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Vaxmate : AI Driven Child Vaccination Reminder

Apurva Rajendra Khalekar

Prof. P.V.Kulkarni

Gayatri Sanjay Pawar

Radhika Purushottam Tayade

Abstract

Domain: Software Development

Subdomain: Smart Healthcare System

Problem Statement: *Parents often miss or delay child vaccinations due to lack of reminders, awareness, and proper record management. Existing systems are mostly manual and lack intelligent features. There is a need for an AI-powered vaccination management system that uses machine learning and chatbot support to provide personalized reminders, predictive alerts, and real-time vaccine information.*

Solution: *The proposed system is an AI-based child vaccination management app that integrates a smart chatbot and machine learning algorithms to automate vaccination tracking. It provides personalized reminders, predicts missed vaccinations, and offers real-time vaccine guidance through an interactive chatbot and admin dashboard.*

Key Words: Child Vaccination, Artificial Intelligence (AI), Machine Learning (ML), Chatbot, Predictive Analytics, Health Management System, Smart Reminder, Vaccination Tracking, Mobile Application, Healthcare Automation.

1.INTRODUCTION

Vaccination plays a crucial role in protecting children from life-threatening diseases. However, many parents fail to follow proper vaccination schedules due to lack of awareness, manual record-keeping, and absence of timely reminders. In recent years, technology-driven healthcare systems have emerged to simplify such challenges.

This paper presents an AI-based Child Vaccination Management System that leverages machine learning and an intelligent chatbot to automate vaccination tracking and improve parental engagement. The system predicts possible missed doses, sends smart reminders, and provides real-time vaccine information through an interactive interface. By integrating AI and ML, the proposed solution enhances vaccination compliance, reduces human error, and promotes better child healthcare management.

Previous research has focused on applying deep learning and computer vision techniques for plant disease detection. Various CNN-based models like VGG16, ResNet, and MobileNet have been used to classify leaf diseases with high accuracy using datasets such as PlantVillage.

2. RELATED WORK

2.1. Reinforcement learning based Vaccine Allocation System

This proposes a Reinforcement Learning (RL) model to optimize vaccine allocation and budget sharing. The system learns from simulated epidemic data and dynamically adjusts vaccine distribution based on infection rates, resource availability, and fairness constraints.

Advantage:
Offers an adaptive and data-driven solution for efficient and equitable vaccine distribution.

Disadvantage:
Needs large datasets and high computational power, limiting real-world implementation.

2.2. ML based Disease Risk Prediction Model

In this study, Xie et al. (2025) used a multicenter retrospective dataset collected from several hospitals to build a pertussis risk prediction model for children. The data included demographic, clinical, and laboratory features, which were preprocessed and optimized through feature selection. Multiple machine learning algorithms such as Logistic Regression, Random Forest, Support Vector Machine, and XGBoost were trained and compared. The models were evaluated using standard metrics like accuracy, AUC, sensitivity, and specificity, and the best-performing model underwent external validation to ensure generalizability across different centers.

Advantage:
High prediction accuracy and generalizability through multicenter ML modeling.

Disadvantage:
Limited by retrospective data and lacks prospective real-world validation.

2.3 ML based Vaccination Accessibility Analysis

Tetala et al. (2024) proposed a machine learning-based model that analyzes vaccination history along with social determinants of health such as income, education, and region to predict vaccine accessibility and acceptance. They applied algorithms like Random Forest, Decision Tree, and Logistic Regression to identify key factors influencing vaccination uptake. The model uses healthcare and demographic data to detect areas with low vaccine coverage and suggest targeted interventions. This approach supports data-driven planning to enhance seasonal vaccine distribution and reduce healthcare maintenance costs.

Advantage: Integrates social and medical data to enhance vaccine accessibility and targeted distribution.

Disadvantage: Relies on the accuracy and completeness of social determinant data, which may vary regionally.

2.4. ML based Childhood Vaccination

Uses machine learning (PART, J48, Multilayer Perceptron, Random Forest) to predict childhood vaccination status based on demographic and service-use features.
Advantage: Demonstrates high prediction accuracy (~95.5% for the top algorithm) in identifying children who will be vaccinated.
Disadvantage: Use of cross-sectional survey data limits temporal/causal inference and model applicability in different population settings.

2.5. MobileNetV2 and Transfer learning base vaccination chart system

Designs and tests a chatbot app for parents of children ≤35 months, giving reminders, vaccination information, and consultation; found improved motivation, self-efficacy, and behavioral intention.

Advantage: Shows the feasibility and positive effect of a chatbot intervention to improve vaccination intention among parents.

