UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
UTM Johor Bahru

Project : Phase 1

< PKU Pro Max>

SECD2523 - Database

SEMESTER I, SESSION 2023/2024

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1.0 Introduction

The Pusat Kesihatan Universiti (PKU) of UTM currently relies on outdated manual systems and processes that create major inefficiencies in operations and delivery of care. For example, physical appointment books make it difficult for students to schedule timely appointments. Students may waste time walking into PKU only to find out slots are full for that day, resulting in long wait times and appointment scheduling issues.

Besides, PKU also informs quarantined patients about COVID-19 and influenza isolation protocols through WhatsApp. However, a centralized digital system would enable more systematic and convenient communication with quarantined patients. The system could allow patients to easily check-in, track quarantine progress, and check-out digitally. Currently, quarantined patients fill out separate Google Forms with their details and need to manually confirm status via WhatsApp, which is inconvenient.

Hence, our project aims to develop a management digital system to modernize hospital management system in PKU. The new system will automate core functions like patient registration, appointment scheduling, billing and medical records using a centralized database accessible to all providers. Doctors can easily view test results and prescription history before meeting a patient, nurses can coordinate care and education more seamlessly, and administrators can track key performance metrics through the system.

When it comes to the patient's perspective, the new system will provide conveniences like online appointment booking, reminders and self-check-in upon arrival. It will also allow patients to securely access their medical information online at any time. By replacing fragmented paper trails with digitized processes, this hospital management system can improve quality of care, reduce delays and errors, lower costs, and provide better experiences for both patients and PKU authorities. With the new system, it will bring PKU to better serve the UTM community.

2.0 Background Study

University health clinics like the Pusat Kesihatan Universiti (PKU) at UTM play a critical role in serving students' primary care and health education needs. However, many university clinics in Malaysia still rely on outdated manual systems that create inefficiencies and frustrate users.

For instance, PKU currently uses physical appointment books that require students to visit in-person and hope slots are still available. This outdated booking approach frequently leads to overflowing waiting rooms, unexpected long queues, booking errors, and students wasting time traveling to the clinic. PKU also informs quarantined patients about isolation protocols via WhatsApp which is inconvenient compared to purpose-built medical platforms. Patients must fill separate intake forms and manually confirm their status rather than having an integrated digital patient portal.

These manual processes exist despite digital systems being the norm across many student health centers globally. Studies show that automated systems can promote quality of care, reduce costs, support patient mobility and increase reliability of information (Uslu & Stausberg, 2021). Digital platforms also enhance communication with isolated students during public health emergencies.

Transforming to an integrated electronic medical record (EMR) system can significantly benefit PKU. For instance, a modern hospital management system that integrates with EMR will enhance appointment scheduling, coordinate follow ups with patients and streamline the patient tracking process. The benefits demonstrated in wider EMR literature align well with resolving PKU's specific bottlenecks like long wait times, poor recordkeeping and difficulty in tracking patient real status.

Therefore, transitioning PKU's remaining outdated manual processes to a modern digital system provides an opportunity to rectify bottlenecks and miscoordinations which are currently impacting UTM students and PKU operations. Automating core health center functions through a centralized database architecture can better serve the UTM community.

3.0 Problem Statement

1. Appointment Scheduling Issues

The current manual process of appointment booking through physical registers poses various problems for students in seeking timely access to doctors at PKU. To book an appointment, students first have to physically visit PKU and request the staff to check the appointment register book to see if a slot is available with the desired doctor on that day. If no slots are available, the student is advised to come back later. This lack of visibility into doctor availability and manual checking process makes it extremely difficult for students to get same-day appointments. Consider a scenario where a student wakes up feeling unwell and hopes to see a doctor at PKU. When they arrive at the PKU, the staff informs them that all slots are full for that day. Hence, the student has to return to campus and miss classes until the slots open up later. Such experiences are sometimes faced by students in UTM due to the inefficiency of the manual appointment system. As a result, it inconveniences the students, disrupts student's class schedules, and also leads to congestion during peak times.

2. Disorganized patient records

Another problem stemming from PKU's outdated system is the disorganized management of patient medical records. The patients' records are stored on paper files and folders across various departments and rooms in the clinic. This makes it difficult for doctors to get a complete view of the patient's health during diagnosis. For instance, when a student visits PKU, the doctor has to request the staff to gather the paper files containing the student's medical record from multiple sources. This wastes time and potentially leads to important information of patients being missed out. Without access to organized historical records, doctors may end up ordering repetitive tests. Students also have to explain their medical history repeatedly.

