SECP1513: TECHNOLOGY AND INFORMATION SYSTEM

SEMESTER 1 2025/2026

ASSIGNMENT 4: DESIGN THINKING PROJECT REPORT

PROJECT TITLE: UTM Indoor Navigation System

PREPARED BY GROUP 5 SECTION 04:

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DEADLINE: 19/1/2026

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1. Introduction

Universiti Teknologi Malaysia (UTM) is a large campus with complex indoor environments such as multi-story buildings and identical corridors that lead to confusion between floors or buildings in search for a room or office. Moreover, conventional methods of navigation such as sign posts and maps would be ineffective and a waste of time. Therefore, the proposed Universiti Teknologi Malaysia Smart Indoor Navigation System aims to provide a smarter way of navigating the campus.

2. Detail Steps

This project was conducted as a Design Thinking Project under the theme “Future Digital Campus.” The Design Thinking approach was applied systematically through five main phases: Empathy, Define, Ideation, Prototype, and Testing. Each phase contributed to the development of a user-centred indoor navigation solution for Universiti Teknologi Malaysia (UTM).

2.1 Empathy Phase

The Empathy phase focuses on the experiences and challenges faced by users in navigating indoor spaces at UTM. Surveys have been used on students, staff, and visitors, in general, to gather information about navigation habits, problems, and expectations of these groups. In order to better visualize the primary target users, a user persona has been created: Aiman Hakim, a 19-year-old first-year student at UTM. This character highlights very usual problems like confusion in multi-floor buildings and difficulty locating places due to increased stress when navigating in time pressure.

2.2 Define Phase

Data collected during the Empathy phase was analysed, and insight was taken from the user persona to tackle what core problems users faced in the Define phase. For instance, Aiman struggles with indoor layouts that are not clear or without proper signage, making existing ways of navigation ineffective. The findings developed a focused problem statement and also helped specify the design objectives of the proposed system.

2.3 Ideation Phase

The Ideation phase involved brainstorming and evaluating multiple potential solutions to address the identified problems. Each solution was assessed based on how effectively it could support users similar

to Aiman, who require fast, visual, and easy-to-understand navigation. Then, we chose the best solution based on Aiman's needs.

2.4 Prototype Phase

In the Prototype stage, a non-functional prototype was created to help visualise a possible solution. It was intended to handle requirements for a user persona based on a simplified interface for interaction. Routes that connect indoors would also be visualised.

2.5 Testing Phase

The Testing stage is all about testing the concept of the solution to see how well it meets the requirements and objectives once the concept has been developed and refined based on project requirements and objectives in context to the projected solution.

3. Details Description

3.1 Problem Statement

Based on survey findings, new students and visitors at Universiti Teknologi Malaysia (UTM) face significant challenges navigating large, multi-level buildings with complex layouts. Many users frequently get lost, leading to wasted time, stress, and confusion, especially when under time pressure. Existing navigation aids such as signage and static maps are often inadequate, resulting in inefficient navigation and reduced confidence when moving around campus.

3.2 Proposed Solution

- Static 2D Indoor maps are rudimentary in terms of layout information but difficult to understand under time constraints, not clear for navigating between floors, and non-interactive.
- In QR-Based Indoor Navigation, QR codes are installed indoor; however, the codes have to be searched first by the user, making it inconvenient for route planning. It requires significantly more physical infrastructure and is not very user-friendly compared with the mobile solution.
- Augmented Reality (AR) Navigation projects virtual directions on top of actual views, although it demands high-performance devices and is not needed for general indoor route direction purposes.
- Dynamic 3D Indoor Map Application (Selected Solution) is a mobile application with a 3D map system that helps navigate indoors by manually locating inside buildings through automatic detection of the building itself for correct navigation.

3.3 Justification for Selected Solution

The Dynamic 3D Indoor Map Application was chosen because it offers a good balance between ease of use and practicality. It clearly shows multi-floor building layouts without the high complexity of AR solutions and does not rely on physical markers like QR codes. The system also allows users to plan routes in advance, with automatic detection and manual adjustments, making it suitable for a non-functional prototype and aligned with user needs identified earlier.

4. Design Thinking Assessment Point

Starting from the Empathy phase, feedback from the users of the system was acquired through a survey involving students and staff from UTM. This provided information on how many of the users tend to be lost in buildings, struggle with distinguishing the appropriate routes and floor directions, and are pressed for time when trying to reach destinations on time. All these helped to acquire a deep understanding of how users struggle with indoor space at UTM.

From the above understanding, the Define stage of the project was all about problem definition. It was analysed that the current solutions available, such as directional signposts and static maps, are not very efficient and are hard to understand, especially in situations where every second counts. This leads to frustrating experiences, a lack of confidence, and unnecessary campus-building navigating time.

