SMART TRANSPORT SYSTEM AUTOMATION PERSPECTIVE

BY

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FINAL YEAR DESIGN PROJECT REPORT

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "Smart Transport System Automation Perspective", submitted by Md. Sakib Sarker and to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 13 July 2024.

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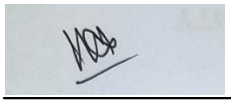

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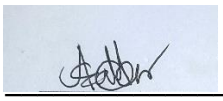

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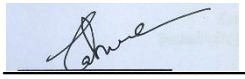

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DECLARATION

I hereby declare that this project has been done by us under the supervision of **Mr. Amit Chakraborty, Assistant Professor, Department of Computer Science and Engineering, Daffodil International University**. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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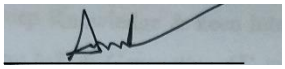

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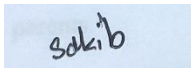

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I am grateful and wish our profound indebtedness to **Mr. Amit Chakraborty, Assistant Professor**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of "*Mobile app,Web app,IoT & Generative AI*" to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts, and correcting them at all stages have made it possible to complete this project.

I would like to express our heartiest gratitude to the **Head of the Department of CSE**, for his kind help in finishing our project and also to other faculty members and the staff of the Department of CSE, Daffodil International University.

I would like to thank our entire course mate in Daffodil International University, who took part in this discussion while completing the course work.

Finally, I must acknowledge with due respect the constant support and patience of our parents.

ABSTRACT

Getting around is a part of everyday life, whether it's going to school, work, or anywhere else. In my research, I have found that transportation can be a hassle, especially in Bangladesh. I have come up with a solution that makes traveling simpler and more convenient for everyone.My idea is to use smart technology to improve how transportation works. By using devices that connect to the internet, like smartphones and GPS, we can keep track of buses in real-time. This means you'll always know where your bus is and when it's coming, so no more waiting around in uncertainty. We've also made it easier to buy tickets. With my system, you can book and pay for your tickets online, right from your phone. No more long lines or searching for change, just a quick and easy way to get your ticket and hop on the bus. And it's not just passengers who benefit. My system helps the people in charge of transportation too. They can see how many people are riding the bus, track revenue, and even manage routes more efficiently.Overall, my research shows that by using simple, everyday technology, I can make transportation better for everyone in Bangladesh. With my solution, traveling becomes easier, more convenient, and just plain simpler for everyone involved.

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Introduction

1.1 Overview

The Smart Transport System Automation Perspective aims to address the challenges associated with traditional university,public and private transportation systems by leveraging IoT technology. The system aims to provide accurate and up-to-date information to passengers, conductors and transport authorities, enabling them to manage the transportation system more efficiently. The system offers a smart ticketing solution that enables passengers to book tickets online, receive path suggestions for traffic-free journeys, and make online payments for a seamless and convenient experience. The system also introduces automation features to streamline the control and management of the transportation system, making it easier and more comfortable for transport authorities to oversee and coordinate vehicle operations. The system provides real-time updates on a dashboard CMS, enabling proactive responses to unavoidable situations, while also prioritizing server and mobile application. The Smart Transport System Automation Perspective is a rare case for any university,public and private transport service or any institute's bus system in Bangladesh, and it can contribute significantly to improving the transportation experience within public, private and universities.

1.2 Background and Present State

Urban population growth has strained public transportation, causing congestion, pollution, and delays. In Bangladesh, traditional transport systems can't keep up with modern demands, leading to long waits and unpredictable schedules. To fix these problems, cities are using smart technologies like mobile apps, web apps, IoT, and AI. These tools create efficient and user-friendly transport networks with real-time tracking, digital ticketing, and route optimization.

The Smart Transport System Automation Perspective aims to revolutionize urban transport, improving efficiency, passenger satisfaction, and sustainability. Successful examples in Bangladesh show significant improvements, proving that smart transport solutions can transform city mobility.

1.3 Problem Statement

Managing university and public transport is a constant challenge. Every morning, we have the same questions: Where is the bus? Will it run today? When does it leave? Where will it stop? When will it return? While boys might find alternative transport, girls face real difficulties. Research also shows gaps in the system. Let's highlight these issues.

Basic Problems:

- Bus Location: Students waiting for the bus don’t know its current location. They can’t tell if they’re late, if the bus is delayed, or if there’s a mechanical problem. Our system will provide real-time bus location updates.
- Ineffective Social Media Groups: Students use social media to track buses, but response times are slow and new students struggle more. Our app's "Route and Route Details" feature will give exact bus locations.
- Uneven Bus Distribution: Some roads need more buses than others on certain days. Our management dashboard will show passenger statistics and ticket sales, helping management allocate buses where needed.
- Manual Ticketing: Manual ticketing leads to lost revenue due to accounting errors. Our system will provide detailed ticket information, including sales, passenger numbers, and payment methods. Authorities can filter by date and time, and view bus, driver, and contractor details.

Research Paper-Based Problems:

- Limited Applications: Most systems use only web or mobile apps. I offer both web, mobile, and IoT solutions to benefit all users.
- Authority Features: Many transport systems lack features for authorities. Our project includes bus scheduling, ticket information, and route tracking to help manage the transport system effectively.
- Bangladesh Context: Smart transport systems are rare in Bangladesh. Our project can significantly improve public and university transport services in the country.

1.4 Objectives

The motivation behind the smart transport system automation perspective is to revolutionize the transportation experience within universities,public and private by leveraging IoT technology. By integrating modern hardware and software, the system aims to address the challenges associated with traditional transportation systems and enhance the overall efficiency and convenience for students and staff.

- Enhanced Vehicle Tracking: Implement a robust system for real-time tracking of vehicle locations using IoT technology, providing accurate and up-to-date information to passengers and transport authorities.
- Efficient Ticketing System: Develop a smart ticketing solution that enables passengers to book tickets online, receive automatic path suggestions for traffic-free journeys, and make online payments for a seamless and convenient experience.
- Automation for Operational Ease: Introduce automation features to streamline the control and management of the transportation system, making it easier and more comfortable for transport authorities to oversee and coordinate vehicle operations.
- Real-time Updates and Security: Ensure the integration of hardware and software components to provide real-time updates on a dashboard software, enabling proactive responses to unavoidable situations, while also prioritizing server and mobile application security.

1.5 Scope and Limitations

The Smart Transport System Automation Perspective aims to improve public transportation by developing and deploying a comprehensive management system. Key features include:

- Ticket Booking System: Passengers can choose routes, select seats, buy tickets, and view them via a mobile app or web interface.
- Ticket Scanning System: Conductors can scan QR codes on tickets to verify passengers and assist with boarding.
- Bus Location Tracking: Provides real-time bus locations and route destinations through GPS integration.

- GPS Device Integration: IoT devices on buses send accurate GPS data to the server.
- Bus Management: A CMS for bus authorities to manage routes, locations, buses, and tickets.
- User Roles: Specific roles for passengers, conductors, and bus authorities with tailored functionalities.
- Dashboard Management: A web-based dashboard for administrators to monitor sales, ticket scans, bus operations, and passenger statistics.
- Transport AI: An AI system to help query the database and provide results through a chat interface.

Despite its benefits, the Smart Transport System Automation Perspective has some limitations:

- Internet Dependency: Requires a stable internet connection for real-time updates and data synchronization, which can be problematic in areas with poor connectivity.
- Initial Cost: Setting up GPS devices, IoT infrastructure, and developing apps may be costly.
- Scalability Challenges: High user loads during peak times may affect performance.
- Technical Issues: Risks of bugs or server downtimes that could impact reliability.
- User Adoption: Users may need training and support to switch from traditional methods to the new system.
- Data Privacy: Requires strong data privacy measures to protect personal and operational data.
- Integration Complexity: Integrating with external systems like payment gateways and travel APIs can be complex and require ongoing maintenance.

1.6 Report Organization

Chapter 1: Introduction to the Smart Transport System Automation Perspective.

Chapter 2: Discussion on literature review of related papers and works, comparative analysis with other research projects and systems, and identifying gaps in existing research and projects.

Chapter 3: Discussion on the development methodology of the Smart Transport System Automation Perspective, including the web server, passenger android app, conductor android app, dashboard CMS, ticket booking, ticket scanning, IoT device for GPS tracking, and system design and project maintenance.

Chapter 4: Discussion on the Implementation of the Smart Transport System Automation Perspective CMS Software, Passenger Android App, Conductor Android App, Ticket Booking, Bus Tracking, and Generative AI for Data Analysis.

Chapter 5: In this chapter, the discussion covers experimental results, system performance, comparative analysis of the system, and outcomes of the system.

Chapter 6: This chapter discusses the environmental impact, societal impact, and impact on daily life management due to the sustainability plan of the system. It explores how the system enhances daily time management and sustainability.

Chapter 7: This chapter discusses the future plans for the Smart Transport System Automation Perspective, including improvements to cloud storage, modern AI integration, enhanced transport solutions, and advanced cybersecurity measures.

1.7 Summary

The Smart Transport System Automation Perspective utilizes IoT technology to provide real-time vehicle tracking, smart ticketing, and automated management features, benefiting both passengers and transport authorities. This innovative solution represents a significant advancement in university transportation systems in Bangladesh, promising improved efficiency and convenience for all stakeholders.

CHAPTER 2

Literature Review

2.1 Overview

The Smart Transport System Automation Perspective presents a comprehensive solution for enhancing smart bus transportation. While existing projects and research endeavors have explored various aspects of smart transportation such as paperless ticketing, QR codes, bus tracking, web-based applications, and mobile apps, the differentiating factor of the Smart Transport System Automation Perspective lies in its focus on providing an integrated solution for bus owners, passengers, and conductors, aimed at simplifying bus maintenance processes. The Smart Transport System Automation Perspective comprises a web server connected to two Android mobile apps and a web CMS designed for bus administrators, along with IoT devices installed within buses. What sets this project apart from others is its consolidation of multiple functionalities onto a single platform, including the web server, CMS dashboard, mobile apps for booking, and IoT device integration. Unlike existing projects that often consist of disparate applications, some catering only to passengers or conductors with ticket scanning capabilities, the Smart Transport System Automation Perspective offers a holistic approach.

This literature review will delve into the main components of the Smart Transport System Automation Perspective, including the web server, CMS dashboard, passenger mobile app, bus conductor mobile app, and IoT devices for location tracking

2.2 Related Works

Similar Technologies to the Smart Transport System Automation Perspective:

Shinde et al. [1] This research includes safety features such as rash driving prevention, accident detection,, real-time tracking of the bus for users, emergency features for women/child safety and bus fail switch, alcohol sensor and accelerometer for accident prevention and RFID authentication for the driver.

Taufik et al. [2] In this project develop a web-based application for passengers, drivers, and bus company administrators, utilizing QR codes for ticketing information, GPS trackers for real-time monitoring, and a modem for network communication.

Pawar et al. [3] Developed a Smart Local Bus Transportation System (SLBTS) using an IoT, which involves the utilization of electronic devices in public vehicles to provide real-time data, collection of information such as number of passengers, vehicle speed, fuel level sensor and temperature sensor for vehicle efficiency monitoring.

Sridevi et al. [4] Develop Smart bus tracking system using IoT, GPS, and GSM technology to track bus location, reduce waiting time, and provide real-time information to users.

Shah et al. [5] In this research automated ticket booking using RFID technology, GPS module for tracking bus location, fare calculation and deduction from passenger's E-wallet, real-time bus tracking feature for passengers, implementation of salting for data protection.

Shirsath et al. [6] This research develops an amazing android application for passengers and bus conductors, along with a web portal for admin. The system aims to reduce waiting time for passengers, provide real-time bus location, and enable ticket booking through QR codes.

Mulla et al. [7] This research summary and main components of the proposed method include the use of GPS and map API for bus tracking, recording biometric attendance, automatic entry of bus arrival and departure timing, and generation of essential reports for higher authority.

