



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
UTM Johor Bahru

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SECD2613 SYSTEM ANALYSIS AND DESIGN

Project: Phase 3

<NavUTM>

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1.0 Overview of the Project

In the current phase of our project, our focus is on gathering information requirements and analyzing system needs prior to designing the recommended system. To collect the necessary data, we conducted a survey targeting UTM students via Google Forms. This survey aimed to capture a range of opinions regarding the existing bus system, identifying both areas for improvement and current inconveniences faced by the users.

Following the collection of these requirements, we proceeded to analyze the system needs through an AS-IS analysis. This method allowed us to gain a comprehensive understanding of the current processes and identify key pain points. Conducting a thorough AS-IS analysis provided us with valuable insights into the existing operations, setting a solid foundation for implementing effective changes that would enhance both service quality and operational efficiency.

To facilitate better understanding and communication among stakeholders, we developed data flow diagrams (DFDs) to visualize how data flows within the proposed system. These diagrams help in simplifying complex systems and consist of a parent diagram (context diagram) and child diagrams. The context diagram provides an overview of the entire system with one process, external entities, and major data flows. It is further broken down into a level 0 diagram, where each process is detailed. This parent diagram is then decomposed into child diagrams, ensuring consistency in input and output.

By creating these DFDs, we can more effectively identify system requirements and functional dependencies. This holistic approach ensures that the new bus system can meet the evolving needs of both passengers and administrators, ultimately leading to a more reliable and user-friendly transportation service.

In more detail, the context diagram represents the high-level view of the system, showing the interaction between the system and external entities such as students, bus drivers, and administrative staff. Each child diagram delves deeper into specific processes, such as scheduling, ticketing, and real-time tracking, providing a granular view of the system's functionality.

This phase of our project not only highlights the importance of detailed analysis and visualization in understanding current challenges but also demonstrates how these tools can

guide us toward more efficient and effective system design. By ensuring all stakeholder needs are considered and addressed, we aim to develop a bus system named NavUTM that significantly improves the daily commute experience for UTM students.

NavUTM is designed specifically for UTM students, providing real-time updates on bus schedules, routes, and delays. This tool aims to make commuting more efficient and less stressful, integrating seamlessly with our proposed enhancements to the bus system. By addressing immediate needs and planning for future improvements with innovative tools like NavUTM, we aim to create a significantly enhanced daily commute for all UTM students.

2.0 Problem Statement

1. Inability to Track Bus Locations

The bus system currently in place at UTM has significant shortcomings, especially in its failure to provide accurate, real-time information about bus locations. As it stands, the system only indicates the departure time from the initial station and the arrival time at the final stop, leaving students in the dark about the actual timing of stops along the route. This often leads to buses arriving unpredictably, sometimes 10 minutes early or 20 minutes late. Because of this uncertainty, students feel compelled to arrive at the bus stop as much as 30 minutes early, just to avoid missing the bus. This results in a significant waste of time, and many students prefer to walk to their destinations to avoid the hassle of waiting.

Objective: To develop a sophisticated real-time bus tracking system that allows students to see the exact location of buses at any given moment. This will minimize the waiting time at bus stops, make the system more reliable, and save students valuable time.

2. Lack of Bus Occupancy Information

Another major issue with the current system is its inability to provide information about the number of passengers on a bus at any given time. During peak hours, especially in the mornings when students are rushing to classes, buses often fill up quickly. Without knowing the occupancy levels, students frequently encounter fully loaded buses, making it impossible for them to board. This leads to overcrowded buses that compromise comfort and safety, particularly if sudden stops are required. Conversely, buses that are underutilized represent a waste of resources. Having real-time occupancy data is crucial for maintaining a balanced and efficient transportation service.

Objective: To implement a system that displays real-time occupancy data for each bus. This will help students decide whether to wait for the next bus or seek alternative transportation, thereby optimizing bus use and enhancing passenger comfort and safety.

3. Insufficient Route Information

The current bus tracking system does not provide adequate information about bus routes or the specific stops each bus services within UTM. This lack of detailed route information forces students to rely on general navigation apps like Google Maps or Waze, which do not account for the unique layout and numerous shortcuts within the university campus. Additionally, since buses do not stop at every bus stop, students often experience confusion and uncertainty about which bus will stop where. This uncertainty results in longer waiting times and missed buses, disrupting students' schedules and daily routines.

Objective: To create a comprehensive routing system that clearly outlines all bus routes and stops within UTM. This system will enable students to plan their journeys with confidence, reducing waiting times and ensuring they reach their destinations efficiently.

3.0 Proposed Solutions

In the dynamic and vibrant campus environment of Universiti Teknologi Malaysia (UTM), NavUTM represents a transformative step towards improving the daily commute for its community members. This innovative system replaces the outdated paper-based bus schedules with a state-of-the-art real-time GPS tracking system, bringing a new level of precision and convenience to campus navigation.

NavUTM revolutionizes the way students and staff plan their journeys by providing accurate, live updates on bus locations. Unlike the static PDF schedules that quickly become obsolete, NavUTM ensures that users are always informed about the exact whereabouts of their buses. This real-time information allows for better planning and reduces the time wasted waiting for buses, as users can now adjust their schedules based on current traffic conditions and estimated times of arrival (ETAs).

One of the standout features of NavUTM is its real-time bus occupancy tracking. This feature gives detailed information about the number of passengers on each bus at any given time. When a bus reaches full capacity, NavUTM doesn't leave students stranded. Instead, it suggests alternative routes or different buses, ensuring that everyone can continue their journey with minimal disruption. For instance, if Bus A is delayed due to traffic, NavUTM's intelligent algorithms might suggest taking Bus B and then transferring to Bus C to reach the destination more efficiently. This dynamic routing ensures that users experience the most efficient and comfortable transit possible.

To further enhance the commuting experience, NavUTM offers personalized notifications that synchronize bus arrivals with individual schedules. This feature helps students arrive punctually for lectures and other important appointments, minimizing the stress associated with commuting.

Another significant aspect of NavUTM is its real-time communication interface. This allows the campus community to actively report traffic incidents, such as congestion, accidents, or road closures, directly through the app. This collaborative approach ensures that the system has access to comprehensive, real-time data, which it uses to recalibrate maps and propose the most effective navigation routes. A verification system is in place to authenticate the accuracy of reported incidents, and users are rewarded with points for their contributions.

This fosters a sense of community engagement and encourages users to actively participate in improving the overall transportation system.

NavUTM places a high priority on security and privacy. It employs advanced encryption techniques and secure data processing methods to protect user information. This commitment to data protection provides users with peace of mind, knowing that their personal information is safe as they navigate the campus.

By integrating these advanced features, NavUTM significantly enhances the predictability and reliability of campus bus services. It offers a smooth, efficient, and stress-free commuting experience, making daily travel more convenient and enjoyable for the entire UTM community.

4.0 Current Business Process/Workflow

1. User Login

- Users authenticate and log into the system using their credentials.

2. Main Menu Display

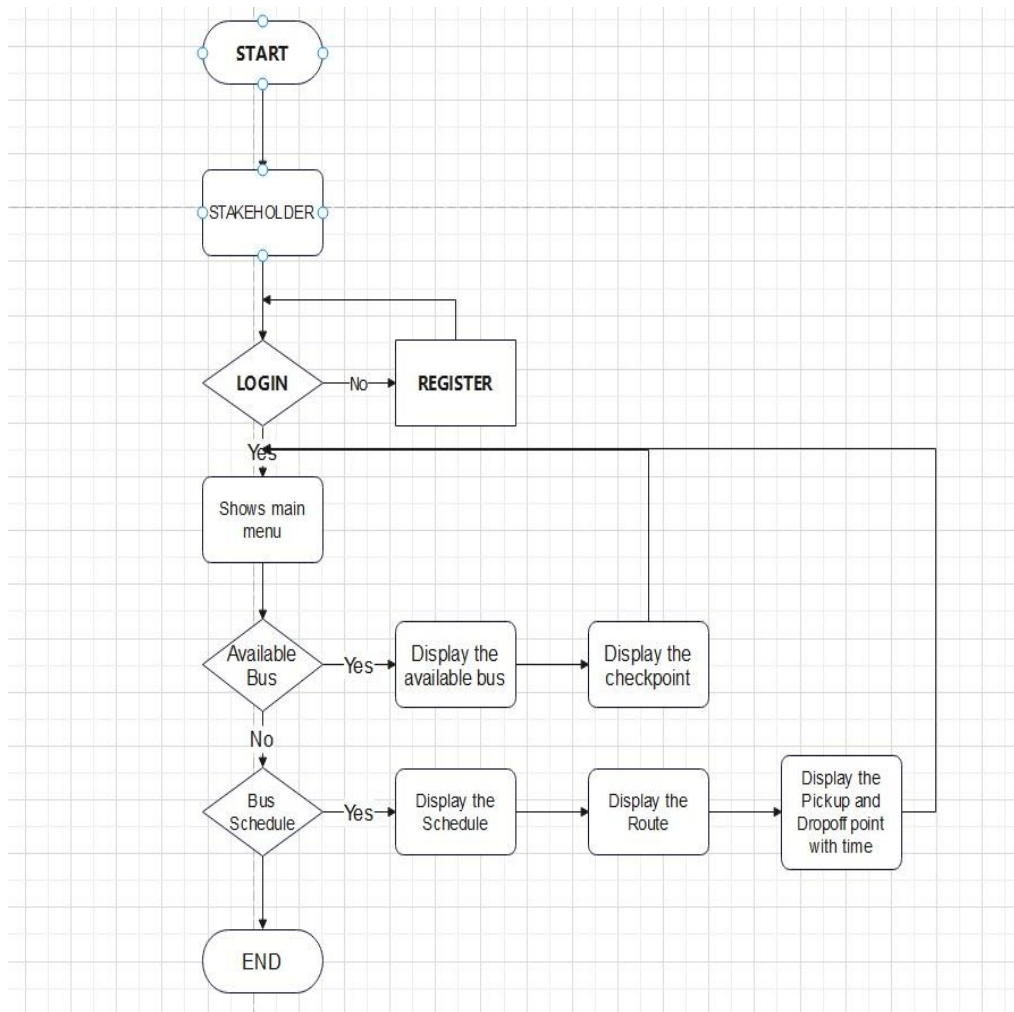
- After logging in, users are presented with the main menu that displays various options.

3. Viewing Available Buses

- Users select the option to view available buses.
 1. The system lists all buses that are currently in service and available for use.
 2. The system provides detailed information on each bus, including their current checkpoints and routes.

4. Viewing Bus Schedules

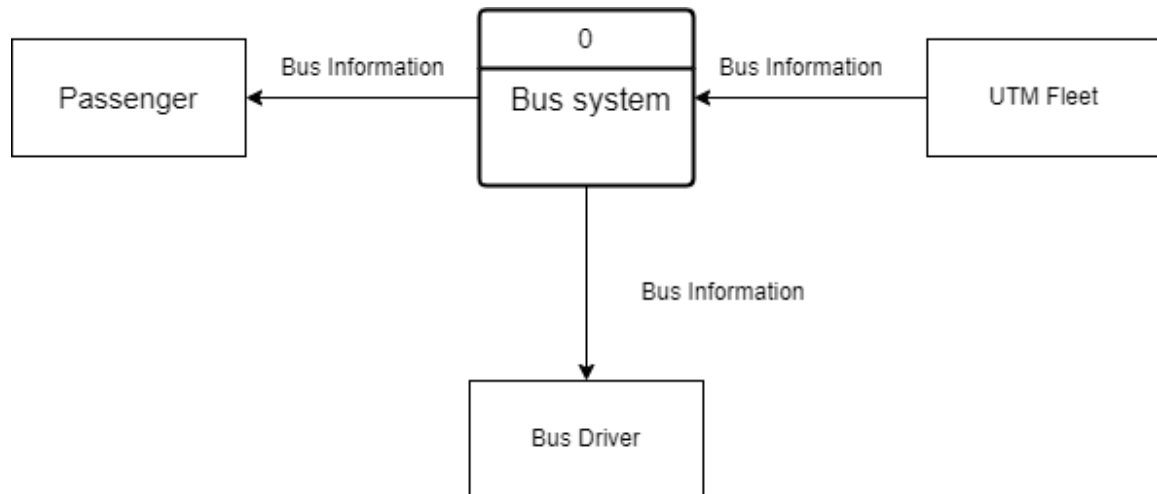
- Users select the option to view bus schedules.
 1. The system displays the bus schedules, categorized by groups and time slots throughout the day.
 2. Detailed routes for each bus are shown, including all intermediate stops.
 3. The system also provides specific times for each pick-up and drop-off point, ensuring users can plan their journeys accurately.



