Group Course Project Task - 3: Smart Telehealth Platform

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1 Introduction & Novel Contributions

Current telehealth ecosystems often assume a "one-patient, one-device" model with persistent high-speed connectivity, a design paradigm that fails in rural contexts. While existing platforms like Practo provide consultations, they lack the resilience required for intermittent networks and the interface simplicity needed for low-literacy populations.

Building upon the 17 literature sources reviewed in Task 1, 'AarogyaMitra' introduces three specific novelties to address these gaps:

(1) **Family Profile Management:** Recognizing that mobile devices in rural India are shared assets and in many families younger child takes care of medical details of older parents, our system introduces a hierarchical profile model. A single "Account Owner" (Intermediary) can manage health records for multiple dependents (e.g., elderly parents) within one login, a feature often absent in many health apps.
(2) **Conversational AI Assistant:** Unlike standard chatbots that use rigid decision trees, we integrate a Generative AI (Gemini) companion. This acts as a "Digital Sahayak," capable of handling vague inputs (e.g., "I forgot the tablet name, it's yellow") and guiding the user through complex tasks via natural conversation, reducing the cognitive load associated with form-filling.
(3) **Offline-First Architecture:** To counter the "anxiety of disconnection," our system employs a robust offline queue. Users can log vitals and set reminders without internet access; the system visually queues these actions and syncs them automatically when connectivity returns, ensuring continuity of care.

2 System Design & Architecture

2.1 Architectural Overview

The 'AarogyaMitra' application follows a **Client-BaaS (Backend-as-a-Service)** architecture supplemented by a custom **Offline-First Middleware**. This design was explicitly chosen to address the primary constraint of the target demographic: intermittent internet connectivity in rural India.

- **Frontend:** A cross-platform mobile application developed using **React Native (Expo)**, ensuring compatibility with both Android and iOS devices commonly used by rural intermediaries.
- **Backend: Google Firebase** serves as the unified backend, handling authentication, NoSQL data storage, and file hosting.
- **Intelligence Layer: Google Gemini API** powers the conversational interfaces, providing natural language processing for three distinct modalities.

2.2 Core Components

2.2.1 Client-Side (Frontend Logic). The application logic is structured around modular navigation for feature isolation and rigorous state management for cross-cutting concerns.

- **Modular Feature Architecture (Navigation):** The app uses a **Root Stack Navigator** to manage authentication and a **Nested Stack** for core feature modules. Distinct screens for features like Vitals or Appointments are loaded on demand, keeping the application lightweight.
- **Global State Management (Context API):** Only data essential to the entire session is held in global context:
  (1) **Profile Context:** Manages the active identity (User vs. Dependent). This context wraps the entire application, ensuring that when a user switches profiles, all downstream modules (Reminders, Vitals, Allergies, Accessibility Needs) automatically read and write to the correct Firestore path for that specific family member.
  (2) **Language Context:** Drives the internationalization (i18n) engine, loading translation resources for supported languages (English and Hindi) to ensure interface consistency across all modules.
- **Offline Queue System:** Unlike standard CRUD apps, AarogyaMitra implements a custom offline layer. Write operations (such as creating reminders or logging vitals) are intercepted by dedicated local queue services. These actions are persisted in local storage and automatically flushed to the backend once a stable connection is detected.

2.2.2 Backend-as-a-Service (Firebase). We utilize Google Firebase as our complete backend, leveraging four of its core services:

- **Authentication:** Handles user identity via Username/Password and Phone/OTP providers. It supports persistent sessions, essential for shared devices.

- **Cloud Firestore (Database):** Acts as the primary database. It stores structured data (UserProfile, VitalsLogs, Appointments) and syncs with the client's offline queue.
- **Firebase Storage:** Securely hosts binary blobs, specifically user-uploaded medical documents (prescriptions, lab reports). The system creates metadata immediately while retrying binary uploads in the background.
- **Notification Services:** Integrates **Expo Notifications** and **Firebase Cloud Messaging (FCM)** to deliver local alerts for medicine reminders and push notifications for appointment updates.

2.2.3 Intelligence Layer (Google Gemini API). To fulfill the high-fidelity requirements for intelligence, the application integrates the Google Gemini API in three distinct functional areas, each with specialized system prompts:

(1) **AI Symptom Checker (Triage)**: A structured conversational module that acts as a "smart front door". It asks clarifying questions about reported symptoms and outputs a triage recommendation, strictly avoiding diagnostic claims.
(2) **Conversational Companion (AI Chat)**: A persistent, context-aware chat assistant that allows users to perform app actions via natural language (e.g., "Book a doctor" or "Log my BP"). It parses user intent and triggers the corresponding UI flows to fulfill the user requirement.
(3) **AI Support Bot**: A dedicated help-desk instance designed to answer usage questions (e.g., "How do I upload a file?") and troubleshoot technical issues, reducing the need for human support.