Sinha et al. [8] In this paper Real-Time College Bus Tracking Application running on Android smartphones, providing the exact location of the student’s respective buses in Google Maps, along with other relevant information.

Kuncara et al. [9] This research is a QR e-ticket system for purchasing bus tickets, which can only be purchased with a smartphone application. It utilizes a mobile android application for bus passes, with passengers and ticket checkers having an android app for scanning and validation purposes.

Anuradha et al. [10] Develop an android application for bus ticketing using a QR reader, a web application for online ticket purchase, and a system for transferring information about accident occurrence. It also involves user registration, location selection, web

service and convenient way for passengers to purchase tickets, make payments, and receive alerts during travel.

Hingmire et al. [11] This research includes a system for purchasing tickets using an Android application and QR codes, a QR code scanner for checking valid tickets, and an admin interface for maintaining bus information and generating/approving tickets.

Gupta al. [12] Using a database for commuter information, automating ticket generation and bus pass formation, ensuring organized and safe handling of user information, developing an android-based application for conductors, and considering future development and dynamic user requirements.

Nair et al. [13] Develop a Android application for real-time bus tracking, easy ticket purchase, handling of data like current bus location and bus-passes with QR codes, and the use of technologies like QR-Code, Bluetooth printing, GPS, Cloud, and E-wallet for development purposes.

Obetta et al. [14] This research design and implementation of a web-based smart campus bus transport management system with real-time display of arrival time and comprising four main modules.

THET et al. [15] Using a real-time web-based bus information system with GPS and Wi-Fi modules installed on the bus, utilizing technologies such as GPS, Google Maps, and GPRS for tracking the location of the bus.

Otieno et al. [16] The summary and main component proposed is a customized location-based service for the public transport integrating a web-based application, an android application, and a customized query interface.

Moovit et al. [28] Moovit is a mobile app that offers bus, train, and subway ticket booking, bus tracking, maps, real-time arrival and departure times, route planning, and ride-sharing services.

Citymappert et al. [29] Citymapper is a mobile application designed for urban travel, offering options such as buses, trains, subways, bicycles, scooters, and walking routes, along with live traffic updates and alerts, and offline maps.

Transit et al. [30] Transit offers real-time tracking, trip planning, service alerts, offline maps, live arrival times, favorites and reminders, integration with ride-sharing, and accessibility information.

Shohoz et al. [31] Shohoz is a popular Bangladeshi app offering ticket services for ride booking, food delivery, bus tickets, ferry tickets, hotel booking, event tickets, and parcel delivery.

2.3 Comparison between existing works

Table 2.3.1. Comparative analysis with previous transport system

SL No	Author Name	Proposed Method
1.	Shinde, N., & Ansari, S. [1]	● Accident detection utilizes location details via GPS, and once an accident is detected, a message is sent via the GSM unit. ● The system provides emergency and bus fail switch options. When either switch is pressed, a 'BUS FAIL' message is sent. ● Drunk driver detected or observed to be intoxicated; an SMS is sent stating 'the driver is drunk'
2.	Taufik, M., Hudiono, H., Rakhmania, A. E., Perdana, R. H. Y., & Sari, A. S. [2]	● Develop website with three user interface applications: one for passengers, one for drivers, and one for the company

		● The website-based application includes the following pages: Dashboard, Register, View Bus Schedule, Order Ticket, Ticket Payment, QR Code-based E-ticket, Real-time Bus Location, and Transaction History ● Modem and QR Code scanner are connected to the USB port on the Raspberry Pi, while the GPS tracker
3.	NPawar, V., & Bhosale, N. P. [3]	● The system monitors bus location, fuel level, speed,alcohol, engine temperature and passenger count ● The web-based application is hosted on a centralized cloud platform and provides real-time sensor updates to end-users. ● In this paper, a GPS receiver 1100 and a WiFi module ESP-8266, operating on the RS232 standard, LED Display ,level sensor,Alcohol sensor ,temperature sensor ,were utilized.
4	Sridevi, K., Jeevitha, A., Kavitha, K., Sathya, K., & Narmadha, K. [4]	● The location of the bus is tracked using a GPS receiver, which sends the position data (latitude and longitude) to a remotely located server using a GSM module. ● In this paper, GPS receivers, a real-time clock (RTC), Wi-Fi technology, and Arduino/Genuino Uno microcontrollers are utilized.

		• Develop an application on smartphones to monitor the location and timing of the college bus using IoT.
5	Shah, M. J., Prasad, R. P., & Singh, A. S. [5]	• Develop an automated bus ticketing system by integrating an RFID (Radio Frequency Identification) card reader with an Arduino Uno and a WiFi module.. • Develop a system incorporating the SIM808 GPS GSM Module and Arduino Uno, which will continuously update the bus location. • Developed S-Bus mobile application with an E-wallet feature that calculates the fare based on the distance traveled, deducts the fare amount, and displays the live bus location.
6	Shirsath, M. S., Chinchole, P. M., Mahajan, V. R., & Mogal, V. G. [6]	• This system comprises two Android applications: one for passengers and another for bus conductors. • Web portal for administrators. • A GPS module will be installed on the bus. • Users are able to book a ticket through the application by selecting their source and destination. Subsequently, a QR code will be generated for their ticket.
7	Mulla, M. R., Mujawar, M. T., Sutar, M. S., Shelke, M. R., & Hippargi, M. S. [7]	• This system utilizes GPS and map API to allow students and staff to track the bus location through an Android app.

		• Biometric attendance can be recorded as part of the system. • This system is equipped with a GSM module connected to an Arduino Uno board, a GPS module, and a biometric fingerprint scanner.
8	Sinha, S., Sahu, P., Zade, M., Jambhulkar, R., & Sonekar, S. V. [8]	• Develop a real-time college bus tracking application that operates on Android smartphones. • Develop an admin feature that allows for sending SMS notifications to designated drivers and students in case of emergencies. • The bus administrator updates information such as the driver's name, contact number, route details, and stops.
9	Kuncara, T., Putra, A. S., Aisyah, N., & Valentino, V. H. [9]	• This research utilizes QR codes for e-ticket payments within the ticket booking system for transportation. • In this research, bus pass tickets can only be purchased using a smartphone application. • The conductor or authorized personnel are responsible for scanning the ticket.
10	Anuradha, D., Devi, M. D., Keerthana, K., & Dhanasree, K. [10]	• Develop an Android application for the bus ticket system using a QR code reader • This system provides both a web application and an Android application for passengers to purchase their tickets online.

		• In this research, during travel, the bus conductor counts the passengers and calculates the total amount. Subsequently, a QR scanner is used for mobile payment
11	Hingmire, S., Mahalle, T., Bhandekar, S., Malamkar, N., Kumar, V., & Zade, P. [11]	• In this research, a QR-based universal online ticket booking system is designed, which incorporates third-party APIs with QR code scanners • The ticket scanner checks the validity of the ticket by verifying its authenticity. • Develop a website where any user or visitor can view our system and search for buses, including checking how many seats are available.
12	Gupta, A., Iram, B., Samrit, B., Dhage, C., & Khan, N. [12]	• The online Bus Pass and Ticket Generation System is a web application featuring two login pages users and administrators. • In the system, users can renew their bus passes each month by making an online transaction for payment. • Developed an Android-based application where the conductor can scan QR code
13	Nair, V., Pawar, A., Tidke, D. L., Pagar, V., & Wani, N. [13]	• In this research, an Android application includes features such as bus location tracking, punching bus passes with QR codes and ticket generation

		• In this research, a Bluetooth printer is provided for easy on-time ticketing. • If a passenger has a bus pass, the QR code will be scanned from the conductor's mobile app.
14	Obetta, J. L., Dialoke, I. C., & Nwakwusi, L. O. [14]	• In this paper, a web application was developed using HTML, CSS, PHP, and MySQL databases. It was implemented on a Windows localhost Apache web server. • Developing a web-based smart campus bus transport management system with real-time display of bus arrival time involves four main modules: login, the administrator's, the passenger's and the driver's module.
15	THET, E. P., & HEIN, W. [15]	• Develop a website to display the arrival time and current location of the bus at every bus stop, as well as manage the bus route. • GPS module connected Wi-Fi module correctly to receive the signals. • GPS module (Neo 6M), Wi-Fi module (ESP 12F) and ESP8266 are installed on the bus.
16	Otieno, E. O., & Ngigi, M. M.[16]	• Develop three main components: the internet application, the server, and the GPS tracking unit. • Develop a client-side web-based application where users can track the

		movement of the vehicle and query the attribute data stored in the database. ● In this research, the Android application allows vehicle operators to update the database, while managers can track using their mobile devices.
17	Moovit [28]	● Users can book their journeys and various modes of transport such as buses, trains, subways, trams, and bikes. ● This app provides real-time updates on bus, train, and subway arrivals.
18	Citymappert [29]	● Servers provide real-time departure and arrival information for public transport services. ● Provides live traffic updates and alerts to help users avoid traffic jams on their routes. ● Users can view a map showing the bus's current location and navigate accordingly
19	Transit [30]	● Tracks buses and trains in real-time on a map. ● Provides route options and schedules for traveling between locations using various transportation modes. ● Displays real-time arrival times for buses, trains, and other services.
20	Shohoz [31]	● This app allows users to book bus tickets for travel. ● This app allows users to purchase and print bus tickets.

		• It seems like you're describing an app that enables users to book seats and check the arrival and departure times of buses.

2.4 Open Issues

This system faces several open issues that highlight areas requiring further research and development:

- Data Protection and Security: Ensuring the protection of passenger and conductor personal and operational data from unauthorized access and cyber threats through data encryption.
- Complex System Integration: Integrating IoT devices, mobile apps, web platforms, and backend databases presents technical challenges.
- System User Adoption: Encouraging people to transition from traditional to smart transport systems is challenging.
- Live Data Accuracy: Ensuring the accuracy of real-time data such as bus locations and schedules, despite issues like data latency and asynchronous updates.
- Environmental Impact: Minimizing energy consumption and electronic waste through paperless solutions is crucial.

2.5 Summary

In this literature review section, I discuss related works focusing on passenger mobile apps, conductor mobile apps, CMS Software, and IoT GPS modules for bus tracking, ticket booking, and ticket scanning. I also highlight their proposed methods for technology development and their limitations. In the second part, I delve into the Smart Transport System Automation Perspective, covering ticket booking, GPS tracking, ticket scanning, and CMS Software for effective management. Additionally, I review other research-based works, detailing their system functionality, technology stack, database usage, server configuration, mobile app development, web-based application implementation, GPS module integration, internet connectivity, ticket scanning methods, and their respective limitations.

CHAPTER 3

Methodology/Requirement Analysis & Design Specification

3.1 Overview

The project aims to develop a digital system for managing university transportation,public transportation and private transportation incorporating features such as real-time vehicle tracking, passenger monitoring,conductor monitoring and ticket booking. Research Gap: The literature review identified gaps in the smart transport system field, which the project plans to address through features like inbound-outbound vehicle scheduling, maintenance checks, trip settlement, driver alerts, and fleet tracking. Dashboard: The system will provide a management dashboard for viewing statistics on passenger traffic, ticket sales, and bus routes. Timeline: The project timeline spans nine months, starting with system design and ending with testing and deployment, utilizing agile methodology and regular meetings with supervisors. Contribution: The Smart Transport System project aims to provide a comprehensive digital solution for public,private and university transportation management, filling existing research gaps and enhancing efficiency in the field.

3.2 Proposed Methodology/ System Design

My project is based on software,mobile hardware,IoT and Generative AI. I have already implemented the hardware part. I have completed a test successfully on real-time GPS tracking on Surjomukhi 22 from the way to Dhamrai the bus from Daffodil International University.

Figure 3.2.1: Block diagram of the system

A block diagram provides a clear overview of the system's workflow. In this section, I'll present the block diagram of the Smart Transport System Automation Perspective (Figure 3.2.1). This diagram illustrates how the entire system operates.

