



**UTM**  
UNIVERSITI TEKNOLOGI MALAYSIA

**FACULTY OF COMPUTING**  
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**Project: Phase 2**

**<NavUTM>**

**SECD2613 SYSTEM ANALYSIS AND DESIGN**

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# 1.0 Overview of the Project

In this status, our group are going to gather the information requirement and analysis the system needs before we proceed to proceed to the next step which is designing the recommended system. To obtain the information, our group conducting questionnaire by releasing the Google Form to the students in UTM. We collect various opinion from the students about the bus system that currently use by the UTM and what is the improvement we should take effort on and inconvenient of the current system .

After gather the requirements information from the students in UTM, our group have a basic understanding about how the system's function that should be improved and we proceed to the next stage which is analysing the system needs based on AS-IS analysis. Based on the AS-IS analysis, we can understand the current process and identifying pain points of the system. By conducting a thorough AS-IS analysis, the bus system's management can gain valuable insights into their current operations and lay the groundwork for implementing effective changes that improve service quality and operational efficiency. We create the data flow diagrams of the system that we proposed to visualise how the data flows within the system, making it easier to understand the bus system.

Data flow diagram also known as DFD. DFD consists of parent diagram and child diagram. Context diagram is the highest level in DFD because it only contains one process with external entities and major data flow of system that representing the entire system and the explosion of context diagram often known as the parent diagram (level 0 diagram). An integer is assigned to each process, and it breaks down the main process. Each process in the parent diagram will be exploded to create child diagram. A child diagram utilises the same number as the parent diagram, receives the same input, and produces the same output.

By creating Data Flow Diagram, it simplifies complex systems for better understanding and communication among stakeholders and helps to identify system requirements and functional dependencies. This holistic approach ensures that the bus system can meet the evolving needs of passengers and administrators, ultimately leading to a more reliable and user-friendly transportation service.

## **2.0 Problem Statement**

### **1. Unable to track the location of bus:**

The current bus system that used by UTM unable should the exact location of the bus and cause students always spent a lot of time waiting for the bus to arrive. According to the current system, it only provides the time of departure at the starting point and time arrived at the end point. The time arriving the bus stop pass by is all based on estimation. Some time it passes by 10 min earlier and some time it passes by the bus stop 20 minutes later. Students cannot really estimate the time accurately. So, most of the students reach the bus stop 30 minutes earlier like when the bus is at the starting point, the student already waiting at the bus stop to prevent they missed the bus. This cause many of the students spent double or even triple of time consumption to reach the destination. Due to this reason many of the students will choose to walk to the destination instead of waiting for the bus.

### **2. Unable to show the bus occupancy:**

The current bus system unable to show the actual value of the passenger in the bus and cause the student that would like to take the bus can't get on the bus due to the bus already full. Especially early in the morning, all students are rushing to attend the class and the number of occupancies is not enough to fulfil the requirements of the students. Due to unable to confirm the actual passenger on the bus, the current bus system unable to maintaining an optimal level of occupancy is crucial for passenger comfort. Overcrowded buses can lead to an unpleasant travel experience, and it is very dangerous if the driver emergency break and all of the passengers didn't have a space to get back from inertia. Besides, while buses with too few passengers can be seen as a waste of resources. Thus, by understanding bus occupancy is critical for optimizing bus service operations, enhancing passenger comfort, and ensuring efficient use of resources.

### **3. Unable to provide route**

The current bus tracking system at the university is inadequate in providing essential information regarding routes to bus stops and the specific routes the buses take. This lack of information significantly inconveniences students who are left with no choice but to rely on general navigation apps like Google Maps or Waze. These applications do not account for the numerous shorter paths and walkways within the University Technology Malaysia (UTM) lead to their destinations more quickly. Moreover, the existing system fails to inform students about the specific bus stops serviced by each bus route. This is particularly problematic since buses do not stop at every bus stop within the campus. Consequently, students often face uncertainty, not knowing which buses will pass by the stops they are waiting at. This uncertainty can lead to longer waiting times and missed buses, disrupting their schedules and daily routines.

### **3.0 Proposed Solutions**

In the bustling campus of Universiti Teknologi Malaysia (UTM), NavUTM marks a significant leap towards enhancing the daily commute of its community. Real-time GPS tracking system replaces paper-based bus schedules that been used by the current bus system, introducing digital precision and convenience that promise to transform campus navigation. NavUTM offers accurate bus location services instead of using static PDF schedules obsolete, and NavUTM empowers users to plan their journeys according to live updates on traffic disruptions and bus estimated times of arrival (ETAs).

NavUTM's real-time bus occupancy feature is particularly innovative, providing information on the number of passengers aboard each bus. When a bus reaches full capacity, NavUTM suggests alternative routes or different buses, ensuring seamless journeys. For example, if Bus A is stuck in traffic, NavUTM's algorithms recommend switching to Bus B and then Bus C, ensuring efficient transit. Personalized notifications further enhance punctuality by syncing bus arrivals with individual schedules, helping students arrive on time for lectures and appointments.

The system includes a real-time communication interface. This allow the campus community to report traffic incidents such as congestion, accidents, or road closures directly through the app. This collaborative incident reporting ensures comprehensive real-time data, enabling NavUTM to recalibrate maps and propose effective navigation routes. A verification system authenticates the accuracy of reported incidents, and a points system rewards users for contributions, fostering community engagement and recognition.

