BUS TRACKING SYSTEM

Project Report

Submitted in partial fulfilment of the requirements For the award of the degree of

Bachelor of Engineering in

COMPUTER ENGINEERING

By

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G. M. Vedak Institute of Technology Tala-Raigad

UNIVERSITY OF MUMBAI

2023-2024

CERTIFICATE

Department of Computer Engineering

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Internal Examiner

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External Examiner

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Place: GMVIT, TALA

Date:

DECLARATION

We declare that this written submission represents our ideas in our own words and whose other's ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been properly cited or from whom proper permission has not been taken when needed.

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This work is not just an individual contribution till its completion. I take this opportunity to thank God, almighty for blessing us with his grace and taking our endeavor to a successful culmination all for bringing it close to the conclusion. I extend my sincere and heartfelt thanks to our esteemed guide **Prof. K. R. Metha** for providing me the right guidance and advice at the crucial junctures and for leading me to many new insights, encouraging and teaching me how to get down to the root of the problem.

I extend my sincere thanks to the Head of the Department of Computer Engineering **prof. K. R. Metha** for allowing us to use the facilities available. I am also grateful to the department faculty and staff members for their support.

I would also like to thank all my friends and well wishers for support during the demanding period of this work. This document in its eternity (as with everything I have or have yet to accomplish) is attributable to the my parents, whose strength and compassion are my constant inspiration.

I would also like to thank my wonderful colleagues and friends for listening my ideas, asking questions and providing feedback and suggestions for improving my ideas.

ABSTRACT

In this project, we have developed a Bus Tracking System that tracks the location of the Bus. This system provides a exact location of the Bus using GPS.
The proposed BTS leverages modern technologies such as Global Positioning System (GPS) and mobile applications to provide real-time tracking and monitoring of bus fleets. By integrating these technologies, the system enables Users to access accurate and up-to-date information regarding bus locations, routes through user-friendly interfaces on their smart phones.

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Chapter 1

INTRODUCTION

1.1 Introduction and Motivation

Public transportation systems play an increasingly important role in the way people move around their communities. For individuals, public transportation provides mobility to those who cannot or prefer not to drive, including access to jobs, education, and medical services. In general, transport mobility the ability for people to move around their community is a strong indicator for employment, with studies showing, for example, a direct connection between car ownership and employment. By helping travelers move from single occupancy vehicles to public transportation systems, communities can reduce traffic congestion as well as its environmental impact.

An important feature of a modern mobile device is that it can position itself. Not only for use on the device but also for remote applications that require tracking of the device. Furthermore, tracking has to robustly deliver position updates when faced with changing conditions such as delays due to positioning and communication, and changing positioning accuracy. The realized system tracks pedestrian targets equipped with GPS enabled devices.

1.2 Existing System

There are many existing platforms and applications that are used to assist commuters plan their travel uses mobile data for the connectivity and communication and GPS to get the real-time location travel uses mobile data for the connectivity and communication and GPS to get the real-time location of the bus (or other means of transport) relative to the commuter. There are solutions that offer a limited accuracy in metropolitan cities.

However, these solutions are not available to the other cities and also, they rely on historical data to provide information. The Intelligent Transport System (ITS)s based solutions can be studied to overcome these pitfall, would help the commuter to effectively utilize the public transport which includes lower waiting time. There are many implementations of Intelligent Transport System all around the world, each solution designed to address a specific demographic region. The components of ITS Technologies are the wireless communication like WiFi. and computational technologies like Al, Real-time data processing, etc.

The solution is also loosely based on the Floating car data, which is based on the collection of position, speed and direction of travel of the vehicles from mobile phones with a two-way communication of GPS enabled vehicles with Smartphone based applications. The task of computing the shortest path of travel is computed with Dijkstra's Algorithm the optimization done are discussed in section III.

1.3 Problem Statement

1. Possessing own transportation has become more common nowadays. The number of vehicles on the road keep on increasing and most of us are eager to own personal vehicle as we can go anywhere without limitation.

2. Undoubtedly, the existence of bus has reduced road traffic and taking bus is a good starting to inculcate the car-pooling value. Besides, it provides a low-cost transportation which means to the low-income family for traveling to another destination. However,
things always don't come perfect.

3. The main drawback of traveling with bus is the inconsistent arrival time which may due to unforeseen circumstances. Even when we know the bus schedule well, there are
number of reasons that bus as may not arrive as expected.

- Traffic congestion
- Heavy downpour
- Bus breakdowns

It is particularly annoying when a person has urgent appointment, but we are late due to time consuming bus trip.

4. Students also cannot check on the updated bus schedule if there is a bus delay happens.
For example, student can choose walk to the building he or she want to go instead of waiting for a delay bus if there is a real time platform for student to know about the bus is delay

1.4 Proposed System

The real time tracking of bus can be done and this information is then given to remote user who wants to know the real time bus information. Our system provides the relevant information regarding

- Real time location: Here the current location of the bus will be displayed.
- Route details: The system will display the route details with stops name.
- Average waiting time and expected time to reach: The system will display the ETA(estimated time of arrival) on the Google maps between two stops.
- Real time traffic to diverse route in case of heavy congestion: The system will display the traffic details for the driver in case of congestion.
- Emergency module: The system will send the notifications to the management in case of emergency.

1.5 Objective

- Aims to provide tracking location of vehicle/bus.
- Allows user to track and monitor real-time location
- Provides effective performance.
- Aims to provide support and safety of students/Passenger.

Chapter 2

LITERATURE REVIEW

2.1 Literature Review Of Existing System

[1] The real time bus tracking and Location updation system IEEE 2021 paper of author A. Deebika Shree, J. Anusuya, S. Malathy.

Summary: This paper uses Arduino as a main component and uses common GPS system with RFID feature. We reviewed this paper and found few drawback of this project which doesn't include a battery backup system and also has no latest GPS connectivity Module which only support 50 channels with 5Hz position update rate and only connects with GPS satellite, also this project has uses Arduino microcontroller so the main drawback of this project having no IOT connectivity and old hardware technology.