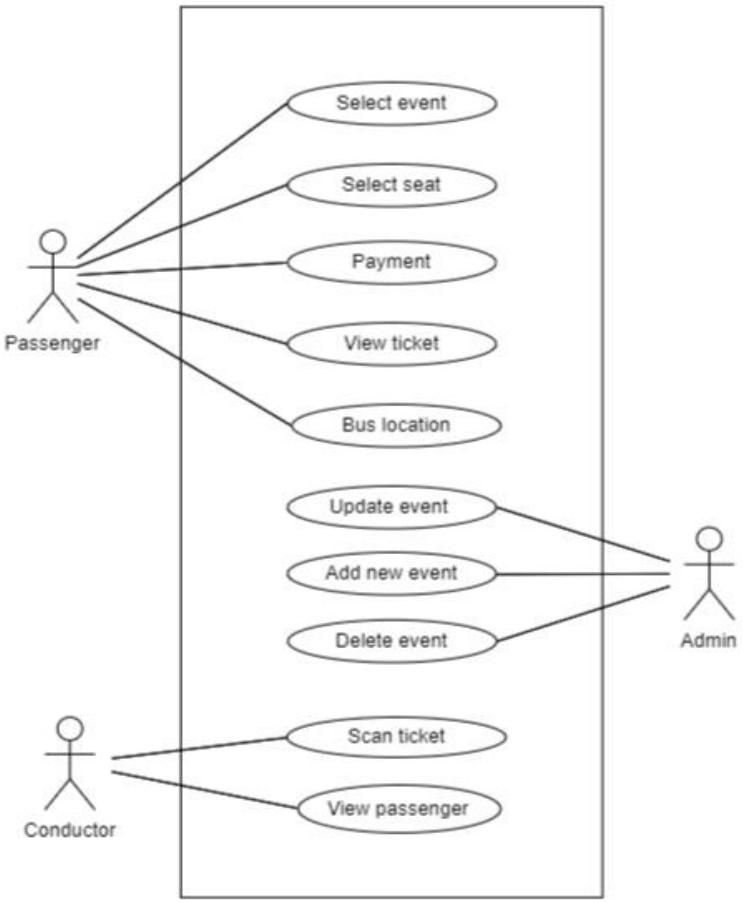


Figure 3.2.2: Use Case Diagram

This use case diagram involves scenarios like passengers booking seats, buying tickets, and viewing bus locations. It also includes conductors scanning tickets and viewing the passenger list, as well as bus authorities managing, updating, and deleting events. This diagram shows how the system interacts with passengers, conductors, and bus authorities.

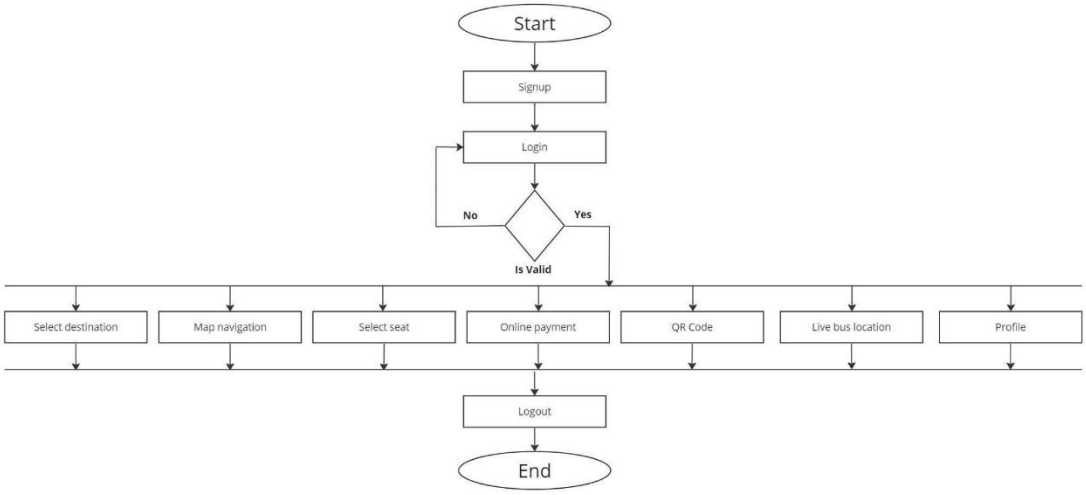


Figure 3.2.3: Passenger activity diagram of the system

A passenger activity diagram is a UML (Unified Modeling Language) that gives a clear idea about the passenger system. In this section, I will show the passenger activity diagram of the system diagram (Figure 3.2.3) of the Smart Transport System Automation Perspective.

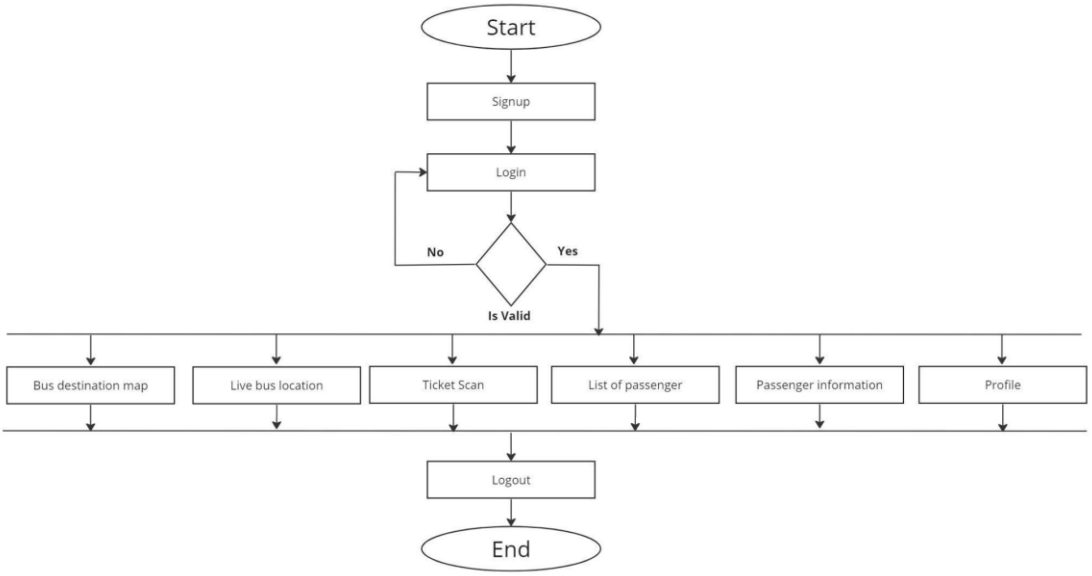


Figure 3.2.4: Conductor activity diagram of the system

A conductor activity diagram is a UML that gives a clear idea about the conductor system. In this section, I will show the conductor activity diagram of the system diagram (Figure 3.2.4) of the Smart Transport System Automation Perspective.

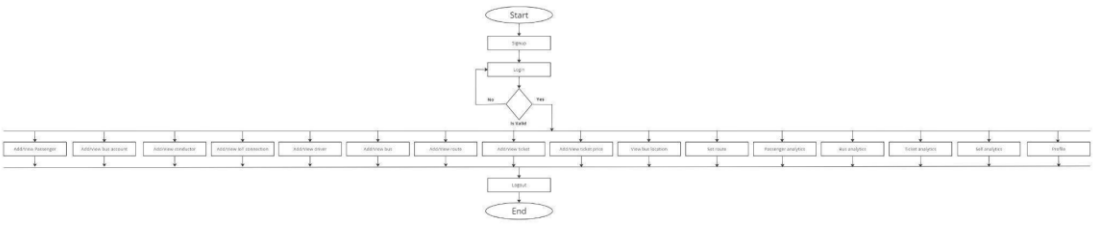


Figure 3.2.5: CMS Software activity diagram of the system

A CMS Software activity diagram is a UML that gives a clear idea about the Dashboard cms system. In this section, I will show the dashboard CMS activity diagram of the system diagram (Figure 3.2.5) of the Smart Transport System Automation Perspective.

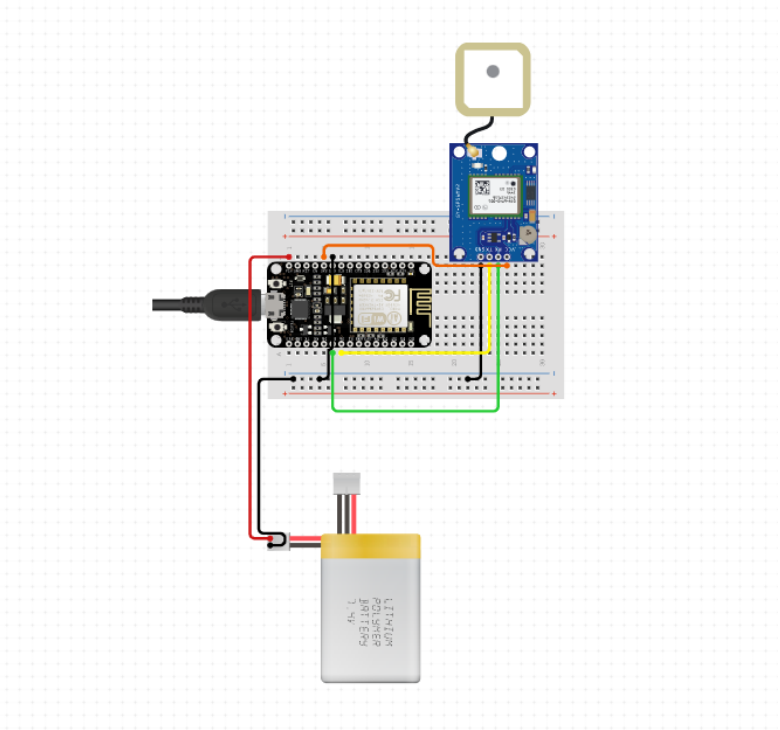


Figure 3.2.6: Circuit design of hardware part

GPS data will be received at the server site then data will be transmitted to the mobile application through the server site. The data transmission diagram is given below.

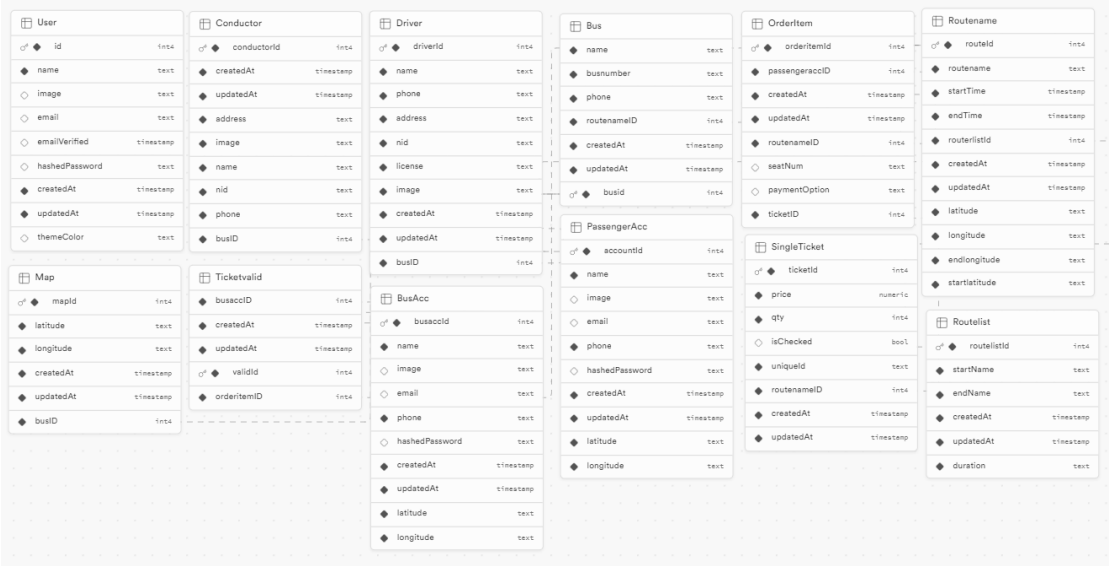


Figure 3.2.7: UML diagram of Database

The UML diagram represents the database schema, illustrating various tables for passengers, conductors, user roles, admins, and bus management.

