American International University-Bangladesh (AIUB)

Department of Computer Science
Faculty of Science & Technology (FST)

Public Transport Optimization

A Software Engineering Project Submitted
By

Semester: Fall (24 – 25)		**Section: F**	**Group Number: 5**	
SN	Student Name	Student ID	Contribution (CO3+CO4)	Individual Marks
01	SAZID – AL – ABEDIN	22-45999-1	20%	
02	MD. SAIDUZZAMAN SOHAG	22-46006-1	20%	
03	MD. SADMAN HOSSAIN	22-46061-1	20%	
04	NOUROZE TARANNUM ANANNYA	22-46062-1	20%	
05	SEEMANTA TORAFDAR	21-45968-3	20%	

The project will be Evaluated for the following Course Outcomes

CO3: *Select* appropriate software engineering models, project management roles and their associated skills for the complex software engineering project and evaluate the sustainability of developed software, taking into consideration the societal and environmental aspects	Total Marks	
Appropriate Process Model Selection and Argumentation with Evidence	[5 Marks]	
Evidence of Argumentation regarding process model selection	[5Marks]	
Analysis the impact of societal, health, safety, legal and cultural issues	[5Marks]	
Submission, Defense, Completeness, Spelling, grammar and Organization of the Project report	[5Marks]	
CO4: *Develop* project management plan to manage software engineering projects following the principles of engineering management and economic decision process	Total Marks	
Develop the project plan, its components of the proposed software products	[5Marks]	

Identify all the activities/tasks related to project management and categorize them within the WBS structure. Perform detailed effort estimation correspond with the WBS and schedule the activities with resources	[5Marks]	
Identify all the potential risks in your project and prioritize them to overcome these risk factors.	[5Marks]	

Description of Student's Contribution in the Project work

Student Name: SAZID – AL – ABEDIN Student ID: 22-45999-1 Contribution in Percentage (%): 20% Contribution in the Project: ▪ Project Proposal ▪ System Functional Requirements ▪ Class Diagram ▪ Process Model and Role Identification and Responsibilities ▪ UI/UX Design ▪ Test plan ▪ Work bench Structure ▪ Project Estimation ▪ Timeline Chart ▪ Earned Value Analysis ▪ Risk Table ▪ Risk Reduction Techniques _____Sazid_____ Signature of the Student
Student Name: MD. SAIDUZZAMAN SOHAG Student ID: 22-46006-1 Contribution in Percentage (%): 20% Contribution in the Project: ▪ Project Proposal ▪ System Functional Requirements ▪ Use Case Diagram ▪ Process Model and Role Identification and Responsibilities ▪ UI/UX Design ▪ Test plan and ▪ Work bench Structure ▪ Project Estimation ▪ Timeline Chart

▪ Earned Value Analysis
▪ Risk Table
▪ Risk Reduction Techniques

_____Sohag_____
Signature of the Student

Student Name: MD. SADMAN HOSSAIN
Student ID: 22-46061-1
Contribution in Percentage (%): 20%
Contribution in the Project:
▪ Project Proposal
▪ System Functional Requirements
▪ Activity Diagram
▪ Process Model and Role Identification and Responsibilities
▪ UI/UX Design
▪ Work bench Structure
▪ Project Estimation
▪ Timeline Chart
▪ Earned Value Analysis
▪ Risk Table
▪ Risk Reduction Techniques

_____Sadman_____
Signature of the Student

Student Name: NOUROZE TARANNUM ANANNYA
Student ID: 22-46062-1
Contribution in Percentage (%): 20%
Contribution in the Project:
- Project Proposal
- System Functional Requirements
- Sequence Diagram
- Process Model and Role Identification and Responsibilities
- UI/UX Design
- Test plan
- Work bench Structure
- Project Estimation
- Timeline Chart
- Earned Value Analysis
- Risk Table
- Risk Reduction Techniques

_____Nouroze_____
Signature of the Student

Student Name: SEEMANTA TORAFDAR
Student ID: 21-45968-3
Contribution in Percentage (%): 20%
Contribution in the Project:
- Project Proposal
- System Functional Requirements
- Class Diagram
- Process Model and Role Identification and Responsibilities
- UI/UX Design
- Test plan
- Work bench Structure
- Project Estimation
- Timeline Chart
- Earned Value Analysis
- Risk Table
- Risk Reduction Techniques

_____Seemanto_____
Signature of the Student

1. PROJECT PROPOSAL

1.1 Background to the Problem

To address the challenges faced by public transport systems in densely populated cities in Bangladesh, this project aims to develop a digital platform to enhance the accessibility, convenience and efficiency of public transport. Currently, passengers encounter significant difficulties due to a lack of real-time information, poor route management, and inefficient ticketing processes. These issues result in overcrowded buses and trains, long wait times, and reduced reliability, which discourages the use of public transport and increases reliance on private vehicles.

The root cause of this problem lies in the absence of real-time data and streamlined ticketing solutions, leading to passenger frustration and overall system inefficiency. Addressing these issues is essential for creating a more sustainable urban transport system that meets the demands of a growing population while promoting public transport usage. By providing real-time tracking, route planning, ticketing, and availability updates, this app seeks to make public transportation a more reliable, accessible and attractive option for daily passengers, contributing to better urban mobility and environmental sustainability.

1.2 Solution to the Problem

The primary objective of this project is to develop a mobile application that enhances the public transportation experience by addressing common issues faced by passengers in urban areas. This app will integrate route searches, live tracking, suggestions, and a secure QR-code ticketing system to offer a convenient, reliable alternative to current transportation options. This solution aims to solve problems related to the lack of real-time information, overcrowding, and inefficient ticketing, making public transport a more attractive choice.

The proposed solution involves a GPS-integrated public transport app with features like route planning, real-time tracking, and cashless secure ticketing. The solution is feasible and scalable to meet business objectives since it supports widely-used mobile and GPS technology, requiring minimal additional infrastructure investment while increasing passenger satisfaction and potentially boosting public transport usage.

Key Functionalities of the Proposed Solution:

- **Route Search**: Provides an intuitive “From - To” search feature that recommends bus routes and options.
- **Bus Suggestion**: It will show available buses on that selected route.
- **Bus Information**: Tapping on a bus option provides details, including Estimated Time Arrival (ETA) and occupancy status, using GPS data.
- **Map with Route Suggestions**: A visual interface that offers route suggestions and relevant information.

- **Ticket Purchase and Validation**: Secure in-app ticketing system with one-hour pre-scan validity, reducing cash transactions.
- **Live Tracking**: Real-time bus tracking, updating users with accurate ETAs and traffic conditions.

Target User Groups: The primary users include daily commuters, students, and professionals in urban areas who depend on public transport. Secondary users are transport operators and government agencies that oversee public transit systems. Commuters benefit through:

- Live tracking will reduced wait times.
- Access to real-time updates that enhance efficiency.
- Cashless transactions that streamline the ticketing process.

Comparison and Extensions in the Proposed Study:

Building on existing solutions, our study addresses key gaps in urban public transport management to better serve densely populated areas like Bangladesh.

1. **User-Centric Mobile Application**: Unlike previous web-based approaches, such as the low-cost GPS model for mobile tracking presented in [1] and [2], our app focuses on a mobile platform for both users and drivers, centralizing route suggestions, live tracking, and digital ticketing.
2. **Integrated Ticketing**: While the reviewed studies focus on bus tracking, our solution extends functionality by integrating QR-based cashless ticketing, enhancing convenience and security for commuters.
3. **Advanced Route Planning**: Beyond real-time tracking, our app includes route planning with estimated arrival times and occupancy data, helping users reduce wait times and overcrowding.
4. **Enhanced Sustainability**: Our project encourages public transport usage by improving convenience, supporting goals like reduced congestion and emissions, aligning with urban sustainability efforts.

References:

[1] "Cost-Effective Bus Tracking Using Driver GPS," *IEEE Xplore*, [Online]. Available: https://ieeexplore.ieee.org/document/10544750.

