HealthMate – Mobile Application As

A Privacy-First Health Companion for Chronic Conditions

Project in Computer Science

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Title:

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Introduction

In Sri Lanka non-communicable diseases (NCDs) such as diabetes and hypertension are a serious and increasing public health concern. The daily tasks for patients with serious chronic diseases include monitoring important health indicators following complex drug schedules and efficiently updating doctors on their health during quick appointments. Inaccurate data, poor adherence and ineffective healthcare consultations are the results of the existing reliance on memory, paper logs or unsecure digital apps. Additionally, when using mobile applications patients are increasingly more worried about the security and privacy of their private health information. This project proposes the development of "**HealthMate**" a privacy first advanced mobile application designed to empower Sri Lankan patients. It leverages a multi-component AI architecture to provide a secure platform for managing personal care plans, logging data and receiving intelligent friendly reminders and useful suggestions.

Problem

1. Symptoms

- Patients with chronic conditions (e.g. diabetes, hypertension) frequently forget to take medications on time.
- Health data such as blood sugar and blood pressure readings are often written on paper or remembered from memory leading to loss or inaccuracy.
- Doctors receive incomplete or inconsistent information during short clinic visits reducing the effectiveness of medical consultations.

- Many available health apps store sensitive data on external servers raising privacy and trust concerns among patients.

2. Justification (Evidence of the Problem)

- According to Sri Lanka's Ministry of Health non-communicable diseases (NCDs) account for more than 70% of deaths with poor adherence to medication being a major cause.
- Studies show that over 50% of patients worldwide do not take their medication as prescribed leading to complications, higher hospitalization rates and increased healthcare costs.
- Global apps offer useful features but are not tailored for Sri Lankan patients and often rely on cloud storage which conflicts with local privacy expectations.
- Feedback from chronic patients and caregivers highlights the need for a simple, personalized and privacy first health tracking solution.

3. Core Problem

The root problem is the lack of a secure, affordable and patient friendly mobile app that allows Sri Lankan patients with chronic conditions to create a personalized care plan, log health data reliably and receive non diagnostic reminders all while ensuring that sensitive health information is stored privately on the user's device rather than in the cloud.

Aim

To Develop AI-based automated solutions and privacy-focused mobile application that would help Sri Lankan users manage their chronic medical conditions. Through on device and cloud-based AI analysis the system will make it easier to create a personalized treatment plan, track health data and receive proactive, non-diagnostic reminders and improved suggestions.

Objectives

1. **Review Existing Digital Health Apps**
   To examine current apps and identify gaps in **privacy, usability and personalization** ensuring the new app addresses these shortcomings.
2. **Analyze User Challenges in Sri Lanka**
   To understand problems faced by chronic condition patients such as medication adherence, limited healthcare access and fragmented health data.
3. **Design My Care Plan (MCP)**
   To create a personalized system for **setting health goals, scheduling medications and daily health tracking**.
4. **Develop a Secure AI-Driven System**
   To provide **personalized guidance and support** while keeping user data safe through secure storage and AI-powered suggestions.
5. **Health Data Visualization and Reports**
   To present health information clearly with **charts and exportable reports** for both users and healthcare providers.
6. **Test the Application**
   To ensure **functionality, usability and security** are reliable before deployment.

Motivation

This project is motivated by the need to empower patients with chronic conditions in Sri Lanka to take control of their health without compromising privacy. Many patients still rely on paper notes or memory which are unreliable and often result in poor adherence to treatment. While global health apps exist they are either too complex dependent on constant internet access or store sensitive health data on external servers raising privacy concerns. With the rapid growth of smartphone use in Sri Lanka there is a strong opportunity to provide a simple, secure and locally relevant digital tool that helps patients follow their care plans more effectively and communicate health trends clearly with doctors.

Methodology

The project follows an Agile-based sprint-driven development methodology adapted for a solo developer working within a fixed 3-month timeline. The focus is on incremental feature delivery, continuous testing and strict adherence to a privacy-first principle.

