

Child Vaccination Registration and Reminder

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Abstract- Child vaccination is a vital public health strategy that ensures protection against preventable diseases. This paper introduces a mobile-based child vaccination registration and reminder application, aimed at streamlining the vaccination process for newborns. Where, Hospitals and healthcare facilities will register newborns, input vaccination schedules, and track immunization status through a centralized system. The app provides automated reminders and notifications to parents, ensuring they stay informed about upcoming vaccinations, reducing the risk of missed doses. In addition to managing vaccinations, the app includes features for tracking the baby's growth metrics such as weight, height, and developmental milestones. By offering health monitoring capabilities alongside vaccination reminders, the system provides an integrated approach to pediatric care. The app not only addresses the gap in communication but also contributes to improving overall child health by supporting parents in adhering to vaccination schedules and monitoring their baby's development.

Keywords: Mobile-based application, Vaccination schedules, public health strategy, Centralized system, Developmental milestones.

I. INTRODUCTION

Vaccination is one of the most effective ways to protect children from serious diseases like measles, polio, and diphtheria. Despite its importance, many children still miss their vaccinations because parents may forget the dates, lack clear information, or face communication gaps with healthcare providers. Missing vaccinations not only puts the child at risk but also increases the chances of disease outbreaks in the community. Ensuring that children get their vaccines on time is crucial for their health and the well-being of society.

One of the major reasons for this problem is the lack of timely information and effective communication between healthcare providers and parents. Many parents may not know the vaccination schedule or forget important appointments because of busy lifestyles, lack of reminders, or poor coordination with healthcare providers. Thirdly, complex schedules of immunization, especially in the early years of a child's life, make it challenging for the parents themselves. This is even harder in areas less advanced in terms of digital infrastructure or even in basic healthcare systems.

Digital solutions, especially applications based on mobile technology, would be critical for improving vaccination adherence and communication among healthcare providers and families. The application will send automated reminders and notifications directly to parents' mobile devices, ensuring they stay informed about upcoming vaccines and reducing the risk of missed doses. This digital solution is especially crucial in regions where healthcare systems may be overwhelmed or lacking in resources.

This app can enhance healthcare delivery by integrating vaccination reminders with health monitoring capabilities in one platform. It encourages a proactive approach to child health, empowering parents with reliable, up-to-date information to safeguard their child's well-being. The system may also lead to better health outcomes through improved vaccination coverage rates, reduced incidence of preventable diseases, and promotion of healthier growth patterns in

children. This paper will discuss the design, functionality, and potential impact of the proposed system, with a focus on how digital tools can bridge gaps in healthcare communication and empower families to take control of their child's health.

II. METHODOLOGY

The development of the child vaccination registration and reminder application followed a structured approach, divided into several stages: requirement gathering, system design, development, and testing. The methodology focused on creating an efficient and user-friendly system for both healthcare providers and parents, ensuring seamless communication regarding vaccination schedules and health monitoring for newborns.

A. Requirement Analysis

The first step involved gathering detailed requirements from both healthcare providers (hospitals, clinics) and parents. Interviews with pediatricians, hospital staff, and parents were conducted to understand their needs and challenges in tracking vaccinations. This stage helped define the core functionalities of the app, such as newborn registration, personalized vaccination scheduling, automated notifications, and health monitoring features.

B. System Design

Based on the requirements, a system architecture was developed, consisting of two main interfaces:

Admin Interface: Used by hospitals to register newborns, input vaccination schedules, and track vaccination adherence. This interface was designed to be secure and easy to use, allowing healthcare providers to access patient records and vaccination data in real-time.

User Interface: Designed for parents, allowing them to receive automated notifications and reminders regarding upcoming vaccinations.

C. Frontend Development

The frontend development of the child vaccination registration and reminder app focuses on creating a simple and user-friendly interface for both parents and healthcare providers. The design emphasizes ease of use, ensuring that parents can easily view vaccination schedules and receive notifications.

Hospital (Admin) App UI: Healthcare providers, as administrators, manage user accounts within the app, including adding new users, editing profiles, and removing inactive accounts. They also control access levels to protect sensitive data. Admins are responsible for entering new birth records, which involve inputting essential details such as the child's name, date of birth, and a unique Child ID (formatted as HHYYMMDDXXX). This unique ID is assigned during registration to track vaccination schedules and histories effectively. Admins can update and modify vaccination schedules as needed, reflecting any changes in public health recommendations. They can view and manage each child's vaccination status, helping healthcare providers monitor compliance and identify any missed vaccinations.