2.3 Data Flow Strategy

The system employs an **Optimistic UI** pattern to ensure perceived performance:

(1) **User Action:** User logs a vital reading or sends a chat message.
(2) **Local Commit:** The app immediately updates the UI (via React State) and saves the action to the local storage queue.
(3) **Synchronization:** A background service monitors network status.
(4) **Remote Commit:** When online, the queue flushes data to Firestore. If the Gemini API is called, the response is fetched and populated back to the UI state.

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3 Compromises in Prototyping

3.1 Nature of the Prototype

This high-fidelity prototype adopts a **"T-shaped" architecture**, combining horizontal breadth with vertical depth to balance comprehensive navigation with functional realism.

- **Horizontal Scope (Breadth):** The prototype implements the full top-level navigation structure (Dashboard, Profiles, Records), ensuring users can explore the complete "information architecture" without hitting dead ends.
- **Vertical Scope (Depth):** We selected three core workflows **Symptom Triage, Appointment Booking, and Vitals Logging**—for deep, functional implementation. These features are vertically integrated with the Firebase backend and Gemini API to support end-to-end user testing.

3.2 Technical & Functional Compromises

To maintain focus on usability testing and core value propositions, the following intentional compromises were made:

3.2.1 Simulated Integrations.

- **Emergency Response Tracking:** The "Emergency Alert" feature functions as a high-fidelity visual simulation. While the user can trigger an alert and receive immediate UI feedback confirming the dispatch, the real-time geospatial tracking of the ambulance on a live map and the backend integration with emergency dispatch centres were omitted.
- **Video Teleconsultation:** While the system successfully generates and stores meeting links, the actual video streaming service is simulated by redirecting to external providers (Google Meet) rather than embedding a custom WebRTC stream. This allows us to test the *booking* flow without the engineering overhead of a streaming server.

3.2.2 AI Model Specificity.

- **General-Purpose vs. Medical LLM:** The prototype utilizes the general-purpose Google Gemini API for the "Symptom Checker" and "Conversational Companion." While effective for demonstrating conversational flows and intent recognition, the model is not fine-tuned on clinical datasets. A production-grade implementation would necessitate a multi-lingual medical model (e.g., Med-PaLM) to ensure higher diagnostic accuracy and strict adherence to clinical safety protocols.

3.2.3 Platform Constraints (Expo Go).

- **Speech-to-Text Features:** The "Conversational Companion" supports voice input via the `expo-speech-recognition` library. However, for ease of dissemination to evaluators via the Expo Go client, this feature may default to text-only input in certain testing environments, as the native microphone permissions require a custom development build.
- **Background Sync Triggers:** While the offline queue logic is fully implemented, the automatic background synchronization (triggering uploads when the app is closed) is limited by mobile OS battery optimizations in the prototype environment. Syncing is currently triggered upon app foregrounding.

3.2.4 Data Scope.

- **Clinician Availability:** The "Doctor" side of the marketplace is simulated. Doctor availability slots are pre-seeded in the database, and booking confirmations are automatic, removing the need for a secondary "Doctor App" user during testing.

4 Conceptual Model

4.1 Metaphor: The "Digital Sahayak"(Companion)

The application is designed around the metaphor of a **Digital Community Health Worker** (*Sahayak*). In rural healthcare systems, patients often rely on a human intermediary to navigate the complex medical system, translate medical jargon, and keep track of records.

AarogyaMitra replicates this trusted human relationship through two distinct behaviors:

- **The Guide (AI):** Like a human health worker, the AI Chat interface listens to symptoms in natural language, offers empathetic guidance, and directs the patient to the right specialist without making diagnostic claims.
- **The Record Keeper (Dashboard):** Like a physical patient file carried by a worker, the Dashboard and "Medical Documents" vault provide a tangible, structured history of the patient's health that persists regardless of internet connectivity.

4.2 Core Design Concepts

4.2.1 Dual-Mode Interaction Space. Recognizing that users possess varying levels of digital literacy and distinct mental models, the design supports two complementary modes of interaction:

- **Conversation-First Mode:** Designed for users who are "interface-averse" or have low reading literacy. These users can accomplish complex tasks (like Triage or Booking) entirely through a linear conversation with the AI, mimicking a phone call or chat with a friend.
- **Task-Oriented Mode:** Designed for "power users" (e.g., Community Health Workers or tech-savvy family members). These users utilize the structured Dashboard to access quick-action tiles (Vitals, Reminders), bypassing the chat for efficiency.

4.2.2 Visual Language & Feedback.

- **Color Psychology:** AarogyaMitra leans on a calming spectrum of **Care Blue** and **Healing Green** to build trust while signalling wellness. Warm accent hues highlight urgent notices without creating alarm.
- **Visibility of System Status (Offline Trust):** To address the "anxiety of disconnection" common in rural areas, the system makes the invisible visible. When offline, items (such as new reminders) are instantly marked with a visual "Queued" badge. This provides immediate conceptual feedback that the "work is done" and the system has taken responsibility for the data, even if the cloud is unreachable.

4.3 The Design Space

4.3.1 Why (The Problem Space) : The design addresses the intersection of **Accessibility** and **Infrastructure**. Rural users face a "double burden": they lack nearby physical clinics and simultaneously lack the high-speed connectivity required by standard telemedicine apps.