[2] The College bus Tracking and Notification System IEEE 2020 paper of author K. Premkumar, Pavithra. K, Presiela. J, Priyadarshani. D, Priyanga. P.

Summary: This paper uses again a common GPS module which can connect only with GPS satellite and having a 50 channel limit with 5Hz update rate but this system uses the IOT Board which is ESP8266 Nodemcu which has inbuilt Wifi system of 2.4Ghz this project gave us few ideas about cloud database and modifying and shaping our project in similar direction, they also include buzzer system to provide alarm option to give the notification to the driver if the user miss their stop.

[3] Application Based Bus tracking System IEEE 2019 paper of author Shubham Jain, Adarsh Trivedi, Shweta Sharma

Summary: This Project uses no external hardware to send location but they send using application. The concept is similar to uber and Ola system where they Collect the location from the driver Smartphone and sends the information to the client side, but to enable this project uses Google API and it can go towards low maintenance but expens

2.2 Research Gap Analysis

For this study, a Bus Tracking System topic was chosen. A Bus Tracking System is allows to track the exact location of the Bus. Evaluate how existing bus tracking systems integrate with other transportation technologies such as traffic management systems, smart city infrastructure, or IoT devices. Identify gaps in seamless integration and inter-operability. Evaluate the coverage and accuracy of bus tracking systems, especially in areas with poor network connectivity or challenging terrain. Identify gaps in coverage and accuracy that may result in unreliable tracking data or inefficient service delivery. Examine the security and privacy measures implemented in current bus tracking systems to protect passenger data and system integrity. Identify gaps in security protocols, data encryption, and compliance with privacy regulations such as GDPR or HIPAA. Analyze the cost-effectiveness of existing bus tracking solutions in terms of implementation, maintenance, and operational expenses. Identify gaps in cost-effectiveness that may limit the scalability or sustainability of bus tracking systems, particularly in resource-constrained environments.

Chapter 3

REQUIREMENT ANALYSIS

3.1 Functional Requirements of System

Functional requirements are the primary requirements that are supposed to be fulfilled. User should experience functional requirements while using our “Bus Tracking System”.

- **User:**

  User should able to:

  - Register
  - Log in
  - Check Bus details
  - Track the Location

- **Admin:**

  Admin should able to perform the following activities :

  - Manage Users
  - Manage Schools
  - Manage Bus Details

3.2 Non functional Requirements

- **Effective requirement**

  Our online portal should be efficient and effective

- **Reliability Requirement**

  Our online portal should provide a reliable environment to registered users. Users trust and smooth experience should be our first priority.

3.3 Software Requirements

3.3.1 User Software Requirement

Web Application : Google Chrome, Edge or Any Compatible Browser.

Operating System : Windows, Android, IOS, etc.

Software : MQTT Client.

3.3.2 Developer Software Requirement

Language Requirement : C/C++ language, HTML, CSS, JavaScript.

Operating System : Windows 7 or Any latest Windows OS.

Software Requirement : Arduino IDE, MQTT Server.

3.4 Hardware Requirements

3.4.1 Computer/Android Requirement

Processor: Any Modern CPU
Storage : 3.5 GB Hard-disk Space
RAM : 4 GB OF Free RAM
Monitor : 1920x1080 Resolution

3.4.2 Component Requirement

Micro controller : Seeed Studio XIAO Esp32 C3
GPS Tracker : Ai thinker A9G GPS module
Battery Capacity : 500Mah
Connectivity : WiFi 2.4Ghz

Chapter 4

DESIGN AND PLANNING

4.1 System Architecture

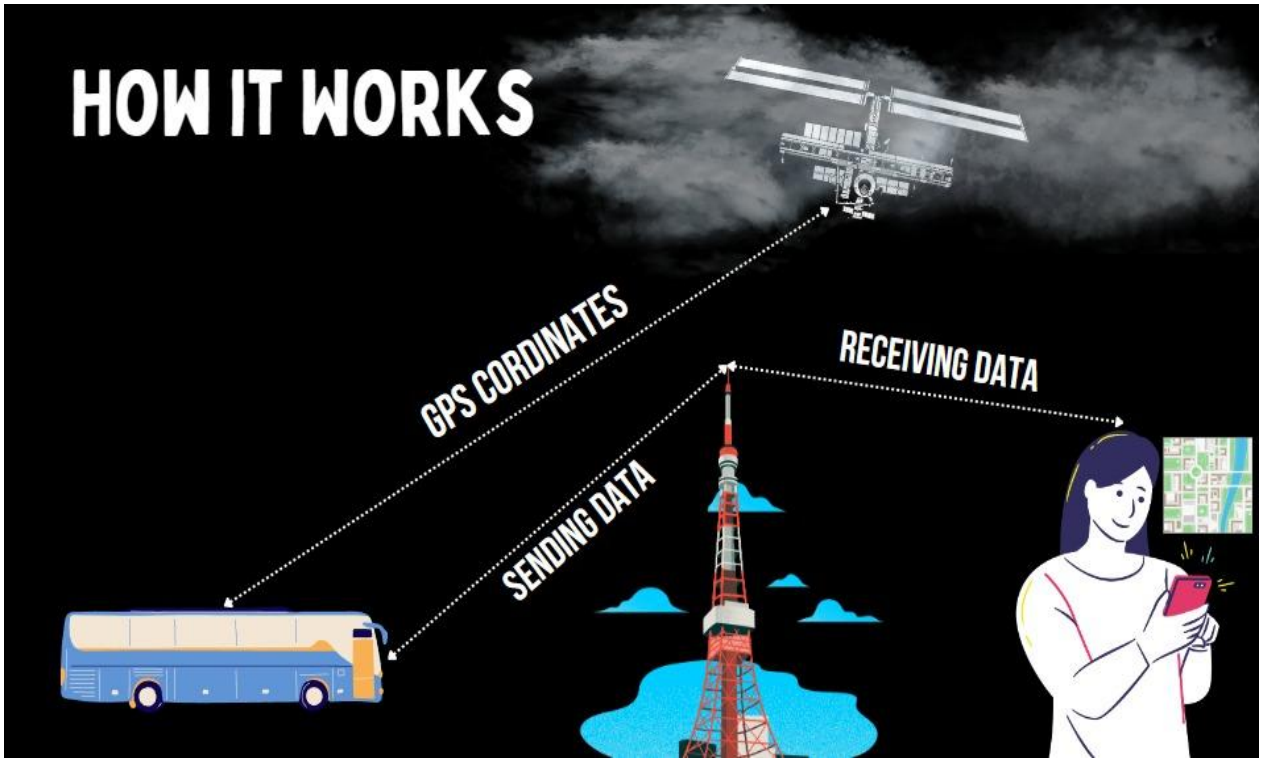


Figure 4.1: System Architecture

4.2 DATA FLOW DIAGRAM

Data Flow Diagrams (DFD'S) describe the processes of how the transfer of data takes place from the input till prediction of the corresponding output.

