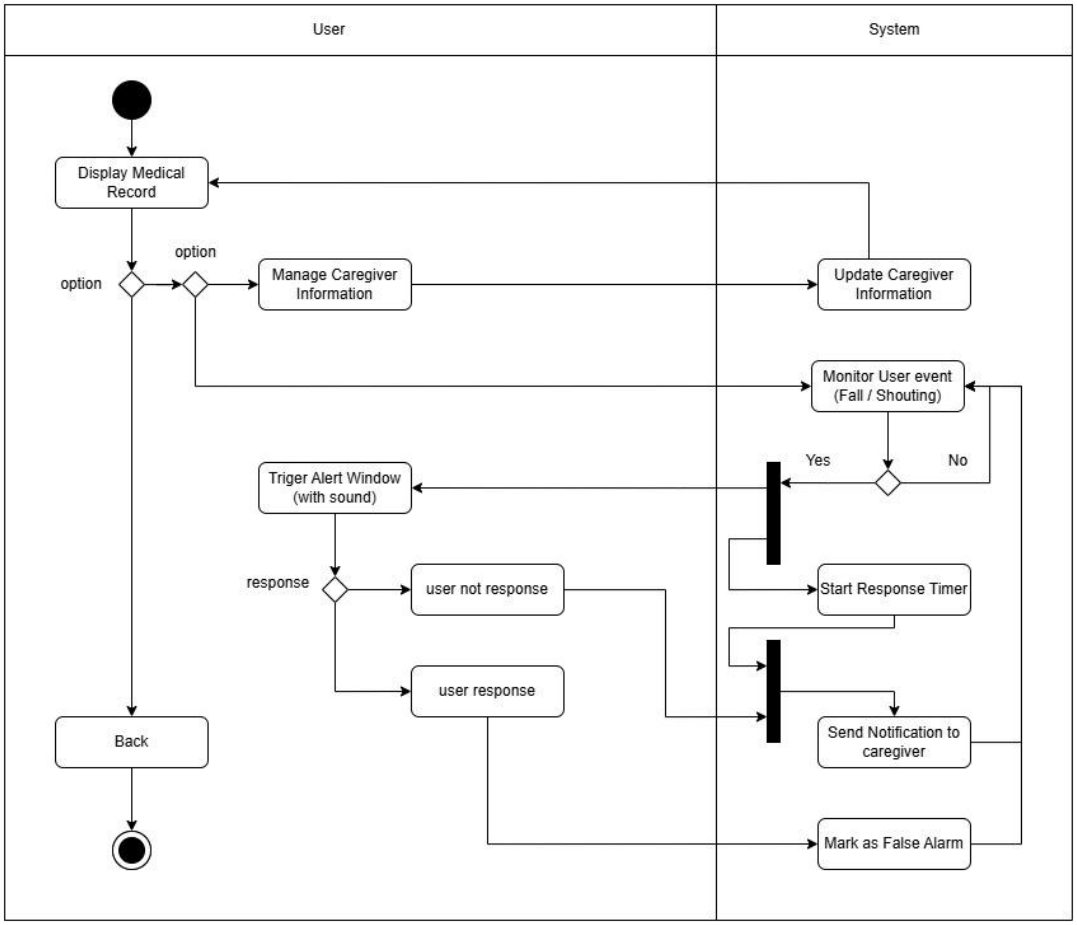


Figure 3.7 Emergency Activity

This diagram describes how the system monitors and responds to critical user events such as fall or calls for help. The process begins with the system continuously monitoring user activity to detect potential emergencies. If an event is detected, the system immediately triggers an alert window accompanied by sound and starts with a response timer. The user is then prompted to respond within the given time frame. If the user responds, the system interprets it as a false alarm and marks the event accordingly. However, if the user does not respond within the set duration, the system automatically sends a notification to all saved caregivers and calls the primary caregiver, alerting them to a possible emergency. In addition, the application allows the user to manage caregiver information by adding or updating contacts, with support for up to three caregivers stored in the system. This ensures that multiple caregivers can be notified during emergencies, improving reliability and response time.

3.2.4 System Block Diagram

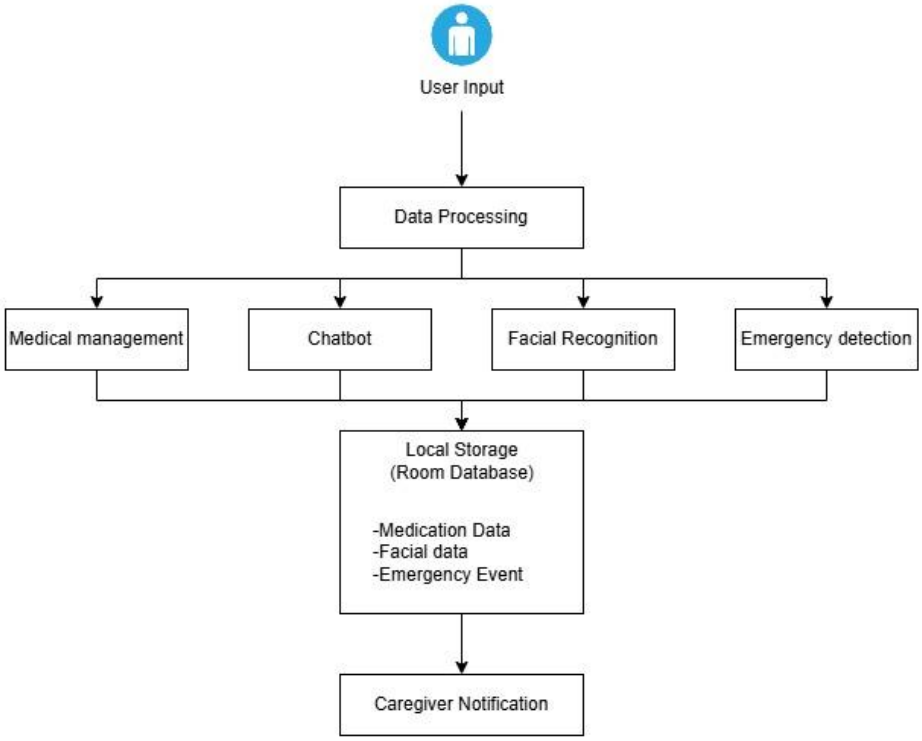


Figure 4.1 Block Diagram

The block diagram illustrates the main data flow of the Elderly Companion Application. The process begins with user input, where users interact with the application through various actions such as text input, image scanning, or sensor detection. This input is processed and directed into four core modules: medical management, chatbot, facial recognition, and emergency detection. Each module handles its specific task, such as managing medication records, responding to health-related queries via the OpenAI API, recognizing familiar faces through image input, and detecting emergency situations like falls or loud noises. All generated data, including medication details, facial recognition results, and emergency events, are stored locally in the Room Database. Based on the stored data, the system can then send caregiver notifications, ensuring timely reminders and alerts to assist the user effectively.

3.2.4 System Component Specifications

Main Page

Purpose:

To act as the central dashboard of the application, giving users quick access to the core features such as medical management, emergency assistance, chatbot interaction, and facial recognition. It provides an overview of active reminders, notifications, and important updates, ensuring that users can easily navigate to their desired function.

Dependencies:

Depends on the navigation component to manage smooth transitions between different modules, and on the database to retrieve and display real-time information such as medical schedules or caregiver details.

Medical Management

Purpose:

To allow users to record, store, and manage their medical information such as medications, schedules, and dosage reminders. It ensures elderly users can keep track of their daily medical needs and caregivers can access accurate health records when required.

Dependencies:

Depends on the Room Database for storing and retrieving medical data, and on the notification system to alert users of scheduled medication times.

Emergency

Purpose:

To provide immediate assistance during critical events such as falls or distress situations. It prompts the user with an alert window, and if no response is detected within the countdown, it automatically notifies and calls the registered caregivers.

Dependencies:

Depends on sensor/event monitoring services to detect emergencies, the caregiver database to fetch contact details, and the device's SMS/Call functionality to notify caregivers.

Chatbot

Purpose:

To provide an interactive communication interface where users can ask health-related questions or request simple actions in the app. The chatbot delivers AI-generated responses and can perform tasks such as retrieving records or showing reminders, making the application more user-friendly.

Dependencies:

Depends on the OpenAI API (or equivalent AI service) for generating responses, and on text/voice input components to capture user queries.

Facial Recognition

Purpose:

To assist users in identifying and recalling individuals by scanning faces and matching them against stored records. It helps elderly users recognize family members or caregivers and allows new faces to be added to the system for future recognition.

Dependencies:

Depends on the device camera or gallery for image input, the facial recognition model for face matching, and the Room Database for storing and retrieving facial profiles.

3.3 Project Timeline

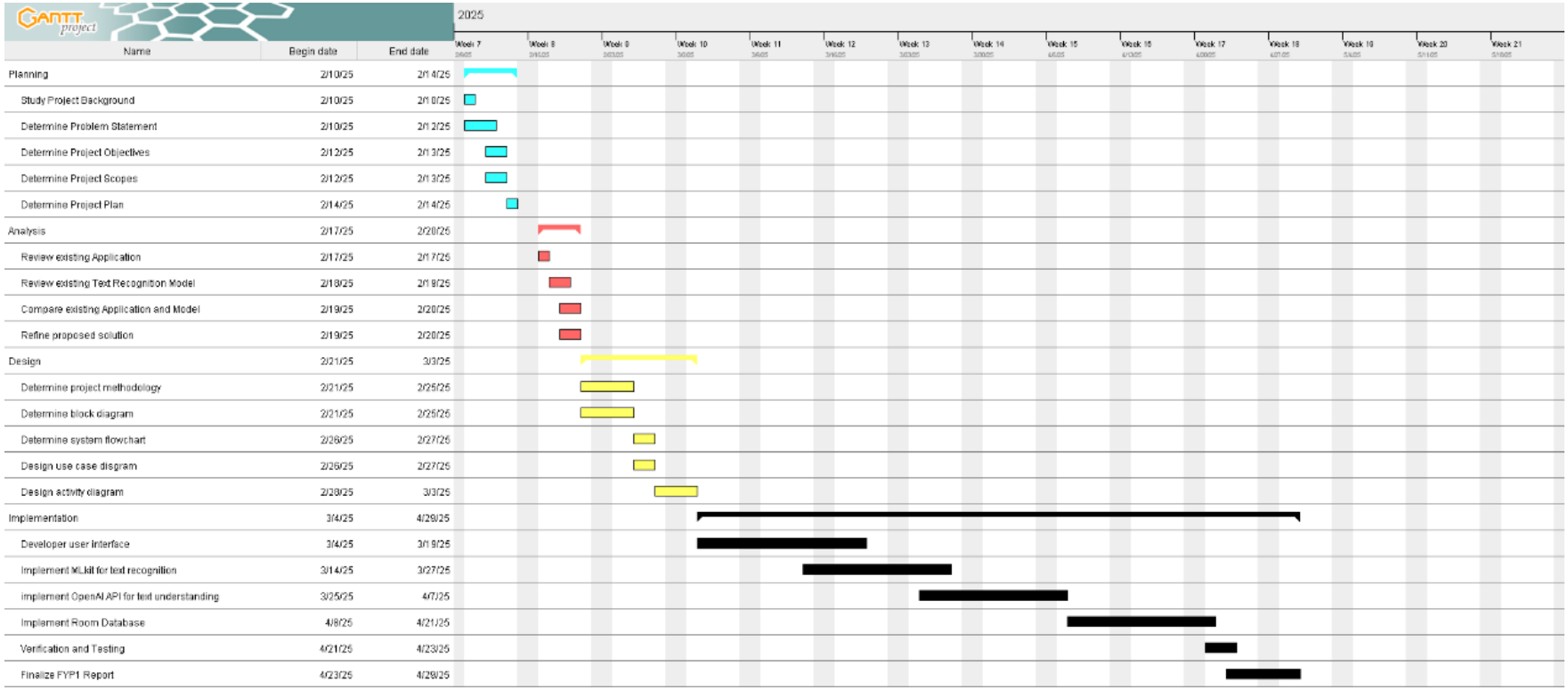
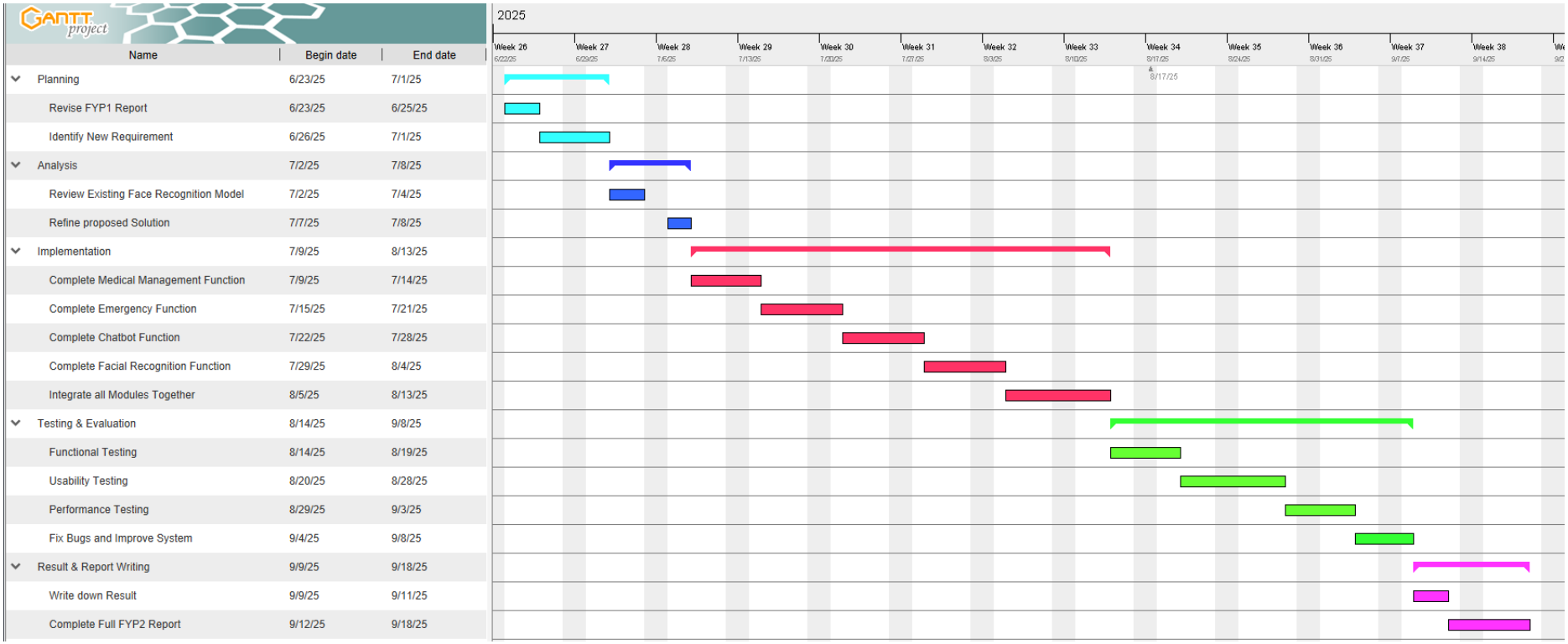


Figure 3.8 FYP 1 Project Timeline



Name	Begin date	End date
Planning	6/23/25	7/1/25
Revise FYP1 Report	6/23/25	6/25/25
Identify New Requirement	6/26/25	7/1/25
Analysis	7/2/25	7/8/25
Review Existing Face Recognition Model	7/2/25	7/4/25
Refine proposed Solution	7/7/25	7/8/25
Implementation	7/9/25	8/13/25
Complete Medical Management Function	7/9/25	7/14/25
Complete Emergency Function	7/15/25	7/21/25
Complete Chatbot Function	7/22/25	7/28/25
Complete Facial Recognition Function	7/29/25	8/4/25
Integrate all Modules Together	8/5/25	8/13/25
Testing & Evaluation	8/14/25	9/8/25
Functional Testing	8/14/25	8/19/25
Usability Testing	8/20/25	8/28/25
Performance Testing	8/29/25	9/3/25
Fix Bugs and Improve System	9/4/25	9/8/25
Result & Report Writing	9/9/25	9/18/25
Write down Result	9/9/25	9/11/25
Complete Full FYP2 Report	9/12/25	9/18/25

Figure 3.9 FYP 2 Project Timeline

CHAPTER 4
System Implementation

4.1 System Setup

4.1.1 Hardware

The hardware involved in this project includes a computer. The computer is used for processing and integrating AI technologies, such as the development of the chatbot, emergency detection system, and gamification features. It is also utilized for testing and refining the application during development.

Description	Specifications
Model	ROG Strix G713IH
Processor	AMD Ryzen 7 4800H with Radeaon Graphics
Operating System	Windows 11 Home Single Language
Graphic	NVIDIA GeForce GTX 1650
Memory	16GB DDR4 RAM
Storage	512GB SATA SSD+ 1TB SATA HDD

Table 5.1 Specifications of laptop

4.1.2 Software

The software for this project will be developed using **Kotlin**, a robust and widely used language for Android application development. The **Android Studio IDE** will be utilized to provide tools for coding, debugging, and testing the application. Java is chosen for its compatibility with a variety of Android devices, strong community support, and object-oriented features, which make it ideal for developing scalable and reliable mobile applications. For backend services, Firebase will be used primarily for real-time caregiver notifications, user authentication, and cloud-based backup of essential data. Meanwhile, the Room Database will be implemented locally to manage critical information such as medication schedules, emergency alert history, and facial recognition data. This ensures quick offline access, real-time responsiveness, and secure data handling directly on the device. Firebase's compliance with GDPR and

HIPAA standards ensures secure transmission and backup of sensitive user information.