4.3.2 What (The Solution Space) : A hybrid mobile application that merges **Generative AI (Gemini)** for accessible input with a **Local-First Database (Firestore/AsyncStorage)** for reliable execution. It is not just a video-calling tool but a comprehensive health management suite (Triage + Logistics + Records).

4.3.3 Where (The Context of Use) : The system is designed for:

- **The Rural Home:** Where connectivity is intermittent (requiring offline queues).
- **Shared Devices:** Where a single smartphone serves an entire multi-generational household. The "Family Profile" concept explicitly models this "1 Device : N Patients" reality, ensuring data segregation between the primary user and their dependents.

4.3.4 When (The Temporal Scope) : The interaction spans the full care lifecycle:

- **Immediate:** Symptom checking and emergency alerts.
- **Short-term:** Appointment booking and document upload.
- **Long-term:** Chronic disease management via recurring medication reminders and longitudinal vitals tracking.

5 Prototype Description and Functionalities

The high-fidelity prototype is a fully functional, end-to-end React Native application built with Expo. It moves beyond the conceptual 'click-through' Figma models and 'Wizard-of-Oz' simulations of Assignment 2, implementing a working system with a live backend (Firebase), real-time AI integration (Google Gemini API), and a robust offline-first architecture.

The application is defined by its support for two complementary interaction styles, allowing it to serve users of all digital literacy levels.

5.1 Dual Interaction Model

- **Task-Oriented (Dashboard Mode):** For users who prefer structured navigation (e.g., tech-savvy intermediaries or health workers), the app provides a clear, icon-based dashboard. This mode allows for efficient, form-based data entry and review.
- **Conversation-First (AI Mode):** For users who are "interface-averse" or have low literacy, the app provides a complete, AI-driven chat experience. Users can describe symptoms, ask questions, and receive guidance in plain language, mimicking a conversation with a human helper.

5.2 Core Functional Modules (Task-Oriented UI)

5.2.1 Home Dashboard: The Home Screen serves as the central command center for the application. It is designed to provide immediate access to critical functions through a clear, hierarchical layout:

- **Global Controls:** The top navigation bar hosts the **Language Selector** for instant localization (top-left) and the **Emergency Alert** button (top-right) for rapid distress signaling.
- **AI Companion Card:** Dominating the upper section is the blue "AI Assistant" interface. This serves as an "all-in-one" conversational entry point, allowing users to bypass menus and perform any task—from describing symptoms to booking doctors—simply by tapping "Chat now".
- **Feature Grid:** Below the AI, structured tiles provide direct access to the core functional modules: Symptoms, My Appointments, Reminders, Medical Documents, Family Profiles, and Record Vitals.
- **Support:** The bottom navigation bar includes a persistent Help/FAQ button (Question Mark icon) alongside Home and Profile navigation.

5.2.2 Family Profile Management: A cornerstone feature for the "Caregiver" (Anil) persona. A single user (the account owner) can create and manage multiple linked profiles. The system provides two distinct linking modalities:

- **Existing User:** Requesting access to manage an account that is already registered on the platform.
- **New User:** Creating a fresh profile for a dependent who does not possess a device or account.

Once linked, the dependent's data is fully visible to the account owner. Selecting a specific profile (Figure 2) instantly switches the application's entire context. This ensures that any new vitals recorded or reminders set are saved strictly to the selected family member's record, maintaining clear data segregation.

5.2.3 Vitals and Reminders. The prototype includes fully functional modules for proactive health monitoring and treatment adherence:

- **Record Vitals (Figure 4):** Users can log six key metrics (Blood Pressure, Blood Sugar, SpO2, Temperature, Heart Rate, Weight). The system acts as a first line of defense by validating inputs against medical thresholds; if a reading is abnormal (e.g., high glucose), the UI immediately displays a **color-coded warning** to alert the user of the potential risk.
- **Reminders (Figure 5):** To ensure adherence, this module allows users to set persistent alerts for both **Medicines** and **Appointments**. Alert is given 10 minutes in prior for medicine and 1 hr in prior for Appointments so that the user can attend to them.

5.2.4 Medical Documents Vault: This module serves as a secure digital repository for prescriptions and lab reports.

- **Document Management (Figure 6):** Users can view a complete history of their uploaded records, sorted by date.
- **Guided Capture (Figure 7):** To ensure legibility, the system provides flexible input options: users can upload existing files from their gallery or use the "Scan or Capture" feature to take a new photo. A prominent "Watch video" button is included to guide low-literacy users on optimal lighting and framing techniques for document capture.

