



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
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Project: Phase 1

<NavUTM>

SECD2613 SYSTEM ANALYSIS AND DESIGN

Lecturer: Dr. Cik Suhaimi Bin Yusof

Group Member:

Name	Matric No.
Ch'ng Seng Hong	A23CS0058
Foo Ming Kuang	A23CS5026
Sathishwar Rao A/L Mahendra Rao	A23CS8021
Tan Jia Ying	A23CS0274

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1.0 Introduction

In current navigation system given by UTM for shuttle bus shows the time scheduled for the buses are the pick-up and drop-off locations. In addition, they also included the bus stop along the route that each bus takes. UTM has nearly 21 shuttle buses that are currently running inside the campus itself. There are nine groups of bus which is sentenced to a specific route. There are two to three buses in a group that takes turn each 10 minutes to pick-up and drop along the routes that it was given.

Besides that, student need to be always aware about their timing to be at the bus stop, so they can catch the bus on time. Furthermore, students are not aware of the timing of the bus arrival for bus stops along the routes. Students are entitled to be wait at the bus stop, so they don't miss the bus. Over the year, students are used to the original navigation system but lately, when new students come in to stay in the campus, they are having a hard time getting on the bus on time to go to their classes and back to campus. Hence, a new bus navigation system should be developed to ease the challenges faced by the students for the bus service.

2.0 Background Study

In recent years, advancements in technology have paved the way for more sophisticated and efficient transportation solutions, particularly in the form of real-time bus tracking systems. These systems leverage GPS technology and mobile applications to provide users with accurate and up-to-date information about bus locations, arrivals, and departures.

Public transportation plays a crucial role in facilitating mobility and accessibility, especially within large university campuses like Universiti Teknologi Malaysia (UTM). Effective transportation systems not only connect various parts of the campus but also contribute to the overall experience and well-being of students, faculty, and staff.

Traditional bus navigation systems rely on fixed schedules and designated bus stops, which can be limiting and inefficient, particularly in dynamic environments such as university campuses. At UTM, the current navigation system for shuttle buses follows a predetermined schedule with designated pick-up and drop-off locations. However, this system fails to provide real-time information about bus locations and arrivals at intermediate stops along the routes.

3.0 Problem Statement

1. Exact Bus Location

Currently the system that is provided for the students does not show the exact location of the bus on time. Students find it harder to know the location of the bus along the route and it leads to students missing their bus they needed to take to reach a stop punctually.

2. Number of Passengers

Students are also unaware about the number of passengers inside the bus. If the one of the bus students are needed to hop in is full, they need to wait for a longer time for another bus to hop in. As for a student, time management is the most important thing they should be aware about. This led them to miss their class or any important events.

3. Bus Arrival Time

The arrival time that is listed in the schedule is not punctual. Students who wait at the bus stop that is listed in the route is unaware about the bus arrival time. The bus schedule only shows the time and location of a bus from where the bus starts its journey and ends, so students who wait at the bus stops in between the routes are clueless of the bus arrival time to their location.

4.0 Proposed Solution

In the bustling campus of Universiti Teknologi Malaysia (UTM), the introduction of NavUTM marks a significant leap towards enhancing the daily commute of its community. This state-of-the-art real-time GPS tracking system is poised to replace the paper-based bus schedules, ushering in an era of digital precision and convenience that promises to transform campus navigation.

NavUTM emerges as a beacon of innovation, offering instantaneous and accurate bus location services that render the static PDF schedules obsolete. This pivotal shift not only refines the transportation experience but also empowers users to meticulously plan their campus sojourns. With the provision of live updates on traffic disruptions, unexpected collisions, and other unforeseen events, NavUTM equips users with the knowledge of bus estimated times of arrival (ETAs), fostering a culture of informed decision-making and adaptable travel strategies.