During the Ideation stage, several ideas were proposed, and these ideas involved static 2D maps, QR Codes for navigation systems, AR navigation, and a dynamic 3D indoor map app. After analysis and evaluation, the dynamic 3D indoor map was deemed the most appropriate solution to the problems identified.

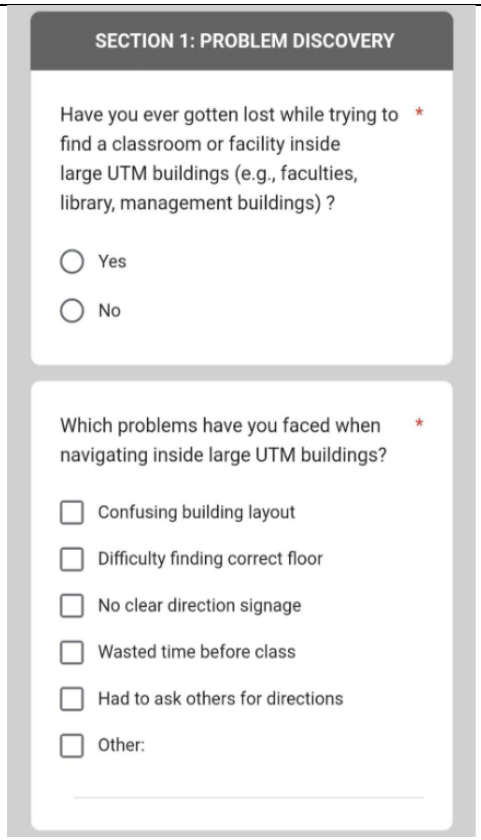
Lastly, the Prototype stage involved creating a non-functional prototype to conceptualize the proposed system. In this prototype, it can be visualized how users can plan their routes and navigate indoor areas efficiently. In general, the proposed design is suitable to cater to user requirements and provide an effective means for improving indoor navigation in UTM.

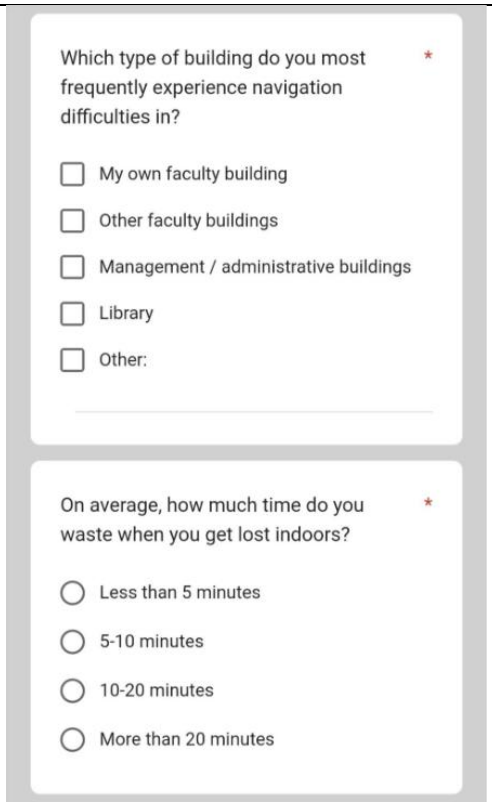
5. Design Thinking Evidence

Evidence supporting the design process includes meeting session photographs, Google Form survey results, user persona documentation, system flow diagrams, and prototype screenshots. These evidence demonstrates the active collaboration of this group.

5.1 Empathy Phase

These are the questions that were asked to UTM Staffs/Students through Google Form:





How stressful is it when you cannot find your destination on time? *

- ◯ Not stressful
- ◯ Slightly stressful
- ◯ Stressful
- ◯ Very stressful

SECTION 2: CURRENT SOLUTIONS & GAPS

What do you usually do when you are lost inside a building? *

- ◯ Ask friends
- ◯ Ask staff
- ◯ Use static maps
- ◯ Explore on my own
- ◯ Arrive late
- ◯ Other: _____

Do you think existing maps or signage at UTM are sufficient? *

- ◯ Yes
- ◯ Somewhat
- ◯ No

SECTION 3: SOLUTION VALIDATION (IDEATION SUPPORT)

How useful would a mobile app that helps users navigate inside large UTM buildings (e.g., faculties, library, management buildings) be for you? *

Not useful

- 1 ◯
- 2 ◯
- 3 ◯
- 4 ◯
- 5 ◯

Very useful

How would you prefer to set your starting location when navigating inside UTM buildings? *

