UTM Indoor Navigation System

presented by SECP1513–04 Group 5

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INTRODUCTION

- Complex Indoor Environments: UTM's large campus features multi-story buildings and repetitive layouts that make navigation difficult.
- Navigation Hurdles: Students and visitors frequently struggle to locate specific rooms due to limited visual cues and confusing corridors.
- Inadequacy of Static Tools: Traditional signage and physical maps are often insufficient for real-time, indoor wayfinding.
- Negative Impact: Poor navigation leads to increased user stress, wasted time, and tardiness for classes or appointments.
- The Solution: A mobile-based indoor navigation system providing clear, visual, and user-friendly guidance across campus.

Problem Overview

- Users frequently get lost in multi-floor buildings
- This causes a lot of time wasted, people getting stressed and late arrivals
- Existing methods :

1. Physical signage
2. Static maps

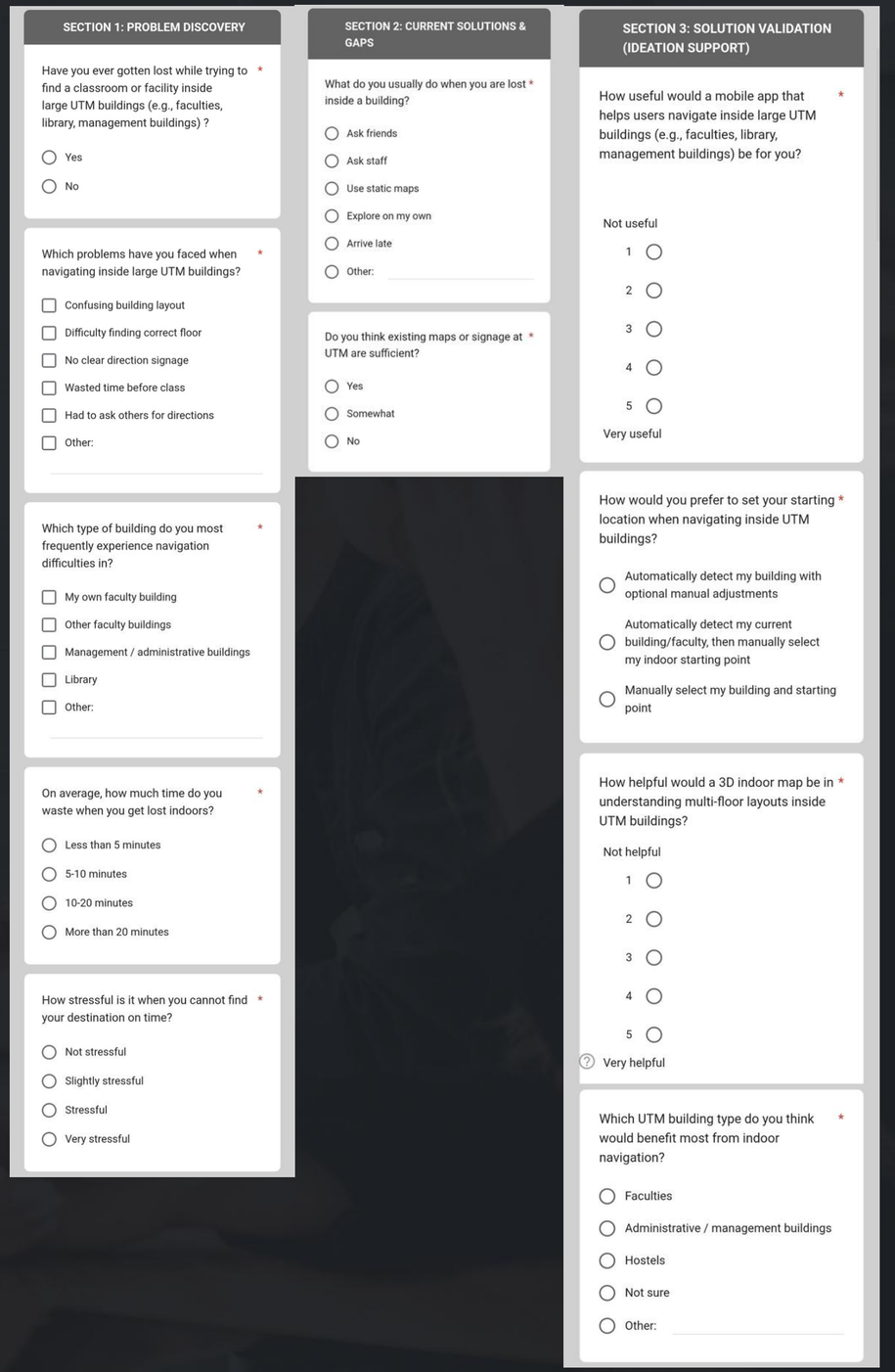
- → Not effective under time pressure

Design Thinking Approach

- Emphaty Phase
- Define Phase
- Ideation Phase
- Prototype Phase
- Testing Phase

Empathy Phase

- Primary Objective: To understand the real-world experiences and navigation hurdles faced by the UTM community.
- Data Collection: Conducted comprehensive surveys involving students, staff, and visitors to gather diverse perspectives.
- Key Insights: Identified common pain points, including navigation habits, specific difficulties, and user expectations.
- Major Findings: High levels of confusion within multi-floor buildings.
