Faculty of Computing

SECD2523 : Database

Project Phase 1

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Table of Contents

1.0 Introduction

In this modern era, healthcare inevitably becomes a major concern to the public thus contributing to the rapid growth of health related technology development. In this context, our main topic is proposing an effective clinic management system.The proposed clinic management system is an alternative way to replace the traditional file-based system due to several reasons.

A clinical management system is vital in delivering an enhanced patients' experience by introducing appointment systems which help to decrease patient waiting time.Next, all patients' health records can be accessed easily via the management system. Furthermore, the management system facilitates the workflow of clinical staff and ensures a smooth day to day clinical operation.The clinical management system also ensures all related authorities' data to be safeguarded hence establishing mutual trust among stakeholders.Last but not least, the clinical management system also contributes to the overall performance of the clinic by providing insights to improve the quality of healthcare services.

Shortly,we are going to propose a new clinical management system with different key features and improved functionalities such as digital record management, appointment system and data storing. Hence, this system enables high quality healthcare services and sustains an effective healthcare ecosystem.

2.0 Background Study

The old registration system at Klinik Lee Taman Perling is a paper-based system. Patients are required to fill out a registration form with their personal information, including their name, address, date of birth, contact information, and insurance information. This form is then collected by a receptionist and entered into a computer database. Dr Lee Kok Kian has informed us that this system is inefficient and time-consuming for both patients and staff. Patients often have to wait in line to register, and staff members have to manually enter data into the computer system. This can lead to errors and delays.

In the system, patient medical history is stored in paper-based charts. When a patient needs to update their medical history, they have to visit the clinic and bring their chart with them. The receptionist will then manually update the chart with the new information. To check a patient's medical history, the receptionist has to manually search through the patient's chart. This is time-consuming and difficult, especially if the patient has a long and complex medical history.

The appointment system at Klinik Lee Taman Perling is also a paper-based system. Patients are required to call the clinic and schedule an appointment with a receptionist. The receptionist then writes down the patient's name, appointment date and time, and the reason for the visit on a paper calendar. This system is also inefficient and time-consuming. Patients often have to wait on hold to schedule an appointment, and receptionists have to manually write down appointments on a calendar. This can lead to errors and missed appointments.

3.0 Problem Statement

Problem 1 : Manual Patient Data Management

The clinic relies on manual, paper-based systems to manage patients' data. This reliance leads to a cascade of issues which are an increased likelihood of data entry errors, delays in processes and difficulties in tracking patients' information accurately. The paper-based systems are particularly evident in the elevated risk of errors during data input, the time-consuming process for updating and retrieving patients' medical history and the overall challenge in maintaining a complete and up-to-date patients' records.

Problem 2 : Inefficient Appointment Scheduling

For appointment scheduling, it is a manual process which is difficult to handle and store. This manual approach results in scheduling conflicts, long waiting times for patients and challenges in effectively managing multiple appointments simultaneously. Patients may feel unsatisfied with this current service due to long waiting times. Besides, there will be higher chances of scheduling errors and conflicts through the manual process. Also, inefficient utilization of staff time in managing patients' appointments.

Problem 3 : Lack Of Comprehensive Medical Records Management

Lack of a centralized system for medical records management becomes a significant challenge for the clinic. The absence of a platform hinders the effective tracking of patients' histories, test reports and treatment plans. This fragmented approach to medical records management has consequential impacts on patient care. Firstly, it creates difficulties in providing continuous and coordinated care to patients. Besides, it increases risk of redundant tests and procedures due to incomplete medical histories. This fragmented approach also poses challenges in meeting regulatory requirements for maintaining accurate and accessible medical records, potentially leading to compliance issues.

4.0 Proposed Solutions (include feasibility study)

Proposed solution 1 : Automated Patient Data Management

To address the challenge of manual patient data management, an automated patient data management system is introduced. This system will replace the traditional paper-based systems with a centralized electronic database. The implementation will include features such as data validation checks to minimize errors during data entry and provides a user-friendly interface for efficient retrieval and update of patients' medical records. The solution aims to enhance accuracy, reduce administrative burden and offer a seamless platform for maintaining up-to-date patients' data.