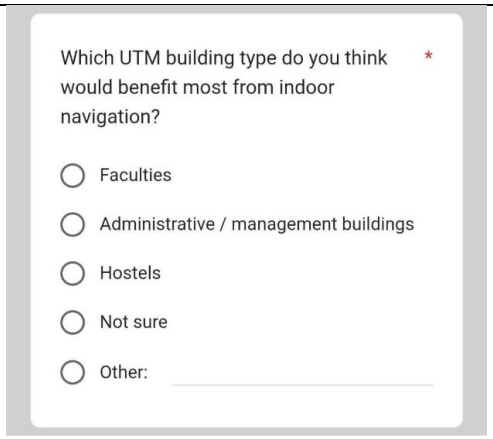
- ◯ Automatically detect my building with optional manual adjustments
- ◯ Automatically detect my current building/faculty, then manually select my indoor starting point
- ◯ Manually select my building and starting point

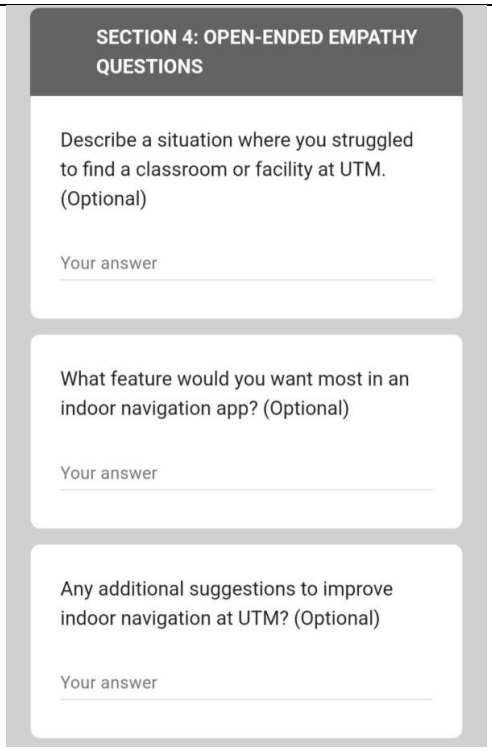
How helpful would a 3D indoor map be in understanding multi-floor layouts inside UTM buildings? *

Not helpful

- 1 ◯
- 2 ◯
- 3 ◯
- 4 ◯
- 5 ◯

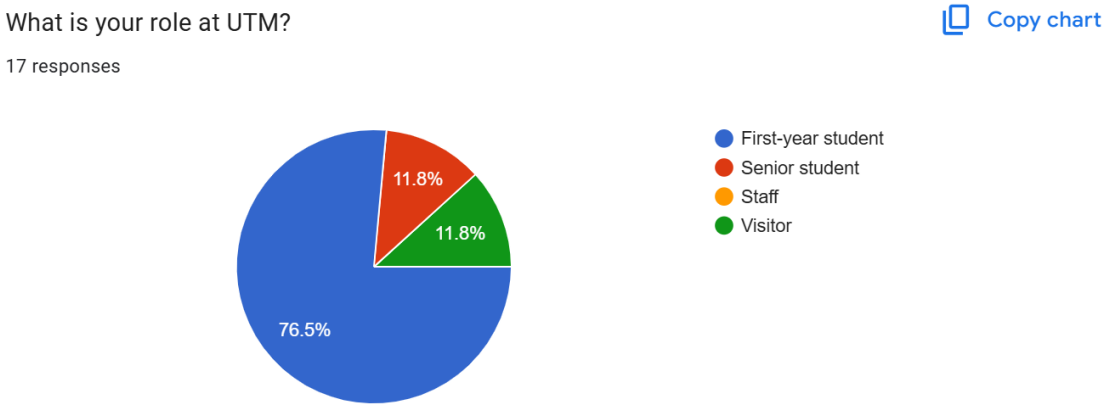
Very helpful





5.2 Define Phase

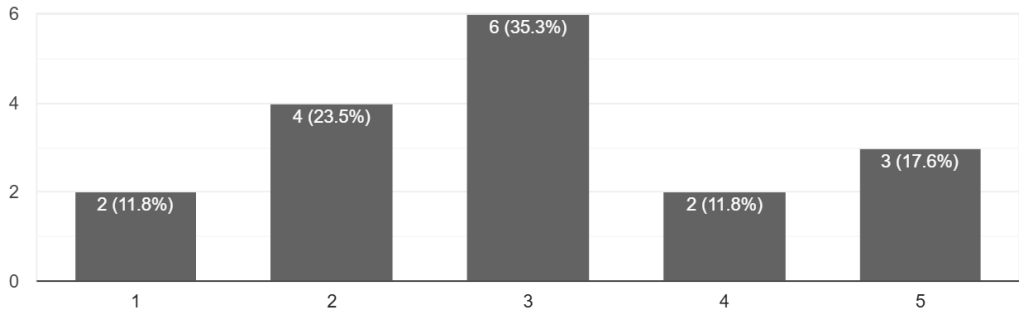
These are summary of the data that we collected through the survey on Google Form.