NavUTM prioritizes security and privacy, employing sophisticated encryption techniques and secure data processing to protect user information. This commitment to data protection ensures privacy and peace of mind for users navigating the campus. By integrating these features, NavUTM enhances the predictability and reliability of campus bus services, offering a smooth and stress-free commuting experience.

### **4.0 Information Gathering Process**

## 4.0 Information Gathering Process

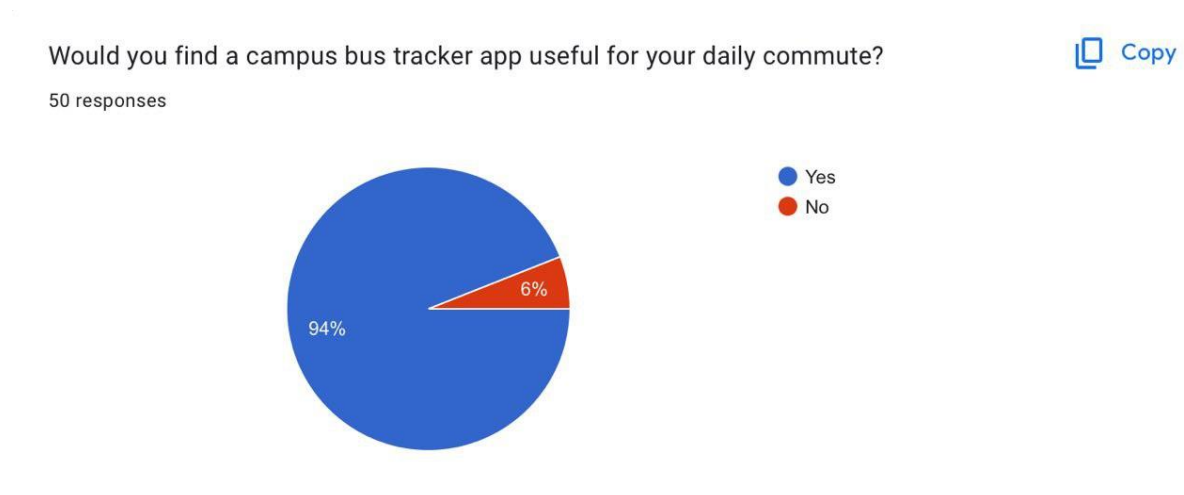
Information gathering involves the systematic collection of data to understand particular issues or requirements. This study focuses on evaluating the potential for a campus bus tracker app at UTM. By conducting interviews and distributing questionnaires to friends and lecturers on campus, the goal is to gather key insights into their preferences and needs for such a tool.

### 4.1 Method Used

To gather comprehensive data, this study used both open-ended and closed-ended questions. A Google Form was distributed to 50 respondents, including students, staff, and lecturers from Universiti Teknologi Malaysia, which helped collect easily analysable quantitative data. In addition, interviews were conducted through Google Meet, allowing for more detailed and nuanced responses. This combination of methods provided a well-rounded understanding of the preferences and needs for a potential campus bus tracker app.

#### 4.1.1 Questionnaires

##### Question 1: Would you find a campus bus tracker app useful for your daily commute?



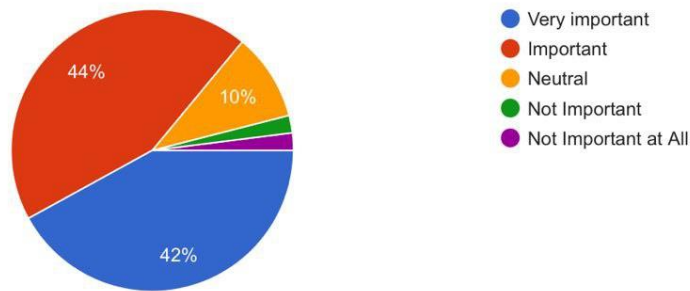
The survey gathered responses from 50 participants to assess the potential usefulness of a campus bus tracker app for daily commutes. Out of these, 47 respondents (94%) indicated that they would find such an app beneficial, highlighting a significant demand for this service. In contrast, only 3 respondents (6%) felt that the app would not be useful for their daily transportation needs. This strong positive response underscores a clear interest and need for a campus bus tracker app among the university community.

##### Question 2: How important is real-time bus location information to you?

How important is real-time bus location information to you?

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50 responses



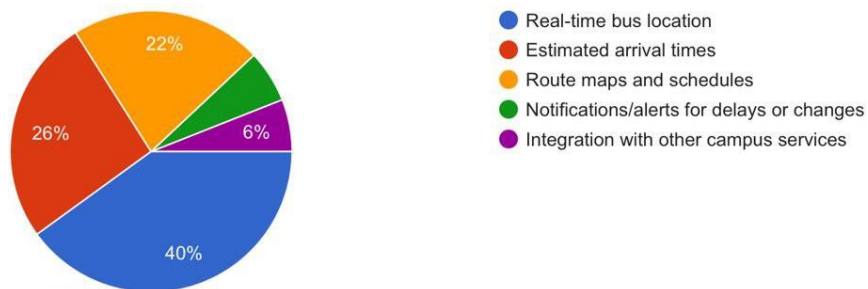
The survey inquired about the importance of real-time bus location information. Among the participants, 44% considered it important and 42% rated it as very important. Meanwhile, 10% of respondents felt neutral about this feature. Only a small portion, 2%, found it not important, and another 2% deemed it not important at all. These findings indicate that the majority of respondents, 86%, value real-time bus location information, emphasizing its significance for a potential campus bus tracker app.

