

SMART TRANSPORTATION TRACKING SYSTEM FOR COLLEGE BUSES

Submitted in partial fulfillment of the requirements for the award of

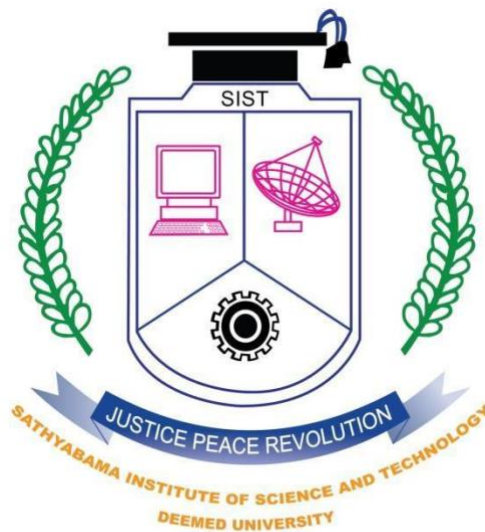
Bachelor of Engineering Degree in

Electrical and Electronics Engineering

by

DIVAGAR G (Register No.40140008)

GUNASEELAN G (Register No.40140011)



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A++" by NAAC

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APRIL 2024



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **DIVAGAR G** (Reg. No. 40140008) and **GUNASEELAN G** (Reg. No. 40140011) who carried out the project entitled "**SMART TRANSPORTATION TRACKING SYSTEM FOR COLLEGE BUSES**" under our supervision from November 2022 to April 2023.

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DECLARATION

We **DIVAGAR G** (Reg. No. 40140008) and **GUNASEELAN G** (Reg. No. 40140011) hereby declare that the Project Report entitled "**SMART TRANSPORTATION TRACKING SYSTEM FOR COLLEGE BUSES**" done by us under the guidance of **Dr.D.N.S.RAVI KUMAR** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

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DATE: 16/04/2024

PLACE: Chennai

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ABSTRACT

The College Bus Tracker Application represents a pioneering solution designed to revolutionize campus transportation for students and faculty. This innovative mobile application, backed by GPS of mobile Phones, introduces a spectrum of features, including real-time bus tracking, seat reservations, and comprehensive route information. Users can now track the precise location of college buses, significantly reducing waiting times and uncertainties. The seat reservation system guarantees a comfortable journey, while detailed route information offers transparency and predictability. Data-driven decision-making leverages insights from GPS, optimizing resource allocation and operational efficiency. With a user-friendly interface, robust security measures, and scalability, the application ensures an efficient, reliable, and user-centric transportation experience. Furthermore, its potential for future expansion and integration with smart transportation systems offers promising avenues for sustainable and data-driven campus transit. The College Bus Tracker Application is set to reshape the expectations of campus transportation, offering a seamless and responsive solution that aligns seamlessly with modern user needs.

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LIST OF SYMBOLS AND ABBREVIATIONS

IoT	- Internet of Things
AMI	- Advanced Metering Infrastructure
SCADA	- Supervisory Control and Data Acquisition
AI	- Artificial Intelligence
ML	- Machine Learning
OCR	- Optical Character Recognition
RFID	- Radio-Frequency Identification
DMS	- Distribution Management System
EMS	- Energy Management System
TCP/IP	- Transmission Control Protocol/Internet Protocol
MQTT	- Message Queuing Telemetry Transport
AES	- Advanced Encryption Standard
PKI	- Public Key Infrastructure
kWh	- Kilowatt Hour

CHAPTER 1

INTRODUCTION

1.1 GENERAL INTRODUCTION

In the ever-evolving landscape of modern education, the seamless operation of campus facilities extends far beyond the confines of the classroom. Efficient transportation solutions play a pivotal role in enhancing the overall campus experience, enabling students and faculty to navigate sprawling campuses with ease. This report delves into the conception, development, and impact of the College Bus Tracker Application – a pioneering technological solution designed to alleviate the challenges of tracking college buses in real time. The pressing need to address the complexities associated with tracking college buses led to the creation of this innovative application. Traditionally, outdated methods like printed schedules and manual communication plagued the efficiency of bus transportation systems, resulting in inaccurate information, communication gaps, wasted time, and a general sense of frustration among users. Recognizing these challenges, our endeavor aimed to bridge the gap between traditional transportation practices and the power of modern technology.

Leveraging the prowess of React Native, a cross-platform framework renowned for its ability to create native-like mobile applications, and Firebase, a dynamic real-time database and authentication platform, the College Bus Tracker Application seeks to revolutionize campus transportation. By providing users with the means to track buses in real time, access accurate schedules, and receive timely notifications, the application fundamentally transforms the way users interact with the transportation system. This report elucidates the multifaceted aspects of the College Bus Tracker Application, ranging from the underlying architecture and technological components to the challenges encountered during its development and the ingenious solutions that were devised. With an unwavering commitment to user experience and a focus on addressing real-world campus transportation issues, this application has the potential to reshape the way students and faculty perceive and engage with transportation systems. As we delve into

the intricacies of this transformative tool, the profound impact it has on campus life becomes increasingly evident.

1.2 MOTIVATION FOR THE SELECTION OF PROBLEM

We got the motivation by observing how much precious time of the students studying in our college is wasted by just waiting for the bus on their particular route, and also there is a lack of information for the buses which are traveling on their particular route for the students who have already missed their particular bus. This work consists of three parts. In the first part, the bus location is received from the satellite and then further it is processed through the Kalman filter and then it is sent to dedicated web servers with the help of cellular networks. In the second part, the coordinates received are processed through the Google Maps API. In the third part, the data received from Google Maps API is processed in the user's device to show real-time location.

1.3 OBJECTIVES

IOT use things to things connection to access the internet of things, allow data to store and access services. Services over internet of things development according to need of person to person and thing to person, machine to machine interaction without human interaction.

1.4 PROJECT OVERVIEW

The College Bus Tracker Application stands as a transformative project, poised to modernize and elevate the campus transportation experience for both students and faculty. Traditional campus transportation systems have long struggled with inefficiencies, relying on manual communication and lacking real-time tracking capabilities. These shortcomings result in unnecessary delays and widespread user frustration. This project endeavors to provide a comprehensive solution to these enduring challenges. Through the incorporation of cutting-edge GPS technology, real-time bus tracking is made possible, empowering users with accurate and up-to-date

bus locations. Simultaneously, the introduction of a user-friendly seat reservation module offers unmatched convenience and comfort, while push notifications ensure users are promptly alerted to any route changes or delays. The project leverages data-driven insights to optimize resource allocation, enabling more efficient campus transportation services that minimize operational costs. In alignment with the institution's core mission of providing a conducive and enjoyable learning environment, this project showcases an unwavering commitment to streamlining and enhancing all aspects of campus life.

CHAPTER 2

LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

S. Jain, A. Trivedi and S. Sharma, "Application Based Bus Tracking System," 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon), Faridabad, India, 2019, pp. 152-154, doi: 10.1109/COMITCon.2019.8862254. This research is based on Bus Tracking System, The main objective of this work is to make a GPS tracking application which would be able to track school buses more accurately and efficiently than present bus-tracking systems. We got the motivation for our research paper by observing how much precious time of the students studying in our college is wasted by just waiting for the bus on their particular route, and also there is a lack of information for the buses which are traveling on their particular route for the students who have already missed their particular bus. This work consists of three parts. In the first part, the bus location is received from the satellite and then further it is processed through the Kalman filter and then it is sent to dedicated web servers with the help of cellular networks. In the second part, the coordinates received is processed through the Google Maps API. In the third part, the data received from Google Maps API is processed in users device to show real-time location.

S. Eken and A. Sayar, "A smart bus tracking system based on location-aware services and QR codes," 2014 IEEE International Symposium on Innovations in Intelligent Systems and Applications (INISTA) Proceedings, Alberobello, Italy, 2014, pp. 299-303, doi: 10.1109/INISTA.2014.6873634. Abstract: When it comes to taking the public transportation, time and patience are of essence. In other words, many people using public transport buses have experienced time loss because of waiting at the bus stops. In this paper, we proposed smart bus tracking system that any passenger with a smart phone or mobile device with the QR (Quick Response) code reader can scan QR codes placed at bus stops to view estimated bus arrival times,

buses' current locations, and bus routes on a map. Anyone can access these maps and have the option to sign up to receive free alerts about expected bus arrival times for the interested buses and related routes via SMS and e-mails. We used C4.5 (a statistical classifier) algorithm for the estimation of bus arrival times to minimize the passengers waiting time. GPS (Global Positioning System) and Google Maps are used for navigation and display services, respectively.