How familiar are you with layouts of large UTM buildings (e.g., faculties, library, management buildings) ?

Copy chart

17 responses



How often do you need to find classrooms or facilities inside large UTM buildings (e.g., faculties, library, management buildings) ?

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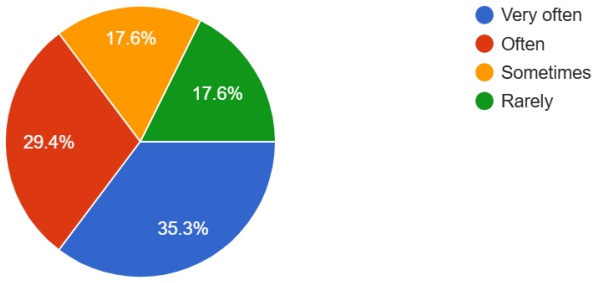
17 responses



SECTION 1: PROBLEM DISCOVERY

Have you ever gotten lost while trying to find a classroom or facility inside large UTM buildings (e.g., faculties, library, management buildings) ?

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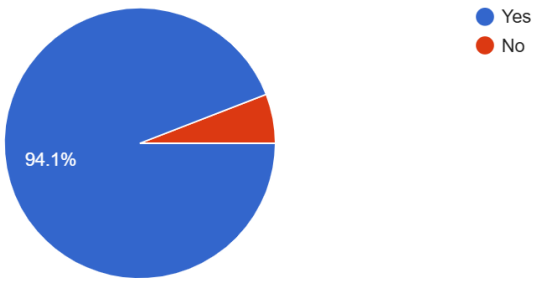
17 responses



Which problems have you faced when navigating inside large UTM buildings?

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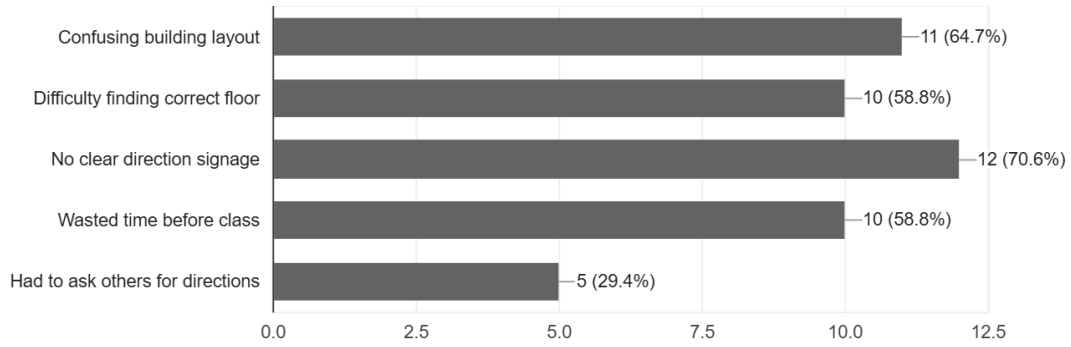
17 responses



Which type of building do you most frequently experience navigation difficulties in?

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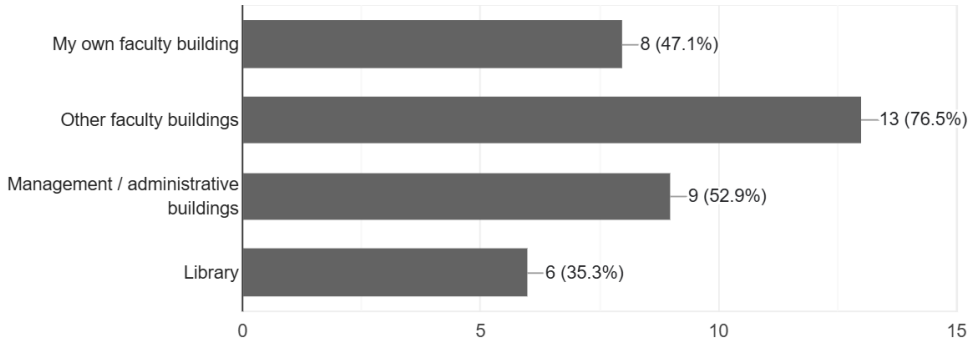
17 responses



On average, how much time do you waste when you get lost indoors?