The system allows for generating reports related to vaccination statuses, compliance rates, and demographic data, which are critical for public health tracking and outreach planning.



The Admin Panel is built with strict data security protocols, ensuring that only authorized personnel can access it, and all actions are logged for accountability. Data privacy is a priority to protect the personal information of children and families. To support effective use of the system, training materials, user manuals, and technical support are provided to healthcare providers.

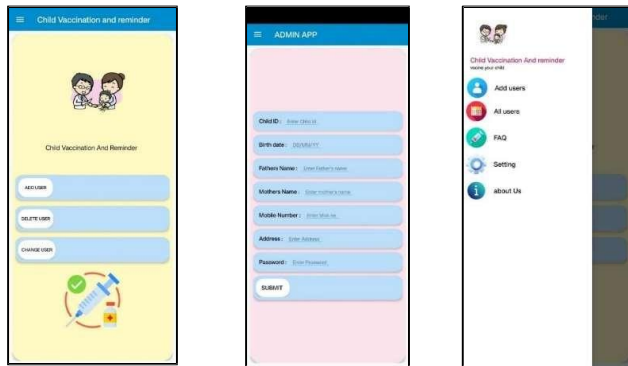


Fig 1. Admin App UI Design

User App UI: The child vaccination app utilizes a secure login system based on a unique Child ID and password, ensuring only authorized users, such as parents and healthcare workers, can access or update vaccination records. The Child ID follows a structured format (HHYYMMDDXXX), representing the hospital, birth date, and a unique identifier, which helps manage data efficiently and prevent duplication. Password protection adds an extra layer of security for accessing the child's data. Once logged in, users remain authenticated through secure token-based sessions for continuous access to sensitive information like vaccination schedules and reminders.

This system provides efficient data management and secure access, with parents being able to track their child's vaccination status and receive reminders, while healthcare workers can update and manage vaccination records. The combination of the Child ID and password offers a simple yet secure solution for handling child vaccination data.

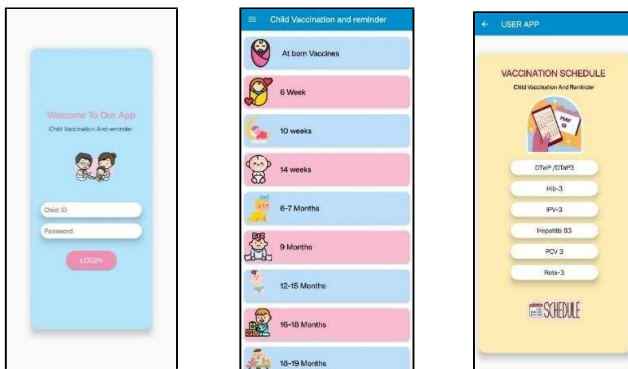


Fig 2. User App UI Design

D. Backend Development: The child vaccination app uses Firebase as the backend to streamline vaccination tracking for parents and healthcare providers. Key features include managing vaccination schedules, sending automated SMS reminders, and securely storing child-related data. Each child is assigned a unique ID at birth, ensuring accurate record management. The backend employs Firebase services such as the Realtime Database for storing child and vaccination data, Firebase Authentication for secure user login, and Firebase Cloud Functions for automated tasks like sending SMS reminders. The NoSQL database structure is designed to

efficiently store child information linked to their vaccination schedules and parental details. APIs handle key functions, including registering new births, retrieving vaccination schedules, updating vaccination statuses, and triggering SMS reminders, providing a seamless and real-time experience for users.

This integrated backend architecture ensures seamless communication between parents and healthcare providers, ultimately improving vaccination compliance and child health outcomes.

Tech Stack: - The technologies used for the backend are:

Firebase Database: A NoSQL cloud-based database that stores all the data related to the app, including child information, vaccination schedules, and vaccine history. Firebase provides real-time data synchronization, so any changes in the data (like vaccine updates) are instantly visible to users.

Firebase Authentication: Used to handle user login and registration securely. It ensures that only authorized users, such as parents and healthcare providers, can access the system and update child records.

