Enhancing Patient-Centric Care and Doctor Convenience in Hospitals

2023-24-015

Project Proposal Report

Amaraweera O.G

IT20616588

B.Sc. (Hons) Degree in Information Technology Specializing in Software Engineering

Department of Computer Science and Software Engineering

Sri Lanka Institute of Information Technology

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Component – Empowering Health Management: QR-Integrated Patient Data for Tailored Dietary Guidance

B.Sc. (Hons) Degree in Information Technology Specializing in Software Engineering

Supervisor - Dr. Kapila Dissanayaka

Co – Supervisor - Ms Bhagyani Chathurika

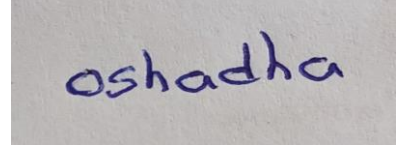Department of Computer Science and Software Engineering

Sri Lanka Institute of Information Technology

Sri Lanka

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Declaration page of the candidates & supervisor

We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Group Member Name	Student ID	Signature
Amaraweera O.G	**IT20616588**	oshadha

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

24/08/2023

Signature of the Supervisor: Date:

(Dr. Kapila Dissanayaka)

Abstract

Providing individualized care and managing patient data effectively are essential for providing high-quality medical services in the current healthcare environment. The current issues Sri Lankan hospitals are facing in providing individualized healthcare solutions and documenting patient medical data are discussed in this study. A more thorough and complex approach is required, as evidenced by the current reliance on a barcode system for data management. Identification and prediction of potential health problems is also a crucial task that requires creative solutions, especially for heart patients.

The importance of recording patient data and designing personalized diet plans cannot be overstated. A comprehensive patient history recording system, facilitated through a unique QR code assigned to each patient, can streamline medical processes, and enhance patient care. The drawbacks of the current patient data recording methods are evident, as the barcode system falls short in capturing the holistic medical profile of patients. Moreover, the absence of dedicated dietary guidance further exacerbates health issues. By creating a centralized database of patient data, equipped with a sophisticated machine learning algorithm, healthcare providers can efficiently manage patient records and make accurate predictions.

This study proposes a multifaceted approach to address these challenges. The objectives include the establishment of a comprehensive patient database linked to QR codes for streamlined data access, the development of a user-friendly mobile application to facilitate personalized diet plans. These objectives collectively empower healthcare professionals with the tools needed to optimize patient care, enhance disease prediction, and improve patient outcomes.

The integration of advanced technology, such as machine learning and mobile applications, into the Sri Lankan healthcare system has the potential to revolutionize patient care. By overcoming the limitations of current practices and offering personalized solutions, this study contributes to a more efficient, accurate, and patient-centric approach to healthcare management, benefiting both patients and medical practitioners alike.

Keywords: - *Personalized healthcare, Patient data optimization, Mobile health application, Custom diet plans, Barcode system.*

Acknowledgment

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We would also like to express our gratitude to coordinators, the course's comprehensive design and analysis lecturer, for giving us the required assistance throughout this project module enabling us to address the flaws we encountered effectively. Finally, we would like to express our appreciation to everyone who helped us complete this study, whether directly or indirectly. Your invaluable help and suggestions inspired us to achieve this task.

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01. Introduction

1.1 Background

The healthcare landscape in Sri Lanka, like many other countries, faces numerous challenges in effectively managing patient data and delivering personalized care. With a predominant reliance on barcode systems for patient data management, there exists a pressing need to transition to more advanced and comprehensive methodologies. This transition is critical for optimizing patient outcomes, particularly for individuals with heart conditions, who require vigilant monitoring and timely interventions. Additionally, the absence of tailored diet plans and the inability to predict medication stock depletion have further underscored the shortcomings of the current healthcare infrastructure. To address these limitations, the integration of innovative technologies, such as machine learning and mobile applications, emerges as a promising solution.