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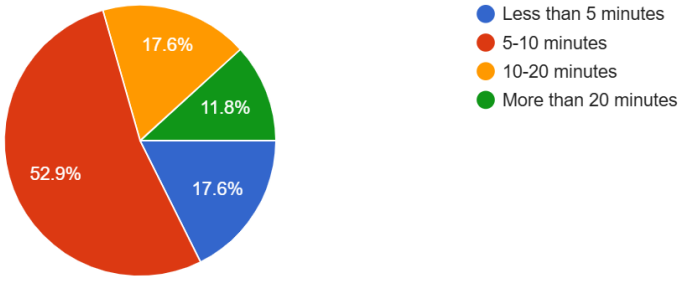
17 responses



How stressful is it when you cannot find your destination on time?

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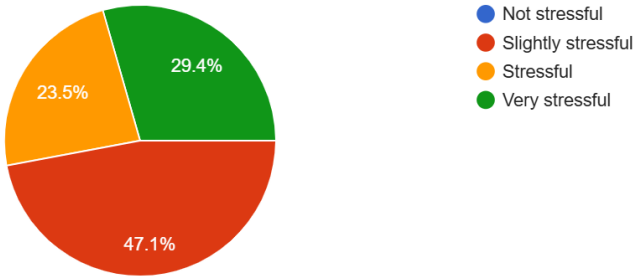
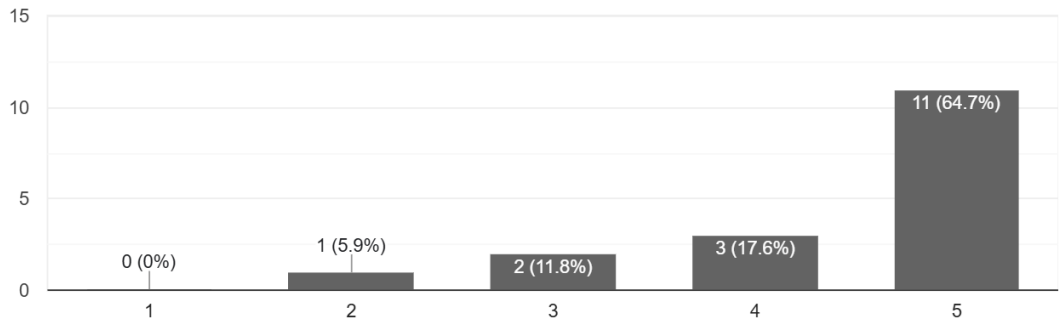
17 responses



How useful would a mobile app that helps users navigate inside large UTM buildings (e.g., faculties, library, management buildings) be for you?

Copy chart

17 responses



How would you prefer to set your starting location when navigating inside UTM buildings?

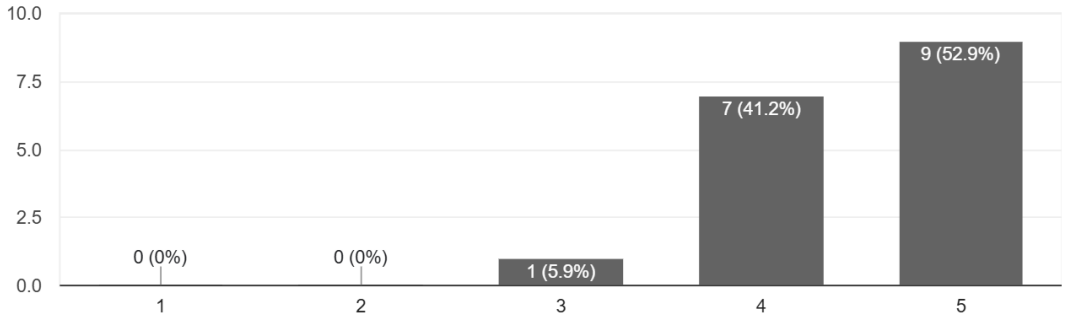
Copy chart

17 responses

How helpful would a 3D indoor map be in understanding multi-floor layouts inside UTM buildings?

Copy chart

17 responses



Which UTM building type do you think would benefit most from indoor navigation?

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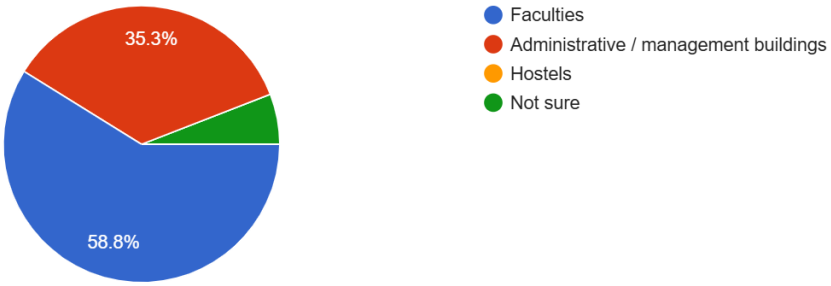
17 responses



5.3 Ideate Phase

On 6/1/2026, we conducted a meeting to discuss the solutions based on the feedbacks gathered during Empathy and Define Phase. We decided that the Dynamic 3D Floor Indoor Map was the best option. After that, we talked about how to make the prototype and came to the conclusion that it will be created using Microsoft PowerPoint.