[2] "Smart City Bus Tracking for Improved Urban Mobility," *IEEE Xplore*, [Online]. Available: https://ieeexplore.ieee.org/document/10346218.

Existing studies in the problem area and solution: Various software platforms, such as Uber and Pathao, offer real-time location tracking and navigation but focus on ridesharing on the other hand public transportation doesn't provide this. Studies on smart cities and transportation highlight that good public transport apps should include real-time data, tools to predict arrival times, and an easy-to-use interface. These studies highlight the importance of digital integration, which our project addresses by combining tracking, routing, and ticketing.

2. SOFTWARE DEVELOPMENT LIFE CYCLE

2.1 Process Model:

The **Incremental model** is particularly well-suited for a **Public Transport Optimization System** due to its flexibility, adaptability, and ability to handle dynamic requirements. Public transport systems are subject to constant changes in traffic patterns, regulations, and user needs, which makes the Incremental model ideal. It allows development in small, manageable chunks, meaning that core functionalities like **route optimization**, **scheduling**, and **tracking** can be delivered early and continuously refined based on real-time feedback from users and stakeholders. This early delivery ensures that even if the system isn't fully complete, users can still benefit from the improvements made in each increment.

Comparison Between other process model:

Waterfall: Less suited due to its rigid structure and the need for all requirements to be defined upfront, making it difficult to adapt to the dynamic nature of public transport.

RAD (Rapid Application Development): While RAD emphasizes fast prototyping and rapid iterations, it may struggle with scaling complex systems and managing integration across large, real-time datasets like those in public transport optimization. It also requires significant upfront investment in prototyping.

DSDM (Dynamic Systems Development Method): DSDM is more flexible than Waterfall, but it still has predefined phases and a focus on upfront planning, which can limit adaptability compared to the Incremental model.

XP (Extreme Programming): XP emphasizes best practices for software engineering, which is valuable for system quality but may not provide the same level of structured release planning and stakeholder management as the Incremental model. It's also highly focused on programming practices and not as suitable for large-scale, multi-phase project management like public transport systems.

Scrum: While Scrum promotes iterative development and flexibility, it is more focused on software development teams and short iterations (sprints) than on large-scale system integration. Public transport optimization typically requires a more phased approach with clear, scheduled milestones, which the Incremental model handles better.

2.2 Project Role Identification and Responsibilities

The development and management of the public transport optimization system require clearly defined roles and responsibilities. These roles ensure effective coordination among stakeholders and the development team, focusing on iterative progress and responsiveness to feedback.

1. **Project Manager**
    - Ensures the successful execution of the project using the Incremental Model.
    - Oversees the delivery of critical functionalities in each increment, ensuring alignment with stakeholder goals.
    - Monitors risks and resource allocation for smooth project execution.
2. **Product Owner**
    - Represents the interests of transport authorities, users, and other stakeholders.
    - Manages the feature backlog, prioritizing functionalities like route optimization, live tracking, and payment processing.
    - Collects feedback after each increment to refine upcoming deliverables.
3. **Development Team**
    - Designs and implements the system in increments, focusing on features such as ticket generation, user management, and live tracking.
    - Conducts integration testing at each stage to ensure seamless operation of newly added modules.
    - Develops user interfaces and backend systems for dynamic data handling.
4. **Testers**
    - Execute functional, integration, and regression testing for each increment.
    - Ensure real-time functionalities like bus tracking and notifications meet performance standards.
    - Validate security measures for payment processing and user data.
5. **Authority**
    - Provide requirements and feedback for each delivered increment.
    - Collaborate with the Product Owner to define priorities and validate completed features.

3. SOFTWARE REQUIREMENTS ANALYSIS

Functional Requirements

Role: User

1. User Login

1.1 The software will allow users to log in with their registered email and password.
1.2 The login credentials (email and password) will be verified against the database records.
1.3 Upon successful login, the user will be directed to their personalized home page.
1.4 If the login fails, the user will receive an error message indicating incorrect credentials.

1.5 If the number of login attempts exceeds three, the system shall temporarily lock the account for one hour (optional function).

Priority Level: High
Precondition: User has a valid email and password.

2. User Registration

2.1 The system shall allow new users to create an account by providing necessary information (name, email, password).
2.2 The email address must be unique and verified through a confirmation link sent to the user's email.

Priority Level: High
Precondition: None.

3. Route Search

3.1 The app shall provide a "From - To" search feature to recommend bus routes based on user input.
3.2 The system shall display available bus routes, including stops and transfers.
3.3 Users shall be able to filter routes based on travel time, number of transfers, and bus capacity.

Priority Level: High
Precondition: User is logged in.

4. Live Bus Tracking

4.1 The app will allow users to view real-time bus locations on a map using GPS data.
4.2 Users shall receive estimated arrival times (ETAs) for buses at their selected stops.
4.3 The system shall automatically update ETAs based on current traffic conditions.

Priority Level: High
Precondition: User has searched for a route.

5. Bus Information

5.1 The system shall provide detailed information about each bus, capacity, and occupancy status.
5.2 Users shall be able to tap on a bus to see additional details, including the estimated time of arrival (ETA) and current location.

Priority Level: Medium
Precondition: User has accessed bus route information.

6. Ticket Purchase

6.1 The app shall allow users to purchase tickets securely within the application.
6.2 Users shall have the option to pay via various digital payment methods (credit/debit cards, mobile wallets).
6.3 The system shall provide a QR code for ticket validation at the bus stop.

Priority Level: High
Precondition: User is logged in and has selected a route.

7. Save Payment Option:

7.1 The app will save the Payment information of the user if they allow to save the info to make the payment smoother.
7.2 It will be an one tap payment. (MFS info will be saved).

Priority Level: Medium
Precondition: user have to make at least one payment using any payment option.

8. Live Notifications

8.1 The app shall send push notifications to users about their selected bus's real-time status (delays, arrivals).
8.2 Users shall have the option to enable or disable notifications in their settings.

Priority Level: Medium
Precondition: User has opted in for notifications.

9. User Profile Management

9.1 Users shall be able to view and edit their personal information (name, email, password, age, phone number)
9.2 The system shall allow users to view their purchase history and current tickets.

Priority Level: Medium
Precondition: User is logged in.

10. Show Ticket Info:

10.1 After purchasing a ticket , details of that ticket will be showed and will be mailed to the user.

10.2 User can download the PDF version of the ticket.

Priority Level: High
Precondition: User have purchased a ticket.

11. **User Rating System for Buses**

11.1 The app shall allow users to rate their bus experience after each journey (e.g., cleanliness, punctuality, driver behavior).

11.2 The system shall aggregate ratings to help operators identify areas for improvement.

Priority Level: Low
Precondition: User has completed a trip.

12. Accessibility Features

12.1 The app shall include features for users with disabilities, such as voice commands and visual aids.

12.2 Information about wheelchair-accessible buses and routes shall be clearly displayed.

Priority Level: High
Precondition: None.

13. Multi-Language Support

13.1 The app shall provide multi-language support to accommodate users from different linguistic backgrounds.

13.2 Users shall be able to select their preferred language during registration and in settings.

Priority Level: Medium
Precondition: None.

Role: Bus Authority

1. Bus Owner Registration and Validation

1.1 The system shall allow bus owners to register by entering their National ID (NID) and other necessary details.

1.2 The system shall validate the bus owner's details through the BRTC (Bangladesh Road Transport Corporation) and NID database to ensure legitimate registration.

Priority Level: High
Precondition: None.

2. Bus Owner Profile Management

2.1 The bus owner shall be able to view and manage the details of their buses, including bus numbers, routes, and schedules.

2.2 The system shall allow the bus owner to update their personal and business information (name, business details, contact information).

Priority Level: Mediam
Precondition: Bus owner is registered and logged in.

3. Employee Management

3.1 The bus owner shall be able to add employees (drivers, conductors) to their company account by providing the employee's details and assigning a password.

