

VACCINO-Child Vaccination Management App

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Abstract—In recent years, mobile application has been increasingly used in the field of healthcare management. Vaccines are an integral part of life to prevent diseases. In past times, Asha worker or primary healthcare professionals used to inform about the date of vaccination of every child which is less efficient.

This work aims to develop a child vaccination management app-VACCINO to ease the process of vaccination. The app manages vaccination schedule, reminders and an integrated option to contact taxi services to provide transportation to the users. The parents can register multiple children. In this, the schedule for each vaccination is generated on the basis of date of birth(DOB) of the children. There is an option for booking slots for vaccination as well. Every Centre has a definite number of slots available for each day. The doctors can view the bookings and confirm the vaccination. This is only possible for the doctors after getting verified by the admin. There is an integrated call option for contacting the taxi drivers as well. Notification reminders will be sent to the parent prior to the day of the vaccination. This app is developed using flutter framework and firebase database.

Index Terms—Vaccination, Flutter, Firebase, App Development, Notification Reminders, Healthcare Information.

I. INTRODUCTION

Vaccines is a life-changing innovation which plays a crucial role in enhancing immunity among children. Vaccination is a safe and effective way to prevent various diseases. There are a lot of vaccinations that are necessary to be taken during childhood days.

In earlier days, Asha worker or healthcare workers inform parents about the vaccination for children. It is not effective as sometimes they may forget to inform the day of vaccination which may cause many problems in children, as timely vaccination is important for children to foster immunity and in preventing diseases.

VACCINO-child vaccination management app is a comprehensive solution for parents and caregivers to provide timely vaccination for children. This app manages vaccination schedule based on their date of birth of children which make it easier to get vaccination dates.

Also provide notification to parents about the vaccination dates. This model also integrates with taxi services to provide ease of transportation to clinic or healthcare centers.

This App uses flutter to provide effective user interface for parents and caregivers. As flutter is a fast-developing app development cross-platform to enhance user interfaces.

Firebase act as a secure and easily accessible for storing and managing vaccination data, taxi service information and doctor's detail.

II. RELATED WORKS

H. Zaini et al.,[1] had developed a baby vaccination schedule app by using software usability measurement inventory (SUMI) model, for helping parents to manage immunization schedules. This work focused on the key factors like efficiency, helpfulness, controllability and learnability as the result. Basic Immunization Management Using Mobile Based Application is a model developed by N.Rahmawati et al.,[2] which discussed about the health condition of the children due to lack of proper information about the vaccination and schedules. The paper proposed by Hasan et al., [3] developed an immunization app which help parents to ensure children's health. In this work, helps parents to keep track of the vaccination schedules and information. Due to heavy work schedules parents may forget the vaccination appointments of their children therefore Asam Hamed Abbas et al., [4] presented a model for parents to remind the appointment through SMS alert using SMS Gateway Technology. Parental Reminder and Planner for Children Vaccination is a web-based application designed by S. N. Rahmat et al.,[5] The app provide past vaccination details of children and easy access at any time anywhere by the parents. Due to poor healthcare and sanitation the mortality rate of child is High therefore S kumari et al.,[6] proposed a system using IoT which can store and access the details of the children and access by the parents and doctors from anywhere at any time. A Bamb et al.,[7] designed a centralized system for Infant Vaccination discuss about the issues that are faced by the parents during the vaccination of their child which provide a digital recording of the vaccinations. A Blockchain Based Technique for Storing Vaccination Records is the work presented by S. K. Deka et al.,[8] used to store the vaccination records of children to ensure the data and proof of immunity which uses blockchain technology. G. Naga Nithin et al.,[9] introduced a Global Level Smart Vaccination Tracking System using Blockchain and IoT. The current vaccination system provides issues in real time tracking so that an technology called blockchain and IoT are used to solve this problem. Children those who lives in developing countries doesn't get the full set of basic vaccination which leads to illness or death to prevent this L Mertz [10] introduced a system called vaccination innovation. G.S. Fuentes et al.,[11] has developed a system called Child Monitoring Health System (CHMS) with SMS Functionality which keep track of the children's growth throughout the development stage and provide SMS functionality for the parents. The work by Y. Chang et al.,[12] focuses on the vaccination awareness of guardians responsible for left-behind children in rural areas of Handan, China. This work suggests the risk of missing vaccination services for the children's those who are living in rural area. Child immunization have a crucial role in healthcare system H. Gupta et al.,[13] proposed a cloud-based system called A Centralized System to Support Health Care in India that enhance the management of vaccination records for infants.