4.2.1 Data Flow Diagram Level 0

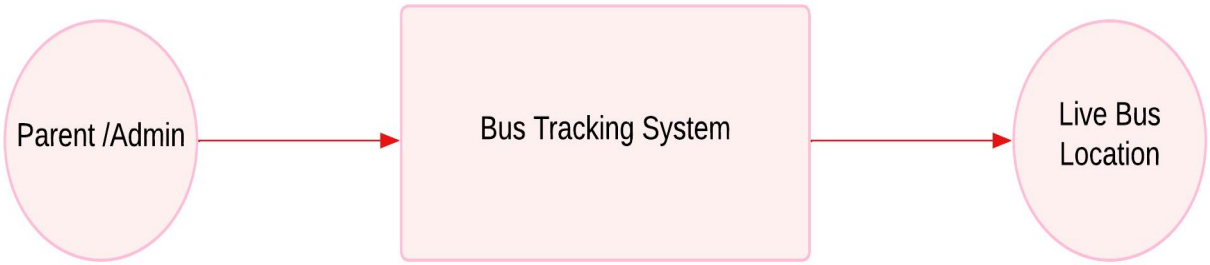


Figure 4.2.1: DFD Diagram Level 0

4.2.2 Data Flow Diagram Level 1

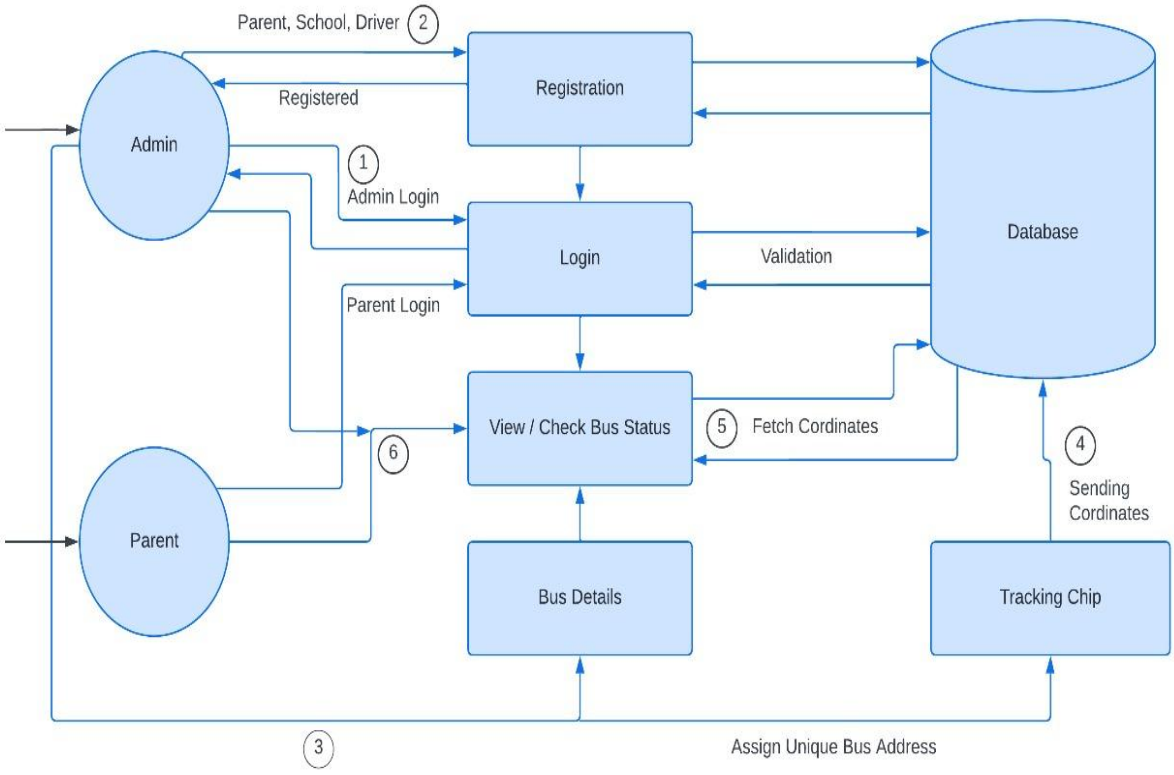


Figure 4.2.2: DFD Diagram Level 1

Chapter 5

IMPLEMENTATION AND OUTPUT

5.1 Implementation

Technologies Used:

- **Arduino IDE**

The Arduino Integrated Development Environment (IDE) is an open-source software designed by Arduino.cc. It's primarily used for writing, compiling, and uploading code to almost all Arduino Modules. The IDE contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

- **Visual Studio Code**

Visual Studio Code (VS Code) is a free, open-source, and cross-platform code editor. It's developed by Microsoft and is optimized for building and debugging modern web and cloud applications.

VS Code supports many programming languages, including but not limited to C, C#, C++, Java, JavaScript, Node.js, Python, PHP, and many more. It provides smart completions based on variable types, function definitions, and imported modules through IntelliSense.