The system's real-time bus occupancy feature is a testament to its ingenuity, providing a window into the number of passengers aboard each bus at any given moment. In scenarios where a bus reaches its full capacity, NavUTM steps in with alternative route suggestions or different bus options, ensuring that users' journeys to their intended destinations remain seamless. Imagine a scenario where Bus A is ensnared in a traffic snarl; NavUTM's advanced real-time algorithms and data analysis come to the rescue, advising commuters to transition to Bus B and subsequently to Bus C, thus orchestrating an uninterrupted and efficient transit.

NavUTM's commitment to punctuality is further exemplified by its personalized notification system, tailored to individual schedules. This feature guarantees that students can synchronize their academic timetables with the bus arrivals, enabling them to depart from their locations at the most opportune times and arrive at lectures and appointments punctually.

The inclusion of a real-time communication interface within NavUTM is a nod to the power of collective intelligence. It empowers the campus community to report traffic-related incidents such as congestion, accidents, or road closures directly through the app. This collaborative approach to incident reporting is instrumental in compiling the most comprehensive and accurate real-time data, which in turn allows NavUTM to swiftly recalibrate its maps and propose the most effective navigation routes.

To uphold the integrity of the information disseminated, NavUTM incorporates a verification system that enables users to authenticate the accuracy of reported incidents. This crowdsourced validation mechanism is crucial in sifting out erroneous data, thereby ensuring the reliability of the information provided. In a bid to foster community engagement, NavUTM introduces a points system that rewards users for their valuable contributions to the platform. As users amass points, they ascend through various levels of recognition, culminating in badges of honour such as bronze, silver, gold, platinum, and diamond, which they can proudly exhibit on their profiles.

At the heart of NavUTM's design philosophy lies an unwavering commitment to security and privacy. The system employs sophisticated encryption techniques and processes all data through secure, localized algorithms or encrypted servers. This rigorous approach to data protection ensures the utmost privacy and security for users, affording them the tranquillity of mind as they navigate the campus using NavUTM.

By weaving together these multifaceted features, NavUTM is set to become an indispensable tool for the UTM community, bolstering the predictability and reliability of the campus bus services and offering a smooth and stress-free commuting experience for all. NavUTM epitomizes UTM's dedication to harnessing technology to elevate the quality of campus life, setting a new standard for academic institutions worldwide.

4.1 Technical

The technical feasibility of the NavUTM system at Universiti Teknologi Malaysia (UTM) is underpinned by the utilization of advanced development tools and APIs, such as Google Maps for mapping services and GPS for location tracking. The integration of these technologies ensures precise real-time bus tracking and route optimization. A robust database architecture is employed to analyze traffic patterns using sophisticated algorithms, enabling the system to provide accurate ETAs and alternative route suggestions in case of delays. This data-driven approach facilitates a seamless and efficient navigation experience for the UTM community, reflecting the system's capability to meet the technical requirements of modern campus transportation solutions.

4.2 Operational

Information System (IS) Support team is essential to ensure the operational feasibility of the real-time bus tracking system. This team will be responsible for the deployment, maintenance, and ongoing support of the NavUTM system, addressing technical issues, and ensuring that the system's integration with UTM's existing infrastructure is smooth and efficient. The IS Support team will also play a critical role in managing the system's database, which is vital for analyzing traffic patterns and optimizing bus routes.

4.3 Economical

Estimated Cost	
Hardware	RM 50000
Software	RM 10000
Installation	RM 8000
Training	RM 20000
Maintenance	RM 5000 per year

Estimated Benefits	
Advertising	RM 50000
Sponsorships	RM 10000
Branded Merchandise	RM 5000

Assumptions	
Discount rate	10%
Sensitivity factor (cost)	1.1
Sensitivity factor (benefits)	0.9
Annual change in production costs	7%
Annual change in benefits	5%

