TECNOLOGY AND INFORMATION SYSTEM

SECP1513 – 02

Design Thinking Project Report:

Library or study space utilization

(Analyze peak times, seating capacity, and resource borrowing to enhance accessibility and comfort)

PREPARED FOR: DR ARYATI BINTI BAKRI

GROUP MEMBERS:

		
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1.0 Introduction

1.1 Background Information

Library in University Technology Malaysia often face overcrowding, especially during study week, midterm test night and every incoming project. Students walk around searching for empty seats or available discussion rooms. If students cannot find a seat or a room, it wastes time, make them feel frustrated and leave the library. To do some research, a lot of time also needed to the location of the references. Thus, in order to solve this problem, our team decided to design an app called “Maroon Space” that can help students plan their study schedules effectively.

1.2 About the Project

“Maroon Space” is an Internet of Things (IoT) application- based technology that incorporates four main elements for efficient data processing which are sensors, connectivity, data processing and interface. By integrating sensors within library seats and rooms, students can track seat and room availability in real-time. The collected data is processed and transmitted through a network to the application interface, where students can easily view current availability and make online bookings rooms accordingly. In addition, “Maroon Space” integrates with the library catalog to provide information on book categories and their corresponding rack locations. Students can quickly identify the type of resources available and locate them in the library, making study sessions more efficient and organized. This system aims to reduce time wasted searching for seats, enable booking online, find books easily and enhance the overall study experience for students.

1.3 Objective and Overview

The objective of “Maroon Space” is to enhance the students’ experience by reducing overcrowding, shortening wait times, and providing a seamless digital space management interface. It will include features such as real-time seating maps, room reservations, notifications, library’s operating hour, library resource borrowing patterns based on genre and integration with the university's identity verification system, so that students can plan their study sessions more effectively and librarians can enhance resource accessibility.

2.0 Target User

“Maroon Space” is an essential need for convenience, efficiency and effective for students. This solution integrates Internet of Things (IoT) technology with smart sensors, network connectivity, and a user-friendly mobile application interface to optimize the utilization of library seats and discussion rooms. This app is designed specifically for University Technology Malaysia students, who require quiet study open spaces or discussion room to study or discuss project, assignment with course mates and friends. This app enables students track real-time availability of seats and rooms, make online bookings, find resources and save their time when searching for available spaces to enhance the overall study experience.

3.0 Problems and Solutions

Problem	Description	Solution
Unclear seat availability	Students cannot know which seats are empty without walking through the library.	Using IoT sensors, seat occupancy can be displayed in real time. Students can check seat availability at any time and anyway.
Inefficient Room Booking	Booking rooms previously requires walk in and register at the counter.	Mobile app with instant room reservation, confirmation and cancellation. Students can book the discussion room early on the app without going to the library and do the cancellation on the app if something unexpected happens. To show you have successful book the room, our app will pop up a message " Booking successful! Study diligently...And success will follow

		suite." When students want to cancel the booking, message "Cancel booking? Do not waste time... Success is earned, not given." will pop up.
Lack of Automated Session Management	Students easily forget their booking time duration and overstay their slots	Students receive automatic notifications before and bookings. For instance, they may receive alerts like, "Don't forget your booked discussion room 5 minutes until it started". Before end the times, "Don't forget your booked discussion room 5 minutes left". This feature keeps user well-informed, allowing them to manage their time efficiently.
Difficulty finding library resources	Students spend extra time searching for books by genre,	Students can search for bookshelf locations by

	which may delay study sessions	genre. For example, students can search for "Technology and Information System", and the app will display the list of bookshelf location.

4.0 Team Working

Our group made sure that there was a smooth flow in our work process by dividing tasks based on our members' strengths. Aidil played an important role in creating and developing our prototype. He concentrated on promoting improvements in the technical domains of our app and make sure our prototype correctly reflected our proposed functions. Li Jing was in charge of creating our prototype and handing out Google Form links to students for our data collection process. She helped in interpreting our data results and worked on compiling our report. Anis handled video editing tasks in our group for our project presentation. She helped in creating our prototype too. In our group, communication and collaboration worked effectively in our project process. Most of our tasks, like discussing our design concept, testing, and giving our feedback, interviews were done as a group to achieve consistency in our work. By focusing on our individual strengths and collaborative efforts, our group effectively accomplished our tasks in this project.

Task Distribution Table:

Name / Task	Muhammad Aidil Farhan bin Zamri	Lim Li Jing	Puteri Anis Annisa binti Mat Lazim
Prototype Development	√	√ (Design support)	√ (Design support)
Data Collection (Google Form)		√	
Survey Analysis	√	√	
Report Writing	√	√	√
Presentation Slides	√	√	√
Video Editing			√
Team Discussion & Feedback	√	√	√

5.0 Design Thinking

5.1 Design Thinking Process

5.1.1 Empathy

In the first stage of the design thinking process, empathy, we designed and distributed a google form to University Technology Malysia students to gather insights into their library habits, challenges, and needs. We also conducted interviews with some

international students and a library staff member to obtain more in-depth qualitative feedback.