III. METHODOLOGY

The methodology used in this Child Vaccination Management app is centered on a user-friendly approach with guidance from local healthcare professionals. This app is developed using Flutter, which is an open-source cross platform for app development. The app features Login page and Sign-up page for users to either login or create a new account. While signing up the user can select his role as healthcare professional or parent. Separate Home page is developed for Parents, Healthcare professionals and Admin.

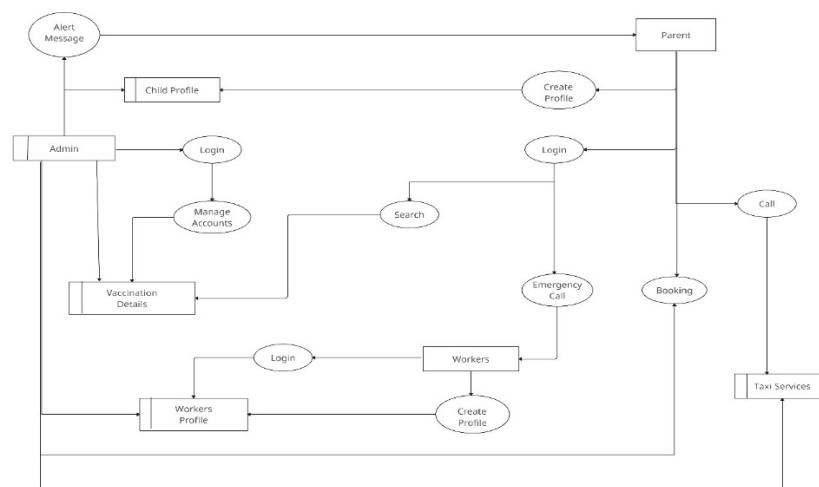


Fig 1: Dataflow Diagram

The required vaccination schedules were collected from government sources and health organizations. These schedules typically include the recommended vaccines and the ages at which they should be administered. Created a database to store information about children, including their date of birth (DOB) and vaccination records. A user interface was designed where users can input the child's DOB and view the vaccination schedule. The schedule for every vaccination is generated on the basis of child's DOB. The dates for every vaccination are calculated by incrementing time period of each vaccination from the child's DOB. The Dataflow diagram of the proposed work is shown in Fig 1.

A. Dataset

The dataset required for the development of child vaccination management app containing information on various vaccinations and their schedules based on the child's DOB was referred from reliable medical sources such as the National Immunization Schedule () and also from the vaccination chart given to Anganwadi centers, hospitals, health centers by the government.