Costs	Year0	Year1	Year2	Year3	Year4	Year5
Development Costs						
- Hardware	55000					
- Software	11000					
- Installation	8800					
- Training	22000					
Total	96800					
Production Costs						
- Maintenance		5500	5885	6297	6738	7210
Annual Prod. Costs		5500	5885	6297	6738	7210
(Present Value)		5000	4864	4732	4603	4477
Accumulated Costs		101800	106664	111396	115999	120476

Benefits	Year0	Year1	Year2	Year3	Year4	Year5
- Advertising		45000	47250	49613	52094	54699
- Sponsorships		9000	9450	9923	10420	10941
- Branded Merchandise		4500	4725	4962	5214	5475
Total		58500	61425	64498	67728	71115
Accumulated Benefits (Present Value)		58500	119925	184423	252151	323266
		53182	99112	152416	208390	267162
Gain or Loss		(48618)	(7552)	41020	92391	146686
Profitability Index	1.52					

5.0 Objective

The objectives of implementing the NavUTM system at Universiti Teknologi Malaysia (UTM) are as follows:

1. **Enhance Commuting Experience:** Improve the overall commuting experience for students, faculty, and staff by providing accurate and real-time information about bus locations and arrivals.
2. **Reduce Waiting Times:** Minimize waiting times at bus stops by enabling users to make informed decisions about when to arrive at the stop based on real-time bus tracking data.
3. **Optimize Resource Allocation:** Improve the efficiency of campus transportation operations by optimizing bus routes and schedules based on actual demand and traffic conditions.
4. **Facilitate Time Management:** Enable users to manage their time more effectively by synchronizing their schedules with real-time bus arrival information, reducing the risk of being late for classes, appointments, or other commitments.

6.0 Scope of the Project

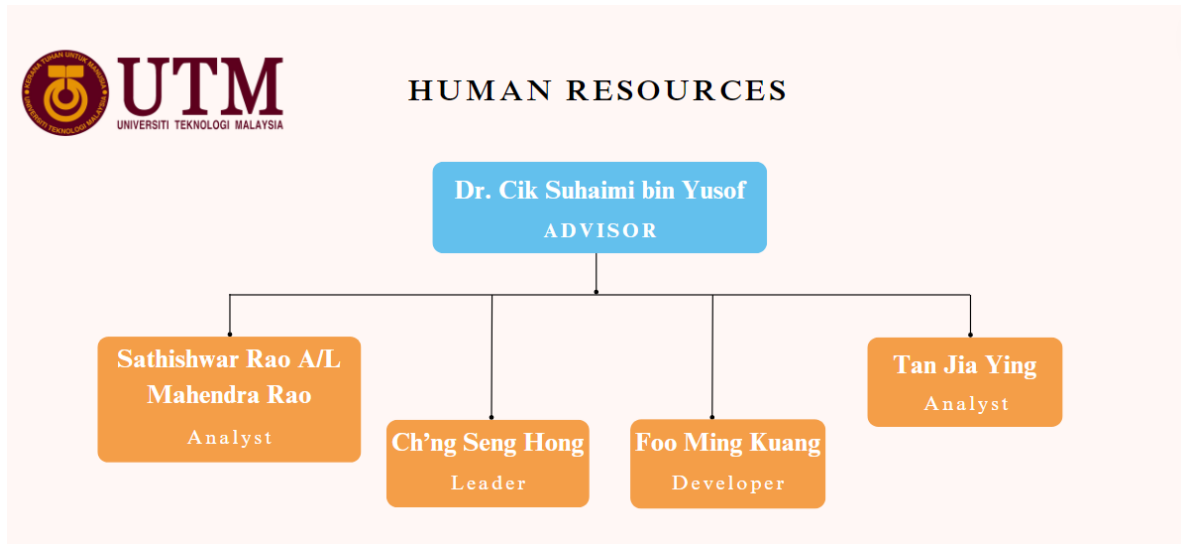
In the context of implementing the NavUTM system at Universiti Teknologi Malaysia (UTM), the scope encompasses various aspects, including system development, hardware installation, software integration, training, testing, and eventual deployment. Each of these components plays a crucial role in realizing the project's objectives of enhancing the commuting experience and optimizing campus transportation operations.