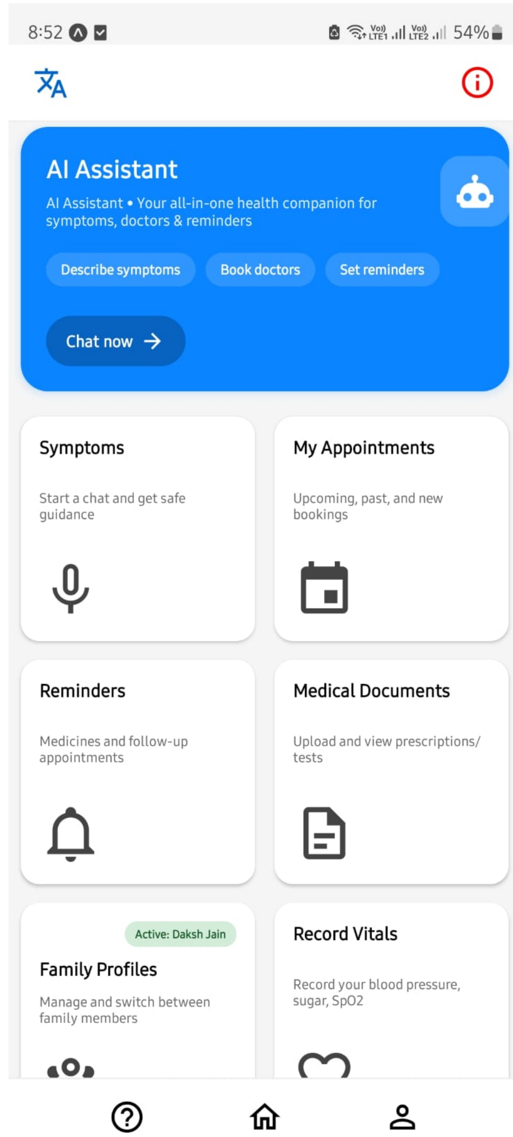

Figure 1: The Home Dashboard featuring the AI Companion and quick-access tiles.

5.3 Conversational Companion (AI-Driven UI)

5.3.1 Unified Conversational Interface: For users who prefer natural language over structured menus, the AI Chat acts as a complete alternative interface (Figure 8). Powered by the Google Gemini API, it supports **all** core application features—from triage to booking—through a simple conversation.

5.3.2 Guided Interactions for Vague Inputs: The AI is specifically prompted to handle ambiguity, a critical feature for low-literacy users. As shown in Figure 9, if a user wants to set a medicine reminder but cannot recall the specific drug name (answering "I don't know"), the AI adapts. It switches to a guided inquiry mode, asking for visual cues (e.g., "What color is it?") and purpose (e.g., "For

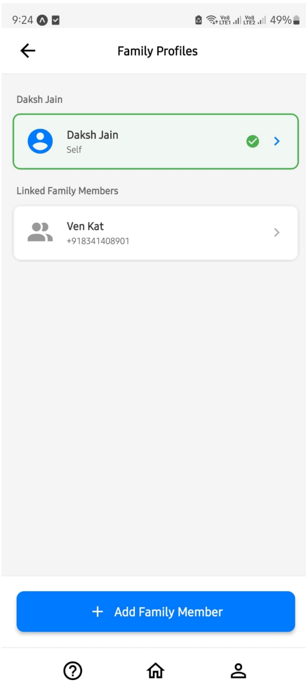

Figure 2: Managing linked profiles.

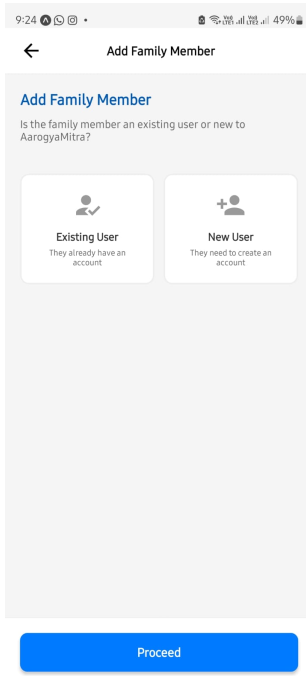

Figure 3: Linking options.

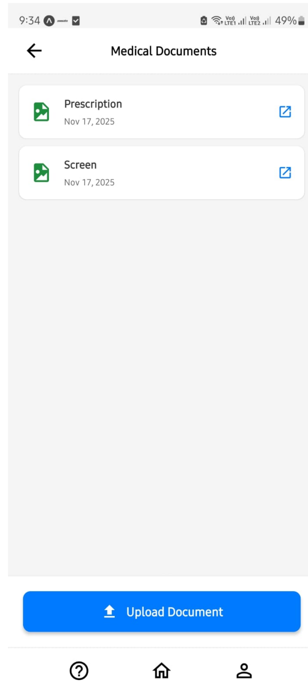

Figure 6: Document repository.

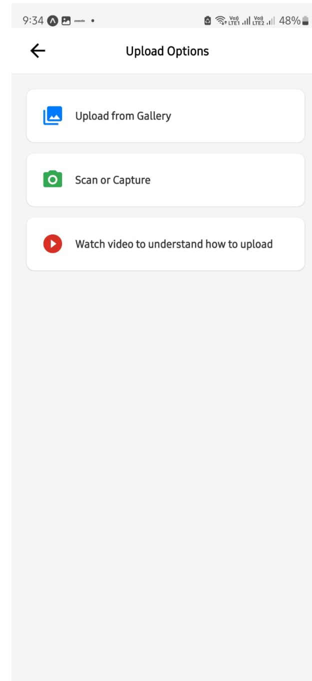

Figure 7: Upload options with guidance.

