

# A Cross-Platform Mobile Application for Child Vaccination Management using React Native and Supabase

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## Abstract

Timely vaccination is critical in reducing childhood mortality and preventing the spread of vaccine-preventable diseases. Traditional vaccination tracking relies heavily on physical cards, which are often misplaced or forgotten, leading to missed immunizations. This research presents a **Child Vaccination Management System**, a cross-platform mobile application developed using **React Native with Expo Router** for the frontend and **Supabase** for backend and database services. The system offers secure user authentication, centralized vaccination record management, and real-time notification features to alert parents about upcoming doses. Designed with an intuitive UI, the application ensures seamless access to vaccination schedules, appointment management, and child health records. By eliminating dependency on physical documents and improving engagement through notifications, this solution enhances vaccination compliance. Future enhancements include AI-driven dose prediction, multilingual support, and integration with national immunization programs.

## 1. Introduction

### 1.1 Child Vaccination

Vaccination is one of the most effective public health interventions for reducing childhood illness and mortality caused by vaccine-preventable diseases. However, traditional vaccination tracking systems still rely on physical vaccination cards, which are prone to damage, loss, or misplacement. These limitations often result in missed immunization appointments, incomplete vaccination schedules, and a lack of timely follow-up by parents or guardians.

To address these challenges, this paper introduces a **Child Vaccination Management System**, a mobile-based solution that offers digital recordkeeping, real-time reminders, and easy access to vaccination information. Built using **React Native with Expo Router** and powered by **Supabase** for backend and database services, the system ensures cross-platform compatibility, secure data handling, and user-friendly interaction. This system is designed not only to assist parents but also to support healthcare providers in managing immunization schedules more effectively.

### 1.2 Aim

The aim of this project is to design and develop a mobile application that simplifies the tracking and management of child vaccinations by:

- Providing a centralized platform for storing and retrieving vaccination records.
- Sending real-time notifications for upcoming or missed vaccination doses.
- Offering an intuitive user interface accessible on both Android and iOS devices.
- Enabling secure and scalable data storage using cloud-based technologies.

### 1.3 Need

The need for a digital vaccination management system arises from several critical issues:

- **Loss of Physical Records:** Traditional vaccination cards are easily lost or damaged, leading to incomplete immunization data.
- **Lack of Timely Reminders:** Parents often miss vaccination appointments due to a lack of timely alerts or scheduling tools.
- **Inaccessible Health Records:** Without centralized digital storage, accessing past vaccination data becomes difficult during emergencies or medical visits.
- **Manual Recordkeeping:** Current systems require manual updates, increasing the chance of human error and data inconsistency.
- **Mobile-First Convenience:** With the growing use of smartphones, there is a strong demand for mobile-first healthcare tools to enhance engagement and compliance.

## 2. Methodology

The development of the Child Vaccination Management System follows a systematic process to ensure functionality, usability, and scalability. The methodology includes:

### 1. Requirement Analysis

- Identifying key functionalities: user registration, vaccination schedule tracking, real-time notifications, and secure data storage.
- Defining user roles: parents and healthcare providers.

### 2. Design Phase

- Designing UI using React Native components and wireframes.
- Structuring backend APIs using Expo Router's server functionality.
- Database schema design for Supabase (users, vaccinations, appointments, notifications).

### 3. Development Phase

- Frontend development using React Native with Expo Router for seamless navigation.
- Backend development using Expo Router's API routes for authentication, data access, and notifications.
- Database integration with Supabase for real-time sync and secure data handling.

### 4. Notification Integration

- Implementing local notifications and scheduling vaccination reminders using device APIs and Supabase cron functions (or third-party services if needed).

### 5. Testing and Debugging

- Unit testing of APIs and validation logic.
- UI/UX testing on multiple devices.
- Bug fixing and performance optimization.

### 6. Deployment

- Deployment using Expo for mobile distribution.
- Backend hosted via Expo Router's server functions with Supabase.

## 2.1 Software Development Model and Process

The Agile Development Model was adopted due to its flexibility and iterative nature. This approach allowed for:

- **Incremental development:** Breaking down features into smaller, manageable sprints.
- **Frequent testing and feedback:** Allowing rapid response to issues and changes.
- **User-centric design:** Incorporating feedback from mentors and peers during development cycles.
- **Continuous integration:** Regular updates and improvements during the development phase.

