E-Bus pass management system with GPS Tracking system

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Abstract- The E-Bus Pass Management System with GPS Tracking aims to revolutionize public transportation by offering a seamless user experience for purchasing bus passes and tracking bus locations in real-time. The system comprises a user-friendly web portal and mobile app, backed by a robust backend server with a GPS tracking system integrated into each bus. Key features include user registration, pass management, live bus tracking, route planning, notifications, and analytics. Utilizing modern technologies like React.js, Node.js, and GPS devices, the system ensures enhanced efficiency, transparency, and convenience for both passengers and transportation authorities.

Keywords: E-Bus Pass Management, GPS Tracking, Real-Time Bus Tracking, User Authentication, Pass Purchase.

I. INTRODUCTION

Although emissions from larger vehicles such as buses are low per passenger, they are often high in absolute terms as a proportion of total emissions. This is because buses not only use heavy engines, but also travel slower,longer and have to stop more often. Public transport is also often controlled or regulated by the state, which creates opportunities for political initiatives to shape the development of electric cars. Finally, public transport services operate with vehicles that require their own charging and cannot rely on public charging networks.Creating reserved charging points is easier than creating a network of public charging stations [1]

Based on the above, public transport and especially buses offer the greatest potential of emission reduction, especially in dense urban areas, where the harmful health effects of emissions are the greatest. There is a huge opportunity to electrify buses and other modes of public transport, such as two-wheelers and IPT, with the 'increase' component of the avoid-change-improvement framework of transport emission reduction strategies. While efforts such as land use and urban planning, demand management programs, transportation integration and so on continue, e-buses are a significant opportunity with a high potential impact in terms of cost and effort [2]

This increases productivity and increases the long-term economic benefits of the city. One of the essential aspects of electrification is the replacement of internal combustion engine (ICE) buses with hybrid electric vehicles or fully E-buses. These present a number of challenges, including investment in alternative charging infrastructure on bus routes, an electrified bus depot for sudden charging and the replacement of the entire ICE-based bus fleet with electric or hybrid electric buses. All these challenges must be overcome for electrified public transport to be successful and economically viable [3]

The system studies the seasonal effects of climate on the ECO charging technology described in Sect, as well as the required cooling capacity to keep the ESS in optimal operating ranges. Colder temperatures help cool the battery; therefore, it takes longer for the battery temperature to exceed the preset set point, which activates the ECO charging process; thus charging tends to be continuous in cold weather. One of the disadvantages of ECO charging is that it takes longer to charge the battery, which leads to costs associated with missing the bus schedule. however, the reduction in energy consumption with longer battery life makes up for it. ECO charging has another advantage in widespread use [4]

The expansion of Internet connections in E-Bus has increased the expectations of customers in all sectors, including the financial sector. Financial services that are accessible and easy to use for customers are no longer enough. Instead, they are looking for financial services that are faster, more convenient, more secure, more entertaining, more innovative and customizable to their specific needs. Rising customer expectations and technological advances have made the financial industry more competitive, making digital transformation imperative to attract new customers and increase customer retention [5]

II. LITERATURE SURVEY:

According to **Busra Yaman**.et al., 2018 The offer of electric vehicles, support policies implemented in Europe and the Czech Republic, electronic mobility infrastructure and infrastructure providers, some examples of electronic mobility services and business models implemented worldwide are

explained. In addition, the impact of electric mobility on electrical systems and oil consumption and imports is mentioned. Battery requirements for electric mobility are briefly discussed. describes the Czech Republic's national electric vehicle action plan and how the country plans to develop its electro-mobility infrastructure. Incentives used and intended for use; legislation and competent authorities are explained [6]

According to **Nikos Avramis**.et al., 2021 One has a warm Mediterranean climate and the other a northern European (cold temperate) climate to compare the different climate effects of a heat management strategy and a reward management strategy. In each city, two bus lines are selected and the effect of speed, height and passenger profile on the energy and thermal management strategy of the vehicles is evaluated. A multiobjective optimization technique, an advanced simplex optimization technique, and a "brute force" Monte Carlo technique were used [7]

According to **Travis Fried**.et al., 2021 The world is facing a gigantic convergence of crises. As of early 2021, COVID-19 has killed nearly 2 million people worldwide and left more than 255 million people unemployed, mostly in middle and low-income countries (New York Times 2020; ILO 2021). Economic collapse could push 88-115 million people into extreme poverty in 2020 and wipe out decades of progress (Mahler et al. 2020). At the same time, climate disruption and rising temperatures promise to exacerbate future economic instability and inequality (WEF 2020). Even drastic reductions in transportation and electricity consumption due to the shutdown of COVID-19 [8]