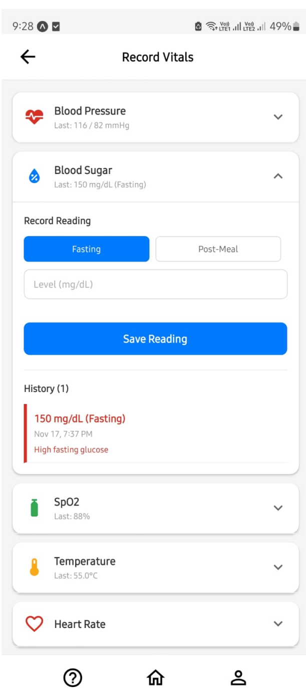

Figure 4: Vitals log showing a high-value warning.

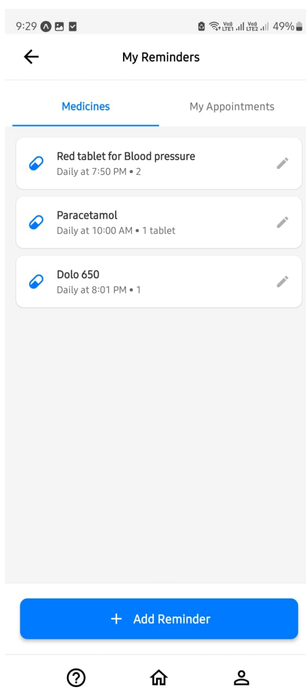

Figure 5: Medicine reminder list.

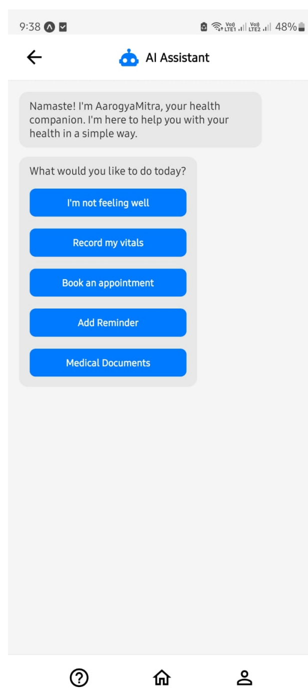

Figure 8: Conversational main menu.

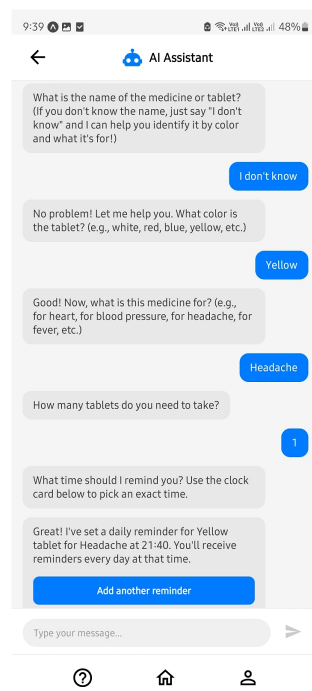

Figure 9: AI guiding a vague input.

headache?"), allowing the user to successfully create a functional reminder ("Yellow tablet for Headache") without technical precision.

5.3.3 Conversational Workflows. The AI Chat is designed to handle variable user intent through structured decision trees:

- **Intelligent Appointment Routing (Figure 10):** When a user requests an appointment, the AI first determines context. It asks, "Do you have a doctor in mind?" If the user knows the name, they can enter it directly. If not, the AI pivots to a diagnostic mode, asking for the health problem (e.g., "Fever") and then autonomously recommending the appropriate specialist (e.g., "General Checkup").
- **Symptom Triage & Escalation (Figure 11):** When a user reports feeling unwell, the AI conducts a safety check. After gathering symptom details (e.g., "Sharp pain"), it provides a preliminary assessment and offers two distinct paths: a "Self-Care Plan" for minor issues, or "Escalate to Doctor" for serious concerns, ensuring safety is prioritized over automation.

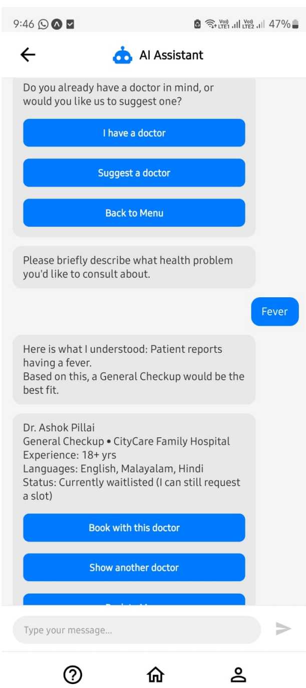

Figure 10: AI suggesting a doctor.