### Question 3: Which feature would you prioritize in a campus bus tracker app?

Which feature would you prioritize in a campus bus tracker app?

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50 responses



When asked which feature they would prioritize in a campus bus tracker app, 40% of respondents chose real-time bus location as their top priority. This was followed by 26% who prioritized estimated arrival times, and 22% who preferred route maps and schedules. Additionally, 6% of respondents valued integration with other campus services, and another 6% prioritized notifications and alerts for delays or changes. These results highlight the strong preference for real-time updates and practical scheduling information among the users.

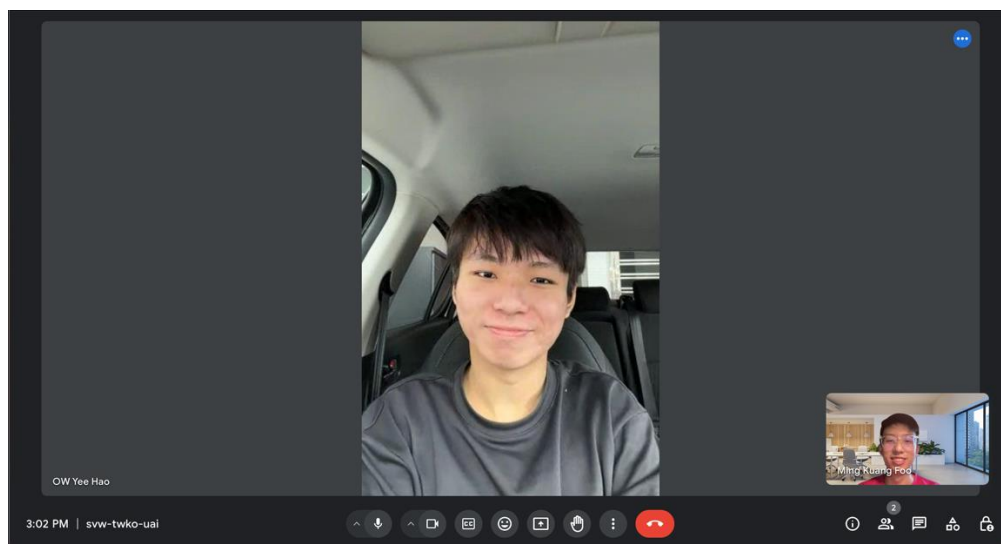


### 4.2.1 Interviewing

As a UTM freshman, what do you think of UTM campus?	So far, everything is going well, but I find the UTM campus to be large and complex. Sometimes, I struggle to navigate and find the route to my destination, especially when attending events.
How are your daily lectures? Is it challenging to find the venue for the lecture?	Yes, the daily lectures have been quite challenging recently. Some lecturers change the venue for their class at the last minute, which makes it difficult for me to locate the new venue in a timely manner. The search process is time-consuming, and as a result, I am often late for the lecture session. These last-minute changes have significantly impacted the smooth flow of our daily lectures.
Do you find the UTM's bus service convenient for your needs?	Well, it's a bit challenging. I am often waiting a long time at the designated bus stops because it's difficult to know when the bus will arrive. The lack of a clear schedule makes it hard to plan when to be at the stop to catch the bus directly. So, in terms of convenience, there's room for improvement.
What do you think about making a UTM bus-tracking app?	I think making a UTM bus-tracking app would be fantastic. As a student who relies on campus buses every day, it would save me a lot of time and reduce the stress of waiting. Sometimes I end up standing at the bus stop for ages because I have no idea where the bus is or when it will arrive. Having real-time updates would let me know exactly when to leave my dorm or class, so I'm not wasting time. Plus, if the app had features like notifications for delays or changes in the schedule, it would be even better. Integrating it with other campus services, like maps or event schedules, would also be really useful. Overall, I think this app would be a huge improvement for the campus transportation system and would make commuting much easier for everyone.
Are there any specific features you would like to see in the app?	Sure, real-time bus location is an absolute must because it's so frustrating not knowing if I've just missed the bus or if it's running late. If I could see exactly where the bus is at any moment, it would make planning my day so much easier. Notifications for delays or

	<p>schedule changes would also be amazing since sometimes the bus doesn't show up on time, and getting an alert about any issues would help a lot. Integrating the app with other campus services would be great too; for example, having a map that shows not only the bus routes but also important buildings and events happening around campus would be super helpful. Including information about peak times or crowded buses so we can avoid them would really enhance the student experience and make getting around campus much more efficient.</p>
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(Table 4.1: Details for interview session)



(Diagram 4.1 Interview through Google Meet with Mr Ow Yee Hao)

## 4.2 Summary for method used (including example interview, questionnaire, observation)

The NavUTM app aims to address several problems identified by students and staff at Universiti Teknologi Malaysia, enhancing their daily commuting experience. One major issue is the uncertainty and frustration caused by not knowing the real-time location of campus buses, which makes it difficult to plan and results in wasted time at bus stops. By providing real-time bus location updates, NavUTM will help students and staff know exactly when a bus is arriving, reducing wait times and improving punctuality. Additionally, the app will send notifications about any delays or schedule changes, ensuring users are always informed and can adjust their

plans accordingly. The integration of campus maps and information about important buildings and events will further assist users in navigating the large campus efficiently, making the overall experience more seamless and less stressful.