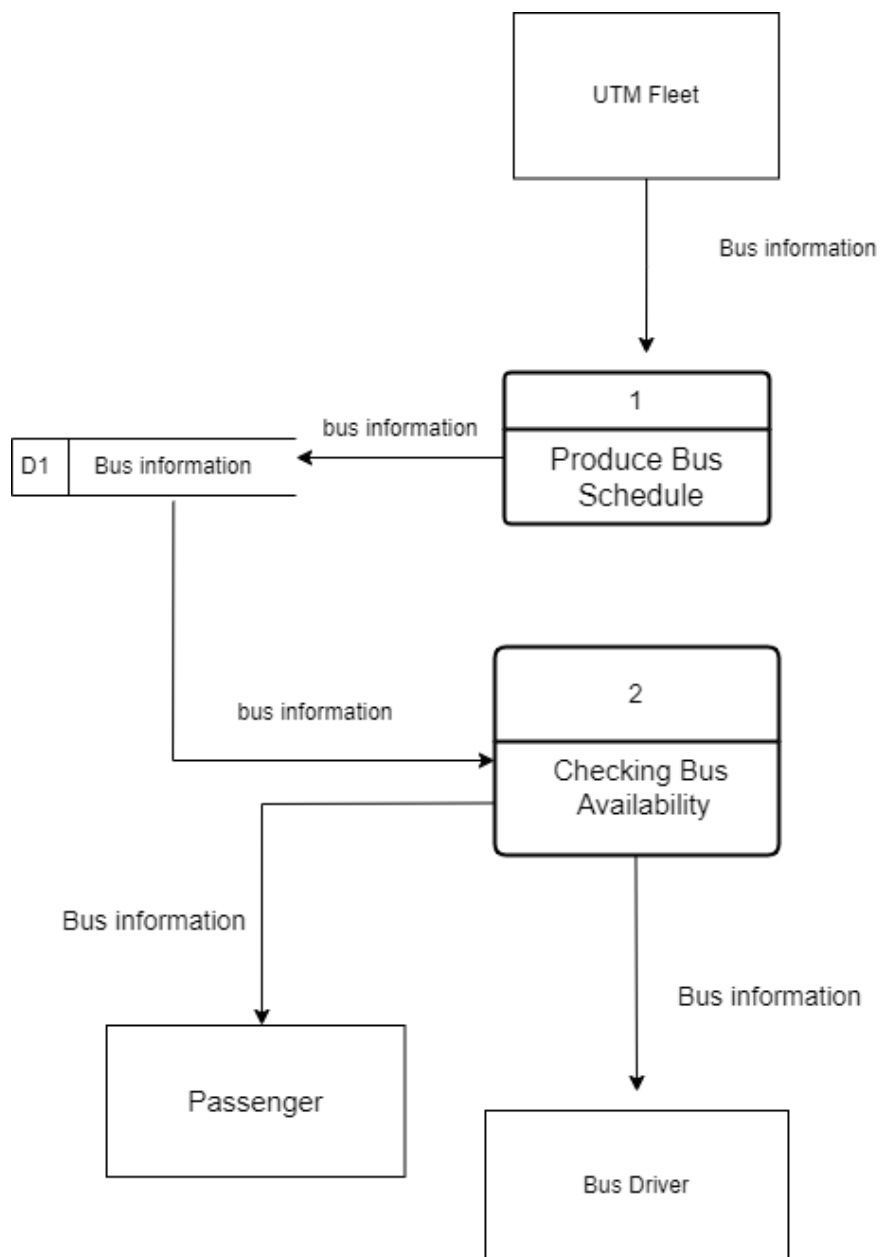
AS-IS System Workflow

5.0 Logical DFD (AS-IS)

- Context Diagram



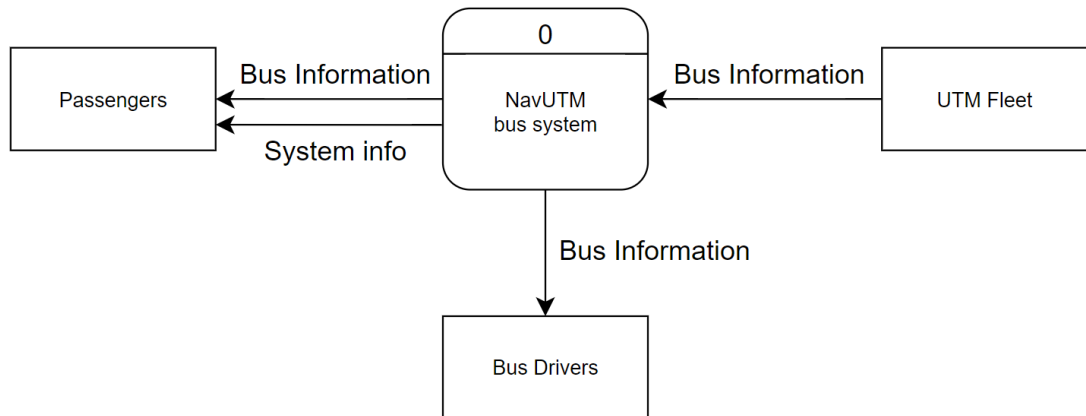
- **Level 0 Diagram**



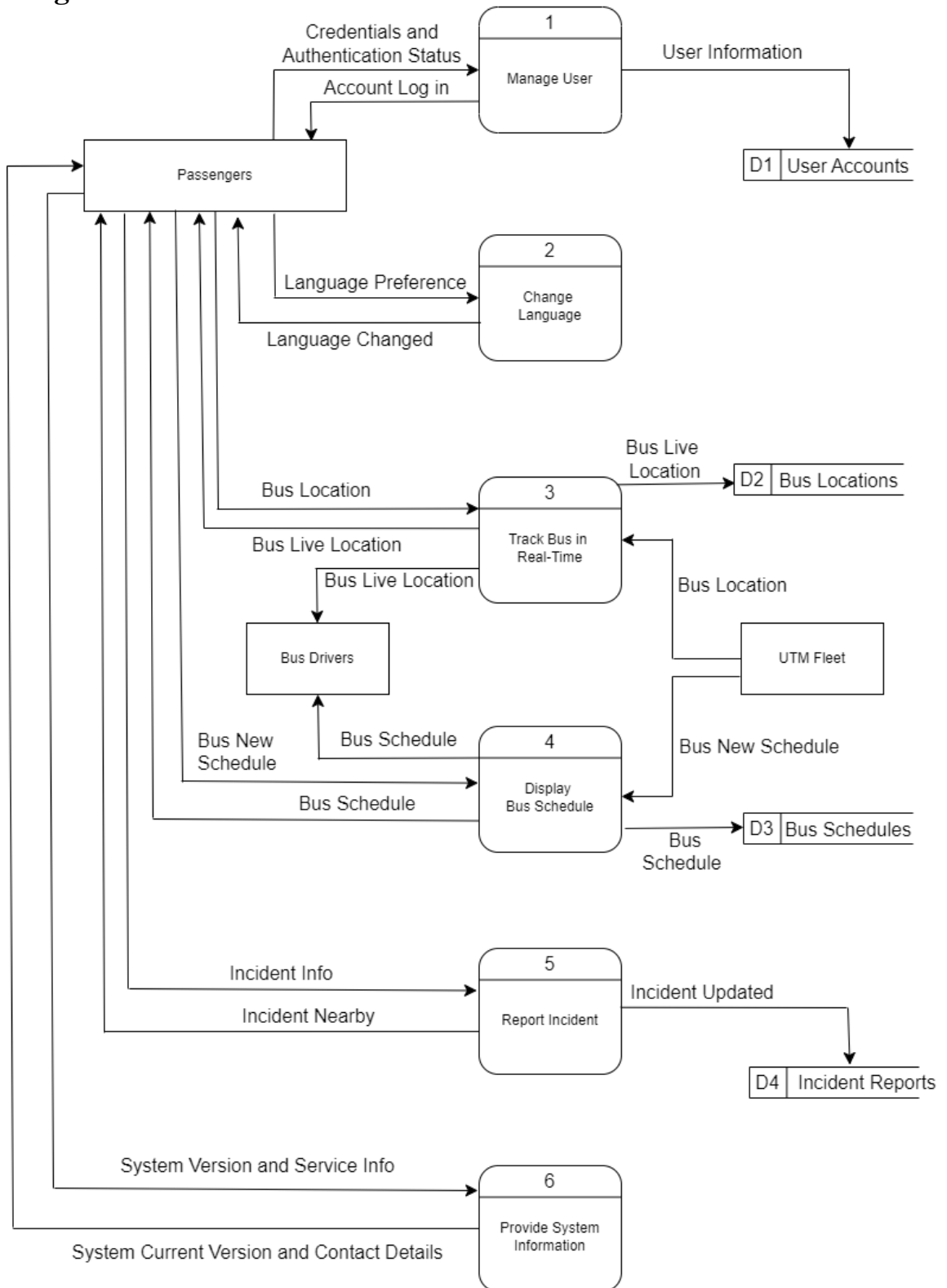
6.0 System Analysis and Specification

6.1 Logical DFD TO-BE system (Context Diagram, Diagram 0, Child)

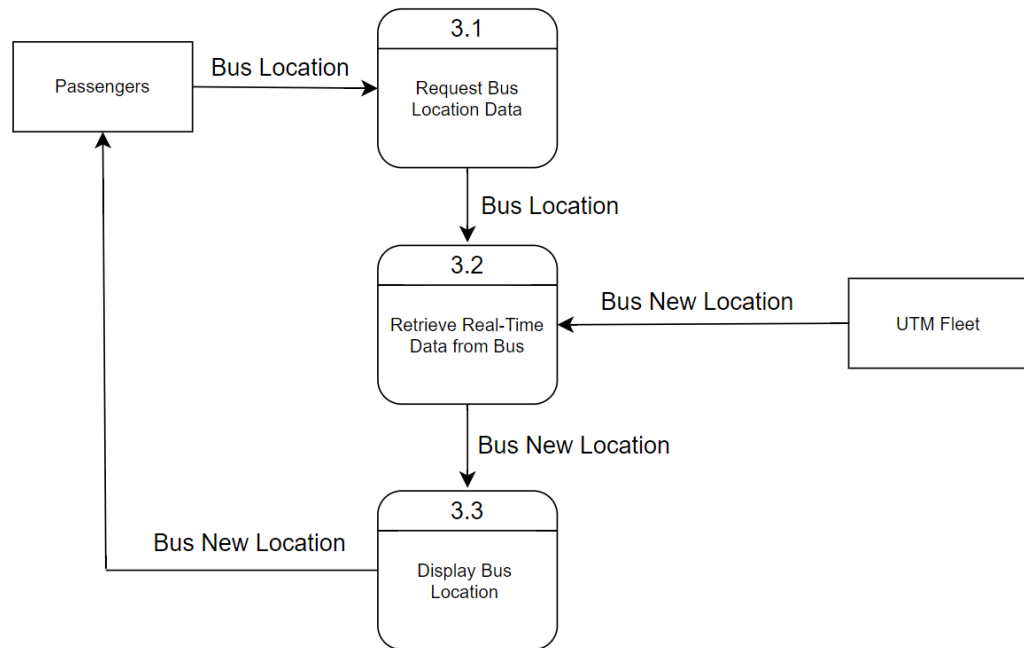
- Context Diagram



- **Diagram 0**



- **Child Diagram**

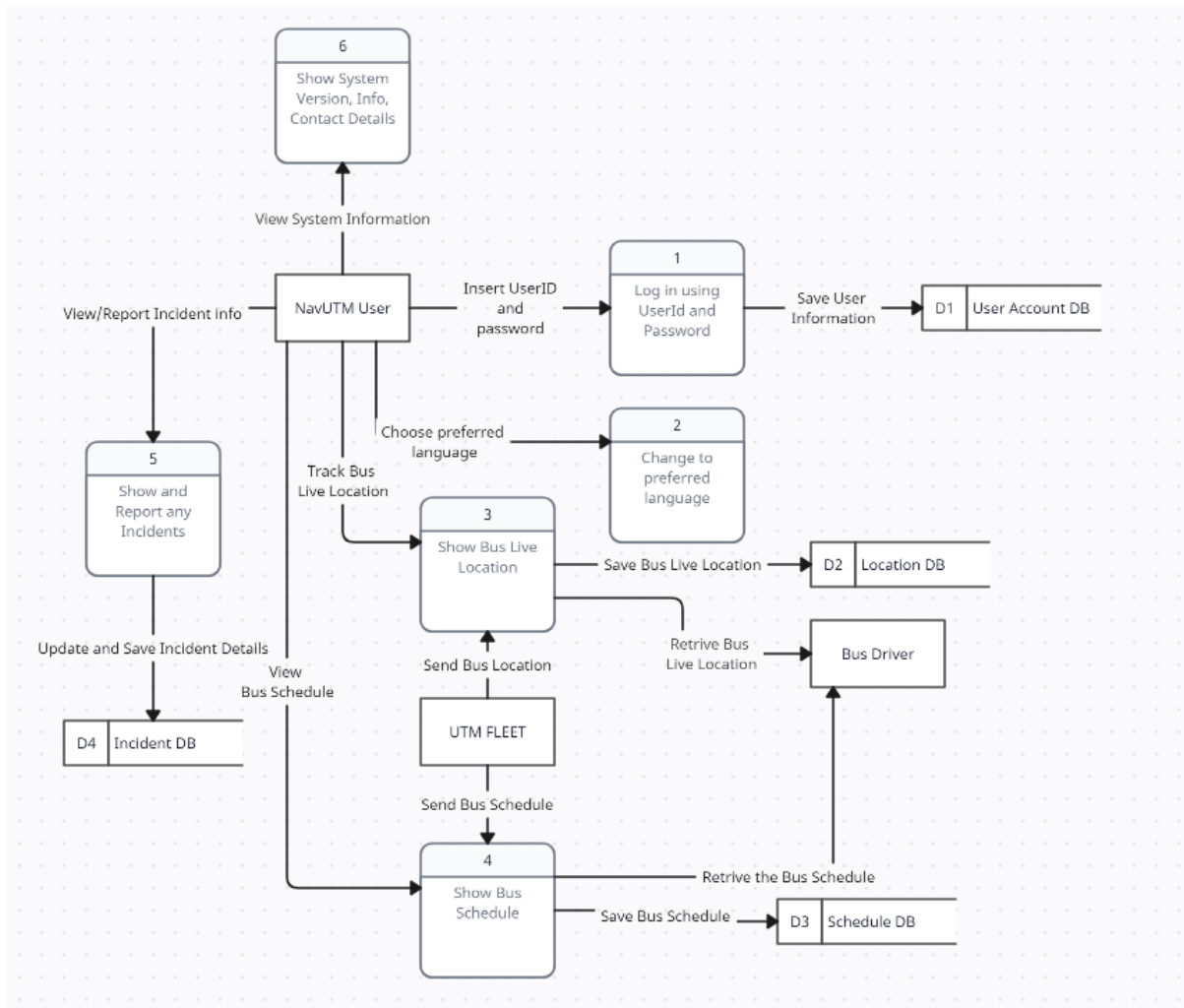


6.2 Process Specification (based on Logical DFD TO-BE)

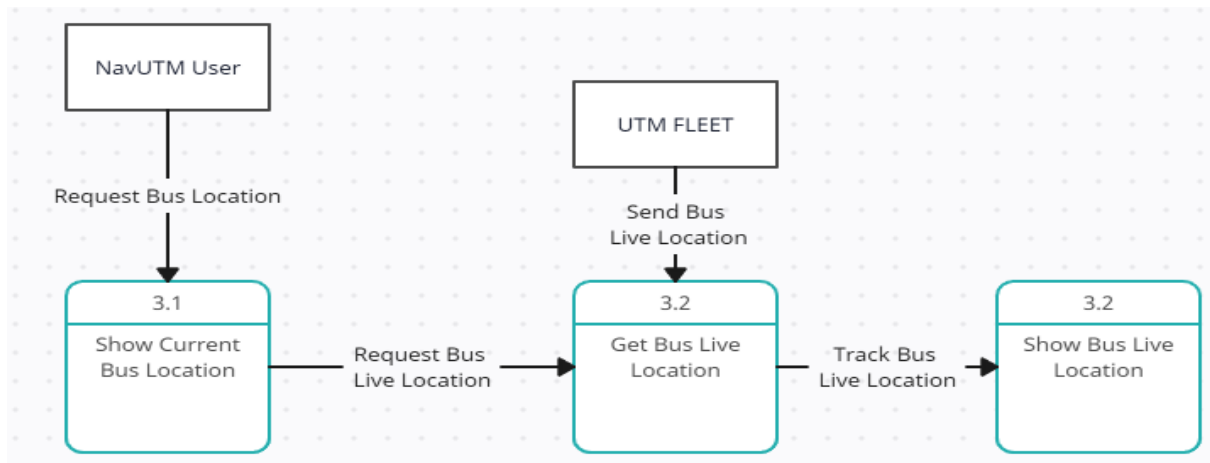
Process	Inputs	Outputs
Manage User	- Credentials and Authentication Status	- User Information - Account Log in
Change Language	- Language Preference	-Language Changed
Track Bus in Real-time	- Bus Location	-Bus Live Location
Display Bus Schedule	- Bus New Schedule	-Bus Schedule
Report Incident	- Incident Info	-Incident Updated -Incident Nearby
Provide System Information	- System Version and Service Info	- System Current Version - Contact Details

7.0 Physical System Design

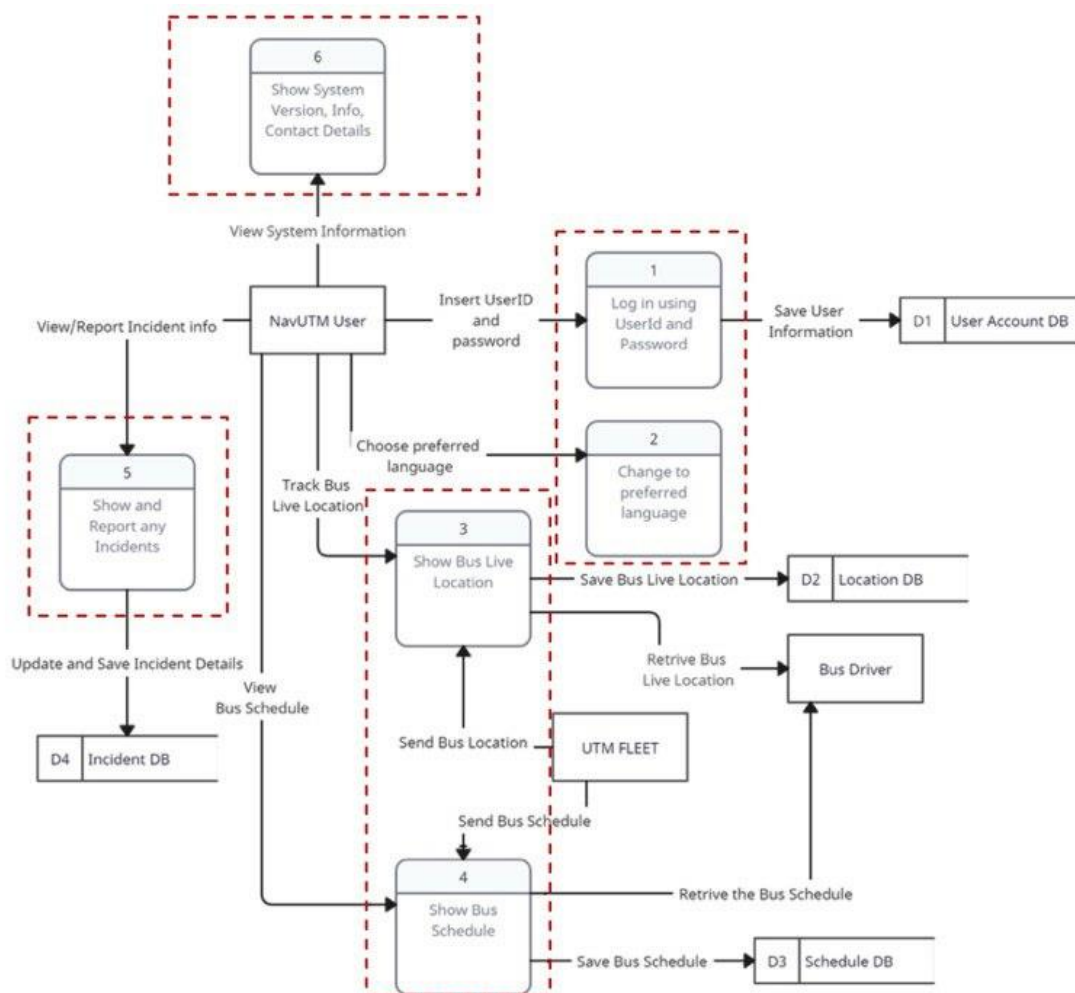