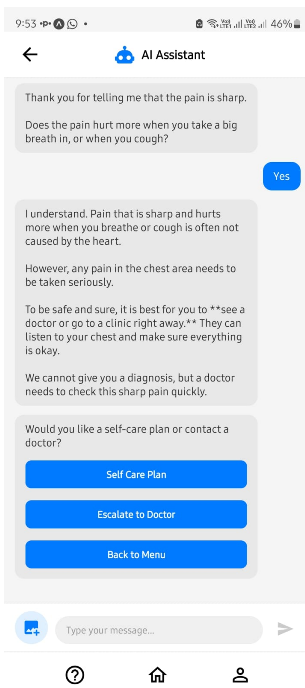

Figure 11: Triage escalation options.

5.3.4 Hybrid Handoff. The two interaction models are linked. The AI can "hand off" the user to the structured UI. For example, after a triage conversation, the chat can present a button that opens the 'Book Appointment' screen with the specialist field (e.g., "Dermatologist") **pre-filled**, streamlining the user journey.

5.4 Multilingual Accessibility

To ensure inclusivity for rural populations with limited English literacy, the prototype implements full bilingual support (English and Hindi) across both the interface and the intelligence layer.

- **Localized UI (Figure 12):** Powered by the global `LanguageContext`, the entire application interface—including navigation labels, buttons, and forms—instantly translates when the user toggles the language selector in the top-left corner.
- **Vernacular AI (Figure 13):** The AI Companion is prompt-engineered to detect and respond in the user's preferred language. This allows users to describe symptoms or ask for help in Hindi, receiving accurate, culturally relevant guidance in the same script.

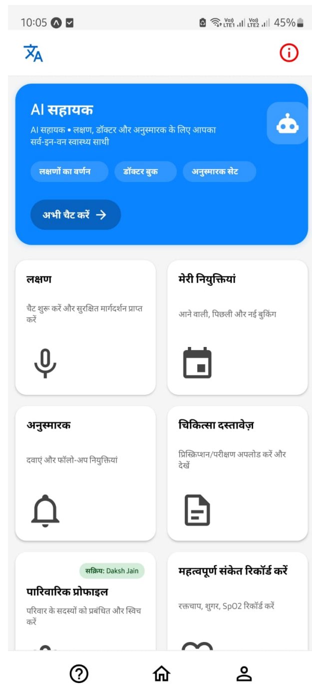

Figure 12: Dashboard in Hindi.

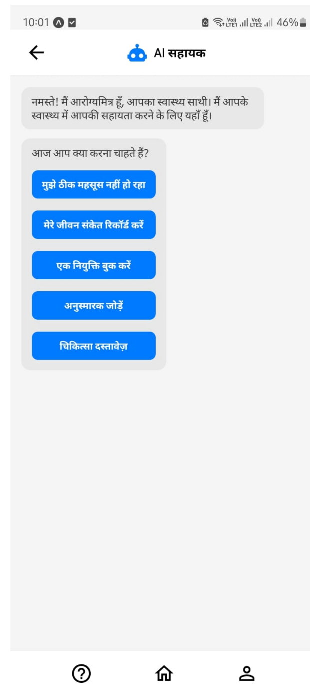

Figure 13: AI Chat in Hindi.

5.5 Key Technical Functionality: Offline-First Reliability

The prototype's most critical technical feature is its resilient offline-first architecture, designed to ensure continuity of care in unreliable network environments.

- **Visual Queuing (Figure 14):** When a user performs an action offline (e.g., adding a medicine), the UI immediately reflects the change but appends a distinct "Queued" badge. This gives the user explicit visual confirmation that their data is saved locally and waiting for a connection.
- **Resilient Notifications (Figure 15):** Reminders are not just server-side events; they are scheduled locally on the device. This ensures that a user receives critical medicine alerts at the correct time, even if the phone is in Airplane Mode or has zero connectivity.
- **Background Sync:** Once the device (via `NetInfo`) detects a stable connection, dedicated local queue services automatically

flush all pending actions from AsyncStorage to Firebase, syncing the data and removing the "Queued" badges.

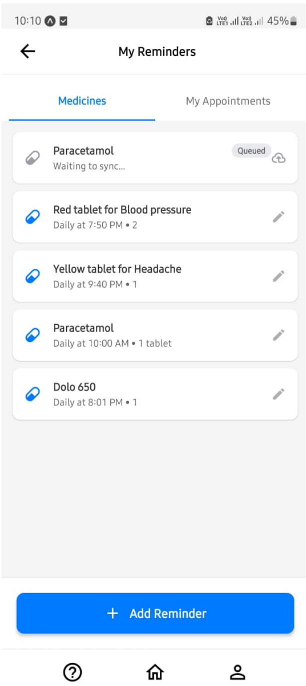

Figure 14: Offline 'Queued' indicator.