3.2 The system shall allow the bus owner to update or delete employee accounts.

3.3 The system shall allow the bus owner to change the passwords of employees, with the restriction that only the owner can change employee passwords.

Priority Level: High
Precondition: Bus owner is logged in.

4. Employee Ticket Verification and Bus Information

4.1 Employees (drivers, conductors) shall be able to log in with a unique password provided by the bus owner.

4.2 Employees shall have the option to scan passenger tickets (QR code-based) and verify the ticket for validity.

4.3 Employees shall have access to view route details, including the current bus location and ETA, as well as the list of passengers on the bus.

4.4 The system shall allow employees to view detailed information about passengers, such as name, contact info, and ticket validity.

Priority Level: High
Precondition: Employee is logged in.

5. Passenger Check-in and Check-out Verification

5.1 The system require employees to scan a passenger's ticket when they get on the bus to validate the passenger's entry.

5.2 The system require employees to scan a passenger's ticket again when they get off to confirm that they have completed their journey.

5.3 If a passenger fails to check out, the system shall apply an additional charge for the unverified journey.

Priority Level: High
Precondition: Employee has scanned the ticket when a passenger get in.

6. Real-Time Bus Vacancy and Seat Availability

6.1 The system shall allow the bus owner and employees to view real-time bus occupancy and available seats.

6.2 When a passenger checks in and out, the system shall update the seat availability in real time for both the client and the bus owner apps.

6.3 The system shall notify the bus owner and employees when the bus reaches full capacity.

Priority Level: High
Precondition: Bus is operating and has passengers.

7. Bus Owner Financial Overview and Reporting

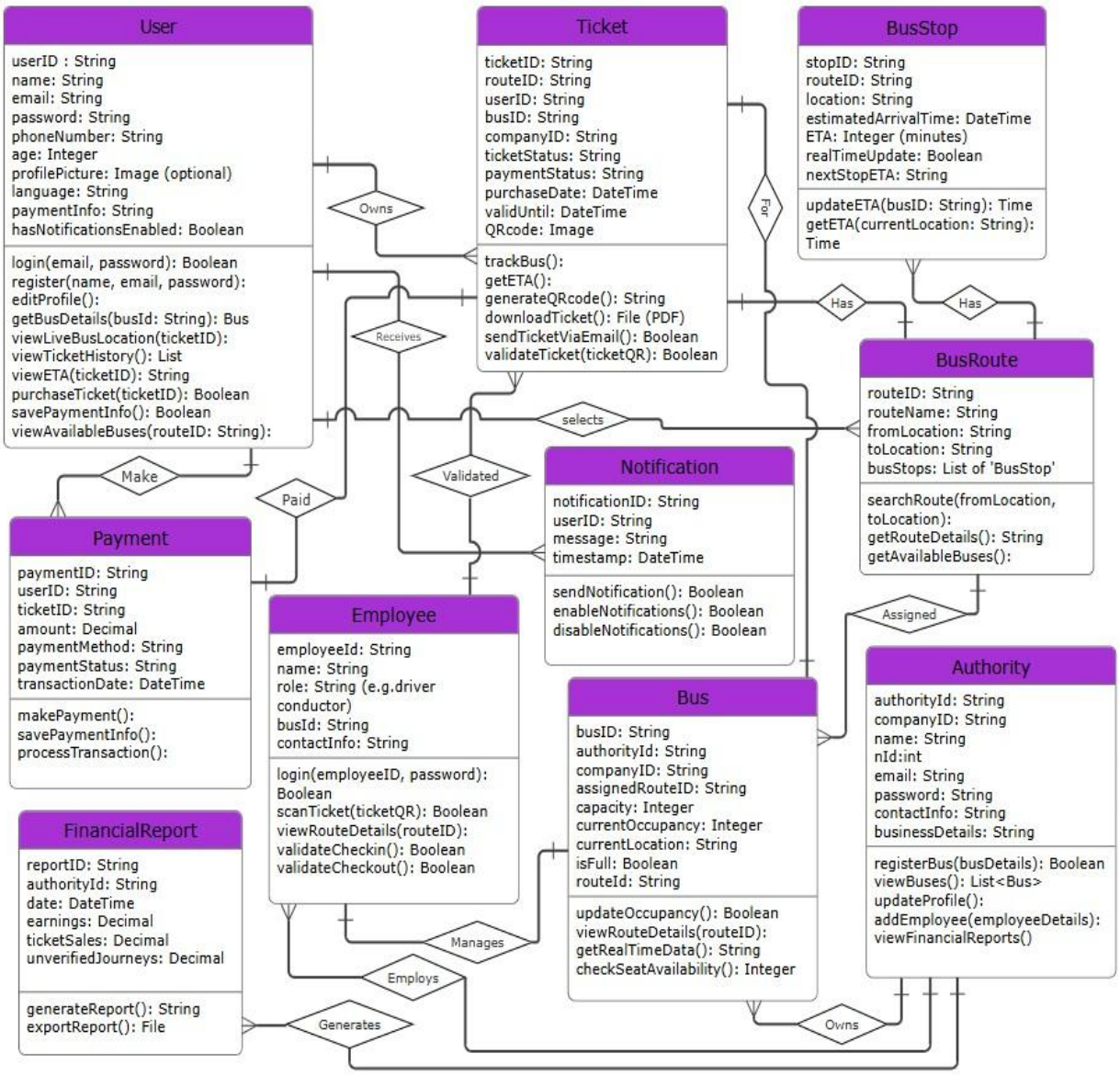
7.1 The bus owner shall be able to view financial reports, including daily earnings, ticket sales, and outstanding charges due to unverified check-outs.

7.2 The system shall allow the bus owner to generate and export financial reports for further analysis.

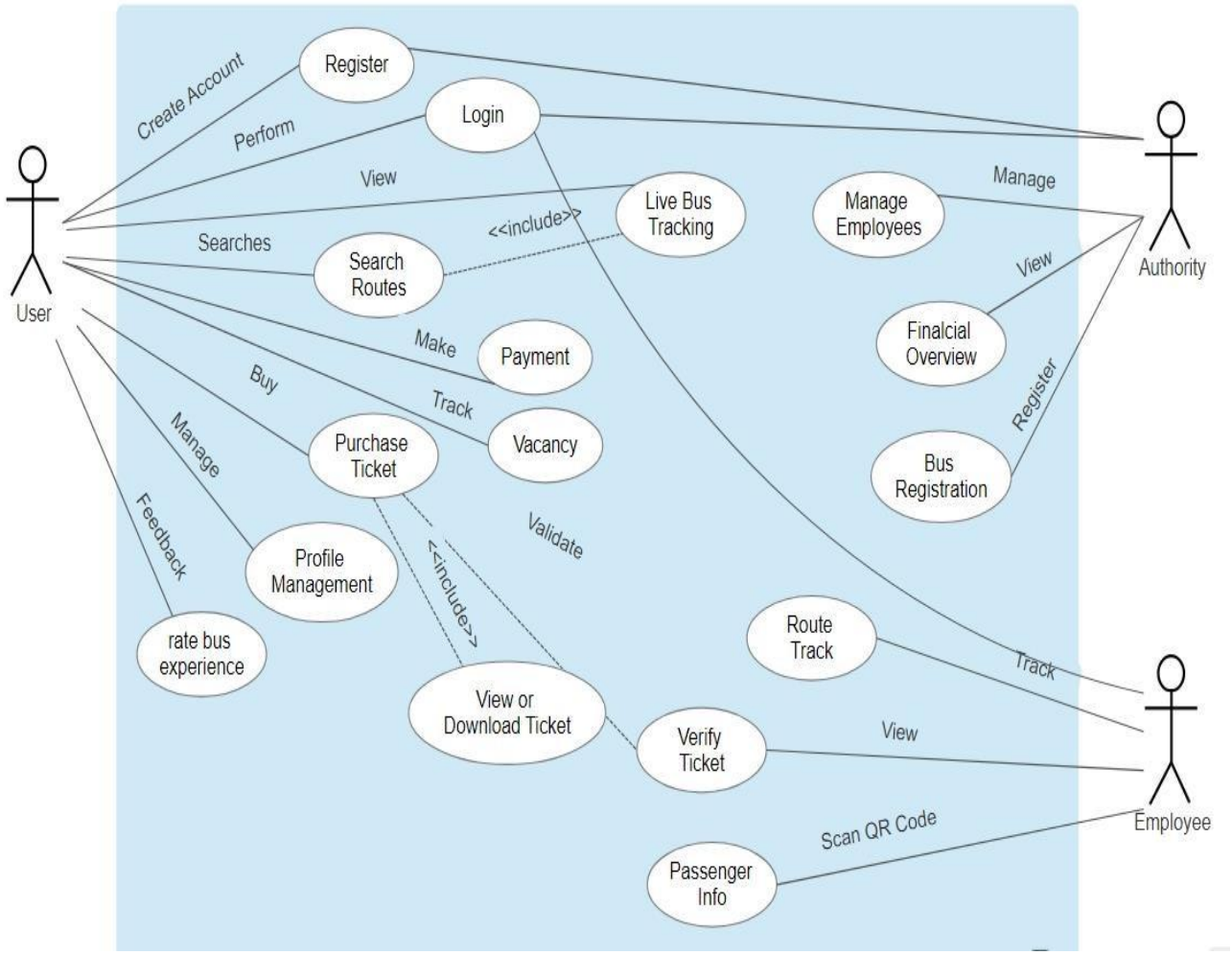
Priority Level: Medium
Precondition: Bus owner is logged in.