3. **Ineffective Quarantine Tracking**

PKU currently relies on communication platforms such as WhatsApp to inform isolated or quarantined students about isolation protocols and gather status updates from them through Google forms. However, this makes systematic tracking and assisting of isolated students difficult. In cases of potential infectious diseases like COVID-19 , the affected patient is simply informed via WhatsApp or phone call to quarantine themselves in his hostel room for a specific period. Despite the use of Google forms to update a patient's status, there is no structured way to monitor if the student is following isolation guidelines or requires any medical assistance. There have been instances of isolated students stepping out or not informing PKU about worsening symptoms on time. This results in public health risks to the campus community.

4. **Poor management of medicine inventory**

Lastly, the manual tracking of medicine inventory and expiry poses challenges for PKU to manage medicine stocks effectively. Essential data on real-time stock levels, consumption rates and expiry dates is not reliably recorded, leading to mismatched supply and demand. For instance, when viral fever cases like influenza start rising in hostels, the demand for medicine like antibiotics rises unexpectedly. However, the pharmacy stocks ran out within days as the spike in consumption was not anticipated earlier. As a result, the students in need are unable to get required medications. On the other hand, lack of usage tracking also results in expiry and wastage of unused medicines. This increases wastage costs and environmental impact.

4.0 Proposed Solutions

Previously, one of our stakeholders, students, had to physically visit the Pusat Kesihatan Universiti (PKU) of UTM to make an appointment by manually checking appointment registers in PKU. This condition frequently results in long waits and overbooking and students having to make several trips in order to make a successful appointment. This situation wastes time for our stakeholders because they might have to take a bus or drive to PKU. However, when they get there, they find out that the available spots are already full, and unable to receive medical treatments, check-ups, vaccinations or similar services. Therefore, we are introducing a new online scheduling system that enables 24/7 self-service booking with real-time information on doctor availability. This ease of use and availability will significantly lessen the appointment delays and frustration of our stakeholders. Automated reminders will also help to reduce the number of no-shows which will free up PKU's resources.

This online scheduling system will allow PKU's staff to log in in advance to arrange, filter and analyze the patient records. For example, doctors of PKU can filter ongoing patient records according to parameters such as test results, prescriptions, diagnoses, etc. In addition, PKU administrators can quickly generate reports with personalized views of operational metrics such as number of appointments, patient flow, resource allocation etc. The system interface should allow configuring specific report templates that organize the data visualization according to the administrator's preferences.

In the past, patient medical history was fragmented across various paper files and rooms, making it challenging for doctors to access all of the patient's medical records during diagnosis. This often led to repetitive tests or gaps in care. The new centralized electronic medical record system will compile all patient data digitally in one location, providing doctors with comprehensive patient profiles to make more precise diagnoses and personalized treatment suggestions. Structured data storage will also enable advanced analytics to find care insights.

Isolation tracking was previously done through manual forms and messaging, which made it difficult to monitor quarantined students. Missed check-ins and worsening health often went undetected. Our system will be upgraded with a management tracking module to fully digitize the entire patient isolation process including check-in procedures and two-way communications. This will ensure tracking compliance and timely assistance for quarantined students. Centralized dashboards will provide improved public health visibility.

Before that, inventory was kept randomly on paper registers, which led to stock-outs or wastage. Monitoring of expiry dates was previously limited because paper registers are inefficient methods of storing and updating information regularly. Therefore, the inventory dashboard module will be introduced in our system to categorize functions of medicine, establish expiration dates and display relevant summary statistics. Furthermore, the new pharmacy management module in our system will provide real-time insight and data-driven optimization of medicine stocks. Automated alerts and analytics will dramatically decrease shortages and waste. As a result, students will have better access to medications.

Aside from that, several other extra features are also offered by our new management system such as mobile self-check-in for clinic visits, patient access to records via health portals, digital payments, automated billing and receipts across services, personalized management reporting, integration with e-prescription etc.

In conclusion, transitioning from fragmented manual processes to a management digital system will benefit UTM students and other stakeholders by enabling self-service and medical record access. It will help PKU operations through digitized procedures, inventory optimization and providing data insights. The outcome will be improved care quality, patient satisfaction and operational efficiency.