7.1.1 Diagram 0



7.1.2 Child Diagram



7.1.3 Partitioning



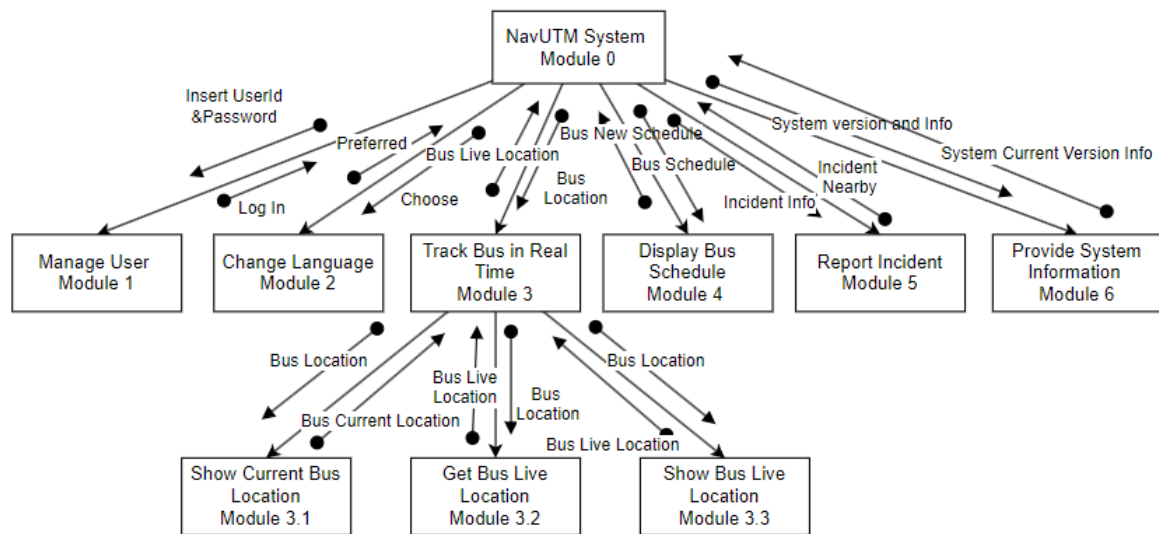
- 7.1.4 CRUD Matrix

Activity	User	Bus Driver	UTM FLEET
User Log in	CR	-	-
Change Language	U	-	-
Show Bus Live Location	R	CUD	RUD
Show Bus Schedule	R	RUD	CUD
Show Incident	R	-	-
Report Incident	C	-	-

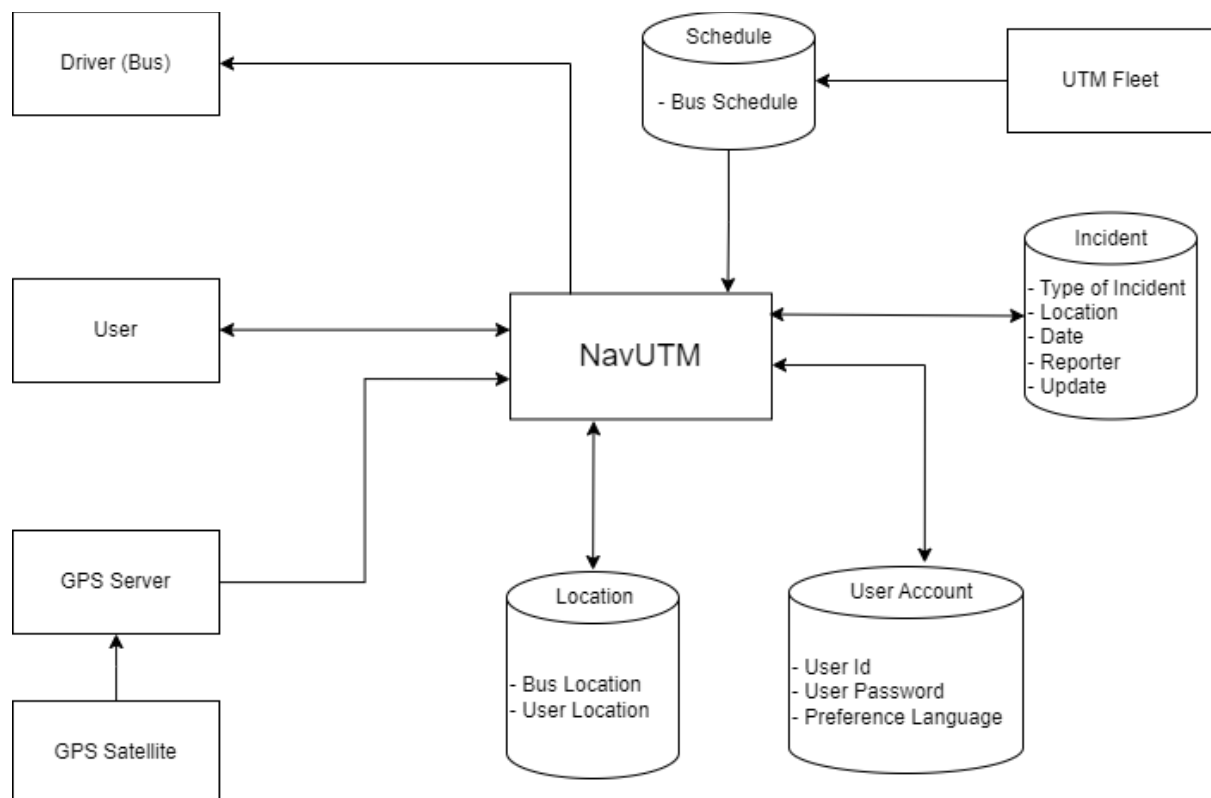
- 7.1.5 Event Response Table

Event	Source	Trigger	Activity	Response	Destination
User Log in	User	UserID and password	Insert UserId and password. Open Main Page	Login Page	User
User change language	User	Language choices	Choose a preferred language	Setting Page	User
User track bus live location	User	Bus Live Location	Display Bus live location	Real Time Location Page	User
User view bus schedule	User	Bus Schedule	Display Bus Schedule	Bus Schedule Page	User
User report incident	User	Submit an incident	Store the incident in Incident DB	Report Incident Page	User
User view incident	User	Incident Information	Display incident	Locate Page	User
User view system info	User	System Information	Display System information	Setting Page	User