Andrea Zanella, Senior Member, IEEE, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, Senior Member, IEEE, and Michele Zorzi, Fellow, IEEE, "Internet of Things for Smart Cities", IEEE Internet of Things Journal, vol. 1, no. 1, pp. 22-32, February 2014. The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. In this paper, we focus specifically to an urban IoT system that, while still being quite a broad category, are characterized by their specific application domain. Urban IoTs, in fact, are designed to support the Smart City vision, which aims at exploiting the most advanced communication technologies to support added-value services for the administration of the city and for the citizens. This paper hence provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT. Furthermore, the paper will present and discuss the technical solutions and best-practice guidelines adopted in the Padova Smart City project, a proof-of-concept deployment of an IoT island in the city of Padova, Italy, performed in collaboration with the city municipality .

Thakre, Rakesh; Urane, Mayur; Qudsi, Mahewash; Ranveer, K V. International Research Journal of Innovations in Engineering and Technology; Dharmapuri Vol.5, Iss. 11,(Nov 2021):41-43. DOI:10.47001/IRJIET/2021.511007. The ability to track vehicle is useful in many applications including public transportation systems, fleet management and others. Furthermore, the number of vehicles on the road globally is also expected to increase rapidly. Here, the development of a City Bus tracking system

using the Global Positioning System (GPS) is undertaken with the aim of enabling users to locate their City Bus with ease and in a convenient manner. The system will provide users with the capability to track City Bus remotely. This project presents the development of the City Bus tracking system's hardware prototype. Specifically, the system will utilize GPS to obtain a City Bus's coordinate and transmit it using GSM modem to the different bus stations. The main hardware components of the system are PIC microcontroller, power supply, LCD, GPS and GSM. The developed City Bus tracking system demonstrates the feasibility of near real-time tracking of City Bus and improved customizability, global operability and cost when compared to existing solutions.

2.2 EXISTING SYSTEM

The existing campus transportation system is characterized by antiquated communication methods and a lack of real-time tracking capabilities, resulting in a suboptimal experience for users. Printed schedules and manual communication often lead to inaccuracies and user frustration. Students and faculty grapple with uncertainties regarding bus arrival times, leading to inefficient time management and disruptions to their daily schedules. Communication gaps, such as delays and route changes, further compound the issues. The absence of real-time tracking and seat reservation options also presents challenges for resource allocation and efficient operation. This outdated system, in the face of evolving user expectations and modern technology, calls for a more efficient, user-centric solution to improve the campus transportation experience.

2.3 OPEN PROBLEMS IN EXISTING SYSTEM

The College Bus Tracker Application aims to overcome these shortcomings by harnessing the power of modern technologies to create a user-centric, efficient, and technologically advanced solution. By providing real-time bus tracking, accurate schedules, timely notifications, and improved communication, the application seeks to revolutionize the way campus transportation is managed and experienced.

2.4 DISADVANTAGES OF EXISTING SYSTEM

- **Manual Communication:**

Traditionally, colleges have relied on manual communication methods to inform students and faculty about bus schedules, routes, and changes. Printed schedules and word-of-mouth communication often result in discrepancies, leading to confusion and inconvenience.

- **Lack of Real-Time Information:**

The existing system lacks the capability to provide real-time information about bus locations. As a result, users are often left waiting at bus stops without knowing when the next bus will arrive, leading to frustration and inefficient use of time.

- **Communication Gaps:**

In scenarios where routes change, delays occur, or buses are cancelled due to unforeseen circumstances, the existing system struggles to promptly communicate such information to users. This lack of real-time updates can disrupt users' plans and schedules.

- **Limited Data Utilization:**

The manual nature of the existing system inhibits the collection and utilization of data on bus usage patterns and user preferences. This prevents the transportation department from optimising routes and schedules based on actual demand.

- **User Frustration:**

The aforementioned challenges contribute to a general sense of frustration among students and faculty. Transportation-related stress impacts the overall campus experience, detracting from the institution's goal of providing a conducive learning environment.

- **Lack of Technological Integration:**

The existing system often lacks technological integration, failing to leverage modern tools that could streamline transportation logistics and enhance user satisfaction.

- **Inefficient Resource Allocation:**

Without accurate data on bus usage, the transportation department may allocate resources inefficiently, leading to underutilization or overburdening of certain routes.

2.5 IEEE STANDARDS FOLLOWED

The Institute of Electrical and Electronics Engineers (IEEE) has several standards related to our project. Some of these standards include:

1. **IEEE Standard 830-1998 - Software Requirements Specification:** This standard provides guidelines for documenting software requirements. It helps ensure that the project requirements are clearly defined, structured, and communicated effectively.
2. **IEEE 829-2008 - Software and System Test Documentation:** This standard outlines the essential elements of a test plan, including objectives, scope, test cases, and test schedules. It ensures proper testing procedures and documentation.
3. **IEEE 1016-2009 - Recommended Practice for Software Design Descriptions:** This standard offers a structured format for documenting software design, which can be beneficial for describing the architecture and components of your College Bus Tracker Application.

4. IEEE 1044-2009 - Classification for Software Anomalies: It defines different types of software anomalies, such as defects, faults, and failures, which can help in identifying and categorizing issues during development.
5. IEEE 1471-2000 - Recommended Practice for Architectural Description: This standard provides a framework for describing the architecture of a software system. It can be useful for documenting the architectural components of your application.
6. IEEE 12207 - Software Lifecycle Processes: This standard defines a set of processes and activities for software development and maintenance. It can help in structuring your development and maintenance procedures.
7. IEEE 1063-2001 - Standard for Software User Documentation: If you plan to create user documentation for your application, this standard can guide you in creating effective and user-friendly documentation.
8. IEEE 730 - Standard for Software Quality Assurance Processes: This standard offers guidelines for quality assurance processes during software development, which can help ensure the quality and reliability of your application.

2.6 CONSTRAINTS

- Budget Constraints: We must ensure that the development of the College Bus Tracker Application remains within the allocated budget, covering expenses such as software development, server hosting, and ongoing maintenance costs. Any additional features or enhancements should be evaluated for their cost-effectiveness.
- Time Constraints: Adhering to project timelines is crucial to ensure that the College Bus Tracker Application is developed, tested, and deployed within the expected timeframe. Delays could result in increased costs, especially if there

are contractual obligations or deadlines tied to the implementation of the application

- **Resource Constraints:** We need to ensure that our development team has the necessary expertise in GPS in mobile phones, mobile app development, and user experience design to successfully create and maintain the College Bus Tracker Application. Any gaps in skillsets should be addressed through training or hiring to prevent bottlenecks in the development process.
- **Technology Constraints:** The technologies chosen for the College Bus Tracker Application should be feasible within our project scope and budget. We need to ensure that our development team is proficient in utilizing GPS effectively to implement real-time bus tracking, seat reservation systems, and route information features.
- **Regulatory Constraints:** Compliance with transportation regulations, data protection laws, and privacy regulations is essential for the College Bus Tracker Application. We must ensure that the application complies with relevant regulations regarding the collection, storage, and use of location data and personal information.
- **Scalability Constraints:** The architecture of the College Bus Tracker Application should be designed to accommodate a growing user base and increasing data loads over time. Scalability considerations are crucial to ensure that the application can handle peak usage times without performance degradation or system crashes.
- **Security Constraints:** Data security is paramount for the College Bus Tracker Application, especially considering the collection and transmission of location data and personal information. Robust security measures must be implemented to protect user data from unauthorized access, breaches, and cybersecurity threats.

- **User Experience Constraints:** The College Bus Tracker Application should be designed with a focus on user-friendliness, ensuring that students and faculty can easily track buses, reserve seats, and access route information. Usability and accessibility constraints should be considered to provide a positive and inclusive user experience for all users.
- **Integration Constraints:** If the College Bus Tracker Application needs to integrate with existing transportation systems or databases, compatibility and data transfer constraints must be considered to ensure seamless integration and interoperability.
- **Performance Constraints:** The College Bus Tracker Application should perform efficiently, even during peak usage times when many users are accessing the system simultaneously. Performance constraints should be addressed to prevent slow response times or system crashes that could disrupt transportation services.
- **Testing Constraints:** Comprehensive testing is essential to ensure the reliability and functionality of the College Bus Tracker Application. Constraints related to testing resources, such as devices for compatibility testing and simulated usage scenarios, should be considered to conduct thorough quality assurance testing.
- **Maintenance Constraints:** Ongoing maintenance and support of the College Bus Tracker Application should be feasible within the available resources and budget. Regular updates, bug fixes, and improvements are necessary to keep the application running smoothly and to address any issues that may arise over time.