According to **Ranjit Singh**.et al., 2022 summarizes earlier research on digital financial transactions (DFTs), pinpoints the variables driving DFT utilization, and points out areas in need of further study. The empirical research published between 2009 and 2020 are the main subject of this review. We find five barriers and fifteen facilitators for the implementation of DFT. The most significant factors influencing the adoption of DFTs, according to the research, are perceived utility, perceived simplicity of use, compatibility, trust, security, effort expectations, performance expectations, and facilitating conditions. [9]

According to **Jose Alejandro**.et al.,2023 examines customer preferences and views of online retailers to develop and direct environmentally, socially, economically, and technologically sustainable business strategies. Based on a sample of 387 respondents, the study examines the primary motivations for and advantages of using electronic markets, as well as consumer preferences and perceptions of the aspects of

sustainable market development. Additionally, it evaluates the technical features of digital platforms. Making use of descriptive statistics [10]

III.PROPOSED SYSTEM

The proposed E-Bus pass management system integrates a user-friendly web portal and mobile app, offering seamless registration, pass purchase, and real-time bus tracking functionalities. Users can easily register, buy different types of passes, and access digital passes stored securely in their accounts. The system utilizes GPS devices installed in each bus to provide live tracking, allowing users to view bus locations, estimated arrival times, and receive timely notifications for delays or route changes. Additionally, the platform offers comprehensive route planning information, trip fare calculation, and personalized alerts, enhancing the overall commuting experience. Built on a robust technology stack with advanced security measures, the system aims to optimize bus service efficiency, improve passenger satisfaction, and ensure reliable and convenient public transportation.

ARCHITECTURE DIAGRAM:
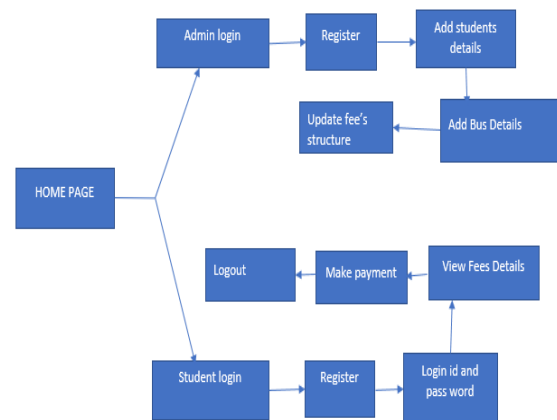
Explanation:

1.User Interface (UI):

Web Portal: A user-friendly interface accessible via web browsers where users can register, purchase bus passes, view bus routes, and track buses in real-time.

Mobile App: A dedicated application for smartphones and tablets offering similar functionalities as the web portal, enabling users to access the system on-the-go.

2.Backend Server:

Database: A centralized database system (e.g., MongoDB or PostgreSQL) to store user profiles, bus routes, schedules, transaction history, and real-time GPS tracking data.

APIs: A set of Application Programming Interfaces (APIs) developed using Node.js and Express.js to handle various system operations, including user authentication, pass management, GPS data processing, and communication between frontend and backend components.

3.GPS Tracking System:

GPS Devices: GPS devices installed in each bus to collect and transmit real-time location data to the tracking server.