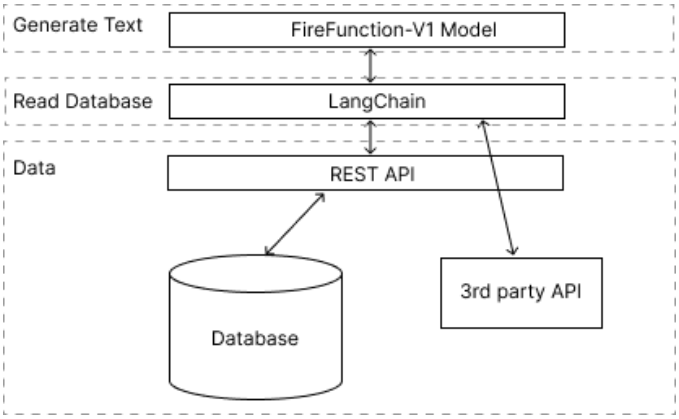


Figure 3.2.8: Workflow diagram of Chatbot

This chatbot generates text based on questions. LangChain is connected to a database and uses the LLMs FireFunction-V1 model to create SQL queries and find the expected output. It helps by generating text answers.

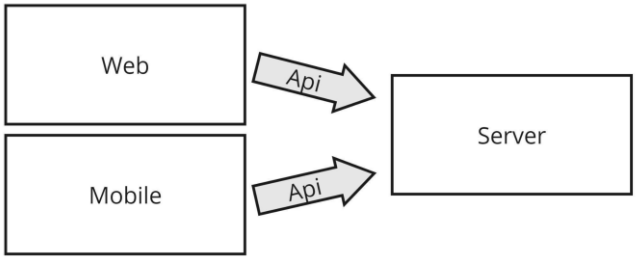


Figure 3.2.9: Web and Mobile app communication of system

APIs act like bridges, linking different parts together for smooth operation. On the user side, I use Next.js & React Native make things easy to use. On the backend, Next.js API routes and REST APIs handle requests smoothly.

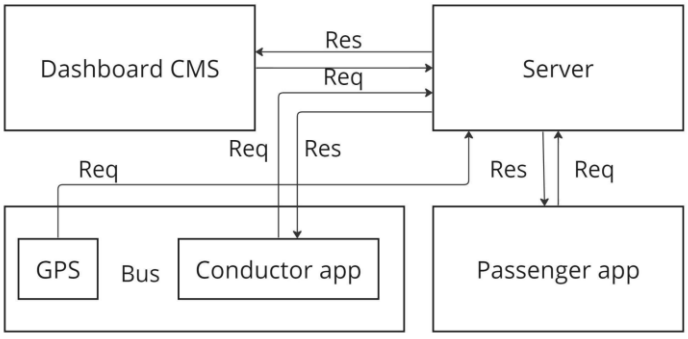


Figure 3.2.10: Data Transmission of system

To enhance the effectiveness and user-friendliness of both the server, web, and mobile applications, a GPS module is installed in the bus, mobile app, web app, and server.

This setup facilitates data transmission by sending and receiving data transmission requests and responses seamlessly.

3.3 Hardware/ Software Requirement

The requirement analysis for the Smart Transport System encompasses a thorough examination of the needs and expectations of both passengers,conductors and transport authorities. By identifying and understanding these requirements, I can ensure that the system meets its objectives effectively.

Hardware Requirements:

- Cloud Server: 16 GB RAM, multi-core processors, and SSD storage cloud.
- IoT Devices: ESP32 , GPS Modules for tracking.
- Development equipment: Computer with 12 GB RAM, modern multi-core processors, SSD storage, and Android emulators.
- Device: Android 6 ,Computer Browser

Software Requirements:

- Development Tools: Visual Studio Code, Android Studio, Postman
- Languages and Frameworks: JavaScript, TypeScript, React Native, React.js, Next.js.
- Back-end Technologies: Node.js, REST API, Prisma ORM, PostgreSQL, Supabase,Mapbox, Next Auth,Blynk.
- AI Tools: LangChain, FireFunction V1 model.
- Version Control: GitHub.

3.4 Project Management and Financial Analysis

Project Management: Project management involves meticulous planning, execution, monitoring, and control of project activities to achieve predetermined objectives within defined constraints. The following aspects are key to the project's management:

- Project Planning: Thorough planning involves defining objectives, establishing timelines, allocating resources, and identifying potential risks.

- Project Timeline:

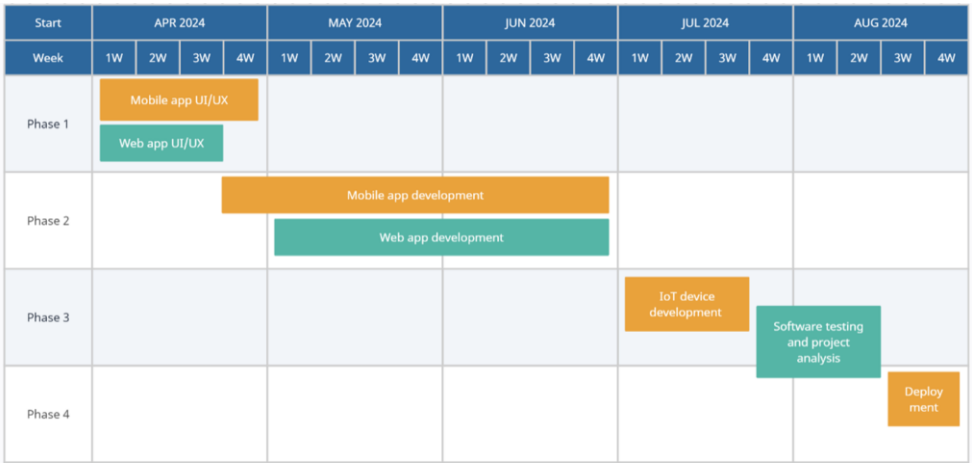


Figure 3.4.1: Project timeline Kanban

- Testing and Quality Assurance: Comprehensive testing and quality assurance procedures are essential to ensure the reliability and functionality of the system.
- Deployment and Monitoring: Efficient deployment of software, hardware, and infrastructure is followed by continuous monitoring to track system performance and user feedback.

Financial Analysis: Financial analysis is essential to evaluate the project's financial viability, sustainability, and potential return on investment. Key components of the financial analysis include:

- Cost Estimation: Estimating development, deployment, and operational expenses to determine the total project cost.
- Revenue Projections: Forecasting potential revenue streams such as ticket sales, transaction fees, and subscription-based services.
- Return on Investment (ROI): Calculating the ROI to assess the project's financial performance and potential for long-term value generation.
- Financial Viability: Evaluating the project's ability to cover costs and generate sufficient revenue to ensure sustainability and success.

Table 3.4.1: Estimated Cost for Smart Transport System Automation Perspective

Cost Category	Description	Estimated cost(in currency)
Hosting	Amazon EC2	26,0000 BDT
Database	Amazon RDS for PostgreSQL(yearly)	16,200 BDT
Domain	Amazon Route 53(yearly)	1,200 BDT
AI Model	FireFunction-V1	50000 BDT
Map API	Google map	20000 BDT
IoT Device	GPS NEO-6,ESP32,Sim router	4,200 BDT
Google Play	App publish	2,800 BDT
Development	Mobile & Web Developer	10,00,000 BDT
Total Cost		1,354,400 BDT

3.5 Summary

Chapter 3 of the project report outlines the methodology, requirement analysis, and design specifications for the Smart Transport Management System. It identifies research gaps, conducts requirement analysis, and proposes methodologies and designs for the system. The chapter highlights front-end designs for passenger and bus applications, along with a web-based dashboard for transport authorities. This sets the stage for subsequent phases of development, testing, and deployment.

CHAPTER 4

Implementation

4.1 Overview

The implementation of the Smart Transport System Automation Perspective involves developing a comprehensive transport management system for mobile, web, AI, and IoT-based platforms. It features user-friendly interfaces for passengers, conductors, and bus authorities. Mobile applications are built with React Native, JavaScript, and TypeScript to ensure responsive design, map integration, and QR code scanning. The web-based dashboard CMS employs HTML, CSS, React.js, Next.js, and other technologies to manage operations and ticketing efficiently. On the back end, the system uses Node.js, REST APIs, Prisma ORM, PostgreSQL, and AI features with LangChain and FireFunction V1 model 46.7b params for robust data management and user interactions. Essential tools like ESP32, GPS modules, Android devices, Visual Studio Code, Android Studio, and Figma facilitate efficient coding, testing, and deployment. This integration aims to enhance public transportation operations, improve user experience, and ensure system reliability.

4.2 Train Model/ Prototype Design

The Smart Transport System Automation Perspective features three different front-end designs, each emphasizing a contemporary, user-friendly interface. The passenger and conductor mobile apps utilize responsive design concepts for cross-platform compatibility. The web-based user interface enhances engagement through visual components for bus management, ticket management, passenger management, sales management, and interactive maps. This ensures an effective and efficient user experience, with a focus on accessibility and usability.