1.2 Literature Survey

The importance of accurate patient data management and its correlation with improved healthcare outcomes has been widely recognized in literature. A study by Alistair E. W. Johnson and his team (2018) demonstrated that effective data recording positively impacts diagnosis accuracy and treatment planning [1]. And, in 2016 Vassilya Uzun and Sami Bilgin studied about implementing all patient history into a QR code and identify medicine by QR code which was in Turkey. System implementation was successful with its motto of "People First." [2]

Personalized dietary interventions have been shown to significantly influence health outcomes. A study by Preya Janubhai Patel and her team [3] (2017) highlighted the impact of tailored dietary plans to manage chronic diseases. In the context of Sri Lanka, where dietary habits are diverse, the absence of dedicated guidance for heart patients emphasizes the need for a localized solution. The integration of mobile health applications for diet planning has demonstrated success in various settings, as shown by Juliana Chen (2019). A similar approach can be adopted to empower Sri Lankan patients with personalized dietary recommendations.[4]

The proposed research aligns with the broader trend toward data-driven healthcare solutions. The integration of patient data through QR codes, the development of a mobile application for personalized diet plans for enhancing the Sri Lankan healthcare system. By leveraging existing research and adapting it to the local context, this study aims to bridge the existing gaps in patient care and contribute to the advancement of healthcare practices in Sri Lanka.

1.3 Research Gap

In the ever-changing field of healthcare, providing customized treatment and managing patient data well have become essential elements in guaranteeing the best possible outcomes for patients and improving the effectiveness of healthcare systems. However, these fundamental elements have faced a few difficulties in the context of Sri Lankan hospitals, requiring creative solutions. The purpose of this study is to close the current research gap by concentrating on the development of an integrated healthcare system that is specifically suited to the healthcare environment in Sri Lanka.

- **01 - There is no proper system to save patient medical data in Sri Lankan hospitals besides a barcode system.**

  The research gap revolves around the absence of an effective patient medical data management system in Sri Lankan hospitals beyond a barcode system. The current approach lacks a comprehensive digital system, hindering accessibility, data security, and scalability. Potential concerns include limited access, security vulnerabilities, and inefficiencies. Addressing this gap would involve adopting advanced healthcare information systems that ensure secure, efficient, and compliant data management, potentially involving a transition from barcode-based methods.

- **02 - Besides a Nutrician, there is no one to guide patients for better diet plans.**

  The absence of professionals other than nutritionists to guide patients on better diet plans underscores the need for specialized dietary experts who can offer tailored advice. And all the patients are not wealthy enough to constantly check in with a Nutrician. It is convenient for every patient if they can get dietary plans without meeting a professional. Through the app we focus on potential heart patients to do so.

- **03 – Improving the QR code technology.**

  Besides replacing the barcode system with QR code system, we study the ways of improving the size of an actual QR code, improving the speed and accuracy. Create QR codes that can be updated with the latest information without changing the printed code. This is particularly useful for updating patient reports and records every time they visit the doctor.

1.4 Research Problem

We focus on the challenge of increasing the patient load that a single doctor can effectively manage within a day. This challenge is addressed by developing a specialized app that utilizes QR codes to store patient data, allowing doctors to swiftly access essential information without prolonged inquiries into symptoms and medical history. The goal is to enhance consultation efficiency and reduce time-consuming interactions, thereby enabling doctors to attend to more patients while maintaining the quality of care.

This study addresses the limited availability of specialized doctors for providing unique diet plans. The absence of a streamlined process for offering tailored dietary guidance hinders patients from accessing accurate and personalized nutritional recommendations. The research seeks to develop an efficient and reliable technological solution that generates legitimate personalized diet plans, empowering patients to make informed dietary choices without solely relying on specialized consultations.

02. Objectives

2.1 Main Objective

- ➢ Create a mobile application that enables Doctors to store their patient's medical information and history within a QR code. This app will facilitate seamless sharing of patient data with doctors during medical appointments. By presenting the QR code to the doctor, they will be able to quickly access the patient's medical history, reports, and relevant information. This technology-driven approach aims to enhance the efficiency of doctor-patient interactions by eliminating the need for extensive manual information exchange.