- Frequent difficulty in locating specific classrooms or offices.
- Significant stress and time-pressure during indoor wayfinding.



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) ? *
- ○ Yes
- ○ No

Which problems have you faced when navigating inside large UTM buildings? *
- ☐ Confusing building layout
- ☐ Difficulty finding correct floor
- ☐ No clear direction signage
- ☐ Wasted time before class
- ☐ Had to ask others for directions
- ☐ Other:

Which type of building do you most frequently experience navigation difficulties in? *
- ☐ My own faculty building
- ☐ Other faculty buildings
- ☐ Management / administrative buildings
- ☐ Library
- ☐ Other:

On average, how much time do you waste when you get lost indoors? *
- ○ Less than 5 minutes
- ○ 5-10 minutes
- ○ 10-20 minutes
- ○ More than 20 minutes

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

Which UTM building type do you think would benefit most from indoor navigation? *
- ○ Faculties
- ○ Administrative / management buildings
- ○ Hostels
- ○ Not sure
- ○ Other:

User Persona

Persona Name: Aiman Hakim

Age: 19

Role: First-year UTM Student

Background:

Aiman is a first-year undergraduate student who recently enrolled at Universiti Teknologi Malaysia. He is unfamiliar with complex faculty buildings that contain multiple floors and similar layouts.

Goals:

- Reach classes and labs on time
- Navigate buildings confidently
- Reduce stress before lectures

Pain Points:

- Confusing indoor layouts
- Unclear signage
- Difficulty identifying correct floors

Needs and Expectations:

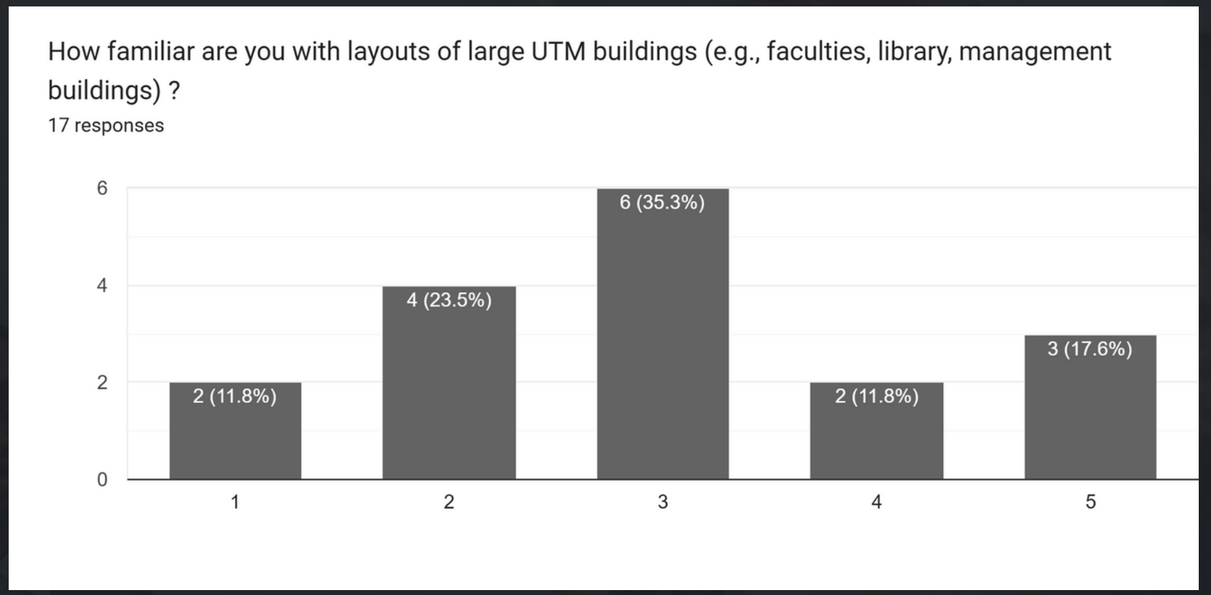
- Clear visual indoor navigation
- Step-by-step guidance between floors
- A mobile-based navigation solution

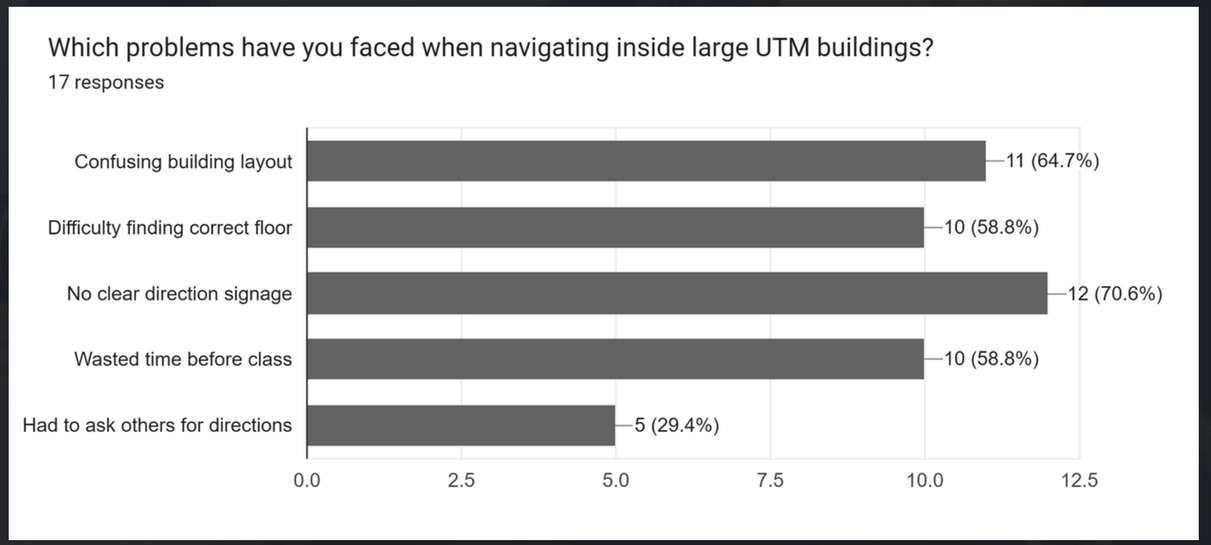
Define Phase

- Analysed survey data

Core problem:

- Current indoor navigation methods are ineffective
- Users lack confidence and waste time
- Established clear problem statement & objectives





Ideation Phase

- Optimal Solution: Selected the Dynamic 3D Floor Indoor Map as the most effective approach based on user feedback and identified needs.
- Prototyping Tool: Chose Microsoft PowerPoint to develop the non-functional prototype and visualize the system's interface and navigation flow.

meeting held on
6/1/2026

Solutions	Pros	Cons
Static 2D Indoor Map	• Simple and easy to create • Low cost • No special technology required	• Hard to interpret under time pressure • Poor support for multi-floor navigation • Not interactive or user-friendly
QR-Based Indoor Navigation	• More interactive than static maps • Can provide location-based directions • Works with mobile devices	• sers must first find QR codes • Depends on physical infrastructure • Inconvenient for route planning
Augmented Reality (AR) Navigation	• Highly visual and engaging • Real-world directions overlaid on camera view • Innovative user experience	• Requires high device performance • Resource-intensive • Overly complex for basic navigation needs
Dynamic 3D Indoor Map Application (Selected Solution)	• Clear visualisation of complex, multi-floor buildings • Interactive and easy to understand • No dependence on physical markers (QR codes) • Less resource-heavy than AR • Allows route planning in advance	• Requires initial development of 3D building models • Depends on accurate indoor location data

Why We Chose Dynamic 3D Indoor Map?

- Optimal Balance: Provides the best mix of usability and practicality for visualizing complex, multi-floor layouts without the high resource demands of AR.
- Infrastructure-Free: Unlike QR-based systems, it operates without physical markers and allows users to plan routes in advance.
- User-Centric Design: Features automatic floor detection with manual overrides, directly addressing pain points identified in earlier phases.
- Feasibility: Offers a clear, visual navigation experience that is well-suited for a non-functional prototype and mobile deployment.

Prototype Phase

Development Goal

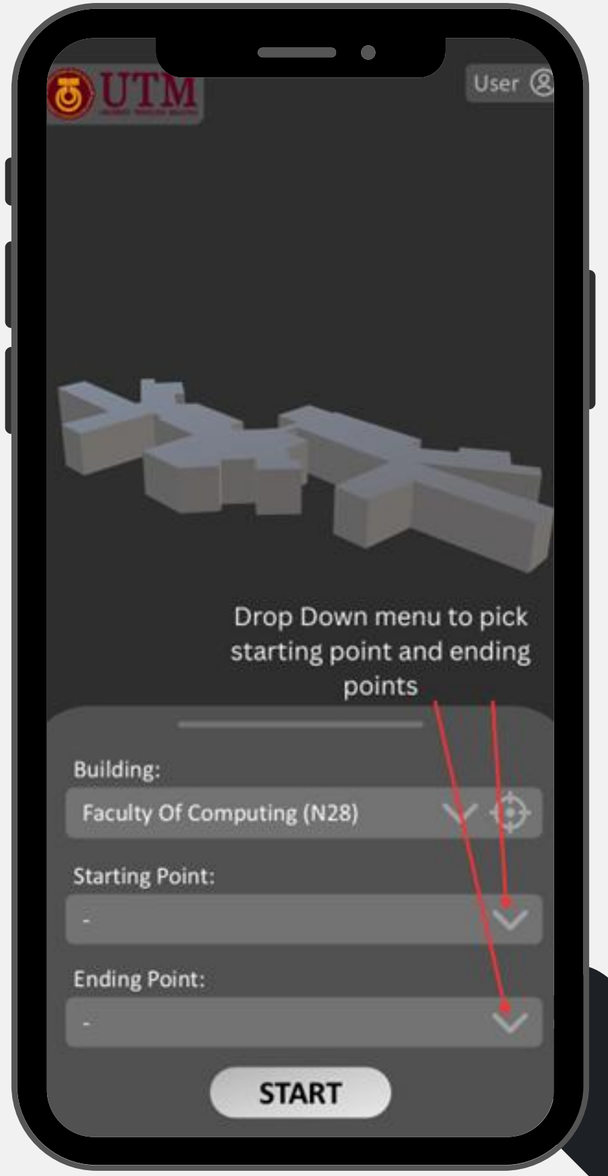
Created a non-functional prototype to demonstrate the UI, navigation flow, and core features without full technical implementation.