5.1.2 Define

Based on the collected data, we identified the following core problems such as unpredictable seat availability leading to wasted time, cumbersome room booking process requiring physical presence, lack of automatic reminders causing overstays and also difficulty in locating library resources, which can increase the time students spend searching for materials and reduce the time available for studying.

5.1.3 Ideate

This phase consists of looking at the problem from different angles and brainstorming creative solutions for the problem statement. During this phase, strategies on how the problem can be efficiently addressed have been brainstormed by our team. We have come up with different solutions for addressing the problems faced by the students, which have been categorized into two approaches based on web portals and mobile app solutions.

5.1.4 Prototype

In this phase, we tried to find a solution to the previously defined problem. Based on our discussion, we found that a better solution would be to develop a mobile app solution because, with the website portal, they could only push the notification reminders to us via email only, and students often ignore those

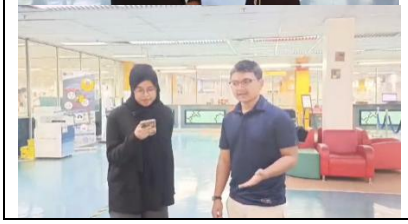
messages. After that, we started to discuss about the main design and features of our solution and started to design our ideas to a tablet, and then we moved all those ideas to Canva to create a designing solution with a better prototype.

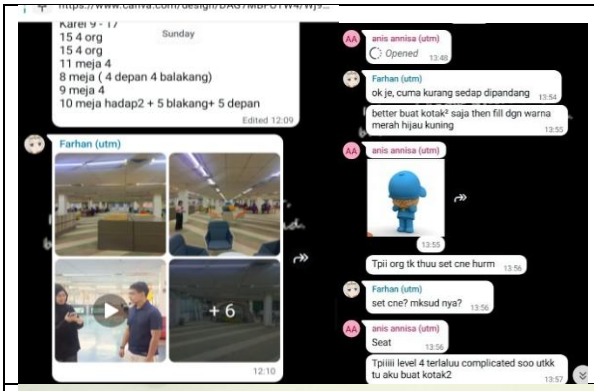
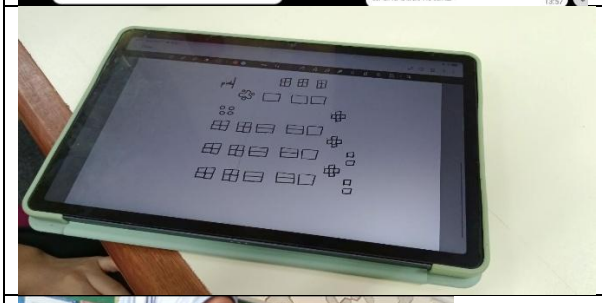
5.1.5 Test

This is the last test, students testing allows us to identify areas for improvement and make necessary adjustments. We test our “Maroon Space” design with two other local students in library and get feedback from them to make sure our "Maroon Space" is useful and needed.

5.2 Design Thinking Evidence

5.2.1 Sample Work

	**<u>Data Collection</u>** We collected the problems and suggestions from the student
 	**Interview session** Interview with two international students from FKE. One of the interviewers is called Ashame Stevo and another one called Sunny.

	**Discussion** We analysed the problems faced by users and listed out all the most suitable solution
	**Building a prototype** After the discussion, we started to build a prototype which is the app interface**.**
 	**Testing** We test our app with two students. One of the interviewers is called Suffiah and another one called Tang Jing

5.2.2 Record for each phase

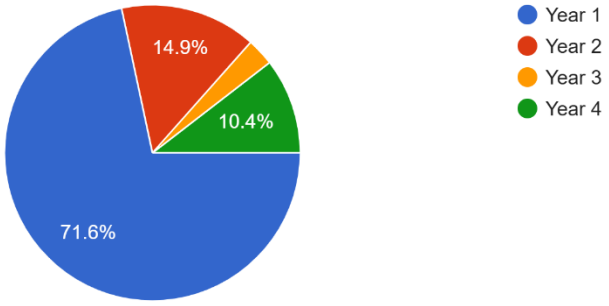
1.Empathy

Data Collection

We do a survey through google form with 67 students UTM.

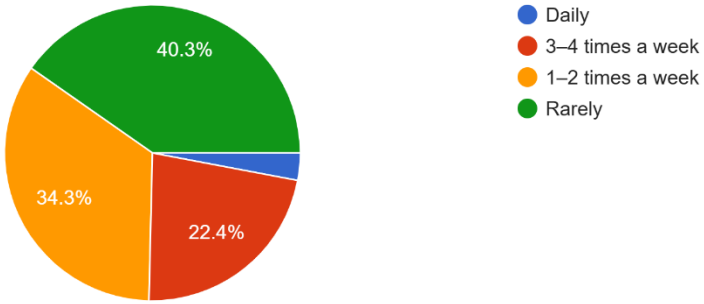
Year

67 responses



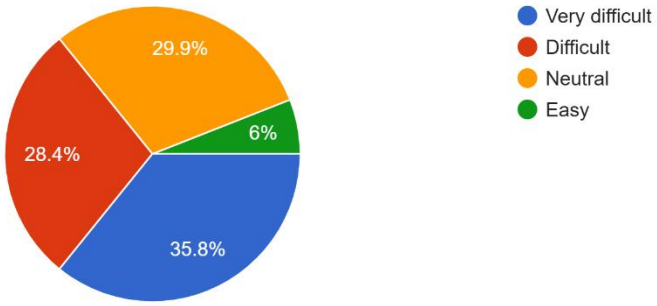
1.How often do you visit the library or study spaces?