- **phpMyAdmin**

phpMyAdmin is a free software tool written in PHP, intended to handle the administration of MySQL over the Web. It supports a wide range of operations on MySQL and MariaDB. Frequently used operations such as managing databases, tables, columns, relations, indexes, users, permissions, etc., can be performed via the user interface, while you still have the ability to directly execute any SQL statemen

- **Android Studio**

Android Studio is the official Integrated Development Environment (IDE) for Android app development. It's designed to provide a unified environment where you can build apps for Android phones, tablets, Android Wear, Android TV, and Android Auto.

- **Seeed Studio XIAO ESP32C3**

The Seeed Studio XIAO ESP32C3 is an IoT mini development board based on the Espressif ESP32-C3 WiFi/Bluetooth dual-mode chip. It's built around a 32-bit RISC-V CPU, which includes an FPU (Floating Point Unit) for 32-bit single-precision arithmetic, providing powerful computing power.

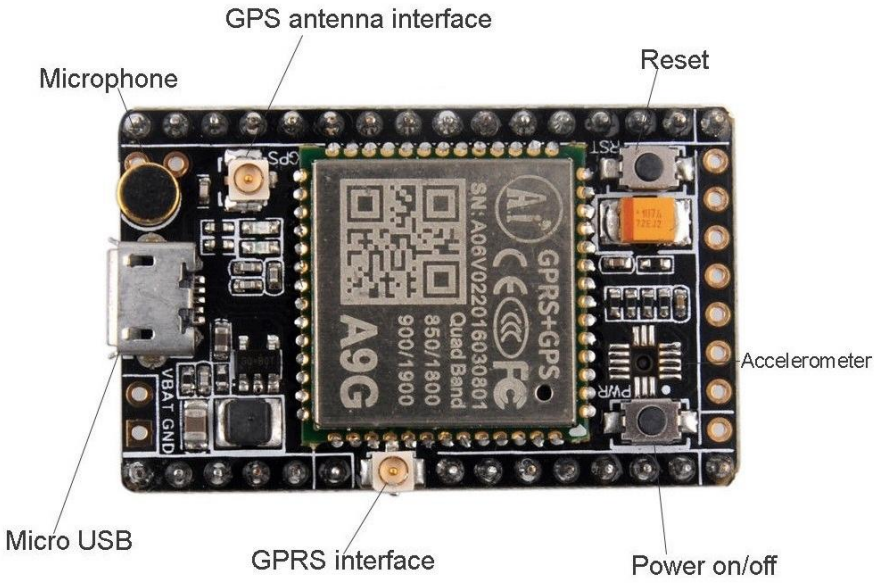
- **A9G GSM/GPRS+GPS Module**

The A9G module is a complete quad-band GSM/GPRS+GPS module based on the RDA8955 chip. It combines GPRS and GPS technologies and integrates them in a compact SMD package. This provides users with a cost-effective IoT solution.

This module is best suited for real IoT projects such as smart-home, outdoor monitoring, long-distance monitoring, GPS Tracker, etc. The module can be operated using a 3.7V Lithium Ion Battery as it requires 3.5~4.2V typical 4.0V supply. The power consumption of this module ranges between 1.03mA to 1.14mA depending upon the application.

5.1.1 Key features of the A9G module include:

- Powerful CPU: It operates at up to 160 MHz.
- Complete WiFi subsystem: Complies with IEEE 802.11b/g/n protocol and supports Station mode, SoftAP mode, SoftAP + Station mode, and promiscuous mode.
- Bluetooth LE subsystem: Supports features of Bluetooth 5 and Bluetooth mesh.
- Ultra-Low Power: Deep sleep power consumption is about 43μA.
- Better RF performance: External RF antenna included.
- Battery charging chip: Supports lithium battery charge and discharge management.
- Rich on-chip resources: 400KB of SRAM, and 4MB of on-board flash memory.
- Ultra small size: As small as a thumb (20x17.5mm).
- Reliable security features: Cryptographic hardware accelerators that support AES-128/256, Hash, RSA, HMAC, digital signature and secure boot.
- Rich interfaces: 1xI2C, 1xSPI, 2xUART, 11xGPIO (PWM), 4xADC, 1xJTAG bonding pad interface.
- Single-sided components, surface mounting design.



5.1.2 Key features of the Seeed Studio XIAO ESP32C3 include:

- Powerful CPU: ESP32-C3, 32bit RISC-V singlecore processor that operates at up to 160 MHz.
- Complete WiFi subsystem: Complies with IEEE 802.11b/g/n protocol and supports Station mode, SoftAP mode, SoftAP + Station mode, and promiscuous mode.
- Bluetooth LE subsystem: Supports features of Bluetooth 5 and Bluetooth mesh.
- Ultra-Low Power: Deep sleep power consumption is about 43μA.
- Better RF performance: External RF antenna included.
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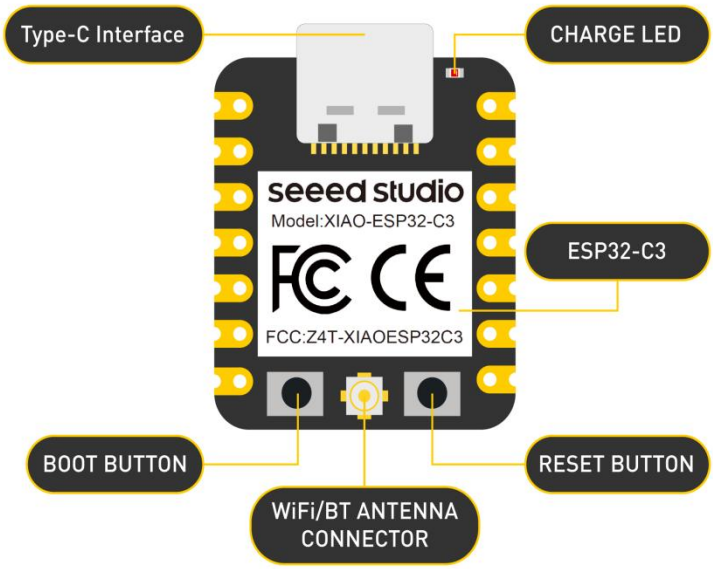


5.1.3 Algorithm

Step 1: Admin Login with username and password.

Step 2: Admin Register's School Name, Address, and Contact Info.