1. **System Development:** This entails the development of the NavUTM system, including the design and implementation of the real-time bus tracking software, mobile applications, and web interfaces. The system should be user-friendly, intuitive, and capable of providing accurate and reliable bus location information to users.
2. **Hardware Installation:** The installation of GPS devices on each shuttle bus is essential for enabling real-time tracking and data transmission. This component involves procuring the necessary hardware, configuring it to integrate with the NavUTM system, and installing it on the buses.
3. **Software Integration:** Integrating the NavUTM system with existing UTM infrastructure is critical for ensuring seamless operation and data exchange. This includes integrating with databases, information systems, and other relevant platforms to facilitate data sharing and communication.
4. **Training and Support:** Providing training for bus drivers, staff, and users on how to use the NavUTM system effectively is crucial for its successful adoption. Additionally, establishing a support system to address technical issues and provide assistance to users ensures a smooth transition and ongoing support.
5. **Testing and Validation:** Thorough testing and validation of the NavUTM system are necessary to ensure its accuracy, reliability, and usability. This involves testing various scenarios, including bus tracking accuracy, data transmission reliability, and user interface functionality, to identify and address any issues before full deployment.

6. **Pilot Implementation:** Piloting the NavUTM system on a selected subset of buses or routes allows for real-world testing and evaluation of its effectiveness. Gathering feedback from users during the pilot phase helps identify areas for improvement and refinement before full-scale implementation.
7. **Scale-Up and Expansion:** Upon successful pilot implementation, scaling up the NavUTM system to cover all shuttle buses and routes across the UTM campus is essential. Additionally, exploring opportunities for future expansion and enhancement of the system ensures its continued relevance and effectiveness in meeting evolving needs and technologies.