- **Front-end Design of Passenger App:**

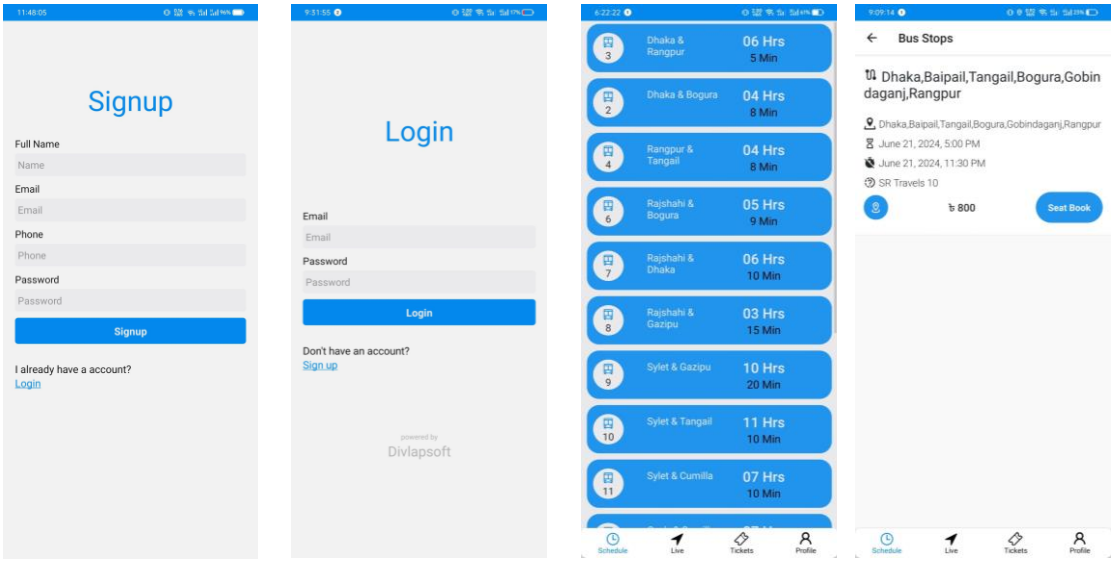


Figure 4.2.1: Signup,Login,Route & Bus Stop of Passenger app

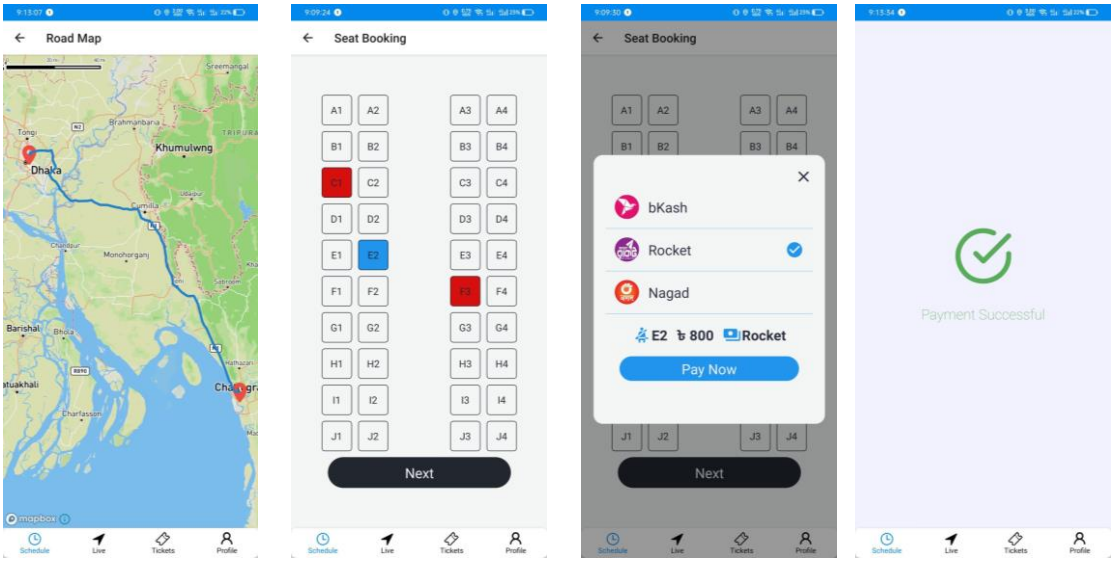


Figure 4.2.2: Road map,Seat book & Payment of Passenger app

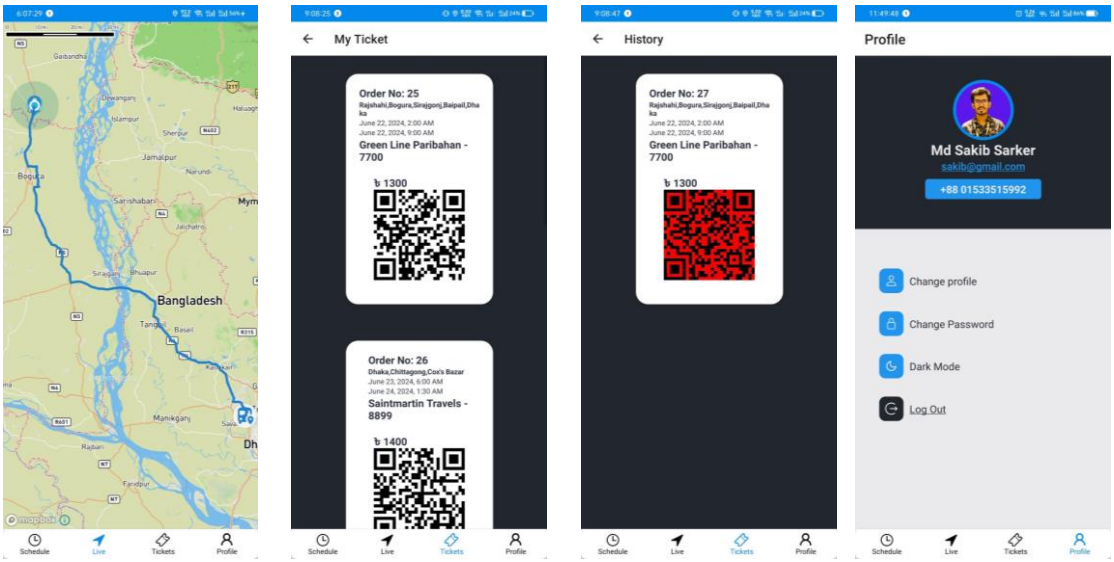


Figure 4.2.3: Live bus,My ticket,Ticket history & profile of Passenger app

- **Front-end Design of Conductor App:**

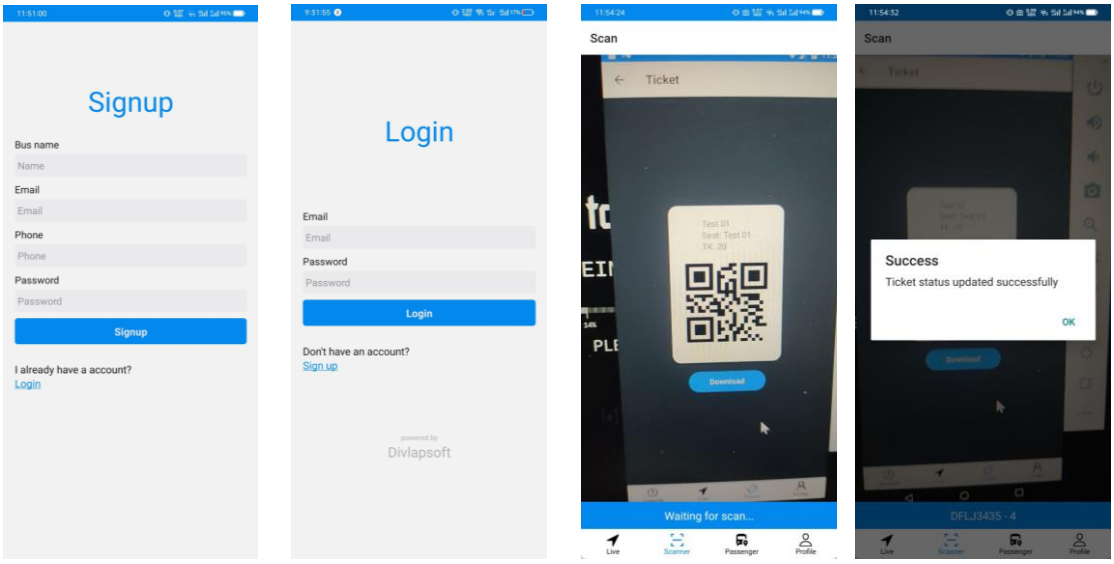


Figure 4.2.4: Signup,Login & Scan ticket of Conductor app

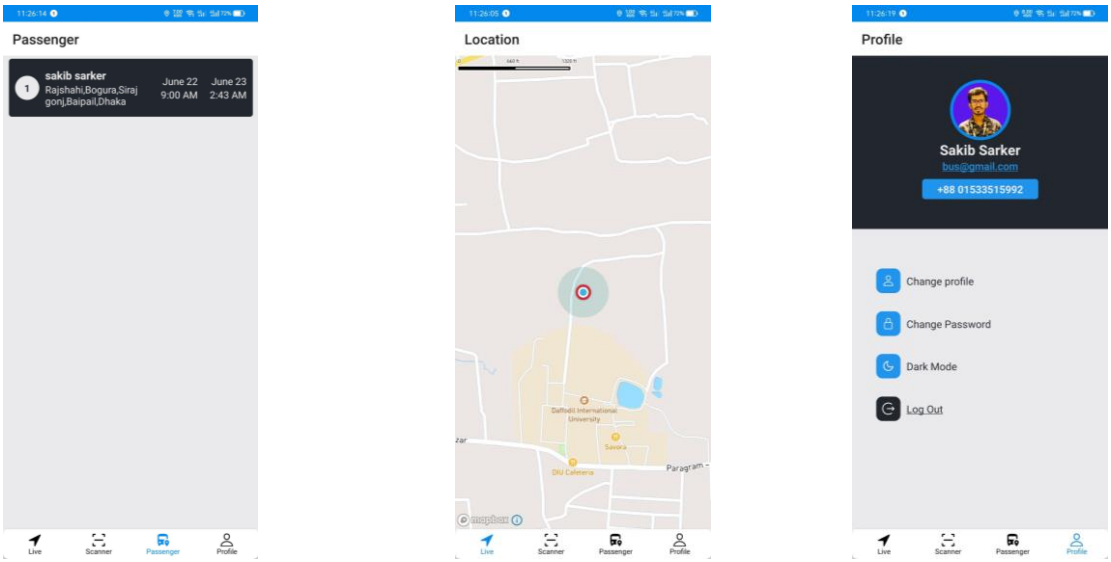


Figure 4.2.5: Passenger list,live bus & profile of Conductor app

- **Front-end Design of CMS Software:**