7.1.6 Structure Chart



7.1.7 System Architecture

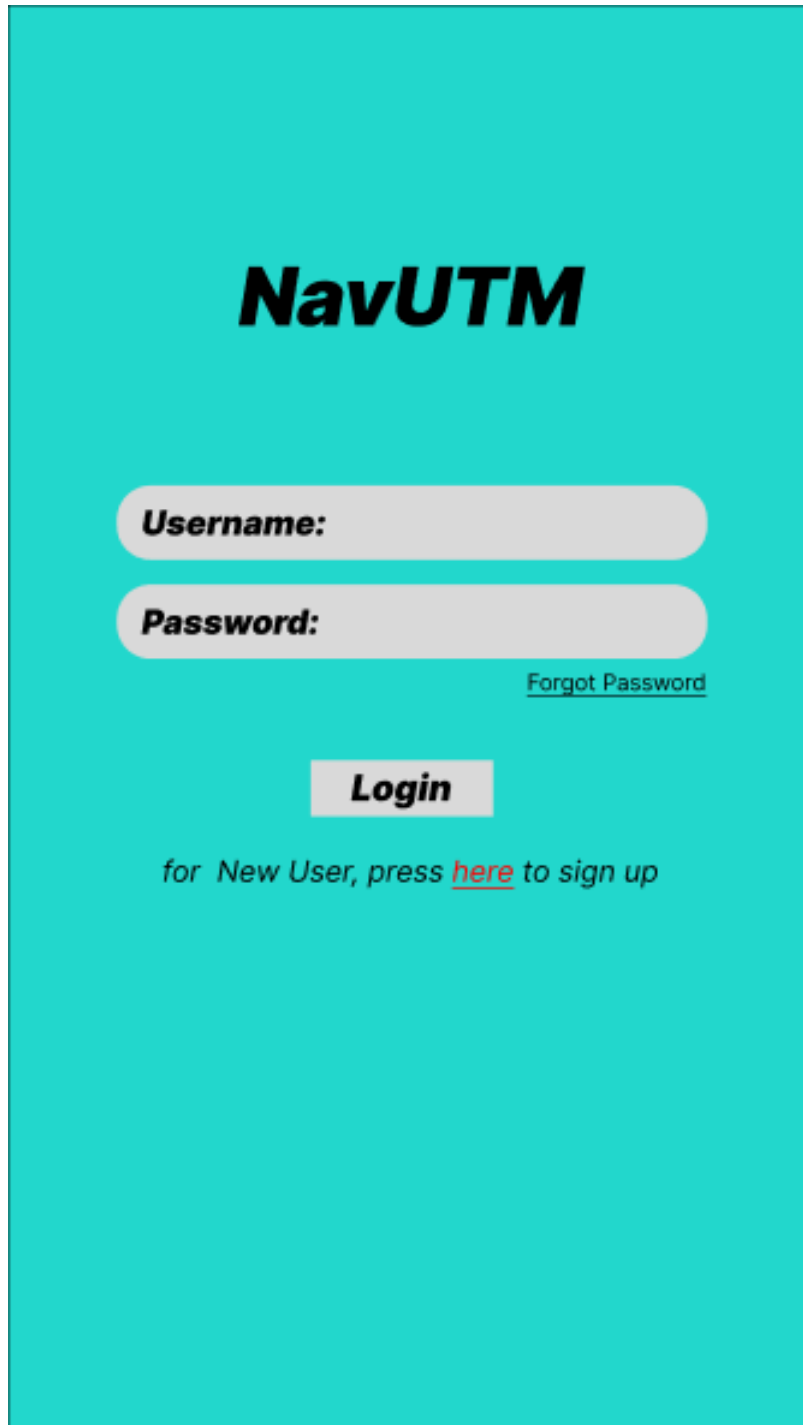


8.0 System Wireframe (Input Design, Output Design)

Figma Link:

<https://www.figma.com/proto/4nQBY7PKTiY3GBiSfFq8AW/SAD-Phase-3?node-id=0-1&t=J4Qv9FvEDxbi2sRg-1>

Login Page



The image shows a login page wireframe for 'NavUTM'. The background is a solid teal color. At the top center, the text 'NavUTM' is displayed in a large, bold, black sans-serif font. Below the logo, there are two rounded rectangular input fields. The first field is labeled 'Username:' in a bold, black sans-serif font. The second field is labeled 'Password:' in a bold, black sans-serif font. To the right of the password field, the text 'Forgot Password' is written in a smaller, black sans-serif font and is underlined. Below the input fields, there is a rectangular button with the text 'Login' in a bold, black sans-serif font. At the bottom of the page, the text 'for New User, press [here](#) to sign up' is displayed in a smaller, black sans-serif font, with the word 'here' in red and underlined.

NavUTM

Username:

Password:

[Forgot Password](#)

Login

for New User, press [here](#) to sign up

Forgot Password Page

NavUTM

Enter email that associated with your account and we will send you a link to reset your password

Email:

Reset Password

[Login Page](#)

Sign Up Page

NavUTM

Username:

Email:

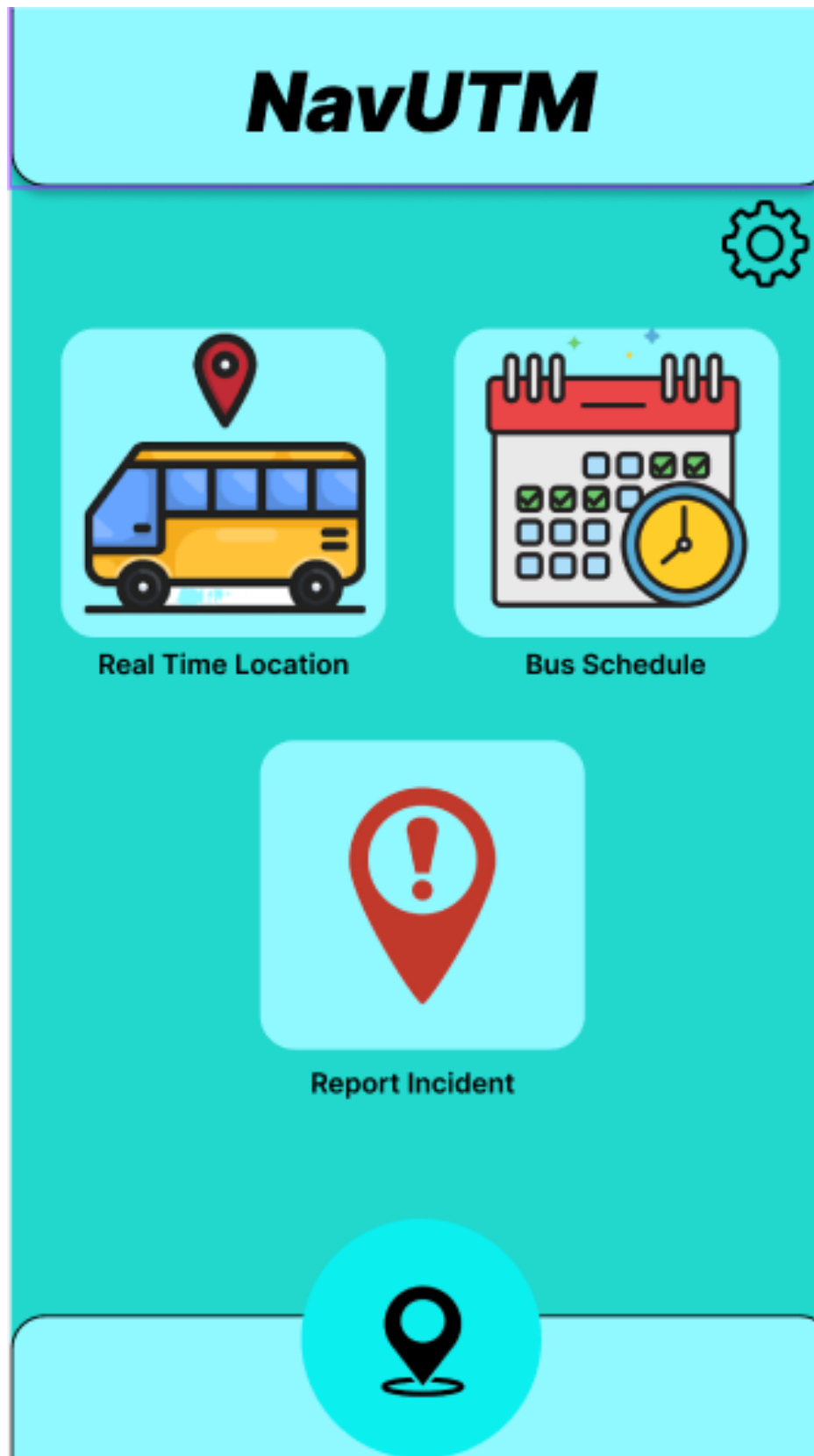
Password:

Reenter Password:

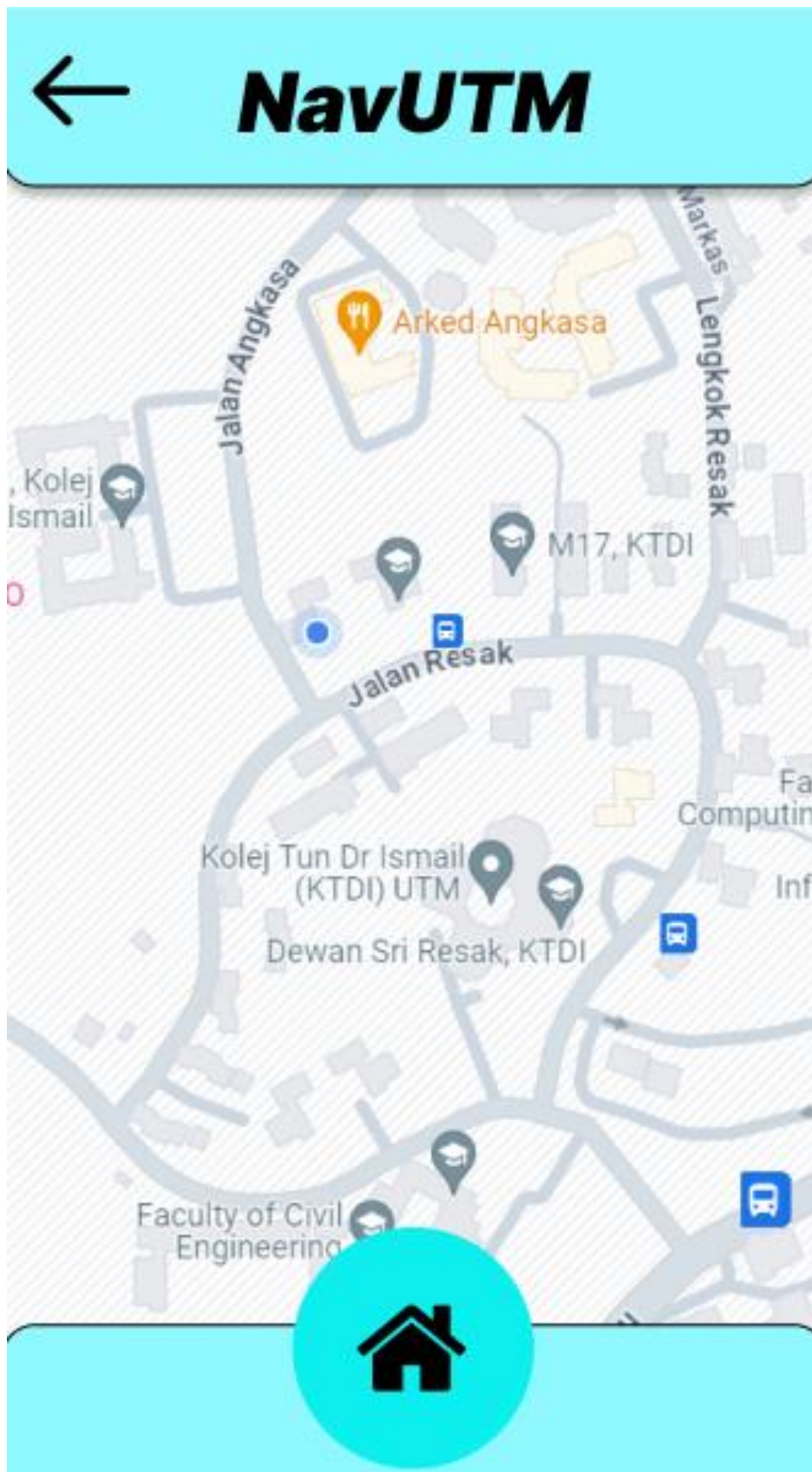
Sign Up

Already a member? [Login](#)