The use of Google Form questionnaires played a crucial role in understanding and analysing the needs of the campus community. Distributed to 50 respondents, including students, staff, and lecturers, the questionnaires gathered both quantitative and qualitative data. The structured questions allowed for easy analysis of key preferences, such as the high importance placed on real-time bus location updates by 86% of respondents. Moreover, the questionnaires revealed that a significant majority found the idea of a bus tracker app beneficial, highlighting specific features like estimated arrival times, route maps, and integration with campus services. This method ensured a broad and representative sample of the university community's opinions, providing clear evidence of the demand for the proposed app features.

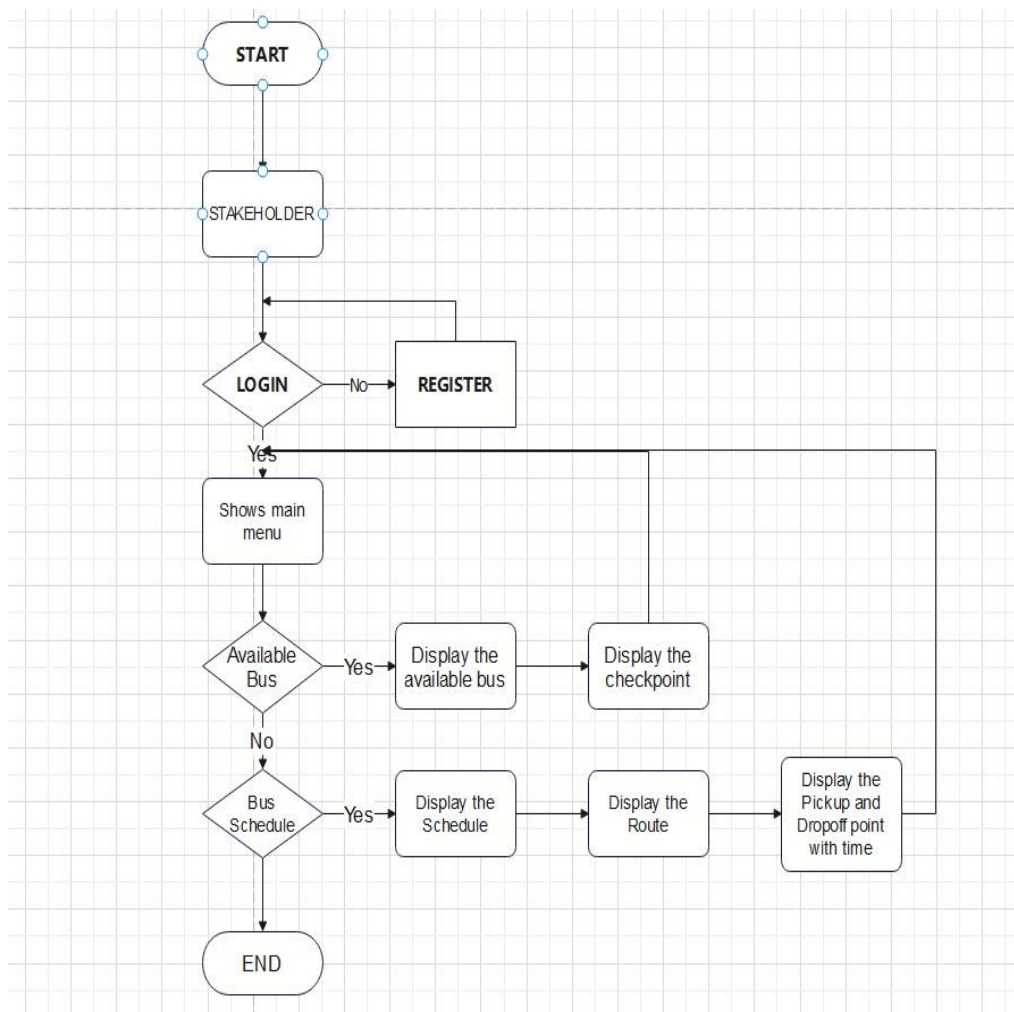
Interviews provided deeper insights into the specific challenges faced by students in their daily commutes and how the NavUTM app could alleviate these issues. Conducted through Google Meet, the interview session with Mr Ow Yee Hao, a student freshman in University that uses school bus services for daily commute. This allowed for more detailed and personalized responses. For example, students shared their struggles with last-minute venue changes for lectures and the difficulty of navigating the sprawling campus. They emphasized the stress and inconvenience caused by the unpredictable bus schedules, highlighting the need for real-time updates and notifications. These in-depth conversations confirmed the findings from the questionnaires and added a qualitative dimension to the data, showing how the app could significantly enhance the user experience by addressing these everyday challenges.