For Infants				
BCG	At birth or as early as possible till one year of age	0.1 ml (0.05ml until 1 month age)	Intra-dermal	Left Upper Arm
Hepatitis B - Birth dose	At birth or as early as possible within 24 hours	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
OPV 0	At birth or as early as possible within the first 15 days	2 drops	Oral	Oral
OPV 1, 2 & 3	At 6 weeks, 10 weeks & 14 weeks (OPV can be given till 5 years of age)	2 drops	Oral	Oral
Pentavalent 1, 2 & 3	At 6 weeks, 10 weeks & 14 weeks (can be given till one year of age)	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
Rotavirus [#]	At 6 weeks, 10 weeks & 14 weeks (can be given till one year of age)	5 drops	Oral	Oral
IPV	Two fractional dose at 6 and 14 weeks of age	0.1 ml	Intra dermal two fractional dose	Intra-dermal: Right upper arm
Measles /MR 1 st Dose ^{\$}	9 completed months-12 months. (can be given till 5 years of age)	0.5 ml	Sub-cutaneous	Right upper Arm
JE -1 ^{**}	9 completed months-12 months.	0.5 ml	Sub-cutaneous	Left upper Arm
Vitamin A (1 st dose)	At 9 completed months with measles- Rubella	1 ml (1 lakh IU)	Oral	Oral
For Children				
DPT booster-1	16-24 months	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
Measles / MR 2 nd dose ^{\$}	16-24 months	0.5 ml	Sub-cutaneous	Right upper Arm
OPV Booster	16-24 months	2 drops	Oral	Oral
JE-2	16-24 months	0.5 ml	Sub-cutaneous	Left Upper Arm
Vitamin A ^{***} (2 nd to 9 th dose)	16-18 months. Then one dose every 6 months up to the age of 5 years.	2 ml (2 lakh IU)	Oral	Oral
DPT Booster-2	5-6 years	0.5 ml	Intra-muscular	Upper Arm
TT	10 years & 16 years	0.5 ml	Intra-muscular	Upper Arm

- * Give TT-2 or Booster doses before 36 weeks of pregnancy. However, give these even if more than 36 weeks have passed. Give TT to a woman in labour, if she has not previously received TT.
- ** JE Vaccine is introduced in select endemic districts after the campaign.
- *** The 2nd to 9th doses of Vitamin A can be administered to children 1-5 years old during biannual rounds, in collaboration with ICDS.
- [#]Phased introduction, at present in Andhra Pradesh, Haryana, Himachal Pradesh and Orissa from 2016 & expanded in Madhya Pradesh, Assam, Rajasthan, and Tripura in February 2017 and planned in Tamil Nadu & Uttar Pradesh in 2017.
- ^{\$} Phased introduction, at present in five states namely Karnataka, Tamil Nadu, Goa, Lakshadweep and Puducherry. (As of Feb' 2017)

(a) National Immunization Schedule, (b) Vaccination Chart of Directorate of a Healthcare services, Kerala

IV. IMPLEMENTATION AND RESULTS

This child vaccination app addresses the challenges associated with managing vaccinations for children efficiently. The lifestyles of modern parents, issues such as lack of awareness about vaccination schedules, missed opportunities for immunization, communication gaps with healthcare providers. This work seeks to provide an effective solution by offering personalized vaccination schedules, timely notifications, reliable vaccine information and education, appointment booking and tracking features, seamless integration with healthcare providers, integrating with transportation services ultimately aiming to improve vaccination coverage rates and contribute to the overall health of children.

The core functionalities of the app include personalized vaccination schedules generated based on the child's age, timely notifications to ensure vaccinations are not missed, access to reliable vaccine information, digital storage of vaccination records for easy retrieval, appointment booking and tracking features to facilitate scheduling and monitoring of vaccination appointments, seamless integration with healthcare provider systems for automated updates of vaccination records, integrating with transportation services. This work aims to simplify the vaccination process, empower parents with knowledge of vaccination, and ultimately contribute to improving vaccination coverage rates and child health outcomes.

The use case diagram for the proposed work is shown in Fig 3.



Fig 3: Use Case Diagram

The app comprises of several modules to ease the management of vaccination includes login module, home module, booking module, vaccination schedule module, taxi service module.

A. Login and Sign-up Module

The module contains login and Sign-up functionalities of the app. The users can login using email and password. At the time of creating a new account, the user will be asked to specify their role, either parent or healthcare professionals. Based on the role they opted, separate home pages will be loaded during signing in.