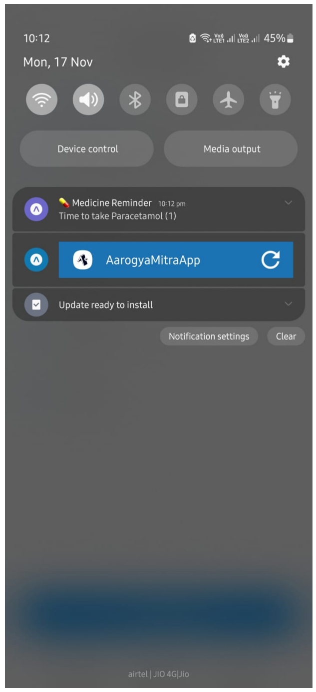

Figure 15: Local system notification.

6 User Evaluation and Results

To validate the high-fidelity prototype, we conducted a summative usability evaluation. The primary objective was to assess the effectiveness of the "Dual-Mode" interaction model and to determine if the offline feedback mechanisms successfully instilled trust in users during low-connectivity scenarios.

6.1 Evaluation Methodology

We employed a **Task-Based Usability Test** combined with **Direct Observation**. Unlike a think-aloud protocol, participants were asked to interact with the application naturally. They were explicitly instructed to request assistance only if they encountered a difficulty or felt "stuck." Evaluators took notes on these friction points and tracked successful task completions.

6.1.1 *Settings and Apparatus.*

- **Environment:** Semi-naturalistic setting to ensure unbiased use by the user.
- **Device:** The prototype was deployed on a physical Android device via the Expo Go client to simulate the actual form factor, touch interactions, and user flow.
- **Connectivity Simulation:** We manually toggled "Airplane Mode" during specific tasks to evaluate the system's offline-first behaviour and the user's reaction to the "Queued" status indicators.

6.2 Participant Demographics

We recruited 4 participants to represent our core personas: the "Tech-Savvy Intermediary" and the "Low-Literacy User".

Table 1: Participant Demographics

ID	Age	Tech Proficiency	User Type
P1	23	High	IITGN Student
P2	34	High	Shopkeeper
P3	42	Low	Cleaner
P4	35	Low	Mess Worker

6.3 Evaluation Tasks

Participants were asked to complete four scenarios designed to test the vertical depth of the prototype's core features.

(1) **Task 1: AI Triage (Conversation Mode)** *Scenario:* "You have a severe headache and don't know which doctor to see. Use the Chat Assistant to explain your symptoms and find a recommendation." *Goal:* Test the Gemini API integration and the clarity of the medical disclaimer.
(2) **Task 2: Appointment Booking** *Scenario:* "The assistant suggested a General Physician. Go ahead and book the appointment for tomorrow morning." *Goal:* Test the ease of Appointment Booking feature.
(3) **Task 3: Record Vitals (Family Context)** *Scenario:* "You are now managing your father's health. Switch the profile to 'Ramesh' and **record a Blood Pressure reading** of 120/80." *Goal:* Validate the `ProfileContext` logic and the ease of data entry using the specialized vitals form.
(4) **Task 4: Set Medicine Reminder (Offline Mode)** *Scenario:* "Internet connectivity is lost (Facilitator enables Airplane Mode). **Add a daily medicine reminder** for 'Paracetamol' at 2:00 PM." *Goal:* Observe if the user notices the "Queued" badge and understands that their reminder is saved despite the lack of connection.

6.4 Quantitative Results

6.4.1 *Task Success Rates.*

Participants generally performed well across the core tasks, with success defined as completing the workflow without facilitator intervention.

- **Task 1 (AI Triage):** 100% [4/4] Completion Rate.
- **Task 2 (Booking):** 75% [3/4] Completion Rate.
- **Task 3 (Record Vitals):** 100% [4/4] Completion Rate.
- **Task 4 (Set Reminder):** 75% [3/4] Completion Rate.

6.4.2 *Feature Usability Ratings.*

Post-test, participants rated the usability of specific features on a 5-point Likert scale (1 = Very Difficult, 5 = Very Easy).

6.5 Qualitative Findings & Observations

6.5.1 *Successes.*

Participants responded positively to the core metaphors of the application, particularly regarding family management.

Table 2: Mean Usability Ratings (N=4)

Feature / Component	Rating (1-5)
AI Chat Interface	4.50
Dashboard Navigation	4.00
Appointment Booking	4.00
Offline "Queued" Indicators	3.50
Profile Switching	3.75

- **Profile Switching Clarity:** Users effectively utilized the profile switcher, noting that the green bar clearly indicated whose health data was currently being viewed.
- **Offline Reassurance:** Upon seeing the "Queued" badge during Task 4, participants explicitly stated they understood they did not need to re-enter the data later.

6.5.2 Friction Points. While the overall flow was smooth, testing revealed specific hurdles in the interaction design that led to hesitation.

- **AI Handoff Awareness:** Some users hesitated after the AI recommendation in Task 1, not immediately noticing the "Book Appointment" button that appeared within the chat stream.
- **Navigation Visibility:** Users occasionally struggled to locate the "Past Appointments" tab, suggesting the tab switching UI needs higher contrast.