Technical feasibility

The new PKU Online Management System will use simple and familiar technology that is easily accessible. Patients and other stakeholders only need an internet connection and a device such as a phone, laptop or tablet. After that, users can log in to the system using any web browser. We want to create a system that is user-friendly and easily understandable by stakeholders. Therefore, the user interface would not have a lot of clutter buttons or colorful colors. Behind the scenes, the system will connect with a secure database system to neatly organize all the data. Our PKU Online Management System enables stakeholders to store and organize their personal information in an orderly and structured way. Our PKU Online Management System prioritizes aspect security so the stakeholders do not have to worry about issues such as data leakage and missing data because the system will perform regular backups to prevent data loss. Furthermore, encryption and passwords are further measures that protect patient data.

Operational feasibility

After conducting numerous staff interviews and discussions, we designed our PKU management system. Our team analyzed and conducted the research and observation over the course of time to evaluate how well the proposed new PKU Online Management System can seamlessly integrate with current PKU processes. Training sessions and student volunteers' participation will facilitate a smooth adaptation for everyone during the launch. The system will be implemented gradually in society, starting with one department at a time. This situation allows staff time to get familiar with it. An IT team will be on hand to assist with any updates or problems following the launch. Our team will also conduct the surveys to check if the system fulfills user requirements. Last but not least, while this system offers numerous functions and features for the users, its primary features include collecting, analyzing and organizing patient records and medicine details through the online database system. PKU staff will benefit from this functionality in keeping the data and medical records neatly.

5.0 Objective

The following are possible objectives for our brand-new PKU Online Management System:

- To cut the wait time for student appointments by 50% in 3 months.
- To enable doctors to rapidly access patient history for 80% of visits.
- To ensure over 90% of isolated students follow check-in procedures after 2 months.
- To reduce expired medication waste by 30% within 6 months.
- To lower appointment no-shows by 25% in 6 months.
- To raise the user satisfaction score by 75% in 1 year.
- To cut the patient discharge period by 50% in 1 year.

6.0 Scope

6.1 Project Scope

The scope of this project is to create an integrated digital management system that will optimize the Pusat Kesihatan Universiti (PKU) clinic's operations and services. The purpose of our team in developing this new PKU Online Management System is to help the PKU staff easily manage and update the medicine details, patient records, and reservation information to provide better care to their patients. The system requires the students and other stakeholders to create an account using their email addresses first before logging in to our system to ensure secure access to sensitive medical information. The system will also prompt users to enable two-step verification to prevent their personal information from being accessed by hackers or other malicious individuals. Lastly, the system will have two primary user groups which are students and PKU staff. Each user group will have unique capabilities and perspectives:

For students:

In the new PKU Online Management System, students can benefit from convenient and streamlined processes for booking, rescheduling, or canceling appointments online. Our system also offers an intuitive interface that makes it simple for students to schedule their medical appointments. Students can check upcoming appointment status and receive timely reminders from the system via SMS, email, or in-app notifications, ensuring that they stay informed and never miss their medical consultations. When they arrive at the clinic, they can use the digital features of the system to register and experience a seamless check-in procedure. This situation can minimize wait times and improve the overall efficiency of the PKU's operations. Next, students can have secure access to their comprehensive medical records. This includes the ability to view and download prescriptions, lab results, and vaccination history.

For PKU staff:

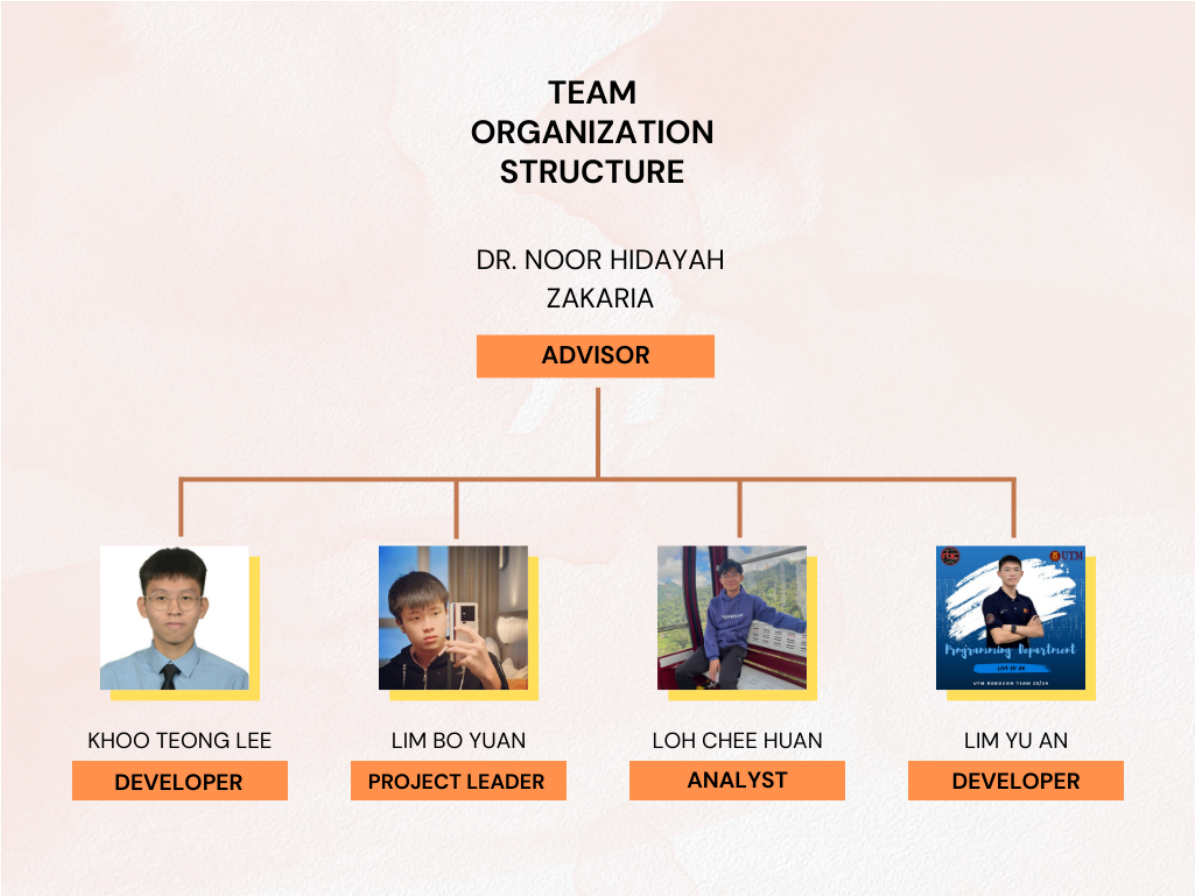
Specialized modules in the new PKU Online Management System offer functions specifically tailored to manage medicine details, patient records, and clinic operations, catering to the different roles within PKU. For instance, the system will provide a user-friendly interface for doctors to quickly access the patient's medical history and past prescriptions during the diagnosis process. Nurses benefit from modules that enable the efficient coordination of patient education and care plans, ensuring that patients receive comprehensive and customized healthcare services. Laboratory technicians, through dedicated modules, can effortlessly upload and monitor test results because the system will optimize the process of laboratory data management, minimizing errors and guaranteeing that doctors receive vital diagnostic information promptly. Pharmacists are equipped with specialized modules that enable them to keep an eye on medication stocks and handle orders effectively including real-time inventory tracking and automated low-stock alerts.