2.2 Specific Objective

- ➢ Develop a machine learning algorithm that generates personalized diet plans for individuals at risk of heart disease. The aim is to provide these potential heart patients with tailored dietary recommendations that can help them adopt healthier eating habits and reduce their risk of developing heart-related conditions. By utilizing machine learning, the algorithm will analyze several factors such as medical history, medical reports, and risk factors to create customized diet plans that align with everyone's needs.

03. Methodology

3.1 Requirement Gathering

- ➢ Some of the prerequisites will be gathered by reviewing prior research and web materials written about the research topic. And all the medical information involves identifying heart

problems and generating dietary plans are gathered from doctors and conducting interviews with them.

3.2 Feasibility Study

➢ Evaluate whether the app's technical requirements can be met. Consider factors like the app's compatibility with different mobile platforms (iOS, Android), required programming languages, APIs (Application Programming Interfaces), and the integration of QR code technology. Identify the programming languages, frameworks, and tools necessary for app development. QR code integration, user authentication, data encryption, and seamless data transmission are some technical aspects to consider. And most importantly examine how sensitive patient data will be stored, encrypted, and transmitted securely. Ensure compliance with data protection regulations to safeguard patient information.

3.3 System Analysis

3.3.1 Overall System Diagram
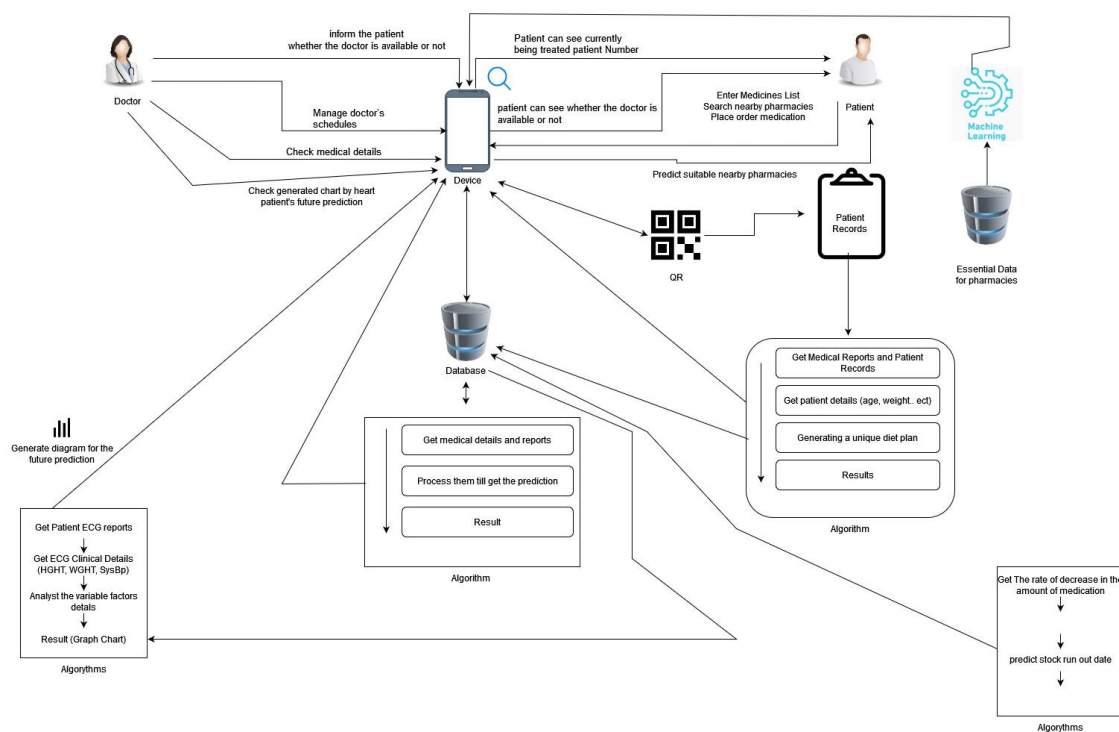
Figure 1 : Overall System Diagram

3.3.2 System Overview for Generating Diets
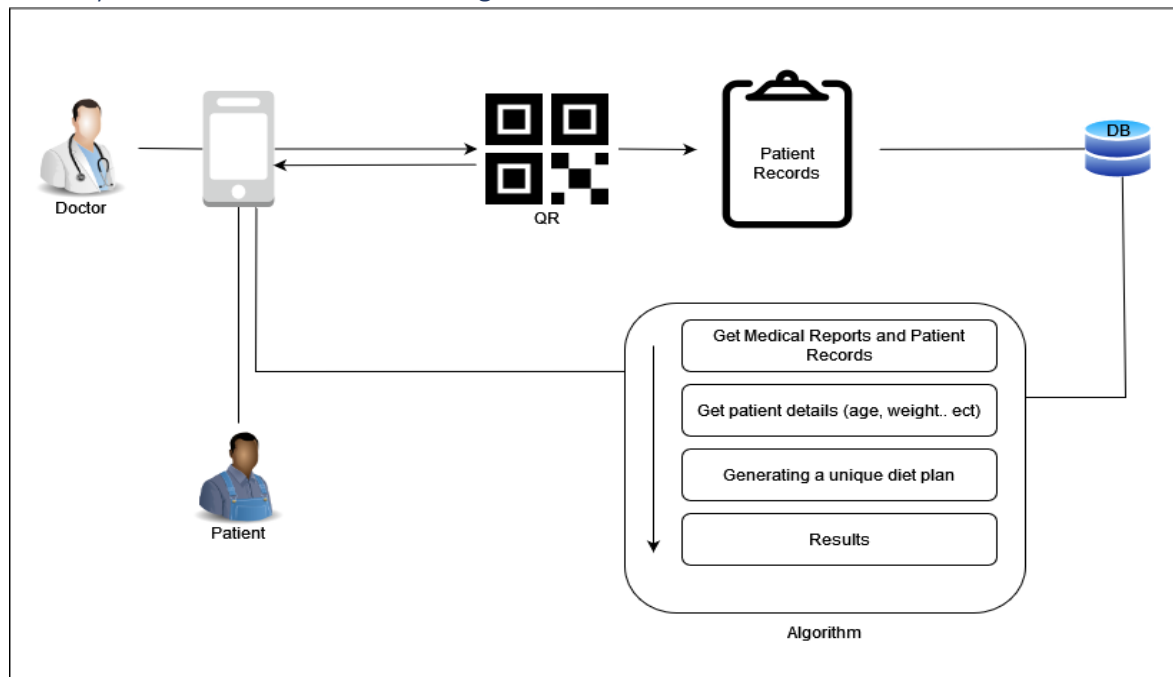
Figure 2 : system Overview for Generating Diets

04. Project Requirements

4.1 Tasks

- Create a machine learning algorithm to generate diet plans according to the patient data.
- Create QR code system to store all the patient records and data.
- Develop a user-friendly mobile application.

4.2 User Requirements

- The user should download the app and register.
- The user should enter their personal data (height,weight,age... etc.)
- The user should be able to see their suggested diet plan.
- The user should be able to view their unique QR code.

4.3 Software Requirements

Tools and Technology	Explanation
Python	To create algorithms which will generate unique diet plans for a unique patient.
ReactNative	To develop mobile apps for any platform (android/apple), so that any user can use it without any problem.
VsCode / Android Studio	Use it as the source-code editors to develop the app and the algorithms.
Python Libraries	For the QR code development.
OpenRefine	To help us clean, organize, and refine messy and inconsistent data sets, making them more structured and usable
Google colab	To train machine learning models using libraries like TensorFlow, PyTorch, and scikit-learn and for faster model training.
Github	As for the version controlling system.

Table 1 : Software Requirements

4.4 Functional Requirements
- Data collection and processing.
- Train model.
- Generate unique diet plans for each patient.
- User-friendly Interface.