4. SYSTEM DESIGN SPECIFICATION

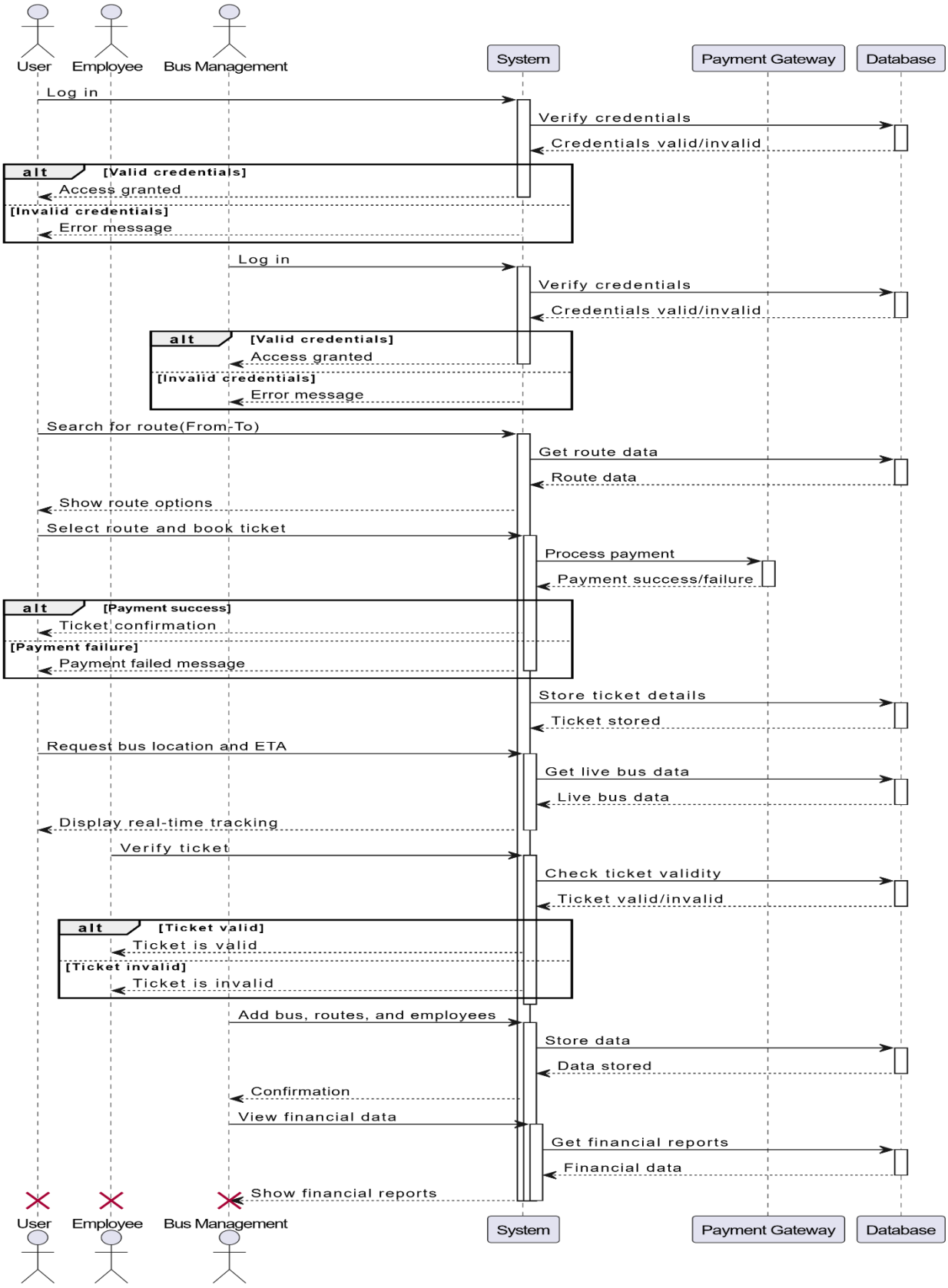
4.1 Class Diagram:



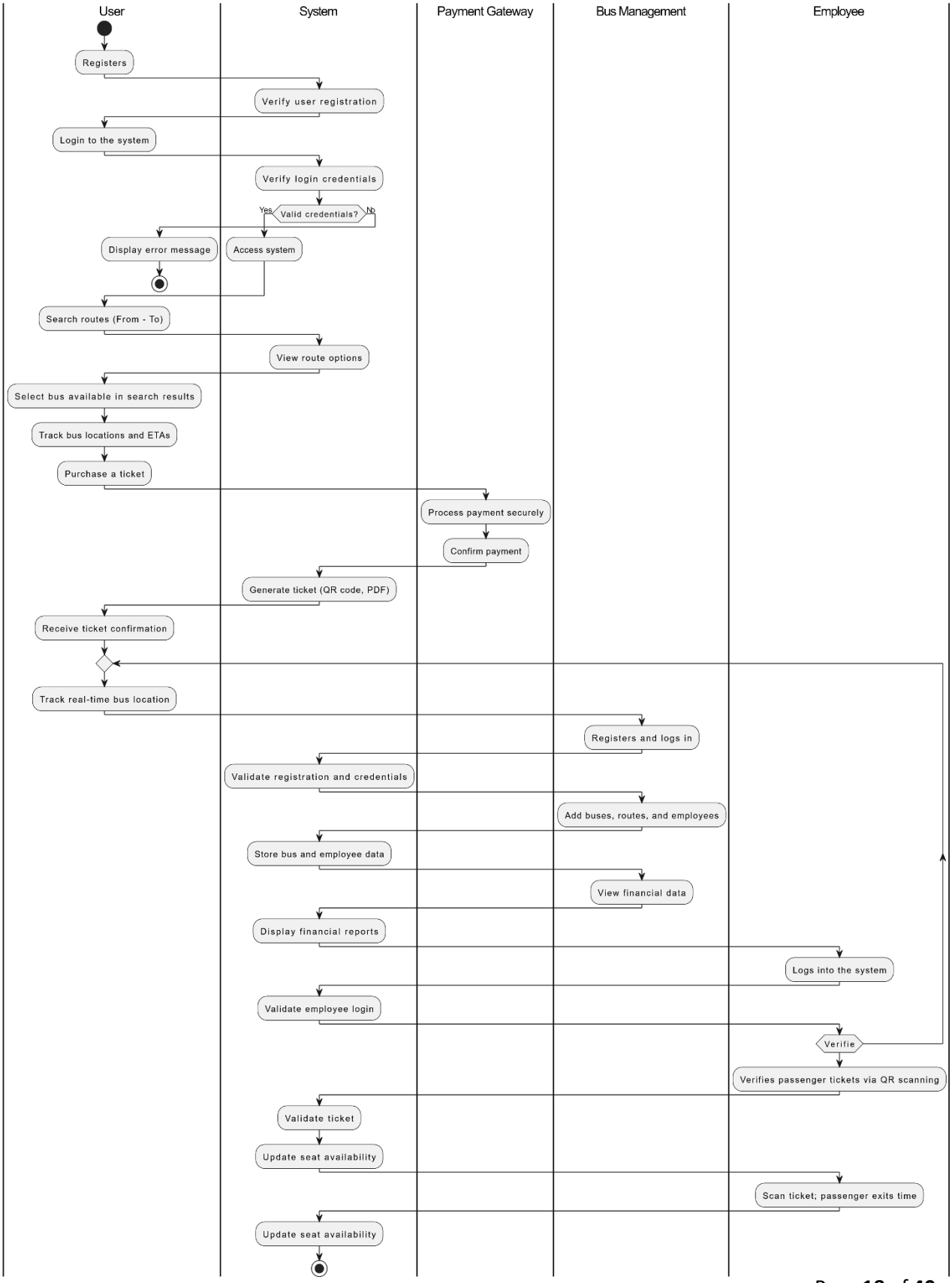
4.2 Use-case Diagram:



4.3 Sequence Diagram:

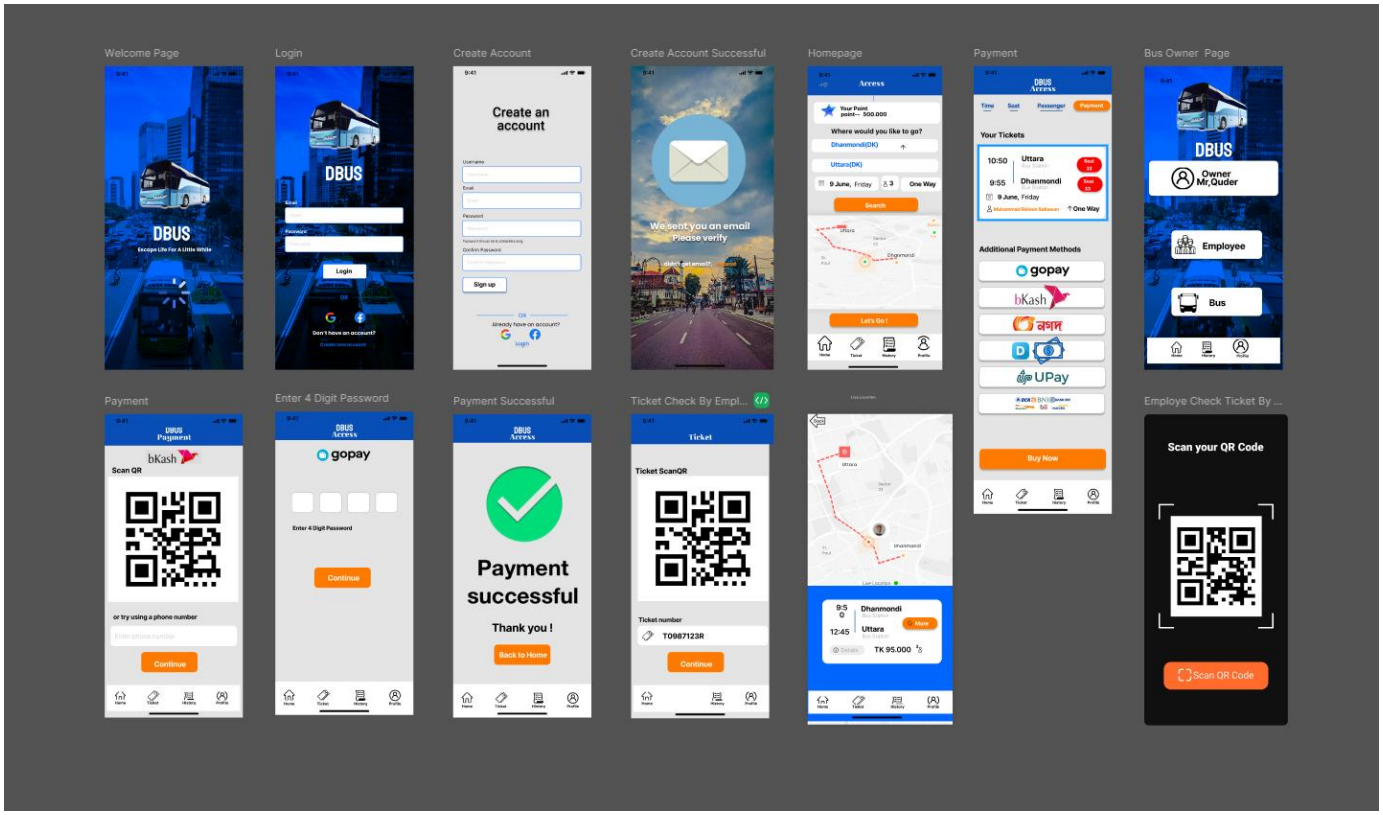


4.4 Activity Diagram



© MMH

UI / UX Design (Prototype)



UI / UX Design (Prototype)

Project Name: Public Transportation Optimization	Test Designed By: Sazid-Al-Abedin
Test Case ID: FR_U1	Test Designed Date: 17/12/2024
Test Priority (Low, Medium, High): High	Test Executed By:
Module Name: User Login	Test Execution Date:
Test Title: Verify login with valid username and password	
Description: Test user login functionality with valid credentials	
Precondition (if any): User has valid email and password	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Go to the login page	Username: user@gmail.com	Login page should load successfully		
2. Enter valid email and password	Password: User@123	User should be allowed to submit the form		
3. Click the login button		User should be logged in		
4. Validate redirection after login		User is redirected to the home page		

Post Condition: User is logged in successfully, and session details are created.

Project Name: Public Transportation Optimization	Test Designed By: Sazid-Al-Abedin
Test Case ID: FR_U2	Test Designed Date: 17/12/2024
Test Priority (Low, Medium, High): High	Test Executed By:
Module Name: User Registration	Test Execution Date:
Test Title: Verify user registration with valid input data	
Description: Test new user registration functionality in the application	
Precondition (if any): None	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Go to the registration page		Registration page should load successfully		
2. Enter valid registration information	Name: Wyan Bruce Email: bruce@gmail.com Password: Bruce@1	System accepts user input		
3. Click submit		Confirmation email is sent to user		
4. Verify the confirmation email	Email: Confirmation link	Account is successfully verified		
5. Attempt to log in with new credentials	Username: bruce@gmail.com Password: Bruce@1	User should successfully log in		
Post Condition: User account is created, verified, and functional for login.				

Project Name: Public Transport Optimization			Test Designed By: Md. Sadman Hossain	
Test Case ID: FR_U3			Test Designed Date: 1/21/2025	
Test Priority (Low, Medium, High): High			Test Executed By:	
Module Name: Route Search			Test Execution Date:	
Test Title: Verify bus route search functionality				
Description: Test the "From-To" route search feature				
Precondition (if any): User is logged in				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Input "From" and "To" locations	From : A To : B	System displays available routes		
2. Select a route	Route: Option 1	Selected route details are displayed		
Post Condition: User can search and view bus routes.				