Proposed solution 2 : Automated Appointment Scheduling

To solve the problem of inefficient appointment scheduling, the proposed solution involves the implementation of an automated appointment scheduling system. The system will enable real-time availability checks, allowing patients to book appointments online. Integration with the overall clinic calendar will avoid scheduling conflicts and reduce clinic staff workload. The goal of this solution is to improve patients' satisfaction, reduce scheduling errors and optimize the use of staff time.

Proposed solution 3 : Electronic Medical Records (ERM)

To overcome the lack of comprehensive medical records management, the development of an Electronic Medical Records (ERM) system is recommended. This system will provide a secure and centralized platform for managing and accessing detailed patients' medical records. Ensuring seamless information sharing, interoperability with other healthcare systems will be established, while maintaining the confidentiality and security of patients' information through the implementation of role-based access controls.

Through these proposed enhancements, the clinic aims to introduce a systematic platform for patient data management, modernize its appointment scheduling practices and provide a more convenient and efficient experience for both patients and staff.

4.1 Feasibility Study

- **Technical feasibility :**

The considerations of technical feasibility included evaluating the availability and compatibility of technologies required for developing and maintaining the system, the feasibility of incorporating advanced features like real-time availability checks and robust data validation and the potential for seamless integration with other healthcare systems. This technical assessment is essential to ensure that the proposed solutions align with the clinic's technological infrastructure and can be effectively implemented.

- **Operational feasibility :**

The feasibility will evaluate the adaptability of staff and patients to the new systems. This includes assessing the potential reduction in workload for clinic staff with the introduction of automation and the overall impact on the patients' experience. The operational feasibility study is to identify potential challenges in adoption and ensure a smooth operation for the new systems.

- **Legal feasibility :**

Ensuring legal feasibility for the proposed clinic management system is crucial to comply with laws and regulations. The study will assess adherence to data privacy laws, consent procedures and security standards for the Patient Data Management System. The Appointment Scheduling System will be evaluated for data security, accessibility compliance and informed consent. The EMR system will focus on interoperability standards and legal data retention. This assessment aims to identify and address potential legal risks, ensuring ethical alignment and compliance with healthcare regulations.

By conducting a comprehensive feasibility study encompassing technical, operational and legal aspects, the clinic can make informed decisions regarding the adoption of the proposed solutions. This study will help to ensure that the implementation aligns with the clinic's goals.

5.0 Objectives

The following are the objectives of our system :
1. To store the medical history of existing patients

2. To store new registration record for new patients

3. To store the information of the appointment booking

4. To notify the user about the appointment details

5. To protect the information of each party.

6.0 Scope and system boundaries

6.1 Scope of the project

6.1.1 System

Website

- Allow user to login and register to their account

- Allow user to book or manage the appointment details

- Help admin to track the medical history

- Provide a platform for user and admin to communicate with each other

- Notification of the appointment details

6.1.2 User

Staff and doctors

- View and manage the appointment schedule

- Check and update patient's medical history

- Manage patient's information

- Communicate with patients

- Check the doctors availability

Patients

- Self-registration and manage their profile

- Appointment scheduling or manage own appointment

- Access to their own health records

- Contact with the staff

Administrators

- Manage the setting of the system
- Assign the access control
- Manage user authentication and authorization

6.2 Boundaries of the system

This is a clinic management system that is focused on the registration and appointment function. It allows the user to register a new account and make an appointment on a safety platform. They can make a change on the appointment time such as book, cancel or reschedule. This system integrated with the Electronic Health Records so that the staff and patients can check and manage the health records or medical history. There is also a notification function to push the notification to the patients in order to remind them the appointment time and details. This proposed system will not include the medical diagnosis and suggest the medical planning to the patients. This system is not suitable for the large-scale hospital management as it is only suitable for the small-scale clinic. Moreover, the billing services will not be involved in the proposed system.