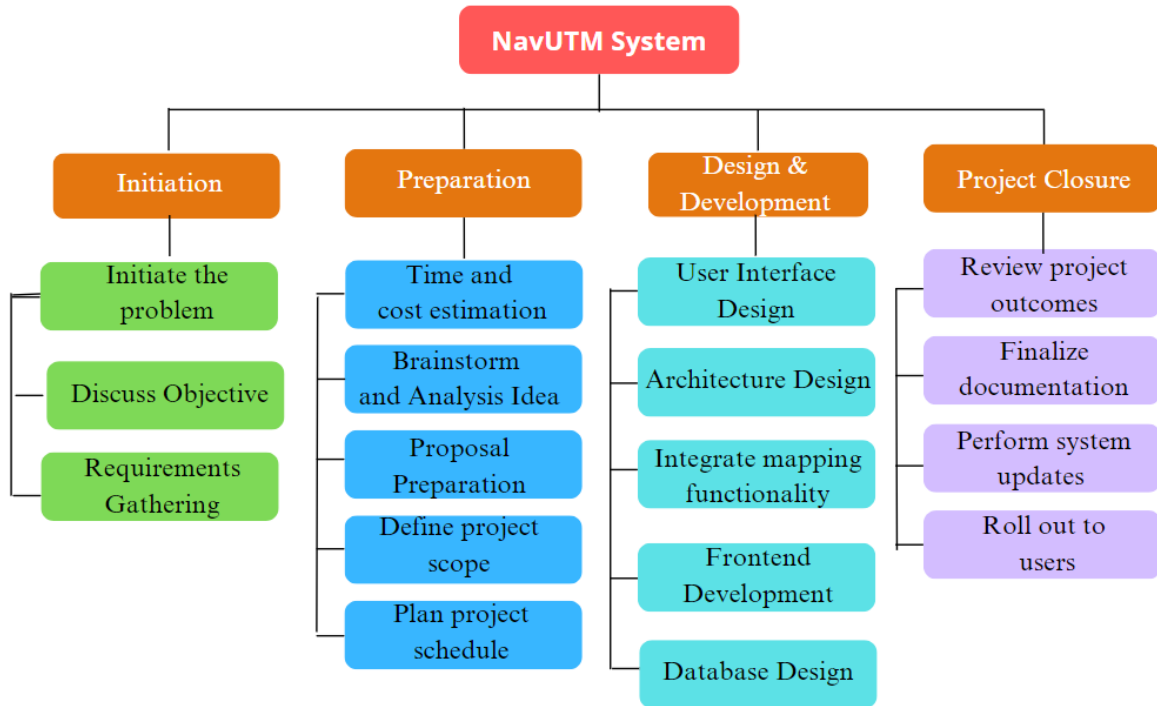
7.0 Project Planning

7.1 Human Resource



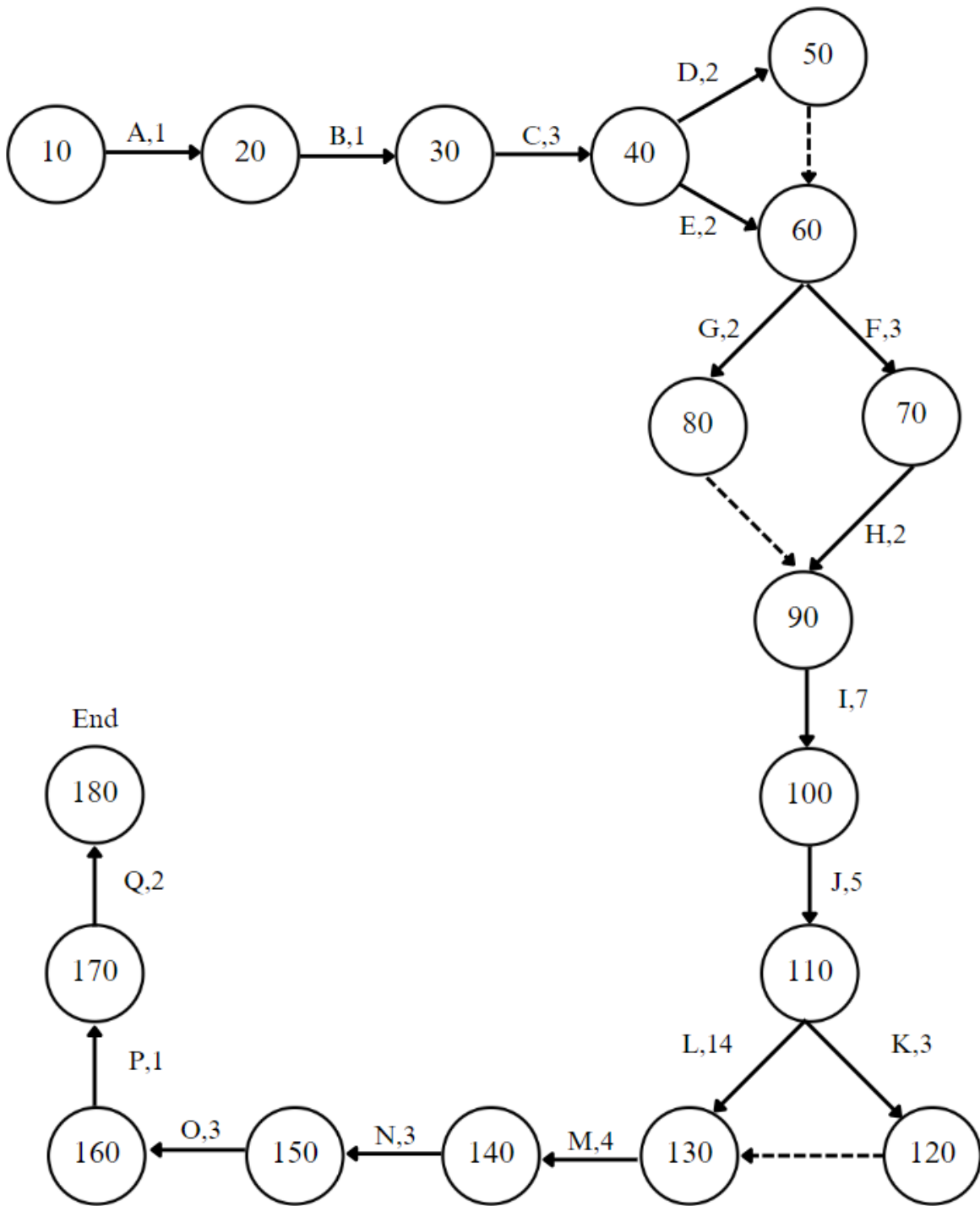
7.2 Work Breakdown Structure (WBS)