User Centric Design Requirements

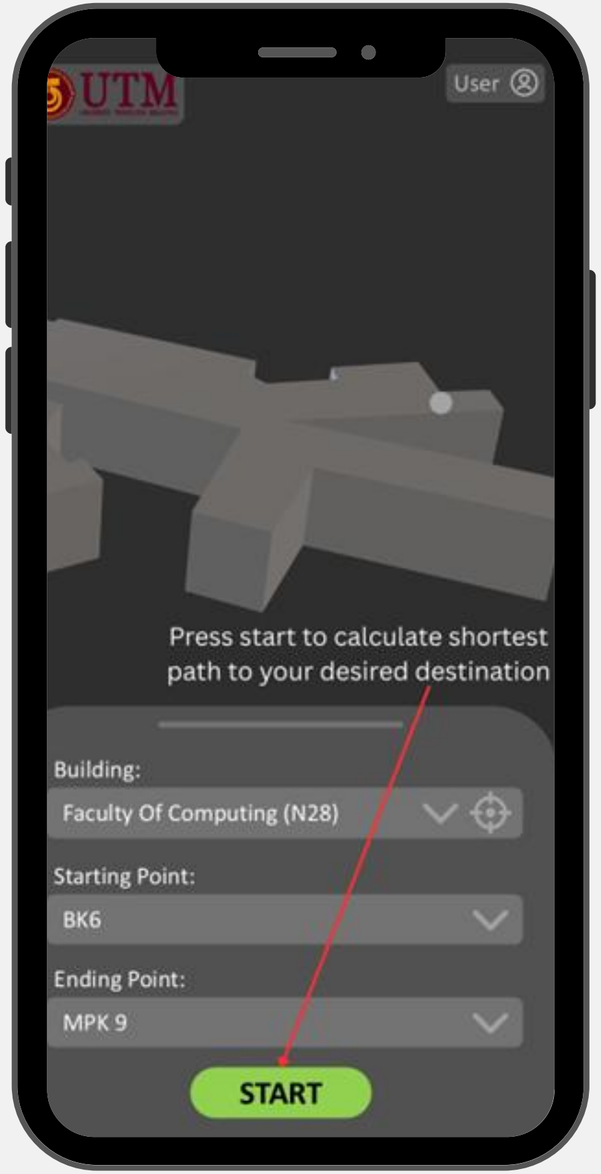
- Minimalist UI: Simple interface designed to reduce user cognitive load.
- Guided Planning: Clear, step-by-step navigation for ease of use.
- 3D Spatial Models: High-quality visual representation of complex indoor spaces.
- Manual Precision: User-selected start and end points to ensure navigation accuracy