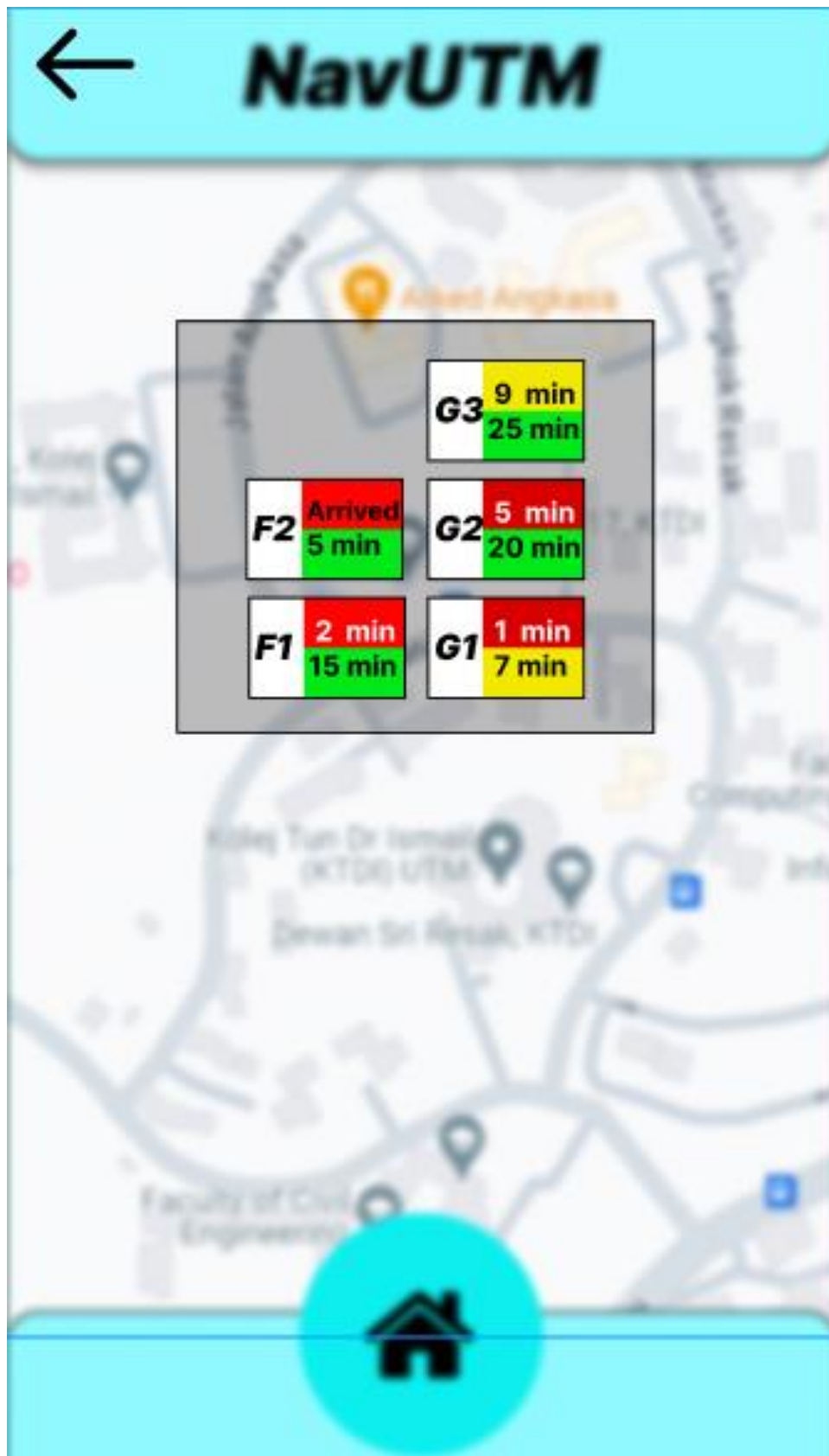
Main Page



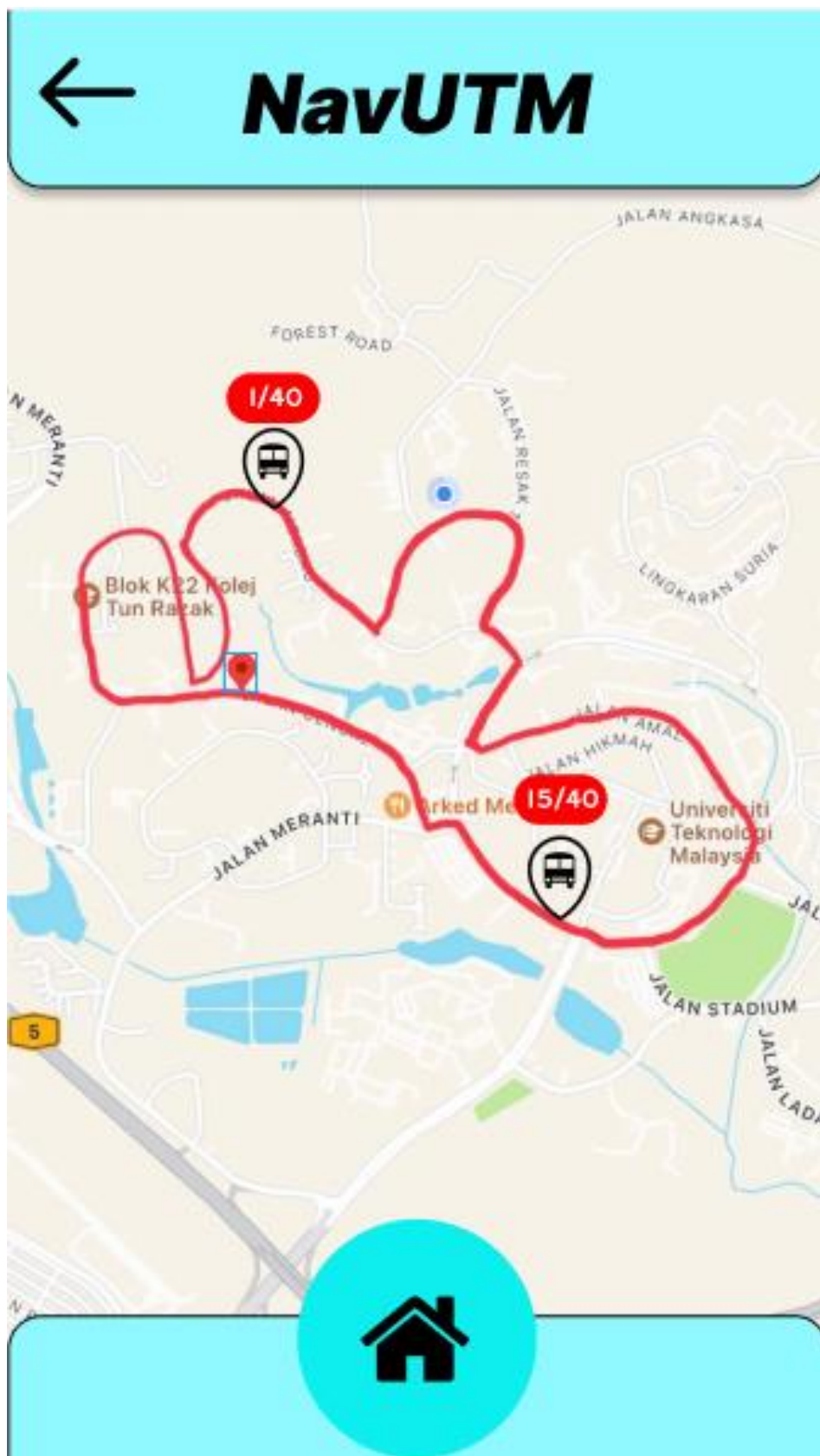
Feature 1: Real Time Location



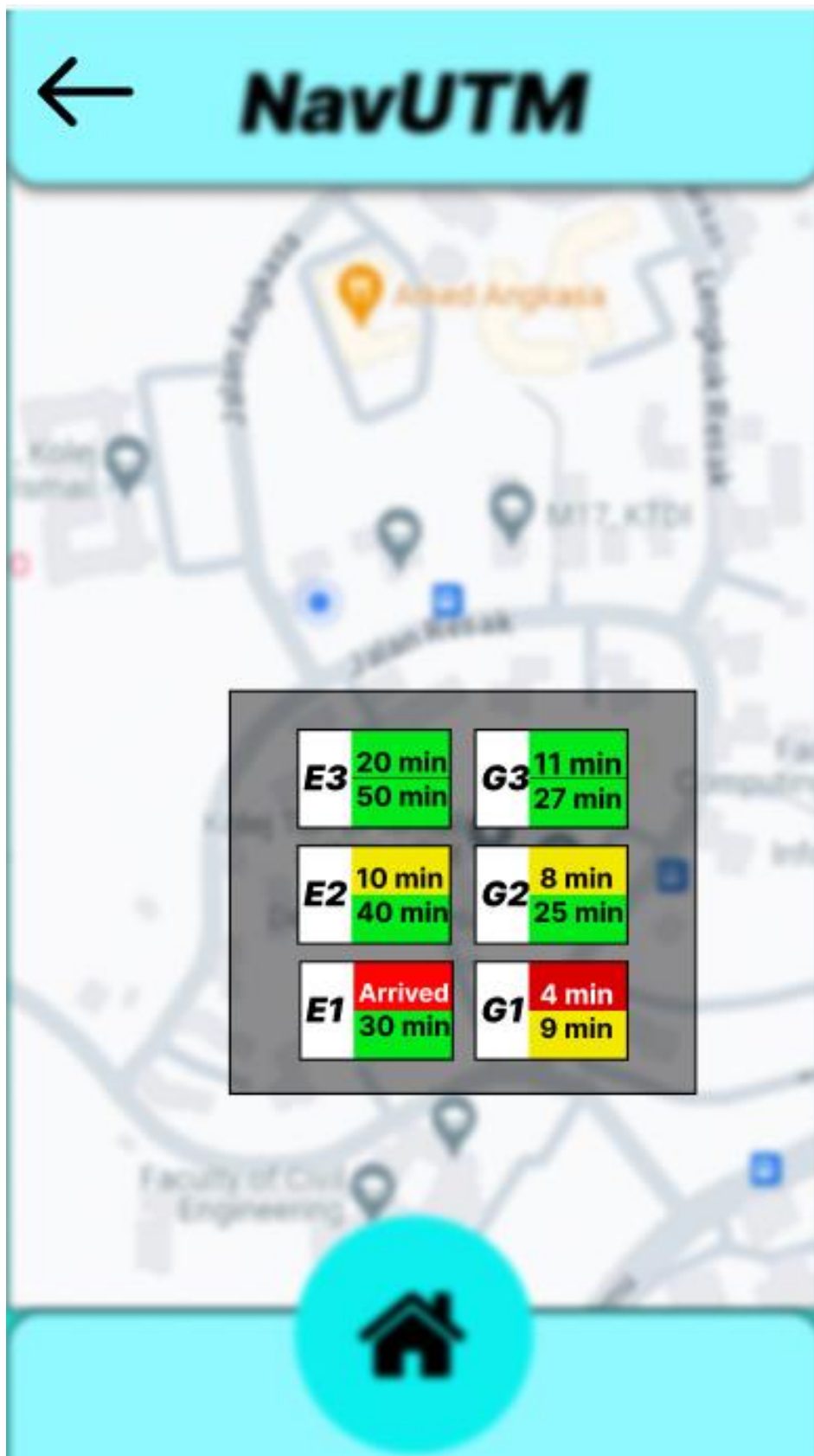
When click on one of the bus stop



press F1 button will show the route and occupancy of the bus.



Choose other bus stop will also show the bus that will pass by the bus stop.

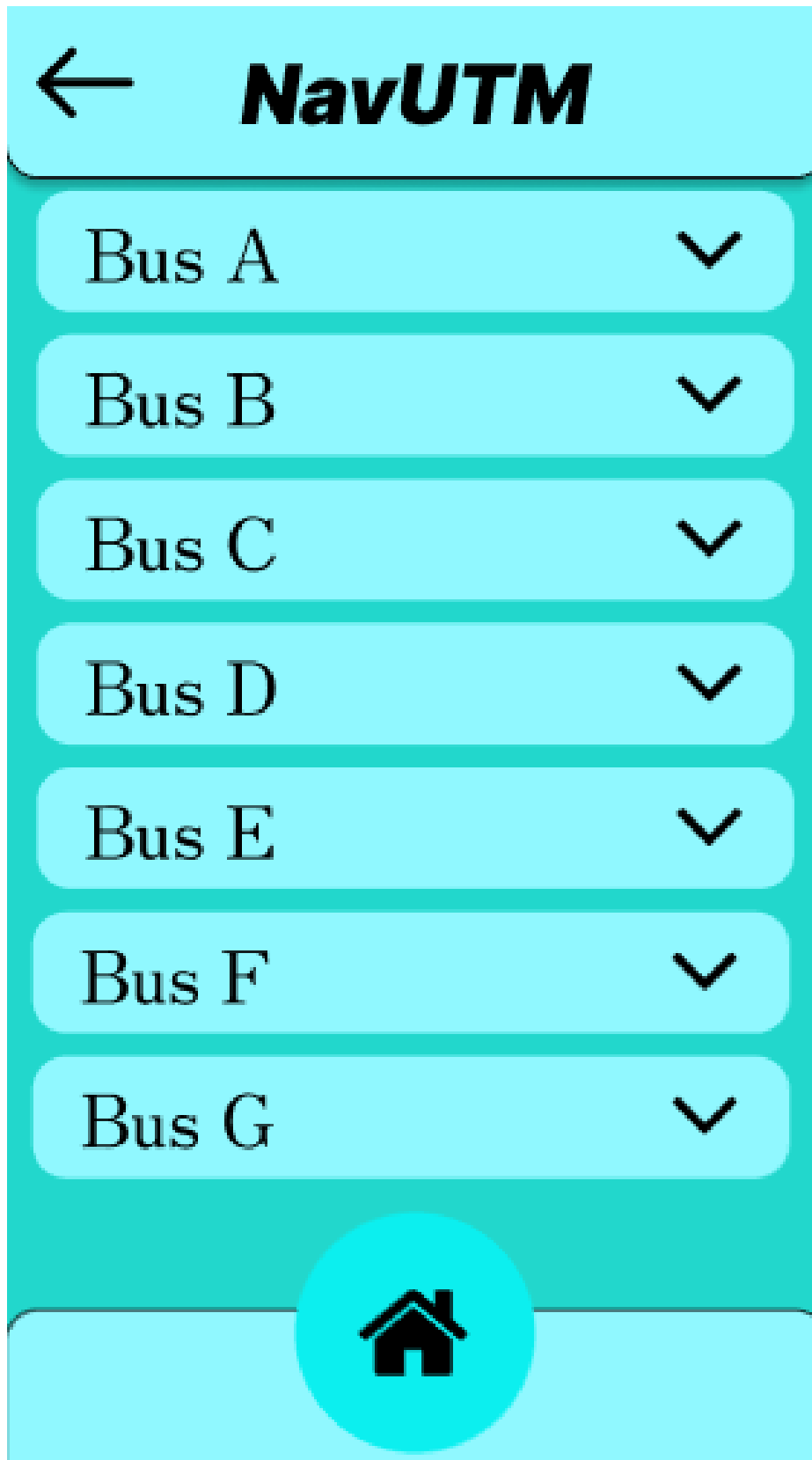


Every bus will show their route when click the icon of the bus.