6.2 System Boundaries

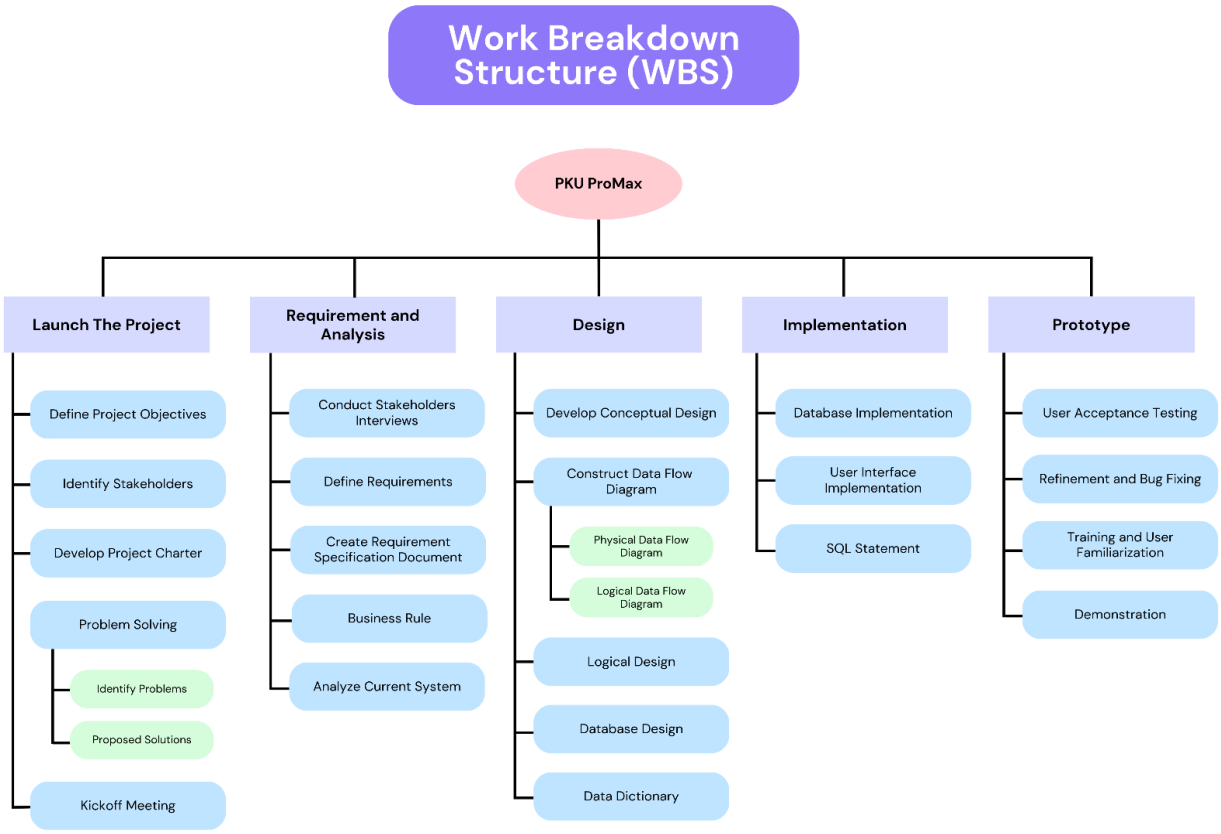
When defining the boundaries of the new PKU Online Management System, the primary goal is to digitize the current in-person processes at PKU by incorporating modules for appointment scheduling, electronic medical records, isolation management, and inventory management. Integration between these modules is the most crucial aspect of our system, which guarantees smooth communication and coordination between patients and PKU staff. However, advanced features like medical device integration or telehealth platforms are excluded. In addition, PKU's internal operations are the only ones with access to patient records and medication details. The system does not reach outside of PKU’s boundaries. External system connections to other systems or databases are explicitly out of scope.