The application's AI-powered chatbot will be integrated using the ChatGPT API, allowing users to manage medication schedules, answer health-related queries, and receive personalized reminders through natural conversational interactions. For image recognition tasks, external APIs will be utilized to process medication labels and appointment notes efficiently, reducing on-device computation requirements. Emergency detection algorithms will use device sensors (microphone and accelerometer) to identify critical events such as falls, shouting, or phone dropping in real-time, automatically triggering alerts if necessary.

Memory support features, including facial recognition for familiar faces, will be incorporated to assist elderly users in recalling family members, caregivers, and friends. The system will match live camera input against stored facial data and display associated names and memories, helping to strengthen emotional connection and support memory retention. By combining the flexibility of Java development, the efficiency of Room Database for local storage, Firebase for cloud backup and caregiver communication, and AI APIs for chatbot, image recognition, and facial identification, the Elderly Companion Application will deliver a high-performing, accessible, and secure solution tailored for elderly care.

4.2 Setting and Configuration

4.2.1 Software

Before starting to develop the Elderly Companion Mobile Application, there is software needed to be installed and downloaded into my laptop:

1. Android Studio: 2023.1.1.28

4.2.2 Android Studio Setup

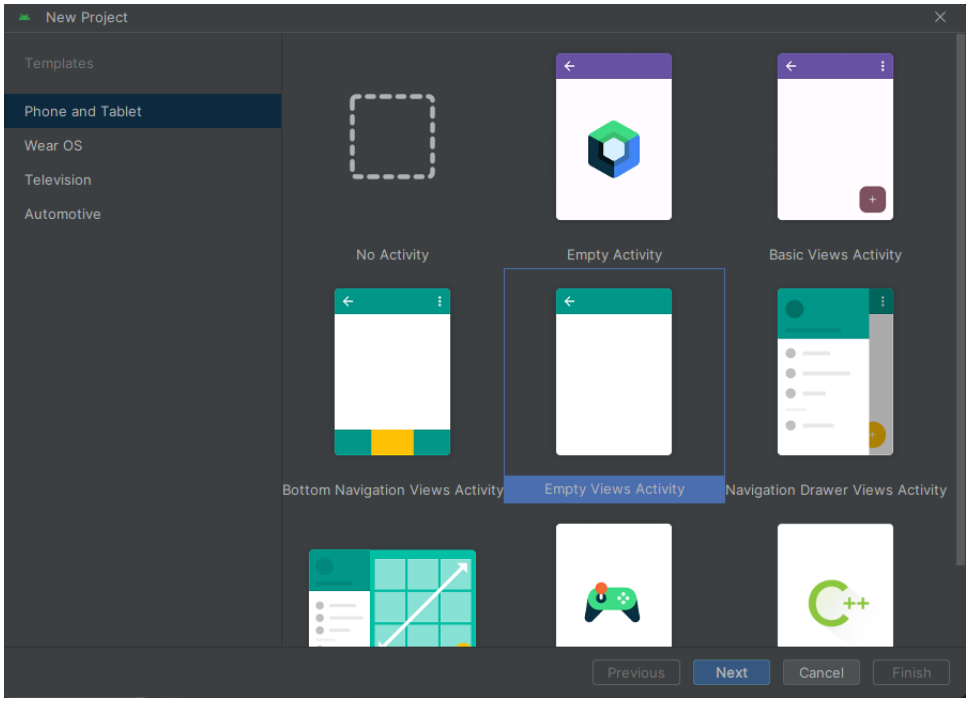


Figure 5.1 Select Activity

First, click “Empty View Activity” to start a new project.

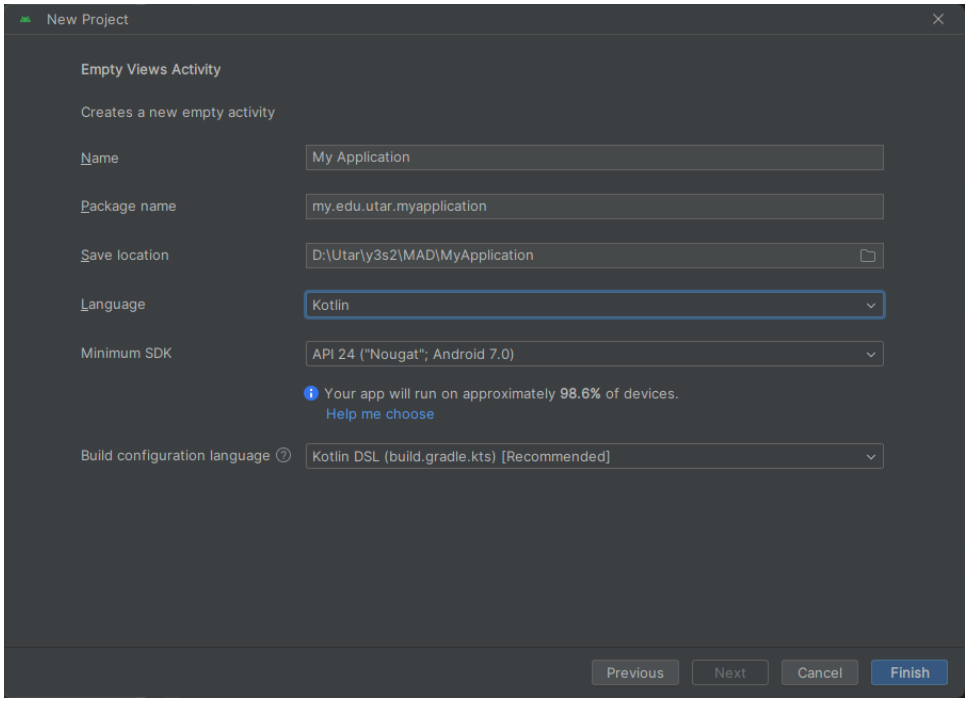


Figure 5.2 Activity Configuration

Set language to Kotlin, minimum SDK API 24 ("Nougat", Android 7.0) and Kotlin DSL configuration language to run the application

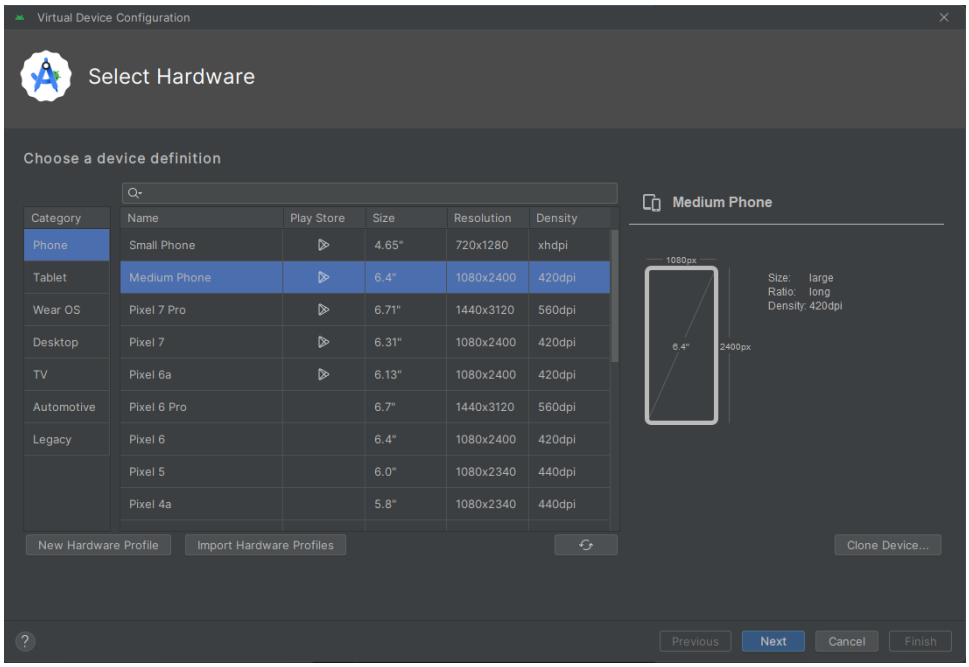


Figure 5.3 Select Hardware

Select Medium Phone for virtual device and press next

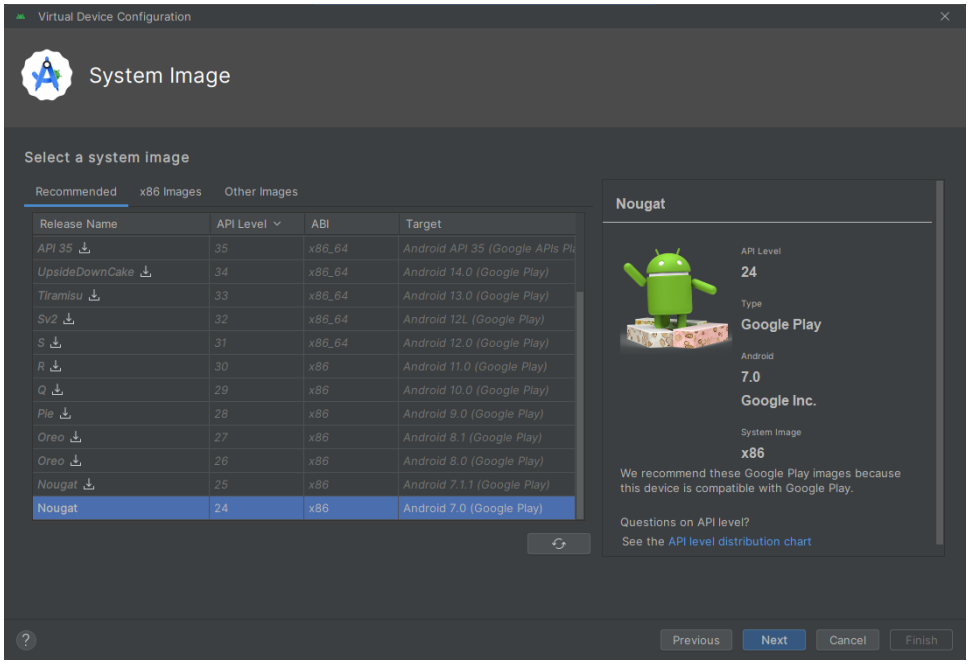


Figure 5.4 System Image

Select Nougat and press next

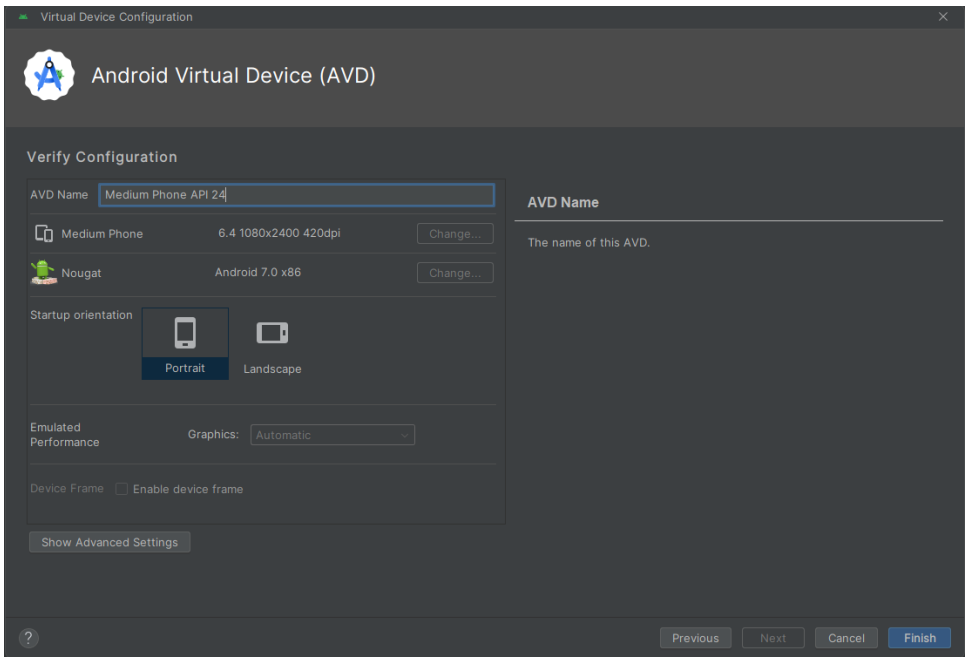


Figure 5.5 Android Virtual Device

Define virtual device name

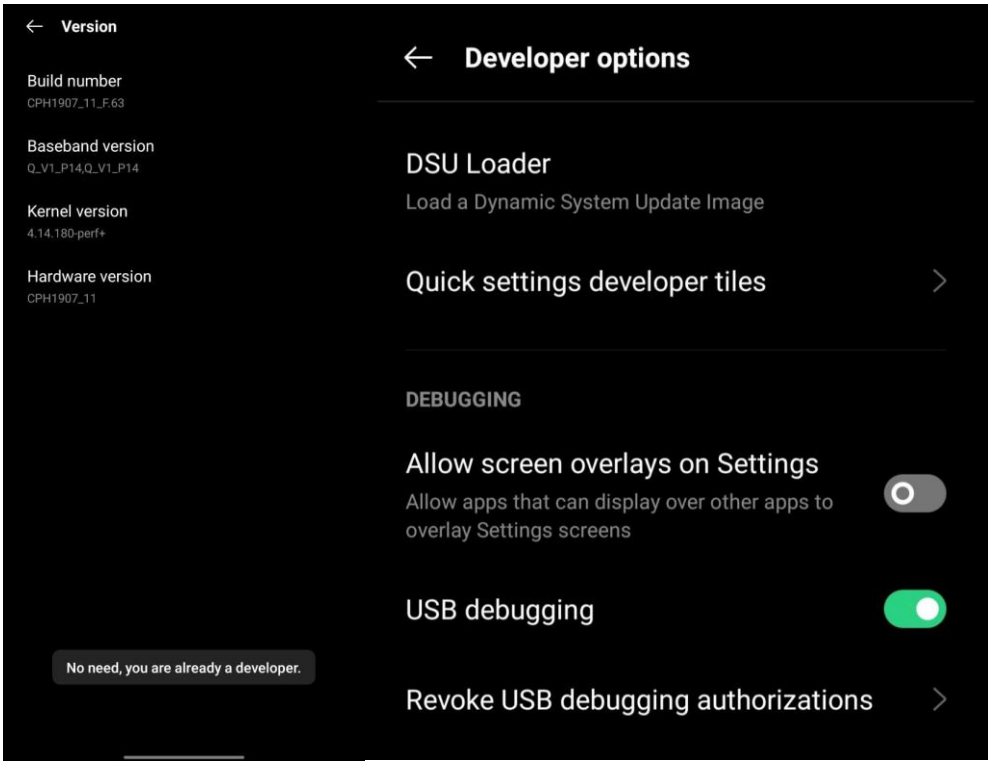


Figure 5.6 Activate USB Debugging

To run on physical device, go to phone's settings, click on build number for activate developer mode and allow USB debugging

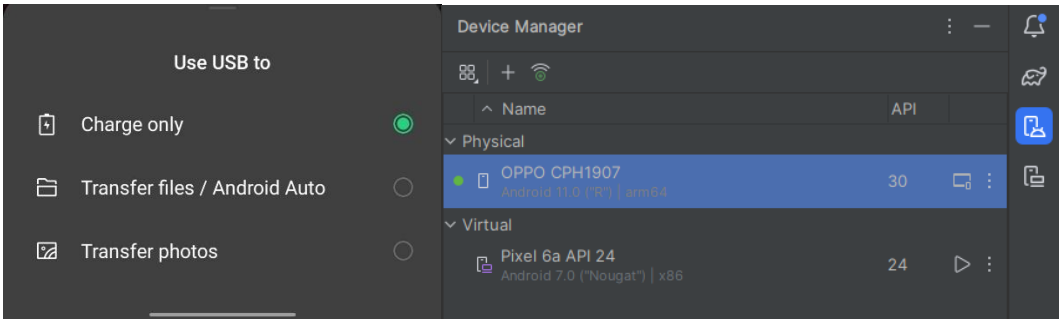


Figure 5.7 Device Manager

View the physical device in the device manager

4.3 System Requirements

4.3.1 Functional requirements

Main Page:

1. Users should be able to view active dose and next dose information
2. Users should be able to view bottom navigation bar.
3. Users should be able to enter Medical Module Page.
4. Users should be able to enter Ai Assistant Module Page.
5. Users should be able to enter Emergency Module Page.
6. Users should be able to enter Family Face Recognition Module Page.
7. Users should be able to enter SOS alert Page.

Medical Module Page:

1. Users should be able to view all medical information saved.
2. Users should be able to enter Add Medication Page.
3. Users should be able to enter all information manually.
4. Users should be able to scan a photo from camera or gallery.
5. Users should be able to get scanned results after scanning a photo.
6. Users should be able to add reminder time.
7. Users should be able to get alert when Reminder time up.
8. Users should be able to click I took it to stop the alert.
9. Users should be able to click Remind me Later to get delay reminder after 5 minutes.

Emergency Module Page:

1. Users should be able to view all emergency contact.
2. Users should be able to add Emergency contact up to 3 people.
3. Users should be able to add emergency contact from phone contact.
4. Users should be able to add emergency contact manually.
5. Users should be able to continuously monitor by the fall detection sensor.
6. Users should be able to get alert when fall detect.
7. Users should be able to click “Yes, I’m fine” button to stop the alert.
8. Users should be able to click “I need help” button to send SMS and call to primary emergency contact.

Chabot Module Page:

1. Users should be able to use the chatbot interface.
2. Users should be able to send questions to chatbot.
3. Users should be able to get replies from chatbot.
4. Users should be able to click the predefine button at the top of the chatbot.
5. Users should be able to perform some action to the medication through chat.