6.6 Design Implications

Based on the friction points and visual analysis of the prototype, future iterations will implement the following refinements:

- **Profile Context Clarity:** While the distinction line between the account owner ("Daksh Jain") and "Linked Family Members" (Figure 2) is present, participants still took time to verify the active profile. To enhance this, we propose increasing the visual weight or contrast of the **active profile card's border** to provide a more obvious, peripheral cue of the active user context.
- **Input Mode Ambiguity:** During the initial AI greeting, users hesitated, unsure whether to type a generic "Hello" or tap the specific action buttons (e.g., "I'm not feeling well"). To resolve this, we propose **dynamically hiding the text input box** during this specific "Introduction State." This constraint guides users to select a clear starting intent via the buttons, reducing cognitive load before enabling free-text interaction.

7 Ethics and Risk Assessment

The development and evaluation of 'AarogyaMitra' involve direct interaction with potentially vulnerable populations and generative AI technologies. Consequently, our ethical framework addresses two distinct dimensions: the safety of human participants during usability testing, and the inherent risks of deploying Large Language Models (LLMs) in a healthcare context.

7.1 User Study Ethics

The evaluation followed standard Human-Computer Interaction (HCI) ethical protocols to ensure participant safety and dignity.

- **Informed Consent:** All participants were verbally informed of the study's purpose, the nature of the prototype, and their right to withdraw at any time without consequence. It was explicitly clarified that the application is a student project and not a certified medical device.
- **Data Anonymization:** No Personally Identifiable Information (PII) was recorded in the evaluation logs. Participants used pre-generated dummy profiles (e.g., "Ramesh") rather than their own identities to test the "Family Profile" features, ensuring no real health data was exposed to the backend.
- **Psychological Safety:** Scenarios were designed to be hypothetical (e.g., "Imagine you have a headache") rather than asking participants to disclose actual, potentially stigmatizing medical conditions.

7.2 AI Safety and Guardrails

A significant ethical risk in high-fidelity prototyping with live LLMs (Google Gemini) is the potential for "hallucination" or providing inaccurate medical advice. We implemented strict technical guardrails to mitigate this.

- **System Prompt Engineering:** The AI integration includes a rigid "System Instruction" layer. This instruction explicitly forbids the model from offering diagnoses or prescriptions. It mandates that the AI must frame all outputs as "triage suggestions" and consistently append a recommendation to see a human doctor.
- **Scope Limitation:** The AI's role is restricted to information gathering (symptom checking) and navigational assistance (booking). It is technically decoupled from the "Prescription" module, preventing the AI from generating fake medical documents.
- **Transparency:** The user interface clearly labels the chat as an "AI Assistant," ensuring users do not mistake the automated responder for a human clinician.

7.3 Data Privacy and Security

While this is a prototype, the architecture respects data sovereignty principles relevant to the target demographic.

- **Storage Segregation:** User uploads (images/PDFs) are stored after taking permission from the user and can be deleted at any point. It also cannot be viewed by admin or any person.
- **Voluntary Data Submission:** The app employs progressive disclosure; users are only asked for data (like Vitals) when they initiate a specific logging action, rather than aggressive background data collection.

7.4 Risk Matrix Summary

7.5 Statement of Compliance

This project complies with the course guidelines for non-invasive user research. No sensitive personal health information was collected, stored, or processed during the development or evaluation of this high-fidelity prototype.

Table 3: Risk Assessment and Mitigation

Identified Risk	Mitigation Strategy
AI providing incorrect medical advice	Strict system prompts to refuse diagnosis; hard-coded "Consult a Doctor" disclaimers.
User frustration due to offline failure	"Optimistic UI" and "Queued" badges provide immediate feedback that data is safe.
Privacy leak during device sharing	"Family Profiles" enforce logical separation of records within a single login.

8 Conclusion

This project successfully transitioned the 'AarogyaMitra' platform from conceptual low-fidelity prototype to a fully functional, high-fidelity mobile application. The high-fidelity prototype demonstrates that complex technical architectures—specifically Offline-First syncing and Generative AI—can be effectively simplified into an accessible user experience tailored for the specific constraints of rural healthcare.

The development process validated the "T-shaped" prototyping strategy. By implementing the horizontal breadth of the dashboard alongside the vertical depth of core flows like Triage and Booking, we were able to test the system's holistic logic against real-world user behaviors. The "Dual-Mode" interaction model proved to be a critical design success; offering both a structured dashboard for power users and a conversational AI companion for low-literacy users effectively bridges the digital divide, ensuring inclusivity across our target demographic.

Technically, the successful implementation of the custom offline queue system stands as the project's most significant achievement. It solves the "connectivity gap" identified in our initial research, proving that modern BaaS architectures can provide the reliability required for medical data even in intermittent network environments. The visual feedback of the "Queued" badges successfully fostered user trust during the evaluation, addressing a major adoption barrier.

Moving forward, the roadmap focuses on resolving the simulated constraints—specifically integrating real-time WebRTC video consultations and live emergency tracking—to transform this high-fidelity prototype into a pilot-ready solution. By grounding the design in real-world constraints and aligning the interaction model with familiar metaphors from community healthcare, AarogyaMitra offers a scalable blueprint for the future of accessible digital health.

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