# Group Project Case Study: Child Vaccine Schedule Tracking System

### **1. Case Study (For Analysis)**

**Organization:** City Health Clinic (CHC), a public-facing network of 5 community health clinics.

**Current Process:** The CHC is responsible for providing pediatric care, including mandatory childhood vaccinations, to thousands of children from birth to age 18. The current process for managing vaccination schedules is almost entirely manual and fragmented:

1. **Patient Registration:** When a new child is born or joins the clinic, a nurse or administrative staff member manually creates a physical patient file and a paper "Vaccination Card" (often a small yellow booklet).
2. **Tracking:** All vaccinations given are recorded by hand in the physical file and on the paper card, which the parent must keep and bring to every appointment.
3. **Scheduling:** The nurse manually calculates the next required vaccine (e.g., "6-month" or "1-year" shots) based on the child's birth date and the national immunization schedule, then writes an appointment card for the parent. A copy is written in a large, shared paper diary or a basic spreadsheet at the front desk.
4. **Reminders:** A few days before the appointment, an admin assistant tries to manually call the parents to remind them. This is inconsistent and time-consuming.

**Identified Problems:** Over time, this manual process has led to significant problems:

* **Incomplete and Lost Records:** Parents frequently lose the paper vaccination card, making it impossible for nurses to know which vaccines the child has received. The clinic's physical files are the only backup, and these can also be misplaced or misfiled.
* **Missed or Off-Schedule Vaccinations:** With complex schedules (e.g., doses at 2, 4, 6, 12, 18 months), it's easy for nurses to make calculation errors. Parents often forget appointments, and the manual reminder system is unreliable, leading to gaps in immunization and public health risks.
* **No Real-Time Visibility:** A parent cannot simply call and confirm their child's vaccination status. A nurse must physically locate the file, which can take a long time. Clinic managers have no way to quickly see how many children are overdue for their shots.
* **Inefficient Reporting:** The government requires the CHC to submit quarterly reports on vaccination rates. This requires a team of staff to spend days manually going through thousands of files to count doses. This data is also critical for managing the clinic's vaccine inventory (stock), but it's never up-to-date.
* **Low Efficiency:** Nurses and admin staff are spending a large portion of their day on paperwork and reminder calls instead of on patient care.

**The Proposal:** To address these critical issues, the CHC Director proposes the development of a **"Child Vaccine Schedule Tracking System"**. This system will digitize and automate the entire vaccination process.

**The proposed system will allow:**

1. **Digital Patient Records:** A central, secure database for every child's demographic information and complete vaccination history.
2. **Automated Scheduling:** The system will automatically calculate the *entire* recommended vaccination schedule for a child based on their date of birth and the national immunization guidelines.
3. **Parent Portal & Access:** A simple web portal or mobile app where parents can securely log in to see their child's vaccination history and upcoming appointment dates.
4. **Automated Reminders:** The system will automatically send SMS and/or email reminders to parents 1 week and 1 day before a scheduled appointment.
5. **Clinic Staff Portal:** A secure interface for nurses and doctors to log new vaccinations (which automatically updates the child's record) and view any child's complete history instantly.
6. **Reporting Dashboard:** An admin dashboard for clinic managers to instantly generate reports on vaccination rates, see which children are overdue, and forecast vaccine inventory needs.

The project aims to improve public health outcomes by increasing vaccination compliance, improving data accuracy, and increasing operational efficiency at all 5 clinic locations.

### **2. Key User Stories (System Requirements)**

Here are some key user stories to help define the system's requirements:

**As a Parent...**

* "I want to log in and see a simple list of all the vaccines my child has received, so I don't have to rely on the paper card."
* "I want to receive an automatic SMS reminder for my child's upcoming vaccine appointments, so I don't forget."
* "I want to see my child's upcoming appointment schedule for the next year, so I can plan ahead."

