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ADDRESSING PANORAMA BUS SYSTEM USAGE WITH ENHANCED SERVICE QUALITY

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Article Info

Abstract

Modern society relies heavily on transportation for economic development, access to essential services like healthcare and education, and fostering global connectivity. Transportation infrastructure plays a pivotal role in urban planning, environmental sustainability, and facilitating international trade and cultural exchanges. Public transportation, such as buses, serves as a critical component of Malaysia's transport network, yet faces challenges including poor service quality and traffic congestion, deterring widespread public favor. To address these issues, the Bus Service System (BSS) mobile application was developed, aiming to enhance bus system attractiveness and efficiency through bus information provision. Employing the Rapid Application Development (RAD) methodology facilitated rapid prototyping and iterative refinement, crucial for meeting user needs and improving system usability. Testing revealed positive user feedback, affirming the application's ease of use and functional integration. Moving forward, future enhancements could focus on improving real-time bus arrival accuracy, robust integration with mapping services like Google Maps, and completing immersive 3D modeling to further enrich user experience and usability. By addressing these areas, the BSS application seeks to transform public transportation accessibility and usability in Malaysia, thereby promoting sustainable urban mobility and reducing reliance on private vehicles.

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INTRODUCTION

Modern society relies heavily on transportation for economic growth, access to services, and global connectivity. Transportation influences trade, urban planning, and environmental concerns, with modern technologies enhancing accessibility. However, bus travel time is often variable due to sharing roads with other traffic, making it less reliable. Despite advancements, coordinating public transport remains challenging (Parslov, 2023; Hörcher, 2021).

Public transport, typically government-funded, includes various modes like buses, taxis, and ferries, with hubs such as bus stops and taxi stands (Muna, 2016). In Malaysia, buses are a major part of the public transport network but face issues like limited reach and inefficiency, leading to traffic congestion and environmental impacts (AlKheder, 2021).

Modern society depends on transportation for economic growth and global connectivity. In Malaysia, public transportation, especially the bus system, faces challenges like poor service quality and an unattractive application. To tackle these issues and reduce traffic congestion, the BSS mobile app was introduced. BSS aims to improve the bus system, encourage public transport use, and decrease private vehicle numbers on the road.

LITERATURE REVIEW

Transportation is essential for societal development and welfare, providing access to jobs, goods, and services, and enhancing economic well-being (Ubaid Illahi M. S., 2021). As population mobility increases, the importance of transport systems grows. Despite more people owning personal vehicles, public transport remains a vital infrastructure component, serving crucial functions (Daniil Bolobonov, 2021).

Transportation

Transportation is crucial for society, providing access to jobs, goods, and services, and boosting economic growth. Even with more people owning cars, public transport, especially buses, remains essential, connecting communities and supporting urban life. Land transportation supports global trade and economic activity, while non-motorized options like biking and walking offer environmental and health benefits. Figure 1 shows Bus Rapid KL.

Figure 1: Bus Rapid KL

Buses are a key part of public transport, providing wide coverage and affordability, making them accessible to many people. They reduce traffic congestion and pollution by carrying many passengers at once. Buses also connect different neighborhoods to important services like jobs, schools, and healthcare, promoting social inclusion. Overall, well-planned bus networks improve urban mobility and contribute to a more sustainable environment by supporting low-carbon transportation options.

Technology

Modern transportation technologies have greatly advanced, enhancing infrastructure, vehicle design, and passenger services. The Hyperloop, developed by HyperloopTT, is an ultra-high-speed system using pressurized capsules that float on a magnetic field within tubes, offering swift, energy-efficient travel. These capsules are made with advanced materials and sensors for real-time monitoring, ensuring safety and performance. This system reduces environmental impact and provides a seamless travel experience with digital ticketing and biometric check-in (HyperloopTT, 2024). Figure 2 shows the HyperloopTT. Similarly, autonomous vehicles like Waymo use detailed maps and real-time data to navigate without a driver, employing Lidar technology for safe and efficient travel (Waymo One, 2023).