Firebase Cloud Functions: These are serverless functions that perform background tasks like sending SMS reminders to parents before their child's vaccination date. They run automatically based on triggers, such as a scheduled vaccination or an upcoming due date.

Database Design: The Firebase Realtime Database is structured in a simple and efficient way using a NoSQL format (JSON), making it easy to store and retrieve vaccination-related data. Each child is linked to their parents' information and has a unique identifier assigned at birth.

Fields:

Child_ID: A unique identifier for each child.

Birth: The child's birth date, used to determine vaccination schedules.

address: The family's address.

father/mother: Names of the parents or guardians.

mobile: Contact number used to send SMS reminders for upcoming vaccinations.

password: A password used for secure login to access and arrange the child record.

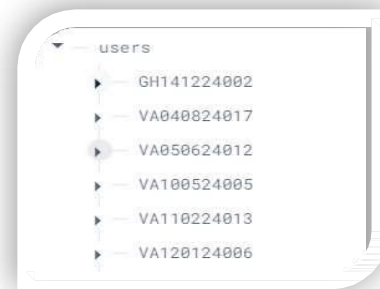
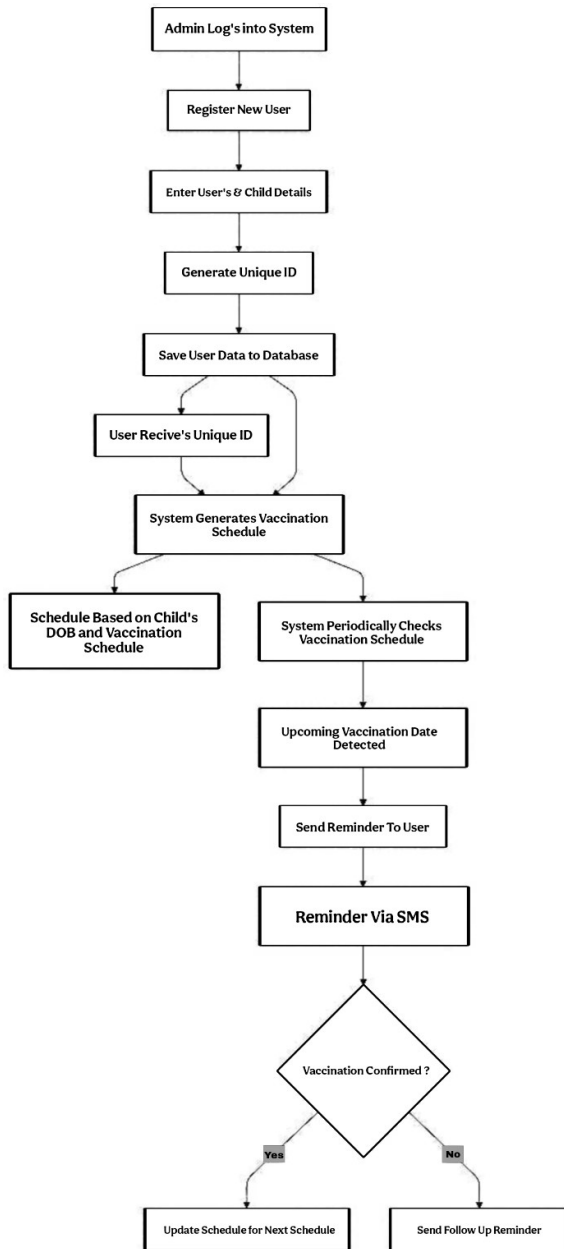


Figure 3.- Database Design



Figure 4. Child Database Design

III. FLOW DIAGRAM



Admin Logs into the system: The process begins when the system administrator logs into the platform using secure credentials.

Register New User: The admin registers a new user, typically a parent or guardian of a child, in the system. This step ensures that every user is uniquely identified within the system.

Enter User & Child Details: The admin inputs detailed information about the user (parent/guardian) and their child. Details include the child's name, date of birth (DOB), gender, and other necessary contact details like phone number or email address.

Generate Unique ID: The system automatically generates a unique identification number for each user-child pair.

Save User Data to Database: All user and child details, along with the unique ID, are securely saved in the database. The system ensures data protection and quick retrieval when needed.