Project Name: Public Transport Optimization			Test Designed By: Md. Sadman Hossain	
Test Case ID: FR_U4			Test Designed Date: 1/21/2025	
Test Priority (Low, Medium, High):			Test Executed By:	
Module Name: Live Bus Tracking			Test Execution Date:	
Test Title: Verify real-time bus tracking functionality				
Description: Test the ability to track buses in real time				
Precondition (if any): User has searched for a route				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Search and select a bus route	Route: A → B	Route details page opens		
2. Enable live tracking		Real-time bus locations are shown on a map		
3. Check Estimated Time Arrival (ETA) updates		ETA update dynamically		
Post Condition: Real-time location and ETA are displayed for the selected route				

Project Name: Public Transport Optimization			Test Designed By: Md. Saiduzzaman Sohag	
Test Case ID: FR_U5			Test Designed Date: 1/21/2025	
Test Priority (Low, Medium, High): Medium			Test Executed By:	
Module Name: Bus Information			Test Execution Date:	
Test Title: Verify detailed bus information display				
Description: Test that users can view detailed bus information				
Precondition (if any): User has accessed route information				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Search for a route	Route: A → B	Route details are displayed		
2. Tap on a bus	Bus: Option 1	Bus capacity and location details		
Post Condition: Users can view detailed bus information.				

Project Name: Public Transport Optimization			Test Designed By: Md. Saiduzzaman Sohag	
Test Case ID: FR_U6			Test Designed Date: 1/21/2025	
Test Priority (Low, Medium, High): High			Test Executed By:	
Module Name: Ticket Purchase			Test Execution Date:	
Test Title: Verify secure ticket purchase functionality				
Description: Test that users can securely purchase tickets				
Precondition (if any): User is logged in and has selected a route				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Select a route	Route: A → B	Route details are displayed		
2. Go to the purchase page		Payment page loads		
3. Select a payment method and pay	Method: MFS(bKash, Rocket etc)	Payment successfully		
Post Condition: Ticket is purchased, and a QR code is issued.				

Project Name:	Test Designed By: Nouroze Tarannum Anannya
Test Case ID: FR_U7	Test Designed Date: 1/21/2025
Test Priority (Low, Medium, High):	Test Executed By:
Module Name: Save Payment Option	Test Execution Date:
Test Title: Verify the functionality to save payment information	
Description: Test that users can save their payment details to enable smoother future payments	
Precondition (if any): User has made at least one payment using any payment method	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Initiate a ticket purchase process	Route: A → B, Payment Method: MFS(bKash,Rocket etc)	Payment page is displayed		
2. Enter payment details and enable "Save"	Phone Number: 01611252799	Option to save payment details appears		
3. Complete payment	Payment Amount: 40tk	Payment is successfully processed		
4. Verify payment details saved		System confirms payment details saved		
5. Complete payment using saved details		Payment is processed with one tap		
Post Condition: User's payment information is saved securely and can be used for future payments with one tap.				

Project Name:			Test Designed By: Nouroze Tarannum Anannya	
Test Case ID: FR_U8			Test Designed Date: 1/21/2025	
Test Priority (Low, Medium, High):			Test Executed By:	
Module Name: Live Notifications			Test Execution Date:	
Test Title: Verify live notifications functionality				
Description: Test push notifications for real-time bus updates				
Precondition (if any): User has enabled notifications				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Enable notifications in settings		Notifications enabled successfully		
2. Track a bus route	Route: A → B	User receives notifications for ETAs		
Post Condition: Notifications are sent based on real-time updates.				

Project Name: Public Transport Optimization			Test Designed By: Seemanta Torafdar	
Test Case ID: FR_U9			Test Designed Date: 17-12-2024	
Test Priority (Low, Medium, High): Medium			Test Executed By:	
Module Name: User Profile Management			Test Execution Date:	
Test Title: Verify user profile management functionality				
Description: Test that users can view and edit their personal information and view their purchase history				
Precondition (if any): User is logged in				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Go to the "Profile" page		Profile page is displayed		
2. View personal information		User details (name, email, phone, etc.) are displayed correctly		

3. Edit personal information	Name: John Doe → John D., Phone: 1234567890	Updated information is saved and reflected		
4. Verify purchase history		Verify purchase history		
5. Attempt invalid updates	Email: invalid. Email	System displays an error message		
Post Condition: User's personal information is updated successfully, and purchase history is displayed correctly.				

Project Name: Public Transport Optimization			Test Designed By: Seemanta Torafdar	
Test Case ID: FR_U10			Test Designed Date: 17-12-2024	
Test Priority (Low, Medium, High): High			Test Executed By:	
Module Name: Show Ticket Info			Test Execution Date:	
Test Title: Verify ticket details and PDF generation				
Description: Test that purchased tickets are displayed and downloadable				
Precondition (if any): User has purchased a ticket				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Go to "My Tickets" section		Purchased ticket details are displayed		
2. Download ticket as PDF		Ticket PDF is downloaded successfully		
Post Condition: Ticket details are shown and downloadable.				

Project Name: Public Transport Optimization	Test Designed By: Sazid-Al-Abedin
Test Case ID: FR_M1	Test Designed Date: 17-12-2024
Test Priority (Low, Medium, High): High	Test Executed By:
Module Name: Bus Authority Registration and Validation	Test Execution Date:
Test Title: Verify Bus Authority registration and validation functionality	
Description: Ensure the system allows Bus Authority to register and validates their details through BRTC and NID databases.	
Precondition (if any): None	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Go to the bus authority registration page		Registration page is displayed		
2. Enter valid National ID (NID) and details	NID: 1234567890, Name: John , Contact: 01736365742	System accepts the details and validates through BRTC/NID database		
3. Submit registration		Registration is completed successfully		
4. Enter invalid NID or incomplete details	NID: invalid	System shows error message: "Invalid NID or incomplete details"		

Post Condition: The Bus Authority registration details are validated and stored in the system.

Project Name: Public Transport Optimization			Test Designed By: Md. Sadman Hossain	
Test Case ID: FR_M2			Test Designed Date: 17-12-2024	
Test Priority (Low, Medium, High): High			Test Executed By:	
Module Name: Employee Management			Test Execution Date:	
Test Title: Verify the functionality to manage employees				
Description: Ensure Bus Authority can add, update, and delete employees.				
Precondition (if any): Bus Authority is logged in				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Go to employee management page		Employee management page is displayed		
2. Add a new employee	Name: Jane Doe, Role: Driver, Password: 12345	Employee is added successfully		
3. Update employee details	Name: Jane Doe → Jane D.	Details updated successfully		
4. Delete an employee	Employee ID: 001	Employees are deleted successfully		
5. Attempt unauthorized password change	Employee ID: 001, Attempted by another user	System shows error: "Unauthorized action"		
Post Condition: Employees are added, updated, and removed successfully, with restrictions in place.				

Project Name: Public Transport Optimization	Test Designed By: Nouroze Tarannum Anannya
Test Case ID: FR_M4	Test Designed Date: 17-12-2024
Test Priority (Low, Medium, High): High	Test Executed By:
Module Name: Employee Ticket Verification and Bus Information	Test Execution Date:
Test Title: Verify employee ticket scanning and route information access	
Description: Ensure employees can log in, verify tickets, and access route and passenger information.	
Precondition (if any): Employee is logged in	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Log in as an employee	Username: employee1, Password: emp123	Employees logs in successfully		
2. Scan a valid ticket	Ticket QR Code: valid	Employee is added successfully		
3. Scan an invalid/expired ticket	Ticket QR Code: invalid456	System shows error: "Invalid/Expired Ticket"		
4. View route details	Bus Route: A → B	Route details are displayed		
5. Access passenger details	Passenger Name: John Doe, Contact: 123456789	Passenger information is displayed		
Post Condition: Employee can scan tickets, view passenger details, and access route information.				

Project Name: Public Transport Optimization	Test Designed By: Seemanta Torafdar
Test Case ID: FR_M5	Test Designed Date: 17-12-2024
Test Priority (Low, Medium, High): High	Test Executed By:
Module Name: Passenger Check-in and Check-out Verification	Test Execution Date:
Test Title: Verify passenger check-in and check-out functionality	
Description: Ensure passengers are checked in and out properly, with additional charges applied for unverified journeys.	
Precondition (if any): Employee has scanned the ticket when a passenger gets in	

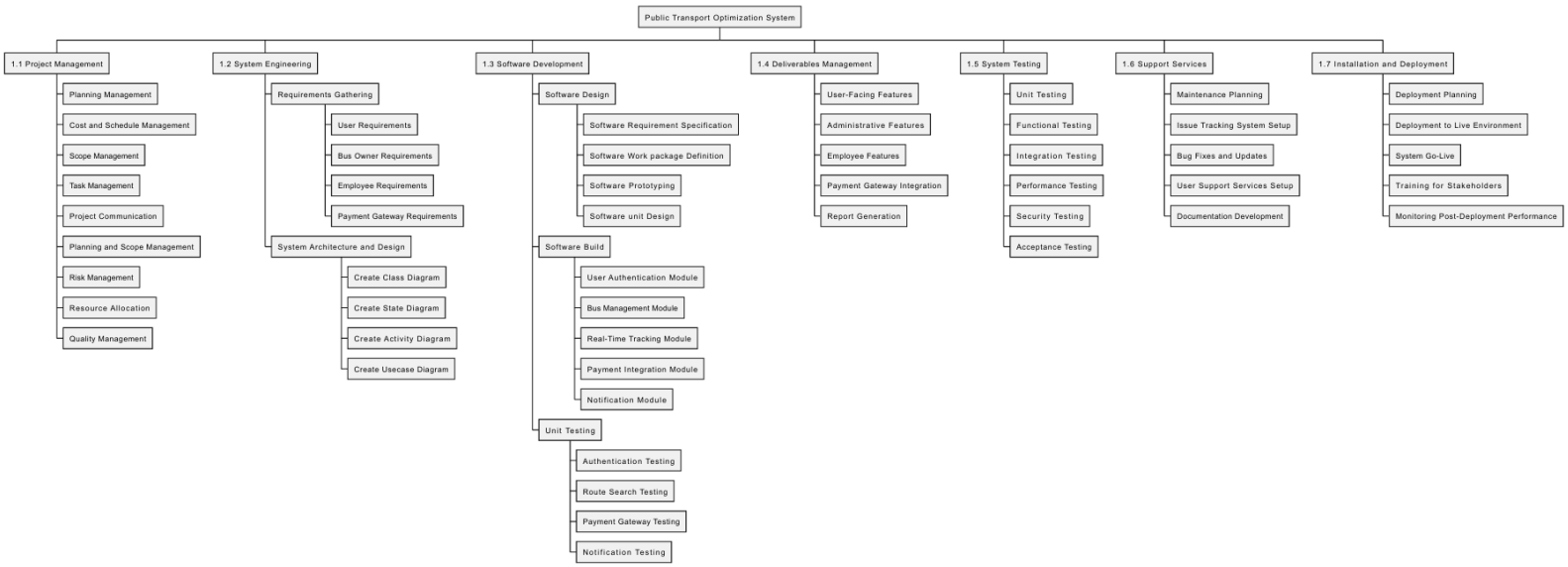
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Scan ticket for check-in	Ticket QR Code: checkin123	Passenger is checked in successfully		
2. Scan ticket for check-out	Ticket QR Code: checkout123	Passenger is checked out successfully		
3. Skip check-out	Ticket QR Code: skip123	Additional charge is applied		

4. Attempt check-in with invalid ticket	Ticket QR Code: invalid123	System shows error: "Invalid Ticket"		
Post Condition: Passengers are checked in and out successfully, and additional charges are applied for skipped check-outs.				

Project Name: Public Transport Optimization			Test Designed By: Md. Saiduzzaman Sohag	
Test Case ID: FR_M6			Test Designed Date: 17-12-2024	
Test Priority (Low, Medium, High): High			Test Executed By:	
Module Name: Real-Time Bus Vacancy and Seat Availability			Test Execution Date:	
Test Title: Verify real-time updates for bus vacancy and seat availability				
Description: Ensure the system updates and displays bus occupancy and available seats in real time.				
Precondition (if any): Bus is operating and has passengers				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. View bus occupancy	Bus ID: 12345	Bus occupancy and seat availability are displayed		
2. Bus reaches full capacity		System shows message: "Bus is Full"		
Post Condition: Real-time updates for bus occupancy and seat availability as expected.				

Project Name: Public Transport Optimization			Test Designed By: Md. Saiduzzaman Sohag	
Test Case ID: FR_M7			Test Designed Date: 17-12-2024	
Test Priority (Low, Medium, High): Medium			Test Executed By:	
Module Name: Bus Authority Financial Overview and Reporting			Test Execution Date:	
Test Title: Verify financial report generation and export functionality				
Description: Ensure bus owners can view daily earnings and generate/export reports.				
Precondition (if any): Bus Authority is logged in				
Test Steps	Test Data	Expected Results	Actual Results	Status (Pass / Fail)
1. Navigate to financial overview page	Bus ID: 12345	Financial overview page is displayed		
2. View daily earnings		Daily earnings are displayed correctly		
3. Generate a report	Date Range: 01/12/2024 - 05/12/2024	Report is generated successfully		
4. Export report to PDF		Report is exported successfully		
5. Attempt export with no data	Date Range: 01/01/1900 - 01/01/1900	System shows error: "No data available"		
Post Condition: Bus Authority can view and export financial data for further analysis.				

Work Breakdown Structure (WBS)