Figure 2: HyperloopTT

Wi-Fi technologies have transformed transportation by providing onboard connectivity in cars, buses, trains, and aircraft. This connectivity allows passengers to stay connected for work and entertainment, enhancing the travel experience. Wi-Fi supports innovative passenger services and improves urban transportation through smart city traffic systems, integrating wireless communication units for better efficiency and safety (Yongjie Lin, 2022; Rui Ma, 2015). These advancements in transportation technologies not only improve safety and efficiency but also promote environmental sustainability and enhance the overall passenger experience.

Mobile Apps

Mobile applications have become essential tools in modern life, offering various functionalities across multiple domains, such as communication, social media, shopping, health, fitness, and gaming (Konstantin Holl, 2019). Their quality is vital, as subpar apps can harm a company's reputation and result in financial losses. The design and performance of these apps hinge on meeting both functional and non-functional requirements, ensuring they provide necessary features while maintaining usability, performance, reliability, scalability, and security (BoundlessNews By Themeinwp, 2024).

Usability is a key aspect of mobile application design, emphasizing user-friendliness, efficiency, and satisfaction. Usability principles, such as those outlined by Nielsen, include efficiency, satisfaction, learnability, memorability, and error minimization (Swaid, 2017). Human-Computer Interaction (HCI) and Mobile User Interface (UI) Design Principles play a crucial role in creating interfaces that are intuitive and easy to navigate, ultimately enhancing the user experience. By prioritizing usability, developers can create applications that are not only functional but also enjoyable and accessible, leading to higher user satisfaction and better overall performance (Yoon, 2023).

METHODOLOGY

The RAD methodology is chosen for this project because it allows for rapid development and efficient use of resources. With only four primary phases, RAD facilitates quick prototyping and iterative development based on user feedback. This approach is ideal for small-scale projects, like ours, because it shortens development time while maintaining quality. Additionally, RAD is cost-effective, making it a suitable choice for projects with limited budgets. Figure 3 shows the flowchart of the Bus Service System application.