Sprint 0 (Preparation Phase):

- Finalize requirements through literature review and user discussions with patients, caregivers and healthcare professionals.
- Design UI/UX wireframes and system architecture (frontend, backend, AI and data storage).
- Perform risk assessments with a focus on security, privacy and adherence to the law.

MVP Development Phase (3 Months):

- **Month 1:** Build the foundation — secure local storage, user authentication and the **My Care Plan (MCP)** feature for personalized goals and medication schedules.
- **Month 2:** Implement manual data logging for health metrics, develop data visualizations and integrate AI-powered reminders and motivational nudges using Neo4j + LangChain.
- **Month 3:** Add report export functionality (PDF/CSV), perform unit/integration/security testing, finalize legal documentation (Privacy Policy, Disclaimer) and deploy the MVP to the Google Play Store.

This phased approach ensures early access to important medical features, manageable progress and a safe, privacy-focused solution designed specifically for managing chronic diseases in Sri Lanka.

Phase	**Duration**	**Key Tasks**	**Deliverables**
Sprint 0: Planning & Setup	Weeks 1-2	- Requirement gathering - UI/UX & system design - Privacy & risk check	- Final requirements - UI/UX Wireframes & Sys architecture - Risk/privacy report
Month 1: Foundations	Weeks 3-6	- Foundation setup - Secure local data storage - User authentication - My Care Plan	- SQLite storage - Basic Authentication - MCP goals & meds

Month 2: Personalization & Discovery	Weeks 7-10	- Health data logging - Data visualization - AI reminders & tips	- Logging interface - Dashboards - AI reminders
Month 3: Testing & Launch	Weeks 11-14	- Reporting & export features - Testing - Legal documentation - MVP Deployment	- CSV/PDF health reports - Privacy & disclaimer - Tested MVP - Play Store release

Proposed approaches

The development of **HealthMate** will follow a structured and iterative approach ensuring privacy, scalability and user-centered design. The following strategies define the proposed approach:

1. **MVP-First Strategy**
    - Begin with a Minimum Viable Product (MVP) that focuses on the most essential features:
        - My Care Plan (MCP) creation.
        - Manual health data logging (blood sugar, blood pressure, medication).
        - Reminders and alerts for medication and logging.
        - Report generation (PDF/CSV) for doctor consultations.
    - This ensures a working solution is available within the project timeline while future iterations can expand functionality.
2. **Hybrid AI Setup**
    - Implement on-device AI for reminders, alerts and basic observations to maintain privacy.
    - Use cloud-based AI microservices (Python + LangChain) for more advanced suggestions (e.g. trend summaries, adherence analysis) while keeping raw patient data local and anonymized.
    - Neo4j ontology will serve as the knowledge base for conditions, medications and goals enabling personalized yet non-diagnostic recommendations.

3. **Privacy by Design**

    - Follow a privacy-first principle where all raw health data remains securely on the user's device.
    - Firebase Firestore will only handle non-sensitive metadata (e.g. user authentication, app analytics).
    - Encrypted local storage will be used for MCP data and health logs following with the Sri Lankan Personal Data Protection Act (PDPA).

4. **Modular Architecture**

    - The system will be designed with clear separation of components for scalability and maintainability:
        - Frontend: React Native with Expo Go (mobile app).
        - Backend 1: Java Spring Boot (system services, authentication).
        - Backend 2: Python microservices (AI/ML with LangChain).
        - Database: Firebase Firestore (metadata) + Encrypted local DB (PHI).
        - Ontology: Neo4j for condition–medication–goal relationships.

5. **Continuous Testing**

    - Employ agile sprints with regular testing cycles covering:
        - Unit testing of features.
        - Integration testing between modules.
        - Security testing for encryption and privacy compliance.
        - Usability testing to ensure the app remains accessible for elderly users.

6. **User-Centered Feedback**

    - Collect iterative feedback from a pilot group of patients and doctors.
    - Refine UI/UX, reminders and reports based on real world use.
    - Ensure that recommendations and alerts are clear, supportive and culturally relevant for Sri Lankan users.