User Receives Unique ID: The unique ID is shared with the parent/guardian. This ID can be used for future reference, such as checking vaccination status or schedule updates.

System Generates Vaccination Schedule: Based on the child's

DOB and predefined vaccination guidelines (e.g., national or hospital-specific schedules), the system creates a personalized vaccination plan.

Schedule Based on Child's DOB and Guidelines: The vaccination schedule includes specific dates for all required vaccinations. The schedule adheres to medical recommendations to ensure the child is immunized at the right age.

Periodic Check for Upcoming Vaccination Dates: The system continuously monitors the database to identify upcoming vaccination dates. This automated process ensures no vaccination is missed.

Upcoming Vaccination Detected: When a vaccination date is approaching, the system flags it as "upcoming" to initiate reminder notifications.

Send Reminder: A reminder is sent to the user through various channels such as: Push Notifications within the app, Emails to registered email addresses. SMS to mobile numbers for added reliability.

Reminder via Notification, Email, or SMS:

The user is notified well in advance of the vaccination date, giving them time to prepare.

Vaccination Confirmation: The system waits for the parent/guardian to confirm whether the vaccination was completed. Confirmation can be done via the app or by the admin after verification.

If Vaccination is Confirmed:

The system updates the record and sets the schedule for the next dose.

The child's vaccination history remains up to date.

If Vaccination is Not Confirmed:

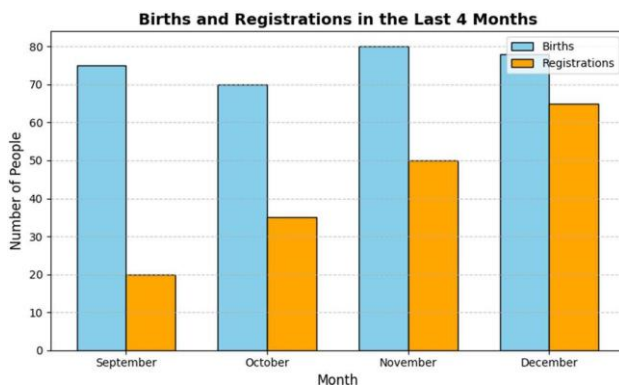
A follow-up reminder is sent to ensure the parent/guardian is aware of the missed dose. This ensures that no vaccination is permanently missed.

Update Schedule for Next Dose or Follow-Up:

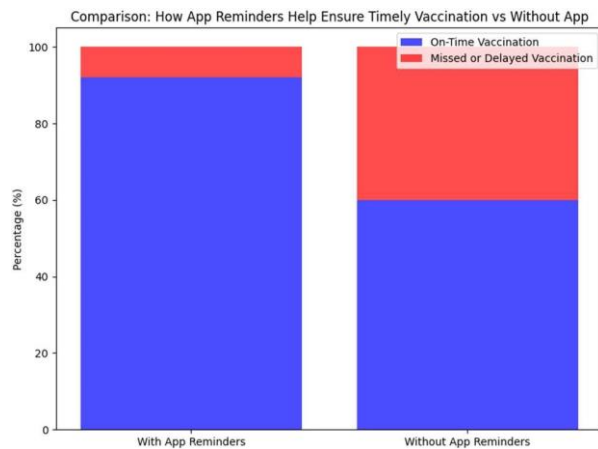
If the vaccination is completed, the system prepares for the next dose based on the schedule. If not completed, reminders continue until the vaccination is done.

IV. RESULT AND CONCLUSION

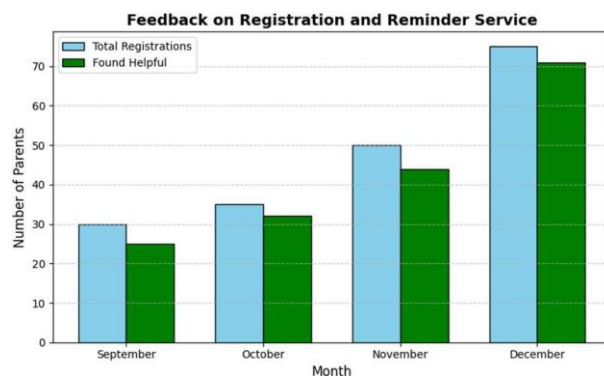
The child vaccination registration and reminder application were developed and thoroughly tested in a real-world environment. During the test phase, all hospitals successfully utilized the admin interface to register newborns and create personalized vaccination schedules. The system ensured that automated reminders and notifications were efficiently sent to parents, significantly reducing the chances of missed or delayed vaccinations. Feedback from healthcare providers indicated that the admin interface simplified their workflow by centralizing patient records and vaccination schedules, making data management more streamlined and reducing errors in scheduling. Additionally, the ease of access to patient data improved decision-making processes related to pediatric care. Parents who tested the app found the reminders to be timely, informative, and helpful in staying organized. Many reported that it eliminated the stress of remembering vaccine dates, allowing them to focus on other aspects of their child's health. Overall, the application effectively bridged the communication gap between healthcare providers and parents, improving vaccine adherence and providing a holistic approach to monitoring child health.