Step 3: Admin Register's Driver Info like Driver Name, Driver ID, etc.

Step 4: Admin Register's New Bus and link the School and Driver with it.

Step 5: Admin Register's Parent Info and Assign Bus Number to it.

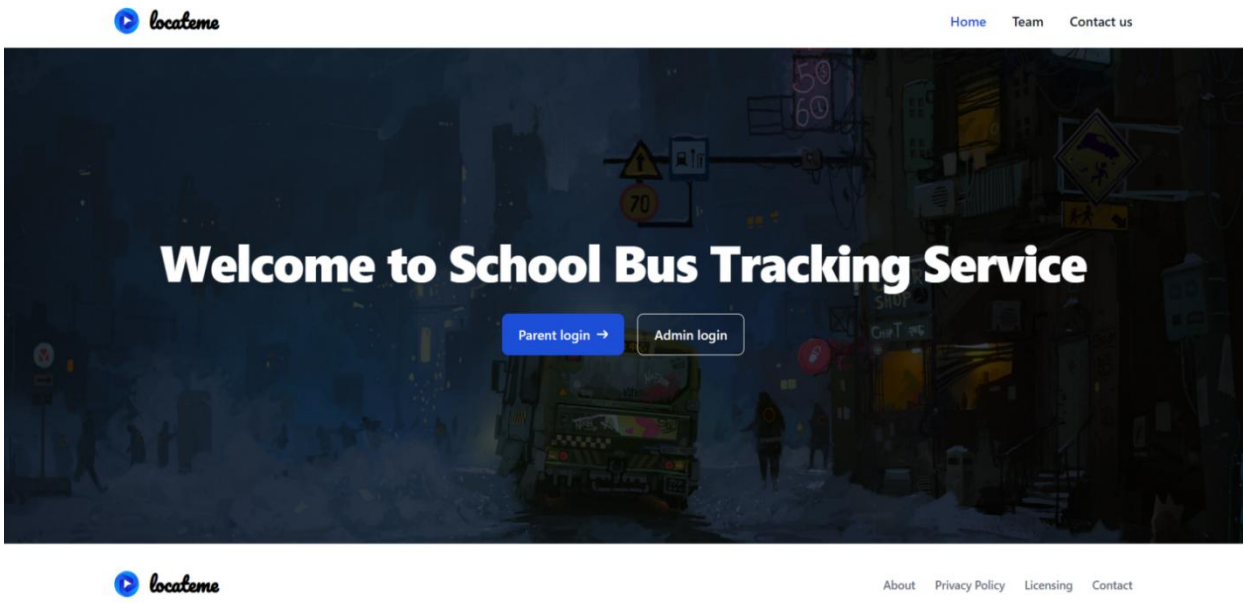
Step 6: Parent Login with the provided email ID and password.

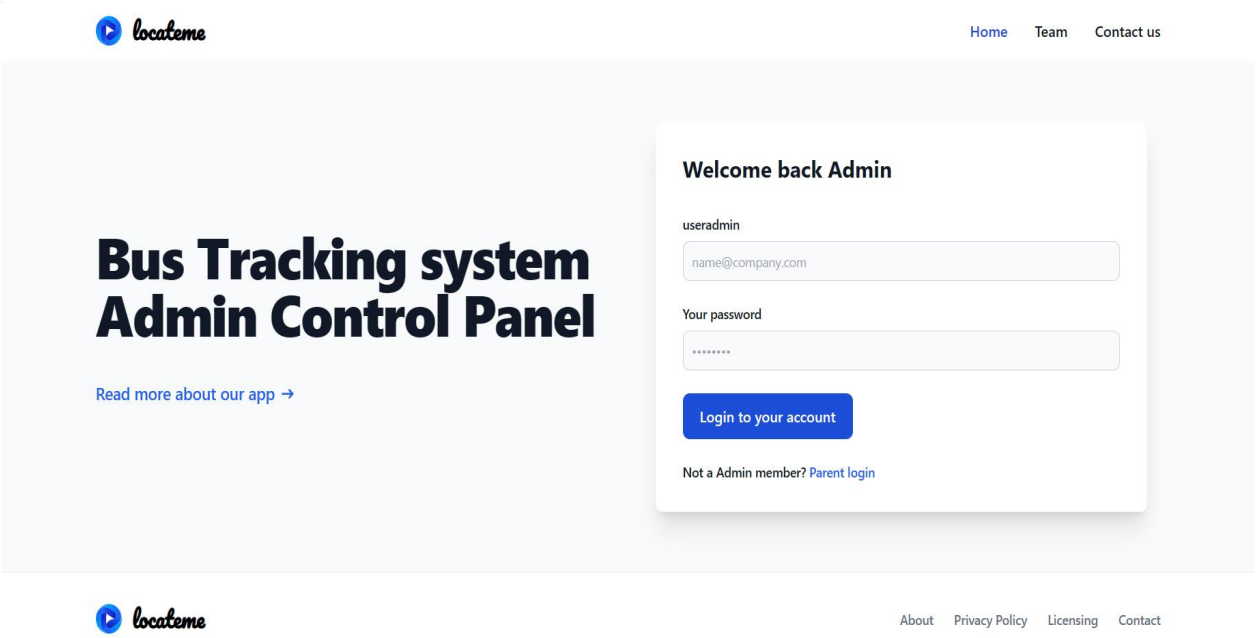
Step 7: The Parent is Able to View the Live Location of the Bus.

Step 8: The parent can contact the driver.