7. Project Planning

7.1. Human Resource



7.2. Work Breakdown Structure (WBS)



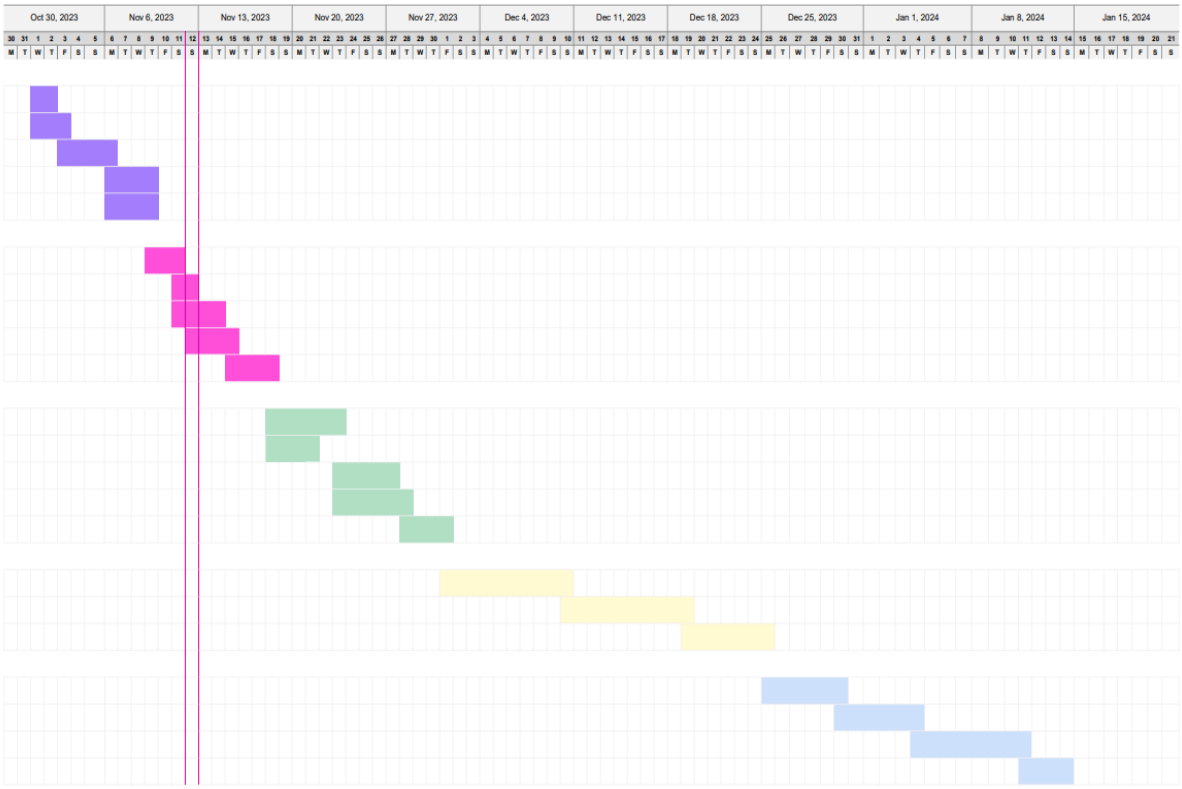
7.3. Project Gantt Chart

PKU Health Management System

Project start: Wed, 11/1/2023

Display week: 1

TASK	ASSIGNED TO	START	END
Launch The Project			
Define Project Objectives	Chee Huan	11/1/23	11/2/23
Identify Stakeholders	Bo Yuan	11/1/23	11/3/23
Develop Project Charter	Yu An	11/3/23	11/6/23
Problem Solving	Teong Lee	11/6/23	11/9/23
Kickoff Meeting	Bo Yuan	11/6/23	11/9/23
Planning and design			
Conduct Stakeholders Interview		11/9/23	11/11/23
Define Requirements		11/11/23	11/12/23
Create Requirement Specification Document		11/11/23	11/14/23
Business Rule		11/12/23	11/15/23
Analyze Current System		11/15/23	11/18/23
Design			
Develop Conceptual Design		11/18/23	11/23/23
Construct Data Flow Diagram		11/18/23	11/21/23
Logical Design		11/23/23	11/27/23
Database Design		11/23/23	11/28/23
Data Dictionary		11/28/23	12/1/23
Implementation			
Database Implementation		12/1/23	12/10/23
User Interface Implementation		12/10/23	12/19/23
SQL Statement		12/19/23	12/25/23
Testing & Deployment			
User Acceptance Testing		12/25/23	12/30/23
Refinement and Bug Fixing		12/30/23	1/4/24
Training and User Familiarization		1/4/24	1/11/24
Demonstration		1/11/24	1/14/24