4.5 Non-Functional Requirements
- The app must be reliable.
- Applications for cellphones running Android should function normally.
- The interface must be simple and user friendly.
- Security and Data privacy.
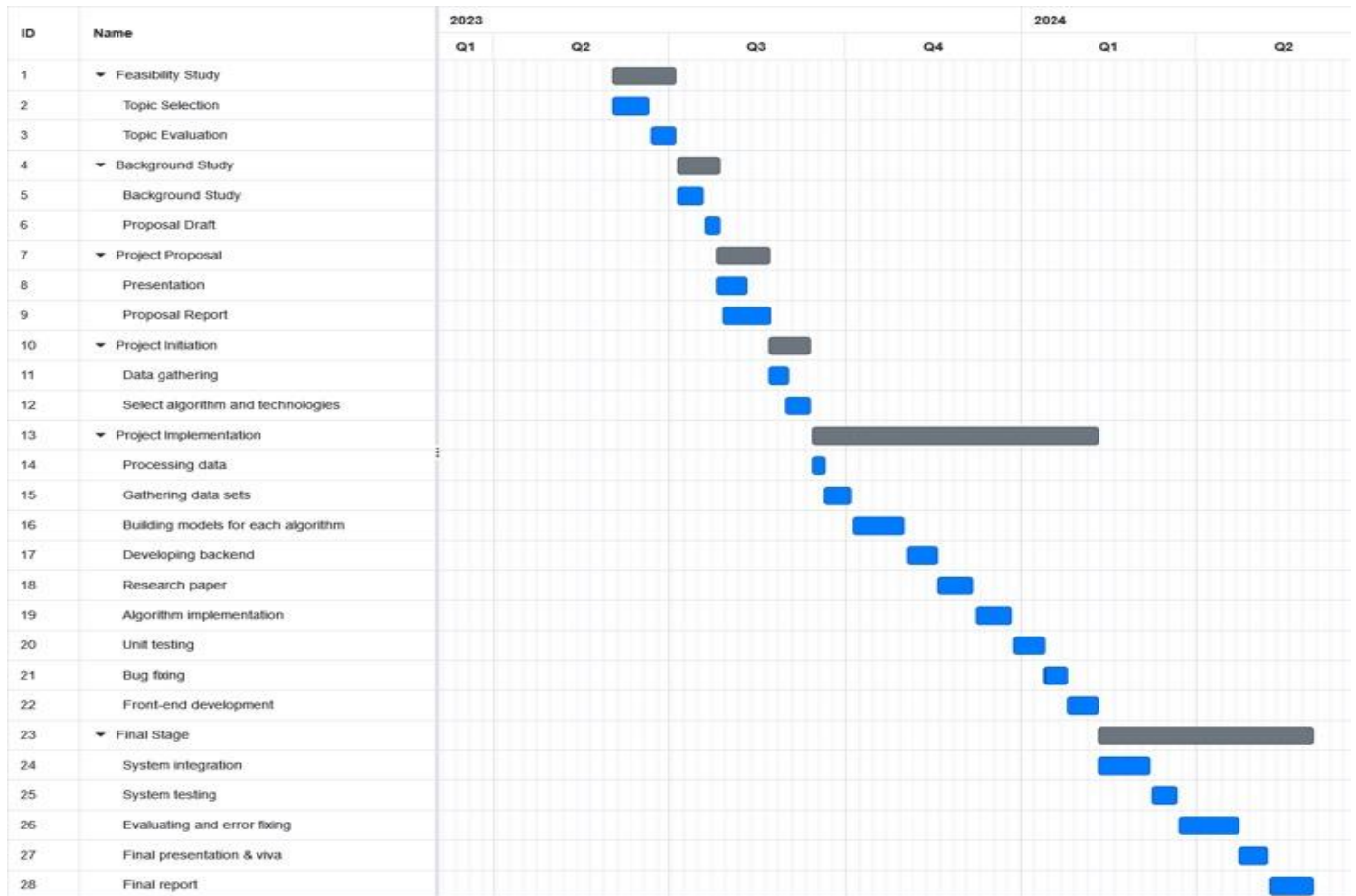
05. Evaluation Criteria