Project Estimation

Project Name: Public Transport Optimization

Project Type: Organic

Where,

P = 1.05

T=0.38

Coefficient = 2.4

SLOC=4780

Now,

PM = Coefficient <Effort Factor> * (SLOC/1000) ^ P

=2.4 (4780/1000)^1.05

= 12.41

DM = 2.50 * (12.41)^0.38

= 5.63 ~ 6

Required number of people = **ST**

=PM / DM

=12.41/6

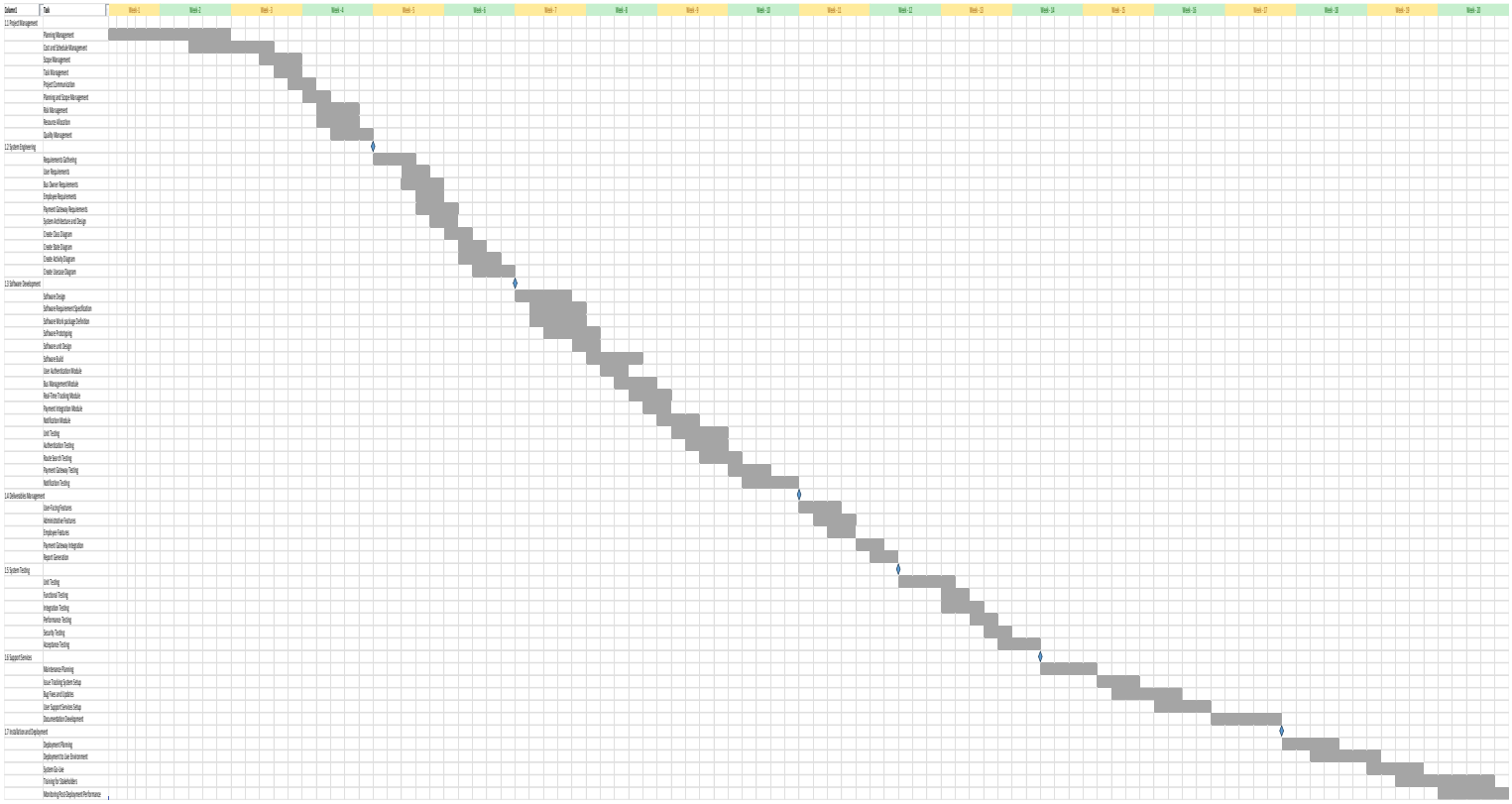
=2.06 ~ 3

© MMH

Timelinne Chart -1

Task	Person	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20
					Increment 1				Increment 2					Increment 3			Increment 4				
A: Overall Design	John																				
B: Analysis	Alex																				
C: Design	John																				
D: Code	Alex																				
E: Test	John																				
F: Delivery	Alex																				

Timeline Chart -2



EVA Exercise:

Task	Planned Effort	Actual Effort
1	10.0	8.5
2	6.0	7.0
3	3.0	4.0
4	2.0	3.0
5	2.0	1.0
6	2.0	2.0
7	3.0	3.5
8	3.0	3.0
9	3.0	2.5
10	3.0	3.5
11	2.0	--
12	3.0	--
13	2.0	--
14	3.0	--
15	2.0	--
Total Task = 64; Effort estimation = 273 Person Days		

BCWP = 37

BCWS = 49.0

ACWP = 38

- BAC = PM * 22 = 12.41 * 22 = 273
- SPI = BCWP / BCWS = 37 / 49 = 0.755
- SP = BCWP - BCWS = 37 - 49 = -12 Person-day
- CPI = BCWP / ACWP = 37 / 38 = 0.974
- CV = BCWP - ACWP = 37 - 38 = -1 Person-day

% schedule for completion = BCWS / BAC = 49 / 273 = 17.95%

[% of work schedule to be done at this

Complete = BCWP / BAC = 37 / 273 = 13.55%

[% of work completed at this time]

Risk Table

Risk	Category	Probability	Impact	RRM
Size estimate may be significantly Low	PS	60%	2	
Larger number of users than planned	PS	30%	3	
Less reuse than planned	PS	70%	2	
Delivery deadline will be tightened	BU	50%	2	
Funding will be lost	CU	40	1	
Customer will change requirements	PS	80%	2	
Technology Will not meet expectations	TE	30%	1	
Lack Of training on tools	DE	80%	3	
Staff inexperienced	ST	30%	2	
Staff turnover will be high	ST	60%	2	
Delayed development of core features like ticket validation or live tracking	PS	40%	2	
Inaccurate real-time updates due to GPS or network issues.	BU	50%	2	
Incorrect or incomplete financial reporting.	BU	30%	1	
Employees misuse their access to passenger information.	BU	30%	2	
Lack of training for employees to operate the system effectively.	PS	40%	3	

© MMH

Risks	Risk reduction techniques
Size estimate may be significantly low	Adjust project scope or budget as needed; communicate change
Larger number of users than planned	Monitor user base closely; allocate additional resources if necessary
Less reuse than planned	Encourage modular design and code reuse; review during design phases
Delivery deadline will be tightened	Break project into smaller milestones to manage timelines effectively
Funding will be lost	Secure alternative funding sources or adjust project priorities
Customer will change requirements	Establish clear communication channels; document all changes
Technology will not meet expectations	Conduct proof of concept and prototype before full implementation
Lack of training on tools	Provide comprehensive training and support to all staff
Staff inexperienced	Provide mentoring and on-the-job training
Staff turnover will be high	Improve retention programs, ensure knowledge transfer documentation
Delayed development of core features like ticket validation or live tracking	Allocate buffer time in the schedule, prioritize critical features, and perform frequent progress reviews.

Inaccurate real-time updates due to GPS or network issues.	Implement redundancy by integrating multiple data sources or notifying users when updates are delayed.
Incorrect or incomplete financial reporting.	Perform thorough testing of financial reporting modules and integrate automated audits.
Employees misuse their access to passenger information.	Implement strict access control and audit logs to monitor employee actions.
Lack of training for employees to operate the system effectively.	Provide comprehensive training sessions and create detailed user manuals for employees.

Rubric for Project Assessment (CO3)

Criteria	Marks distribution (Max 3X5= 15)				Acquired Marks
	Inadequate (1-2)	**Satisfactory (3)**	**Good (4)**	**Excellent (5)**	
Selection of Software Engineering Models	Does not articulate a position or argument of choosing appropriate model. Does not present any evidence to support the arguments for the choice of the model	Articulates a position or argument for choosing models that is unfocused or ambiguous. Presents incomplete/vague evidence to support argument for model choice	Articulates a position or argument of choosing models that is limited in scope. Does not present enough evidence to support the argument for the choice of the model	Clearly articulates a position or argument for the choosing software engineering models. Presents sufficient amount of evidence to support argument for the model selection	
Role identification and Responsibility Allocation	The project has poor project management plans for identifying roles and assigning the responsibilities	Identify few roles in the project management where some of the roles are left alone with any project responsibilities	Identify most of the roles in the project management and assign their responsibilities	Well planned project with proper role identification and responsibility allocation in the project management activities	
Impact identification					
Formatting and Submission	Project report is not complete and Several errors in spelling and	Some errors in spelling and	Few errors in spelling and grammar. Presents most	Project report is complete and No errors in spelling	

	grammar. Present a Confusing organization of concepts, supporting arguments, and real-life example. Sentences rambling, and details are repeated.	grammar. Some problems of organizing the answer in a logical order of defining, elaborating, and providing real-life examples.	of the details in a logical flow of organization in definition, details, and example.	and grammar. Consistently presents a logical and effective organization of definition, details, and real-life example of the topic.	
				Acquired marks:	
				CO Pass / Fail:	

Rubric for Project Assessment (CO4)

Marking Criteria	Marks Distribution (Maximum 3X5=15)				Acquired Marks
	Inadequate (1-2)	**Satisfactory (3)**	**Good (4)**	**Excellent (5)**	
Project Planning	No background information regarding the project is given; project goals and benefits are missing.	Insufficient background information is given; project goals and benefits are poorly stated	Sufficient background information is given; the purpose and goals of the project are explained.	Thorough and relevant background information is given; project goals are clear and easy to identify.	
Effort Estimation and Scheduling	Student vaguely discuss the impact of societal, health, safety, legal and cultural issues in their project	Student provided with partial relevance to the impact of societal, health, safety, legal and cultural issues in their project	Student fairly provided the analysis to the impact of societal, health, safety, legal and cultural issues in their project	Student comprehensively provided the analysis to the impact of societal, health, safety, legal and cultural issues in their project	

Risk Management	Ambiguous representative example.	Partially identify / indicate towards real-life example.	Real-life example is fairly connected towards the definition.	Comprehensively defend with real life example.	
				Acquired Marks:	
				CO Pass / Fail:	