67 responses



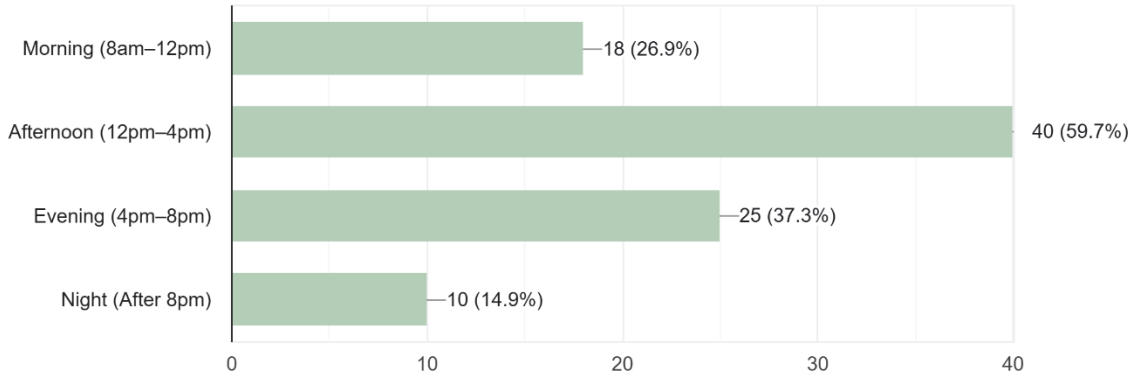
2.How difficult is it for you to find a seat during peak hours?

67 responses



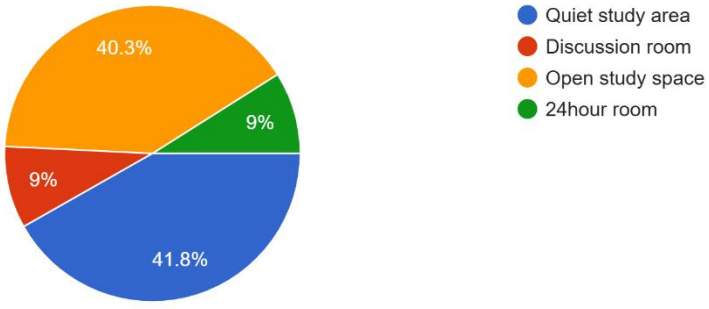
3.What time do you usually visit the library? (Select all that apply)

67 responses



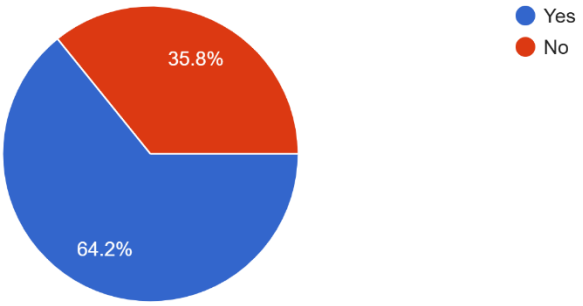
4.Which area do you usually use?

67 responses



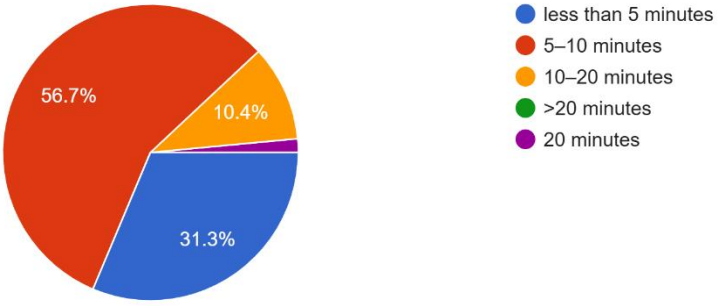
5.Have you ever left the library because no seats were available?

67 responses



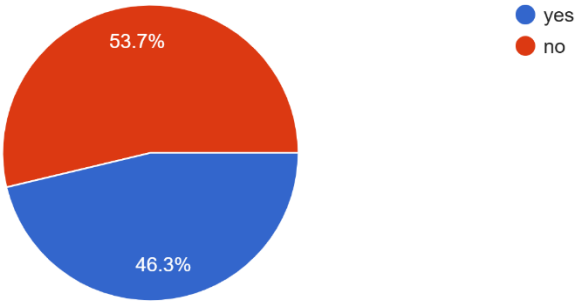
6.On average, how long do you spend looking for a seat?