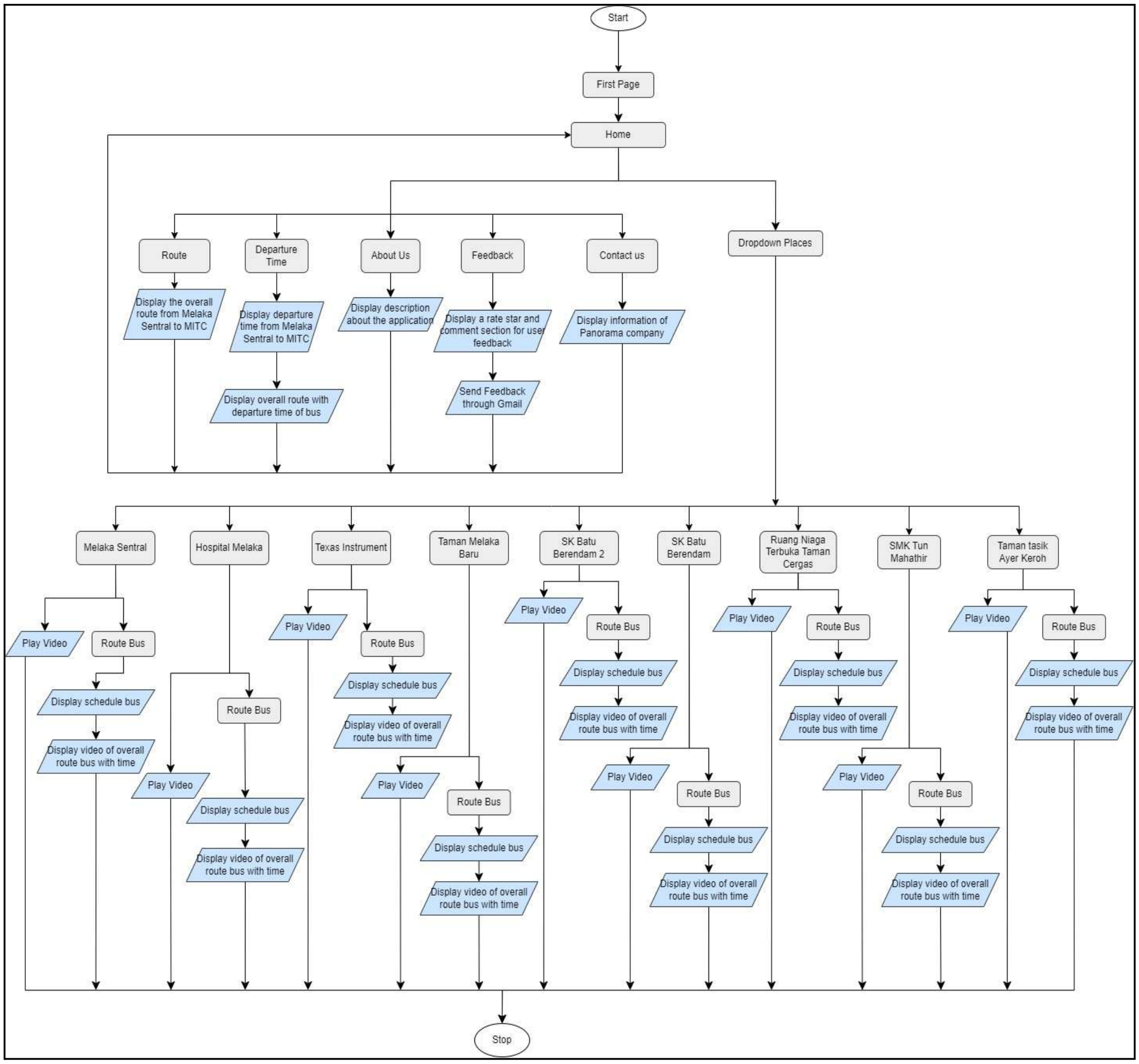

Figure 3: Flowchart of the application

RESULT AND DISCUSSION

To assess the application's usability, we used the System Usability Scale (SUS) and tested it with 30 users who had prior bus travel experience. Participants, including family, children, and random passengers, completed a questionnaire with demographic questions and SUS ratings. This section summarizes the testing process using data from Table 1, which details responses to each questionnaire question. Users rated their opinions on a five-point scale (1-Strongly Disagree to 5-Strongly Agree). The System Usability Scale (SUS) method is used to organize this feedback. Table 1 shows the summary of the questionnaire answer collected from the tester.

Table 1 Summary of the questionnaire answer collect from tester.

No.	**Question**	**Scale**				
		1	**2**	**3**	**4**	**5**
1	I think I would like to use this application frequently.			2	14	14
2	I found this application unnecessarily complex.		4	6	10	10
3	I thought this application was easy to use.			2	12	16
4	I think I would need assistance to be able to use this application.	6	6	5	10	3
5	I found the various functions in this application were well integrated.				18	12
6	I thought there was too much inconsistency in this application.	10	11	3	5	1
7	I would imagine that most people would learn to use this application very quickly.			3	14	13
8	I found this application very cumbersome.	13	11		5	1
9	I felt very confident using this application.			2	16	12
10	I needed to learn a lot of things before I could get going with this application.	10	9	3	6	2

The System Usability Scale (SUS) requires a specific formula to determine the outcome accurately, involving several steps. Firstly, each answer must be converted into numerical values: strongly agree to 5, agree to 4, neutral to 3, disagree to 2, and strongly disagree to 1. Secondly, the SUS score is calculated using the formula detailed in Figure 4 (a) and (b), which outlines the step-by-step process for obtaining the SUS result.

Step 1: Convert the scale into number for each of the 10 questions

- Strongly Disagree : 1 point
- Disagree : 2 point
- Neutral : 3 point
- Agree : 4 point
- Strongly Agree : 5 point

(a)

Step 2: Calculate

- X = Sum of the points for all odd-numbered question – 5
- Y = 25 – Sum of the points for all even-numbered questions
- SUS Score = (X + Y) x 2.5

(b)

Figure 4 Formula to calculate SUS result.

