University Transport Management System Proposal

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Institution: Namal University, Mianwali

Course: Software Engineering

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Introduction

Namal University, Mianwali, provides transport facilities to students, faculty, and staff to commute safely between the campus, hostels, and nearby city areas. The university operates several buses for daily hostel–campus routes and occasionally for academic trips, industrial visits, or university events.

While buses are already in use, the current transport management relies heavily on manual processes such as paper-based records and phone calls, which often leads to confusion, delays, and lack of real-time information.

The Namal University Transport Management System (NUTMS) is designed to automate and modernize these operations. Students and faculty can book seats online, track buses live, and receive instant notifications about delays or schedule changes. Administrators and drivers benefit from a centralized platform to manage routes, monitor trips, and generate accurate reports, improving overall efficiency, safety, and user convenience.

Problem Statement

Even though Namal University operates a fleet of buses for hostel and city routes, as well as occasional trips, the system faces several issues:

- **Manual Coordination:** Route management, seat bookings, and trip updates are handled via paper or phone, causing delays and miscommunication.
- **No Real-Time Updates:** Students and faculty are often unaware of bus locations or delays.
- **Seat Management Issues:** Limited control over seat allocation can lead to overcrowding or conflicts during peak hours.
- **Payment and Fine Challenges:** Late faculty members or cancellations do not have automated financial handling.
- **Administrative Burden:** Admins find it difficult to track usage, performance, and maintenance without a centralized system.

To resolve these issues, a digital transport management system is needed that ensures online booking, real-time tracking, seat limitation enforcement, notifications, and automated transactions.

Project Objective

The key objectives of NUTMS are:

- **Online Booking:** Enable students and faculty to reserve seats digitally.
- **Separate Day Scholar Service:** Assign dedicated buses for day scholars with specific time slots.
- **Automated Route and Schedule Management:** Optimize bus allocation and trip planning.

- **Real-Time Tracking and Notifications:** GPS integration for live bus tracking and instant alerts for delays, cancellations, or emergencies.
- **Seat Limitation Enforcement:** Prevent overbooking and ensure safety compliance.
- **Online Transactions and Automated Deductions:** Students pay online; late faculty or cancellations are automatically charged.
- **Centralized Admin Dashboard:** Monitor all bookings, buses, drivers, payments, and generate performance reports.

Stakeholder Identification

Stakeholder	**Role/Description**
Students	Primary users who book rides, track buses, and receive notifications.
Drivers	Operate university vehicles and update trip status.
Admins/Transport Managers	Manage schedules, vehicles, and driver assignments.
University Management	Decision-makers and reviewers of system data.
IT Support Team	Maintain and update the system.

Software Development Methodology

NUMTS will be based on Agile Methodology, Scrum Framework because NUMTS involves user needs (handling peak-hour or emergency notification), also agile allow for incremental development, frequent testing, and adjustments based on the feedback.

Reason:

- **Iterative Development:** The project is divided into sprints (2-4 weeks) allowing delivery of core features (online booking in sprint 1, GPS tracking in Sprint 2).
- **Stakeholder Collaboration:** Sprint reviews with students, admins, and drivers help ensure that system meets their real-world needs.
- **Flexibility:** Unlike Waterfall, Agile is open to changes (we can add requirements if changed).
- **Team Size:** It can be well addressed by 4-6 members in a team consisting of developers, tester and Scrum Master.
- **Risk mitigation:** Prototypes can address issues like real-time updates, testing to ensure safety and compliance.

Phase Overview:

1. Planning: Define Backlog (user stories from stakeholder).

2. Sprints: Develop, test and review features.
3. Deployment: Incremental releases, with final testing and handover.
4. Maintenance: Post-launch support for updates.

Tools and Technologies

NUTMS is envisioned as a web-based application with mobile responsiveness for easy access to students and faculty. Based on the requirements by the requirement provider, the system will be made using the following cost-effective and scalable tools for security and ease of integration.

User Interface (Frontend):

- **React.js:** A JavaScript library for building responsive UIs. The system will use it to build interfaces for booking forms and tracking maps. It is easy for students to use and provides real-time updates via WebSockets.
- **HTML & CSS:** Used for structuring and styling the web application.
- **Material UI:** Ensures compatibility and responsiveness for mobile, tablets, and other devices.

Server Logic (Backend):

- **Node.js with Express.js:** Handles user authentication and API integrations (e.g., notifications and bookings).