Identifier	Providers	Created	Signed in	User ID
rshta@gmail.com		May 6, 2024	May 6, 2024	BjU1J2w0C32BR9DQpc2AZ...
riwa0033@gmail.com		May 6, 2024	May 6, 2024	c3K9x8bu7cY420H4GmAM...
arun@gmail.com		May 6, 2024	May 6, 2024	XuAR8H4Q2Qw7huJ7WNTL...
sasu@gmail.com		May 6, 2024	May 6, 2024	u7wLcomgTwARVAMRQzme...
roy@gmail.com		May 6, 2024	May 6, 2024	3C3cp80RyFst1C0a7Roa4...
asme@gmail.com		May 6, 2024	May 6, 2024	VMSB4H5ublogK25w7TRhu...
rithe@gmail.com		May 6, 2024	May 6, 2024	F7kmd0NZ7W0u04BmLZVG...
kchu@gmail.com		May 5, 2024	May 5, 2024	Td0Kp28RbQn3uwtm3mG...
doctor@gmail.com		May 5, 2024	May 5, 2024	/photothopJEFwH4ELMhj2

(a)

(b)

Sign Up

Name

Email

Password

Sign Up

Already have an account? [Login](#)

(c)
Fig 4: (a)Login Database, (b)Login page, (c) Sign Up Page

B. Home Module

For parents

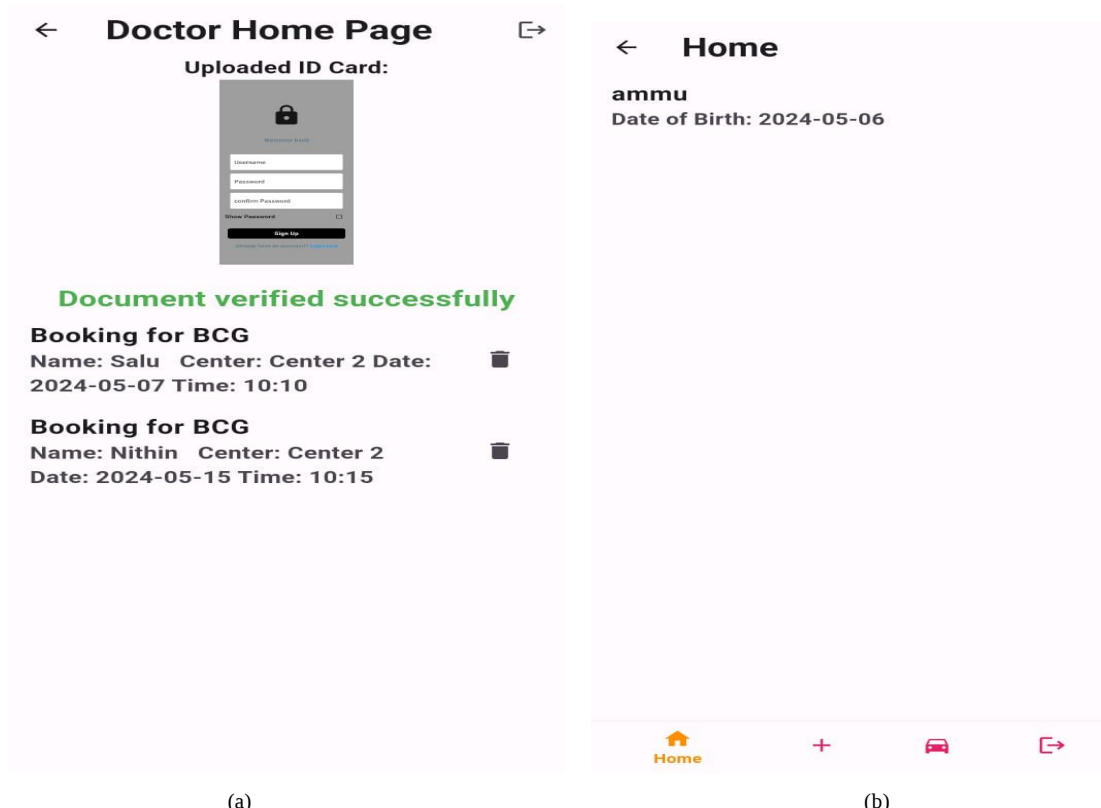
In this part of module, the parents can register their children with their name, date of birth and gender. It then displays the details of the children. Also provide an option to register multiple children

For doctors

After successfully logging in, they will have an option to upload photo of their Id card for verification to ensure their credibility. After being verified by the admin, they can view the booked vaccination slots and confirm their vaccination.