7.0 Project Planning

7.1 Human Resource
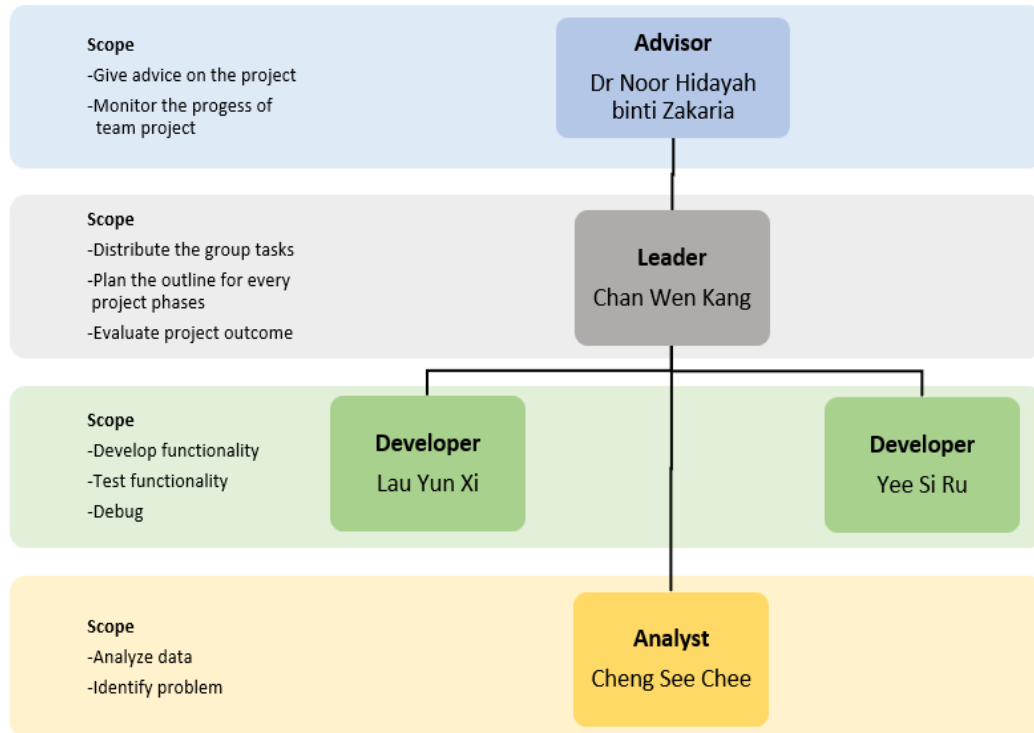
7.2 Work Breakdown Structure (WBS)
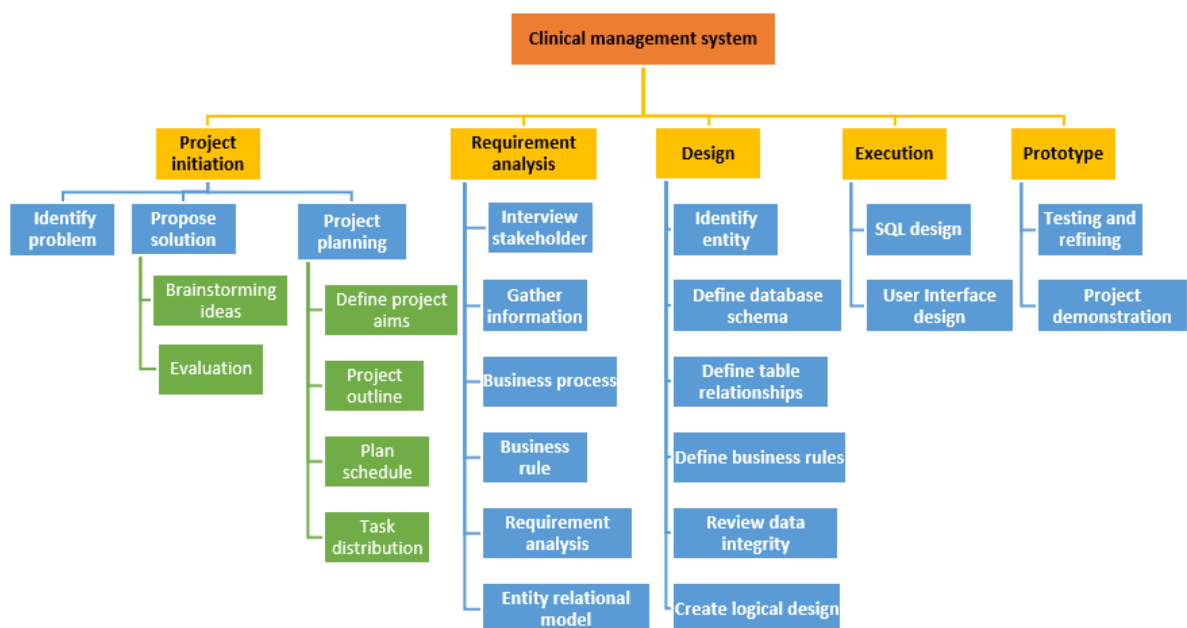
7.3 Gantt Chart