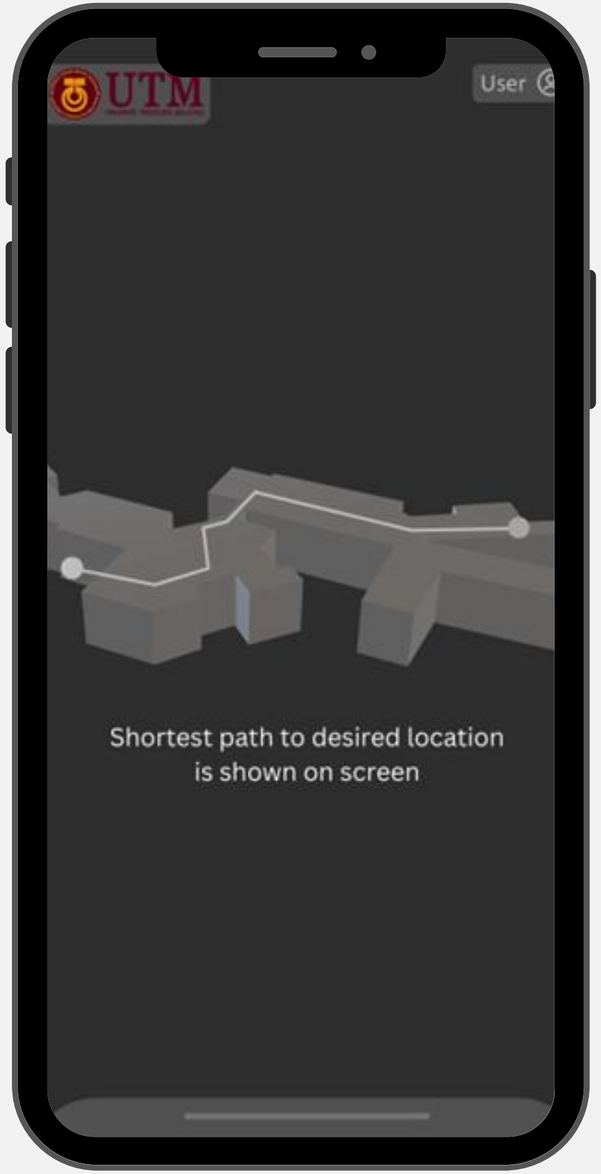
How the System Works

Convenience at your Fingertips



How the System Works

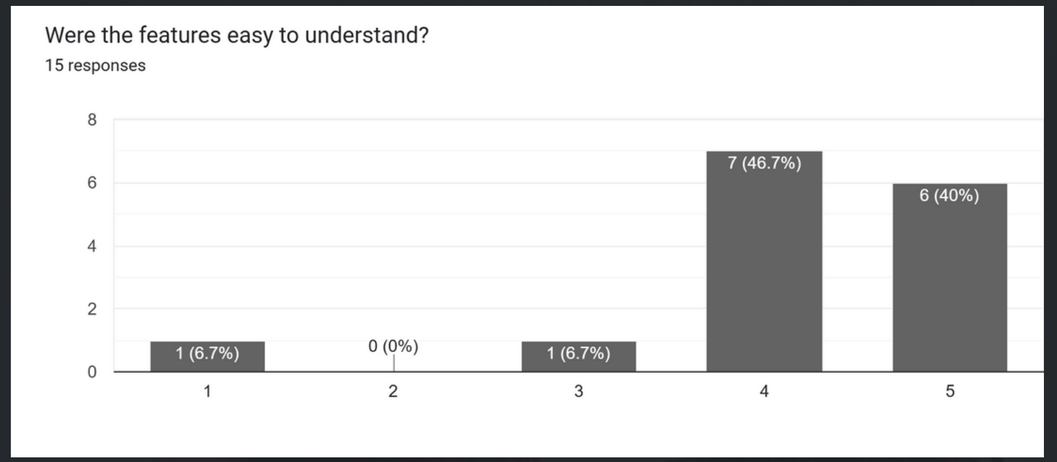


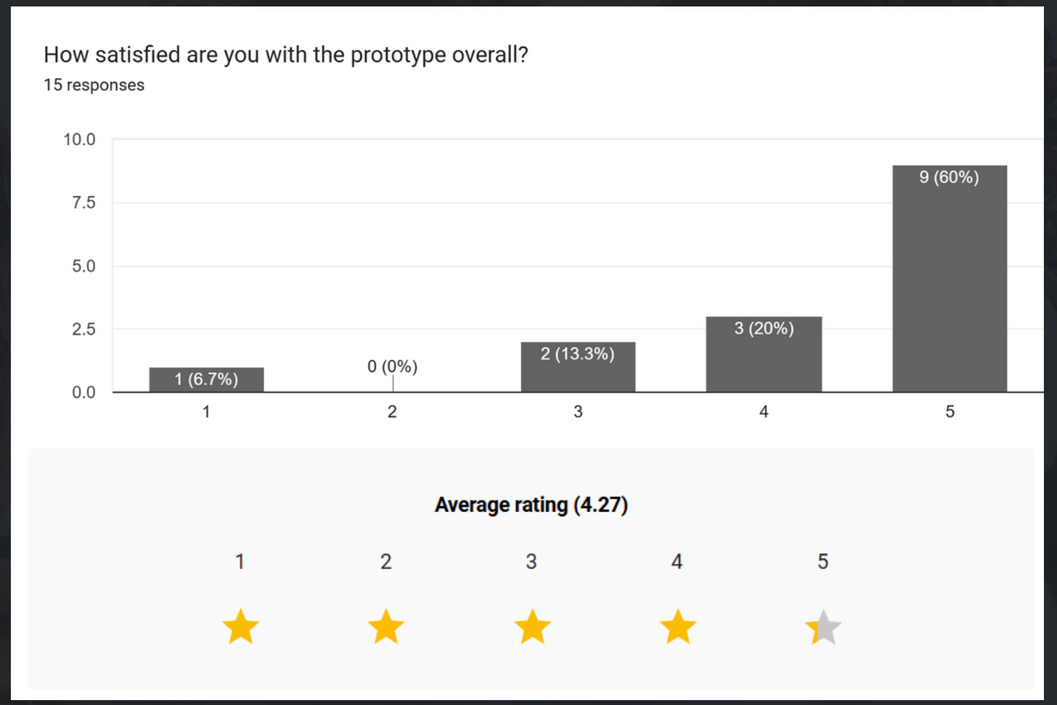


Testing Phase

- Users evaluation on the prototype via Google Form

- Feedback collected on:
  - Usability
  - Interface clarity
  - Navigation concept
  - Used for future improvements





Feedback & Future Enhancements

- **Improved Vertical Navigation**
  Add clearer visual markers for floor transitions, such as stairways and elevators, to simplify multi-level movement.
- **Inclusive Accessibility**
  Incorporate wheelchair-friendly routing and high-contrast, easy-to-read labels for improved text legibility
- **Automated Positioning**
  Integrate Wi-Fi or Bluetooth-based detection to provide real-time location accuracy and reduce manual input.
- **Enhanced Map Details**
  Refine 3D visuals with recognizable landmarks and provide estimated walking times for more efficient trip planning.

CONCLUSION

- ***Problem-Solution Fit: Successfully addressed UTM's complex navigation challenges by applying a user-centered Design Thinking methodology.***
- ***Enhanced Experience: The Dynamic 3D Indoor Map provides an intuitive visual guide, significantly reducing user stress and time wastage.***
- ***Concept Validation: While non-functional, the prototype effectively demonstrates a flow and feature set that aligns with the "Future Digital Campus" theme.***
- ***Impact: Highlights how digital innovation can improve campus accessibility and the overall experience for students, staff, and visitors.***

Frequently Asked Questions (FAQ)

Why do students need an indoor navigation system?

UTM buildings are large and complex, especially for new students and visitors. Finding classrooms, labs, or offices inside multi-floor buildings can be confusing and stressful, particularly when time is limited before classes.

How is this different from Google Maps?

Google Maps works well for outdoor navigation but provides limited support inside buildings. This system focuses specifically on indoor spaces, offering clearer visual guidance between rooms and floors.

Why do students need an indoor navigation system?

A 3D map helps users better understand spatial layout, including stairs, corridors, and floor changes. This makes it easier to visualise routes compared to flat 2D maps.

Who would benefit most from this system?

New students, visiting students, parents, and guests who are unfamiliar with UTM building layouts would benefit the most from this system.