For admin

Admins can view the list of children registered; images of Id card uploaded by the doctors for verification. After checking the authenticity of the id card, admin can confirm their verification.



(a) (b)
Fig 5: (a) Doctor Homepage, (b) Parent Home page

C. Vaccination Schedule Module

This module offers a detailed vaccination schedule based on the child's date of birth (DOB). By inputting the DOB, parents or caregivers receive a complete schedule detailing when each vaccination should be taken. This feature ensures timely and efficient vaccination, helping safeguard the child against various diseases.

← Vaccination Schedule			
Vaccination	Date	Time Period	Booking
BCG	2024-05-06 00:00:00.000	At birth or as early as possible	Available
Hepatitis B - Birth Dose	2024-05-07 00:00:00.000	At birth or as possible within	Available
OPV-0	2024-05-22 00:00:00.000	At birth or as early as possible	Available
OPV 1,2 & 3	[2024-06-17 00:00:00.000, 2024-07-27 00:00:00.000, 2024-06-17 00:00:00.000, 2024-07-27 00:00:00.000,	At 6, 10, and 14 weeks of age	Available
Pentavalent 1,2 & 3	[2024-06-17 00:00:00.000, 2024-07-27 00:00:00.000,	At 6 weeks, 10 weeks,	Available

Fig 6: Vaccination Schedule

D. Booking Module

This module provides an interface for parents or guardians to book appointments for vaccinations. This module includes features such as selection of date, time and vaccination centres. Also the user can select vaccination centres based on their preferences and availability of slots in that centre.

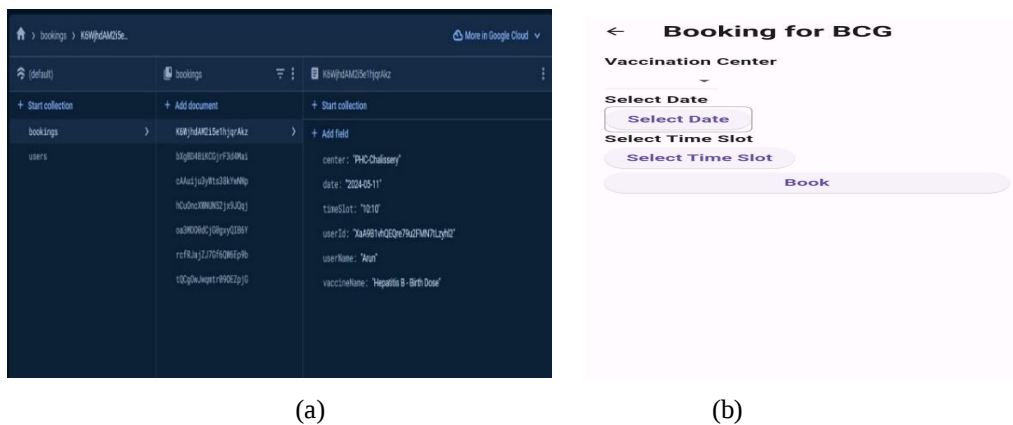


Fig 7: (a) Booking Database, (b) Booking page

E. Taxi Service Module

This module collaborates with taxi services to ease the transportation of parents to health cares and hospitals. This module offers an option to user to select their place and it then displays the phone number of taxi drivers in that place. On clicking the phone number, it then directs to caller dialog to call the taxi services.



Fig 8: Taxi service page

V. CONCLUSIONS

Child vaccination management app provide a significant role in addressing the challenges that are related to managing childhood vaccination. This app helps parents and caregivers to access the information about the child vaccination schedule by entering the date of birth of the child. It provides timely reminder, personalized vaccination schedules and option to call taxi services. By providing a user-friendly interface help users to understand more effectively. This app aims to improve vaccination coverage rates and contribute to the overall health of children.

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