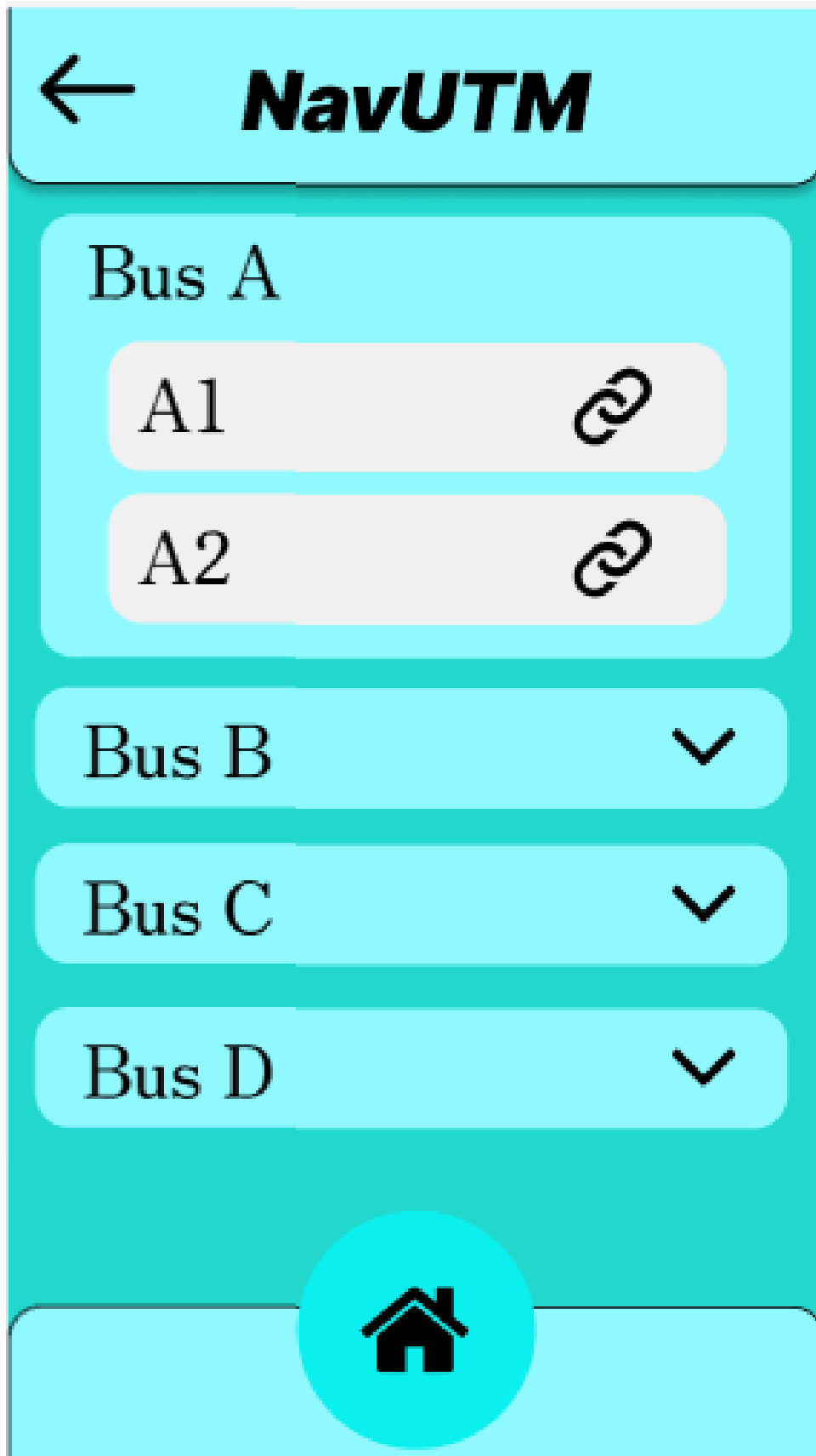


Feature 2: Bus Schedule


It will show the bus type in UTM.



Click on bus A



It will show the bus schedule for the route



NavUTM

BAS: A1

ON-CAMPUS SHUTTLE BUS SERVICES - DRIVER DETAIL

ROUTE : KP to CP (JALAN AMAL)
(KP - CP - JLN AMAL - KP)

FROM
KP (U5)

↔

FROM
CENTER POINT
(CP)

MORNING

7 15
7 45
8 15
8 45
9 15

7 30
8 00
8 30
9 00
9 30

AFTERNOON


11 00
11 40
12 20
13 00
13 40
14 20

11 20
12 00
12 40
13 20
14 00
14 40

EVENING

no services
16 00
16 40
17 20
18 00
18 40

15 40
16 20
17 00
17 40
18 20
19 00






Feature 3: Report Incident



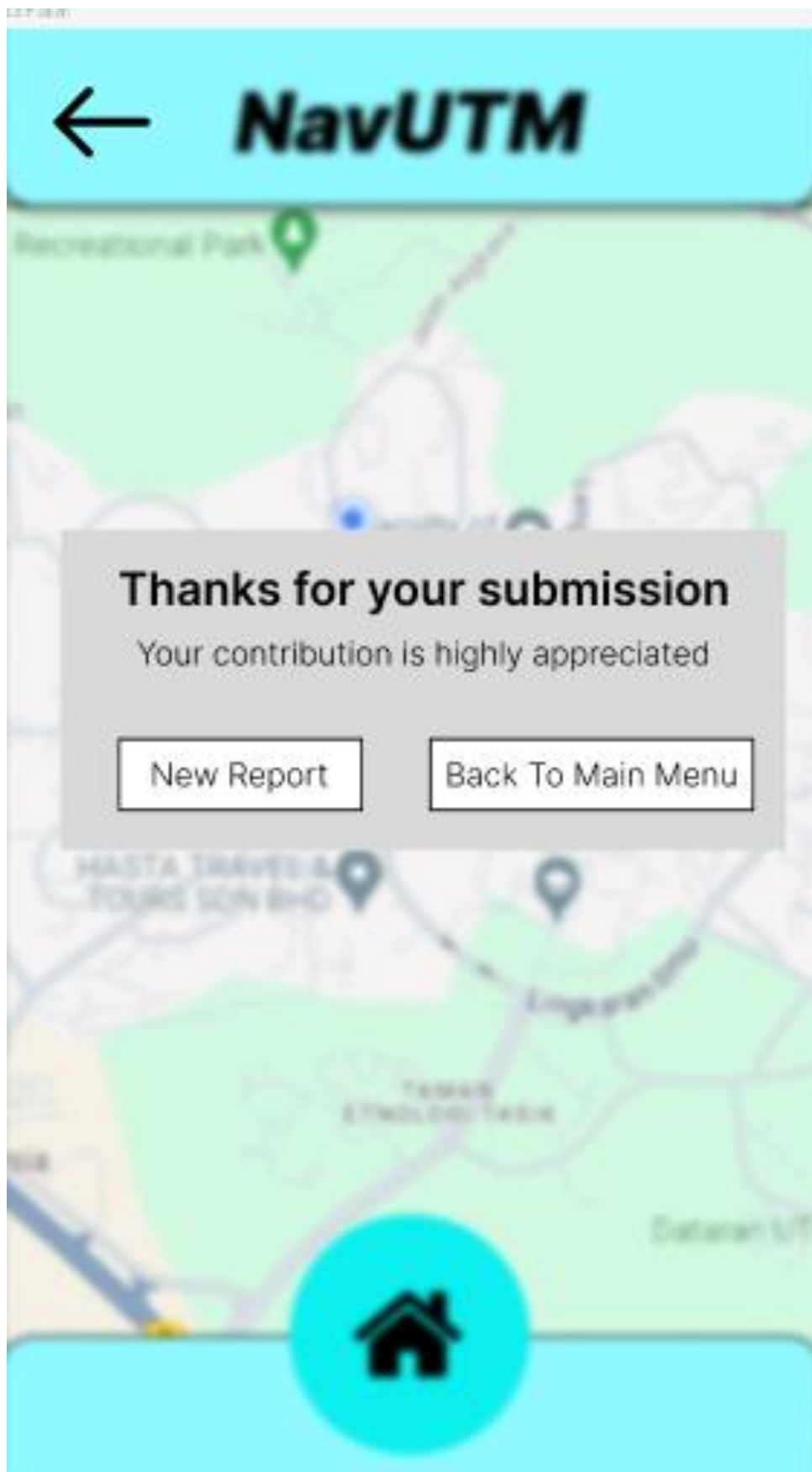
Flag a point and fill the form

The image shows a mobile application interface for NavUTM. At the top, there is a blue header bar with a back arrow icon and the text "NavUTM". Below the header, a map is visible in the background. Overlaid on the map is a grey form with the following sections:

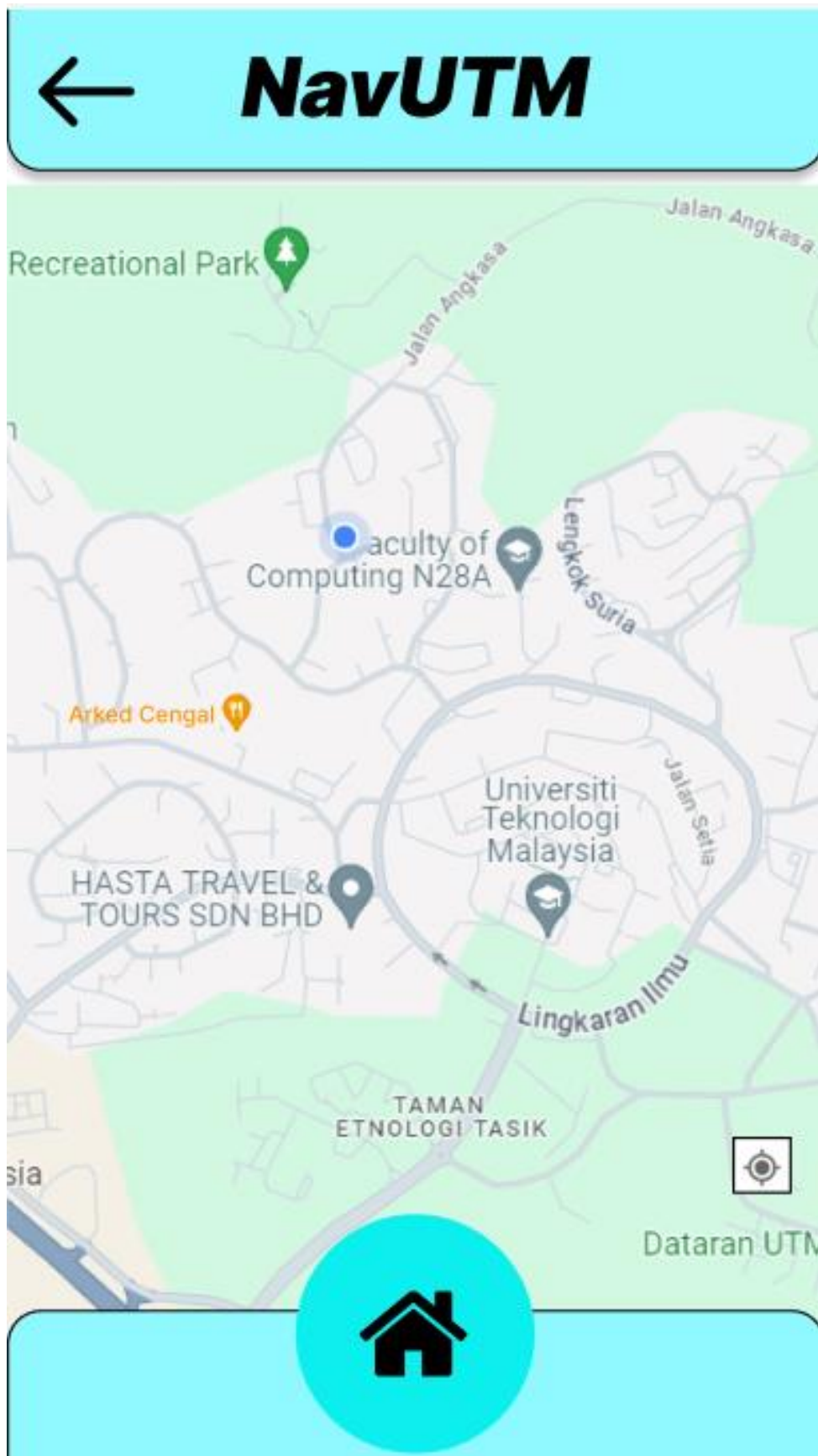
- Report Type:**
 - ☐  **Facilities Broken**
 - ☐  **Appear Wild Animal**
 - ☐  **Accident Happen**
- Description:**
 - A white text input field.
- Time:**
 - Two circular input fields containing "23" and "59" separated by a colon.
- Date:**
 - Three circular input fields labeled "dd", "mm", and "yyyy".
- Submit:**
 - A rectangular button with the text "Submit".

