KIU

7GUARD

Project Proposal
Software Engineering Project 2024

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Abstract

This project is developed for Santa Dora Hospital, aiming to have a CHDR (Child Health and Development Record) card that maintains up-to-data details and a steady database of the vaccination records of children starting from birth to seven years old. Given the limited use of such systems in Sri Lanka, the primary goal of developing such a system is to make the manual process of vaccinations more efficient, accessible and secure for the users to utilize. This is a user-friendly platform that allows parents or guardians of the children to make channeling appointments beforehand and have a CHDR (Child Health and Development Record) with updated vaccination details that can be accessed anywhere at any time. Additionally, it provides important information about the vaccines, side-effects and vitamins for children's healthcare development. As for the administration side, they will have a well-managed and secure database. The healthcare providers will be at ease with the proper management of their service delivery as well.

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1. Introduction and Description

7GUARD is a web-based system that manages the vaccine registration and the CHDR (Child Health and Development Record) card of children. Referring to [1] and [2], the system is designed as a user-friendly system that allows users to make an online appointment for vaccination, limiting the process to only few seconds and saving the time and effort of the users. The system also provides a real-time updated CHDR (Child Health and Development Record) card that is accessible at any given time, ensuring the safety of the data included in it. The users can view the details of the vaccines, vitamins and the relevant advises regarding the side effects if they prefer to be more educated about the treatments their children receive. The users can get a prescription from the doctor for any side effect that might occur as well. If the users have any suggestions or feedback regarding the services they receive, they can submit their opinions to the system.

The pharmacist can register the vaccine manufacturers that supply the vaccines to the hospital and maintain records of that while the admin has a well-balanced database with the details of the registered vaccines and issued vaccines.

1.1. Problem Specifications

Santa Dora Hospital currently does not have a system that keeps records of the children vaccination process. The channeling is done through phone calls while the receptionist makes the appointment for the patients. The records of issued vaccines are not digitally stored. The vaccine manufacturers details are not stored in the hospital database as well.

These paper-based records are prone to errors, misplacement, and often become inaccessible when needed, leading to incomplete vaccination histories or resulting serious cases of risking the medical conditions of the children. The healthcare providers who are managing the vaccine inventory might struggle to keep up with the manual process or accidently make an error in writing down.

The parents or the guardians might forget or mix up the specific date for the vaccination or be unaware of when and what the next vaccine should be. Therefore, for the parents or guardians, calling the hospital and arranging a vaccine appointment might be a bit difficult at times.

Also, a platform that supplies the details and advises about the vaccine side effects or areas to be more educated about is not commonly seen. If the parents can look for these details after post-vaccination, it would be beneficial for them.

1.2. Solution Outlines

To control and prevent the above-mentioned problems, 7GUARD introduces new features as solutions. Firstly, providing automated reminders and alerts to the parents and guardians about upcoming or overdue vaccinations can make the users aware of their appointments.

Implementing a secure database that digitally records the vaccine details and vaccine manufacturer details will help in having proof of the services if any doubt is to be occurred. Since the vaccine history of children are systemized, the data will not get lost or damaged by natural causes.

Also, the system supplies reliable educational resources for anyone who wants to learn about the vaccine related side effects and vitamins required for the children. This way of providing immediate guidance along with user friendly communication helps in maintaining a healthy relationship with the users.

As for the primary stakeholders of the system, parents, guardians and children are recognized as the users. A registered parent has the access to their profile of the system and the CHDR (Child Health and Development Record). If the parent is absent, a legal guardian can take the parent's place and go through the registration process. According to [4] the children from newborn to twelve years old are identified as users but have no access to the system. The age range could be changed if the parents were unable to get their children vaccinated on time.

Other than that, there is the admin panel with super admin, doctor, nurse, hospital receptionist, pharmacist and the vaccine manufacturers. The super admin position is assigned by the hospital to their trusted employee. There are doctors assigned for vaccination process, the nurses who interacts with the parents or guardians and the children. The nurses can be assigned for managing the data records based on the hospital's opinion. The hospital receptionist can manage the scheduling appointments, displaying the availability of the doctors and issuing the appointment number to the user. The pharmacist handles the data entered to the database about the vaccines and vaccine manufacturers. Additionally, there is the vaccine manufactures who supplies the vaccines to the

hospital. Also, there are the developers from the admin side who manages the system. The person who are from the top-level view the feedbacks sent by the users.