After converting all responses into numerical values, the answers need to be calculated according to the number of questions. X and Y will be the terms for each calculation. X is used to calculate the sum of the responses to all odd-numbered questions, while Y is used for all even-numbered questions. The sum of X responses is then subtracted by five, and the total of Y responses is subtracted from twenty-five. To calculate the SUS score, X and Y are added together, and the total is multiplied by 2.5. This process successfully yields the SUS result.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
1. I think that I would like to use this system frequently.				/	
2. I found the system unnecessarily complex.		/			
3. I thought the system was easy to use.				/	
4. I think that I would need the support of a technical person to be able to use this system.				/	
5. I found the various functions in this system were well integrated.				/	
6. I thought there was too much inconsistency in this system.		/			
7. I would imagine that most people would learn to use this system very quickly.				/	
8. I found the system very cumbersome to use.	/				
9. I felt very confident using the system				/	
10. I needed to learn a lot of things before I could get going with this system.	/				

Figure 5 Tester one result for BSS application

Figure 5 displays the questions along with the answers provided by tester one. In this diagram, the first participant's answers were duplicated into a new version where all odd-numbered questions are marked with an orange tick, while even-numbered questions are marked with a blue tick. This method helps distinguish between the two sets of answers visually. Table 2 shows the result of each participant using SUS.

First participant SUS result:

Odd-numbered question (X) = [(4 + 4 + 4 + 4 + 4) – 5]
= 15

Even-numbered question (Y) = [25 – (2 + 4 + 2 + 1 + 1)]
= 15

SUS Score for the first participant = (15 + 15) * 2.5
= 75

Table 2 Result of each participant using SUS

Participants	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Odd Question	Even Question	SUS Score
1	4	2	4	4	4	2	4	1	4	1	15	15	75
2	4	2	4	2	4	1	5	2	4	1	16	17	82.5
3	5	5	5	1	5	1	5	1	5	1	20	16	90
4	5	5	5	1	5	1	5	1	5	1	20	16	90
5	5	5	5	1	5	1	5	1	5	1	20	16	90
6	5	5	5	5	5	2	4	1	4	2	18	10	70
7	3	4	5	3	5	1	5	1	4	2	17	14	77.5
8	5	4	5	4	4	3	3	2	4	2	16	10	65
9	4	4	4	2	5	2	4	1	5	1	17	15	80
10	4	5	3	4	5	5	5	5	5	5	17	1	45
11	4	5	5	2	4	2	4	2	4	2	16	12	70
12	4	4	4	4	4	3	4	4	4	4	15	6	52.5
13	5	5	4	2	5	2	4	1	5	1	18	14	80

Table 2 (Continued)

14	5	4	4	3	4	3	4	2	4	3	16	10	65
15	5	4	4	1	5	3	5	1	5	1	19	15	85
16	4	4	4	1	4	2	4	2	4	2	15	14	72.5
17	5	5	5	4	4	1	3	2	4	4	16	9	62.5
18	4	4	4	4	4	2	4	1	4	2	15	12	67.5
19	5	4	5	4	5	4	5	4	5	4	20	5	62.5
20	4	3	5	3	4	2	4	2	5	3	17	12	72.5
21	5	4	5	5	4	4	5	4	4	5	18	3	52.5
22	5	5	5	1	5	1	5	1	5	1	20	16	90
23	3	5	5	5	4	4	3	2	3	3	13	6	47.5
24	4	4	5	4	4	4	4	4	4	4	16	5	52.5
25	5	3	5	4	5	2	5	1	5	1	20	14	85
26	5	3	5	2	4	1	5	1	5	2	19	16	87.5
27	4	3	4	3	4	4	4	4	3	4	14	7	52.5
28	4	2	4	3	4	1	5	2	5	2	17	15	80
29	5	3	5	4	4	2	4	2	4	4	17	10	67.5
30	4	2	4	3	4	1	5	2	5	3	17	14	77.5
												Total =	71.58333

This application was tested using the System Usability Scale (SUS), resulting in a total score of 71.5. The SUS score is derived by summing up all individual user scores based on a specified formula, then dividing by the total number of users. The feedback from testers of various ages indicates positive usability. Additionally, Figure 6 provides guidelines to interpret the SUS score and determine its level of usability.

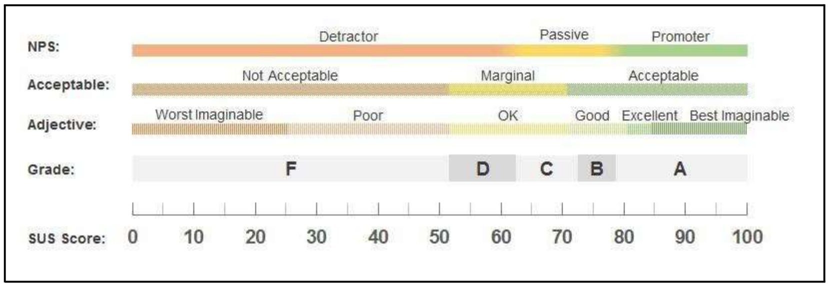

Figure 6 Table of SUS score.

Based on the testing results, this application has received a favorable rating equivalent to a C grade. This indicates that users have found the application to promote positive interaction and provide an enjoyable user experience.

CONCLUSION

In conclusion, this project effectively addressed the challenges faced by Malaysia's bus system through the development of the Bus Service System (BSS) mobile application. We successfully met our objectives by designing detailed 3D maps that enhance route visualization and navigation, and by developing a mobile app with a multimedia-rich interface to improve user experience. The app's functionality was further validated through usability testing with 30 participants, which yielded a positive System Usability Scale (SUS) score of 71.5. This score reflects the app’s intuitive design and user-friendly features. The project utilized Rapid Application Development (RAD) to facilitate a swift and effective design process, incorporating iterative feedback to refine the final product. Overall, the BSS application represents a significant advancement in Malaysia’s public transportation landscape, offering improved accessibility, reducing traffic congestion, and contributing to a more sustainable urban environment.

REFERENCES (APA 7TH EDITION)

Anders Parslov, N. C. (2023). Short-term bus travel time prediction for transfer synchronization with intelligent uncertainty handling. Expert Systems with Applications, 0957-4174.

Daniel Hörcher, A. T. (2021). A review of public transport economics. Economics of Transportation, 100196.

Muna Norkhairunnisak Ustadi, N. A. (2016). A Study towards the Efficiency of Public Transportation Hub Characteristics: A Case Study of Northern Region, Peninsular, Malaysia. Procedia Economics and Finance 35 , 612-621.

AlKheder, S. (2021). Promoting public transport as a strategy to reduce GHG emissions from private vehicles in Kuwait. Environmental Challenges, 100075.

Ubaid Illahi, M. S. (2021). Assessment of transport sustainability using a hybrid approach: A comparison of four metropolitan cities of India. Case Studies on Transport Policy, 703-714.

Daniil Bolobonov, A. F. (2021). Managing Public Transport Safety Using Digital Technologies. Transportation Research Procedia, 862-870.

Sauro, J., PhD. (2018). 5 ways to interpret a SUS Score – MeasuringU. https://measuringu.com/interpret-sus-score/

About us: HyperloopTT. (2024). Retrieved from Hyperloop Transportation Technologies: https://www.hyperlooptt.com/

Waymo Driver. (2024). Retrieved from Waymo LLC: https://waymo.com/waymo-driver/

Yongjie Lin, Q. L. (2022). A Review of Wi-Fi-Based Traffic Detection Technology in the Field of Intelligent Transportation Systems. Sustainable Building Infrastructure and Resilience, 428.

Rui Ma, Q. G. (2015). An Improved WiFi Indoor Positioning Algorithm by Weighted Fusion. Sensors for Indoor Mapping and Navigation, 20.

Konstantin Holl, F. E. (2019). Chapter One - Mobile Application Quality Assurance, . Advances in Computers, Elsevier,, 1 - 77.

BoundlessNews By Themeinwp. (2024). Retrieved from Functional and Non-functional Requirements for Mobile Applications: https://cm-strategies.com/functional-and-non-functional-requirements-for-mobile-applications/

Swaid, S. (2017). Usability of Mobiel Apps: An Integrated Approach. LA, CA: Lawrence Berkeley National Laboratory.

Yoon, H. (2023). A Quantitative Evaluation for Usability under Software Quality Models. International Journal on Recent and Innovation Trends in Computing and Communication, 24-29.