No	Task Name	Duration(week)	Start week	End week	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
1	Complete project execution	15	W1	W15	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
2	Project initiation	3	W3	W5			█	█	█										
3	Identify problem	1	W3	W3			█												
4	Propose solution	1	W3	W3			█												
5	Brainstorming ideas	1	W3	W3			█												
6	Evaluation	1	W3	W3			█												
7	Project planning	2	W4	W5				█	█										
8	Define project aims	1	W4	W4				█											
9	Project outline	2	W4	W5				█	█										
10	Plan schedule	1	W5	W5					█										
11	Task distribution	1	W5	W5					█										
12	Requirement analysis	2	W6	W7						█	█								
13	Interview stakeholder	1	W6	W6						█									
14	Gather information	1	W6	W6						█									
15	Business process	1	W7	W7							█								
16	Business rule	1	W7	W7							█								
17	Requirement analysis	1	W7	W7							█								
18	Entity relational model	1	W7	W7							█								
19	Design	3	W8	W10								█	█	█					
20	Identify entity	1	W8	W8								█							
21	Define database schema	1	W8	W8								█							
22	Define table relationships	1	W8	W8								█							
23	Define business rules	1	W9	W9									█						
24	Review data integrity	2	W9	W10									█	█					
25	Create logical design	2	W9	W10									█	█					
26	Execution	3	W11	W13											█	█	█		
27	SQL design	2	W11	W12											█	█			
28	User interface design	2	W12	W13												█	█		
29	Prototype	2	W14	W15														█	█
30	Testing and refining	2	W14	W15														█	█
31	Project demonstration	1	W15	W15															█

Date headers: 9/10/2023 (W1), 6/11/2023 (W5), 4/12/2023 (W9), 1/1/2024 (W13)

8.0 Requirement Analysis (based from AS-IS analysis)

Based on Manual Patient Data Management, the requirements are as below:

1) Functional Requirements:
   a. The system should allow for the creation, editing, and deletion of patient records.
   b. The system should store patient information, including name, address, date of birth, contact information, and insurance information.
   c. The system should allow for the storage and retrieval of patient medical history.

2) Non-Functional Requirements:
   a. The system should be secure and protect patient information.
   b. The system should be easy to use for both patients and staff.
   c. The system should be scalable to accommodate future growth.

Based on the Inefficient Appointment Scheduling problem, the requirements are as below:

1) Functional Requirements:
   a. The system should allow patients to schedule appointments online.
   b. The system should check for appointment conflicts and prevent double booking.
   c. The system should send reminders to patients about their appointments.

2) Non-Functional Requirements:
   a. The system should be available 24/7.
   b. The system should be easy to use for both patients and staff.
   c. The system should be integrated with the clinic's calendar system.

Based on the problem Lack of Comprehensive Medical Records Management, the requirements are as below:

1) Functional Requirements:
    a. The system should store and retrieve patient medical records, including test results, treatment plans, and allergies.
    b. The system should allow for the secure sharing of patient information with other healthcare providers.
    c. The system should meet all regulatory requirements for the storage and handling of patient information.

2) Non-Functional Requirements:
    a. The system should be secure and protect patient information.
    b. The system should be easy to use for both healthcare providers and patients.
    c. The system should be interoperable with other healthcare systems.