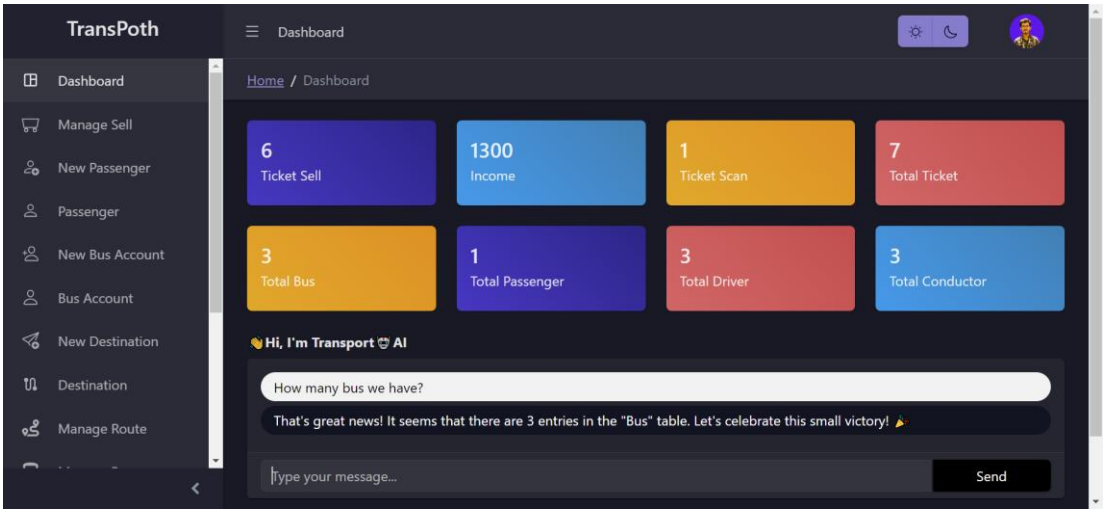


Figure 4.2.6: Dashboard of CMS Software

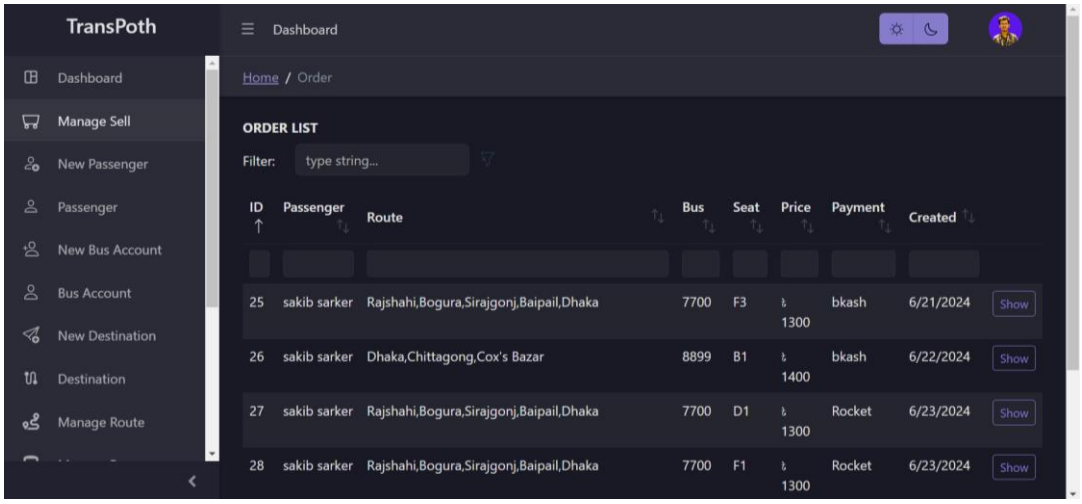


Figure 4.2.7: Order list of CMS Software

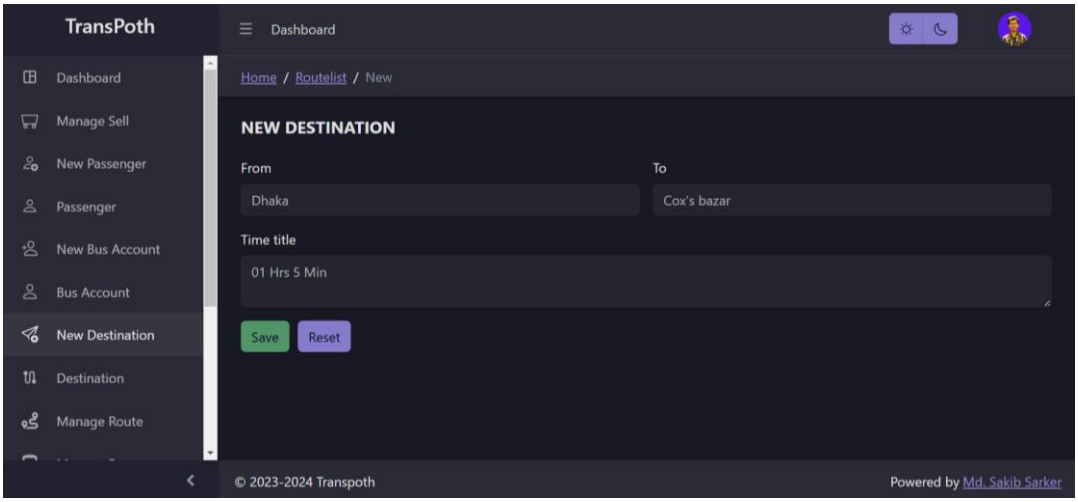


Figure 4.2.8: New Destination of CMS Software

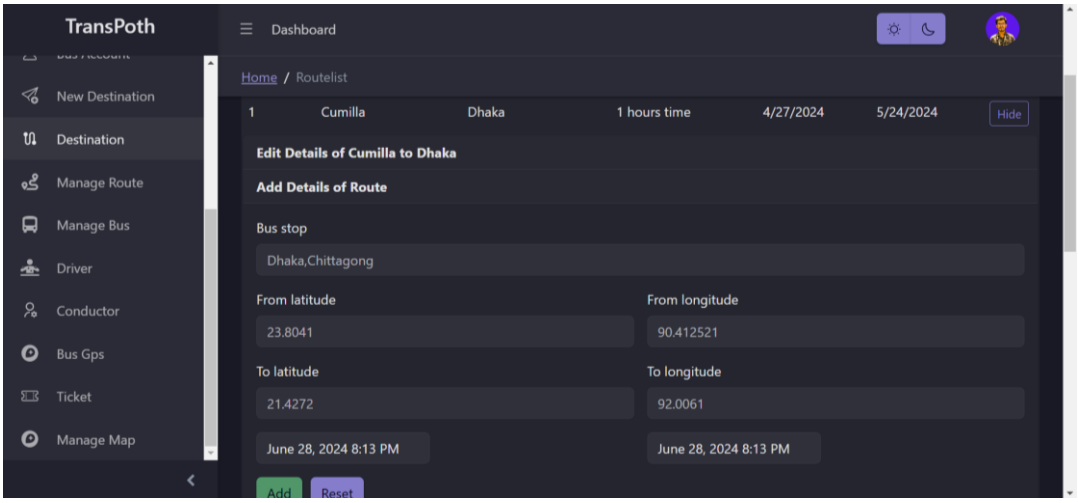


Figure 4.2.9: New route of CMS Software

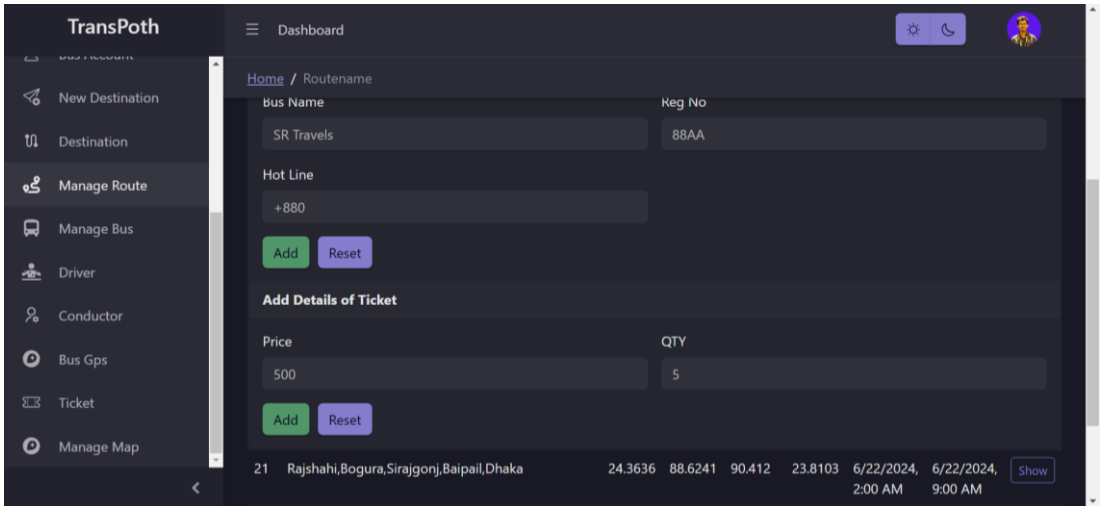


Figure 4.2.10: New bus & ticket of CMS Software

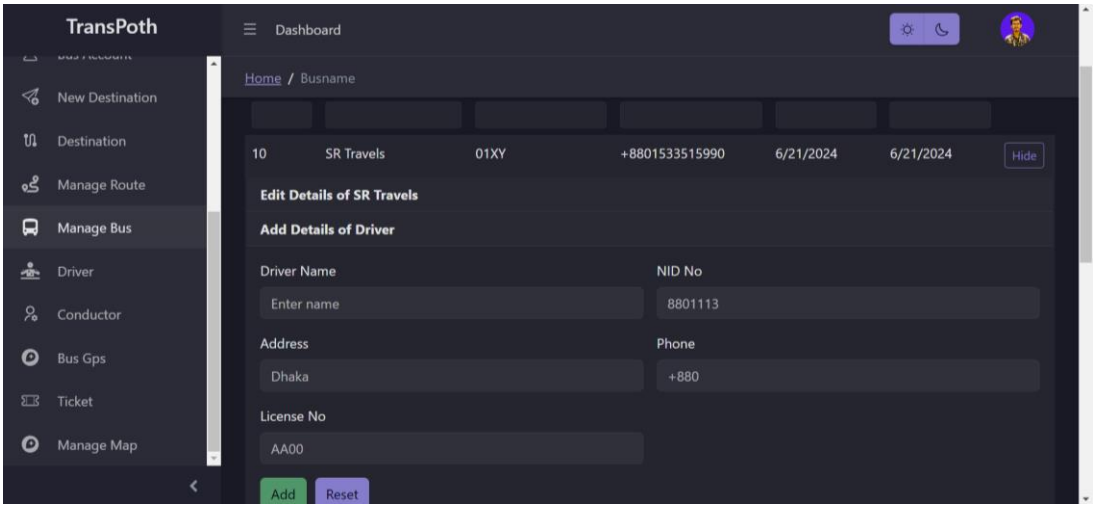


Figure 4.2.11: New driver of CMS Software

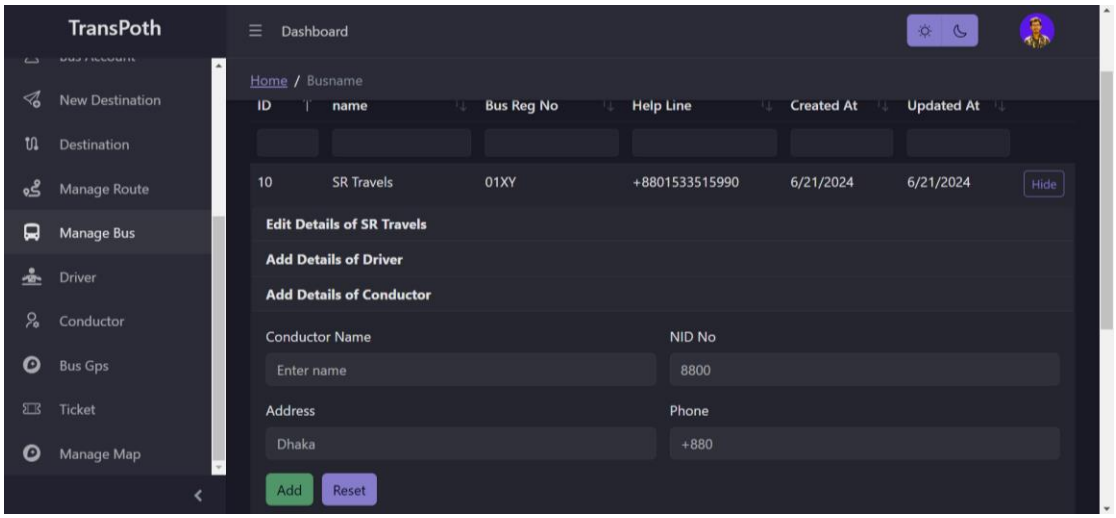


Figure 4.2.12: New conductor of CMS Software

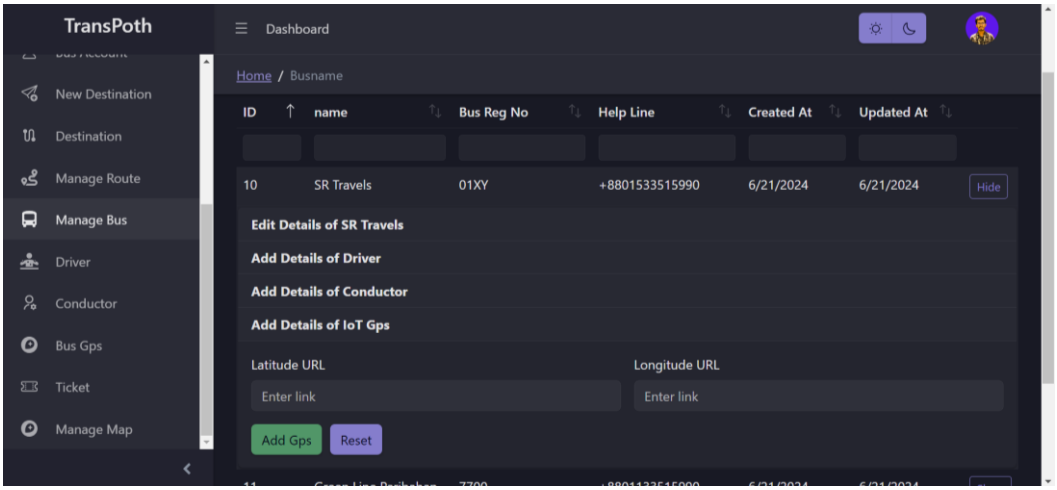
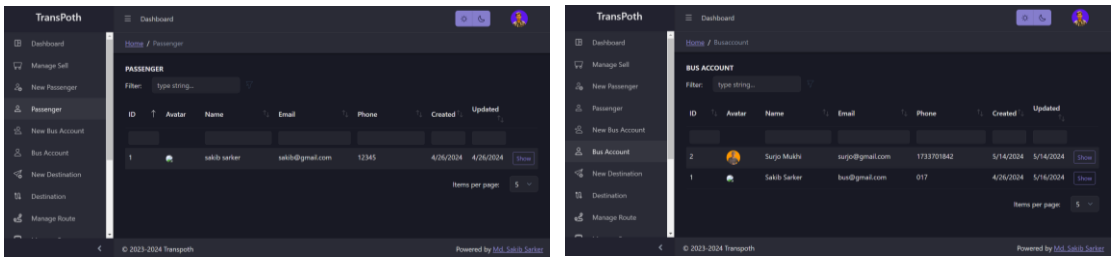