5.4 Prototype Phase

This prototype was designed based on the feedbacks gathered during Empathy and Define phase where users prefers the prototype to be:

- Simple and minimal interface to reduce cognitive load
- Clear step-by-step navigation planning
- Visual representation of indoor spaces using a 3D building model

How do users use the prototype?

Screen 1: Main Navigation Interface

This screen allows users to begin navigation by selecting the required inputs. The interface includes fields for Building, Starting Point, and Ending Point, along with a START button to confirm the route.

Screen 2: Building Selection

Users select the building they wish to navigate within (e.g., Faculty of Computing, N28). This ensures that navigation is limited to the correct indoor environment.

Screen 3: Starting Point Selection

Users select their current indoor location, such as a classroom or reference point (e.g., BK6). This step provides an accurate starting position for route planning.

Screen 4: Destination Selection

Users select their intended destination within the same building (e.g., MPK 9). This allows the system to generate a relevant navigation route.

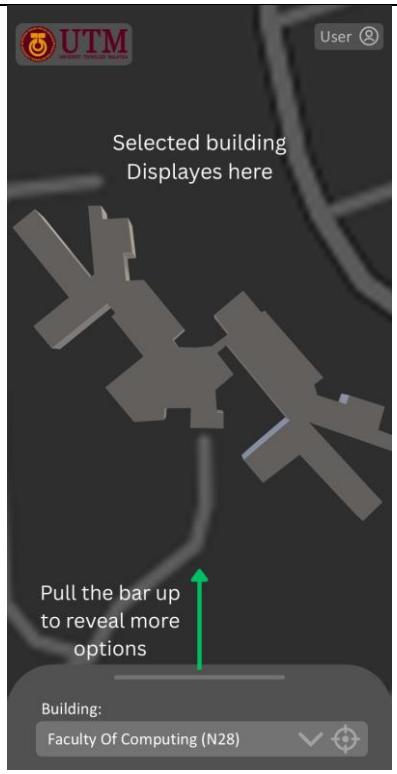
Screen 5: Route Confirmation

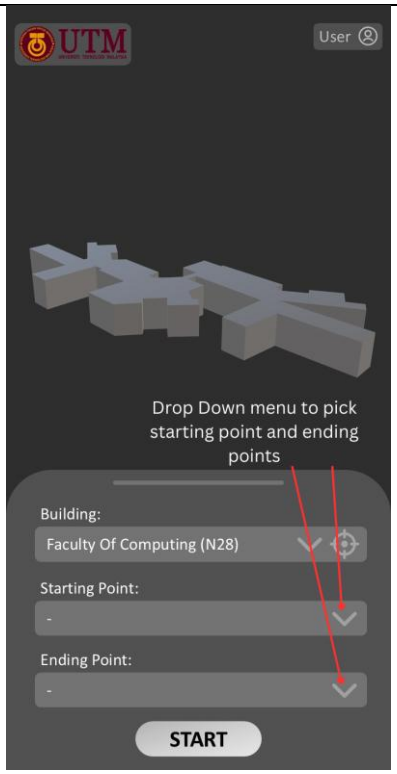
After all required inputs are selected, users tap the START button to initiate navigation. This confirms the route details before displaying the navigation view.

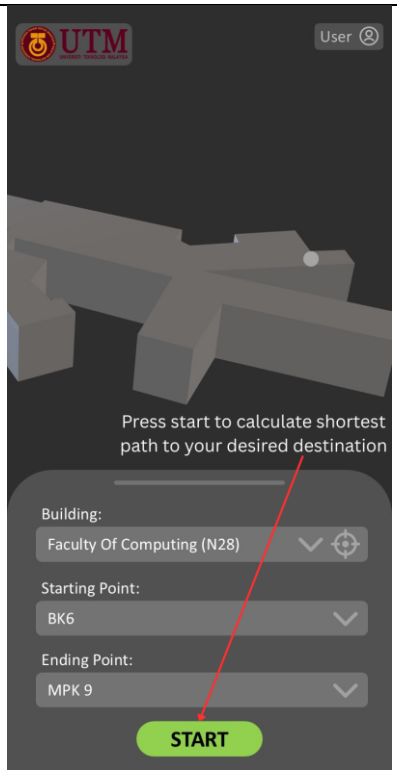
Screen 6: 3D Indoor Navigation View

The system displays the navigation route using a 3D representation of the building, guiding users visually through corridors and floor transitions until the destination is reached.