67 responses



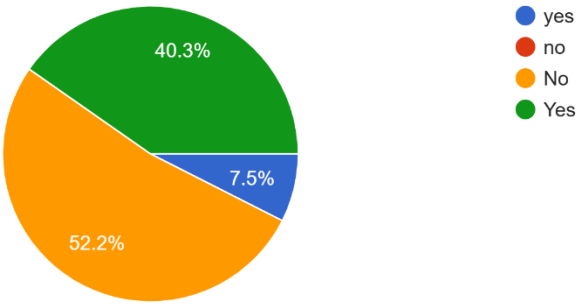
7. Do you find it easy to locate the books or resources you need in the library?

67 responses



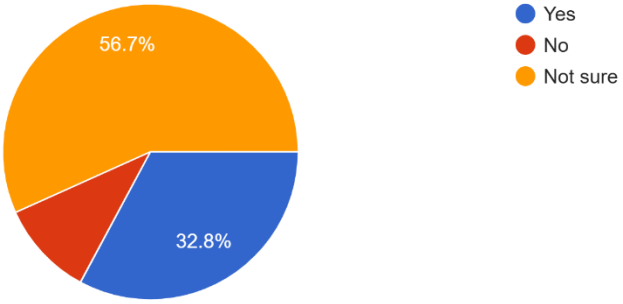
8. Do you think online booking can help reduce time wasted in finding a room?

67 responses



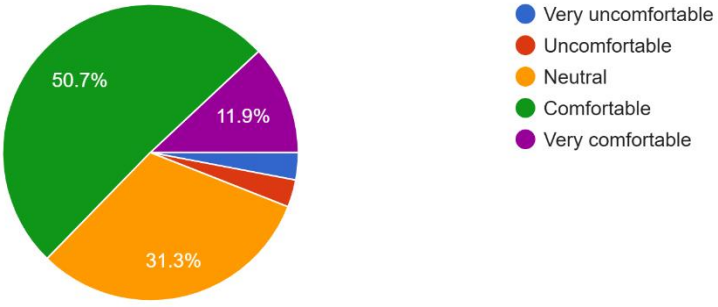
9.Do you feel the library has adequate resources for students?

67 responses



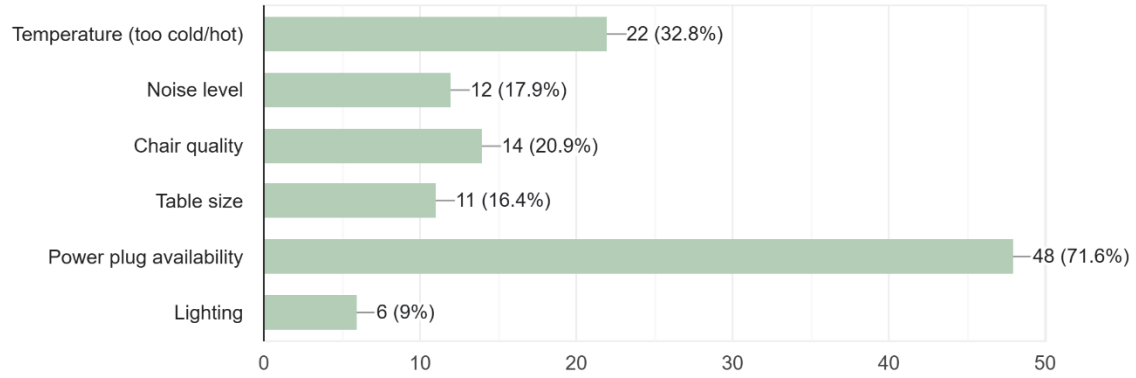
10.How is the environment?

67 responses



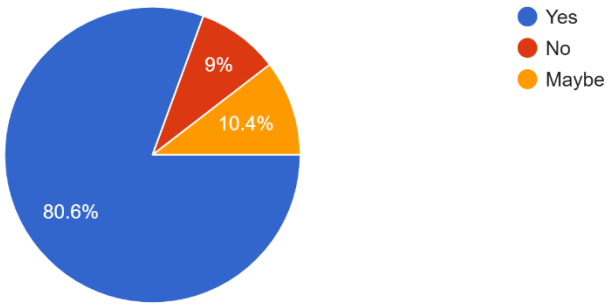
11.What do you find uncomfortable? (Select all that apply)

67 responses



12.Would you need to use a system that shows real-time seat availability?