**As a Clinic Nurse...**

* "I want to search for a child by their name or ID and instantly see their complete vaccination history, so I know exactly what they need today."
* "I want to enter the details of a vaccine I just administered, and have the system automatically update the child's record and schedule the next due date."
* "I want the system to show me a daily list of all children with appointments, so I can prepare for their visits."

**As a Clinic Administrator / Manager...**

* "I want to run a report that shows me what percentage of 2-year-olds in my clinic are fully vaccinated, so I can report this to the health department."
* "I want to see a list of all children who are more than 30 days overdue for a vaccine, so my staff can follow up with them directly."
* "I want to generate a report that forecasts how many doses of the MMR vaccine we will need next month, so I can manage our inventory and budget."

# Case Study Analysis

**1. Problem Statement**

The City Health Clinic's (CHC) current process for tracking child vaccinations across its five clinics is entirely manual, fragmented, and paper-based . This system relies on physical patient files and parent-held paper cards, which are frequently lost, misfiled, or contain illegible entries .

This core data integrity failure leads to significant public health risks, including:

* **Missed or Off-Schedule Vaccinations:** Gaps in immunization occur due to unreliable manual reminder calls and errors in calculating complex schedules .
* **Lack of Visibility:** There is no real-time data access. Parents cannot verify their child's status, and clinic managers cannot identify at-risk or overdue children .
* **Operational Inefficiency:** Skilled nurses and staff spend a disproportionate amount of time on manual data entry, file retrieval, and paperwork instead of patient care .
* **Failed Reporting:** Mandatory government reporting on vaccination rates is a time-consuming, inaccurate, and manual process that provides no actionable data for managing vaccine inventory .

**2. Key Requirements & System Scope**

The objective is to develop a centralized, secure **Child Vaccine Schedule Tracking System**. This system will digitize all records, automate scheduling and reminders, and provide reporting tools for staff and access for parents.

Based on our analysis, the system scope is defined by the following key requirements:

**A. Core System & Data:**

1. **Centralized Database:** A single, secure database to serve all 5 CHC clinics.
2. **Digital Patient Records:** A central record for each child, including demographics and a complete, un-editable vaccination history (log).
3. **Dynamic Schedule Management:** The system *must* have an admin interface where authorized staff can manage the vaccination rules (e.g., "MMR, Dose 1, 12 months") without needing a developer. This prevents the system from becoming obsolete when national guidelines change .

**B. Staff Portal (Nurse, Doctor, Admin):**

4. **Automated Schedule Generation:** When a child is registered, the system will automatically generate their complete, personalized vaccination schedule based on their date of birth and the rules from the admin module.

5. **Vaccination Logging:** An interface for nurses to quickly look up a child and log a new vaccination. The system will automatically update the child's history and the "next due" appointment.

6. **Reporting Dashboard:** A dashboard for clinic managers to generate reports on: \* Vaccination compliance rates (e.g., "% of 2-year-olds fully vaccinated"). \* A list of all children currently overdue for any vaccine.

7. **Inventory Forecasting (Limited Scope):** The system will provide a **forecasting** report (e.g., "50 children will need their 6-month vaccine next month"). This scope *explicitly excludes* managing on-hand inventory, stock levels, or lot numbers .

**C. Parent Portal (Web-Only):**

8. **Responsive Web Portal:** The system will provide a **mobile-friendly web portal** for parents. A native mobile app (iOS/Android) is explicitly **out-of-scope** .

9. **Secure Parent Authentication:** The portal *must* have a secure process to link a parent's account to their child's medical record. This will be handled by an **in-clinic, staff-verified process** where staff generate a one-time-use code or link for the parent to use.

10. **Parent View:** Once logged in, parents can view their child's completed vaccination history and their list of upcoming appointments.

**D. Automated Reminders:** 11. **Email & SMS Notifications:** The system will automatically send appointment reminders to parents via email and SMS (e.g., 7 days and 1 day before the appointment). This will require integration with a third-party SMS service .