There are some additional requirements for the system:

1) The system should be accessible from multiple devices, including computers, tablets, and smartphones.
2) The system should be translated into multiple languages.
3) The system should be trained with a large dataset of patient data.

8.1 Current business process (scenarios, workflow)

1. **Patient Registration and Data Management**

   Scenario: A new patient visits the clinic for the first time.

   Workflow:

   a. The receptionist greets the patient and collects their personal information, including name, address, date of birth, contact information, and insurance details.

   b. The receptionist manually enters this information into the clinic's paper-based registration form.

   c. The receptionist assigns a patient ID number and creates a paper-based chart for the patient's medical records.

   Scenario: An existing patient visits the clinic for a follow-up appointment.

   Workflow:

   a. The receptionist verifies the patient's identity and retrieves their paper-based chart.

   b. The receptionist updates the patient's registration information if necessary.

   c. The receptionist adds any new medical information to the patient's chart.

2. **Appointment Scheduling**

   Scenario: A patient calls the clinic to schedule an appointment.

   Workflow:

   a. The receptionist manually checks the doctor's schedule and finds an available time slot.

   b. The receptionist records the patient's name, appointment date and time, and reason for the visit in the clinic's paper-based appointment calendar.

   c. The receptionist informs the patient of the appointment details and asks them to confirm their attendance.

   d. The receptionist manually adds a reminder note about the appointment to the patient's chart.

Scenario: A patient wants to reschedule or cancel an appointment.

Workflow:

    a.   The patient calls the clinic to notify the receptionist of the change.

    b.   The receptionist manually checks the doctor's schedule and finds a new time slot if necessary.

    c.   The receptionist updates the appointment details in the clinic's paper-based calendar.

    d.   The receptionist informs the patient of the new appointment details or confirms the cancellation.

3. **Medical Records Management**

Scenario: A doctor needs to review a patient's medical history.

Workflow:

    a.   The doctor retrieves the patient's paper-based chart from the receptionist.

    b.   The doctor manually reviews the patient's medical history, including past illnesses, surgeries, allergies, medications, and social history.

    c.   The doctor takes notes or adds updates to the patient's chart.

    d.   The doctor returns the patient's chart to the receptionist.

Scenario: A patient needs to access their medical records.

Workflow:

    a.   The patient submits a written request to the clinic for access to their medical records.

    b.   The clinic staff manually retrieves the patient's paper-based records and prepares a copy.

    c.   The clinic staff provides the patient with a copy of their medical records.

9.0 Transaction requirement (data entry, data update/delete, data queries)

9.1 Proposed Business rule

- **Registration** - All patients should give a correct and valid personal information for the registration propose
- **Appointment** - Appointment needs to be made with a valid doctor and their available time slot.
- **Security** - Every account must have a unique account number and secure login credentials.
- **Patient profile** - One patient own one profile with only one medical history
- **Staff and doctor profile** - Profile only can be managed by administrator.

9.2 Data Requirement

- **Patients**

Personal Info	1. Full Name 2. Age 3. Gender 4. Email 5. Phone Number
Medical Information	1. Allergy 2. Surgery history 3. Family medical history 4. Medications taken
Account	1. Unique account number 2. Register date

- **Appointment**

Details	1. Appointment date 2. Appointment time slot 3. Type of appointment 4. Appointment doctor
Preferencecs	1. Type of Notification

- **Staff and doctor**

Details	1. Full Name 2. Gender 3. Age 4. Contact number 5. Professional qualifications
Schedule	1. Working time 2. Availability 3. Day off

- **Security**

User Credentials	1. Login ID 2. Password

9.3 Transaction requirement

1. **Data Entry**

Registrations	Patients should key in their personal details such as full name, age, gender etc. After that, users are required to give their medical history which is allergies, what medications they are currently taking and many more. When the input process finishes, the system will generate a unique account number for use.
Appointment	To book an appointment, the user should select a date and select a doctor. After selection, there will be a time slot of that day for the selected doctor to be displayed for the user to choose. Users may key in their requirement and preference on the provided space.
Staff and Doctor profile	Only the administrator can add the profile. To add a profile, admin should provide the general details such as full name, genders, age and contact number. The following steps will be the admin to enter the professional qualification of the added doctors or staff. The schedule information also needs to enter the system to store to the database.