Family Face Recognition Module Page:

1. Users should be able to view all saved faces.
2. Users should be able to click on the face and get voice replies for that face.
3. Users should be able to call the saved face information.
4. Users should be able to see detailed information for the face.
5. Users should be able to edit detailed information for the saved faces.
6. Users should be able to delete saved faces.
7. Users should be able to improve recognition by adding different angle photos.
8. Users should be able to scan a face from camera or gallery.
9. Users should be able to get feedback when the scan face is saved.
10. Users should be able to add new face when not saved.
11. Users should be able to take a quiz by clicking “Who is this?”.
12. Users should be able to get replies when answering wrongly.
13. Users should be able to get replies when answering correctly.

4.3.2 Non-Functional Requirements

Performance

1. System should be able to respond to user actions within acceptable time limits.
2. System should be able to perform on-device recognition accurately and effectively.

Reliability

1. System should be able to provide effective error handling to handle unexpected situations.
2. System should be able to provide meaningful error messages to users.
3. System should be able to run smoothly.

Security

1. System should enforce least-privilege permissions: request CAMERA/CONTACTS/NOTIFICATIONS only when needed; revoke or degrade gracefully if denied.

Usability

1. System should be able to ensure that the user interface is intuitive, easy to navigate and visually appealing.

Integration and Compatibility

1. System should be able to integrate seamlessly with external APIs for functionality (e.g., AI/chat); requests use timeouts/retries and offline fallbacks.
2. System should be compatible with various devices to ensure wide user reach.

4.4 System Operation

4.4.1 Home Page User Interface

Figure 5.8 shows the dashboard presents a summary card showing Today Active Meds and Next Dose, followed by four primary feature tiles: Medication, AI Assistant, Emergency, and Family. A prominent SOS bar is placed at the bottom for immediate help. Users may also navigate to these pages using the bottom navigation bar, which includes Home, Medical, Emergency, Face, and AI Assistant Chat Bot.

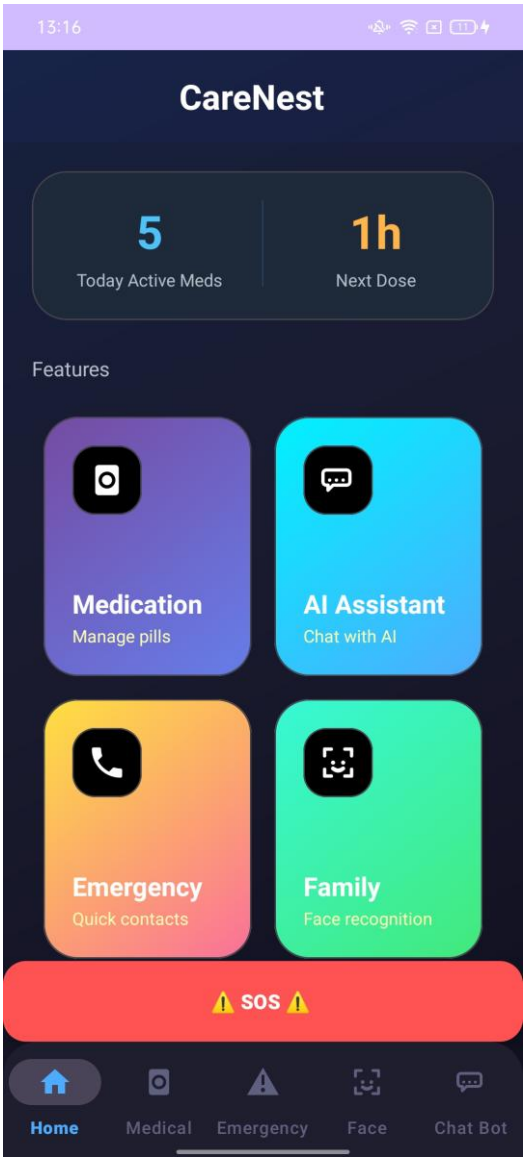


Figure 5.8 Home Page

4.4.2 Medical Module Page

Figure 5.9 shows the Medical List page, where all saved medications are displayed according to their scheduled reminder times. The medications are grouped into categories. Each card displays the medication name, dosage, and instruction, along with the reminder time. Expired medications are also listed under an Expired section to inform the user of records that are no longer active. A floating "+" button is provided for the user to quickly add a new medication. Figure 5.10 shows the initial Add Medication form with an option to upload a medication photo, fields for medication details, and buttons to add reminder time or save the record. User can manually enter medication details such as name, dosage, instructions, frequency, and date range.

Figure 5.9 Medication List

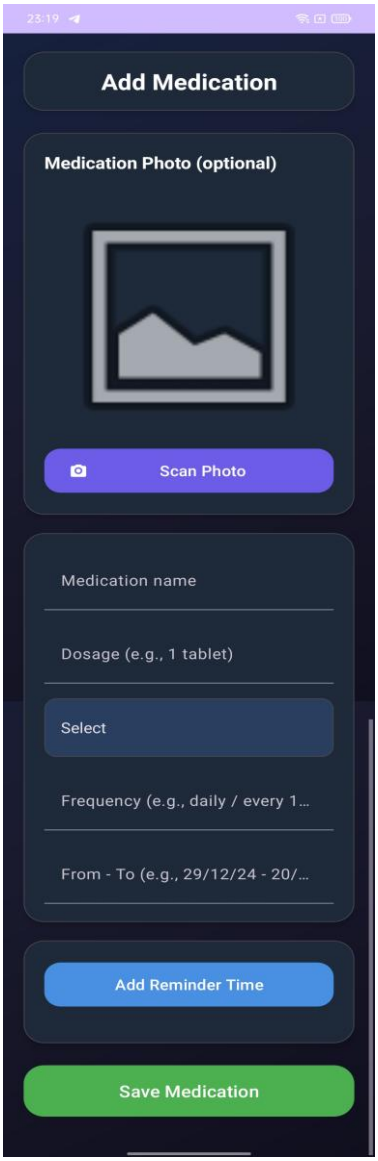


Figure 5.10 Add Medication

Figure 5.11 shows the Scan Medication dialog when user click at Scan Photo, where the user can choose to take a new photo or select an existing one from the gallery for automatic extraction. Figure 5.12 shows the result after scanning a prescription photo, where the system successfully extracts and auto-fills the medication information such as name, dosage, and instruction.

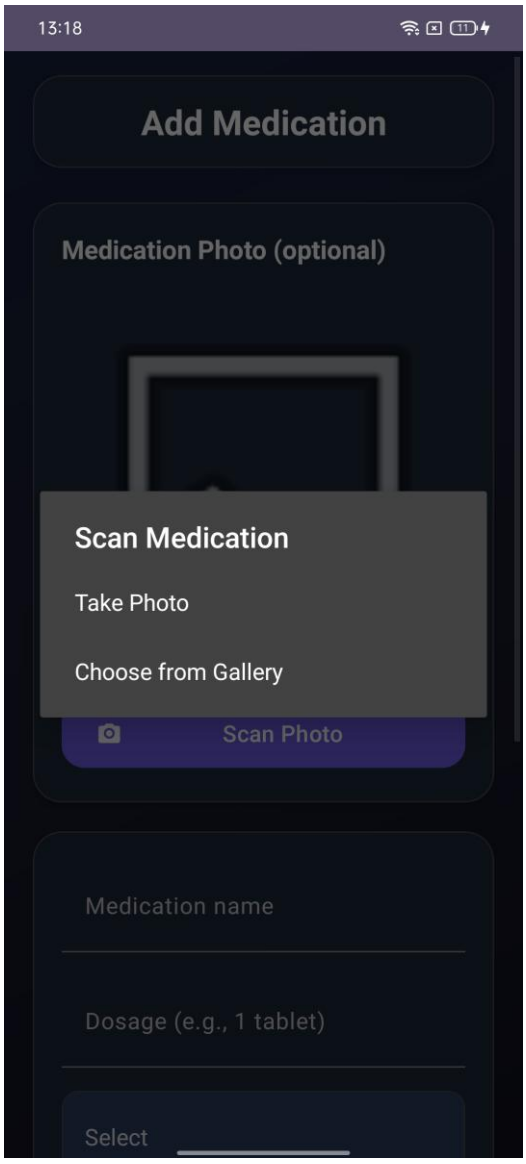


Figure 5.11 Scan Medication

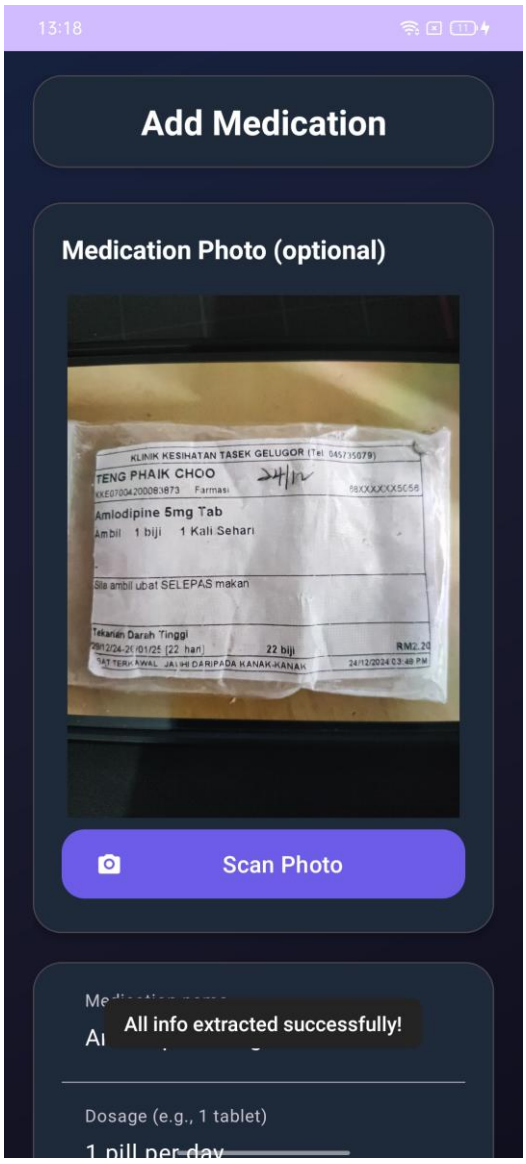


Figure 5.12 Info Extracted

Figure 5.13 shows the medication details filled in automatically after scanning, allowing the user to verify or edit the extracted information. Figure 5.14 shows the dropdown menu for selecting medication instructions, where the user can choose between options such as Before Food or After Food.

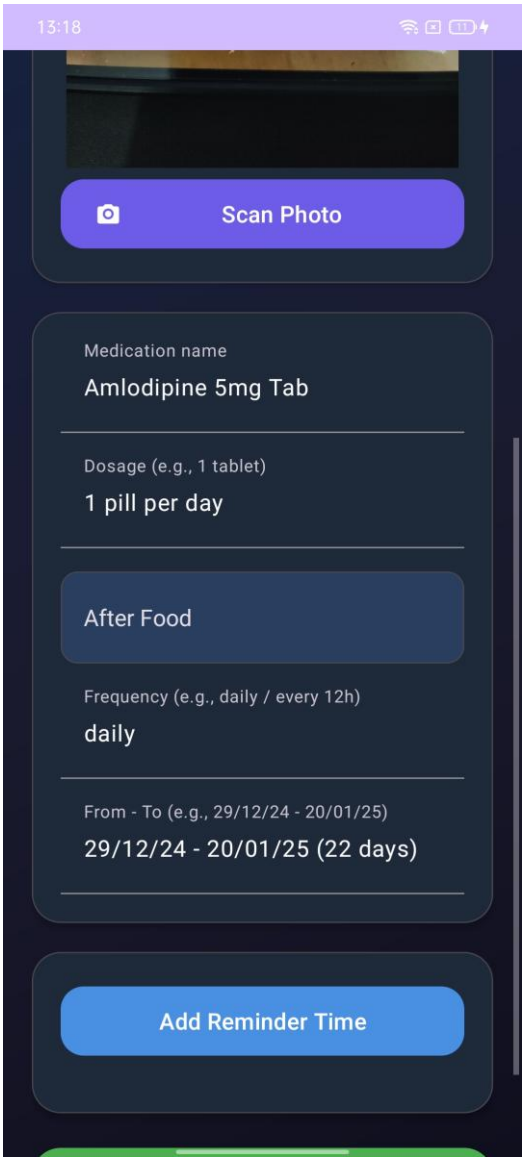


Figure 5.13 Detail filled

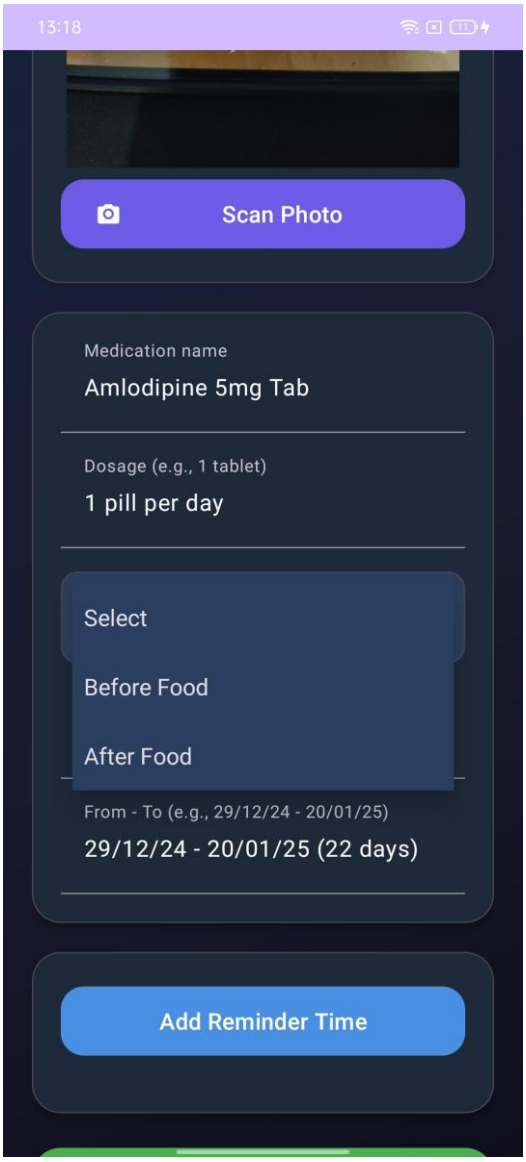


Figure 5.14 Dropdown menu

Figure 5.15 shows the date picker interface that allows the user to select the medication start and end dates. Figure 5.16 shows the reminder time options, where the user can quickly select standard times (Morning, Noon, Afternoon, Evening, Night) or choose a custom time.

Figure 5.15 Date picker

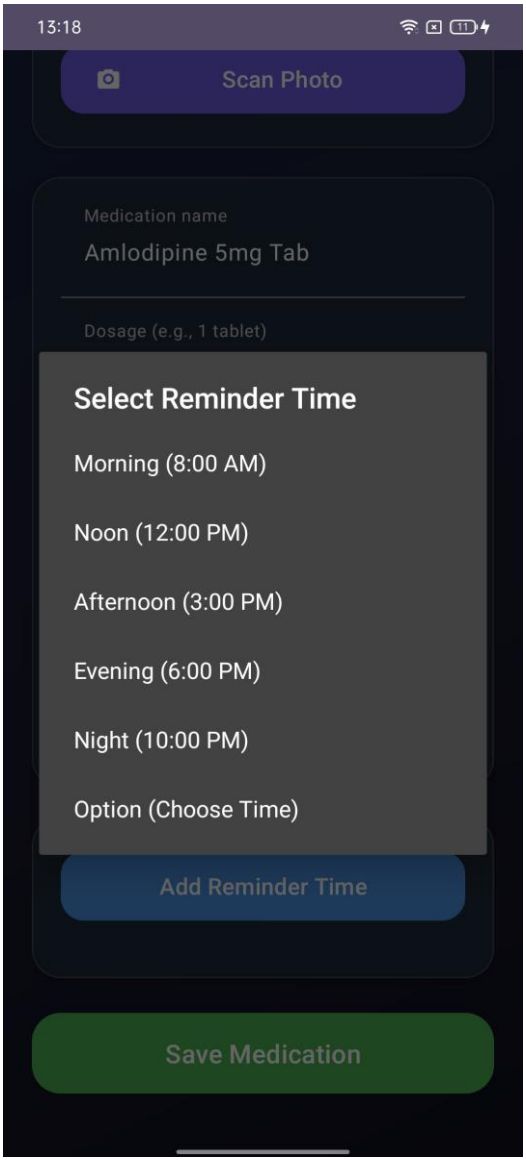


Figure 5.16 Time Picker

Figure 5.17 shows the custom time picker that enables the user to set a specific time for the reminder using a clock interface. Figure 5.18 shows the confirmation message displayed after the medication information is successfully saved into the system.