# System Request Drafting

| **Field** | **Description** |
| --- | --- |
| Project Name | Child Vaccine Schedule Tracking System |
| Project Sponsor | City Health Clinic (CHC) Management |
| Business Need | The clinic's current manual, paper-based vaccination tracking process is highly inefficient, prone to critical data loss, and results in missed appointments and incomplete immunizations. This creates significant public health risks, fails reporting requirements, and drains valuable staff time on manual paperwork instead of patient care. |
| Business Requirements | The system must be a centralized, secure web application accessible by all 5 CHC clinics, which will:  • Provide a staff portal to log vaccinations and view patient histories instantly.  • Automatically generate personalized vaccine schedules based on dynamic, admin-manageable rules.  • Provide a mobile-friendly web portal for parents to securely view their child's records and upcoming appointments.  • Implement an automated SMS and email reminder system for appointments.  • Provide a dashboard for managers to generate reports on vaccination rates, overdue children, and inventory forecasts. |
| Business Value | This project will deliver critical value by: • **Improving Public Health:** Increasing vaccination compliance and reducing missed appointments.  • **Improving Data Accuracy:** Eliminating lost paper records and calculation errors. <\*br>  • **Increasing Operational Efficiency:** Automating scheduling, reminders, and reporting, freeing up staff and nurse time.  • **Enhancing Reporting:** Providing instant, accurate data for government reports and inventory planning.  • **Improving Parent Experience:** Giving parents secure, on-demand access to their child's health records. |
| Special Issues or Constraints | • **Scope:** The parent portal must be a **mobile-friendly website only**. A native mobile app is explicitly out-of-scope.  • **Security:** Parent account creation and linking to a child's record **must** be handled via an in-clinic, staff-verified process due to medical data privacy.  • **Inventory:** The system will only provide **forecasting** data (e.g., "50 doses needed next month"). It will *not* track on-hand inventory, stock levels, or lot numbers.  • **Schedule:** The vaccination schedule rules must be dynamically manageable by an admin, not hard-coded.  • **Cost:** The system requires integration with a third-party SMS service, which will have an ongoing operational cost. |

# Feasibility Matrix

| Feasibility Type | Rating (High/Med/Low) | Justification |
| --- | --- | --- |
| Technical | Medium | The project is a centralized web application, which is standard technology. However, the rating is **Medium** (not High) due to specific complexities: 1) It requires medical-grade security for patient data. 2) The parent authentication process must be custom-built to be verified in-clinic. 3) It requires integration with a third-party SMS API. 4) The vaccine schedule must be a dynamic rules engine, not hard-coded. These are all achievable, but they increase the technical complexity. |
| Operational | High | The project has extremely high operational feasibility. It directly solves the most critical problems for *all* user groups: it eliminates data loss for nurses, automates manual reminder calls for staff, automates reporting for managers, and provides on-demand access for parents. User acceptance is expected to be very high as it removes major daily frustrations. |
| Economic | High | The project has clear, positive economic value. **Costs** include one-time development and an ongoing subscription for the SMS service. **Benefits** are significant: 1) Tangible savings from drastically reduced staff/nurse hours spent on manual paperwork, data entry, and reminder calls. 2) Tangible savings from better inventory forecasting, reducing vaccine waste. 3) Intangible (but critical) value from improved public health outcomes and avoiding penalties for failed reporting. |
| Schedule | Medium | Our analysis and clear scope definition (no native app, no inventory tracking) make the schedule *achievable*. However, the project is still moderately complex with several distinct parts (staff portal, parent portal, admin rules engine, database, SMS integration). It is not a simple or fast project. The rating is **Medium** because it will require a realistic, multi-month timeline, but it has no major unknown dependencies that would make the schedule high-risk. |

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# FEASIBILITY REPORT

## **Project: Child Vaccine Schedule Tracking System**

### **I. Executive Summary (Tóm tắt dự án)**

This report assesses the feasibility of developing a **Child Vaccine Schedule Tracking System** for the City Health Clinic (CHC) network. The project aims to replace the current manual, paper-based tracking system, which is inefficient, highly prone to data loss, and contributes to missed vaccinations, posing a public health risk .

