FYP Topic Submission Form

1- Group Information

Project/Group ID	24-FYP-204

2- Main Topic Details

A- Basic Information

Title	*NTU Real-Time Bus ID Verification and Tracking for Enhanced Transport Efficiency and Student Safety*
Type of Project	*Research and Development*
Category of Project	*Web Based/ Mobile App*
Industry Project	*Name: Mr. Shakeel Anwar* *Position: Transport Officer* *Organization: National Textile University Faisalabad* *Contact Number: +92 300 7608464*
Problem Statement	*The current NTU bus system suffers from inefficiencies and financial issues, allowing students to board without proper verification, leading to overcrowding and unauthorized access. There is no real-time mechanism for verifying student IDs, tracking bus locations, or monitoring driver performance. Additionally, the lack of effective communication channels prevents timely transport-related announcements, resulting in confusion, delays, and poor management of bus capacity.*
Objectives	*To implement a real-time ID verification system to significantly reduce unauthorized boarding's and ensure only fare-paying students access the buses.* *To improve bus utilization rates by leveraging live tracking and occupancy monitoring for effective resource management and generating alerts for overcrowding or underutilization.* *To enhance communication efficiency by providing timely transport-related announcements to students and parents via a dedicated mobile*

	app, while offering a transparent platform to track bus locations and receive real-time updates on delays or changes.
Introduction and background of the problem	*The significance of the NTU bus system stems from current inefficiencies and security concerns, where unauthorized students can board, leading to overcrowding and unfair usage. This lack of real-time ID verification and bus tracking compromises safety and operational efficiency. Previous efforts to address these issues have been limited, with manual checks proving inadequate. The proposed automated Bus ID Card Scanner System aims to leverage QR code technology for immediate ID verification, along with GPS tracking to enhance resource management and communication. This innovation will ultimately improve transportation safety, streamline operations, and provide real-time updates to students and parents.*
Proposed Solution	*The proposed solution to enhance the NTU bus system involves developing an integrated platform that leverages real-time technologies to address key inefficiencies and improve overall transportation management.* *Methodology:* *Real-Time ID Verification: Utilize QR code scanning to instantly verify student IDs at boarding points. This ensures that only authorized and fare-paying students can access the buses, with immediate flagging of unauthorized or fake cards to prevent misuse.* *Live GPS Tracking: Implement a real-time bus location tracking system that is accessible to admins, parents, and students. This feature will facilitate better route management, enhance safety monitoring, and provide transparency regarding bus locations and schedules.* *Overcrowding and Underutilization Alerts: Monitor the number of students boarding each bus, generating alerts for administrators and drivers when buses are overcrowded or underutilized. This will enable proactive resource management and facilitate necessary route adjustments.*

	Driver Efficiency Monitoring: Track driver speed, stop intervals, and overall journey times, comparing this data against scheduled routes. This will ensure compliance with timetables and speed limits, optimizing bus schedules and improving overall route efficiency. *Parental and Student App: Develop a dedicated mobile app that provides real-time bus tracking, route details, and important transport updates. Parents will be able to track their child's bus, download fee slips, and receive notifications about delays or changes, while students can provide feedback on driver performance.* *Real-Time Transport Announcements: Enable the transportation department to communicate important updates instantly, such as route changes, delays, and emergency notifications. This will ensure that timely information reaches students and parents, enhancing overall communication within the transportation system.*
Proposed Tools and Technologies	*Firebase: For real-time data synchronization, user authentication, cloud storage, and notifications.* *React.js and Next.js: To build a dynamic and scalable admin panel to effectively manage route details, student details, bus schedules, and important announcements.* *Flutter: For driver interface for scanning student IDs and streaming GPS locations, along with a parental app for tracking bus status and receiving updates.* *GPS and Camera: For real-time GPS tracking of buses and QR code scanning for student ID verification.* *Google Maps and Map box: To provide accurate live mapping and route tracking for bus locations.* *GitHub: For code version management, backup, and collaboration to ensure the project's integrity and history.*

B- Detail of FYP Idea

Related Technologies / Literature Review

Two existing technologies are particularly relevant to enhancing the NTU bus management system:

QR Code Technology:
Overview: QR codes are two-dimensional barcodes scanned by smartphones or dedicated readers, commonly used in ticketing, payments, and identity verification.

Relevance: In the bus management system, QR codes will enable real-time ID verification for students, confirming their authorization to board and reducing unauthorized access. Research indicates that QR codes can streamline boarding processes and enhance operational efficiency.

GPS Tracking Systems:
Overview: GPS technology provides real-time vehicle tracking using satellite signals, widely applied in logistics, fleet management, and public transport.

Relevance: Integrating GPS tracking in the bus system will offer real-time visibility of bus locations, improving route management and safety while keeping parents and students informed about arrivals and departures. Studies show that GPS significantly enhances resource allocation and operational efficiency in public transportation.