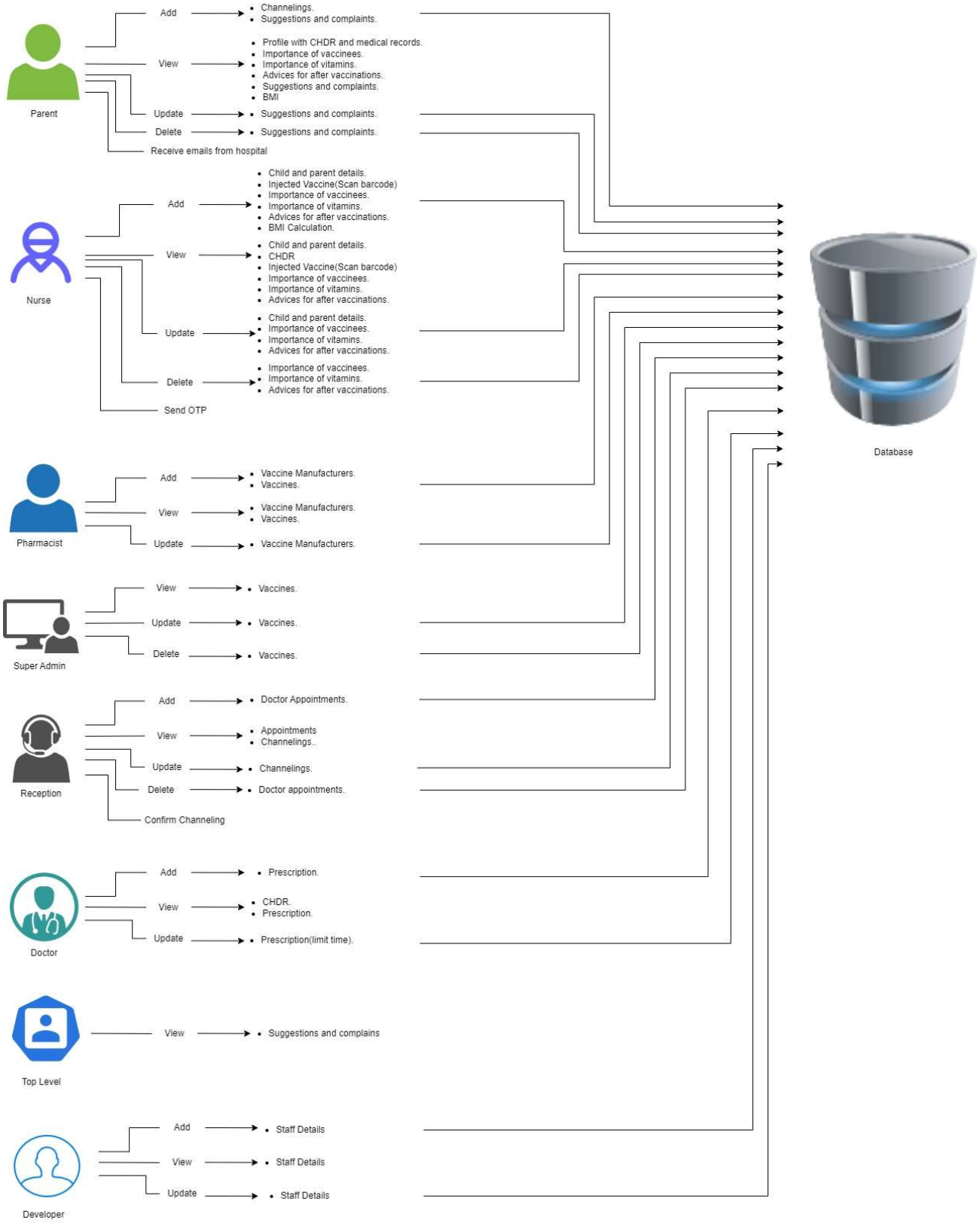

Figure 1: High-level architecture diagram

1.3. Key Benefits

The system provides automated reminders and real-time updates. The reminders are helpful if the parents are forgetful or unaware of their schedule. The updates help to keep up with the new features. The consistency of data is easy to handle. The currently provided CHDR (Child Health and Development Record) card being lost is a possibility and a risk. Since the CHDR (Child Health and Development Record) issued by the system is online accessible, the relevant details about the children's vaccination will always be present. The system will also easily generate reports such as the BMI (Body Mass Index) chart in the CHDR (Child Health and Development Record). The online channeling saves time of the parents and doctors as well.