8. Requirement Analysis

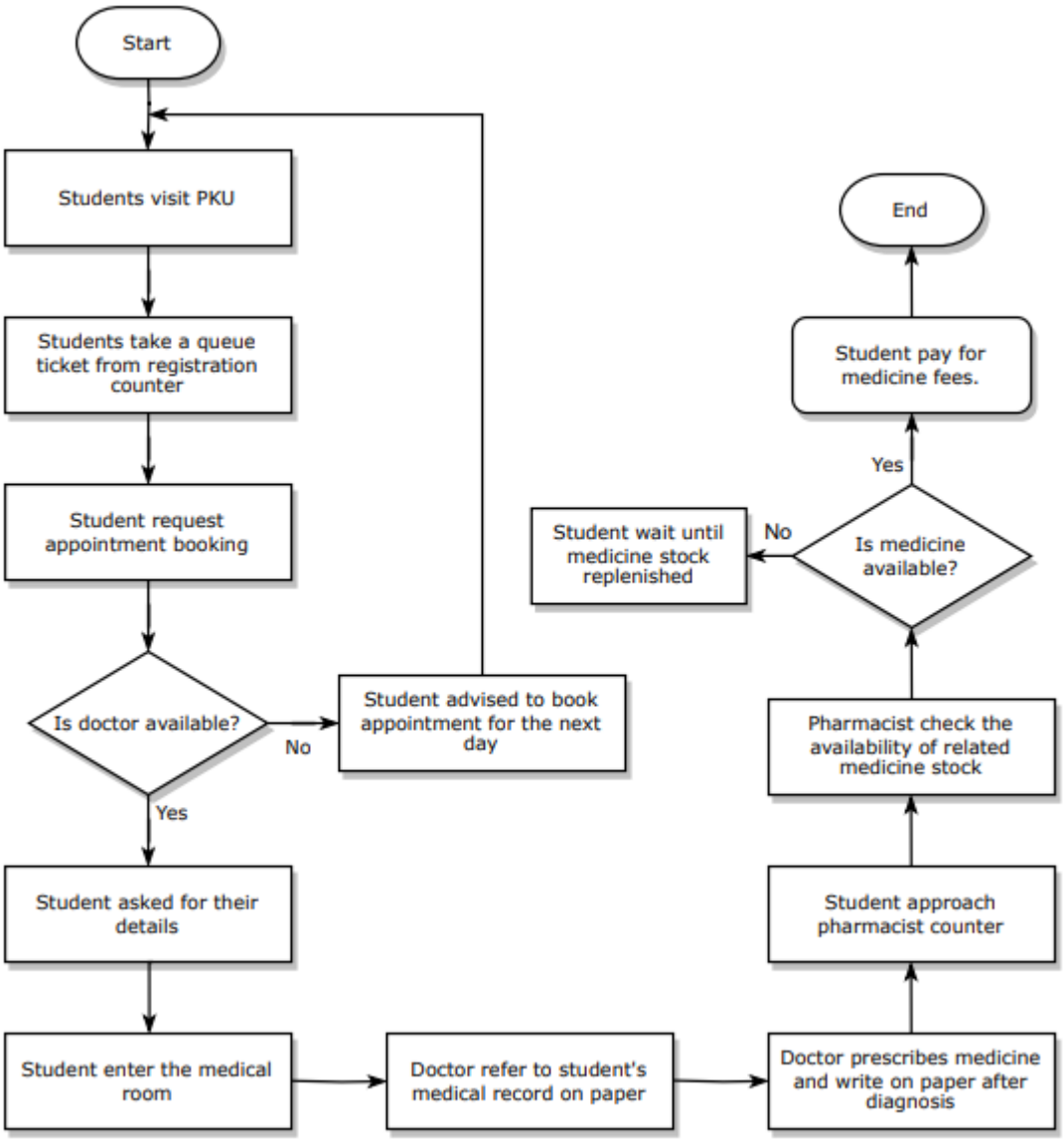
8.1. Current Business Process (scenarios and workflow)

Below are the scenarios and workflow of the current business process of PKU :

Scenario : A student wakes up feeling feverish and body aches on Monday morning. He decides to visit the PKU clinic to see a doctor and get medication.

Workflow :

1. Students physically visit the PKU during working hours.
2. Students take a queue ticket from the registration counter.
3. When their turn comes, students proceed to the registration counter to request an appointment booking with a specific doctor based on their medical concern.
4. Staff manually check the availability of the doctor for the current day through a paper register.
5. If slots are available for the doctor on that day, the staff will then ask students for their details, and book appointments by recording them in the paper register.
6. If no slots are available for that day, the student is advised to book an appointment for the next day.
7. On appointment day, students again take queue tickets for seeing the doctor.
8. When turns come, students are directed to enter medical rooms.
9. The doctor will refer to paper files for the student's medical records.
10. After diagnosis, the doctor prescribes medicine, writes it on a paper prescription slip, and sends it to the staff at the pharmacist counter.
11. Students then approach the pharmacist counter.
12. The pharmacist checks the availability of related medicine stock.
13. If the stock is unavailable, students are informed to return to their dorms and wait until the related medicine stock is replenished. Alternatively, they seek the medicine at the clinic outside.
14. Students pay for medicine fees if required.



AS - IS System Workflow

9. Transaction Requirement

Data entry :

- Enter patient registration details.
- Enter appointment booking request.
- Enter medicine prescribed by the doctor.
- Enter student check-in and check-out data for isolation.
- Enter inventory receipts for medicine.

Data update /delete :

- Update/delete patient information.
- Update/delete appointment booking status.
- Update/delete medicine quantity after issuance or replenishment.
- Update/delete isolation status based on student check-in.