Literature Review
Research indicates that real-time tracking systems in public transport increase ridership and user satisfaction by providing accurate arrival times. Additionally, automated ID verification, particularly using QR codes, effectively reduces fraud and ensures only authorized users access services, enhancing safety and efficiency.

Proposed Methodology

Agile Software Development
Iterative Development:
The project will be developed in iterative cycles (sprints), allowing for continuous feedback and improvements. Each sprint will focus on specific features, such as QR code scanning, GPS tracking, and the mobile app interface.

User-Centered Design:
Engaging with end-users (students, parents, and transport department staff) throughout the development process will ensure that the system meets their needs. Regular feedback sessions will be conducted to gather insights and make necessary adjustments.

Continuous Integration and Testing:

The development process will include automated testing to ensure that each feature works as intended and integrates smoothly with the overall system. Continuous integration practices will be adopted to facilitate seamless updates and deployments.

Documentation:
Comprehensive documentation will be maintained throughout the development process, including system requirements, design specifications, and user manuals. This will support both development and future maintenance efforts.

Research Methodology

Literature Review:
A thorough literature review will be conducted to identify existing technologies and methodologies related to bus management systems, QR code technology, and GPS tracking. This will inform the design and functionality of the proposed system.

Technology Evaluation:
An evaluation of different technologies (e.g., various QR code libraries, GPS service providers) will be performed to select the most suitable tools for implementation. This evaluation will include cost analysis, performance metrics, and compatibility with existing infrastructure.

Prototype Development:
Prototyping will be utilized to develop initial versions of key components (e.g., mobile app, admin panel) for testing and validation. These prototypes will be assessed through user testing to gather feedback and refine functionalities.

Data Collection and Analysis:
Data will be collected during the testing phases to analyze user interactions, system performance, and overall effectiveness. This data will guide further iterations and improvements to the system.

Evaluation and Validation:
The final system will undergo rigorous evaluation to ensure it meets the defined requirements and achieves the project objectives. Validation will include user acceptance testing and performance assessments against key metrics (e.g., reduction in unauthorized boarding's, improvements in bus utilization).

Schedule of activities and Gantt chart

Activity	Tentative Date
Technology Evaluation	**1 week**
System Design	**2 weeks**
Prototype Development	**2 weeks**

User Testing and Feedback	**1 week**
Development of Core Features	**2 weeks**
Integration of Systems	**2 weeks**
Quality Assurance Testing	**2 weeks**
Deployment	**1 week**
User Training	**2 weeks**
Project Evaluation	**2 weeks**

3- FPY Topic (Option 2)

Basic Information

Title	*NTU Quality Assurance Program Self-Assessment Report Management System*
Type of Project	*Research and Development*
Category of Project	*Web Based*
Industry Project	*Name: Mr. Haroon Ijaz* *Department: Quality Assurance* *Organization: National Textile University Faisalabad* *Contact Number: +92 308 9900899*

Problem Statement	*National Textile University's Quality Assurance Department faces a range of issues due to its current manual document management system. The lack of a standardized format across departments has resulted in document tampering, reformatting, and significant data duplication. This creates challenges in accessing accurate, up-to-date information and tracking document history. Additionally, there is no efficient version control mechanism, making it difficult to monitor changes, compare document versions, or track who made alterations.*

Proposed Solution	*To address the document management challenges faced by the National Textile University's Quality Assurance Department, we propose developing a web-based system using React.js for the front-end, Next.js for server-side rendering and routing, and PostgreSQL for the database management.* *The proposed solution will consist of two primary components: a main panel for quality assurance personnel and child panels for other department employees. The main panel will allow the QA team to define document formats, assign tasks, and generate authorization keys for other departments. These authorized employees will access the child panels to work on assigned documents, input data, save updates, and print or download files. The system will include robust version control to track document changes, log user actions, and compare versions. Additionally, session management features will allow the QA team to specify session durations and remotely terminate access when necessary. Real-time notifications will keep the QA team informed of progress, and all documents will follow a standardized format to minimize reformatting efforts and ensure consistency.* *A PostgreSQL database will manage document storage, version tracking, user information, and authorization key generation. This combination of technologies will provide a highly scalable, secure, and efficient system, improving document accuracy, reducing duplication, and streamlining workflows across departments.*
Proposed Tools and Technologies	*Frontend Technologies:* *React.js: For building a dynamic and interactive user interface.* *Next.js: For server-side rendering, routing, and API handling to enhance performance and SEO.* *Tailwind CSS: For creating responsive and modern UI designs.* *Backend Technologies:* *Node.js: For server-side execution and handling backend functionality.* *Next.js API Routes: For API creation to handle document operations, authentication, and session management.* *Database:* *PostgreSQL: For managing user data, document versions,*

	authorization keys, and version control. *Authentication and Notifications:* *Firebase: For handling secure user authentication and sending real-time notifications to the Quality Assurance team when tasks are completed, or session activities are modified.* *Version Control and Collaboration:* *Firebase Authentication: For managing user sessions, login/logout functionality, and session control.*

Supervisor Signature

Co-Supervisor Signature