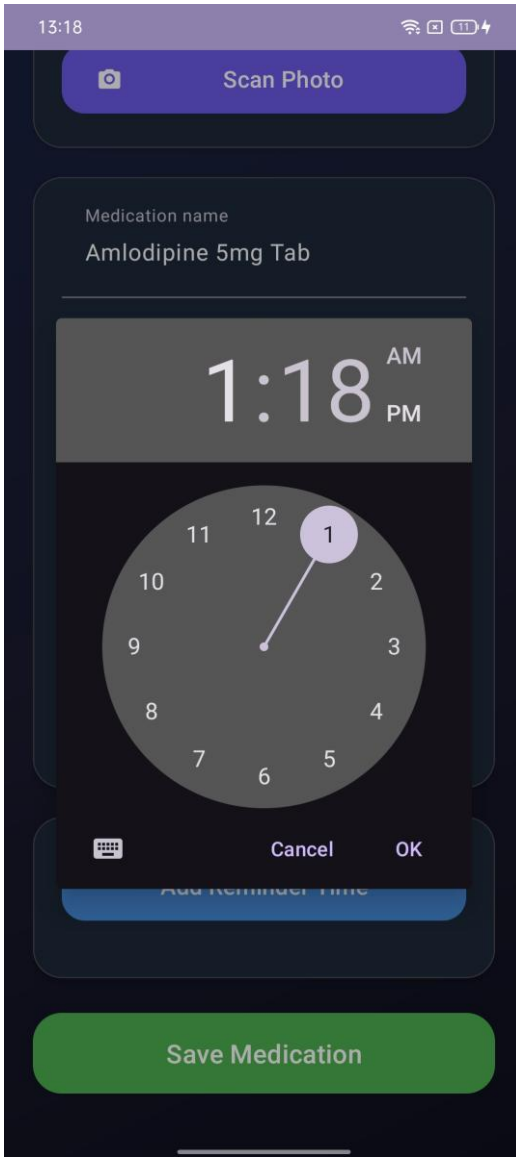


Figure 5.17 Custom Time Picker

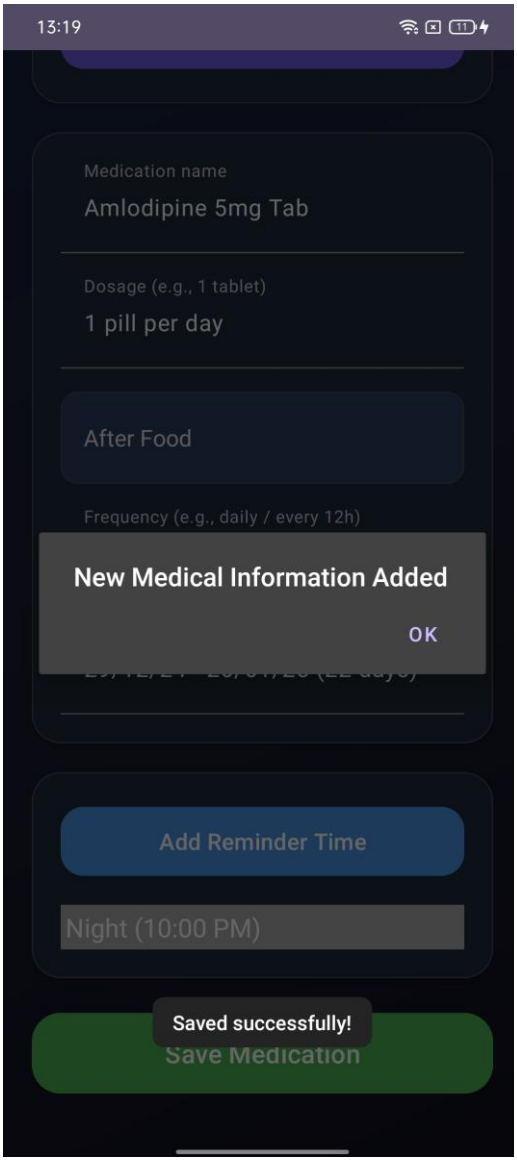


Figure 5.18 Confirmation Message

Figure 5.19 shows the Medical List page where all saved medications are displayed according to their reminder times (e.g., Morning, Noon). Users can tap on an item to view options such as Edit or Delete the selected medication record.

Figure 5.20 shows the Medication Reminder Alert screen that pops up at the scheduled time. It provides details of the medicine, dosage, and instruction, along with action buttons for the user to confirm intake (I took it) or postpone the alert (Remind me Later). If the user clicks I took it, the alarm will stop immediately, whereas clicking Remind me Later will snooze the reminder and alert the user again after 5 minutes.

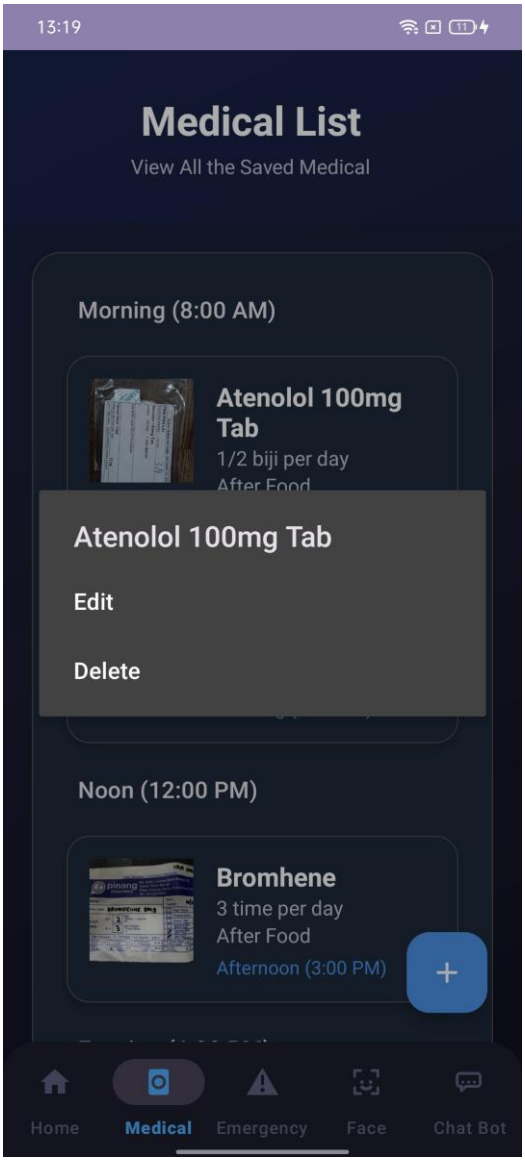


Figure 5.19Medical Edit

Figure 5.20 Alert Screen

4.4.3 Emergency Module Page

Figure 5.21 shows the Emergency Contacts page where users can view, manage, and quickly access saved contacts. A button is provided to add new emergency contacts. Figure 5.22 shows the option to add a new emergency contact either by selecting directly from the phone's contact list or by entering the details manually.

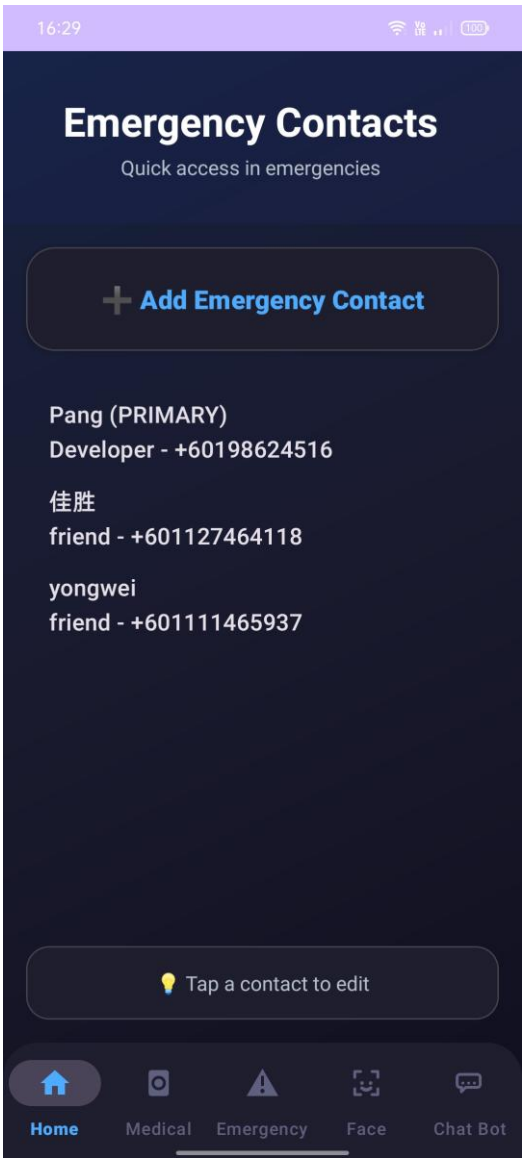


Figure 5.21 Emergency Main

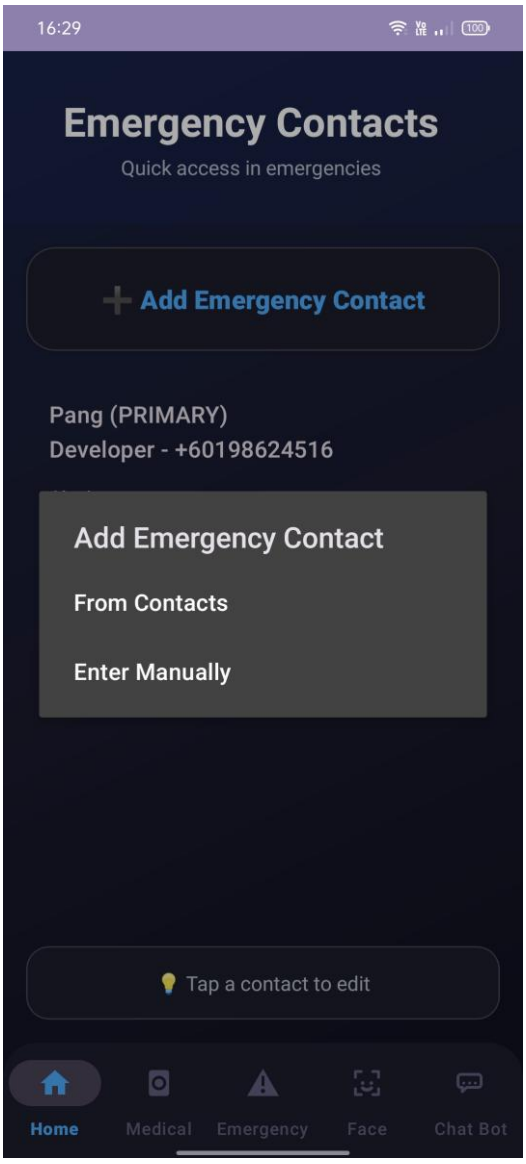


Figure 5.22 Add Emergency

Figure 5.23 shows the contact creation form, where the user can enter the full name, phone number, relationship, and optionally set the person as the Primary Emergency Contact. Figure 5.24 shows the system validation that prevents duplicate entries. If a phone number already exists in the list, the user is notified immediately.

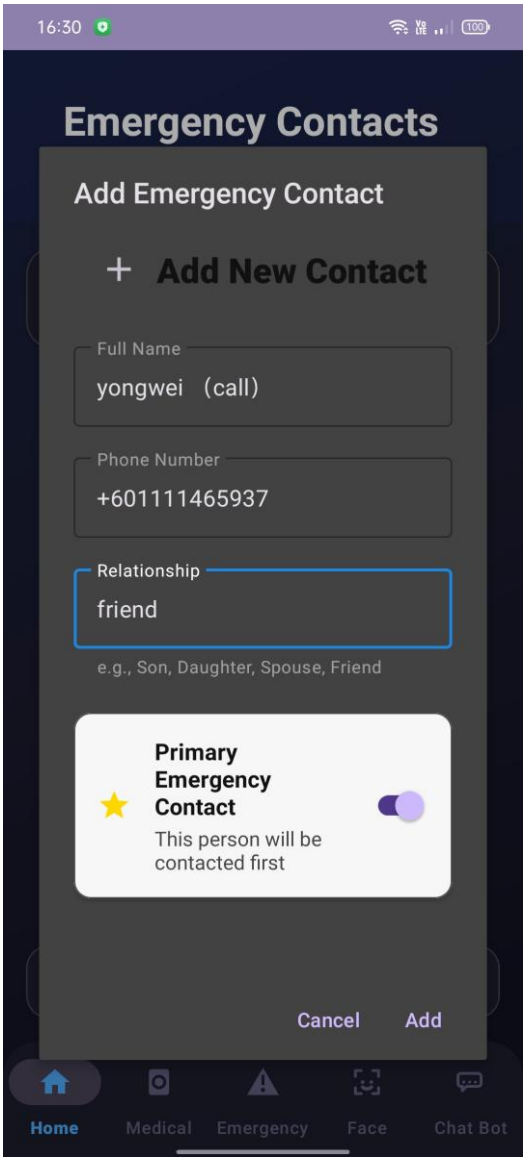


Figure 5.23 Add Emergency Form

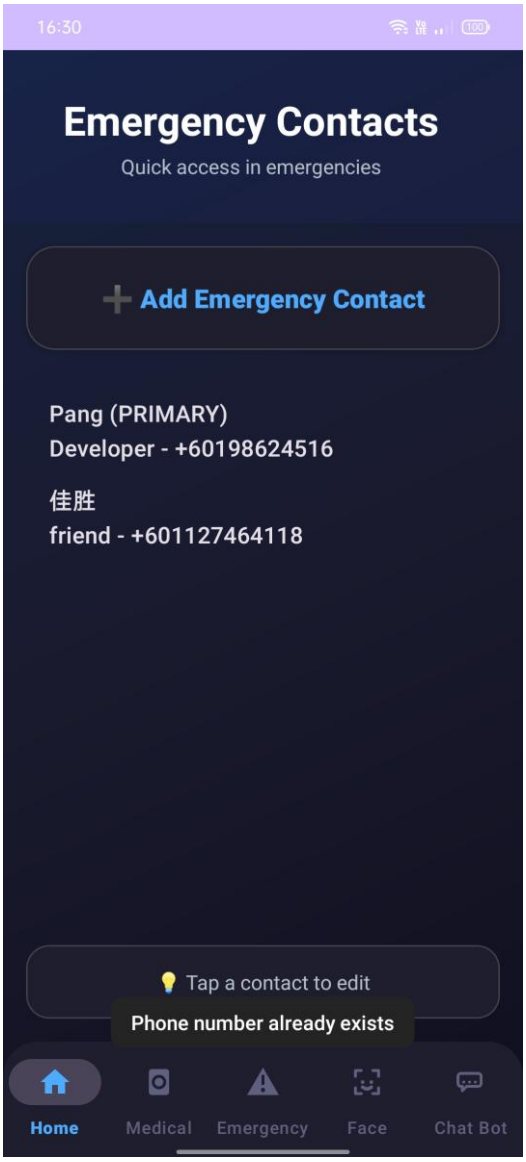


Figure 5.24 Number Exists

Figure 5.25 shows the updated contact list after a new emergency contact has been successfully added. A confirmation message is displayed to the user. Figure 5.26 shows the restriction applied by the system that allows a maximum of three emergency contacts to be saved. A message is shown when this limit is reached.

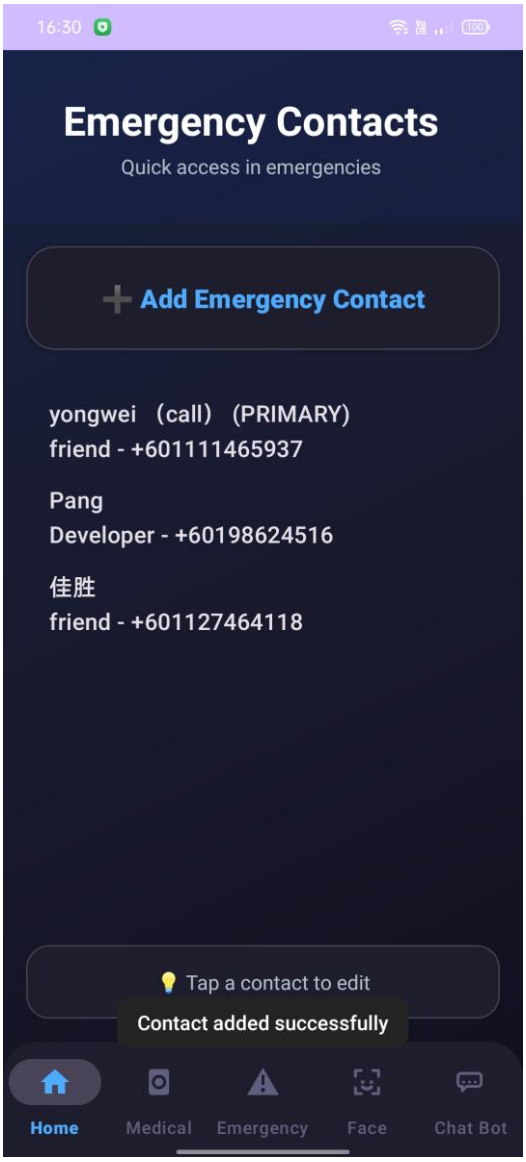


Figure 5.25 Contact Added Successfully

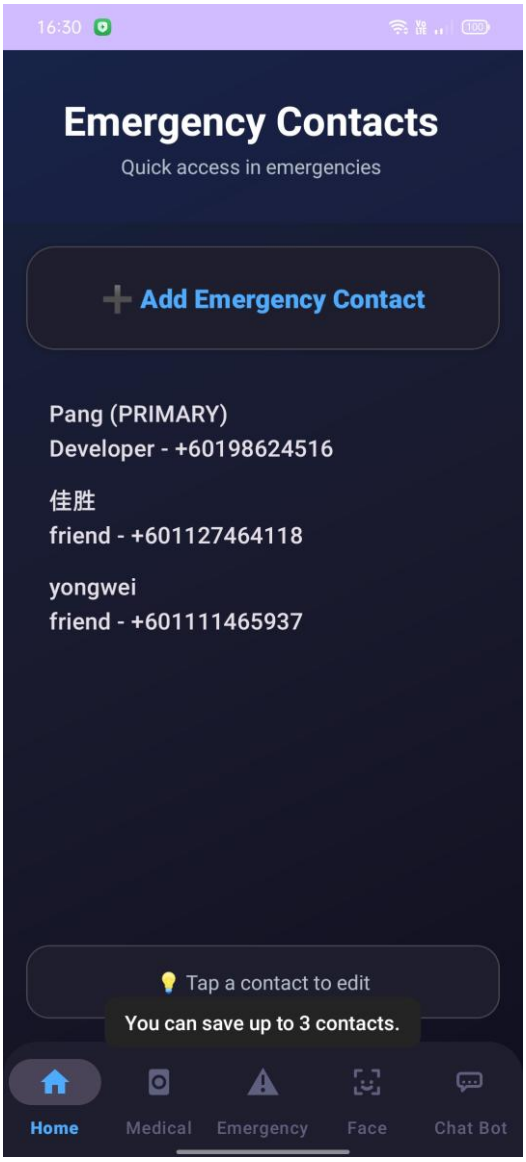


Figure 5.26 Up to 3 Contact

Figure 5.27 shows the contact management options available when tapping an existing contact, such as Set as Primary, Edit, or Delete. Figure 2.28 shows the Emergency Alert screen that appears when the system detects a potential emergency. The user is prompted with the question “Are you okay?”, with options to confirm safety (YES, I’m fine) or request assistance (I NEED HELP). If no response is given within 15s countdown, the system will automatically send for help after the countdown ends.