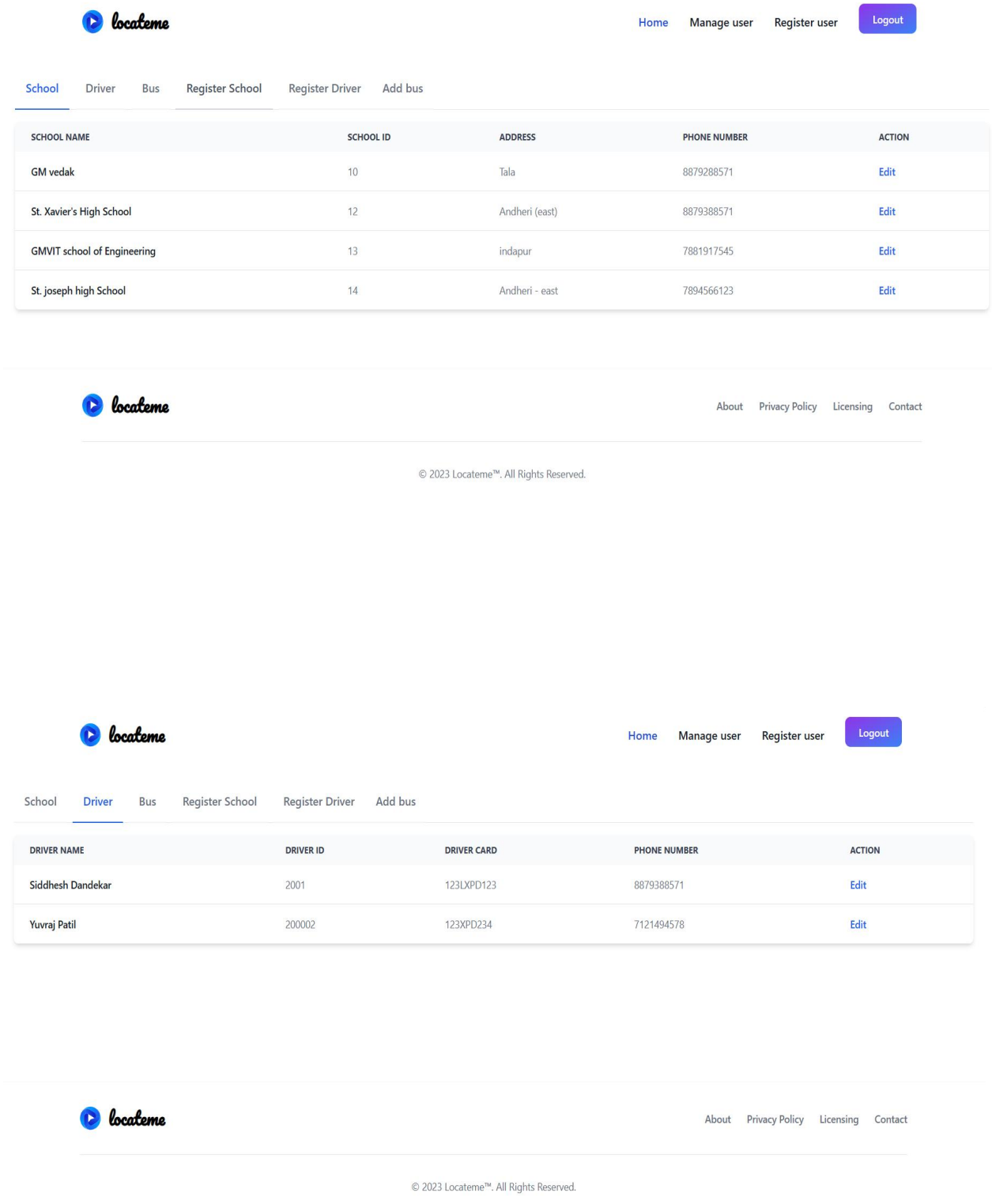
5.2 Output Screen

Home page





Admin Panel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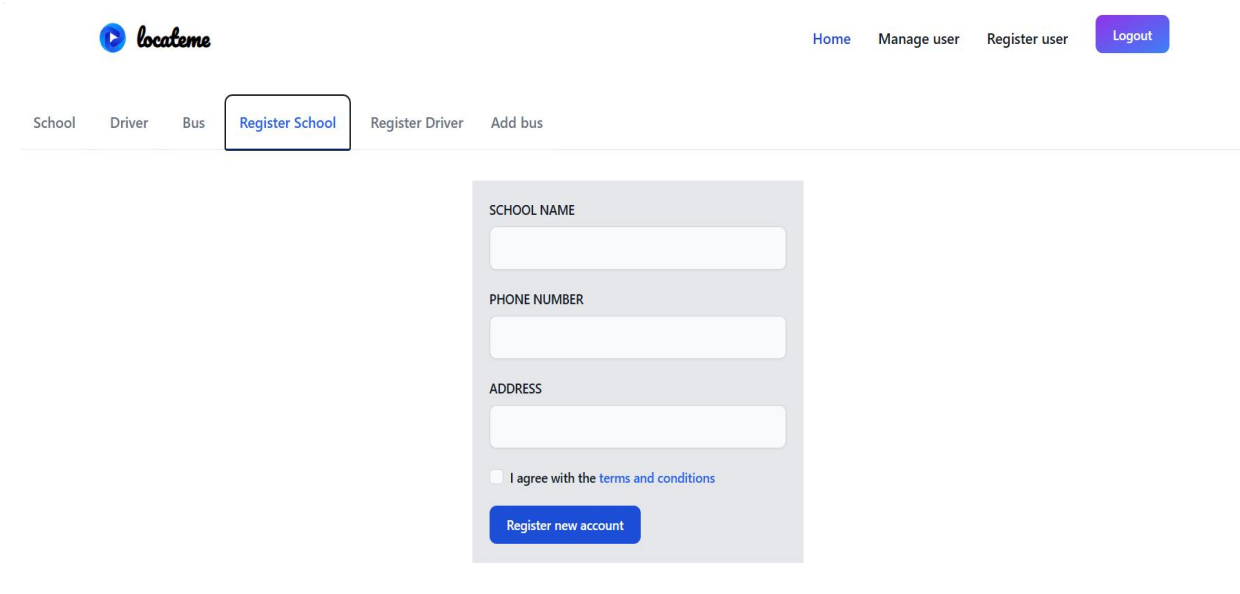
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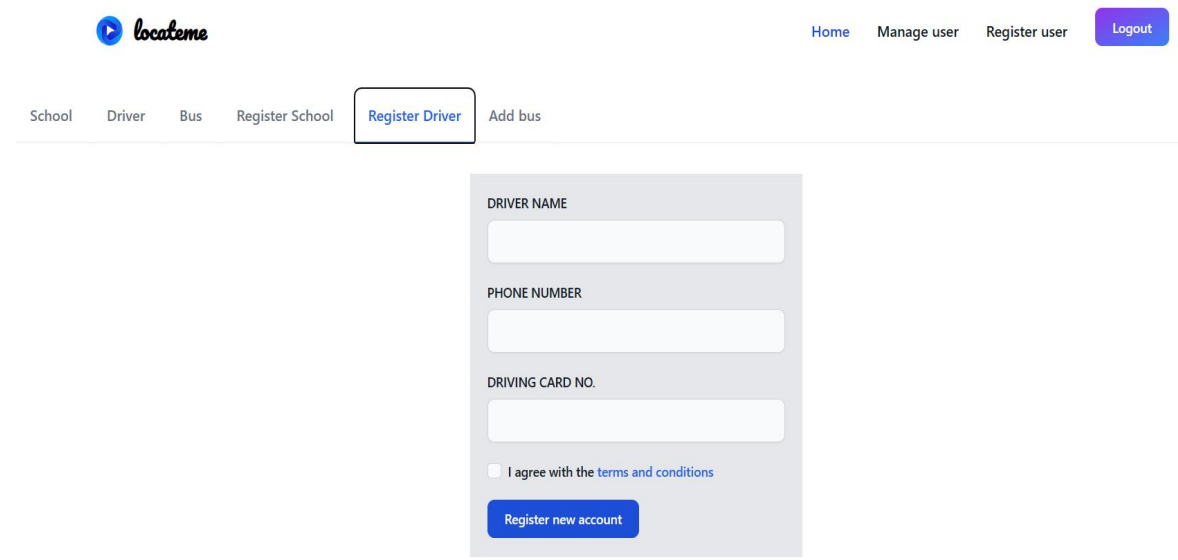