Database:

- **PostgreSQL:** A relational database for storing user profiles, bookings, routes, and payment records. Supports ACID transactions for reliable financial handling.

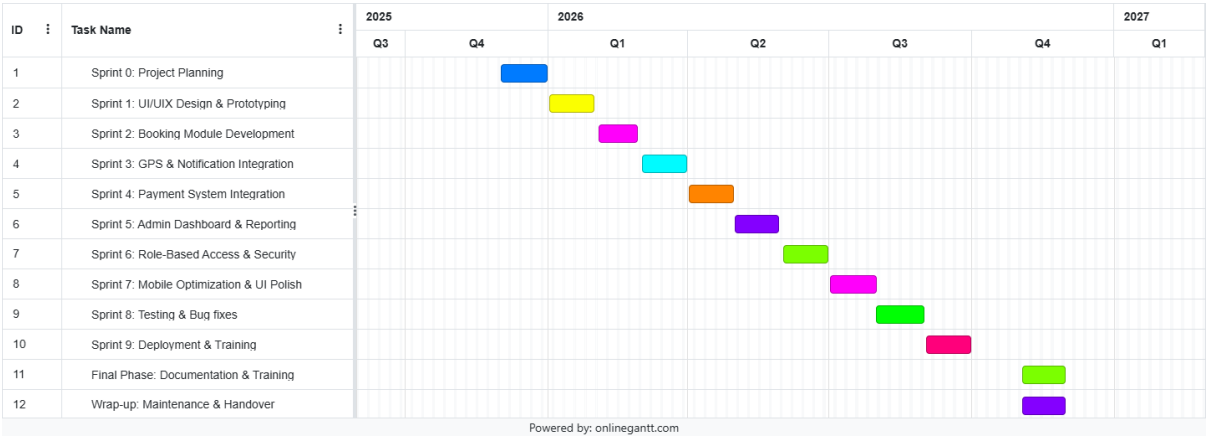
Real-Time Features and Integration

- **Google Maps API or OpenStreet Map:** System will use Leaflets.js, a free, open-source library for GPS and route visualization. It is lightweight and integrates with OpenStreetMap data without API costs.
- **Socket.io:** The system will use WebSocket via native JavaScript. Since the system uses Node.js, Socket.io's free tier will be utilized.
- **Payment Methods:** Mobile wallets like JazzCash and EasyPaisa will be used for transactions. These are secure and compliant with Pakistan regulations. They also provide free sandbox environments for testing. The estimated cost for API integration and basic transactions is $0–$50.

Development and Collaboration Tools

- **Version Control:** The system will use Git with GitLab, which is a free community edition and easily accessible.
- **IDE:** Visual Studio Code will be used for HTML, CSS, and other interfaces.
- **Testing:** Jest and Cypress will be used for free web testing.
- **Deployment and Hosting:** The system will use Vercel, which provides a free tier for web apps.

Gantt Chart



GitHub Repository

The complete project repository is available at:

https://github.com/YourUsername/YourRepository

Namal University, Mianwali

Department of Computer Science

Requirement Provider (RP) Agreement

Course: Software Engineering (CSC-225)

Project Title: Transport Management System of Namal University Mianwali

Department: Department of Computer Science, Namal University, Mianwali

Purpose: This agreement ensures collaboration between the **Student Project Team** and the **Requirement Provider (RP)** for developing the Transport Management System (TMS) with mutual communication and feedback.

Requirement Provider (RP):

- **Name:** Muhammad Bilal
- **Designation / Occupation:** Lecturer
- **Organization / Department:** Computer Science
- **Email:** muhammad.bilal@namal.edu.pk

Student Team:

No.	Name	Roll No.	Email	Role
1	Altaf Hussain	11	bscs24f110@namal.edu.pk	Group Lead
2	Najia Nayab	62	bscs24f62@namal.edu.pk	Member
3	Rabia Ashraf	65	bscs24f65@namal.edu.pk	Member

Agreement Summary:

1. The RP will meet (physically or virtually) with the student team at least once every two weeks.
2. The RP will validate project milestones and provide timely feedback.
3. The student team will share progress reports and updates regularly with the RP.

Signatures:

Requirement Provider (RP)
Name: Muhammad Bilal
Signature: M. Bilal
Date: 07-11-2025

Student Team Signatures:

Team Lead: Altaf
Member 01: Najia
Member 02: Rabia