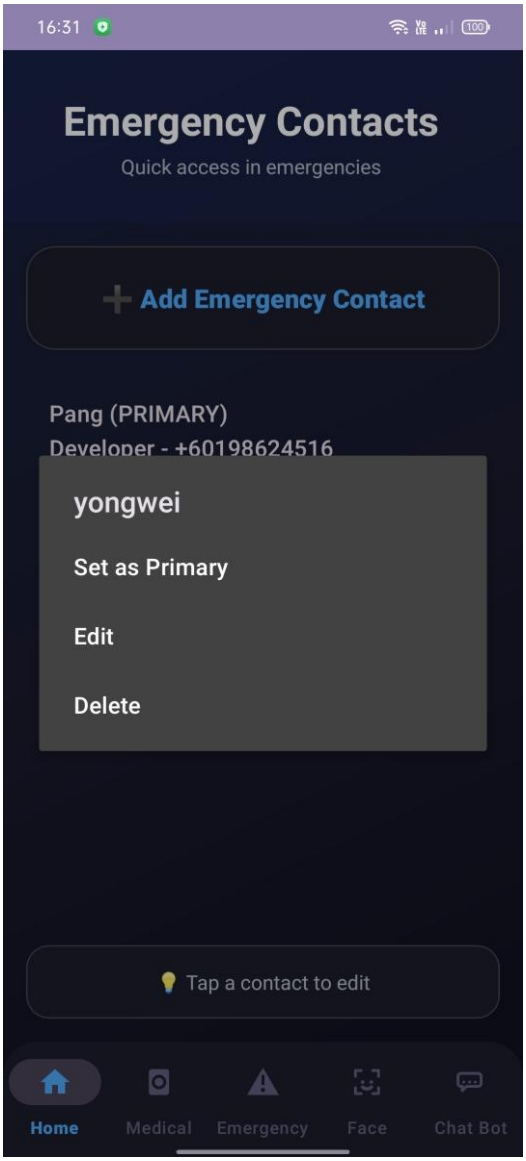


Figure 5.27 Contact Management

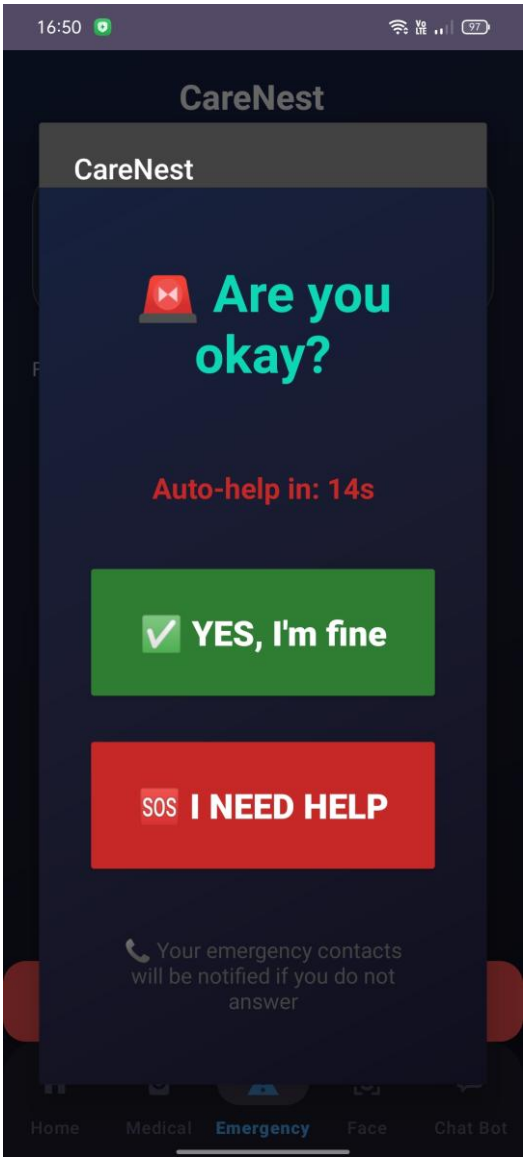


Figure 5.28 Alert Screen

Figure 5.29 shows the message after the user clicks YES, I'm fine in the emergency alert. The system stops the emergency alarm and displays a confirmation message at the bottom of the screen, "Glad you're okay!", to reassure the user. Figure 5.30 shows the confirmation alert after the user requests emergency help. The system indicates that emergency contacts are being notified.

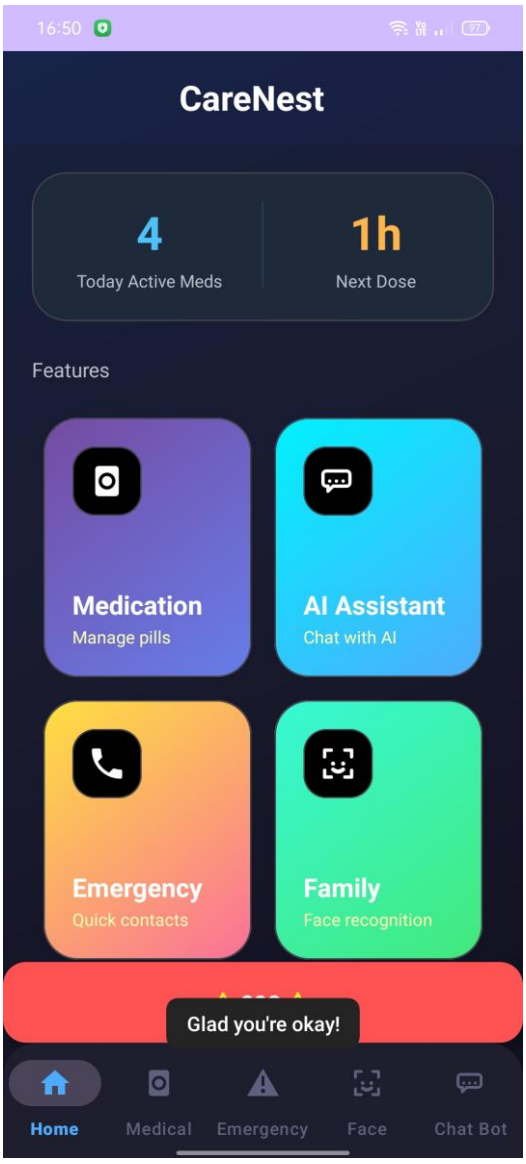


Figure 5.29 Click I'm Fine

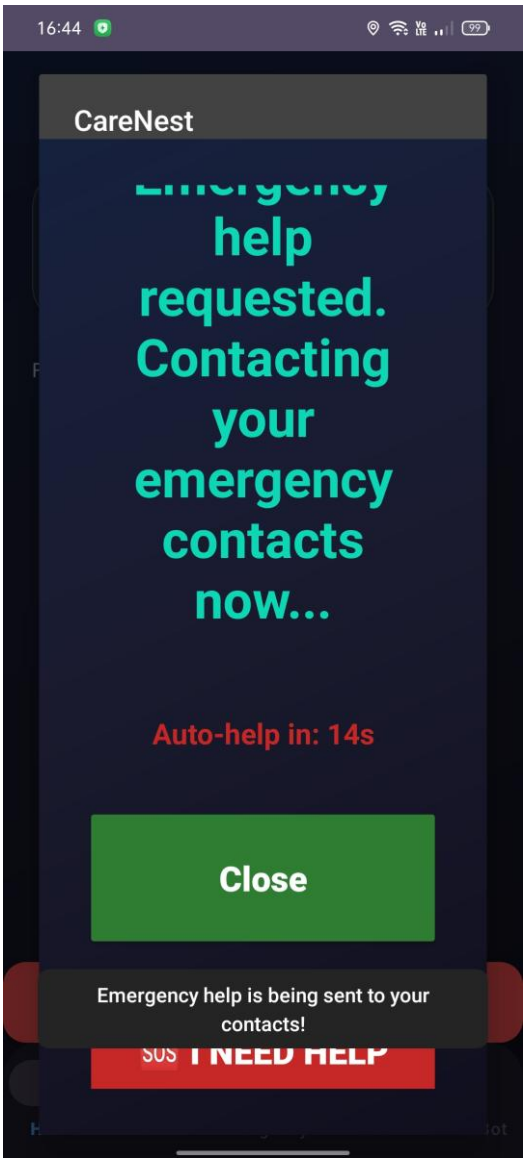


Figure 5.30 Click I need Help

Figure 5.31 and Figure 5.32 show an example of an emergency SMS that is automatically sent to a registered contact. The message contains a help request along with the user's real-time location coordinates for quick assistance.

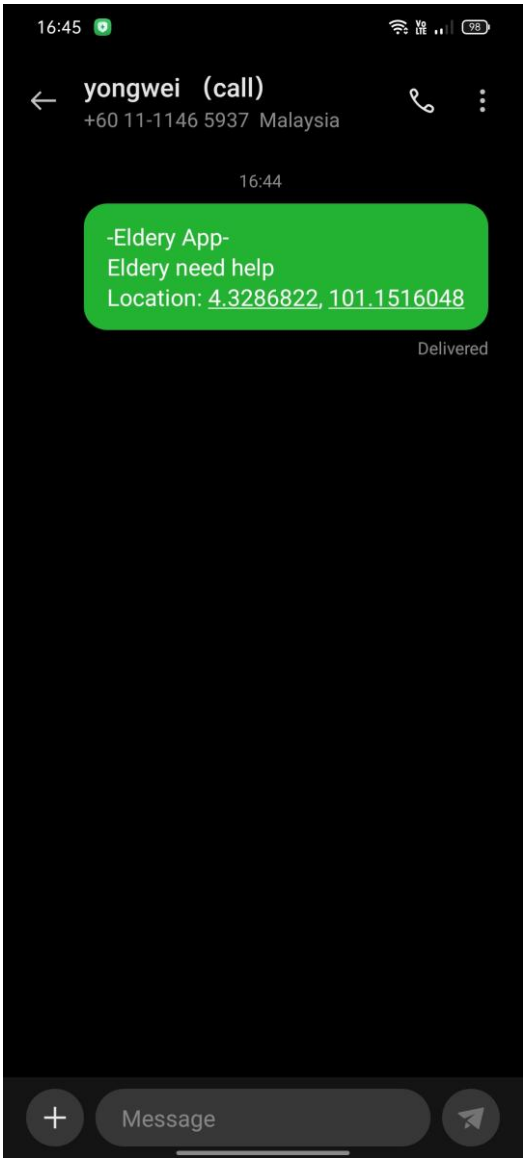


Figure 5.31 example sent1

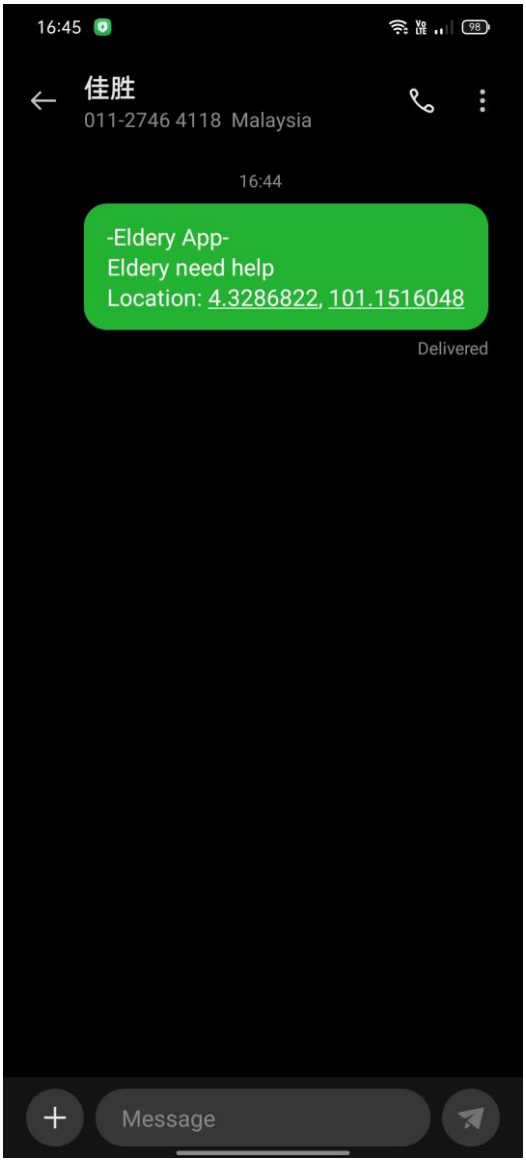


Figure 5.32 example sent2

4.4.4 Medical Module Page

Figure 5.33 shows the AI Assistant main interface, where users can interact with the chatbot to manage their medical records. It provides suggested commands such as viewing today's record, finding a medicine, or adding new medication, making the system easy to use for elderly users. Figure 5.34 shows the chatbot responding to the command "show my record today," displaying a list of the medications scheduled for the day along with their dosage and time. This feature helps users quickly review their daily medication intake.

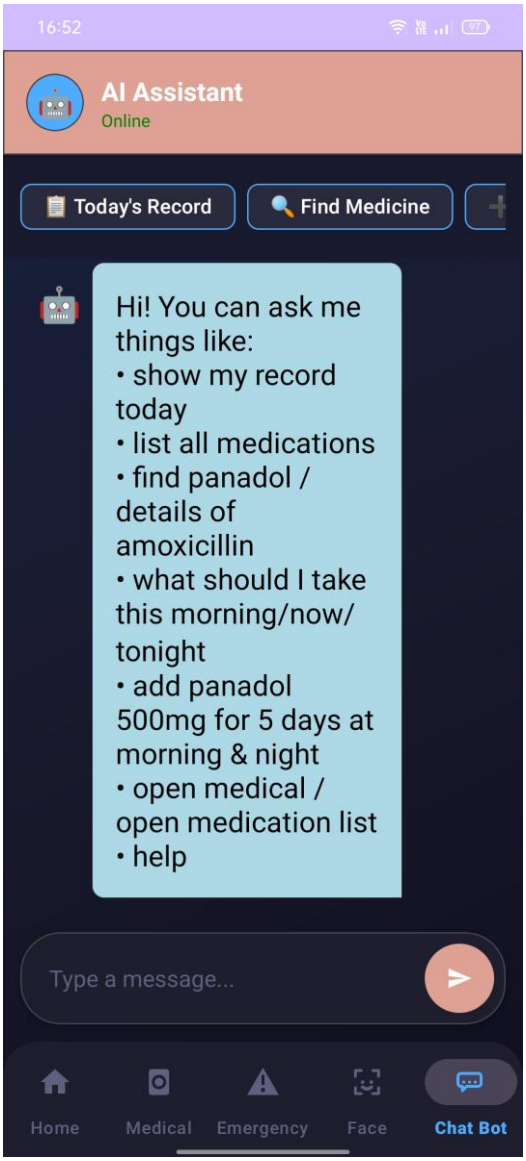


Figure 5.33 Assistance Main

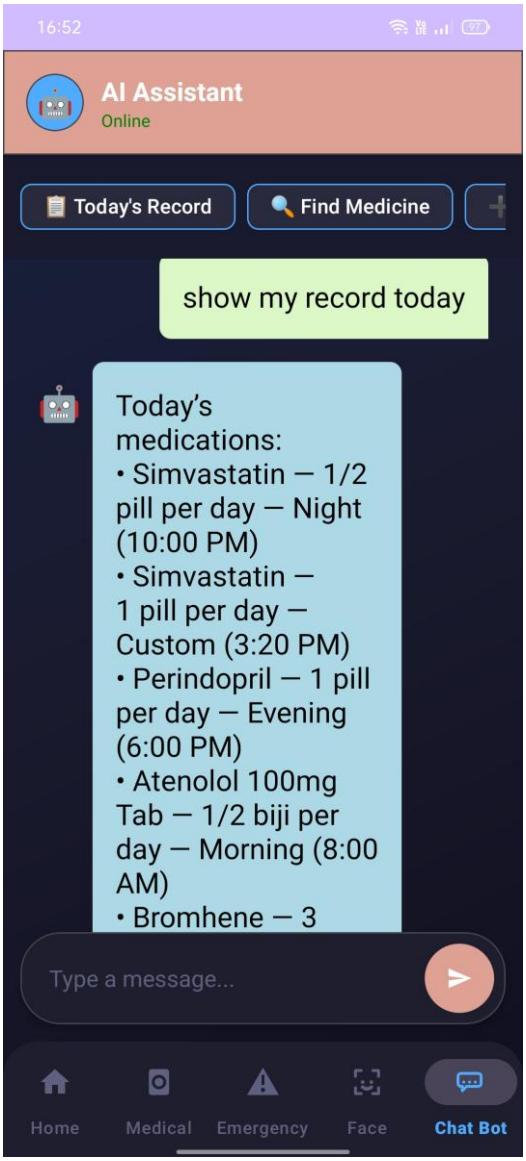


Figure 5.34 Responding Record

Figure 5.35 shows the “Find Medicine” function, where the user is prompted to enter the name of a medication. This allows elderly users to conveniently retrieve details of specific medicines from the saved list. Figure 5.36 shows the result of the “find simvastatin” query, where the chatbot displays all records of Simvastatin stored in the system, including dosage and timing. This ensures users can easily track and verify their prescribed medications.