Pictures of the prototype (left to right):







 UTM User Shortest path to desired location is shown on screen	

5.5 Testing Phase

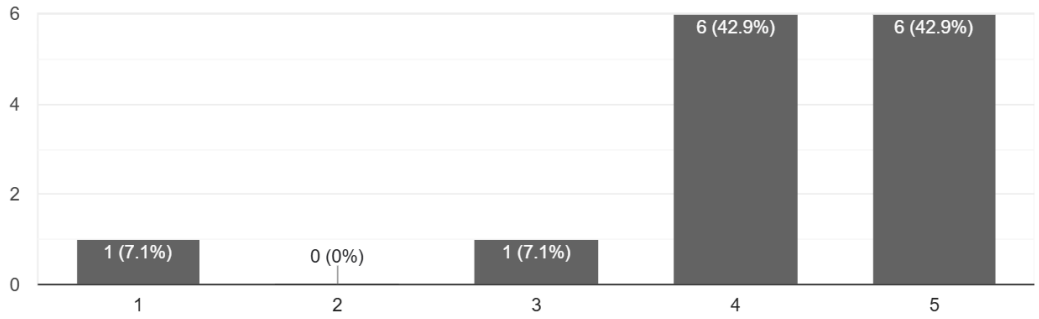
For this testing phase, we created another survey through Google Form, asking the users to test our prototype. After that, we ask for their opinions. Here are the feedbacks that we received from those users.

SECTION 2: FEEDBACK QUESTIONS

Were the features easy to understand?

Copy chart

14 responses



How clear was the navigation in the prototype?

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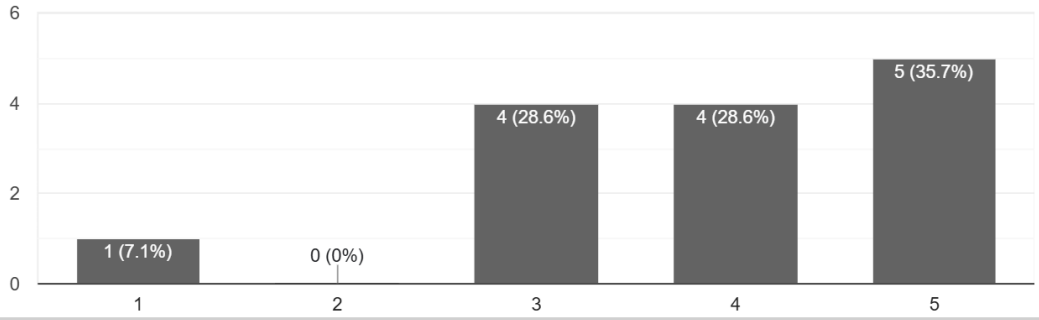
14 responses



How useful is the auto-detection feature?

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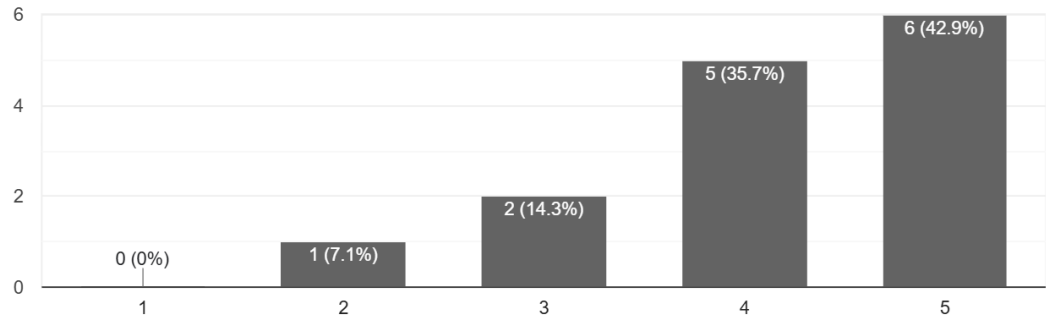
14 responses



How satisfied are you with the prototype overall?