Keeping records of vaccine registration details in a digital database will reduce error in data entering and managing. This way, data will not be misplaced or lost. No unauthorized data modifications will happen since the database is well secured. The hospital staff that relates to the children vaccination process will be able to get in touch with technical terms of the system and get familiar with the new and fast methods of working with technology.

The vaccine manufacturers will have their details safely stored in the system as a proof of their service done to the betterment of the healthcare of the children.

For the system developers, their system designing skills, backend and frontend coding skills, teamwork and communication skills, leadership skills, critical and logical thinking along with industrial experiences will enhance as the project proceeds.

2. Objectives

Among the several objectives the system aims to achieve, one of the main objectives is scheduling vaccinations according to the availability of doctors and the vaccines. The users can view the date and time their doctor is available for injecting the vaccines to the children. Based on that the user can request to have a vaccine reserved for them. This prevents the unnecessary rush or ques to get channeling numbers. No channeling number overlapping would happen as the numbers are issued through the system with proper management. No commotion regarding the doctor availability would happen as the times and dates are clearly maintained. If the appointment is to be cancelled, the system will notify the users beforehand. The system aims to minimize user inconvenience as much as possible with quick updates of appointment dates and times.

Sending reminders of upcoming or overdue appointments helps to manage the vaccination schedules and reservations of the vaccines. The reminders would not allow the users to forget or ignore the scheduled appointment. If the vaccine requested by the user is not currently in the stock, a reminder is sent through an email regarding the situation, asking the user to buy the vaccine from another hospital and make an appointment to get the said vaccine injected to the child. For overdue appointments, a reminder is sent to the user with a message that says the appointment is canceled because the user was unable to participate in the vaccination process.

The system displays a set of advises that gives key ideas about the side effects that might show in children after getting vaccinated. This also includes the remedies for such cases under the guidance of the relevant healthcare providers. This gives the users an idea about why they should acknowledge the vaccination process of children since birth, how to check for any changes in their children after being vaccinated and how to treat for any difference until they reach the doctor. In addition to these advises, the user can also be educated about the vitamins the children require based on their current health record. All these details are displayed after confirming the relevance by the authorized doctor.

To improve the user experience, the system is designed with a clean and straightforward interface for the parents and the guardians to use with ease. There will be clear instructions and easily understandable forms to fill to gather the required information. The users would not face any difficulties or confusions while navigating the system. The system will be accessible on various devices including smartphones, tablets and computers so that the users can effectively interact with the system features.

The admins will also have a clear and easily handled interface so that they can manage the data without a struggle. The instructions will be quick and on to the point, leaving no space for visual errors to happen.

The system introduces a smart goal that identifies as the most unique feature of the system. The CHDR (Child Health and Development Record) card is currently issued as a hard copy. To know about the vaccination details and the BMI (Body Mass Index) calculations, the parents, guardians or even the doctors must have a look at the card. The risk of this card being misplaced or damaged should not be ignored. In an emergency, if the vaccination records of the child are needed, the manual CHDR (Child Health and Development Record) card might not be with the parents. Hence, an online accessible CHDR (Child Health and Development Record) card is provided through the system. A user can view this through their 7GUARD profiles at anywhere at any time. The specified doctor or an authorized healthcare provider of the hospital can view this through the admin if needed as well.

3. Procedure

The project conducted by dividing the entire process into ten functions based on the requirements. The ten team members have an equal responsibility of fulfilling their tasks on time under the guidance of the supervisor and the team leader.

3.1 Flow of the Project

The procedure is categorized by the activities tied to the specific procedures. System prototype methodology will be used as the client requirements in medical-related systems can evolve or change over time. This methodology is suitable because it enables developers to create an evolving prototype that resembles the final system but is continually refined. By building an interactive model, developers can present the system's core functionalities to the client early in the process, gather feedback, and make iterative improvements. Also, this methodology is used as a prototype is required while developing the system.

The stakeholders are selected according to their importance, qualities and personalities based on their roles. The main client Santa Dora Hospital is selected because it is a government approved hospital with a recognized reputation for vaccinating children. The hospital staff is welcoming and willing to support the project.

The system developers are grouped combining their skills, such as, presenting skills, coding skills, communication skills and the ability to be responsible.

3.1.1. User and Admin Registration

The specific admins should register to the system to continue their specific tasks. They are registered to the system by the developer from the technical division of the hospital. When they are registered to the system, they can simply log in to it by using their national identity card number and the password. After logging in, they can view the pages of the system according to what type of a user (nurse, doctor, hospital receptionist, pharmacist, super admin) they are. The pages are unique for each of them.