The project followed the standard Agile cycle:

1. Planning
2. Design
3. Development
4. Testing
5. Review
6. Release

## 2.2 Hardware and Software Requirements

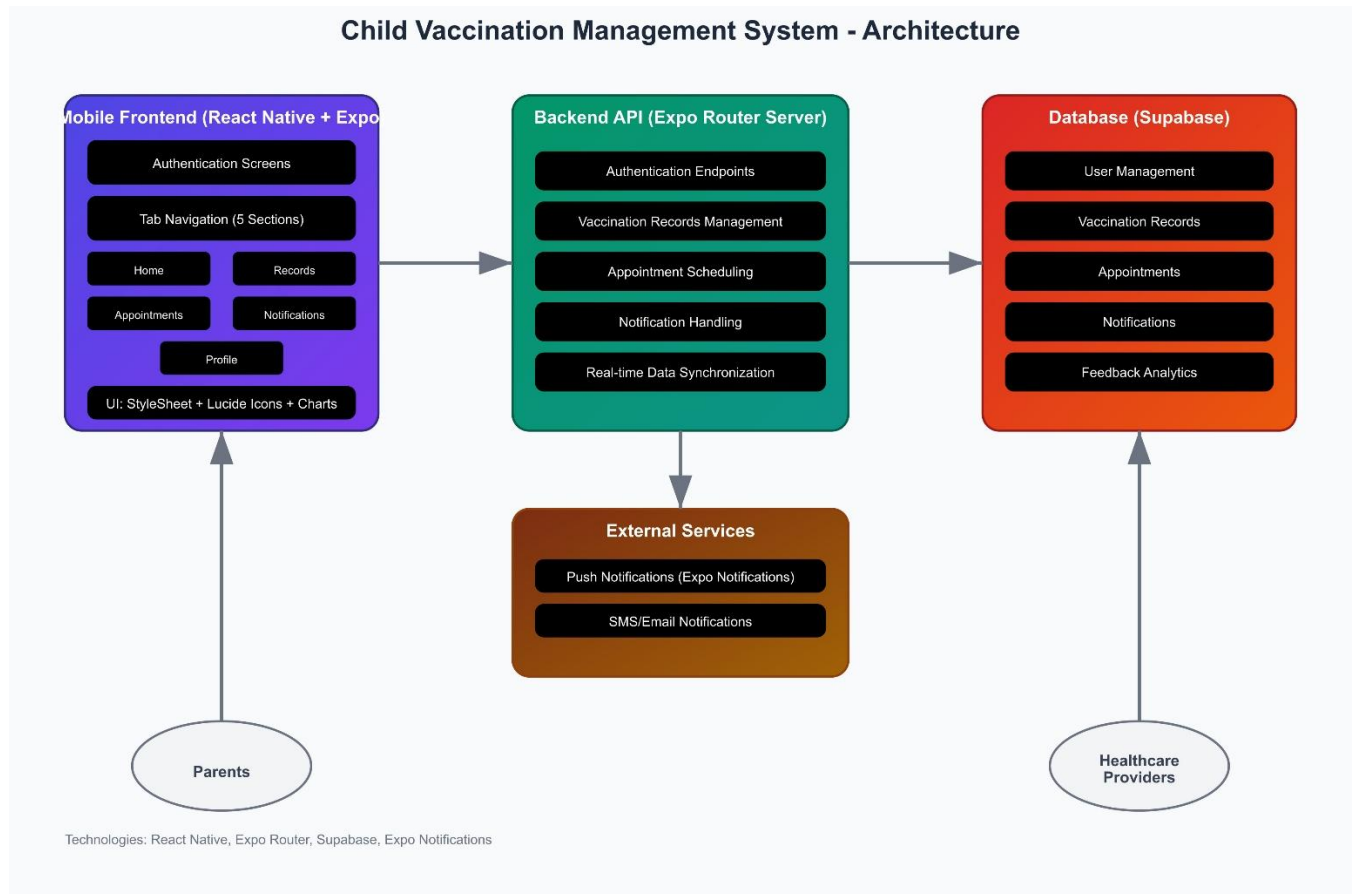
### Hardware Requirements:

- **Device:** Smartphone (Android/iOS), Laptop/Desktop
- **Processor:** Intel i5 or higher
- **RAM:** Minimum 8 GB
- **Storage:** Minimum 90 GB
- **Display:** SVGA or higher
- **Internet:** Required for backend API access and real-time data sync

### Software Requirements:

- **Operating System:** Windows 10/11, macOS, or Linux
- **Frontend Framework:** React Native with Expo
- **Backend:** Expo Router API Routes
- **Database:** Supabase (PostgreSQL)
- **IDE/Editor:** Visual Studio Code
- **Package Manager:** npm / yarn
- **Browser:** Google Chrome / Firefox
- **Notification API:** Expo Notifications / Firebase Cloud Messaging (optional)

## Architecture



**Fig-1: Architecture**

### 3. Technical Details

The **Child Vaccination Management System** is a cross-platform mobile application designed with a modern tech stack for efficient, scalable, and user-friendly healthcare tracking. Below are the core technical components of the system:

#### 3.1 Frontend

- **Framework:** React Native
- **Navigation:** Expo Router
- **Styling:** React Native StyleSheet
- **Components:**
  - Authentication Screens (Login/Register)
  - Tab Navigation with 5 Main Sections:
    - Home (Vaccination Dashboard with Charts)
    - Records (Vaccination History)
    - Appointments (Slot Booking - Future Scope)
    - Notifications
    - Profile
- **UI Libraries Used:**
  - lucide-react-native for icons

- react-native-chart-kit for vaccination progress charts
- **Device Compatibility:** Android & iOS

### 3.2 Backend

- **Platform:** Expo Router Server Functions (Edge Runtime API Routes)
- **Functionality:**
  - User Authentication APIs (Login, Register)
  - Vaccination Record Management APIs
  - Appointment Scheduling APIs
  - Notification Trigger and Management APIs
- **Security:** API route protection via session tokens or Supabase Auth

### 3.3 Database

- **Database Platform:** Supabase (PostgreSQL)
- **Key Tables:**
  - Users – stores user profiles
  - Vaccinations – stores vaccine name, age, schedule
  - Appointments – stores booking data (future enhancement)
  - Notifications – for scheduled alerts
- **Data Sync:** Real-time syncing using Supabase subscriptions (optional)
- **Authentication:** Supabase Auth with email/password and session management

### 3.4 Notification System

- **Implementation Options:**
  - Expo Push Notification service (planned)
  - Firebase Cloud Messaging (optional for advanced scheduling)
- **Purpose:** To notify parents about upcoming/missed vaccination dates after registration and on a periodic basis

### 3.5 Tools and Dependencies

- **Development IDE:** Visual Studio Code
- **Version Control:** GitHub
- **Device Testing:** Expo Go (on Android and iOS devices)
- **Package Manager:** npm
- **Important Packages:**
  - expo-router
  - @supabase/supabase-js
  - react-native-chart-kit
  - lucide-react-native
  - react-native-paper (optional for enhanced UI components)

## 4. System Functionality

### 4.1 Core User Workflows

#### **4.1.1 Parent User Journey**

- 1.Account registration and child profile creation
- 2.Vaccination schedule setup and customization
- 3.Real-time notification receipt and management
- 4.Vaccination record viewing and updates
- 5.Appointment scheduling and confirmation

#### **4.1.2 Healthcare Provider Workflow**

- 1.Professional account registration and verification
- 2.Patient record access and management
- 3.Vaccination administration recording
- 4.Appointment scheduling and management
- 5.Bulk notification and reminder sending.

### **4.2 Advanced Features**

#### **4.2.1 Analytics Dashboard**

1. Vaccination completion rates
2. Appointment adherence statistics
3. Geographic vaccination trends
4. Age-group specific analytics

#### **4.2.2 Integration Capabilities**

1. Healthcare management system integration
2. Government immunization program connectivity
3. Third-party calendar synchronization
4. Electronic health record (EHR) compatibility

### **5. Conclusion and Future Work**

The Child Vaccination Management System addresses the critical challenge of ensuring timely and complete immunization for children by digitizing vaccination records and scheduling. The system, developed using React Native and Supabase, successfully replaces traditional paper-based vaccination cards with a reliable, user-friendly, and accessible mobile solution. Features such as real-time notifications, centralized data management, and an intuitive user interface contribute to better awareness and compliance among parents. The project demonstrates the practical application of modern mobile and cloud technologies in healthcare and lays the foundation for future enhancements to increase its impact and reach.

#### **5.1 Summary of Achievements**

- Developed a fully functional cross-platform mobile app using React Native with Expo Router.
- Implemented secure user authentication using Supabase Auth.
- Designed a clean and responsive UI with tab-based navigation and chart integration.
- Enabled real-time vaccination record management.
- Structured database schema using Supabase (PostgreSQL).
- Designed backend API routes with Expo Router server functions.
- Integrated notification logic to inform users about due vaccinations (initial prototype).
- Ensured scalable and future-ready architecture for integration with other health systems.

## 5.2 Future Enhancements and Features

- Vaccination Slot Booking System: Enable parents to book appointments at nearby centers.
- Automated Notification Scheduling: Use Supabase CRON jobs or Firebase Cloud Messaging for time-based push reminders.
- Multi-language Support: Expand usability for non-English speaking users.
- Analytics Dashboard: Provide parents with data visualizations of vaccination progress and missed doses.
- Role-based Access: Include logins for healthcare providers with analytics and control access.
- AI Recommendations: Use machine learning to suggest optimal schedules and track immunization patterns.
- Integration with Government Systems: Connect with national vaccination portals for live data updates and validation.

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