Work Breakdown Structure



7.3 PERT Chart (based on WBS)

Activity		Predecessor	Duration(day)
A	Initiate the problem	None	1
B	Discuss Objective	A	1
C	Requirements Gathering	B	3
D	Time and cost estimation	C	2
E	Brainstorm and Analysis Idea	C	2
F	Proposal Preparation	E	3
G	Plan project schedule	E	2
H	Define project scope	F	2
I	User Interface Design	G,H	7
J	Architecture Design	I	5
K	Integrate mapping functionality	J	3
L	Frontend Development	J	14
M	Database Design	L	4
N	Review project outcomes	M	2
O	Finalize documentation	N	3
P	Roll out to users	P	1
Q	Perform system updates	Q	2



Note all duration are in days.

Path 1: A-B-C-D-G-I-J-L-M-N-O-P-Q

Length: $1+1+3+2+2+7+5+14+4+3+3+1+2=48$

Path 2: A-B-C-D-G-I-J-K-M-N-O-P-Q

Length: $1+1+3+2+2+7+5+3+4+3+3+1+2=37$

Path 3: A-B-C-D-F-H-I-J-L-M-N-O-P-Q

Length: $1+1+3+2+3+2+7+5+14+4+3+3+1+2=51$

Path 4: A-B-C-D-F-H-I-J-K-M-N-O-P-Q

Length: $1+1+3+2+3+2+7+5+3+4+3+3+1+2=40$

Path 5: A-B-C-E-G-I-J-L-M-N-O-P-Q

Length: $1+1+3+2+2+7+5+14+4+3+3+1+2=48$

Path 6: A-B-C-E-G-I-J-K-M-N-O-P-Q

Length: $1+1+3+2+2+7+5+3+4+3+3+1+2=37$

Path 7: A-B-C-E-F-H-I-J-L-M-N-O-P-Q

Length: $1+1+3+2+3+2+7+5+14+4+3+3+1+2=51$

Path 8: A-B-C-E-F-H-I-J-K-M-N-O-P-Q

Length: $1+1+3+2+3+2+7+5+3+4+3+3+1+2=40$

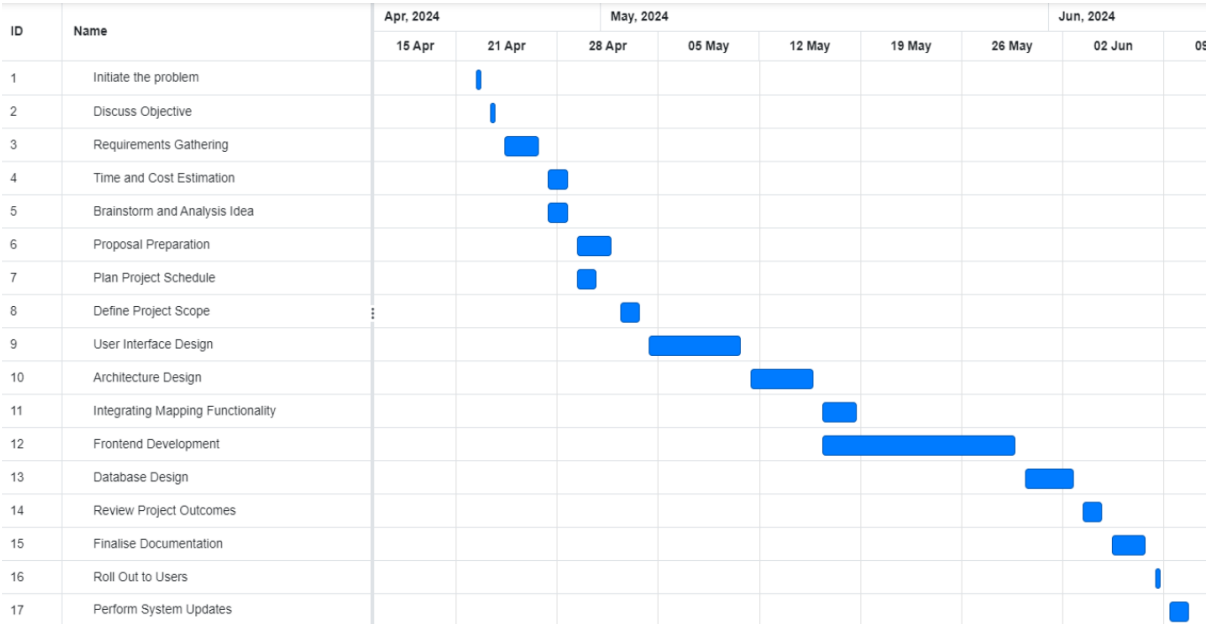
Since the critical path is the longest path through the network diagram,

Path 3 (A-B-C-D-F-H-I-J-L-M-N-O-P-Q) and

Path 7 (A-B-C-E-F-H-I-J-L-M-N-O-P-Q)

are the critical path for this Project.

7.4 Gantt Chart



8.0 Benefit and Overall Summary of Proposed System

Nav UTM improve the commuting experience of UTM students. NavUTM providing real-time information on bus locations and by using the accurate arrival time estimates feature allowing students to plan their journeys to class or other event on campus more efficiently. Instead of aimlessly waiting at the bus station under the hot sunny day, user can utilize the NavUTM to track the exact location of buses and received reliable estimates of when the bus will arrive at their stop.