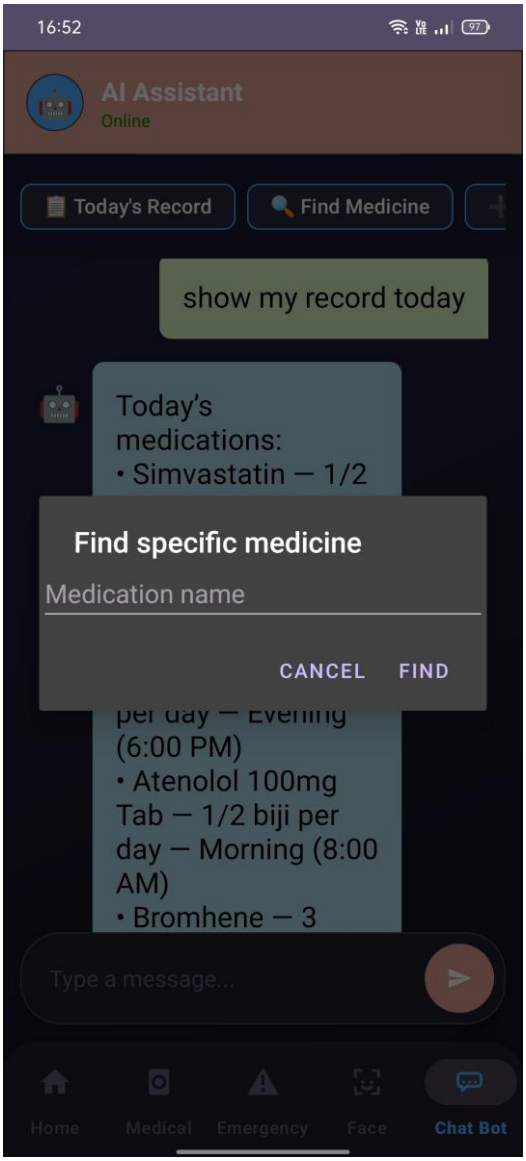


Figure 5.35 Find Specific

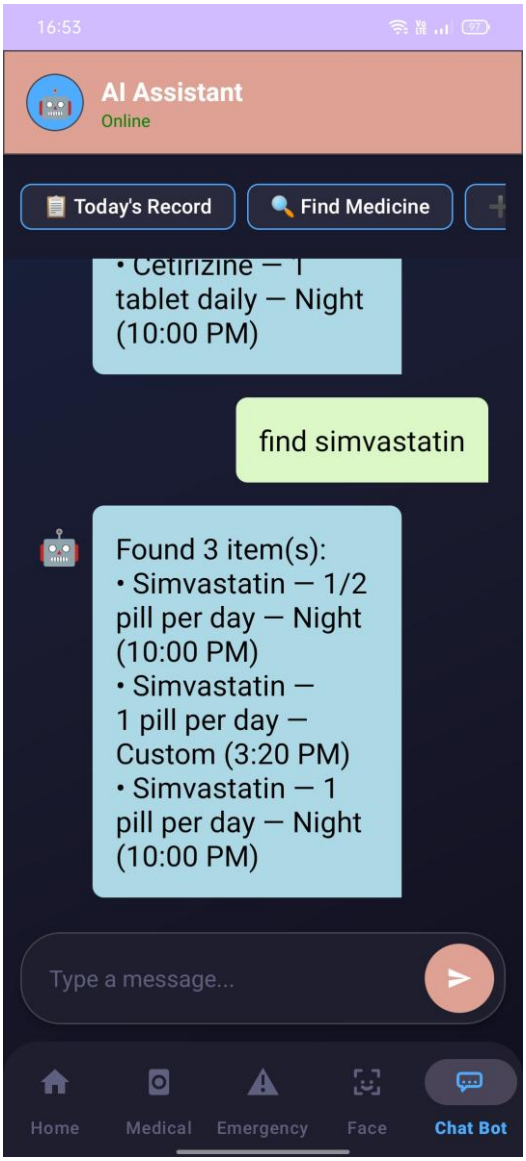


Figure 5.36 Responding Find

Figure 5.37 shows the process of adding a new medication through the chatbot by entering the command “add Panadol for 30 days at night.” The AI Assistant successfully adds the medication as requested by the user. Figure 5.38 shows the updated Medical List, where Panadol has been successfully added under the Night (10:00 PM) section. This proves that the chatbot can seamlessly update the medication schedule in the system.

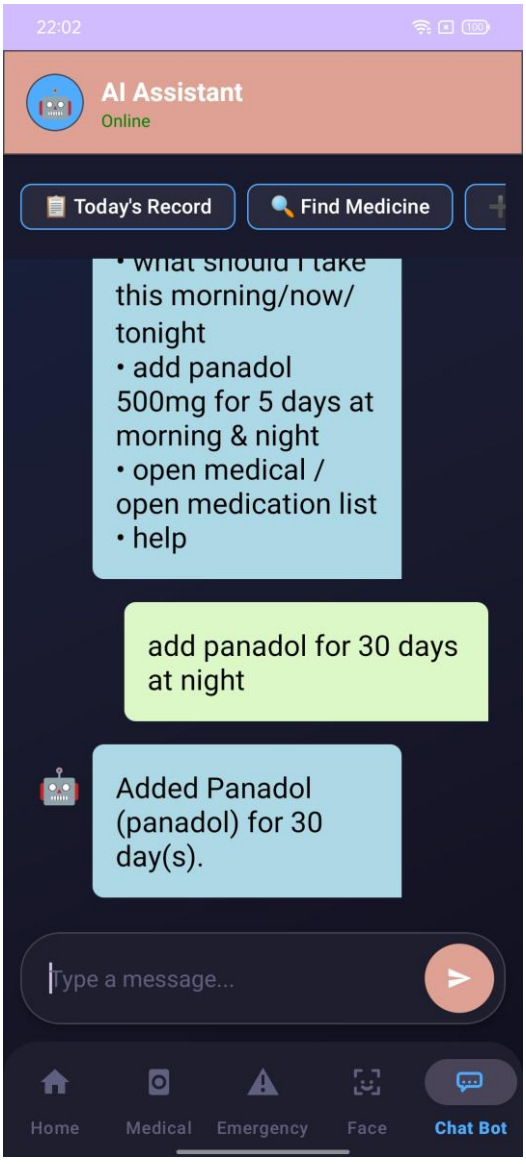


Figure 5.37 Add Panadol

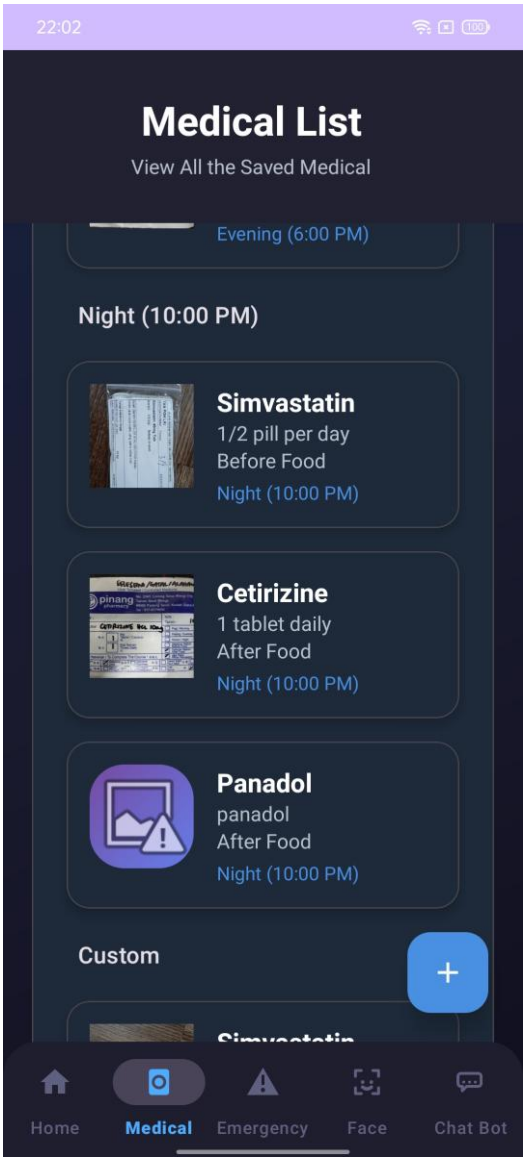


Figure 5.38 Add Success

4.4.1 Family Face Recognition Module Page

Figure 5.39 shows the main Face Recognition screen where users can manage saved faces and recognize family members. The interface displays stored profiles with names and relationships and provides an option to scan new faces via camera or gallery. Figure 5.40 shows the recognition result when User click on a saved face. It displays the person's photo, name, and relationship, along with options to call, view details, or improve recognition accuracy.

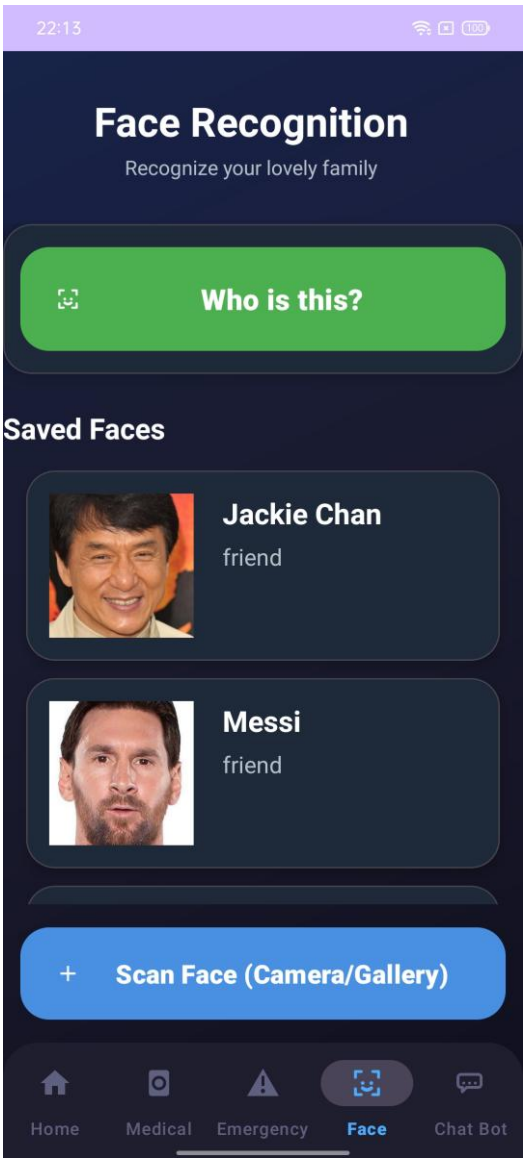


Figure 5.39 Face Main

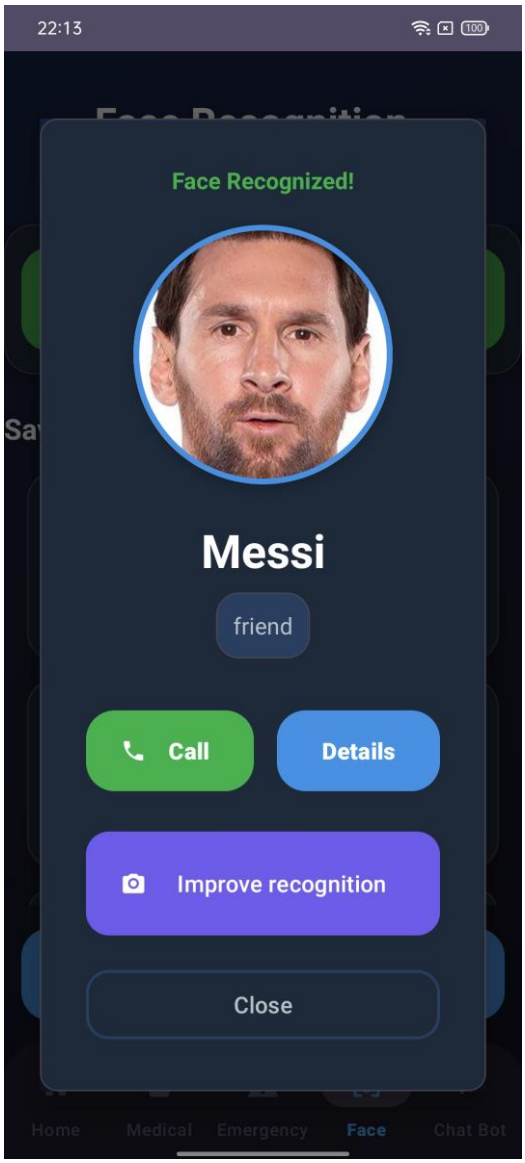


Figure 5.40 Face Click

Figure 5.41 shows the detailed information of a recognized member. It provides additional context such as relationship, phone number, and notes, ensuring that elderly users can easily identify and connect with their loved ones. Figure 5.42 shows the "Improve Recognition" option where users can add a new angle of the face either by taking a photo from the camera or selecting one from the gallery. This enhances the recognition model for better accuracy.

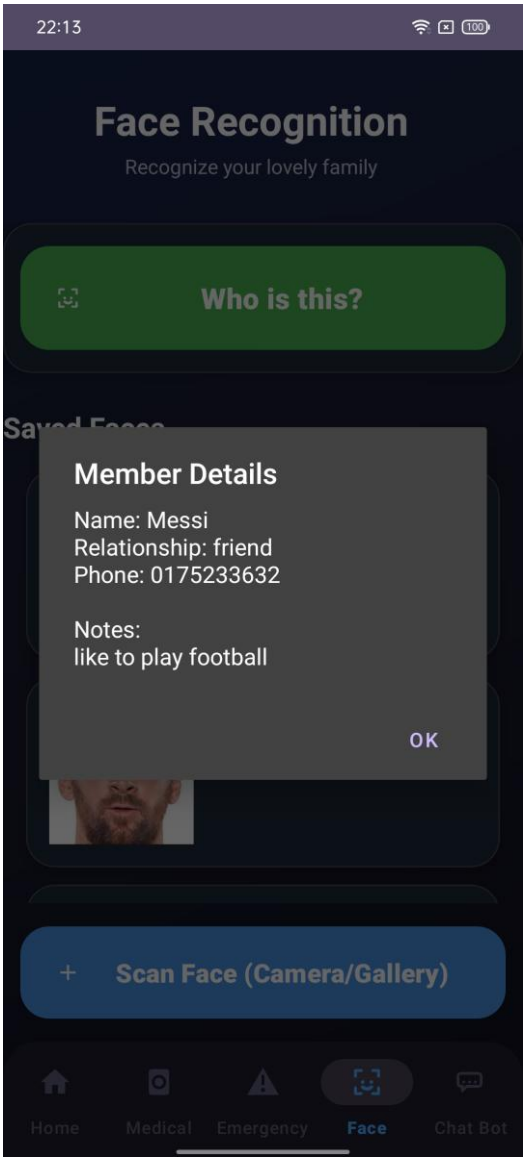


Figure 5.41 Face Detail

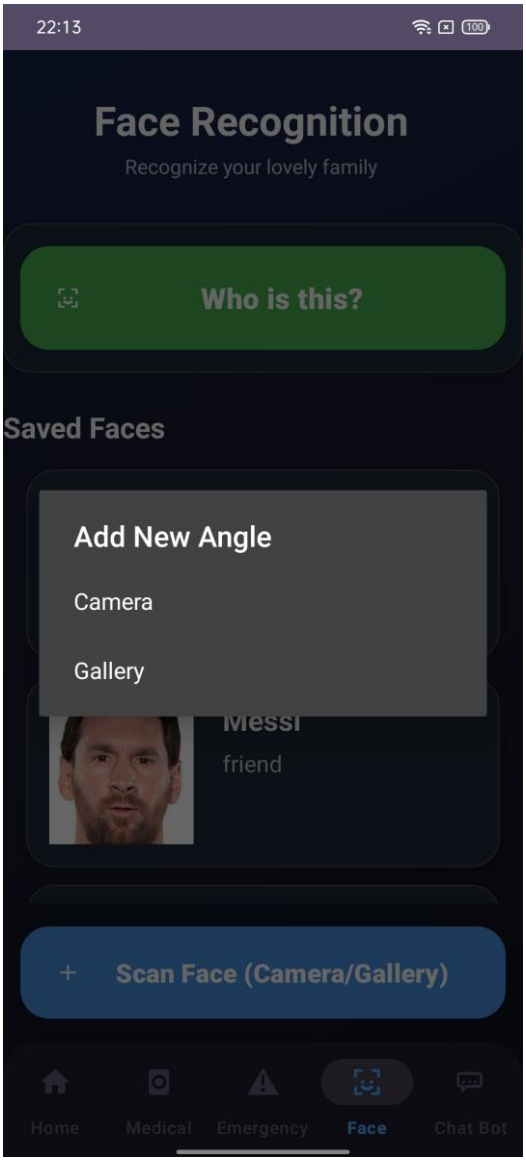


Figure 5.42 Improve Recognition

Figure 5.43 shows the confirmation message after adding a new sample. The system notifies the user that a new face sample has been successfully added to improve recognition reliability. Figure 5.44 shows the scanning process where users can choose between capturing a new face photo using the camera or uploading an existing one from the gallery.