Tracking Server: A dedicated server responsible for receiving, processing, and storing GPS data, updating bus locations in the database, and sending real-time updates to the frontend for display on the map.
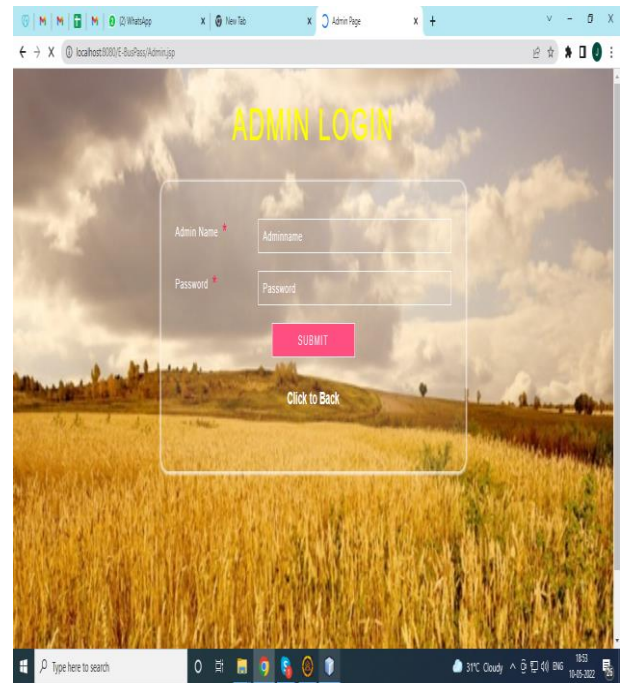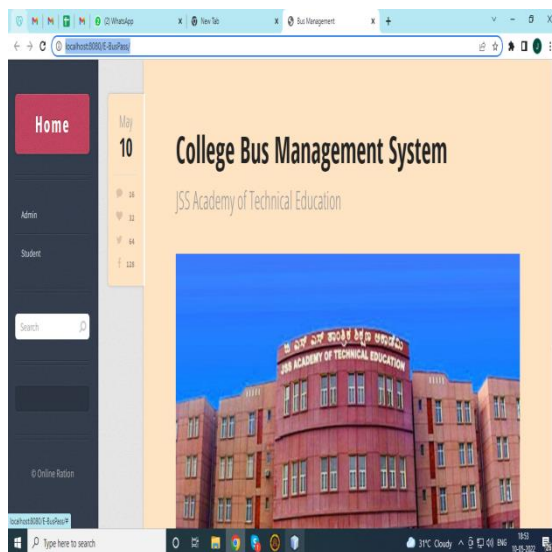
IV.RESULTS AND DISCUSSION

FIGURE.1 Homepage

The homepage serves as the initial point of interaction for users, offering a streamlined interface that provides easy access to various functionalities. Through a user-friendly design and intuitive navigation, the homepage effectively guides users to the desired sections of the platform.

FIGURE.2 Admin Login

The admin login functionality provides a secure gateway for authorized personnel to access and manage the system's backend. Utilizing robust authentication mechanisms, such as multi-factor authentication and encryption, the admin login ensures the confidentiality and integrity of sensitive data.
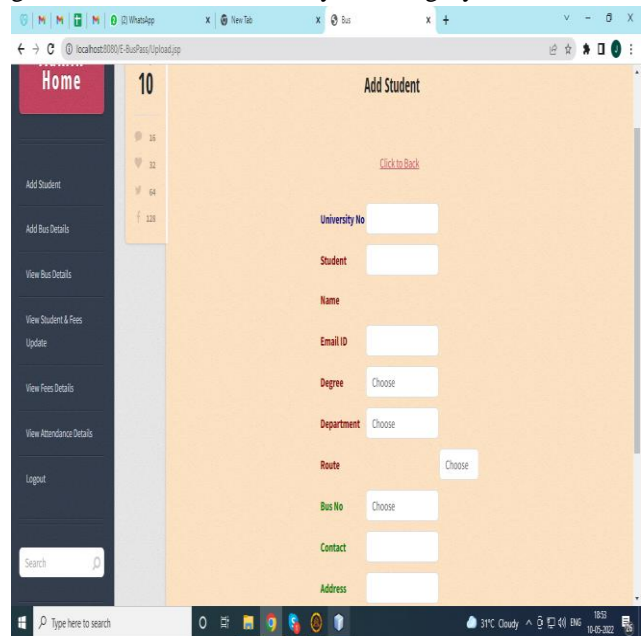

FIGURE.3 Add Student

The 'Add Student' feature facilitates the seamless integration of student data into the system, ensuring accuracy and consistency. Through an intuitive form-based interface, administrators can easily input and validate student information, including personal details, academic records, and contact information. The implementation of data validation

rules and error-checking mechanisms minimizes the risk of data entry errors and ensures data integrity.
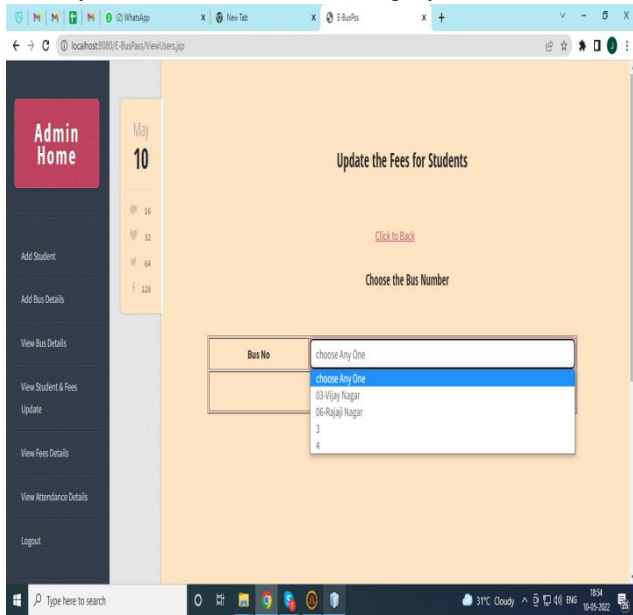

FIGURE.4 Update Fees for Students

The 'Update Fees for Students' functionality offers a flexible and efficient way to manage student fee records and transactions. Administrators can easily update and track fee payments, generate invoices, and monitor outstanding balances through an intuitive interface. Integration with secure payment gateways enables seamless online transactions, ensuring timely and accurate fee collection.