Besides, NavUTM enhances campus safety by providing users with real-time updates on traffic conditions and potential hazards along bus routes. Additionally, the NavUTM includes features such as emergency notifications and alerts, allowing students to stay informed about any safety concerns or incidents occurring in the vicinity. This promotes a safer commuting environment and gives students peace of mind as they travel to and from campus.

Moreover, NavUTM provide user personalised notifications. NavUTM send notification based on their schedule to ensure that they didn't miss their buses and reach their destination punctually. It's like an all-in-one app for commuting, that make our journey simplify and no need keep switching app to see the schedule and bus timetable.

As summary, NavUTM is a comprehensive solution designed to address the challenges faced by students navigating the UTM. By providing real-time bus tracking, accurate arrival time estimates and personalized notifications, NavUTM enhances campus navigation, improves time management, and ensures a seamless and stress-free commuting experience. With its focus on accuracy, reliability, community engagement, and user privacy, NavUTM sets a new standard for campus transportation solutions and enhance the quality of campus life.

URL of the GitHub Repository: https://github.com/chngsenghong/Project1_SAD_20232024

Repository Snapshot:

SECD2613 SYSTEM ANALYSIS AND DESIGN PROJECT



NavUTM

Description

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Here's the link to kanban board link [Kanban Board Link](#)

URL of the Kanban Board: <https://github.com/users/chngsenghong/projects/1/views/1>

Kanban Board Snapshot:

