FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS DOCUMENT

FUNCTIONAL REQUIREMENTS

NO.	Requirement	Detailed Requirement	Services Used	Detailed Explanation
1	User Registration	Users and admin should be able to create accounts to access the system.	User Management Service	Users enter their details in a registration form. The data is validated and stored in the database.
2	User Login	Users and admins should be able to log in to access their respective dashboards.	User Management Service	Users log in using their credentials. Authentication is handled via JWT for secure access.
3	View Available Buses	Users should be able to view a list of available buses for booking.	Bus Management Service	After logging in, users can access a dashboard displaying available buses, their routes, and schedules.
4	Book Buses	Users should be able to book a bus for their desired route and time.	Bus Management Service	Users select a bus and complete a booking form. Booking details are stored, and a confirmation is provided to the user.
5	User Profile	Users should be able to view and update their profile details.	User Management Service	Users can view their personal details and update information such as contact details or preferences.
6	Admin Control Panel	Admins should be able to manage bus records, user accounts, and operational statistics.	Admin Management Service	Admins have a dashboard to manage buses, including CRUD operations for bus records and user management functionalities.

NO.	Requirement	Detailed Requirement	Services Used	Detailed Explanation
7	Manage Passengers	Admins should be able to view passenger records, including boarding and exiting statistics.	Passenger Management Service	Admins can track passenger data, including boarding times and seat assignments, ensuring operational efficiency.
8	Manage Buses	Admin should be able to add, update, or remove bus records as needed.	Bus Management Service	Admins can perform CRUD operations on bus records to keep the database accurate and up to date.
9	Notification Settings	Users and admins should be able to configure notification preferences for updates and alerts.	Notification Service	Users can set preferences for receiving notifications about bus statuses, delays, and other relevant information.
10	View Real-Time Bus Tracking	Users should be able to view real-time bus locations and statuses on a map.	Bus Management Service	Users can access a real-time tracking interface that shows bus locations, routes, and estimated arrival times.
11	View Operational Statistics	Admins should be able to monitor system performance, including bus thread health and occupancy.	Admin Control Panel	Admins have access to operational statistics to monitor bus performance and make informed decisions.
12	Bus Thread Management	The system should maintain a dedicated thread for each bus to handle operations like route planning and passenger management.	Bus Management Service	Each bus operates on a separate thread, ensuring that operations are handled concurrently and efficiently, minimizing delays.
13	Heartbeat Mechanism	The system should implement a heartbeat mechanism to monitor the health of each bus thread.	Monitoring Service	A heartbeat signal is sent at regular intervals to ensure each bus thread is functioning correctly. If a thread fails to respond, the system can trigger alerts and take corrective actions.

NON-FUNCTIONAL REQUIREMENTS

NO	Requirement	Detailed Requirement	Services Used	Detailed Explanation
1	Performance	The software must handle multiple buses concurrently and update their routes and passengers' details as requested, especially during peak times, without any performance degradation.	Bus Management Service	The system should efficiently manage concurrent bus operations and data updates to ensure smooth performance, even when multiple requests are processed simultaneously.
2	Scalability	The system should accommodate an increasing number of buses and passengers, dynamically scaling the number of threads to simulate additional buses while maintaining optimal performance.	Thread Management Service	The architecture should support scalable thread management, enabling the system to expand with increased loads, ensuring that the performance remains stable as user and bus counts grow.
3	Security	All bus and user data must be securely stored and transmitted. Authentication should utilize JWT tokens to ensure that only authorized users can access sensitive information.	Security Service	Implementing JWT for authentication will enhance security, ensuring that users have appropriate access rights and that data transmission is encrypted to protect against unauthorized access or data breaches.
4	Reliability and Maintainability	The system should reliably identify issues with buses using a heartbeat mechanism. If a bus thread becomes unresponsive, the system must detect the issue promptly and initiate corrective actions.	Monitoring Service	The heartbeat mechanism will continuously monitor bus threads to ensure they are responsive. In case of unresponsiveness, the system should trigger alerts and initiate predefined recovery procedures to resolve the issue quickly.
5	Usability	The user interface must be intuitive and user-friendly for both passengers booking tickets and admins managing buses and routes, with a responsive design suitable for both desktop and mobile devices.	User Interface Design	A well-designed user interface should provide clear navigation and interaction options, ensuring that both passengers and administrators can easily use the system, regardless of the device they are using.