FIGURE.5 Add Bus Details

The 'Add Bus Details' feature enables administrators to efficiently manage and update bus-related information, including routes, schedules, and capacity. Through a user-

friendly interface, administrators can easily input, validate, and maintain accurate bus details, ensuring timely updates and compliance with regulatory requirements.
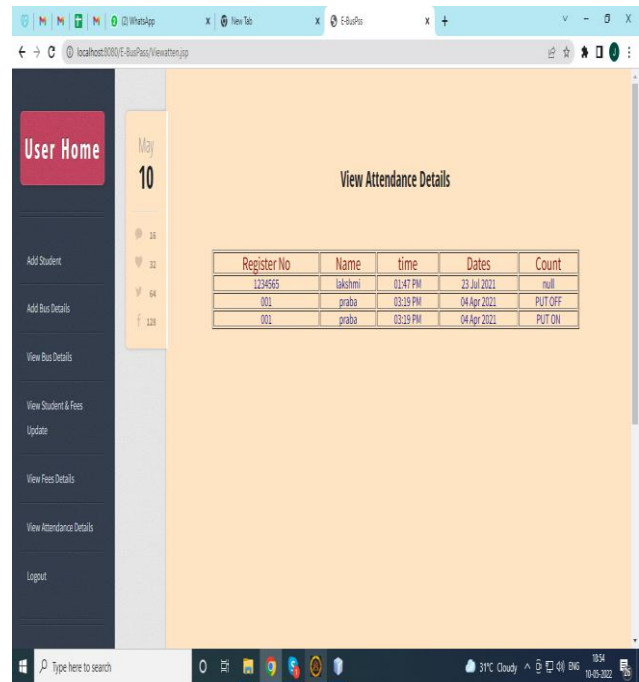

FIGURE.6 View Attendance Details

The 'View Attendance Details' functionality provides administrators with comprehensive insights into student attendance records, facilitating efficient monitoring and management of attendance-related data.
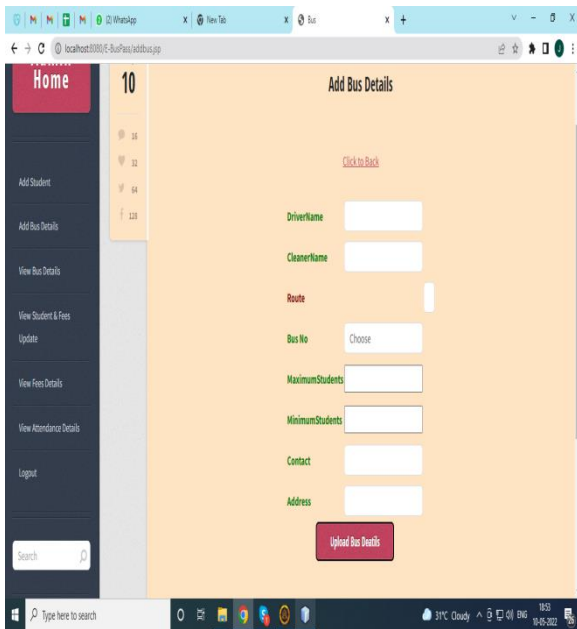
V.CONCLUSION

The E-Bus Pass Management System with GPS Tracking represents a significant advancement in public transportation management, addressing the challenges faced by passengers and transportation authorities alike. By integrating digital pass management with real-time GPS tracking, the system offers passengers the convenience of purchasing and managing bus passes online while providing accurate and timely bus location information. This enhances the overall efficiency of bus operations, reduces passenger wait times, and improves the quality of service. Moreover, the system's analytics capabilities enable transportation authorities to make data-driven decisions for optimizing bus routes, schedules, and service quality. With its user-centric design, advanced technology stack, and comprehensive feature set, the E-Bus Pass Management System with GPS Tracking sets a new standard for modern, efficient, and customer-focused public transportation systems.

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