67 responses



13.What improvements would you like to see in the library or study space?

online booking seat
notification reminder,online booking,live map & location of book type
a system that can show any space seat in the library
It's better to have list of books and references available in library so that we know where to find it easily.
a booking system is needed
booking room &notification&live map
live map to check avaibility seat
need a booking system
Better resources navigation
real time check seat and book room online with notification
booking discussion room system
more seat
More seating spaces and better vibe
online booking discussion room and also notification reminder before end our session
Can add more private personal study room

a system can book a seat and show the space seat
Improve power plug availability
Plug availability
Real-time seat availability as suggested
Power plug
Open to booking study room online
Can book the discussion room early
updated technical reference
Increase power outlet availability
more power plug availability
increase the number of single study room
live seat show and notification and online booking please!!!
more seat with power plug
notification reminders with booking system
People usually study at night so library need to enlarge the space of 24 hour room
Seat available to check and more plugged
do a system that can check are they any space seats time by time
a system that can check the updating table time by time
Provide more individual study room.
provide a good app for students to check whether the seat available or not. improve the security too please
More power plug
isolated room with optimal privacy with CCTV to prevent misuse.
book discussion room with notification reminders
More group discussion room and stronger WiFi
More space and electric supply
system that easily to find the genre of course
Improve seats
add on power plug
More plugs available
a system that can booking space and discussion room
Other than seat availability, more working power plugs
book discussion room and live map provided
more tables and chairs

Interview

The table below presents the questions and answer obtained during the Interview.

Question	**Answers**

1. Hallo, what is your name and what is your course?	Hello, my name is Ashame Stevo and I am from India. My course is related to faculty of engineering.
Can I ask you some question?	Okay.
How much time do you typically spend searching for a suitable place to sit, especially during peak hours?	Too much because I want to find a seat to study.
What type of space like quiet zone, collaborative table, private pod do you look for when you need to study?	I like study quiet and library is too big so there are much quiet.
Okay, Thank you.	Okay, Welcome.
2. Can you please introduce yourself what is your name, what is your course and which you are like?	I am Sunny. I am from FKE.I am year 2 electronics student.
Okay. So, for the first question how often do you visit the library?	Quite often. I mean maybe 5 days a week.
So when you decide to go to the library, what time of day is it usually?	After breaktime. Actually, my course like don't have a day so after that I will usually be like.
Can you recall a recent time when you left the library or a study space without finding a good spot? What happened?	Yes, that have a quite often.
If you can instantly check in your phone about the availability of the room, there a bit helpful for you. Did that helpful for you?	Much.

Okay, that's all. That's all for the question. Thank you.	Welcome.
3.(Interview with library staff) When is the peak time where people usually go to library? And do you think the spaces is enough for students?	Students come when study week and the new registration. When the new semester started, there are most crowded because they want to explore library. At that moment, space is not enough.
What things that you think must be improve?	We don't have the check availability seat system yet. For all student I also want to upgrade facilities, improve the environment and this service.

2.Define

The table below shows the core problems faced by users, synthesized from our empathy research.

Problems	Descriptions
Unclear seat availability	Students do not know which seats are empty before arriving at the library. This leads to wasted time, frustration, especially during peak hours like study week.
Inefficient Booking	The process to book study rooms is manual. This lacks real-time confirmation maybe not have any room already.
Lack of Automated Session	Students often overstay their allotted slot because there is no reminder system. This causes inconvenience for others and creates scheduling

	conflicts for library administration.
Difficulty finding library resources	Students may struggle to identify book categories and locate the correct racks in the library. This increases time spent searching for materials and reduces study efficiency.

3. Ideate

The table below shows the possible solutions that can be used to solve users' problems.

Problems	Web Portal	Application
Unclear seat availability	A website that lists room/seat status in a table or simple list format, accessible from library computers or personal laptops.	A mobile app with a color-coded floor plan. Green colour means that have available seat, meanwhile Red means that the seat has occupied. We can see the updates live via IoT sensors.
Inefficient Booking	A webpage form for room reservation that sends a confirmation email.	A seamless flow within the app to select a room, choose a time slot, confirm, and check a booking detail on the app.

Lack of Automated Session Management	The system sends reminder emails at set intervals before and after the booking.	The app sends automatic reminders before booking starts and 10 minutes before it ends directly to the student's phone.
Difficulty finding library resources	A webpage showing book categories and rack locations. Students can search by genre to identify where the books are located.	The app can search book categories to get the corresponding rack location.

Table 5.2.2.3 Possible solutions to solve the problems

4. Prototype

The reasons for this decision are outlined in the table below.

Reasons	Web Portal	Application
Accessibility & Convenience	Requires a browser and is best used on a larger screen or need to scroll more when open website by using mobile phone. Less convenient for quick, on-the-go checks.	students can check availability seat from anywhere, anytime using their smartphones, which they always carry or also can download on the laptop/Mac.
Reminders	Email reminders are easy to ignore.	Enables direct push notifications

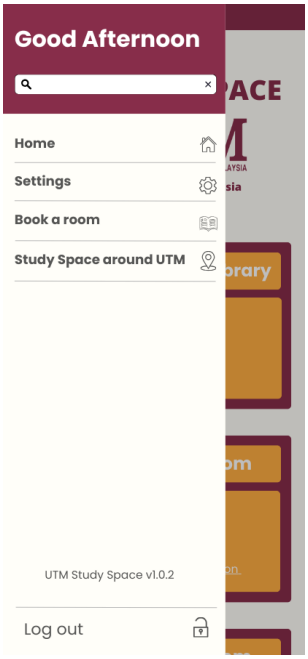
Login status	Need to login again every time.	After login will remain on the menu, no need to login again