Other users (parents or guardians) are registered to the system by the nurse. The parent or the guardian should be registered first and then the children under them. Each child has a unique CHDR (Child Health and Development Record) number that identifies them. After the registration, the user receives an email with their username and a randomly selected one time password (OTP) given by the system. When the parent or guardian log in first, they should update the username and password. Then they can log in to the system at any time with the newly created username and password. After that they can view the home page and their profile that contains the parent or guardian details, CHDR (Child Health and Development Record) and relevant medical records related to their children.

3.1.2. Appointment Dates

Through the admin side, only the hospital receptionist can add and update the dates and times the doctor is available for vaccinations. This is solely based on the schedule of the particular doctor. Hence, if the dates or the time is to be changed under unavoidable circumstances, the hospital receptionist will update the dates and times accordingly. The reminder of the update will be given to the users that made appointments on the changed dates and times, within a reasonable period before it could make any inconvenience to the user.

After logging in to the system, the user can easily view the dates and times that are shown through the system interface with the doctor's name, the channeling date and time.

3.1.3. Channeling

Channeling feature of the system provides channeling facility to parents or the guardians of the children. Mainly when user can make a normal channeling or a vaccine channeling. If it is a normal channeling, they can proceed with the usual process of the hospital. If it is a vaccine channeling, they should specify whether they are reserving a vaccine from the hospital or bringing the vaccine from an outside third party. If the user is ordering the vaccine from the hospital the user should be notified whether the vaccine is available or not. The vaccine channeling can be only done on the dates displayed in the system, based on the doctor's schedule. After filling the basic details, user can submit their channeling form and an email will be sent to their registered email address with their channeling number and respective details like channeling fee and doctor details. Without paying the relevant installment before the channel, the user cannot consult the doctor even though they have

already received a channel number. If the user chooses to order the vaccine from another party, they can proceed in the same way.

The admin side of the channeling part is done through the hospital receptionist. After every channeling all the records will be stored in the database. After the user paid the installment, the system will provide a bill to the user through an email confirming their payments and channelings. The receptionist has the update and delete authority, if the user wants to change their channels or cancel them. Also, the channeling has more restrictions such as, every doctor has a specific number of patients they can monitor on a day. Therefore, when the patient amount exceeds the user will be notified about it.

3.1.4. Calculating BMI (Body Mass Index)

The admin (nurse) enters the weight and height of a child based on their gender before receiving the vaccine. With that data, the Body Mass Index of the child is calculated through the system. The weight, height and BMI (Body Mass Index) of the child is recorded in the database. The nurse cannot edit or delete the data as the consistency of data should be managed.

This generates a BMI (Body Mass Index) chart in the CHDR (Child Health and Development Record) of a child. After the first time this is generated, the same chart is updated by the passing years and all the BMI (Body Mass Index) records of the child will be shown in one chart. The user can view this through their profiles.

3.1.5. Vaccine Registration

When the vaccines are supplied through the vaccine manufacturer, the pharmacist can register the vaccine details to the system. The pharmacist can add the barcode of the vaccine, vaccine name and the vaccine description. There is no edit or delete option because, if the vaccines are outdated or illegal, the hospital should have the relevant details to track which vaccines should be examined for the damage. After the pharmacist reads the barcode, the vaccine name and description are added to the database automatically. The pharmacist must manually add the vaccine quantity, manufactured date and the expire date of the vaccines only. If the manually added details should be somehow changed for fair reason, there is a super admin who is the only person allowed edit or delete those details.

3.1.6. Injected Vaccine/Scanning Process

The purpose of this function is to keep records of the injected vaccines and update the CHDR (Child Health and Development Record) with the issued vaccine code. This is introduced to replace the manual process of pasting the vaccine sticker on the manual CHDR (Child Health and Development Record) card. The nurse scans the barcode of the vaccine and the CHDR (Child Health and Development Record) is updated automatically with the vaccine details.

If any side effects are to be occurred for any child after receiving the vaccine a prescription is provided by the doctor with the precautions and instructions to avoid any more challenges to the child's health. If any changes are to be done in the prescription, the doctor has the authority to edit the prescription data within a limited period of fifteen minutes.

The user can view the prescription through their profiles. A printed copy of the prescription can be also issued by the hospital as well.