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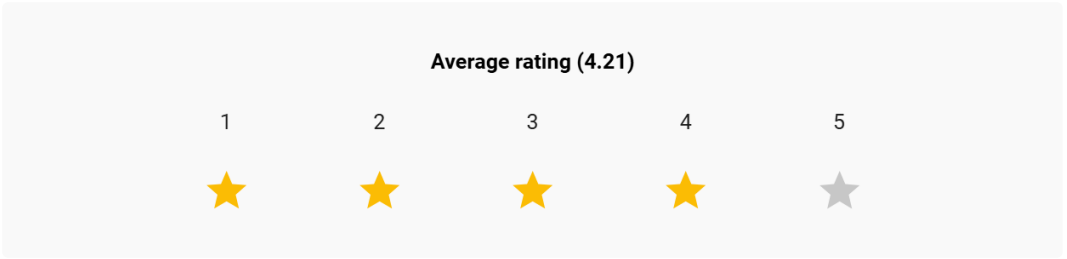
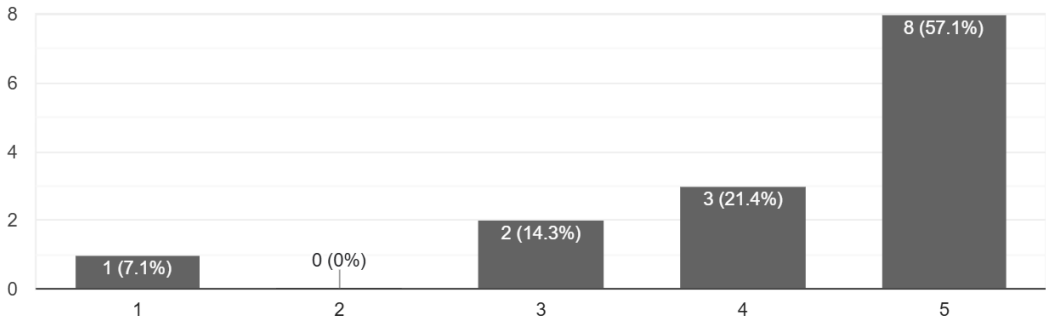
14 responses





6. Improvement

From the feedback received during the Testing Phase, several improvement suggestions were found to further optimize the effectiveness of the UTM Indoor Navigation System. The main suggestions are:

- Improved visual markers for floor transitions, like stairways, elevators, or similar, to better navigate a multi-level facility.
- Features aimed at making the system more accessible, such as routes for wheelchairs and easy-to-read labels for text.

Future improvements may also be applied to the following:

- Enhanced location accuracy by incorporating automated indoor positioning systems, such as Wi-Fi or Bluetooth-based detection, to decrease dependence on manually locating the device.
- Better visuals of the 3D map, incorporating important landmarks as well as the estimation of the walking time, to ensure more efficient navigation, thus enhancing the functionality of the system for practical use.

7. Reflections

AHMAD NUR SHAZLAN BIN BAHRI

My objectives are to cultivate strong analytical and research abilities to pursue a career in the technology field in the future. Through this project, I realized how critical it is to understand the needs of the end users by analyzing the collected data. To move forward in improving myself, I would like to enhance my abilities to conduct better data analysis and research and communicate effectively to design solutions based on the needs of the end users.

AMAL HIJAZ BIN ABD WAHID

My objective is to develop a strong skill set in problem-solving and system design. This project demonstrated the importance of structured thought processes and proper documentation in order to implement ideas in practical terms. In the future, my aim is to work on my technical writing, analysis, and teamwork abilities.

SHARWIN RAJ A/L K SEGAR

My aim would be to have a career in system design and software development. This project has helped me understand the role of Design Thinking and prototyping in making the system user-friendly. Going forward, my aim would be to increase my competence levels in the area of UI/UX design, prototyping, and software fundamentals.

AMREISH A/L UMAPATHY

My intention is to be employed in a technology field related to problem-solving and solution design. The project has made me realize the importance of empathy and feedback in defining problem-solving strategies and solutions. To enhance my preparedness in this field, I would like to develop my analytical and problem-solving abilities and learn more about working on projects and interpreting data.

8. Conclusion

In conclusion, the UTM Indoor Navigation System project effectively responds to the frequent challenges of navigation faced by students and visitors at Universiti Teknologi Malaysia. Through the application of methodologies from Design Thinking, the team identified user needs and found an appropriate, user-centered solution. The Dynamic 3D Indoor Map Application that was proposed can guide users through buildings with multiple floors by providing effective navigation, thus reducing confusion, wastage of time, and stress. Although the prototype is non-functional, it gives a clear demonstration of the system concept and a view of how user-centered design can improve navigation on campus and the overall experience.

9. Task Distribution

AHMAD NUR SHAZLAN BIN BAHRI

- Creating Google Form and collect survey responses
- Creating video

AMAL HIJAZ BIN ABD WAHID

- Writing the report (Introduction, Details Step, Details Description)
- Documenting and compiling all 5 phases into the report.

SHARWIN RAJ A/L K SEGAR

- Designing and producing the prototype.
- Producing the Prototype and Testing Phase

AMREISH A/L UMAPATHY

- Analysing and summarising the survey responses
- Producing the Problem Statement, Empathy and Define phase