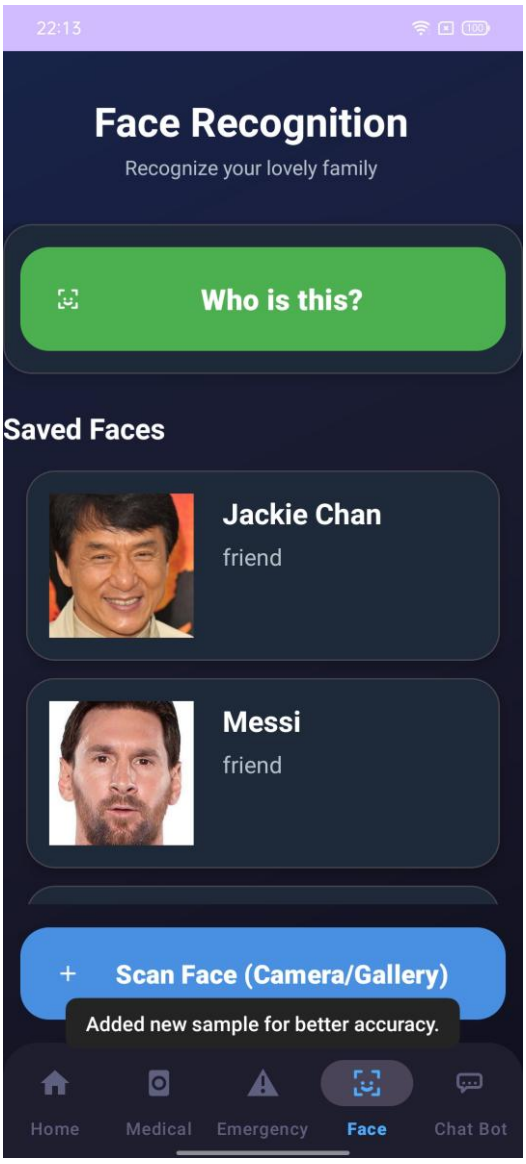


Figure 5.43 Added Accuracy

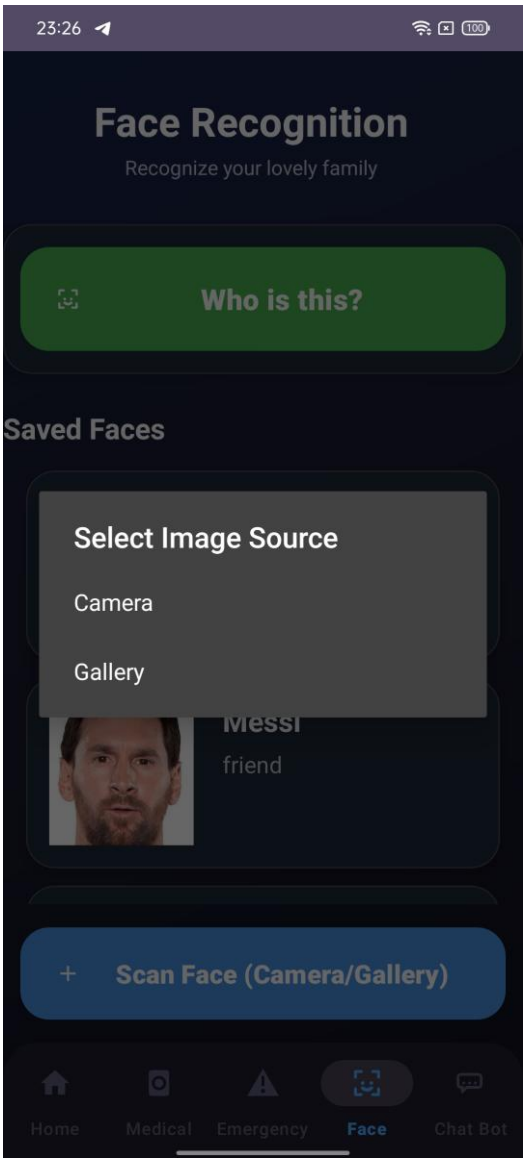


Figure 5.44 Scan Face

Figure 5.45 shows the recognition output after scanning, confirming the identity of the detected person and displaying the stored profile information. Figure 5.46 displays the screen when the system cannot recognize a face. In this case, the user is prompted to manually save the person's details, including name, relationship, phone, and notes, so that the system can identify them in future attempts.

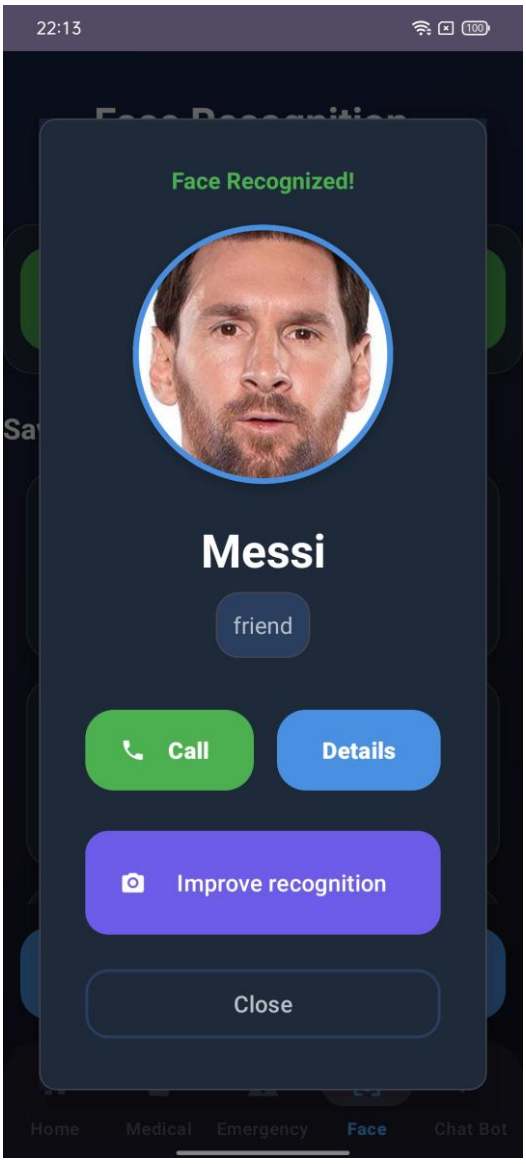


Figure 5.45 Recognized

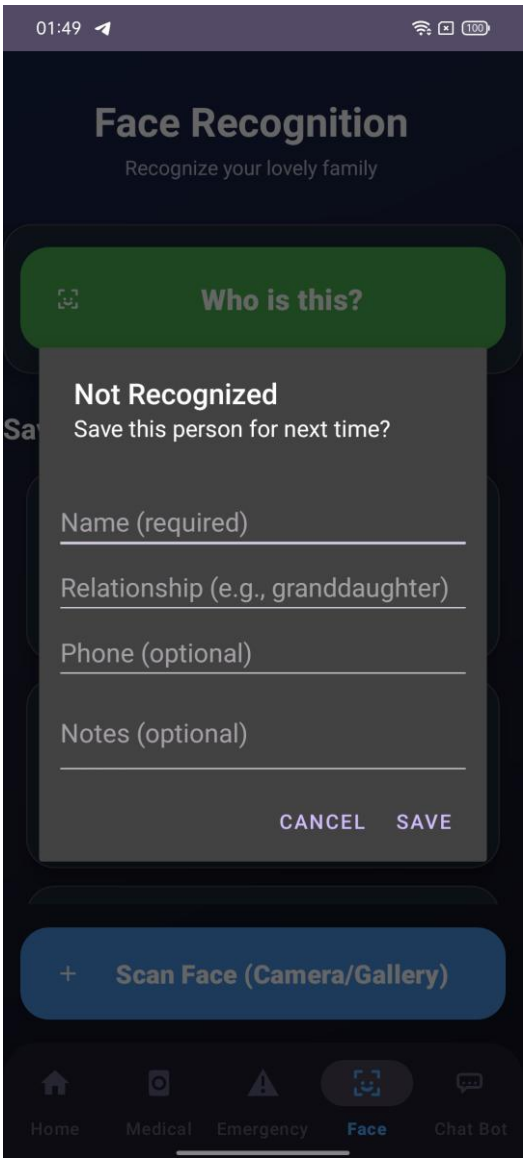


Figure 5.46 Not Recognized

Figure 5.47 shows the prompt that appears when a face is saved, the system will suggest improving recognition accuracy. The user can choose to add another photo from either the camera or gallery, providing different angles for better identification in the future. Figure 5.48 shows the quiz-based recognition feature where the system prompts the user to select the correct identity of a scanned face from multiple options. This supports training and testing recognition accuracy.

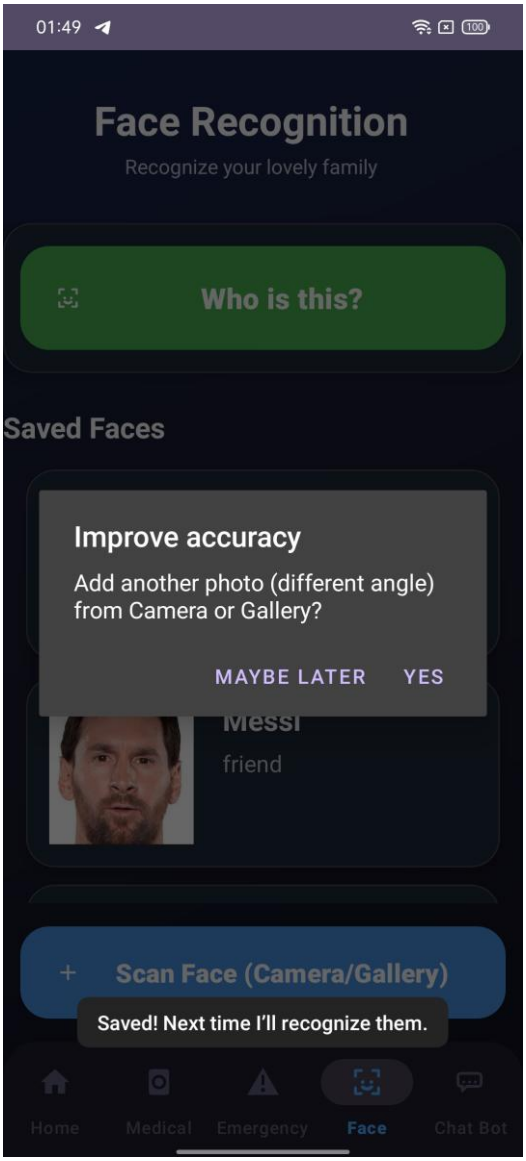


Figure 5.47 Ask To Add

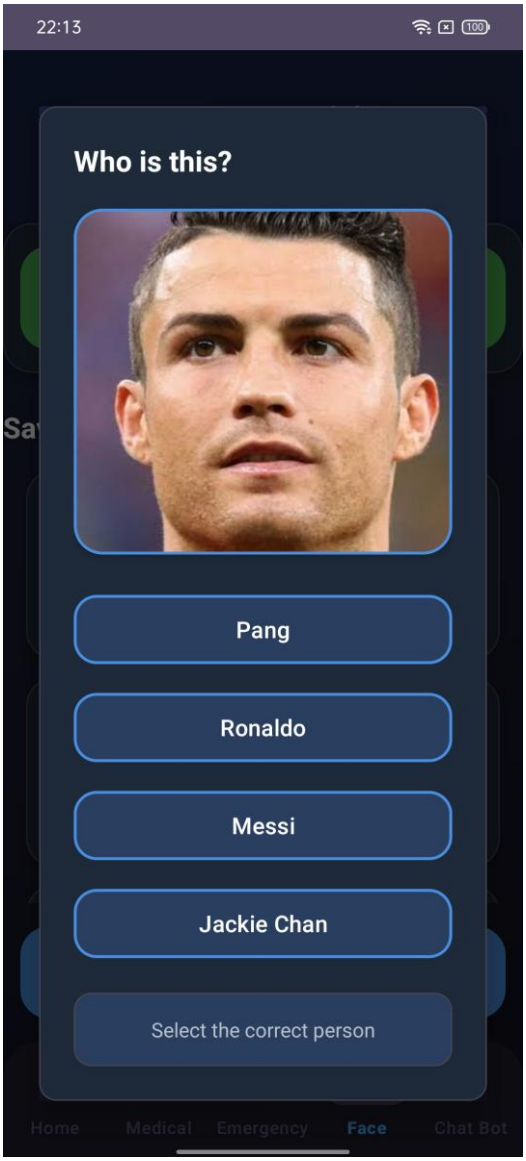


Figure 5.48 Face Quiz

Figure 5.49 shows the positive feedback when the user selects the correct identity. A “Correct!” message is displayed to confirm the accurate response. Figure 5.50 shows the system feedback when the user selects a wrong option. It informs the user of the correct identity to improve learning and recognition understanding.

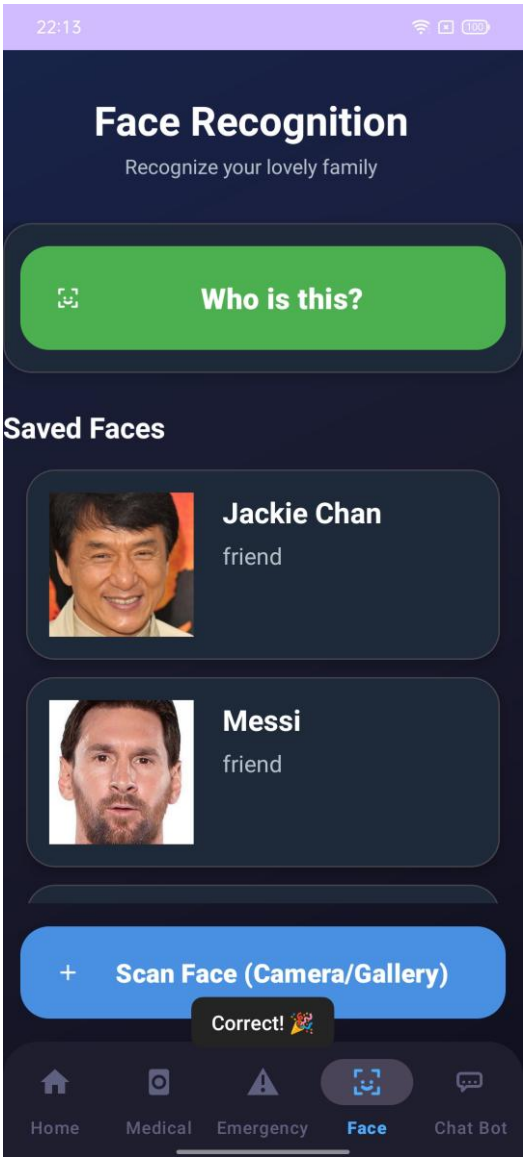


Figure 5.49 Face Correct

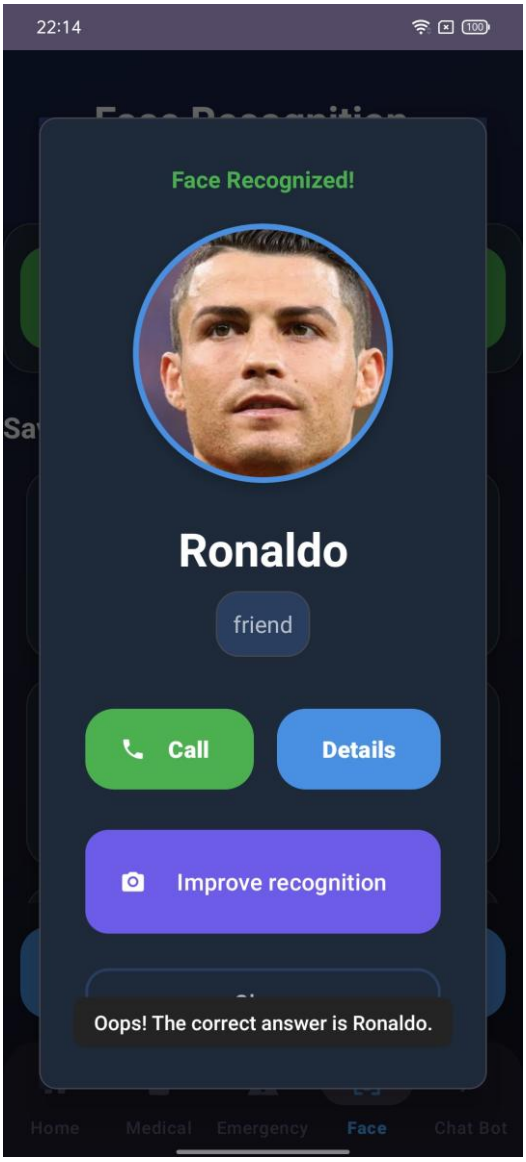


Figure 5.50 Face Wrong

4.5 Implementation issues and challenges

Through the development of the elderly care mobile application, several issues and challenges were encountered. One of the first difficulties arose in managing the medication reminder and alarm system, as Android's background restrictions and battery optimization sometimes prevented alarms from triggering reliably. Extra effort was needed to refine the use of Alarm Manager and notification channels to ensure consistency. The chatbot integration also presented challenges, as parsing conversational input such as "add medical" into structured records for the Room database was not straightforward. Additional validation and handling were implemented to avoid duplication and incomplete entries. The emergency SOS and fall detection module brought further challenges, particularly in ensuring accurate location retrieval and managing the countdown timer that could either auto-send alerts or be canceled when the user confirmed their safety. Similarly, the face recognition module faced difficulties in handling poor lighting and angled images, which reduced accuracy. To address this, multiple sample images were allowed for each person, and a fallback was introduced to let users manually register unrecognized faces. On the data side, defining medication schedules in Room Database was complex, especially when managing multiple time slots and expired records that required careful removal while keeping history intact. Finally, integrating all the modules—medication, chatbot, emergency, and face recognition—into a single smooth UI flow posed architectural challenges, as asynchronous tasks such as alarms, database updates, and recognition processes had to be synchronized without causing performance issues or crashes.