2.7 TRADEOFF

- **Cost vs. Benefits:** The initial cost of implementing the College Bus Tracker Application with advanced features may be relatively high. However, the benefits of enhanced campus transportation, including cost savings through efficient resource allocation, improved user satisfaction, and data-driven decision-making, are expected to outweigh the upfront investment.
- **User Data Privacy vs. Security:** Balancing the need for protecting user data privacy and ensuring the security of sensitive information is paramount. Our College Bus tracking application will implement robust security measures while safeguarding user privacy, fostering trust while mitigating potential cyber threats.
- **Coverage vs. Granularity:** IoT-based tracking devices can provide granular data on bus locations and seat availability. However, achieving broad coverage across the entire campus may require careful placement and allocation of resources, ensuring that all key routes are covered while delivering granular data to the extent feasible.
- **Reliability vs. Complexity:** Ensuring the reliability of the College Bus Tracker Application is crucial. While the complexity of IoT devices and associated software may pose implementation and maintenance challenges, we prioritize a robust and reliable user experience.
- **Energy Consumption vs. Functionality:** IoT devices require a consistent power supply to function optimally. Balancing energy consumption while ensuring the required functionality of the application is a critical trade-off, and we'll strive to optimize this balance to provide a seamless user experience.

CHAPTER 3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

3.1 AIM OF THE PROJECT

The primary aim of the College Bus Tracker Application is to revolutionize campus transportation for students and faculty by introducing a modern and efficient solution. This innovative mobile application seeks to address the longstanding challenges associated with traditional college bus systems, which often lead to inefficiencies, delays, and user frustration. Our project's central objective is to usher in a new era of campus transportation, where users can effortlessly track the real-time location of college buses, significantly reducing uncertainties and waiting times. Moreover, we aspire to enhance user convenience by providing features like seat reservations and real-time updates on route changes or delays. By implementing data-driven decision-making, we intend to optimize resource allocation, ensuring efficient campus transportation services that minimize operational costs. At its core, the College Bus Tracker Application is dedicated to fostering a more convenient, user-centric, and efficient campus transportation experience that aligns seamlessly with the modern expectations of our educational institution.

3.2 SCOPE OF THE PROJECT

The scope of the College Bus Tracker Application project is both comprehensive and user-centric, with the overarching goal of transforming the campus transportation experience for students and faculty. This multifaceted scope encompasses several pivotal elements. Firstly, the application will introduce real-time tracking capabilities for college buses, allowing users to precisely pinpoint their locations, anticipate arrivals, and significantly reduce the uncertainty and waiting times often associated with traditional transportation systems. Additionally, users will enjoy the convenience of seat reservations, ensuring a guaranteed place on the bus and an altogether more comfortable journey.

3.3 ADVANTAGES

- **Enhanced User Convenience:** The College Bus Tracker Application provides a hassle-free and efficient way for students and faculty to track the real-time location of college buses. This feature minimizes waiting times and uncertainties, offering a more convenient transportation experience.
- **Seat Reservations:** The application allows users to reserve seats on college buses, ensuring a guaranteed spot and providing a comfortable and stress-free journey, especially during peak hours.
- **Improved Transparency:** The provision of detailed route information, including stops, schedules, and updates, enhances transparency. Users can stay informed about the bus's progress and any route changes, making planning their trips easier.
- **User-Friendly Interface:** The College Bus Tracker Application boasts a user-friendly and intuitive interface. It's designed to accommodate a wide range of users, regardless of their tech-savviness, ensuring a smooth user experience.
- **Data Security and Privacy:** User data security and privacy are of utmost importance. The application includes robust security measures to protect user information and ensure compliance with data privacy regulations, instilling trust and confidence in users.
- **Scalability:** The application is designed to scale as the user base grows, ensuring it can handle increased data loads and users, maintaining efficiency and performance over time.

- **Efficiency and Reliability:** Efficiency and reliability are at the core of the College Bus Tracker Application. Users can depend on accurate tracking, timely updates, and a smooth booking experience, leading to greater user satisfaction.

CHAPTER 4

SOFTWARE AND PROJECT DESCRIPTION

4.1 BLOCK DIAGRAM

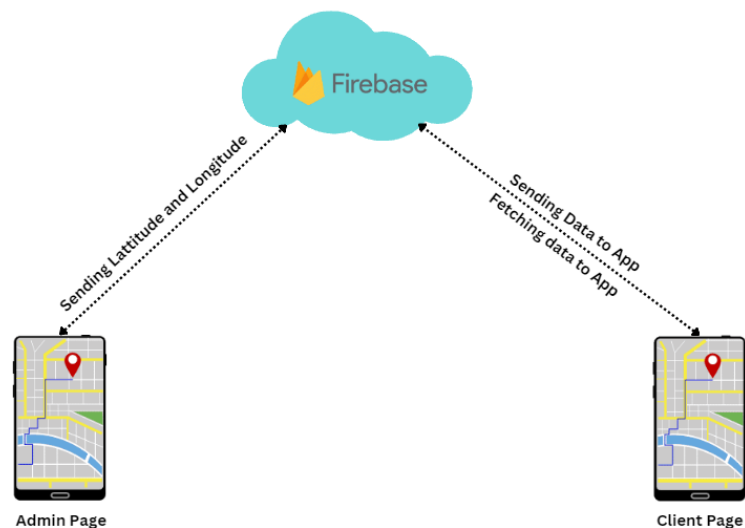


Fig 4.1 : Block diagram

The College Bus Tracker Application functions through a streamlined process where drivers utilize the Admin app to toggle their GPS location as they conduct their designated bus routes. This action triggers an immediate and dynamic update within the application's backend, promptly recording the precise location of each bus into the database as it progresses along its journey. Subsequently, the client application seamlessly accesses this continually updated location data, presenting users with a real-time visualization of the buses' movements on their respective routes. By harnessing this innovative technology, students and faculty gain unprecedented insight into the current whereabouts of campus buses, fostering a more efficient and reliable transportation experience. This approach significantly reduces the uncertainty and inconvenience often associated with waiting for buses, as users can accurately track their arrivals and plan their journeys accordingly.

4.2 JAVASCRIPT

JavaScript serves as the backbone of interactivity and dynamism in the College Bus Tracker Application, enriching its functionality and user experience. At its core, JavaScript empowers the client-side operations of the application, enabling seamless communication with the server, handling user interactions, and dynamically updating the interface based on real-time data. Within this project, JavaScript is employed extensively to deliver a responsive and intuitive platform for users to track buses, reserve seats, and access route information with ease.

One of the primary functions of JavaScript in the College Bus Tracker Application is to facilitate real-time updates of bus locations. Through JavaScript, the client application continuously fetches the latest location data stored in the database and dynamically renders this information on the user interface. This dynamic rendering ensures that users receive up-to-date information about the exact whereabouts of buses on their routes, allowing for efficient planning and minimizing waiting times.

Moreover, JavaScript plays a vital role in enabling interactive features within the application. Through event-driven programming, JavaScript responds to user actions such as clicking buttons, selecting routes, or making seat reservations. These interactions trigger corresponding functions that update the interface, fetch relevant data from the server, and execute business logic to fulfill user requests. For instance, when a user selects a specific bus route, JavaScript initiates the retrieval of relevant route information from the server and updates the interface to display details such as stops, schedules, and available seats.

Furthermore, JavaScript enhances the user experience by providing feedback and validation mechanisms. Through form validation scripts, JavaScript ensures that user input for seat reservations adheres to predefined criteria, such as selecting a valid bus route and specifying the desired number of seats. This validation process occurs in real-time, providing immediate feedback to users and preventing erroneous submissions. Additionally, JavaScript is utilized to display alerts, notifications, and

error messages, keeping users informed about the status of their actions and any potential issues encountered during the process.



Fig 4.2 : Javascript

4.3 FIREBASE



Fig 4.3 : Symbol of firebase

Firebase serves as the backend for the application, providing real-time data storage, authentication, and notifications.

- **Real-Time Database:** Firebase Realtime Database stores bus location data, route details, schedules, and user information. It allows for instant updates and synchronization, enabling real-time tracking.