5.1 Gantt Chart

ID	Name	2023				2024	
		Q1	Q2	Q3	Q4	Q1	Q2
1	▼ Feasibility Study		▭				
2	Topic Selection		▪				
3	Topic Evaluation			▪			
4	▼ Background Study			▭			
5	Background Study			▪			
6	Proposal Draft			▪			
7	▼ Project Proposal			▭			
8	Presentation			▪			
9	Proposal Report			▪			
10	▼ Project Initiation			▭			
11	Data gathering			▪			
12	Select algorithm and technologies			▪			
13	▼ Project Implementation				▭		
14	Processing data			▪			
15	Gathering data sets				▪		
16	Building models for each algorithm				▪		
17	Developing backend				▪		
18	Research paper				▪		
19	Algorithm implementation				▪		
20	Unit testing				▪		
21	Bug fixing				▪		
22	Front-end development				▪		
23	▼ Final Stage					▭	
24	System integration					▪	
25	System testing					▪	
26	Evaluating and error fixing					▪	
27	Final presentation & viva					▪	
28	Final report						▪

Figure 3 : Gantt Chart
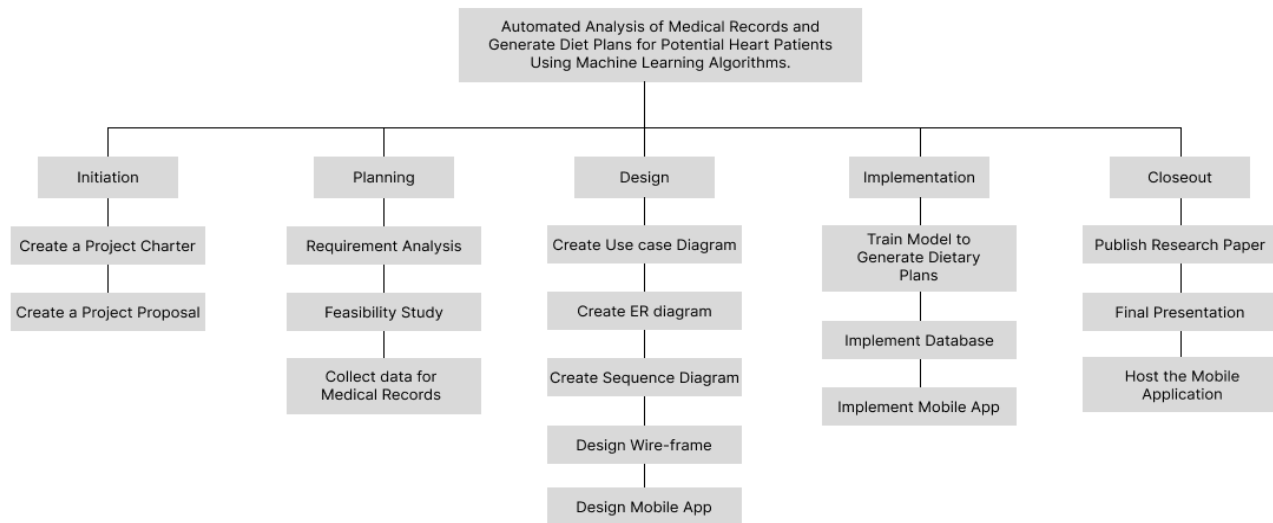
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5.2 Work Breakdown Structure

Figure 4 : Work Breakdown Structure

06. Budget

Development:

- Backend Development: LKR10,000 - LKR15,000
- Frontend Development: LKR8,000 - LKR12,000
- Machine Learning Algorithm: LKR6,000 - LKR10,000
- QR Code Generation: LKR2,000 - LKR3,000
- Total Development: LKR26,000 - LKR40,000

Infrastructure:

- Database Setup and Hosting: LKR3,000 - LKR5,000
- Security Implementation: LKR2,000 - LKR4,000
- Total Infrastructure: LKR5,000 - LKR9,000

Testing and QA:

- Testing and Quality Assurance: LKR4,000 - LKR6,000

Miscellaneous:

- Unforeseen Expenses (10% of Development): LKR2,600 - LKR4,000

Ongoing Maintenance (per year):

- Maintenance and Updates: LKR3,000 - LKR5,000 per year

Total Estimated Budget:

- Minimum: LKR40,600
- Maximum: LKR64,000

07. References List

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