Figure 4.2.13: New gps of CMS SoftwareFigure



4.2.14: List passenger & bus account of CMS Software

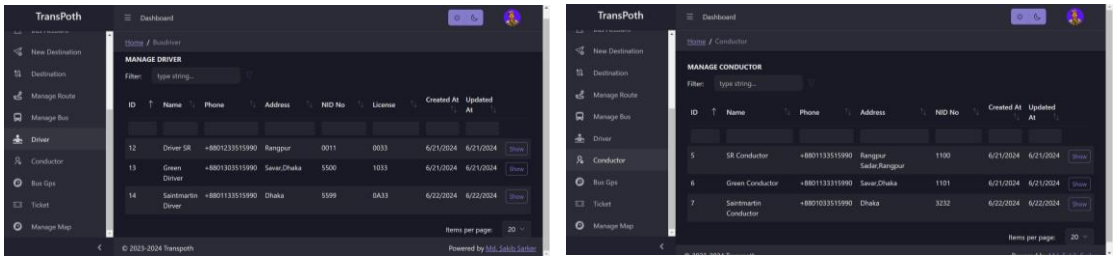


Figure 4.2.15: List driver & conductor of CMS Software

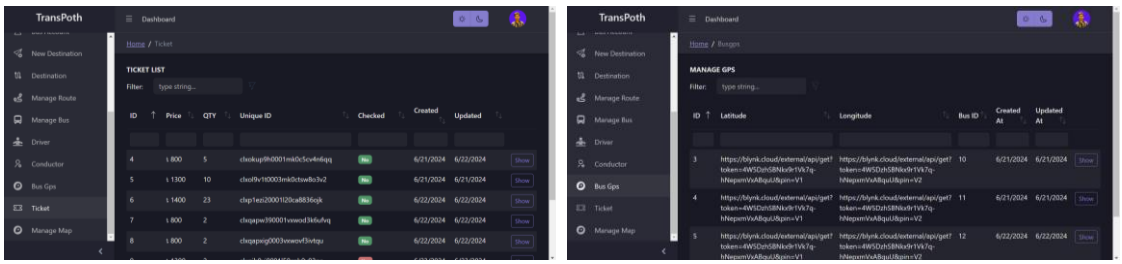


Figure 4.2.16: List ticket & bus gps of CMS Software

4.3 System Testing/ Model Evaluation

The Smart Transport System Automation Perspective involves multiple testing phases to ensure reliability and efficiency. These phases include testing the map functionality, build integrity, database performance, API responses, and both the passenger and conductor applications. Each phase is critical to validating the system's components and ensuring seamless operation across all user interfaces and backend processes.

Table 4.3.1: AI Model Performance Evaluation

Model name	Model Size	Short function context accuracy	Long function context accuracy
FireFunction-v1	46.7B Params	87.88%	89.16%

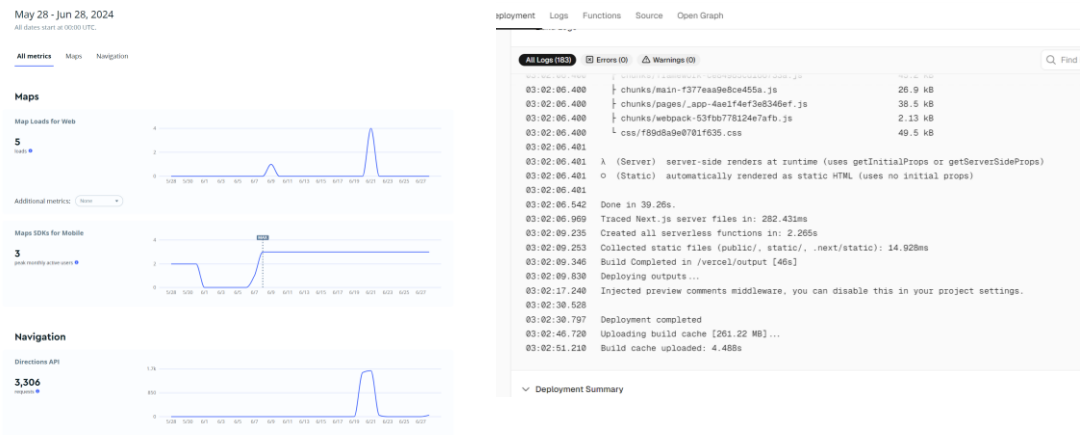


Figure 4.3.1: Map & CMS software Test

In this figure, the Mapbox API is tested, showing the map load, Map SDK, and navigation results. The Vercel build is also tested, displaying the test log of the build process.

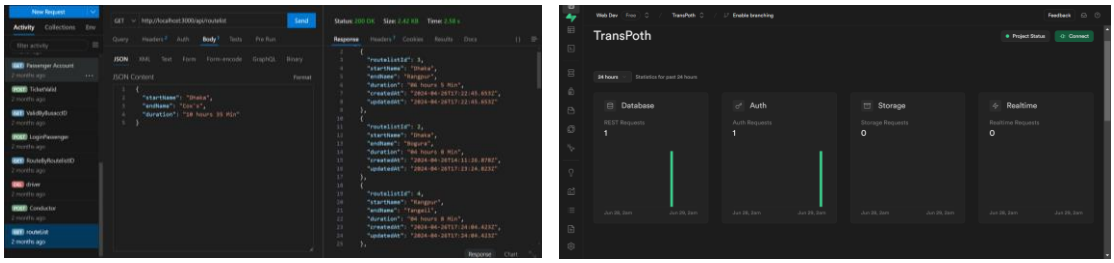


Figure 4.3.2: API & Database Test

In this screenshot, the backend API is tested using Thunder Client REST API tester. Additionally, it shows the PostgreSQL connection and usage testing.

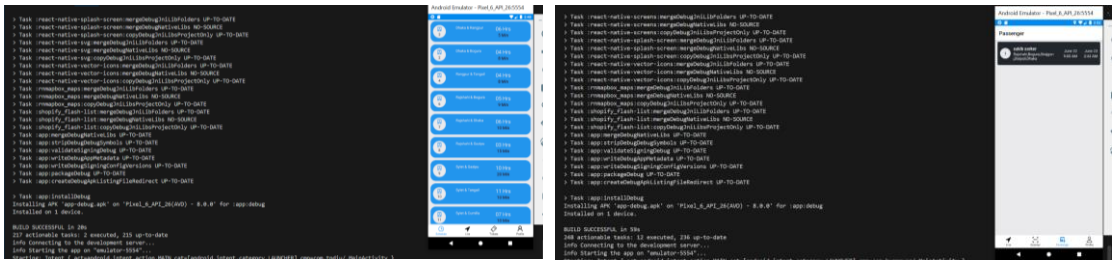


Figure 4.3.3: Passenger & Conductor App Test

In this figure, the passenger and conductor mobile app tests are shown on an Android emulator version 7 and a Pixel 6 mobile. The screenshot displays the successful app build after executing multiple test cases.

4.4 Summary

The Smart Transport System Automation Perspective integrates mobile, web, AI, and IoT technologies to enhance public transportation. Front-end development focuses on responsive interfaces using React Native and Next.js, complemented by robust back-end solutions with Node.js, Prisma ORM, and PostgreSQL. Testing phases ensure functionality across maps, APIs, databases, and mobile apps, ensuring reliability and efficiency. With tools like LangChain and LLMs enhancing AI capabilities, the project aims to streamline operations, improve user experience, and ensure system reliability, marking a significant advancement in urban transport infrastructure.

CHAPTER 5

Result And Analysis

5.1 Overview

This chapter presents the results and analysis of the Smart Transport System Automation Perspective, focusing on the system's performance, experimental outcomes, and comparative analysis. The implementation includes various phases of testing to ensure functionality, reliability, and efficiency. By analyzing the collected data, I can evaluate the system's effectiveness and identify areas for improvement.

5.2 Experimental/ Simulation Result

The experimental and simulation results cover multiple aspects of the Smart Transport System Automation Perspective, including:

- Map Functionality: Testing of the Mapbox API demonstrated efficient map load times, accurate navigation, and reliable SDK performance.
- Backend Performance: Tests using Thunder Client REST API tester showed consistent API responses, validating endpoint functionality and data integrity.
- Database Management: PostgreSQL tests confirmed successful connections and efficient data handling under various load conditions.
- Mobile App Testing: The passenger and conductor apps, tested on an Android emulator version 7 and a Pixel 6, showed seamless execution of multiple test cases, including real-time updates and QR code scanning.

These results indicate a high level of reliability and performance across different components of the system.

5.3 Performance/ Comparative Analysis

- The performance of the Smart Transport System Automation Perspective was compared against traditional transport systems and other smart transport solutions. Key findings include:
- Efficiency: The system significantly reduced wait times and improved schedule accuracy compared to traditional methods.

- User Experience: Enhanced features such as real-time bus tracking and digital ticketing provided a superior user experience.
- Scalability: The system demonstrated scalability, handling increased user loads without compromising performance.
- Environmental Impact: The optimized routes and reduced emissions showcased the system's positive environmental impact.
- When compared to other smart transport solutions, the integration of AI-driven features and robust backend infrastructure provided a competitive advantage in terms of efficiency and user satisfaction.

5.4 Summary

The results and analysis of the Smart Transport System Automation Perspective highlight its effectiveness in enhancing urban transportation. Experimental results confirm reliable performance across map functionalities, backend operations, database management, and mobile applications. Comparative analysis demonstrates the system's superiority in efficiency, user experience, scalability, and environmental impact. These findings validate the system's potential to revolutionize public transportation, making it more efficient, user-friendly, and sustainable.

CHAPTER 6

Impact on Society, Environment, and Sustainability

6.1 Impact on Life

The Smart Transport System Automation Perspective significantly improves daily life by enhancing time efficiency and safety for users.

- Time Efficiency: The system streamlines the ticket booking and payment process, reducing wait times and making it easier for passengers to plan their journeys.
- Secure Payment: The app's secure payment gateways ensure that financial transactions are safe and protected against fraud.
- Passenger Monitoring and Tracking: The integration of IoT devices enables continuous monitoring of bus locations and passenger movements, enhancing safety for both passengers and drivers.
- Emergency Situations: Real-time data can be used in emergencies to provide timely assistance for passenger safety.
- Environmentally Friendly: The adoption of digital tickets and mobile applications minimizes the need for paper-based tickets, reducing paper waste and promoting environmental sustainability.
- Job Creation: The development, deployment, and maintenance of the Smart Transport System Automation Perspective create jobs in various sectors, including technology, transport, and customer service.

6.2 Impact on Society & Environment

The Smart Transport System Automation Perspective brings about changes in society and the environment, promoting sustainable urban development and improving quality of life.

- Impact on Public Transportation: The system enhances the efficiency of public transportation, making it a more attractive option.
- Impact on Traffic Jams: Increased public transport usage reduces congestion and dependence on private vehicles.

- Impact on Time Management: Improved bus routes and schedules reduce travel time.
- Paperless Ticketing: By offering paperless ticket solutions, the system conserves natural resources and reduces waste.
- Traffic Management: Real-time data and efficient route planning help manage traffic flow

6.3 Ethical Aspects

Implementing the system involves several ethical considerations to ensure fairness, assistance, and respect for user rights:

- User Data Protection: Ensuring strict protection of personal data belonging to passengers and conductors.
- Safeguarding User Roles: Implementing robust security measures to protect data from unauthorized access and ensuring access is role-based.
- Minimal Data Collection: Collecting only necessary data from users that is essential for the system's operation.
- Issue Resolution: Providing effective customer support through helplines and maintaining good communication with users to address issues promptly.
- Fair Ticket Pricing: Ensuring transparent and equitable pricing for tickets on every route.