- Authentication: Firebase Authentication ensures secure user registration and login. Users' authentication credentials are stored and managed securely.
- Cloud Messaging: Firebase Cloud Messaging facilitates push notifications. The application can send notifications to users' devices regarding bus updates, route changes, or other relevant information.

```
import { initializeApp } from 'firebase/app';
import { getAuth } from 'firebase/auth';
import { getFirestore } from 'firebase/firestore';
import Constants from 'expo-constants';

const firebaseConfig = {
  apiKey: "AIzaSyB4Gygq6eN0Wc_sI_zb9d485ur1M36tM4A",
  authDomain: "navigobus.firebaseio.com",
  projectId: "navigobus",
  storageBucket: "navigobus.appspot.com",
  messagingSenderId: "265582428505",
  appId: "1:265582428505:web:5bba5c37a07312194d4c48"
};

// initialize firebase
initializeApp(firebaseConfig);

export const auth = getAuth();
export const database = getFirestore();
```

Fig 4.4 : Connectivity of Firebase with Application

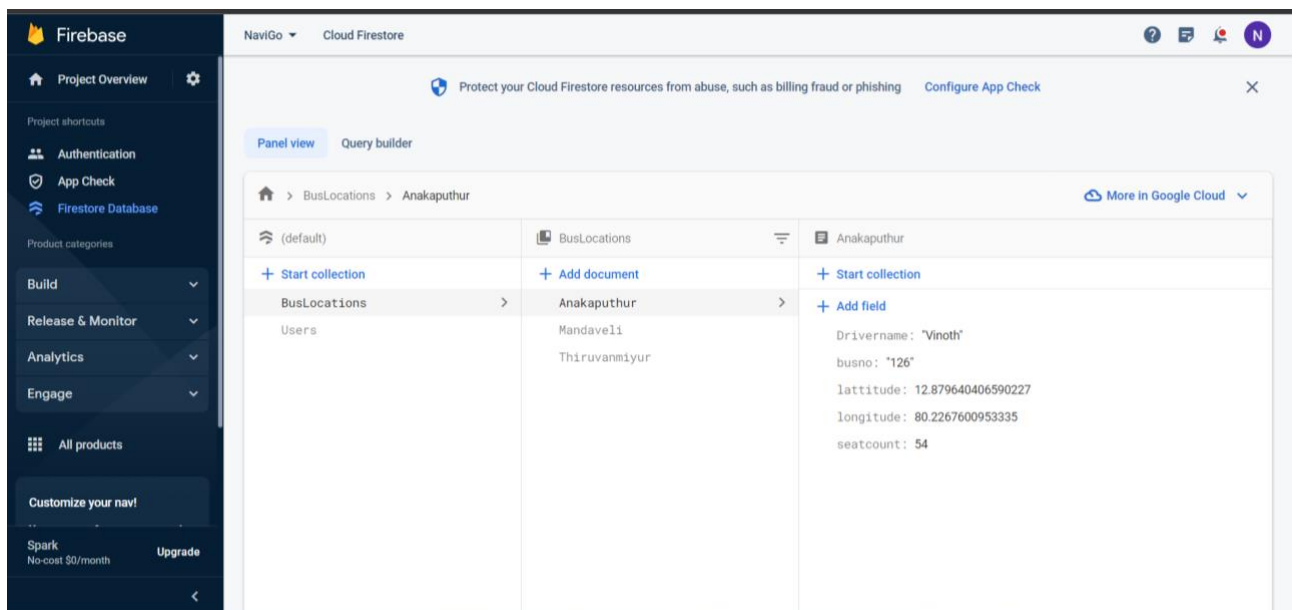
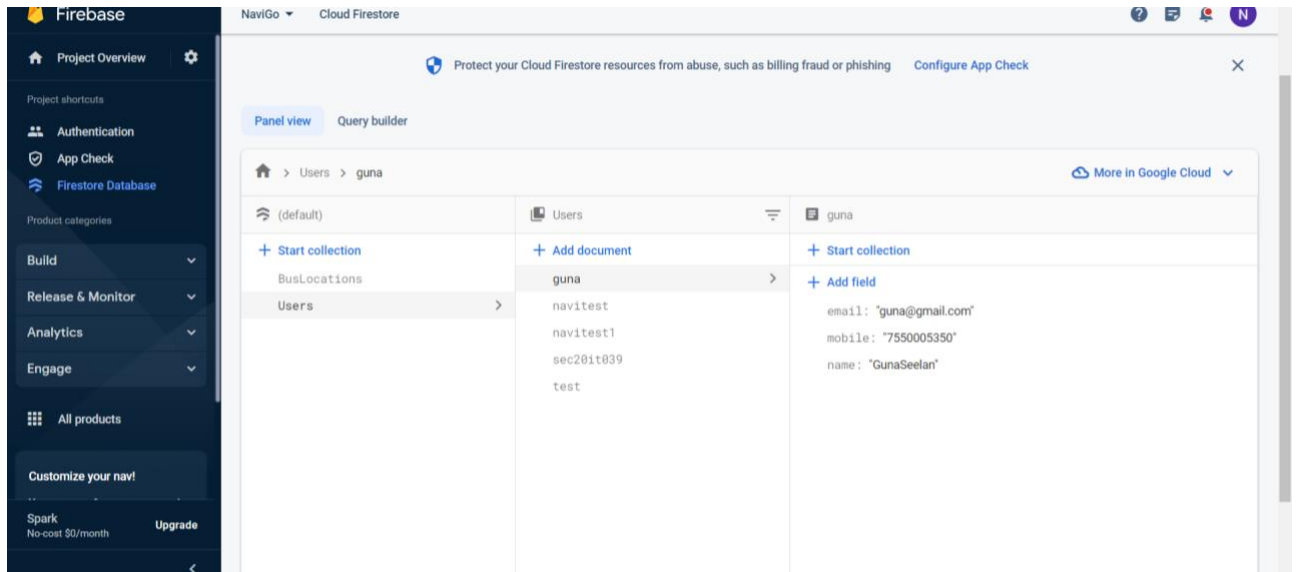


Fig 4.5: Photocopy of Firebase Application

4.4 REACT NATIVE

One of the primary advantages of using React Native is its ability to streamline the development process by enabling code reusability. With React Native, developers can write a single codebase using JavaScript and React components, which can then be compiled into native code for both iOS and Android platforms. This approach significantly reduces development time and effort, as it eliminates the need to maintain separate codebases for each platform.

Furthermore, React Native offers a highly performant and responsive user interface through its native rendering capabilities. By utilizing native components, React Native ensures that the application delivers a smooth and fluid user experience, with animations, transitions, and gestures that feel natural to users on their respective devices. This native performance is crucial for the College Bus Tracker application, as it enhances usability and encourages user engagement.

Moreover, React Native provides extensive support for third-party libraries and plugins, enabling integration with a wide range of functionalities and services. This flexibility allows us to incorporate essential features such as GPS tracking, real-time data updates, and secure authentication mechanisms seamlessly into the application. Additionally, React Native's modular architecture facilitates easy integration with external APIs, enabling access to external data sources and services to enrich the functionality of the College Bus Tracker application.

Another key benefit of React Native is its strong community support and active development ecosystem. With a vast community of developers contributing to the framework, React Native offers a wealth of resources, documentation, and community-driven solutions to common challenges. This support ecosystem ensures that developers have access to the latest tools, best practices, and updates, empowering them to build robust and feature-rich applications efficiently.

In terms of scalability, React Native provides a solid foundation for future expansion and enhancements of the College Bus Tracker application. Its modular architecture and component-based structure make it easy to add new features, optimize performance, and adapt to changing requirements as the project evolves. Whether

it's integrating additional functionalities, scaling to accommodate a growing user base, or extending support to new platforms, React Native offers the flexibility and scalability needed to meet the demands of a dynamic and evolving transportation management system.

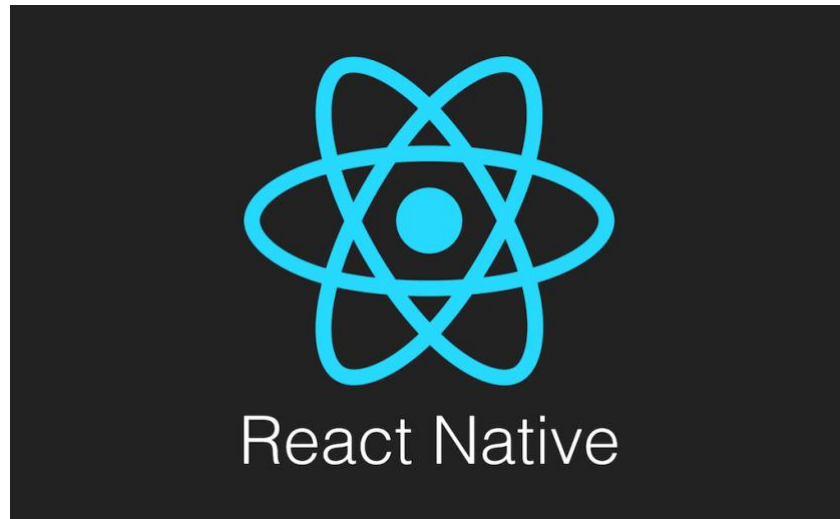


Fig 4.6 : React Native

```
const [modalVisible, setModalVisible] = useState(true);
//const [modalVisible, setModalVisible] = useState(false);

const [open, setOpen] = useState(false);
const [value, setValue] = useState(null);
const [items, setItems] = useState([
  {label: 'UTI bank', value: 'UTI bank'},
  {label: 'Sadharsivam Nagar', value: 'Sadharsivam Nagar'},
  {label: 'Kaivelli', value: 'Kaivelli'},
  {label: 'Ram Nagar', value: 'Ram Nagar'}
]);

// console.log("Hi!");
const [searchQuery, setSearchQuery] = useState('');
const [dropdownVisible, setDropdownVisible] = useState(true);
const [data, setData] = useState([
  { id: 1, name: 'Kovillambakkam' },
  { id: 2, name: 'Chrompet' },
  { id: 3, name: 'MEPZ' },
]);

const handleSearchQueryChange = (query) => {
  setSearchQuery(query);
};

const handleSelectOption = (option) => {
  setSearchQuery(option);
  setDropdownVisible(false);
  //set
};

if (!location) {
  return (
```

Fig 4.7 : Usage of React Native in our Project

4.5 PROPOSED SYSTEM EXPLANATION

The College Bus Tracker Application is a groundbreaking solution designed to revolutionize the way campus transportation is managed and experienced. This section presents an in-depth overview of the proposed system, highlighting its key features and the benefits it offers to users and the institution as a whole.

1. Real-Time Bus Tracking:

The core of the proposed system revolves around real-time bus tracking. Through the integration of GPS technology, users can accurately track the current location of college buses on an interactive map. This real-time tracking feature provides a level of convenience and certainty that was previously absent from the campus transportation experience.

2. User-Friendly Interface:

The proposed system boasts an intuitive and user-friendly interface that allows users, including students and faculty, to effortlessly navigate the application. Clear markers, color-coded routes, and easy-to-understand icons ensure that users can access bus information and track their locations with ease.

3. Accurate Schedules and Routes:

The application offers comprehensive information about bus routes and schedules, enabling users to plan their journeys effectively. This includes details about departure and arrival times, stop locations, and potential delays. By providing accurate and updated information, the system enhances time management for all users.

4. Push Notifications for Updates:

One of the most innovative features of the proposed system is the integration of push notifications. Users receive real-time notifications about route changes, delays, and cancellations. This proactive communication keeps users informed and empowers them to adjust their plans accordingly.

5. Secure User Authentication:

To ensure the security and privacy of user data, the proposed system incorporates secure user authentication mechanisms. Only authorized users, such as registered students and faculty members, can access the application's features, enhancing data integrity and user trust.

6. Data-Driven Optimization:

The application's real-time data collection has a broader impact on campus transportation. The transportation department can utilize the gathered data to analyze bus usage patterns, optimize routes, and allocate resources more efficiently. This data-driven approach contributes to cost savings and improved transportation services.

7. Technological Innovation:

The proposed system leverages the power of modern technologies, such as React Native and Firebase, to provide a seamless and responsive experience. This technological innovation not only enhances the user experience but also showcases the institution's commitment to embracing innovative solutions.

8. Positive Impact on Campus Experience:

By addressing the shortcomings of the existing system, the proposed system aims to create a positive impact on the overall campus experience. Students and faculty can navigate campus with confidence, reducing frustration and enhancing their engagement with other aspects of college life.

9. Scalability and Adaptability:

Built with scalability in mind, the proposed system can accommodate a growing user base and potential future enhancements. This adaptability ensures that the application remains relevant and effective as the institution evolves.

4.6 WORKING MODULES

- MODULE -1 Client Module
- MODULE-2 Admin Module

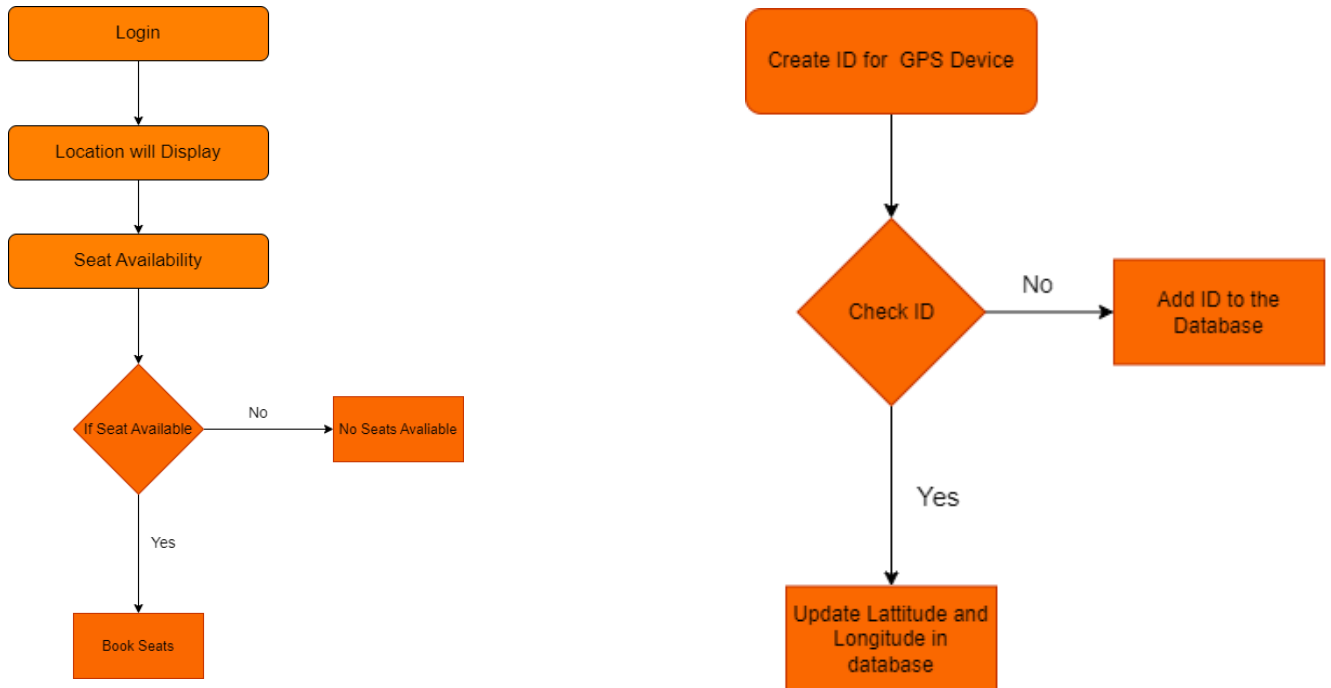


Fig 4.8: Methodology

- **MODULE -1 :**

The process starts with the user logging in to a movie ticketing website or app. Once logged in, the user's location will be displayed on the screen. This will help the user find busses near them. The user will then be able to select a bus and can able to see the bus timing . Once the selection is made, the system will check for seat availability. If there are available seats, the user can proceed to book their seats. If there are no seats available, the user will be informed and the process will end.

- MODULE -2 :

The first step is to create a unique ID for the GPS device. This ID could be a random string of characters or numbers, or it could be based on some other information, such as the device's serial number. The flowchart then instructs you to check the ID. It's not clear exactly how this would be done, but it's possible that the system would check to make sure the ID is unique and hasn't already been assigned to another device. If the ID is unique, then it is added to a database. This database would likely store information about the GPS device, such as its ID, its location, and any other relevant data. The final step is to update the latitude and longitude of the GPS device in the database. This information is likely obtained from the GPS device itself.