2. Data Update/Delete

Update Personal information	- The user can update their personal information on the profile page. - The doctors are able to modify the medical history of the patients after every consultant.
Appointment changes	- Patients able to cancel or reschedule their appointment through the system - The staff can change the status of appointment due to the doctor availability
Doctor and staff profile	- Modification of the details of the doctor and staff are allowable for staff - The admin has the authority to delete the profile of a doctor or staff from the database.

3. Data Queries

Patient and appointment	Staff able to search the information of patients based on different details. They are also able to check for the appointment on a specific date. It also includes the past and upcoming appointments. Moreover, doctors can use the system to check the medical history of a patient and give a treatment plan.
Doctor and staff	The details about the doctor and staff can be retrieved from the system in order to get their details such as working time, contact number, etc.

9.4 Performance requirement

To develop a new system, there must be some performance requirements that should be fulfilled by the system in order to ensure the system can perform efficiently. The performance requirements are able to help the system to run smoothly on different user's views. The following are the proposed performance requirement:

- **Reliability**

  The system should perform all functions without any errors and unexpected failures. This is able to improve the trust from the user toward the system. Based on the data integrity, the system is required to ensure all the data stored in the database are always accurate and consistent. Therefore, real-time monitoring is suggested to be implemented to keep track of the performance.

- **Scalability**

  This factor refers to the ability of the system to handle increasing loads. When a larger amount of data or user input to the system, it can remain effective and will not occur corrupt. Therefore, the system should estimate a suitable amount that can handle the growth. Performance testing needs to be implemented regularly to test the handling ability.

- **Security**

  All of the data in the system should be safely protected and prevented unauthorized access. The risk of data leakage is able to be reduced and safe to use. Hence, all sensitive data should be encrypted during the transmission and storage. All users must authenticate themselves securely before accessing the system. Moreover, the patient data should regularly back up to prevent the occurrence of system failures which will cause data loss.

10.0 Benefit and Summary of Proposed System

With this proposal, we aim to develop a clinic management system that focuses on registration and appointment function. This system is designed to improve the efficiency of the clinic operations. We hope to realize a user-friendly system and it can secure all the information of each user included in this system. The proposed system aims to solve the existing problem during the operation of the clinic.

The following are the highlighted benefits of the proposed system :

Clinic's benefits

- Able to improve the overall efficiency on the operation
- All of the information of patients is more accurate
- Able to improve the communication as the staff, doctors and patients can communicate with each other and enable better coordination.
- The risk of leak of information can be reduce as the data have been protected
- Able to manages the details of patients easily

Patients's benefits

- More convenience during the appointment process and user experience can be improve
- Reduces the concern as they can communicate with the clinic through the communication function
- Build trust to the system on the personal information
- Reduces the risk of miss appointment

11.0 Summary

In summary, the proposed clinic management system is aimed to address the inefficiencies and challenges faced by Klinik Lee Taman Perling. The clinic wishes to modernize its operation and enhance the overall patient experience by transitioning its outdated paper-based system to a digital platform.

The proposed system is introduced to establish a user-friendly interface accessible to patients, doctors and staff. This accessibility facilitates a seamless communication, efficient management of appointments and enables doctors to access and update the patients' medical records conveniently.

The feasibility study conducted covers technical, operational and legal aspects, ensuring the proposed solutions align with the clinic's infrastructure and compliance with healthcare regulations. This assessment serves as a guiding framework for the successful implementation and integration of the new system.

The delineation of system scope and boundaries clarifies the system's focus on registration, appointment management and electronic health records while ensuring scalability for a small-scale clinic. Exclusion of medical diagnosis and billing services ensure a streamlined focus on core functionalities.

The proposed system's performance requirements prioritize reliability, scalability and security to ensure efficient functioning, data integrity and protection of sensitive patient information.

Ultimately, the identified benefits encompass improved operational efficiency for the clinic, improved user experience for patients and strengthened data security measures. By embracing this system, Klinik Lee Taman Perling aspires to foster better coordination, trust and satisfaction among all stakeholders involved.