6.4 Sustainability Plan

This system will ensure long-term sustainability through a comprehensive plan that addresses environmental and economic aspects.

- Passenger Monitoring: Implementing this system enhances passenger safety by monitoring movements and identifying users.
- Women's Security: The system benefits women's safety in public transport by monitoring movements and providing emergency assistance.
- Paperless Tickets: Environmentally friendly solution that reduces paper waste.
- Economic Sustainability: Implementation will create job opportunities in IT, development, bus conductors, and drivers.

- Fuel Efficiency: Optimizing bus routes and schedules minimizes fuel consumption.
- Time Management: Enhancing passenger time management by providing real-time bus movement and accurate departure times.

6.5 Summary

The system offers significant benefits for society, the environment, and sustainability. By enhancing public transportation and reducing environmental impact, it supports smarter city development. Ethical considerations, including data protection and fair ticket pricing, are integral to its design and implementation. A comprehensive sustainability plan ensures these benefits are sustained in the long term.

CHAPTER 7

Conclusion and Future Work

7.1 Conclusions

The Smart Transport System Automation Perspective integrates mobile, web, IoT, and generative AI technologies to enhance public, private, and university transportation in Bangladesh. This innovative solution enables real-time vehicle tracking, smart ticketing, and automated management, benefiting passengers and transport authorities alike. I have made significant progress with user-friendly interfaces, mobile apps, AI, and IoT devices operating seamlessly together. While facing challenges, our future plans include enhancing cloud storage, security, AI integration, and expanding to more transport systems. With clear objectives guiding us, we're enthusiastic about further improving transportation efficiency and convenience.

7.2 Further Suggested Works

It sounds like you have some ambitious plans for the future of the Smart Transport System project! Here's a refined version of your plans:

- Improve Cloud-Based Storage: Increase storage capacity and optimize data management for better system performance and scalability.
- Enhance System Security: Implement advanced security measures to protect sensitive data and ensure user privacy against cyber threats.
- Integrate Advanced Sensors: Install sensors on bus windows to accurately count passengers, improving route optimization and passenger management.
- AI Integration: Enhance AI capabilities to suggest optimal route paths, provide traffic updates, send automatic alerts to guardians, deploy chatbots for customer service, and enable integrated ticket booking.
- Expand to Bangladeshi Transport Systems: Extend the system to integrate with other transport networks across Bangladesh, promoting seamless connectivity and enhancing overall transportation efficiency.
- Develop Smart Bus Stops: Create smart bus stops with online tracking and ticket purchase options, enhancing passenger convenience and facilitating real-time bus management.

7.3 Limitations/ Conflict of Interests

Implementing this project presents several challenges:

- Technical Challenges: Integrating multiple technologies and systems (e.g., GPS, IoT devices, mobile apps,web app) can be technically challenging.
- Data Latency: Ensuring the accuracy and reliability of real-time data, such as bus locations and schedules, is essential. However, issues such as data latency may arise.
- Internet Connectivity: Ensuring consistent internet connectivity for mobile devices and the CMS software is crucial for system operation.
- High Initial Costs: The initial investment required for implementing this system, including hardware, software, and buses, can be substantial.
- User Adoption: Factors such as user familiarity with technology, perceived benefits, and trust in the system play a significant role in user adoption.
- Stakeholder Interests: Different stakeholders may have competing interests and priorities.
- Data Privacy Concerns: Balancing robust data privacy measures with usability and convenience can present challenges.

These limitations and conflicts of interest will be essential for the successful deployment and operation of the System ,ensuring its effectiveness.

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APPENDIX A

Complex Engineering Problems (EP) and Complex Engineering Activities (EA) Analysis

Title:Smart Transport System Automation Perspective

Students ID: 202-15-3824

CO Description for FYDP-Phase-I

CO	CO Descriptions	PO
Phase -I		
CO1	Integrate recently gained and previously acquired knowledge to identify a **transport system** problem for the Final Year Design Project (FYDP)	**PO1**
CO2	Analyze different aspects of the goals in designing a solution for this FYDP	**PO2**
CO3	Explore diverse problem domains through a literature review, delineate the issues, and establish this goals for the FYDP	**PO4**
CO4	Perform economic evaluation and cost estimation and employ suitable project management procedures throughout the development life cycle of the FYDP	**PO11**
Phase -II		
CO5	Design and develop technical solutions and system components or processes that meet specified requirements, ensuring compliance with public health and safety standards, as well as considering cultural, socioeconomic, and environmental factors in this FYDP	**PO3**
CO6	Choose and apply appropriate methodologies, resources, and contemporary engineering and IT technologies to address complex engineering processes, encompassing prediction and modeling, while adhering to relevant constraints in this FYDP	**PO5**
CO7	Analyze societal, health, safety, legal, and cultural considerations, along with associated responsibilities, in the context of professional engineering practice and the resolution of this problem, employing logical reasoning guided by contextual understanding.	**PO6**
CO8	Comprehend and evaluate the enduring sustainability and impact of professional engineering endeavors in addressing intricate engineering challenges within social and environmental frameworks.	**PO7**
CO9	Implement ethical principles and adhere to professional standards and norms in this FYDP	**PO8**
CO10	Capable of operating proficiently both individually and as a team member or leader across diverse teams and interdisciplinary settings in this FYDP.	**PO9**
CO11	Proficiently communicate with the engineering community and broader society regarding complex engineering endeavors, including the ability to comprehend and generate comprehensive reports and design documentation, as well as provide and receive clear instructions throughout this FYDP.	**PO10**

CO12	Acknowledge the importance of self-directed and life-long learning within the evolving landscape of technology, and possess the readiness and capability to engage in lifelong learning endeavors.	**PO12**

Addressing CO (1 to 8), Knowledge Profile (K), Attainment of Complex Engineering Problems (EP), and Attainment of Complex Engineering Activities (EA)

Addressing CO (1 to 8), Knowledge Profile (K), Attainment of Complex Engineering Problems (EP):

SN	EP Definition	Attainment	CO	Justification (with Knowledge Profile)	References
1.	**EP1: Depth of Knowledge required**	Yes	CO1, CO2, CO3, CO5, CO6, CO7 and CO8	This project enhances bus services through advanced technology. Implementing GPS tracking for real-time bus monitoring, enabling users to book tickets, access route information, and check arrival times. This project requires expertise in programming languages and technologies including Node.js, Next.js , React Native,Generative AI and IoT fundamentals, covering the **engineering fundamentals (K3)** and **specialist knowledge (K4)** needed for its success.	**Page no:1,6** **Section: 1.1,2.2**
				K5 (Engineering Practice) In page 4-5 proposed methodology includes the Research Design/ Prototype Design section, where I presented a mobile app and cms software prototype illustrating the system's functioning.	**Page no:18-23** **Section: 3.2**

				K6 (Engineering Practice) In Chapter 8 Resources Utilized I detailed the technologies utilized for the frontend, backend,Generative AI and IoT devices installed in buses in the implementation section.	**Page no:18-23** **Section: 3.2,3.3**
				The project covers **research literature, including K8,** by reviewing mobile apps, system interfaces, generative AI, security api, and industry transport solution trends, enabling informed decision-making for integrating a smarter system.	**Page no:6-16** **Section: 2.2,2.3**
2.	**EP2: Range of Conflicting Requirements**	Yes	CO2, and CO7	This system confronts **EP-2** by addressing technical challenges, internet connectivity, user adoption, various technology integrations, real-time updates, system security, passenger privacy, and market adoption. By addressing these conflicting requirements, the project aims to develop a comprehensive and user-friendly transport system.	**Page no:41** **Section: 7.3**
3.	**EP3: Depth of analysis required**	Yes	CO2, and CO6	I analyzed other transportation mobile apps, existing projects, and research. Then, I chose to develop my project using the latest technologies, including the Next.js framework, React Native, IoT, Generative AI and improved transport solutions.	**Page no:35-36** **Section: 5.2,5.3**
4.	**EP4: Familiarity of Issues**	Yes	CO8	To develop a Smart Transport System Automation Perspective similar to identifying gaps in existing research and developing this system.	**Page no:16,38** **Section: 2.4,6.3**

5.	**EP5: Extends of application codes**	No	CO5	N/A	N/A
6.	**EP6: Extends of stakeholders involved and conflicting requirements**	Yes	CO8	The project involves various stakeholders like passengers, bus conductors,bus authority. Each group has different needs and priorities, sometimes conflicting, which require negotiation and compromise. Effective communication and collaboration are key to aligning everyone towards common project goals.	**Page no:23-25** **Section: 3.3,3.4**
7.	**EP7: Interdependence**	Yes	CO5	This project relies heavily on the interdependence of various technological components. Integrating IoT devices like GPS and ESP32, mobile apps for passengers and conductors, web applications for bus authorities, generative AI for data analysis and chatbots, and backend systems requires seamless interaction and asynchronous operation.	**Page no:18-23,35-36** **Section: 3.2,5.3**

Addressing CO11 with Complex Engineering Activities (EA) [Some or all of the following]:

SN	EA Definition	Attainment	CO	Justification	References

1.	**EA1: Range of resources**	Yes	CO11	Implementing this system requires a range of resources to support its technology. These include hardware like GPS, ESP32, mobile devices and emulators for app testing, development tools such as Visual Studio Code and Android Studio, frameworks like React Native and Next.js, and generative AI for data analysis. The system also utilizes FireFunction V1 LLMs for enhanced functionality.	**Page no:22,33-34** **Section: 3.3,4.3**
2.	**EA2: Level of interaction**	Yes		The project involves various interactions among its components: mobile applications for passengers and conductors, web applications for bus authorities, and generative AI for data analysis and chat functionalities with authorities.	**Page no:26-32** **Section: 4.2**
3.	**EA3: Innovation**	Yes		The system innovates public, private, and university transportation with IoT, generative AI, mobile and web apps. It includes features like ticket scanning, booking, real-time updates, passenger monitoring, and smart bus management for improved efficiency and user experience.	**Page no:2,3,18-23** **Section: 1.3,1.4,3.2**
4.	**EA4: Consequences for society and the environment**	Yes		This system offers significant benefits for society and the environment by minimizing public transportation issues, improving time management in daily life, reducing traffic impact, minimizing paper waste, ensuring passenger safety, and generating economic benefits through job creation.	**Page no:37-38,38,38** **Section: 6.2,6.3,6.4**

5.	**EA-5: Familiarity**	Yes		The analysis of various research and mobile apps like Moovit, Transit, and AbhiBus reveals their popularity for real-time ticket booking, route checking, bus tracking, and ticket purchasing functionalities.	**Page no: 6-9,9-16** **Section: 2.2,2.3**

Addressing CO (4, 9, 10, and 12):

SN	COs	Attainment	Justification	References
1	CO4	Yes	The project captures **CO4** by integrating financial management practices, including budgeting, resource allocation, cost management, and risk mitigation, ensuring efficient fund distribution, monitoring expenditures, and identifying optimization areas while maintaining quality.	**Page no:23-25 Section: 3.4**
2	CO9	Yes	The project upholds ethical practices by prioritizing user privacy, maintaining transparency in data usage, providing fair suggestions, respecting cultural sensitivities, and promoting accessibility, fostering trust, transparency, and integrity among stakeholders.	**Page no:3-4,40 Section: 1.5,7.2,**
3	CO10	No	N/A	N/A
4	CO12	Yes	The project's implementation phase emphasizes lifelong learning through diverse testing protocols, automated frameworks ensuring ongoing improvement and adaptation to emerging tech trends, with results analysis refining the platform for enhanced effectiveness.	**Page no:26-32,37,38-29 Section: 4.2,6.1,6.4**

Smart Transport System Automation Perspective

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