Data queries :

- List details of patients by name, ID etc.
- Identify appointment availability and slots.
- View medical history for a patient.
- Identify medicine stock availability.
- Display isolation detail and history for a student.
- Generate reports on appointments, patients and medicine inventory.

10. Benefit and Summary of Proposed System

The new PKU Online Management System aims to improve productivity and convenience for both students and staff by automating previously manual workflows. We propose developing this integrated digital system because we have observed several pain points in current processes, from delayed appointment scheduling to problems with medication inventory. For instance, the PKU staff is facing challenges with organizing patient records, appointment scheduling issues, managing the medicine inventory, ineffective quarantine tracking etc. To address the problems raised by our stakeholders, our team suggested several crucial features to be included in this system to overcome the problem and meet our objectives in the future. For instance, the students can log in to the online system and make medical appointments for medical care or view their entire medical records. Meanwhile, all information will be collected and arranged, providing PKU staff with a clear understanding of the reservation arrangements and quick access to patient medical records. The users of this system can benefit significantly from these features.

For students :

The new PKU Online Management System allows self-service appointment booking 24/7 based on real-time visibility into doctor availability. Students can book, change or cancel appointments through the portal at any time that fits their schedule. This situation eliminates the need for them to physically visit the clinic during business hours and manually check registers and hope that slots are still available. Reminders that are set up automatically in the online system can help ensure students stay informed and do not miss their medical consultations. Additionally, students can now easily access their digital health records like lab results, prescriptions and immunization history at any time securely through patient portals. This encourages improved coordination of care and avoids situations in which students are required to explain their medical history repeatedly. For quicker visits, students can also use the system to digitally check in and register when they arrive at the clinic.

For staff :

The new PKU Online Management System centralizes data and streamlines tasks for improved coordination. Now, doctors can easily retrieve a complete profile of a patient's medical history, prescriptions, procedures etc. This avoids unnecessary diagnoses and repeated testing which previously wasted clinic resources and time. Nurses and lab technicians also benefit from improved system-wide visibility into patient care plans and test results across the system to optimize the delivery of healthcare. Inventory management features provide real-time tracking of medicine supplies and expiration alerts to prevent stock shortages or wastage issues faced earlier. Administrative tasks like billing and operational reporting are automated to cut down on the overhead of manual processes.

In summary, this system streamlines the operational complexity involved in managing medical inventory, updating medical records, scheduling medical appointments and keeping track of quarantined students. The transition from disjointed paper-based procedures to an integrated digital system driven by a centralized database aims to reduce delays, expenses and errors while improving patient satisfaction. By optimizing workflows through automation and role-based access to well-organized patient data, PKU can deliver high-quality and coordinated care to the UTM community.

11. Summary

Pusat Kesihatan Universiti(PKU) at UTM faces some operational inefficiencies due to partially outdated manual systems. These include the physical appointment books causing scheduling issues for the students and the use of Whatsapp for communication with quarantined patients, leading to inconvenience in status tracking. The proposed project aims to develop an improved and modernized hospital management system at PKU by implementing an integrated digital platform within it.

Our background study had emphasized the critical role of PKU, highlighting the prevalent issue of manual systems. The study will draw direct attention to those particular problems such as appointment scheduling, disorganized patient records and ineffective quarantine tracking. It also cites global studies to support the benefits of automated systems in healthcare.

The proposed solution suggests transitioning from manual process to a modern digital system. It addresses the appointment scheduling challenges through an online appointment system, providing real-time information and automated reminders. The introduction of a centralized electronic medical record system aims to organize patient data and improve diagnosis and treatment. The system will also upgrade isolation tracking with a management module for digital check-ins and communication. All of the features mentioned are essential in enhancing the overall system.

Before project initiation, a Work Breakdown Structure(WBS) was developed to outline the tasks and subtasks required for the implementation of PKU Hospital Management System. It is an important process before launching the project as it will facilitate a clear understanding of the project's scope and allow for effective resource allocation. Concurrently, a Gantt Chart was constructed to visualize the project timeline, providing a roadmap for task dependencies and milestones. Both the WBS and Gantt Chart serve as crucial planning tools, guiding my project team in executing the tasks sequentially and ensuring efficient project management.

In summary, the transition of the management digital system is expected to benefit the UTM community by providing self-service options and improved access to medical records. The system aims to enhance PKU operations through digitized procedures, inventory optimization and data driven insights. The new proposed system will definitely bring the PKU to improve care quality, patient satisfaction as well as operational efficiency.