At the bottom of the screen, there is a large blue circular button with a white house icon, likely a home button. The text "Dataran UTM" is visible on the map in the bottom right corner.

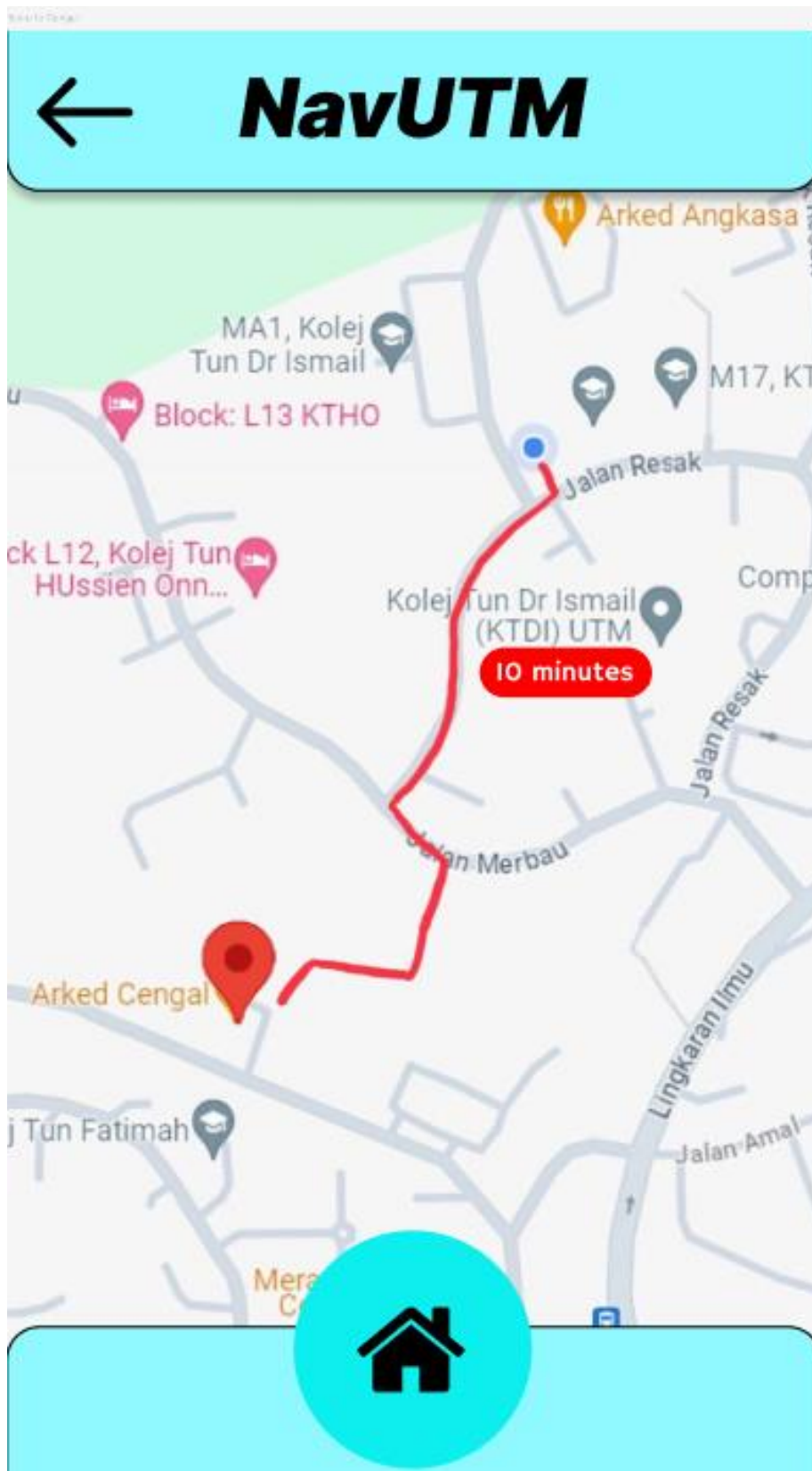
After filling in the form



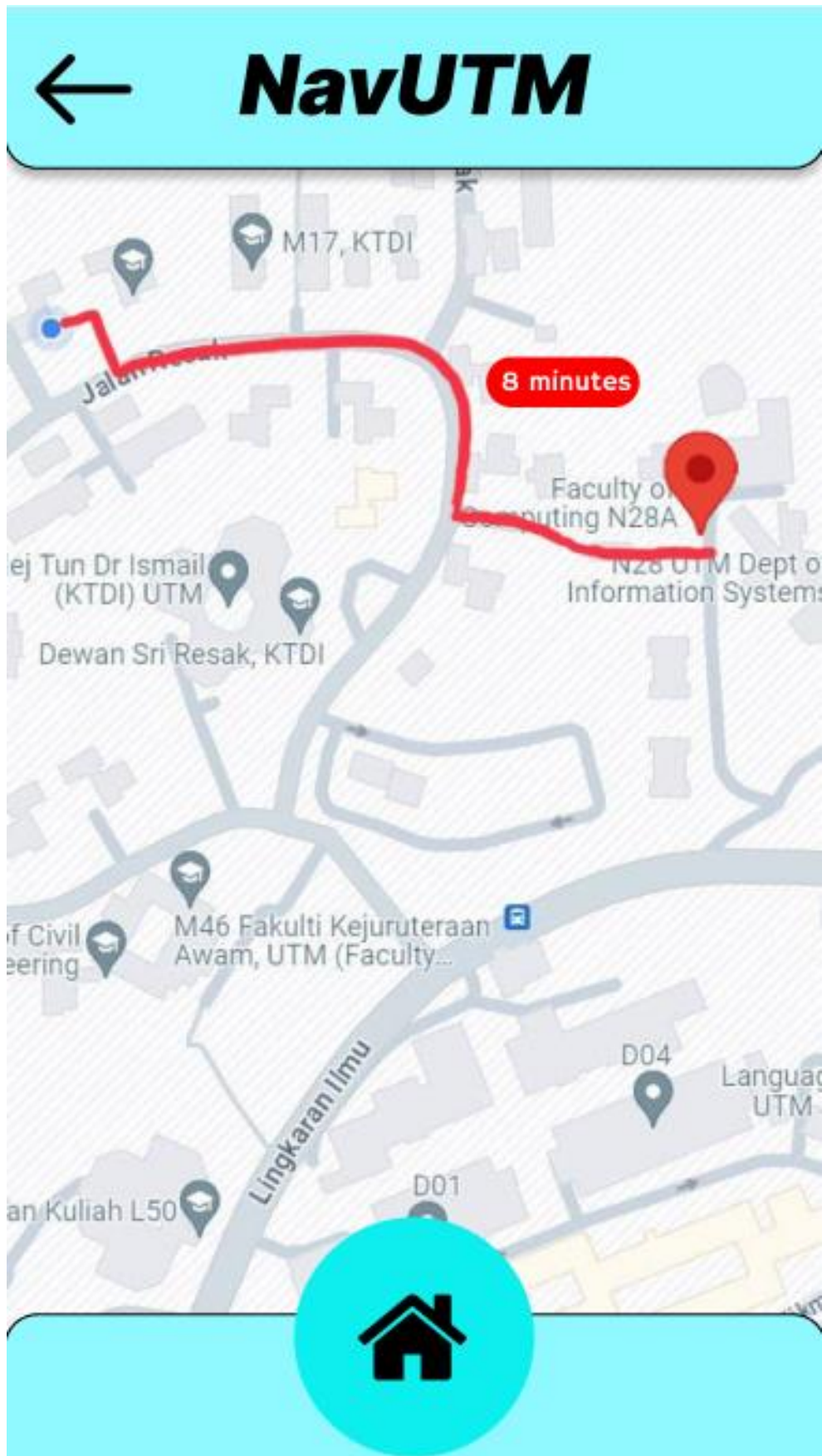
Feature 4: Locate



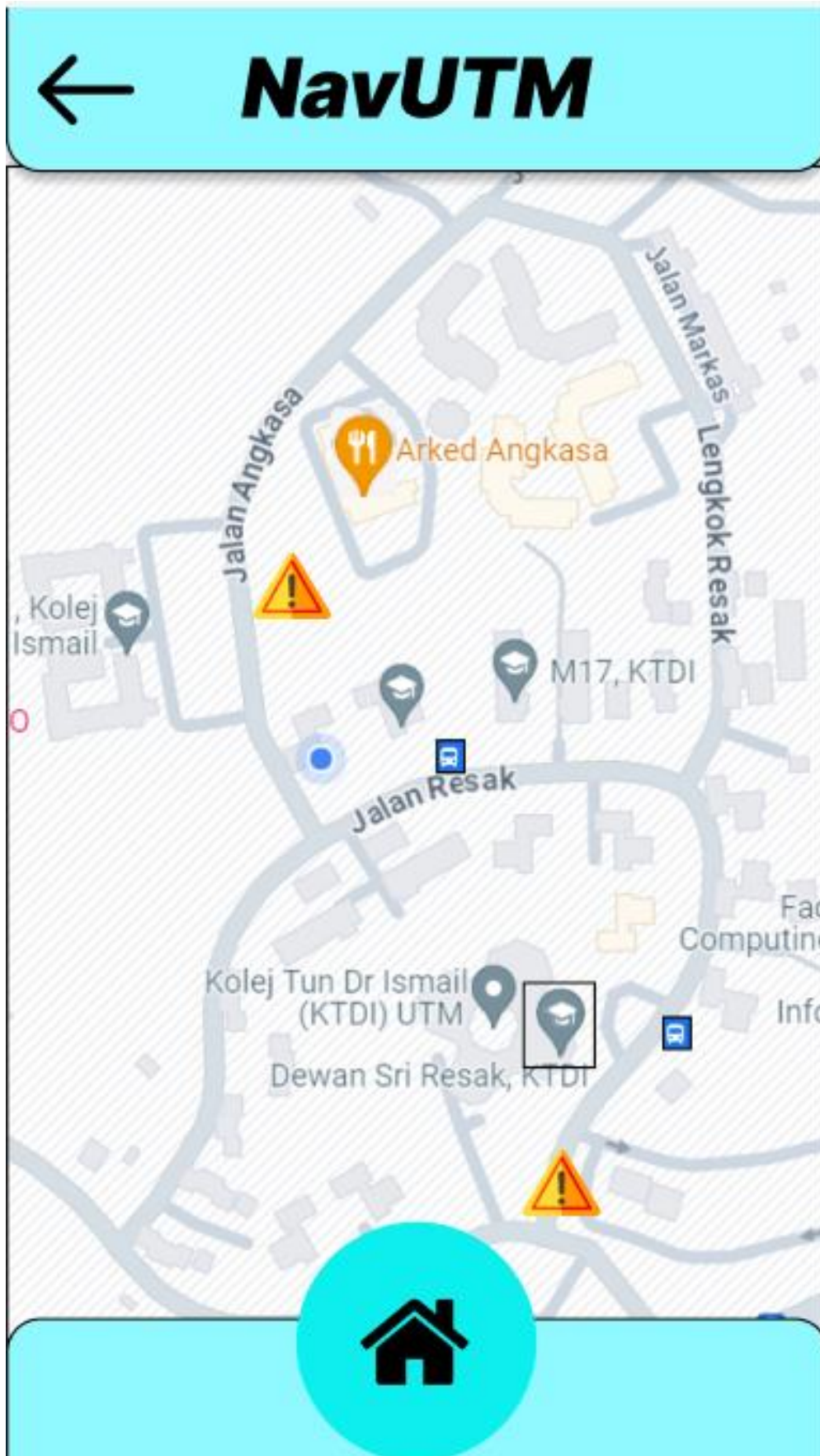
For example, if wan go to Arked Cengal
It will show the shortest walking path