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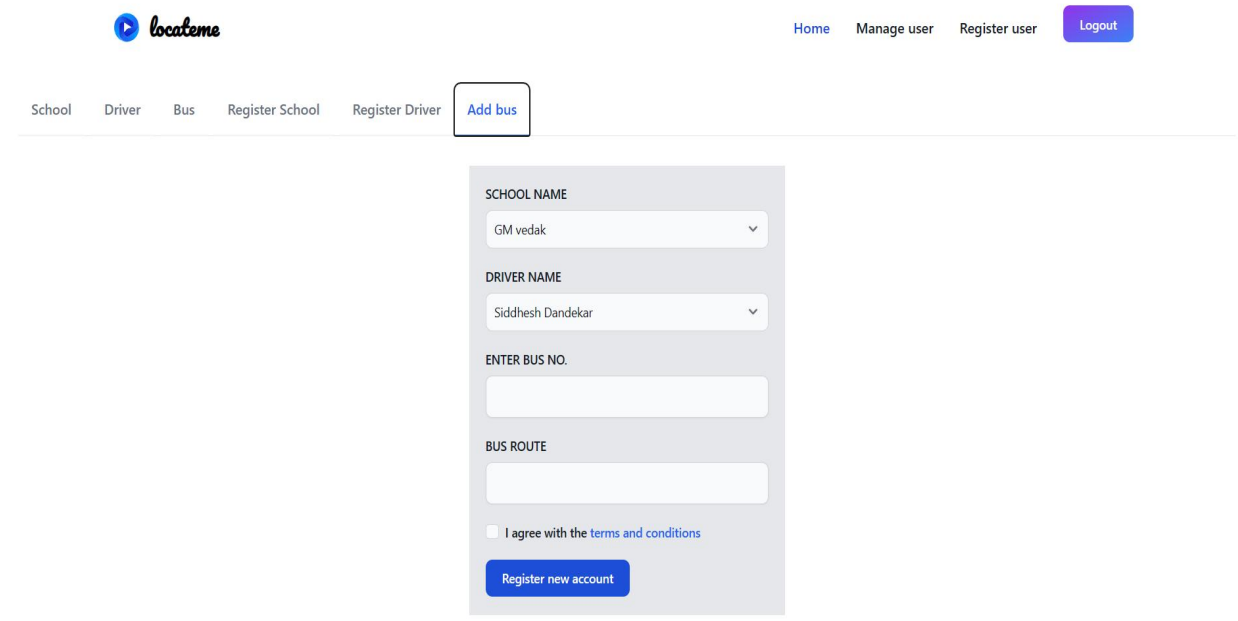
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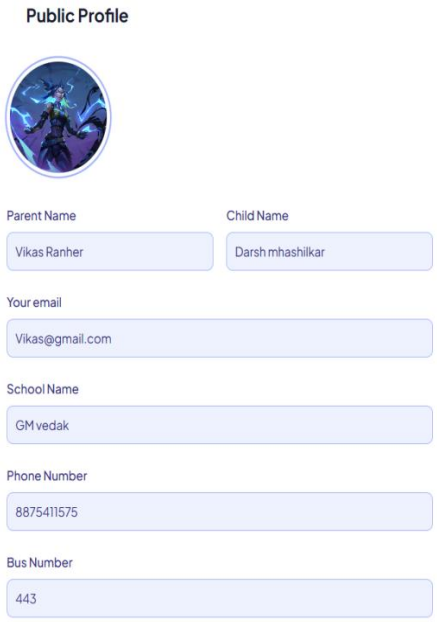
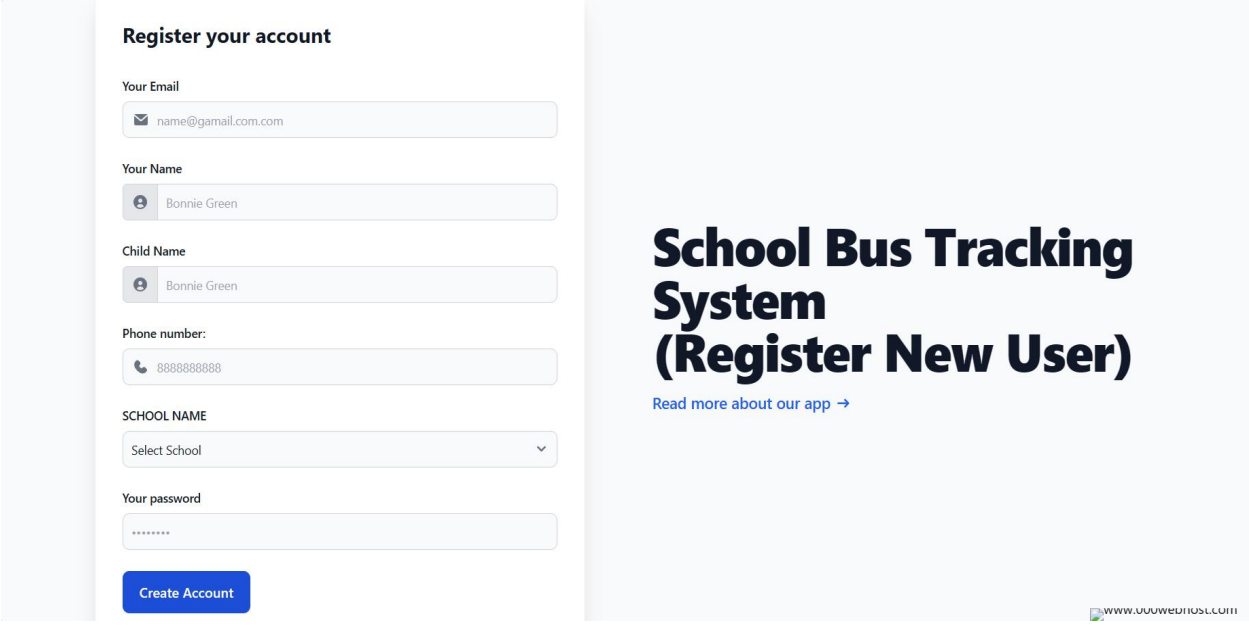
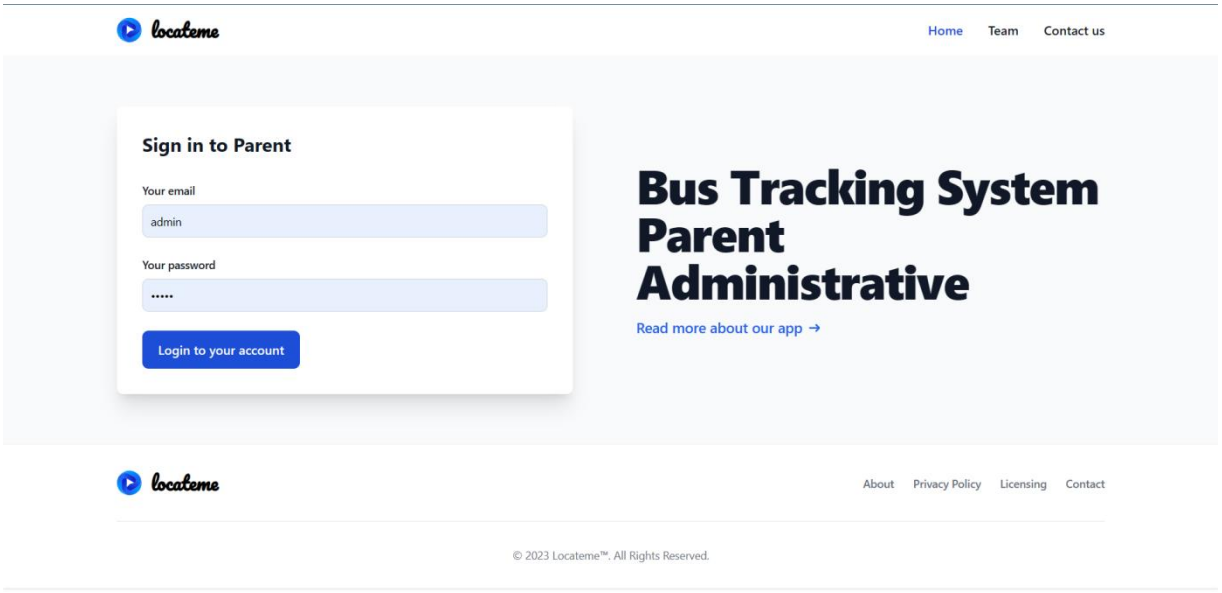