CHAPTER 5

RESULTS

5.1 MOBILE APPLICATION OUTPUT

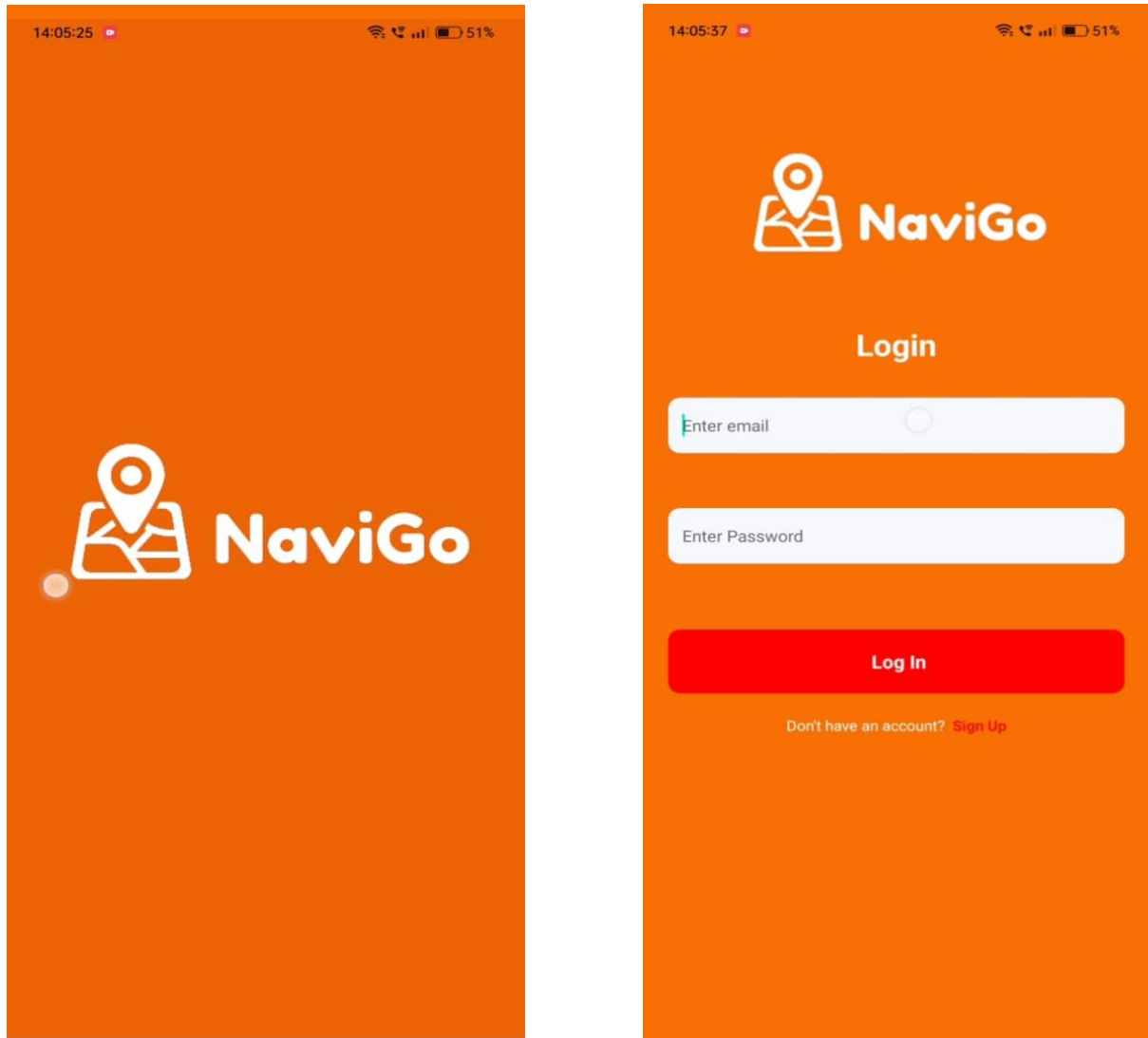


Fig 5.1 : Client side login

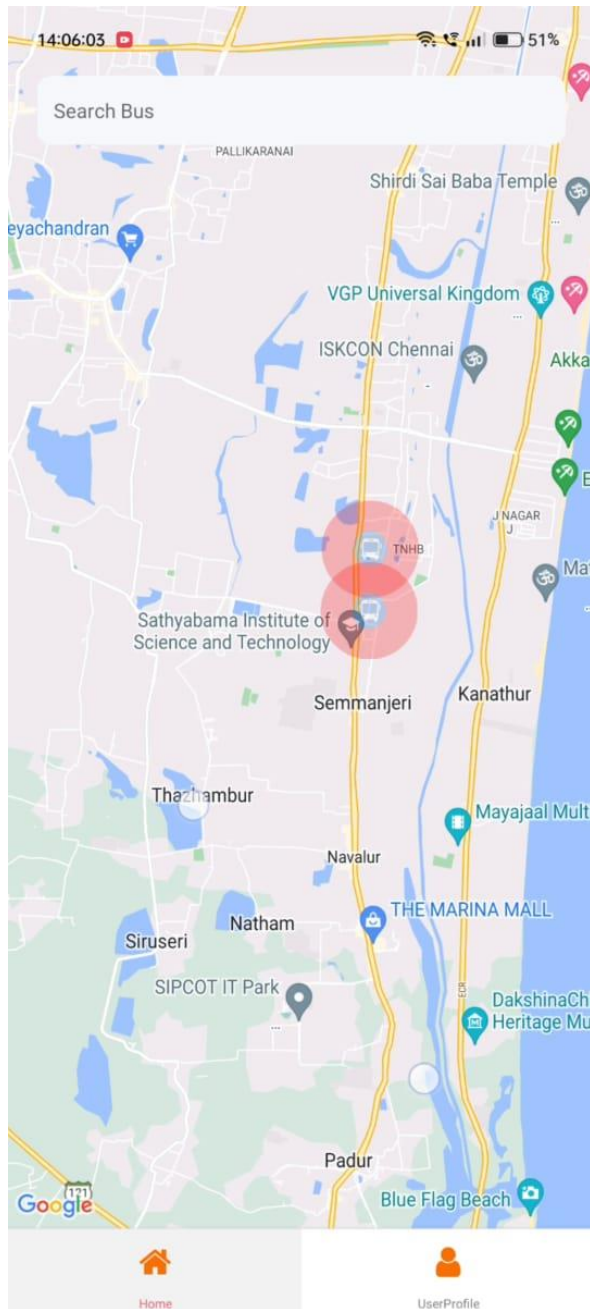


Fig 5.2 : Client side Dashboard

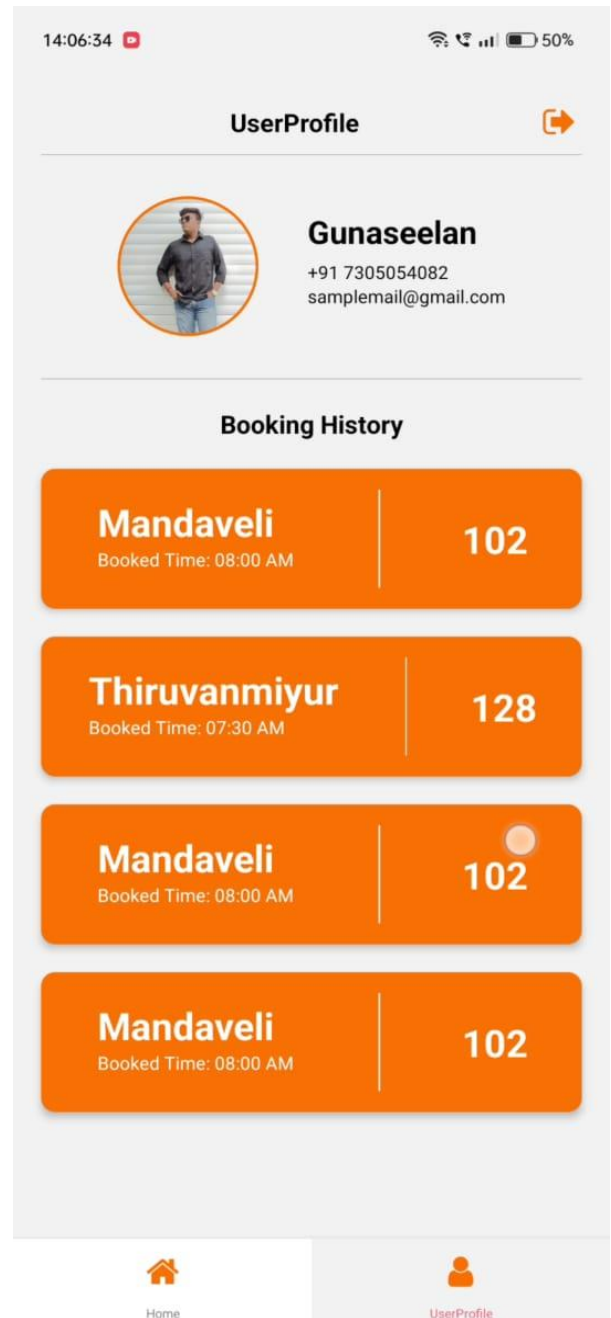
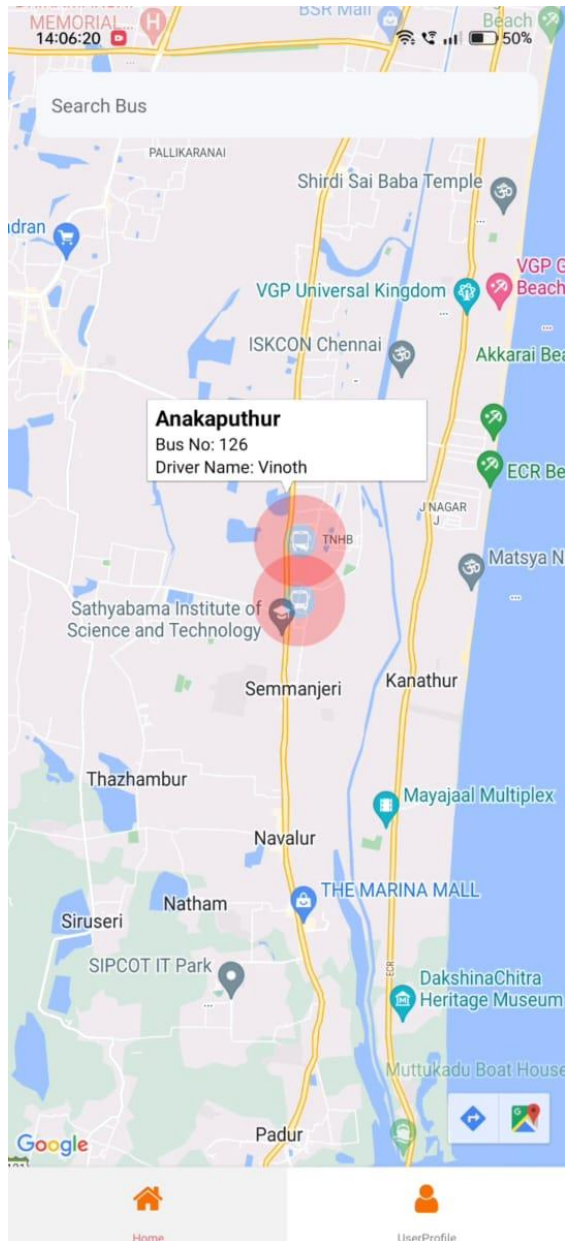


Fig 5.3 : To check bus availability

09:24:07
74%

Admin Dashboard

Latitude:
Longitude:

Share your Bus Location
☒
NOT Called

Route Buses

Maduravayul
Bus No: 101
☒

Anakaputhur
Bus No: 126
☐

Mandaveli
Bus No: 127
☐

Kalpakkam
Bus No: 139
☐

Home
Add Buses
UserProfile

09:24:09
74%

Add a New Bus

Boarding Point

Enter Bus Route

Bus Number

Enter Bus Number

Driver Name

Enter Driver Name

Driver Mobile Number

Enter Mobile Number

Date

<
December 2023
09:24
>

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Home
Add Buses
UserProfile

Fig 5.4 : Admin side application

5.2 FIREBASE DATA

The NodeMCU plays a vital role in this system, which senses the data from sensors and process the data. The Wi-Fi unit in the NodeMCU is used to send the data to the cloud, this data can be monitored continuously from anywhere in the world (where there is an active internet connection).

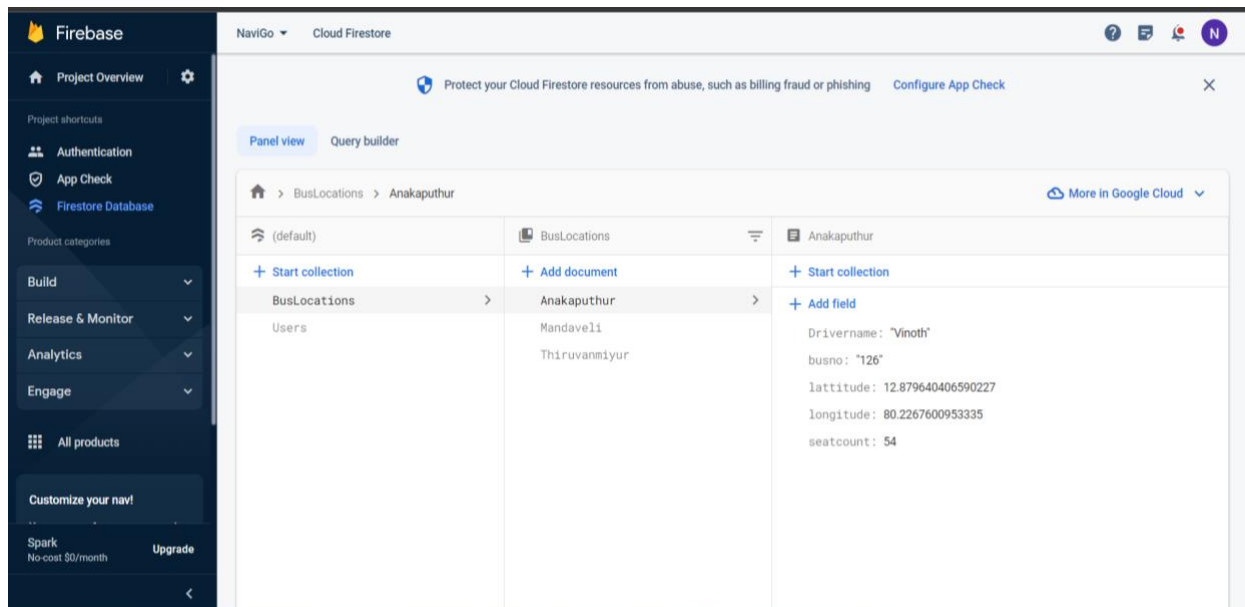


Fig 5.5 : Firebase Output

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 SUMMARY

In summary, the College Bus Tracker Application is poised to revolutionize campus transportation by introducing real-time tracking, seat reservations, and detailed route information. This innovative application enhances user convenience, reduces waiting times, and ensures guaranteed seating. It optimizes resource allocation through data-driven decision-making, leading to cost savings and improved operational efficiency. The user-friendly interface accommodates diverse user preferences, while robust security measures protect user data and privacy. The application is scalable, capable of handling a growing user base, and provides an efficient, reliable transportation experience. Moreover, it promotes environmental sustainability by optimizing bus routes. Data-driven insights from IoT sensors offer opportunities for continuous improvements, ensuring that the College Bus Tracker Application aligns seamlessly with the dynamic expectations of the educational institution and its community.