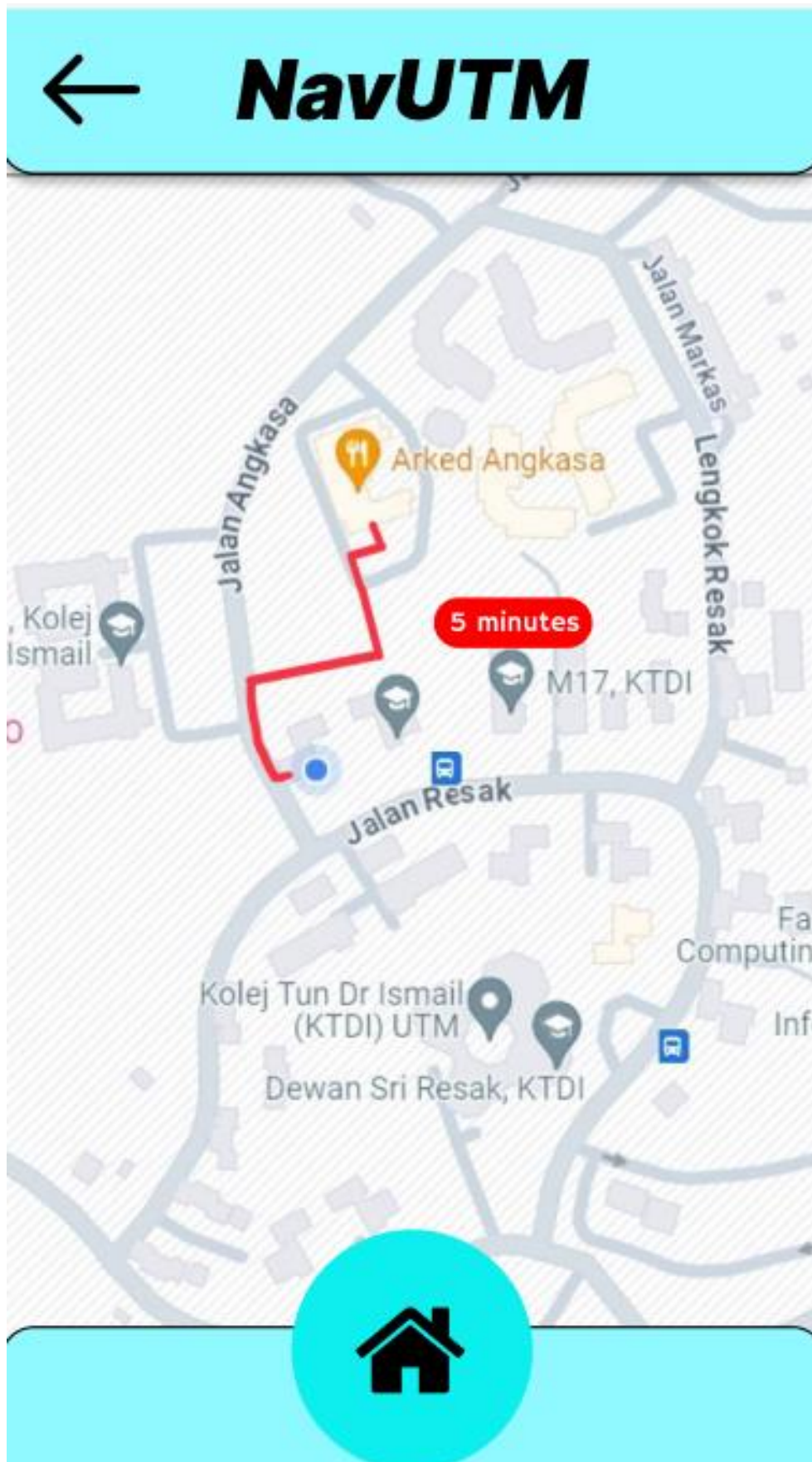
Or go to N28a



Move to nearer location by clicking the locate button



Click Arked Angkasa will show the shortest walking path



By press and hold the hazard sign that show the dangerous at the surrounding.





NavUTM

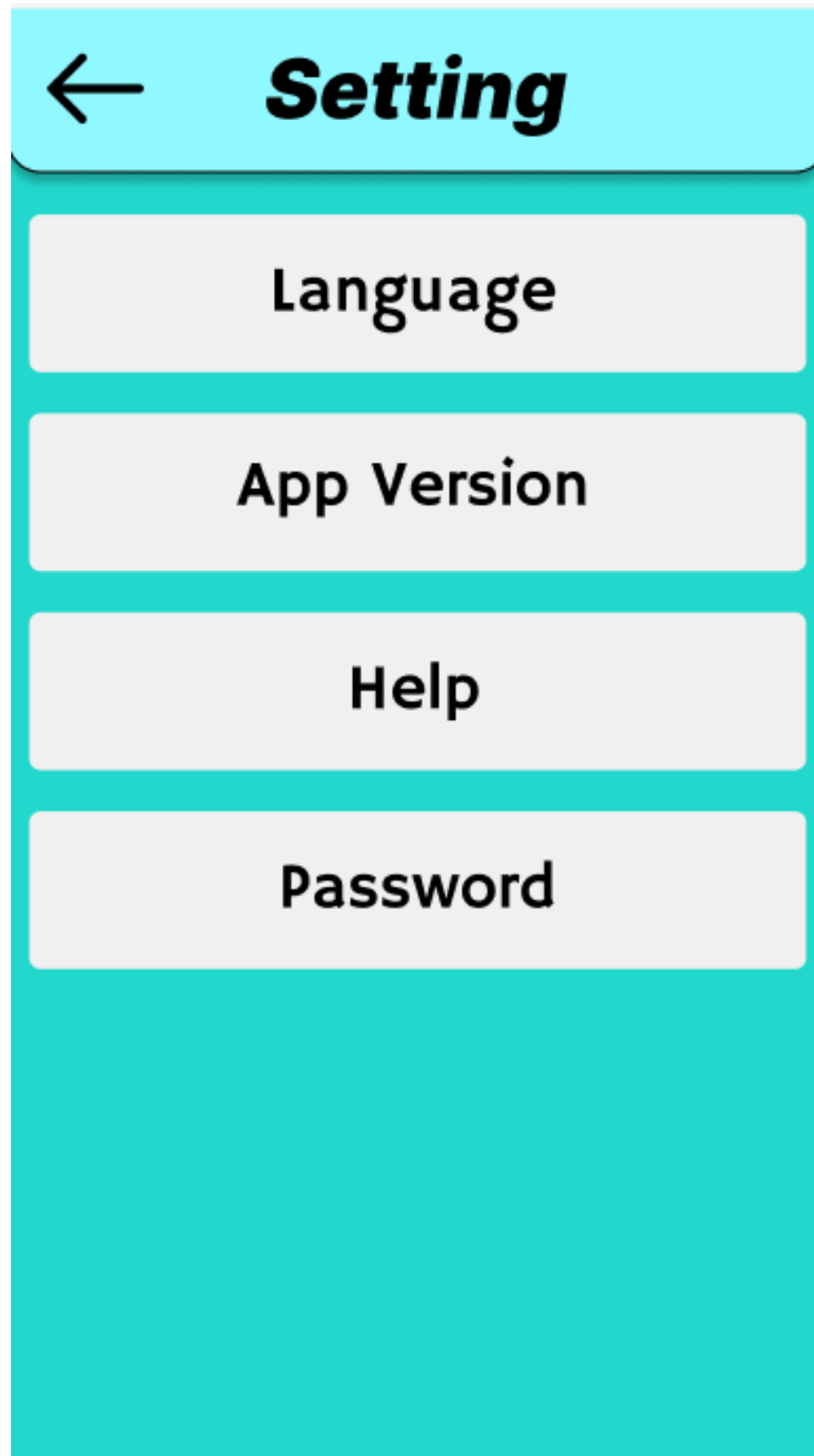


***There's an
accident occur***

The road has been closed



Feature: Setting



Click Language to change the system language



To get help, click **Help**



Help

Customer Service

Contact us with:



NavUTM@graduate.utm.my



1800 88 8888

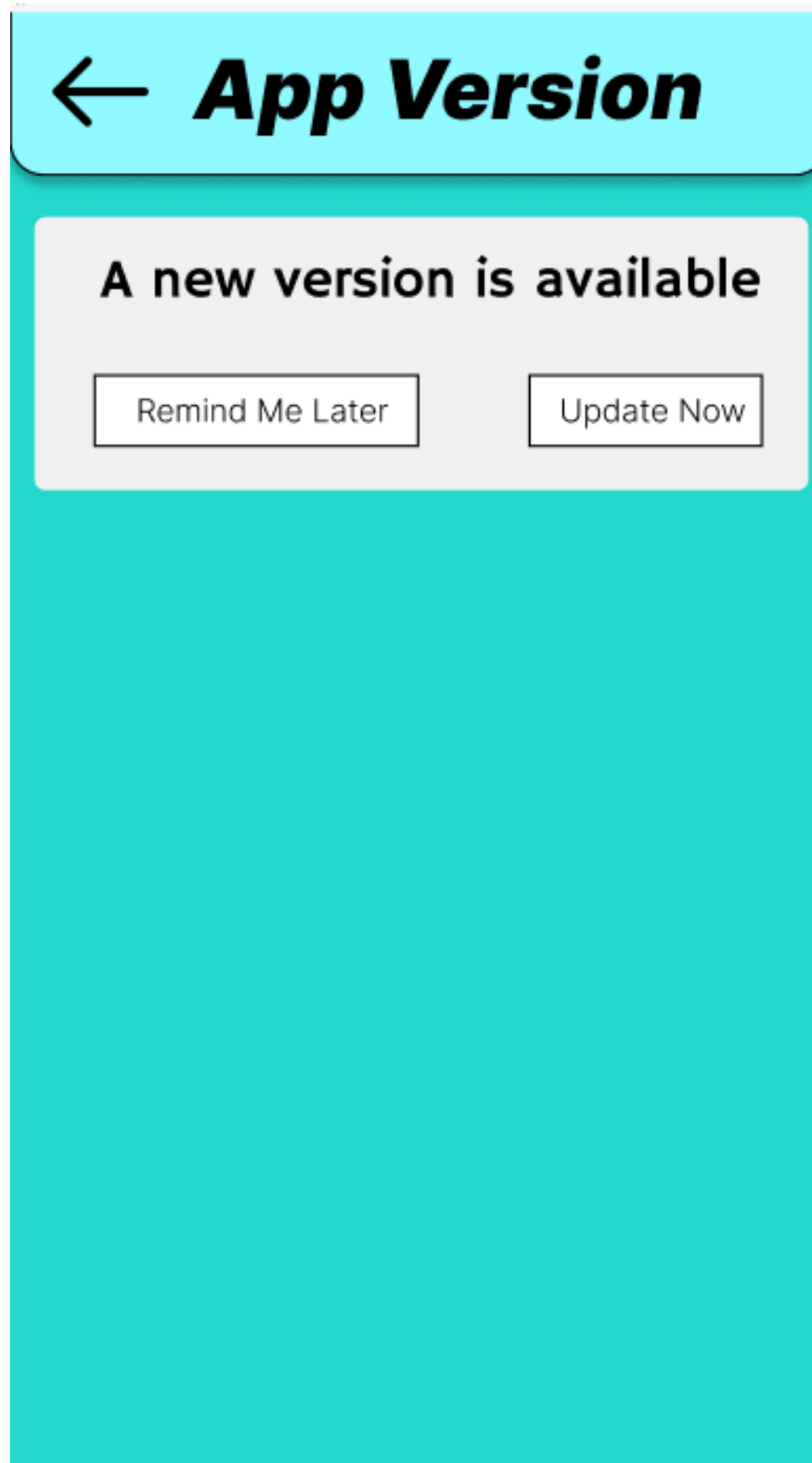


NavUTM




NavUTM

To check the version of the app, click App Version



To change password, click Password.

 **Password**

Current Password:

New Password:

Reenter New Password:

Password

Password has been reset

Please login again

9.0 Summary of proposed system

NavUTM represents a major step forward in enhancing campus mobility and safety. This system, which provides real-time bus location tracking, occupancy information, hazard alerts, and user reporting capabilities, addresses key inefficiencies and safety concerns in the current transportation and safety management processes.

The structured approach outlined was instrumental in the successful development and implementation of the NavUTM. Key components such as the Logical DFD (AS-IS and TO-BE), Physical DFD, System Analysis and Specification, and System Wireframe played critical roles in ensuring the system's robustness and alignment with user needs.

By mapping out how information was traditionally handled, we could identify bottlenecks, inefficiencies, and potential areas for improvement. Besides, by constructing DFD (TO-BE) depicted how the system should function once the new navigation solution was implemented. It helped in visualizing the desired data flow and interactions, ensuring that all necessary processes were included and optimized for better performance and user experience.

The System Analysis and Specification involved a thorough analysis of system requirements, including functional and non-functional specifications. By detailing what the system should do (functional requirements) and how it should perform (non-functional requirements like speed, reliability, and user-friendliness), we established a clear and comprehensive blueprint for development. This analysis also helped in identifying potential technical challenges and constraints, ensuring that solutions were feasible and scalable.

Last but not least, the system wireframe was crucial in translating the technical specifications into a user-friendly interface. Wireframes provided a visual guide for the layout, design, and navigation of the application, ensuring that the product was intuitive and easy to use. By designing input and output screens, the wireframe ensured that users could easily interact with the system, report hazards, check bus locations and occupancy, and receive alerts. This step was essential in bridging the gap between complex technical functionalities and a seamless user experience.

In conclusion, the structured and methodical approach provided by the content list was crucial in progressing from concept to implementation. Each section built upon the previous one, ensuring a cohesive and thorough development process. The Logical and Physical DFDs, System Analysis and Specification and System Wireframe were particularly critical in translating high-level goals into detailed, actionable plans. By systematically addressing each aspect of the system, from problem identification through to physical implementation and user interface design, the project ensured that the NavUTM met the needs of its users and stakeholders. The result is a robust, user-friendly system that significantly improves transportation efficiency and safety on the UTM campus.