The proposed solution is a centralized, secure web application accessible by all 5 CHC clinics [cite: 198]. It will provide digital patient records, automated schedule generation, a staff portal for logging vaccinations, a secure parent-facing web portal, automated SMS/email reminders, and an administrative reporting dashboard .

This study evaluates the project's feasibility across four key criteria. The findings are:

* **Organizational Feasibility: High.** The project directly solves critical, daily operational problems and has high user acceptance.
* **Economic Feasibility: High.** The project has clear positive value from saved labor costs and reduced vaccine waste.
* **Technical Feasibility: Medium.** The project is complex due to medical-grade security requirements, third-party API integration, and the need for a dynamic rules engine.
* **Schedule Feasibility: Medium.** The project is achievable, but its complexity requires a carefully managed, multi-month timeline.

The project is deemed highly beneficial and achievable. The final recommendation is to **Accept Project (Triển khai chính thức)**, with a clear understanding of the defined scope and technical complexities.

### **II. Project Context and Needs (Bối cảnh và nhu cầu)**

**Perceived and Real Needs:** The CHC's current process for managing pediatric vaccinations across its five clinics is entirely manual, relying on physical files and parent-held paper cards . This has led to critical operational failures and public health risks:

* **Data Inaccuracy and Loss:** Physical records are frequently lost, misfiled, or illegible, making it impossible to confirm a child's true vaccination history .
* **Missed Vaccinations:** Manual schedule calculations are prone to error, and the inconsistent, manual reminder system leads to missed appointments and gaps in immunization .
* **Lack of Visibility:** Staff cannot access patient data in real-time, and managers have no way to identify at-risk or overdue children .
* **Operational Inefficiency:** Skilled nurses and staff spend a significant portion of their time on low-value administrative work (filing, data entry, reminder calls) instead of patient care .
* **Failed Reporting:** Mandatory government reporting is a time-consuming and inaccurate manual count, providing no actionable data for managing vaccine inventory .

**Current Organizational Environment:** The current environment is one of high-stress, low-efficiency, and constant data integrity problems. This affects all stakeholders, from parents who have no access to data, to nurses bogged down in paperwork, to managers unable to make data-driven decisions.

### **III. Project Scope and Objectives (Phạm vi và mục tiêu)**

**In-Scope:**

* A centralized, secure web application for all 5 CHC clinics.
* A **Staff Portal** for:
  + Creating digital patient records.
  + Automatically generating personalized vaccine schedules.
  + Logging new vaccinations in real-time.
  + Viewing complete patient histories.
* An **Admin Module** for:
  + Dynamically managing the vaccination rules and schedules (e.g., adding new vaccines, changing dose timing) without hard-coding .
* A **Reporting Dashboard** for:
  + Generating reports on vaccination compliance rates.
  + Identifying and listing overdue children.
  + Providing **forecasting** data for inventory needs (e.g., "50 doses of MMR needed in June") [cite: 202].
* A **Parent Portal** that is:
  + A **mobile-friendly website only** .
  + Accessed via a secure, in-clinic, staff-verified authentication process .
  + Allows parents to view their child's completed history and upcoming appointments.
* An **Automated Notification System** using Email and third-party SMS to send appointment reminders .

**Out-of-Scope:**

* **Native Mobile App:** A downloadable app for iOS or Android is explicitly out-of-scope .
* **Full Inventory Management:** The system will *not* track on-hand inventory, stock levels, lot numbers, or vaccine expiry dates. It only provides *forecasting* .

**Stakeholders:**

* CHC Clinic Management (Sponsor)
* Clinic Nurses and Doctors (Primary Users)
* Clinic Administrative Staff (Primary Users)
* Patients' Parents/Guardians (End Users)

**Objectives (Business Value):**

* **Improve Public Health** by increasing vaccination compliance.
* **Improve Data Accuracy** by eliminating paper records and manual errors.
* **Increase Operational Efficiency** by automating scheduling, reminders, and reporting.
* **Enhance Reporting** for both government compliance and internal planning.
* **Improve Parent Experience** by providing secure, on-demand data access.