Disadvantage: The study sample was relatively small (65 parents) and short-term; long-term vaccination behaviour and larger scale deployment remain untested.

3. PROPOSED SOLUTION

The proposed system is an AI-based Child Vaccination Management System that uses Machine Learning to predict missed vaccinations and an AI chatbot for real-time assistance. Parents register children through a mobile app, which securely stores vaccination data. The system sends automated reminders and alerts to ensure timely immunization. Health workers can monitor records through an admin dashboard. This approach improves vaccination coverage and enhances healthcare efficiency.

3.1 Block Diagram

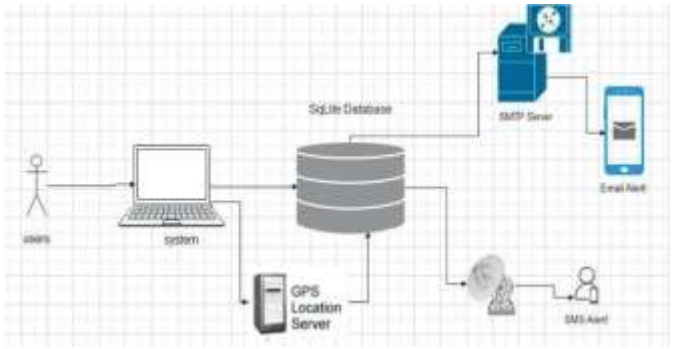

Fig.No.1. Block Diagram

3.2 Architecture

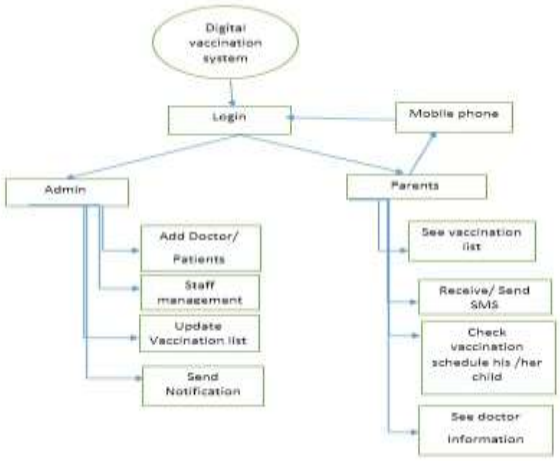

Fig.No.2 System Architecture

4. EXPECTED RESULT

1. Accurate Prediction:
The model successfully predicts the likelihood of missed or delayed vaccinations with high accuracy.

2. Timely Reminders:
Automated notifications and chatbot alerts help parents remember upcoming vaccination dates.

3. Improved Coverage:
Reduction in missed or delayed vaccinations, leading to higher immunization rates among children.

4. Personalized Assistance:
The AI chatbot provides real-time, customized information and guidance to parents.

5. Efficient Data Management:
Centralized and secure storage of vaccination records for easy retrieval and analysis.

6. Enhanced Decision-Making:
Health workers gain actionable insights through dashboards showing vaccination trends and risk reports.

7. User Engagement:
Increased parental awareness and involvement through interactive chatbot conversations.

8. Healthcare Optimization:
Reduction in administrative burden and overall healthcare maintenance costs through automation and predictive analytics.

5. CONCLUSION

The proposed AI-based Child Vaccination Management System offers an intelligent and efficient way to monitor and manage child immunizations. By integrating machine learning for predictive analysis and a chatbot for real-time assistance, the system ensures timely vaccination, reduces missed doses, and enhances parental awareness. This approach bridges the gap between technology and healthcare, contributing to improved child health outcomes and smarter vaccination management.

6. FUTURE SCOPE

The future scope of the Vaccination Reminder System using Machine Learning is quite promising. In the coming years, the system can be integrated with government health databases such as CoWIN or eVIN to automatically update vaccine schedules and maintain accurate digital records.

With advancements in artificial intelligence, the app can be enhanced to personalize reminders by predicting missed or delayed vaccinations based on parents' phone usage patterns and behavior.

It can also be expanded to support multiple regional languages, making it more accessible to people across different regions. Furthermore, offline functionality can be added to benefit users in rural areas with limited internet access.

In the future, the system could connect with wearable devices or smart health tools to track a child's health and synchronize vaccination alerts. The app may also allow secure sharing of vaccination certificates with schools or healthcare providers and use predictive analytics to forecast vaccine demand in hospitals.

Additionally, incorporating an AI-based chatbot can help parents with vaccine-related queries, while cloud integration can provide data backup and synchronization across devices. Overall, the system has the potential to evolve into a comprehensive, intelligent, and globally adaptable vaccination management platform.

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