Accuracy of recognition and performance of the recognition module will be improved in later versions, error handling will be improved, and better UI feedback will be provided to help users while scanning and saving medication.

4.6 Concluding Remark

In conclusion, the implementation of the Elderly Care mobile application successfully brought together the core modules of the system, namely the medication management, AI chatbot, emergency alert, and face recognition features. The development process involved careful setup of both hardware and software environments, configuration of Room Database and alarm scheduling, and integration of external APIs such as OpenAI for intelligent responses. Several challenges were encountered during implementation, particularly in ensuring reliable alarm triggering, handling incomplete chatbot inputs, and improving face recognition accuracy. These issues were addressed through iterative testing and design adjustments, which resulted in a stable and functional application. Overall, the system implementation stage achieved the planned objectives and prepared the application for evaluation in the subsequent chapter.

CHAPTER 5
SYSTEM EVALUATION AND DISCUSSION

5.1 System Testing and Performance Metrics

In this chapter, System testing was carried out using black box testing to ensure that each module of the Elderly Care mobile application functions as intended. Navigation through the dashboard and bottom navigation bar was tested to confirm that users are directed correctly to the main modules, namely Medication, Emergency, Face Recognition, Chatbot, and User Profile. For the Medication module, tests confirmed that medication records can be added, edited, and deleted successfully, while reminders trigger at the scheduled times. The alert screen was validated to ensure that selecting *I took it* stops the alarm immediately and *Remind me Later* reschedules the reminder after five minutes. The Chatbot module was tested by issuing queries such as "show today's record," "find Panadol," and "add new medicine," with both complete and incomplete commands. The chatbot responded correctly and requested missing details when necessary, before saving records. The Emergency module was verified through testing the countdown timer, response buttons, and automatic SMS alerts sent to registered contacts with location details when no user response was received. The Face Recognition module was tested with stored and unregistered faces, under different lighting and angles, to measure accuracy and reliability. The User Profile module was also validated to ensure that user details can be created, updated, and displayed correctly within the app. Performance metrics were recorded to evaluate responsiveness. The medication alarm system consistently triggered within ±30 seconds of the scheduled time. The chatbot returned local responses within 2 seconds and API-based responses within 5 seconds. Face recognition achieved identification within 1 second per image, with results measured in terms of accuracy, precision, recall, and F1-score to validate recognition performance. These results confirm that the application delivers reliable functionality, responsive interactions, and efficient processing, meeting the requirements of supporting elderly users in their daily activities.

5.2 Testing Setup and Result

5.2.4 Main Page Testing

No.	Test Case	Test Data	Expected Output	Actual Output	Result (pass/fail)
1	Select Medication button	-	System directs user to the Medication Page	System directs user to the Medication Page	Pass
2	Select AI Assistant button	-	System directs user to the Chatbot Page	System directs user to the Chatbot Page	Pass
3	Select Emergency button	-	System directs user to the Emergency Contact Page	System directs user to the Emergency Contact Page	Pass
4	Selects Family button	-	System directs user to the Face Recognition	System directs user to the Face Recognition	Pass
5	Select SOS button	-	System directs user to the Alert Screen	System directs user to the Alert Screen	Pass

5.2.4 Bottom Navigation Bar Function Testing

No.	Test Case	Test Data	Expected Output	Actual Output	Result (pass/fail)
1	Select Home button	-	System directs user to the Home Page	System directs user to the Home Page	Pass
2	Select Medication button	-	System directs user to the Medication Page	System directs user to the Medication Page	Pass
3	Select AI Assistant button	-	System directs user to the Chatbot Page	System directs user to the Chatbot Page	Pass
4	Select Emergency button	-	System directs user to the Alert Screen	System directs user to the Alert Screen	Pass
5	Selects Family button	-	System directs user to the Face Recognition	System directs user to the Face Recognition	Pass

5.2.4 Medication Function Testing

No.	Test Case	Test Data	Expected Output	Actual Output	Result (pass/fail)
1	Select Add Medication Button	-	System Direct User to Add Medication page	System Direct User to Add Medication page	Pass
2	Select Scan Photo	-	System lets user choose camera or gallery	System lets user choose camera or gallery	Pass
3	Select Camera after Click Scan Photo	-	System open camera for user to capture image	System open camera for user to capture image	Pass
4	Select gallery after Click Scan Photo	-	System open gallery for user to choose an image	System open gallery for user to choose a image	Pass
5	Select Medication name	Panadol	System let user entry medical name	System let user entry medical name	Pass
6	Select Dosage	1 time	System let user entry dosage	System let user entry dosage	Pass
7	Select dropdown	-	System let user choose Before food or After food	System let user choose Before food or After food	Pass

8	Select Frequency	Twice daily	System let user entry frequency	System let user entry frequency	Pass
9	Select date picker	01/09/25 and 30/09/25	System let user choose a start date and end date	System let user choose a start date and end date	Pass
10	Select Add reminder Time Button	-	System let user choose a Time	System let user choose a Time	Pass
11	Select Save Medication Button	-	System let user save complete medication information	System let user save complete medication information	Pass
12	Select Scan photo and upload a photo	Image that contains: Name: Panadol, Dosage: 1 time, When: After Food, Frequency: Twice daily, Date: 01/09/25 – 30/09/25	Information in the image extracted	Information in the image extracted	Pass
13	Add new medication manually	Name: Panadol, Dosage: 1 time, When: After Food,	Medication saved and displayed in Medical List	Medication saved and displayed in Medical List	Pass

		Frequency: Twice daily, Date: 01/09/25 – 30/09/25, Time: 10:00 PM			
14	Edit existing medication	Update Dosage	Medication details updated correctly	Medication details updated correctly	Pass
15	Delete a medication	Select record	Medication removed from Medical List	Medication removed from Medical List	Pass
16	Reminder triggers at scheduled time	10:00 PM	Reminder alert pops up with alarm	Reminder alert pops up with alarm	Pass
17	Select I took it in reminder	-	Alarm stops and record updated	Alarm stops and record updated	Pass
18	Select Remind me later in reminder	-	Alarm snoozes and re-alerts after 5 minutes	Alarm snoozes and re-alerts after 5 minutes	Pass

5.2.4 Emergency Function Testing

No.	Test Case	Test Data	Expected Output	Actual Output	Result (pass/fail)
1	Select Add Emergency Contact Button	-	System lets user choose to import from contact or manually	System lets user choose to import from contact or manually	Pass
2	Select import contact	-	System let user choose a saved contact in phone	System let user choose a saved contact in phone	Pass
3	Select Full Name text box	yongwei	System let user entry username	System let user entry username	Pass
4	Select phone number text box	+601111465936	System let user entry phone number	System let user entry phone number	Pass
5	Select relationship text box	Friend	System let user entry relationship in text	System let user entry relationship in text	Pass
6	Select primary check box	-	System let user check the check box to primary contact	System let user check the check box to primary contact	Pass
7	Select Add Emergency Contact Manually	Yongwei, +601111465936, Friend	System successfully saved new emergency contact and	System successfully saved new emergency contact and	Pass

			update at the contact list	update at the contact list	
8	Select Add Emergency Contact from Contact	-	System successfully imports contact from phone contact	System successfully imports contact from phone contact	Pass
9	Select Cancel Button	-	System cancel user input	System cancel user input	Pass
10	Select Add Button	-	System Save User input	System Save User input	Pass
11	Select Add Emergency Contact when List have 3 emergency contact	-	System prompt You can save up to 3 contacts	System prompt You can save up to 3 contacts	Pass
12	Phone drop and the fall detection active	-	System shows an alert screen to user and starts countdown	System shows an alert screen to user and starts countdown	Pass
13	Select Yes, I'm Fine for alert screen	-	System stops the alert screen	System stops the alert screen	Pass
14	Select I need help for alert screen	-	System send SMS and make a call to primary emergency	System send SMS and make a call to primary emergency	Pass

			contact number	contact number	
15	SMS and phone call when countdown end and user no action	-	System send SMS and make a call to primary	System send SMS and make a call to primary	Pass

5.2.4 Chatbot Function Testing

No.	Test Case	Test Data	Expected Output	Actual Output	Result (pass/fail)
1	Select Text box at the bottom	Hi	Chatbot reply	Chatbot reply	Pass
2	Request today's record	show my record today	System lists today's scheduled medications	System lists today's scheduled medications	Pass
3	Find medicine details	simvastatin	System displays details of requested medicine	System displays details of requested medicine	Pass
4	Add new medicine	Add Panadol for 30 days	System adds medicine and confirms	System adds medicine and confirms	Pass
5	Click Medication List to Open medical list via chatbot	-	System navigates to Medical List page	System navigates to Medical List page	Pass
6	Click Add medication to Open Add medication via chatbot	-	System navigates to Add Medication page	System navigates to Add Medication page	Pass

5.2.4 Chatbot Function Testing

No.	Test Case	Test Data	Expected Output	Actual Output	Result (pass/fail)
1	Select Scan Face	-	System lets user choose camera or gallery	System lets user choose camera or gallery	Pass
1	Scan saved face	Saved face image	System correctly identifies and displays member info	System correctly identifies and displays member info	Pass
2	Scan unregistered face	New face	System prompts to save face with name/relationship	System prompts to save face with name/relationship	Pass
3	Select Save unregistered face	-	System saved the face and updated in the list	System saved the face and updated in the list	Pass
3	View saved face details	Select member	System displays stored details (name, relation, note)	System displays stored details (name, relation, note)	Pass
4	Improve recognition with new angle	Add new photo	System updates accuracy and confirms saved sample	System updates accuracy and confirms saved sample	Pass
5	Make a call using the call button of the face	-	System call to the number	System call to the number	Pass
5	Click Medication List to Open medical list via chatbot	-	System navigates to Medical List page	System navigates to Medical List page	Pass

6	Click Add medication to Open Add medication via chatbot	-	System navigates to Add Medication page	System navigates to Add Medication page	Pass
7	Select Recognition quiz (who is this?)	Display random face	User selects correct answer, system confirms	User selects correct answer, system confirms	Pass
8	Select Recognition quiz wrong answer	Display random face	System shows correct answer	System shows correct answer	Pass

5.3 Project Challenges

During the development of the elderly care mobile application, several challenges were encountered across different modules. One of the main challenges was in the medication reminder system, where handling multiple reminders per day and ensuring timely alerts required careful synchronization with the Android Alarm Manager. At times, alarms failed to trigger as expected due to device restrictions or overlapping schedules, which required additional testing and adjustments to improve reliability.

Another challenge was with the chatbot integration, where the system needed to accurately interpret user commands in natural language, such as “add Panadol for 30 days at night” or “show my record today.” Handling incomplete or ambiguous input also required extra logic to prompt the user for missing details. This added complexity to the interaction flow and demanded rigorous validation to ensure that the chatbot could update or retrieve medical records correctly.

The face recognition module also introduced difficulties, especially in training the system to correctly identify faces under varying lighting conditions and angles. Elderly users may not always capture clear or frontal photos, leading to recognition errors. To improve accuracy, the feature to add new images from different angles was implemented, but this required balancing usability with technical constraints.

The emergency alert module posed its own set of challenges, particularly in ensuring reliability and responsiveness. Implementing a countdown system that automatically triggers help requests if the user does not respond on time required precise coordination between background services and the UI. Handling permissions for calls, SMS, and location sharing also added to the complexity.

Finally, ensuring that all these modules—medication, chatbot, emergency, and face recognition—integrated smoothly within a single application was a major challenge. Managing background processes, database updates, and user notifications without affecting performance required significant effort in debugging, testing, and optimizing the overall system architecture.

5.4 Objectives Evaluation

The objectives set out at the beginning of this project were successfully achieved through the development and integration of various modules in the elderly care mobile application.

The first objective, to **develop an AI-powered chatbot**, was met by creating a medication management assistant that helps elderly users add, view, and manage schedules with simple text commands. The second objective, to **enhance memory recall with facial recognition**, was accomplished by implementing a face recognition module that identifies saved family members and allows additional images to improve accuracy. The third objective, to **promote caregiver connectivity**, was achieved through the emergency module, which provides SOS alerts and automatic notifications to caregivers during emergencies. The fourth objective, to **ensure user-friendly design and accessibility**, was fulfilled by designing an interface with large buttons, intuitive navigation, and clear alerts suited for elderly users. Overall, the evaluation shows that the system effectively integrates AI technologies to support safety, independence, and memory health for elderly users.

6.5 Concluding Remark

In this chapter, the system was evaluated through functional testing, performance measurement, and user-based validation to assess its overall effectiveness. The results demonstrated that the elderly care mobile application successfully met its objectives by delivering reliable medication reminders, responsive chatbot assistance, accurate face recognition, and dependable emergency alert features. Challenges encountered during development were addressed, ensuring smooth operation and usability for elderly users. The evaluation confirms that the system performs reliably, provides a user-friendly interface, and is ready for practical deployment as a supportive tool for elderly care.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The development of the Elderly Care mobile application has successfully addressed the objectives of creating a supportive and user-friendly tool that enhances safety, independence, and memory health for elderly users. By integrating core modules such as medication management, AI chatbot assistance, emergency alert notifications, and face recognition, the system provides a unified platform that caters to the daily needs of elderly individuals while maintaining caregiver connectivity.

Throughout the project, several challenges were encountered, particularly in ensuring reliable alarm scheduling, handling incomplete chatbot commands, and achieving accurate face recognition under different conditions. System evaluation confirmed that each module performed as expected. Medication reminders triggered on time, the chatbot correctly interpreted and managed user commands, emergency alerts reliably reached caregivers, and face recognition achieved satisfactory accuracy. Furthermore, the user interface was designed with accessibility in mind, using large buttons, intuitive navigation, and clear prompts to support elderly users.

In conclusion, the Elderly Care application demonstrates stability, usability, and practicality for real-world deployment. It shows strong potential to assist elderly individuals in managing their daily routines, staying connected with caregivers, and enhancing their sense of independence. With further refinement and expansion, the system can be extended into a comprehensive digital companion that improves quality of life for the elderly community.

6.2 Recommendation

Apart from the features already implemented, several enhancements can be recommended for future development of the Elderly Care mobile application. One possible improvement is to integrate voice command support for the AI chatbot and navigation. This would allow elderly users with limited typing ability to interact with the system more naturally, improving accessibility and user experience.

Another valuable enhancement is to implement cloud backup and synchronization of medical records, emergency contacts, and face recognition data. With cloud integration, caregivers and family members could securely access updates and reminders in real time, ensuring better coordination and support.

In addition, incorporating wearable device integration such as smartwatches or health trackers could provide automated fall detection, heart rate monitoring, and step tracking, which would enhance the safety monitoring capabilities of the application. Alerts from these devices could be seamlessly linked to the existing emergency notification system.

Lastly, it is recommended to include multilingual support for the interface, particularly in Malay and Chinese, alongside English. This would make the application more inclusive and better suited for the local elderly community, ensuring that users are comfortable interacting with the system in their preferred language.

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https://opac.utar.edu.my/gw_2013_2_8/html/default/en/Guides/IEEE-Reference-Guide-Online-v.04-20-2021.pdf
Or refer to the PDF attachment "IEEE Referencing Style" on the FYP portal.

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Poster

UNIVERSITI TUNKU ABDUL RAHMAN

Faculty of Information and Communication technology
Bachelor of Information Systems (Honours) Information Systems Engineering

CareConnect: AI-Powered Companion for the Elderly

INTRODUCTION

This mobile application is developed to assist elderly users in managing medications, recognizing familiar faces, and responding to emergency situations through a smart, AI-powered platform. It aims to promote independence, safety, and memory support for seniors.

METHOD

01 Developed using Android Studio with Room Database for local storage and OpenAI API for chatbot assistance.

02 Facial recognition implemented using TensorFlow Lite (TFLite) for on-device processing.

03 Emergency alerts supported through countdown timers, sound detection, and SMS/call notifications.

03 ML Kit is used for image text recognition, extracting medication information to text

OBJECTIVE

1.To develop an AI-powered chatbot that assists elderly users in managing their medication schedules and appointment reminders.

2.To enhance memory recall by implementing facial recognition to assist elderly users in identifying familiar faces

3.To promote caregiver connectivity by sending notifications and updates regarding the user's medication schedule or emergency situations.

4.To ensure user-friendly design and accessibility by creating a simple interface with large buttons and intuitive navigation, tailored specifically for elderly users.

RESULT

- A fully functional elderly care mobile app combining medication reminders, emergency detection, chatbot assistance, and facial recognition.
- CareNest successfully improved medication adherence, enhanced safety via SOS/emergency alerts, and supported memory recall through face identification.
- Evaluation showed positive results in usability testing, confirming smooth operation and accessibility for elderly users.