6.2 FUTURE SCOPE

- **Integration with Smart Transportation Systems:** The application can be integrated with broader smart transportation systems to facilitate seamless intermodal transit, connecting buses with other modes of transportation like trams or shared bicycles.
- **Enhanced Data Analytics:** Further development of data analytics capabilities can provide insights into user behavior, leading to more tailored services and optimizations in real-time transportation.
- **Predictive Maintenance:** Implementing predictive maintenance through IoT sensors can help prevent bus breakdowns, reducing service disruptions and enhancing user experience.

- **Multi-Campus Expansion:** The application's success can pave the way for expansion to multiple campuses or educational institutions, creating a comprehensive solution for a broader user base.
- **Eco-Friendly Initiatives:** Future updates can include features that promote eco-friendly transportation, such as encouraging bus-sharing among users or reducing carbon emissions through optimized routes.
- **Integration with Campus Services:** The application can integrate with other campus services like event schedules, academic calendars, and campus security alerts to offer a more holistic campus experience.

6.3 CONCLUSION

The College Bus Tracker Application marks a significant leap forward in enhancing campus transportation. With real-time tracking, seat reservations, and data-driven decision-making, it delivers an efficient and user-centric solution. This project brings transparency, convenience, and reliability to the transportation system, addressing longstanding challenges. As it evolves, the application has the potential to transform not only campus transportation but also contribute to sustainable, data-driven, and user-focused smart campus initiatives. With the future scope of integration, predictive maintenance, and expansion, the College Bus Tracker Application is set to continue reshaping the way students and faculty experience campus transit, making it more efficient, convenient, and environmentally responsible.