This chart compares the number of births (light blue bars) to registrations on the app (orange bars) over the past four months. Although the birth numbers remain consistent, registrations show an increasing trend, especially in November and December. This demonstrates the app's growing adoption and its role in bridging the gap between newborn care and vaccination tracking.



This graph compares vaccination outcomes for users with and without app-based reminders. The blue bar represents timely vaccinations, showing nearly 100% compliance with app reminders. In contrast, the red bar indicates missed or delayed vaccinations, which are significantly higher for users without reminders. This highlights the app's effectiveness in ensuring timely vaccinations through automated reminders.



This bar chart shows the number of parents registered and their feedback on the app's usefulness from September to December. The light blue bars indicate total registrations, while the green bars represent the parents who found the service helpful. The steady increase in both metrics over time reflects growing trust in the app and its effectiveness in helping parents manage vaccination schedules.

V. FUTURE WORK

The child vaccination registration and reminder application effectively addresses the challenge of missed vaccinations by offering an easy-to-use platform for both parents and healthcare providers. By utilizing Firebase for real-time data synchronization, secure user authentication, and automated SMS reminders, the app ensures that children receive timely vaccinations, improving overall vaccine adherence. The system's unique Child ID format guarantees accurate record-keeping and smooth management of vaccination schedules.

For future work, the app could be expanded to integrate with other healthcare systems, supporting data sharing across platforms and improving accessibility through multilingual options. AI-driven insights and the addition of health tracking features, such as integration with wearable devices, could further enhance its functionality, providing personalized health recommendations and a more comprehensive approach to child healthcare. These improvements would contribute to better vaccination coverage and overall child health monitoring.

Reference:

- [1] Patel, MS (Patel, Mitesh S.); Fogel, R (Fogel, Richard); Winegar, AL (Winegar, Angela L.) Effect of Text Message Reminders and Vaccine Reservations on Adherence to a Health System COVID-19 Vaccination Policy A Randomized Clinical Trial, Article Number 2222116-JUL 20 2022
- [2] : Cristian Tinoco Mejia 1, Jorge Isaac Necochea-Chamorro 1-Mobile Applications in Childhood Immunization: A Systematic Review, TEM Journal. Volume 12, Issue 2, pages 645-656, ISSN 2217-8309, DOI: 10.18421/TEM122-08, May 2023
- [3] Danya Arif Siddiqi, Mehr Munir, Mubarak Taighoon Shah, Aamir Javed Khan, Effect of vaccine reminder and tracker bracelets on routine childhood immunization coverage and timeliness in urban Pakistan: protocol for a randomized controlled trial-BMC Public Health volume 19, Article number: 1421, Published: 30 October 2019
- [4] Dr Ankita sharma, Dr Vivek Singh Digital immunization solutions: An analysis of mobile health application in India Nov-Dec 2024 - Volume 49 - Issue 6
- [5] Danya Arif Siddiqi, Mehr Munir, Mubarak Taighoon Shah, Aamir Javed Khan & Subhash Chandir Sho-30 October 2019-Effect of vaccine reminder and tracker bracelets on routine childhood immunization coverage and timeliness in urban Pakistan-BMC Public Health volume 19, Article number: 142 ,
- [6] Ramachandran Venkataramanan 1,2, SV Subramanian 3,4, Mohannad Alajlani 1, Theodoros N Arvanitis 1-13 dec 2022-Effect of mobile health interventions in increasing utilization of Maternal and Child Health care services in developing countries.