## 5.0 Requirement Analysis

### 5.1 Scenarios, workflow

Here are the scenarios and workflow of current business process by stakeholders.

1. Login into system
2. Some options are shown on the main menu.
3. Option for viewing the available bus
  - 3.1 Displays the buses that are available currently.
  - 3.2 Display the checkpoints of the buses.
4. Option for choosing the buses schedules
  - 4.1 Displays the schedule for the buses according to the group throughout the day.
  - 4.2 Displays the routes for the buses.
  - 4.3 Displays the pick-up point and drop-off point with the time.



## AS-IS System Workflow

### 5.2 Functional Requirement(Input, Process, Output)

#### 5.2.1 Context Diagram

PROCESS	INPUT	OUTPUT
NavUTM system	Bus Information Pick-Up Drop-Off point Information Passenger Information Location Information	Bus Respond No of Passenger Detail Pick-Up Drop-Off Location Bus Location

#### 5.2.2 Level 0 Diagram

PROCESS	INPUT	OUTPUT
View Bus List	Bus Information Availablity Information	Bus Info Currently Available buses Updated Bus Info
View Pick-Up and Drop-Off Point	Updated Bus Info Pick-up Information Drop-Off Information	Pick-Up Point Info Drop-Off Point Info Updated Bus Info
View Passenger	Updated Bus Info No of Passengers Information Free Seat Information	No of Passenger Detail Free Seat Detail Updated Bus Info
View Bus Location	Updated Bus Info Tracking location	Live Location of the Bus

#### 5.2.3 Level 1 Diagram

##### 5.2.3.1 Process View Bus List

PROCESS	INPUT	OUTPUT
Search Bus	Bus Information	Bus Info
Search Available Bus	Availability Information	Bus Availability Info

##### 5.2.3.2 Process View Pick-Up and Drop-off Point

PROCESS	INPUT	OUTPUT
Search Pick-Up Point	Pick-Up Information	Pick-Up Point Info
Search Drop-Off Point	Drop-Off Information	Drop-Off Point Info
Response Pick-Up and Drop-Off Point	Pick-Up Point Info Drop-Off Point Info	Update Bus Info

#### 5.2.3.3 Process View Passenger

PROCESS	INPUT	OUTPUT
Check No of Passenger	No Of Passengers Info Free Seat Information	No of Passenger Detail Free Seat Detail

#### 5.2.3.4 Process View Bus Location

PROCESS	INPUT	OUTPUT
Check the Exact Bus Location	Bus Info	Bus Location Status

### 5.3 Non-Functional Requirement

#### 5.3.1 Scalability

- The system can handle more users in one time without having any problem.
- Users can use the system whenever without any server problems.

#### 5.3.2 Usability

- The students and Bus drivers can exchange their information.
- The students can know the location of the bus by getting information from the bus drivers.

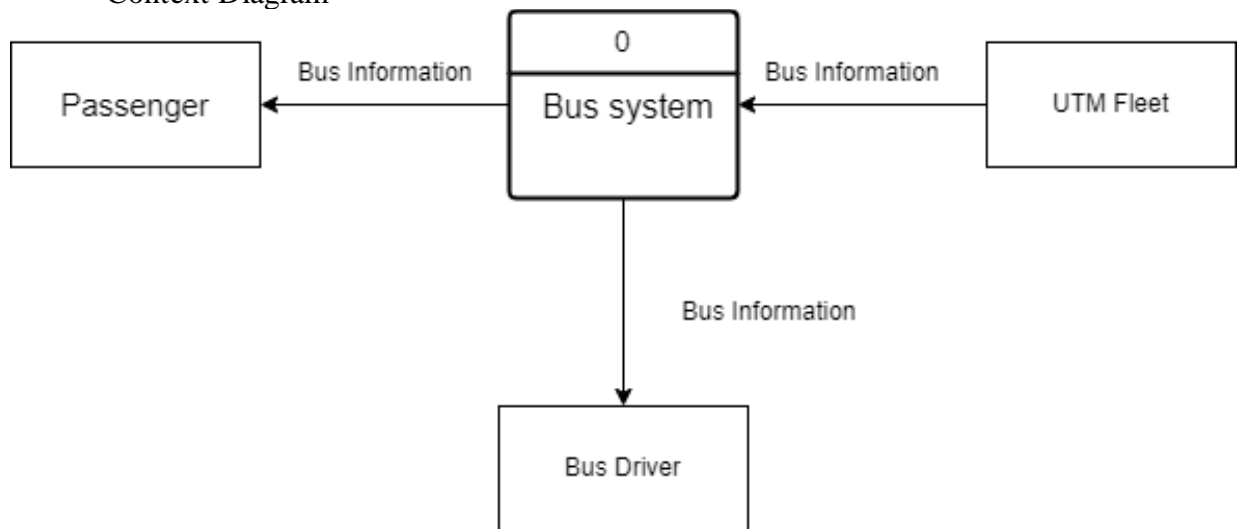
#### 5.3.3 Availability

- Users can access the system if there is Internet connection available.
- Users can use given Wi-Fi by the UTM itself without any problem.
- Users can on their location services in their mobile phone to get accurate and precise location of the bus.