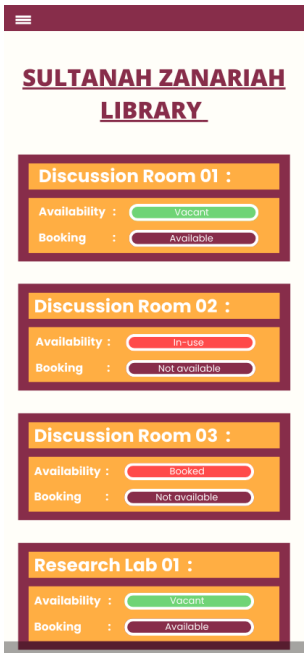
Table 5.2.2.4 Comparison between Web Portal and Application

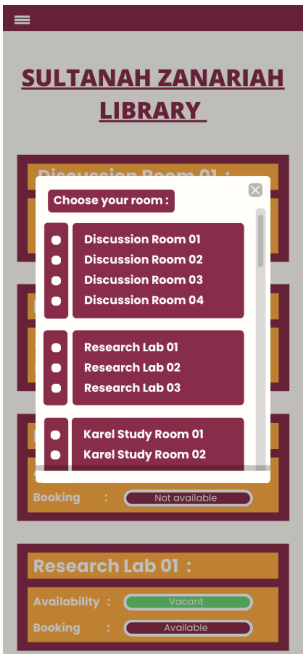
The table below shows the features of our application.

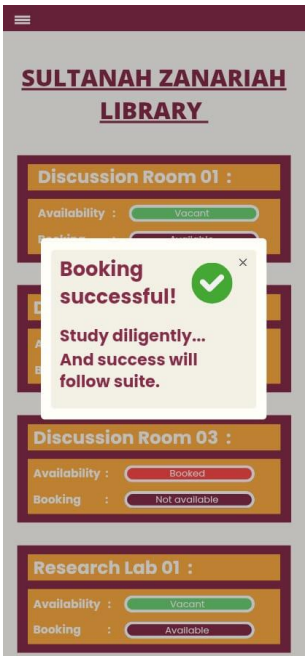
Features	Description
Live seating map	Real time updates for available seating to ensure students are informed about where there is any seat or not. For example, when student want to go PSZ, they can see the seating on floor 3 or floor 2.
One tap booking	Students can choose to book the discussion room they want or empty.
Booking details	Students can check their booking details on the app
Cancellation	Students can cancel the booking
Finding library resources	Students can search for bookshelf locations by genre. For example, students can search for “Technology and Information System” and the app will display the list of bookshelf location.
Schedule of operating hours	Students no need to check on the website of the library.
Login page	Students can login in to “Maroon Space” by using their

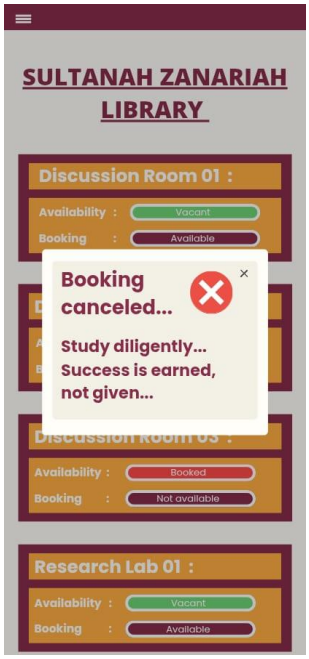
	UTM student's ID and password.