Parent Registration page



Parent Login Page



CHAPTER 6

CONCLUSION

CONCLUSION

This project is extremely unique, well-structured, and well-tested. We have implemented and tested the hardware part of our project, and we are successfully receiving the GPS coordinates through the satellite module. Sending the data through the internet to the users has been implemented.

This Application Implemented the hardware in the bus and got the real-time location of the bus via GPS coordinators in the application we developed.

CHAPTER 7

FUTURE SCOPE

FUTURE SCOPE

- Route Visualization: Show the entire route of each bus, including stops and estimated arrival times at each stop.

- Estimated Time of Arrival (ETA): Provide users with accurate estimates of when a bus will arrive at their chosen stop based on its current location and traffic conditions.

- Push Notifications: Send push notifications to users to alert them about delays, route changes, or other important information regarding their selected bus routes.

- Crowd Density Information: Optionally, incorporate crowd density information to help users choose less crowded buses or times to travel.

- Multi-Platform Support: Develop mobile apps for iOS and Android platforms, as well as a web-based interface accessible from desktop computers.

- Integration with Payment Systems: Integrate with existing payment systems to allow users to purchase tickets or pay fares directly through the app.

- Emergency Assistance: Include features for users to request emergency assistance or report safety concerns during their journey

CHAPTER 8

REFERENCES

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[1] The real time bus tracking and Location updation system IEEE 2021 paper of author A. Deebika Shree, J. Anusuya, S. Malathy.

[2] The College bus Tracking and Notification System IEEE 2020 paper of author K. Premkumar, Pavithra. K, Presiela. J, Priyadarshani. D, Priyanga. P.

[3] Application Based Bus tracking System IEEE 2019 paper of author Shubham Jain, Adarsh Trivedi, Shweta Sha