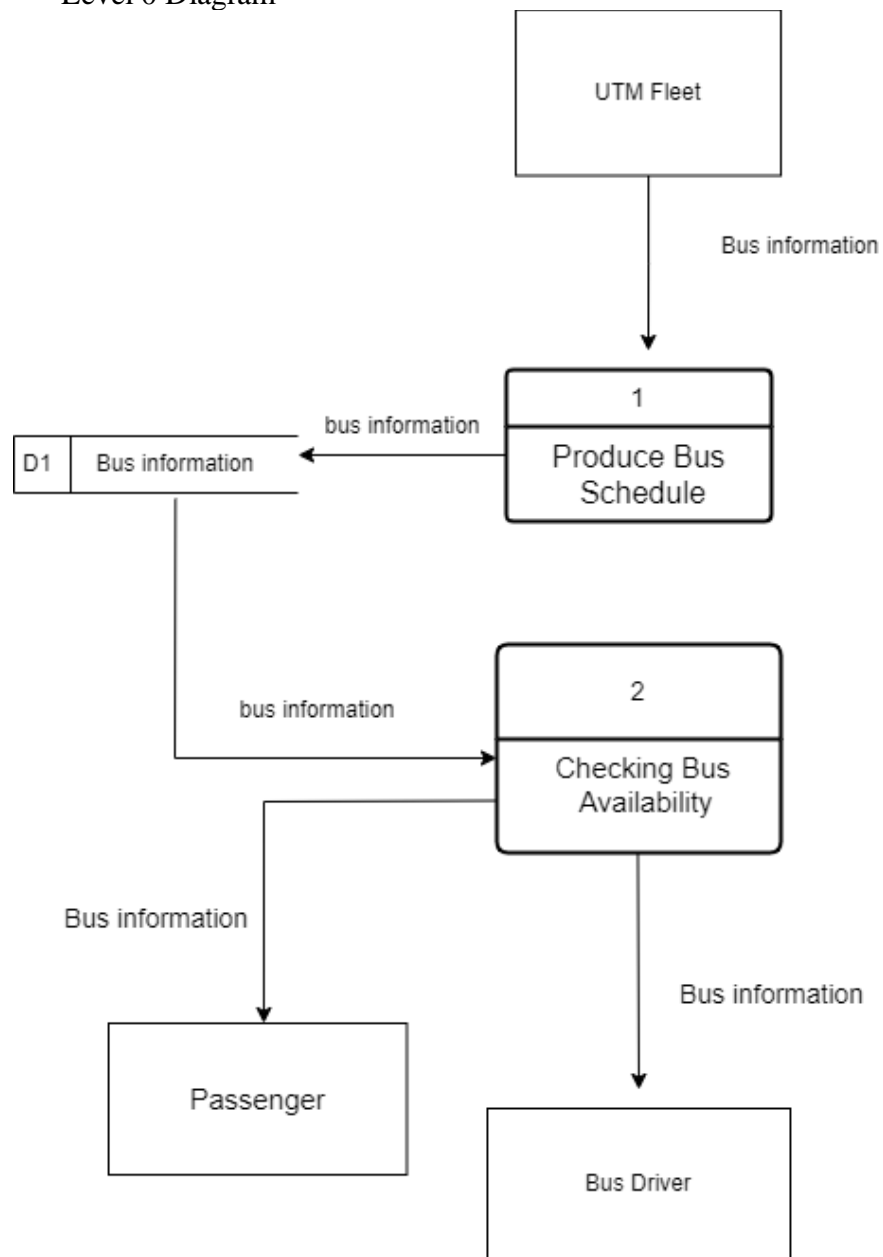
### 5.4 Logical DFD AS-IS system

### 5.4.1 Current System DFD

- Context Diagram



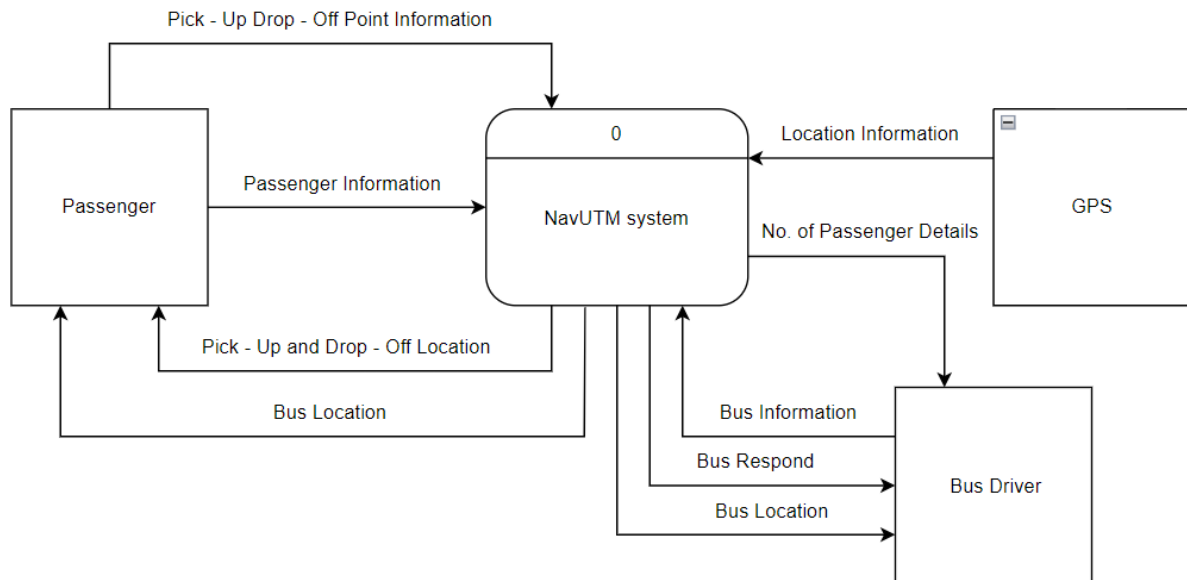
- Level 0 Diagram



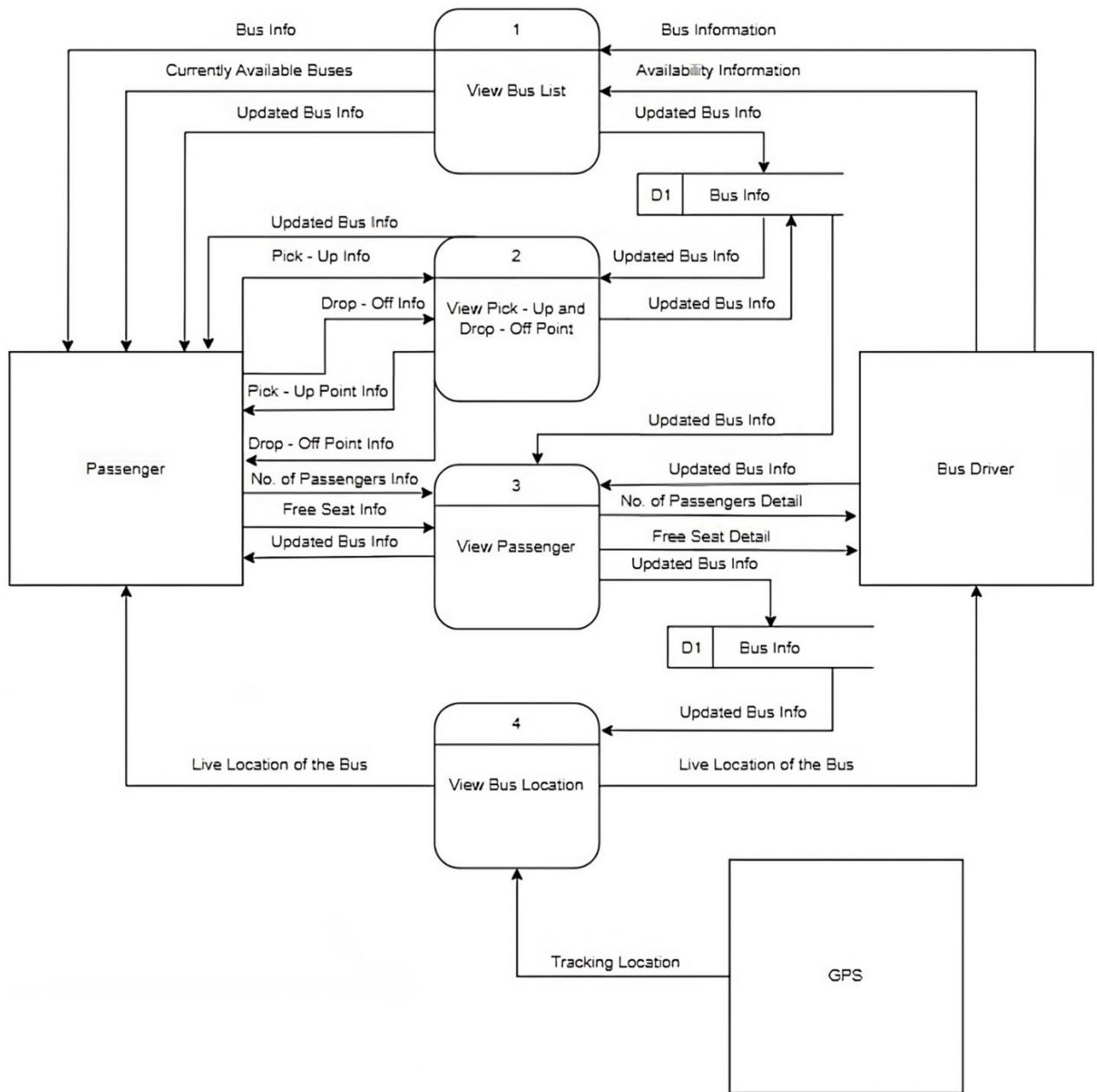


## 5.4.2 Proposed System DFD

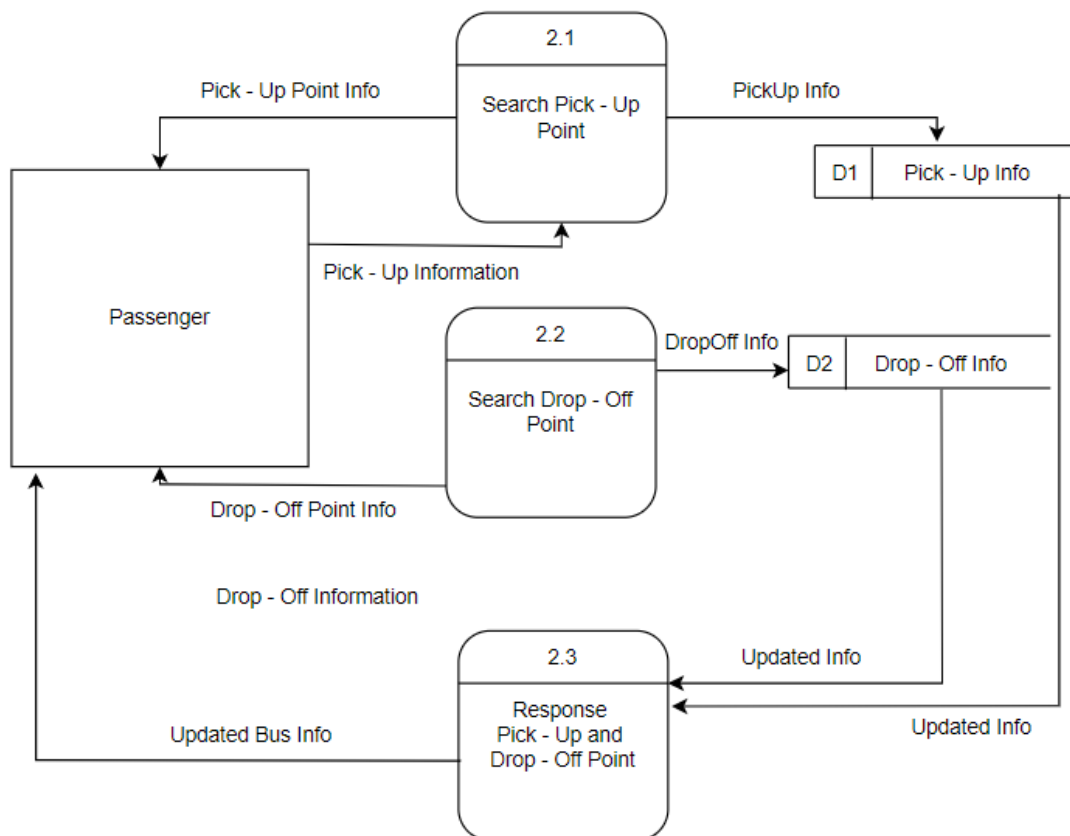
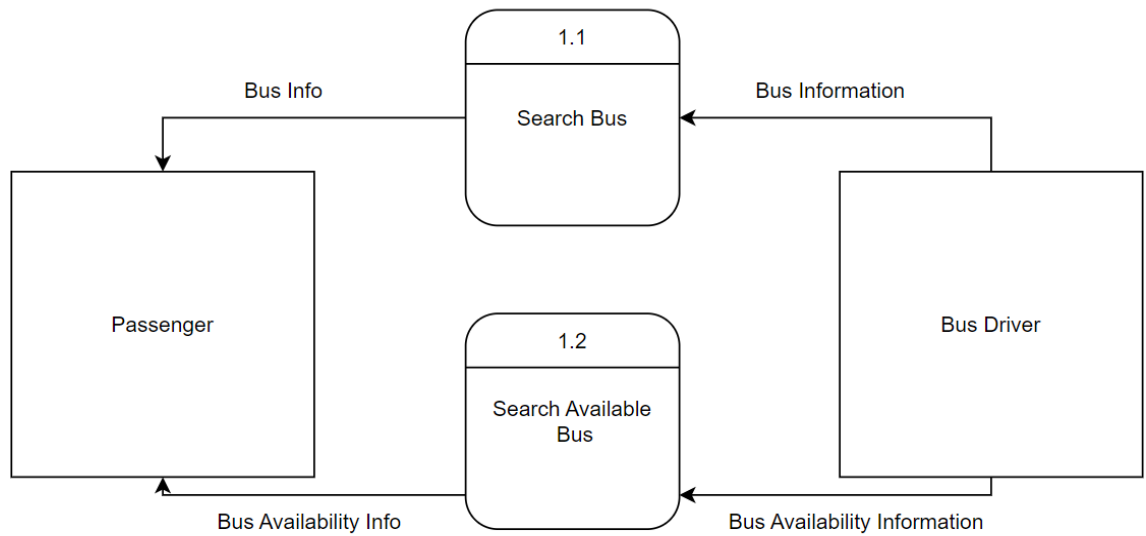
- Context Diagram



- Level 0 Diagram



- Child Diagram



## 6.0 Summary of Requirement Analysis Process

The corporate activities are elaborated in the NavUTM system requirement analysis of the present business processes. The primary options that are offered on this page include login to become a user, choosing bus schedules according to routes and pick-up and drop-off stops, previewing the buses and schedules through main options selection. All basic features, for example, listing the buses, pick and drop areas, passenger information, and bus locations have functional requirements that depict the input, execution, and output. We identified bus information as the type of data by or through which passengers and bus drivers contribute to the outputs such as passenger information, real-time bus position, and bus information as input. Non-functional requirements address the system's ability to handle the multiple users, ensure that a student and a bus driver can exchange information with each other, and remain accessible for multiple users with dependable internet connection and reliable location services.