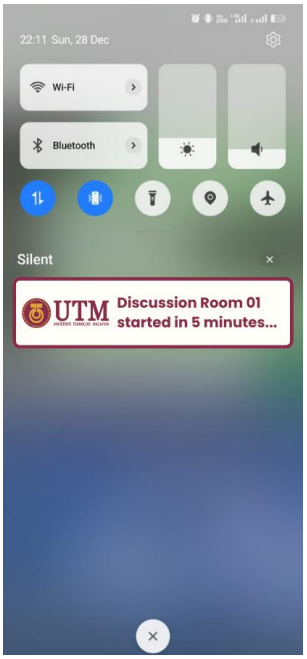


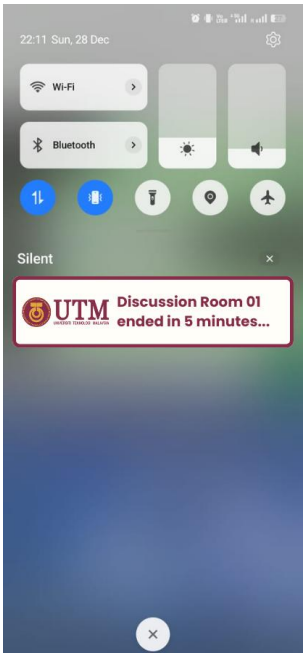


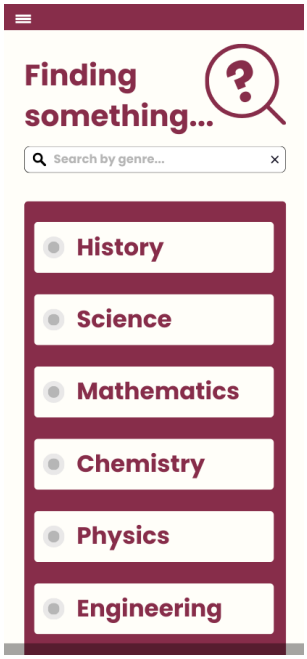


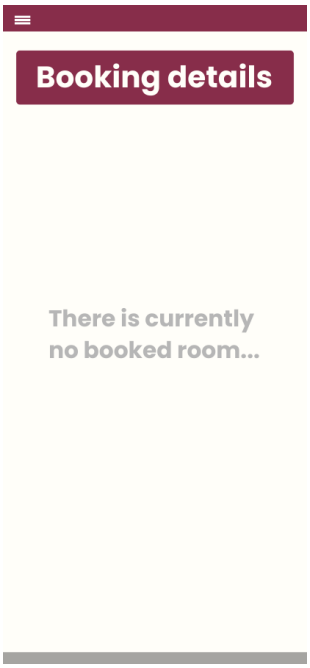


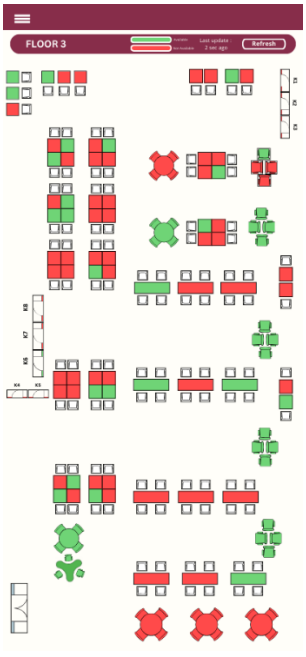

SULTANAH ZANARIAH LIBRARY
Discussion Room 01 :
Availability : Vacant
Booking : Available
Booking canceled...
Study diligently... Success is earned, not given...
Availability : Booked
Booking : Not available
Research Lab 01 :
Availability : Vacant
Booking : Available

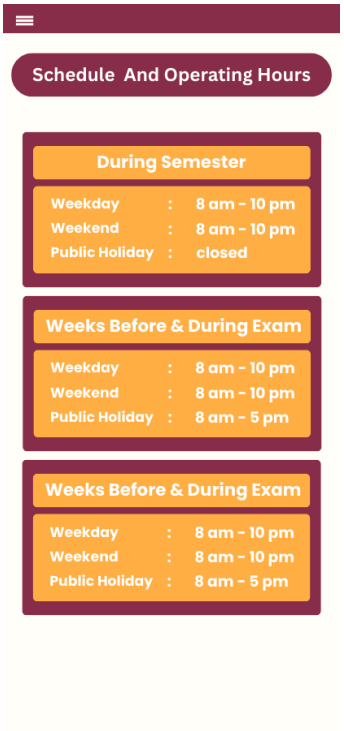

22:11 Sun, 28 Dec
Wi-Fi
Bluetooth
Silent
UTM Discussion Room 01 started in 5 minutes...


22:11 Sun, 28 Dec
Wi-Fi
Bluetooth
Silent
UTM Discussion Room 01 ended in 5 minutes...


Finding something...
Search by genre...
History
Science
Mathematics
Chemistry
Physics
Engineering


Booking details
There is currently no booked room...


FLOOR 3
Refresh



5. Test

Dialog with interviewers

First interview
LIJING: Hallo, what is your name and can you self-introduce yourself?
TJ: My name is Chong Tang Jing. I am 19 years old and year 1 FKE student.
LIJING: do you always go to the library?
TJ: yes, almost three time once week
LIJING: Did you feel that find a space is so difficult?
TJ: yes, over than 5 minutes especially during peak hour like midterm test night.
LIJING: Did you think that find a resources in library are difficult?
TJ: yes, because the library is too big and I can't find where actually the book locates.
LIJING: Okay, now I have designed an app to improve the library system? Let's see on our app and give me some feedback.
TJ: Wow, this looks like so nice. I can check the live seat every time when I want go to library. This really help me a lot because if that seat is almost fully, I not need to go to library. The booking system also looks like useful. I can book early for a single room or discussion room to study with my friends. I see that I can also find the resources by genre to know where the resource locates.
LIJING: Did you think that this app will help a lot of students in UTM?
TJ: Of course, we don't need to get on the bus or walk to library if seats already full. The notification reminder also can help me a lot to avoid overstay. For me, this app really convenience and I like it.
LIJING: Is there any improve for this app?

TJ: I think your app can search more details to find the book. Maybe which rack and which row.
Second Interview Anis: hello we are here today with Aniesya Suffiah for testing our prototype design looking project. Okay so before we go through our prototype. I would like to ask Aniesya Suffiah have you ever facing any problems before in like finding available places that you want in library before this. Suffiah: yes, Puteri Anis because every time I finish my bus, I want go to library and then it's already book or it's full with people so I still want to find a solution with the problem. Anis: Okay, as you need to overcome the problems that you will face before this, we actually have thinking in an app that we can look about availability of the spaces in library in UTM. Okay so you can see this is our prototype here. Suffiah: It's good that your prototype working like it do not put a difficult to students because some students need to go around in the library to find their seats and somehow, they need to go into the counter and ask for the key for room. But then this application might be working in the future, it might have a lot of students to actually not waste their time in go around and then they can actually organize their study time and all of them. Anis: Yes! So that's all from us. Thank you so much for joining us.