### **IV. Evaluation Criteria (Tiêu chí đánh giá)**

The project's feasibility was assessed using the following four criteria:

1. **Technical Feasibility**
2. **Organizational (Operational) Feasibility**
3. **Economic/Financial Feasibility**
4. **Schedule Feasibility**

### **V. Feasibility Analysis (Phân tích khả thi)**

* **Technical Feasibility (Rating: Medium):** The project is a centralized web application, which is standard technology. However, the rating is **Medium** (not High) due to specific complexities: 1) It requires medical-grade security for patient data. 2) The parent authentication process must be custom-built to be verified in-clinic. 3) It requires integration with a third-party SMS API. 4) The vaccine schedule must be a dynamic rules engine, not hard-coded. These are all achievable, but they increase the technical complexity.
* **Organizational (Operational) Feasibility (Rating: High):** The project has extremely high operational feasibility. It directly solves the most critical problems for *all* user groups: it eliminates data loss for nurses, automates manual reminder calls for staff, automates reporting for managers, and provides on-demand access for parents. User acceptance is expected to be very high as it removes major daily frustrations.
* **Economic/Financial Feasibility (Rating: High):** The project has clear, positive economic value. **Costs** include one-time development and an ongoing subscription for the SMS service. **Benefits** are significant: 1) Tangible savings from drastically reduced staff/nurse hours spent on manual paperwork, data entry, and reminder calls. 2) Tangible savings from better inventory forecasting, reducing vaccine waste. 3) Intangible (but critical) value from improved public health outcomes and avoiding penalties for failed reporting.
* **Schedule Feasibility (Rating: Medium):** Our clear scope definition (no native app, no inventory tracking) makes the schedule *achievable*. However, the project is still moderately complex with several distinct parts (staff portal, parent portal, admin rules engine, database, SMS integration). It is not a simple or fast project. The rating is **Medium** because it will require a realistic, multi-month timeline, but it has no major unknown dependencies that would make the schedule high-risk.

### **VI. Risk and Alternatives (Rủi ro và phương án thay thế)**

**Key Risks:**

1. **Security Risk (High):** Handling patient medical data requires strict adherence to privacy laws (like HIPAA). A data breach would be catastrophic.
   * *Mitigation:* Use industry-standard encryption, secure authentication, and conduct a security audit before launch. The staff-verified parent login process is a key part of this mitigation.
2. **Cost Risk (Medium):** The third-party SMS service is an ongoing operational cost that must be budgeted for annually .
   * *Mitigation:* Research and select a cost-effective SMS provider. Use email reminders as a free alternative where possible.
3. **Scope Creep Risk (Medium):** There will be pressure to add features like full inventory tracking or a native mobile app.
   * *Mitigation:* Adhere strictly to the "Out-of-Scope" definitions in Section III. All new feature requests must go through a formal approval process.

**Alternatives:**

1. **Maintain Current System (Do Nothing):** This is not a viable alternative. The current system is failing, causing data loss, and creating a public health risk. These problems will only worsen as patient numbers grow.
2. **Purchase a COTS (Commercial Off-the-Shelf) System:** This would involve buying a pre-built medical records system. This could be faster but may be extremely expensive and not tailored to the clinic's specific, simple workflow. It may also include many features (like billing) that are not needed, adding unnecessary complexity.
3. **Develop In-House (Proposed):** This is the recommended alternative. It allows the CHC to build a solution that is perfectly tailored to its specific needs, addressing the defined problems without unnecessary complexity or cost.

### **VII. Findings and Recommendation (Kết luận và khuyến nghị)**

**Findings:** The proposed Child Vaccine Schedule Tracking System is a vital project that addresses critical operational failures and public health risks. The analysis confirms the project is highly desirable from an operational and economic standpoint. While there are medium-level technical and schedule complexities, these are well-defined and manageable with proper project planning and adherence to the defined scope.