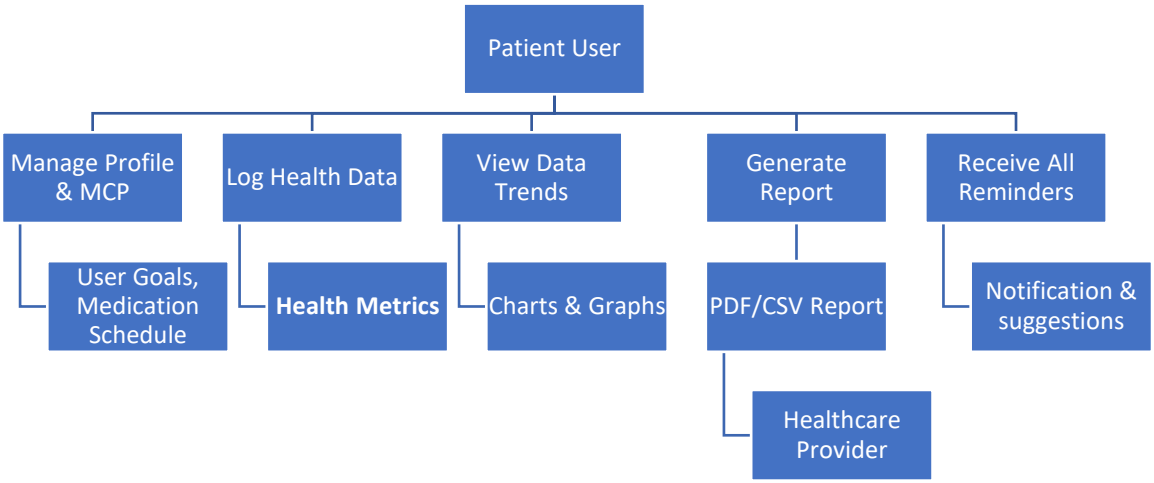

Figure 1:

Resource requirements

Software:

- React Native with Expo Go
- Java Spring Boot
- Python (Flask/FastAPI for AI microservices)
- Firebase Firestore
- Neo4j (Ontology management)
- LangChain (ML orchestration)
- Libraries for PDF/CSV export

Hardware:

- A development computer
- Android smartphone for testing and server resources for hosting the backend services (Spring Boot, Python, Neo4j).
- Cloud-based instances (e.g. AWS EC2, Google Cloud Compute) used for development and testing.

Human Resources:

- Mobile app developer
- Backend developer
- AI/ML specialist
- Database administrator
- QA tester

Time Schedule

Task Name		2025						
		Aug	Sep	Oct	Nov	Dec	Jan	Feb
1.	Proposal writing online workshop							
2.	Project proposal submission							
3.	Project proposal evaluation							
4.	Notify the selection							
5.	Requirement gathering. Literature Survey Progress Report Submission.							
6.	Chapter 1 – Introduction background of the problem draft report submission							
7.	Draft report of chapter 2 - Literature Review - Progress Report Submission							
8.	Draft report of chapter 3 – Research Methodology Progress Report Submission							
9.	Data Collection Project Implementation							
10.	Draft Report of chapter 4 – (Data Analysis of Implementation and evaluation)							
11.	Draft report of chapter 5 - Conclusion and recommendation progress report submission							
12.	Final submission and Viva							

Figure 2:

References

1. Academic & Research Papers

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2. Regulations & Compliance Guidelines

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- WHO Guidelines on NCD Management – https://www.who.int
- HIPAA (Health Insurance Portability & Accountability Act, US) – https://www.hhs.gov/hipaa

3. Industry Reports & Case Studies

- Deloitte (2023). *Digital Health Trends & Patient Data Privacy*.
- PwC (2022). *The Future of Health Apps in Emerging Markets*.

4. Technology & Tools

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- Spring Boot Documentation – https://spring.io/projects/spring-boot
- Firebase Documentation – https://firebase.google.com/docs
- Neo4j Graph Database – https://neo4j.com/docs
- LangChain Documentation – https://python.langchain.com