REFERENCES

- [1] A. K. Gupta, A. Mukherjee, A. Routray and R. Biswas, "A novel power theft detection algorithm for low voltage distribution network," IECON 2017 - 43rd Annual Conference of the IEEE Industrial Electronics Society, Beijing, 2017, pp. 3603-3608.
- [2] M. Golden, B. Min, "Theft and loss of electricity in an Indian State Technical report," Int. Growth Centre 2012.
- [3] Navani JP, Sharma NK and Sapra S. "Technical and non-technical losses in power system and its economic consequence in Indian economy," Int J Electron Comp Sci Eng, Vol 1, pp. 757–61, 2012.
- [4] W. Han and Y. Xiao, "NFD: A practical scheme to detect non-technical loss fraud in smart grid," 2014 IEEE International Conference on Communications (ICC), Sydney, NSW, 2014, pp. 605-609.
- [5] ECI Telecom Ltd., Fighting Electricity Theft with Advanced Metering Infrastructure (March 2011)
- [6] J. Nagi, K. S. Yap, S. K. Tiong, S. K. Ahmed and M. Mohamad, "Nontechnical Loss Detection for Metered Customers in Power Utility Using Support Vector Machines," in IEEE Transactions on Power Delivery, vol. 25, no. 2, pp. 1162-1171, April 2010.
- [7] S.S.S.R. Depuru, "Modeling, Detection, and Prevention of Electricity Theft for Enhanced Performance and Security of Power Grid," The University of Toledo, Aug. 2012.
- [8] J. Nagi, K.S. Yap, S.K. Tiong, S.K. Ahmed, and A.M. Mohammad, "Detection of abnormalities and electricity theft using genetic support vector machines," Proc. IEEE Region 10 Conference TENCON, Hyderabad, India, Jan. 2009, pp. 1–6.
- [9] S. Sahoo, D. Nikovski, T. Muso, and K. Tsuru, "Electricity theft detection using smart meter data," in Innovative Smart Grid Technologies Conference (ISGT), IEEE Power and Energy Society, 2015.
- [10] S. A. Salinas and P. Li, "Privacy-Preserving Energy Theft Detection in Microgrids: A State Estimation Approach," IEEE Trans. Power Syst., vol. 31, no. 2, pp. 883 - 894, 20

1.Real Time Bus Tracking System

Gogri, Kushal. (2020). Real Time Bus Tracking System. International Journal of Engineering Research and. V9. 10.17577/IJERTV9IS060545.

In the busy metropolitan cities like Mumbai, Delhi , people don't have time to invest in waiting for transport. Waiting time for transport in such crowded cities leads to less productivity on a whole. People face this problem in their daily life where they have no idea about the current status of their transport. So the proposed solution is an android based application that will help the user to check out the current location of the bus and also will help the user to know how much time the bus will take to reach the current location of the user. The system will use GPS as the basis for the application and basic android application will be interfacing with the updated database to provide the real-time data to the user, hence enhancing the user-experience.

2. Application Based Bus Tracking System

S. Jain, A. Trivedi and S. Sharma, "Application Based Bus Tracking System," 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon), Faridabad, India, 2019, pp. 152-154, doi: 10.1109/COMITCon.2019.8862254.

This research is based on Bus Tracking System, The main objective of this work is to make a GPS tracking application which would be able to track school buses more accurately and efficiently than present bus-tracking systems. We got the motivation for our research paper by observing how much precious time of the students studying in our college is wasted by just waiting for the bus on their particular route, and also there is a lack of information for the buses which are traveling on their particular route for the students who have already missed their particular bus. This work consists of three parts. In the first part, the bus location is received from the satellite and then further it is processed through the Kalman filter and then it is sent to dedicated web servers with the help of cellular networks. In the second part, the coordinates received is processed through the Google Maps API. In the third part, the data received from Google Maps API is processed in users device to show real-time location.

3. Integrated College Bus Tracking System

Sree, J. & Mamatha, T. & Sreekanth, B. & Mohammed, Noor. (2021). Integrated College Bus Tracking System. International Journal of Scientific Research in Science and Technology. 732-735. 10.32628/IJSRST2183164.

This paper proposes a smart application for College Bus Tracking System, which runs on Android smart phone. This enables students to find out the location of the bus so that they will not get late or will not arrive at the stop too early. The main purpose of this application is to provide exact location of the student's respective buses and providing information like bus details etc. This application may be widely used by the college students since Android smart phones have become common and affordable for all. It is a real time system as the current location of the bus is updated every moment in the form of latitude and longitude, which is received by the students

4.GPS: location-tracking technology

R. Bajaj, S. L. Ranaweera and D. P. Agrawal, "GPS: location-tracking technology," in Computer, vol. 35, no. 4, pp. 92-94, March 2002, doi: 10.1109/MC.2002.993780.

Increasing commercial use of the Global Positioning System will soon make it possible to locate anything, anywhere, anytime. The Global Positioning System can provide extremely accurate location information for mobile objects and people which is far superior to earlier tracking techniques. The challenge today is integrating the necessary components into older systems and improving GPS accuracy in areas with numerous obstructions. As more devices become GPS enabled, accuracy will increase and the system's scale and global reach will benefit everyone. Wireless technology promises to be a key element in any long-term solution.

5. Design and implementation of an accurate real time GPS tracking system

H. A. Abdallah Dafallah, "Design and implementation of an accurate real time GPS tracking system," *The Third International Conference on e-Technologies and Networks for Development (ICeND2014)*, Beirut, Lebanon, 2014, pp. 183-188, doi: 10.1109/ICeND.2014.6991376.

GPS tracking has many uses in today's world; the system can be used for children tracking, asset, car or any equipment tracking and as spy equipment. This paper presents an accurate and reliable real time tracking system using GPS (global positioning system) and GSM (global system for mobile communication) services, which was designed and implemented successfully in university of Khartoum labs. The system permits localization of a portable tracked unit and transmitting the position to the tracking centre. The GPS tracking system consists of portable tracked device attached to a person, vehicle or any asset, and the tracking center where the portable device's location should be monitored. The mobile tracked device receives its coordinates from the GPS and sends these coordinates as SMS via GSM modem to the tracking centre, which is simply a personal computer with many interface programs to display the location on Google maps using free version of Google Maps APIs (application programming interfaces). The testing shows that The system meets its objective of being low-cost, accurate, real time and adaptive for various applications.

6. Mobile application development process: A practical experience

L. Ghandi, C. Silva, D. Martinez and T. Gualotuña, "Mobile application development process: A practical experience," *2017 12th Iberian Conference on Information Systems and Technologies (CISTI)*, Lisbon, Portugal, 2017, pp. 1-6, doi: 10.23919/CISTI.2017.7975825.

Nowadays there is an increasing interest in mobile application development. However, developers often disregard, or at least significantly adapt, existing software development processes to suit their purpose, given the existing specific constraints. Such adjustments can introduce variations and new trends in existing processes that in many occasions are not shared with the scientific community since there is no official documentation, thus justifying further research. In this paper, we present a study and characterization of current mobile application development processes based on a practical experience. We consider a set of real case studies to investigate the current development processes for mobile applications used by software development companies, as well as by independent

developers. The result of the present study is the identification of mobile software development processes, namely agile approaches, and also of shortcomings in current methodologies applied in industry and academy, namely the lack of informed and experienced resources to develop mobile apps.

7. Mobile Application Development: Essential New Directions for IT

C. -C. Teng and R. Helps, "Mobile Application Development: Essential New Directions for IT," *2010 Seventh International Conference on Information Technology: New Generations*, Las Vegas, NV, USA, 2010, pp. 471-475, doi: 10.1109/ITNG.2010.249.

As mobile devices have become more powerful and pervasive, mobile computing has become more important. As the market share of mobile operating systems steadily grows and more IT applications are developed and deployed on mobile devices, this will become a larger and increasing part of professional IT practice. Consequently IT students should gain experience creating and deploying mobile applications. We designed a project for a junior level operating systems course and asked 35 students to develop an application using one of the following leading mobile device software development kits: Apple iPhone, Microsoft Windows Mobile and Google Android. Students were free to select a platform and define their own applications. While iPhone has approximately 50% of the mobile OS market share, only 8 students selected iPhone as their development platform of choice, 15 selected Android, another 12 selected Windows Mobile. A post-project survey was administered to the students to evaluate the process of choosing a platform, hardware and software features used in their applications, and the overall learning experience. This provided several conclusions about preferences, future applications and learning. The feedback was overwhelmingly positive and will help us improve future learning experiences.