5.3 Design Thinking Assessment

5.3.1 During the end of the project demonstration

As a conclusion to our project, we can acknowledge the fact that making an app is a complex task, but it also has several applications. Initially doing all the research work through interviews and Google Form surveys helped us a lot in moving away from our own opinions and gaining a proper insight into the frustrations experienced by the UTM students in the library. Through our research, it has been made easy for us to develop ideas, but it took a lot of effort on our part to convert those ideas into a seamless and efficient digital tool. For example, our design concept of a real-time seating map, booking system library resource guidance and notification reminders had to meet the desires of the students related to ease.

5.3.2 During the transition between design thinking phases

The transitions between design thinking phases were important for our project. From Empathize to Define, we summarized user feedback on seat availability, room booking, session reminders, and library resources into clear problem statements. Beginning the process of moving from the Define stage to the Ideate stage, we identified the following solutions: real-time seating updates, discussion room reservation, alert reminders, and book category browsing. Progressing from the Ideate stage to the Prototype stage, we narrowed down the ideas to a mobile application populated with the parameters of push notifications and accessibility. Finally, in the stage of moving from Prototype to Test, we validated our solutions by understanding the usability of the application in fulfilling the requirements of the students.

6.0 Reflection

Question:

1.What is your goal/dream with regard to your course/program?

2.How does this design thinking impact on your goal/dream with regard to your program?

3.What is the action/improvement/plan necessary for you to improve your potential in the industry**?**

MUHAMMAD AIDIL FARHAN BIN ZAMRI	1. I wish to master the basics and foundations of computer science first before developing my skills in data engineering. Of course, I can show this by getting 3.5 GPA or above for

	every semester. At the end of the journey, I will be able to solve any problems regarding computer science effortlessly.
	2. Design thinking has taught me the importance of good communication skills to properly communicate with my group members, that way I can voice out my opinions clearly. Not limited to my group members, I also learn to communicate and interview strangers, overcoming my fear, social anxieties and nervousness.
	3. To make myself stands out from thousands of applicants, I would learn the new technologies that is advancing rapidly each year, gaining advantages over other applicants. Other than that, I would also pick up and learn a bunch of skills that is crucial or beneficial for me in the industry.
LIM LI JING	1. I aim to develop the skills required for my career, especially technical skills in app development and programming language likes C++, Java, html, CSS, Java Script and python. I aspire to master all the topics and

	subject in my course. At the same time, I must also develop soft skills, especially communication skills to make me more confident when communicate with other. Since our course provides an extended internship period, I need to enhance my skills to effectively manage the responsibilities during my future internship.
	2. Design thinking impacts my goals as it not only improved my communication skills but also improved my critical thinking skills, collaboration with team members and problem-solving skills. For example, I had analyzed the problems from the students and discuss with my team members to solve the problems. I also try to become more extroverted to communicate with stranger to do the interview session.
	3. To enhance my potential in the industry, I plan to attend more activities and programs that can social with other people or participant in some competitions to improve my

	communication skills and confident. To improve my critical thinking and problem-solving skill, I plan to attend more workshops, which can help me refine my abilities and gain useful tips. To improve other technical skills, I have joined some club like Cyber X to learn new knowledge and technique.
PUTERI ANIS ANNISA BINTI MAT LAZIM	1. My goal towards this program is after i have graduated all the skills required in the industry has been mastered by myself. This way, i can be the one who turning all the messy and complex data into a useful and easy to understand by designing reliable pipelines that peoples are able to use it to solve their company including their daily problems.
	2. From this design thinking project, I think it plays a role in me achieving my goals as I have gained a lot of new skills to get this project done. I think through this project, it helps me in sharpen my critical thinking and

	decision making. The most important part is I need to interact with people, get to know frustration they are facing and I need to solve the problems together with my teammates. It gives me a sight on how I will be in the future dealing with people from various department having the exact same goals as me which to help real human problem. By designing the prototype, it gives me an experience on building a real-world data pipeline. Overall, from this project, it shows that to become a good data engineer it is not all about code but making sure the technical solution that I have built give a hand to people who use them.
	3. To improve my potential in the industry, i need to make sure that I will not stop learning and always be updated with all the new tools I need to master in the future.Besides, I think it is important for me to list

	out all the necessary skills needed and start planning what needed to be done in each day semester and year,such as focusing on enlarging my networking and upgrade all the soft skills by joining any club or program during my first year or upgrading all the technical skills required in my future job and sharpen my critical thinking by joining competition like Hackaton in the second year. By doing all this things, im sure that no matter what challenges and diffilcuties i will face in the future , i can get through that as I am well-prepared .

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8.0 Video

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