3.1.7. Advices

In some instances, parents or guardians might wonder the importance of vaccination based on [3], what to do after vaccination, possible side effects, and what to do in case of missed doses. To further improve the efficiency and accessibility of the vaccination system these advises will be available in the system to view by the users.

A nurse will serve as the admin responsible for managing this. The nurse can update and delete advice, ensuring that all information provided is timely and accurate.

3.1.8. Vitamin

This shows the details about the vitamins the children require within the vaccination period. The parents or the guardians can view the details through the system and get an idea of what the vitamins are, the uses of the vitamins and why they are needed.

The nurse can add these details and edit or delete details based on the changes of the healthcare industry.

3.1.9. Vaccine Manufacturer Registration

The vaccine manufacturer is registered to the system by the pharmacist. The pharmacist has the authority to edit details of the manufacturer if any changes are to be done. The pharmacist can also view the properly managed records of this registration as well.

3.1.10. Suggestions and Complaints

In this function users can give their honest opinions about services provided by the hospital. If the users have any suggestions to improve the services, feedback to show their experiences, or complaints to let the hospital know if something is not quite right, they can submit these comments through the provided forms. The users can edit or delete their submissions if needed.

The authoritative person from the top-level management can view these opinions and modify the hospital's services and performances.

3.2. Project Plan

Figure 2: Project plan

4. Personnel and Facilities

All the team members participated in selecting a suitable industry for the project. Then a background research was done by the team regarding the children vaccination process. The team visited hospitals and gathered information about the manual process and did a website analysis to get an overall idea on how the process is done. After an interview with the client, the client requirements were gathered up to now.

- **Supervisor: Ms. Nilusha Chamindi Perera**
  The supervisor checks, advice, instructs and encourages the team members to move through with the system development. The study material and documentation formats are also provided by the supervisor.
- **G. M. A. S. Aponsu (11162) – Leader**
  The leader assigns the tasks based on the opinions of the team members. A logbook with the tasks and the members assigned for those tasks are maintained.
  Other than that, the implementation of vaccine registration part is handled by the leader as well.
- **K. G. G. N. D. Weerathunga (11037)**
  Implementation of user and admin registration and preparing the CHDR (Child Health and Development Record) is handled.
- **K. K. N. T. Madhudhani (11055)**

  Implementation of displaying the appointment dates and times is handled.

- **K. D. M. R. Amada (14633)**
  Implementation of the channeling or scheduling appointments part is handled.
- **K. M. P. U. Bandara (11179)**
  Implementation of vaccine manufacturer registration is handled.
- **A. L. L. Wijesiri (14634)**
  Implementation of injected vaccines and the scanning of the vaccines function is handled by this member.
- **D. R. Ravindya (11497)**
  Implementation of calculating the BMI (Body Mass Index) part is handled.

- **M. H. K. Bandara (11323)**
  Implementation of displaying vitamin details part and the information gathering for the process is handled.
- **S. P. D. Madusanka (11304)**
  Implementation of user suggestion and, complaints part is handled.
- **R. G. C. D. Rajamanthri (11254)**
  Implementation of displaying the advises to the users is handled.

5. Hardware and Software Requirements

Hardware requirements:

- **Processor**: Intel Core or AMD EPYC processors, with at least 4-8 cores for basic operations.
- **RAM**: Minimum 8 GB RAM (expandable to 16 GB or more for high user traffic).
- **Storage**: 500 GB SSD
- **Network**: High-speed internet connectivity with at least 1 Gbps bandwidth for optimal performance and real-time data access.
- **Desktop/Laptop**: Dual-core processor, 4 GB RAM, 500 GB storage.
- **Smart phone/Tablet:** with at least 2 GB RAM and 16 GB storage
- **Operating System**: Compatible with major operating systems (Windows, macOS, Android, iOS).
- **Barcode reader**: for scanning the vaccine codes.

Software Requirements:

- **Operating System**: Windows Server.
- **Web Server**: Apache HTTP Server or Nginx to host the web application.
- **Database**: MySQL
- **Programming Language**: The backend of the system will use Java SpringBoot.

- **Frameworks**: Frontend of the system will use React.js in Visual Studio Code.
- **Version Control**: Git for managing source code changes.
- **API Integration**: RESTful APIs for communication between clients.
- **Web Browsers (for clients)**: Supportive to all browsers.
- **Security Software**: SSL/TLS encryption for securing data transfer. Additional security layers like firewall and antivirus on servers to prevent unauthorized access.
- **Backup Software**: Regular database backup tools to ensure data recovery in case of failures.

6. References

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