

# BUSNAV: A Real Time Bus Tracking Application

<sup>1</sup>. Kalyani Akhade; <sup>2</sup>. Krishna Dadge; <sup>3</sup>. Rutuja Nikam; <sup>4</sup>. Dipti Satpute; <sup>5</sup>. Kunal Shinde

Department of Computer Engineering  
Sinhgad College of Technology and Science, Narhe, Pune.  
Savitribai Phule Pune University, Pune

**Abstract:-** This research focuses on developing an advanced Bus Tracking System, with the primary goal of creating a GPS tracking application that surpasses existing systems in terms of accuracy and efficiency, specifically in tracking buses. The motivation for this study stemmed from the noticeable time wastage individuals experience while waiting for buses on their designated routes, coupled with the absence of real-time information for those who have missed their bus. This research endeavor aims not only to enhance the precision and efficiency of bus tracking but also to address the common issue of people wasting valuable time while awaiting buses and those who miss their rides due to the lack of real-time information. By tackling these challenges, the developed Bus Tracking System strives to optimize the overall public transportation experience, offering users timely and reliable information to streamline their commutes and minimize inconvenience. Through innovative technological solutions and a user-centric approach, this research endeavors to significantly improve the efficiency and effectiveness of bus tracking systems, ultimately benefiting commuters and transit authorities alike.

**Keywords:-** Google Maps API, Firebase, Kotlin, Web-Server.

## I. INTRODUCTION

In today's technologically driven world, where the Global Positioning System (GPS) has become an essential part of our daily lives, particularly in location-based services, the transportation sector, especially public transit systems like buses, faces a notable gap in vehicle tracking accuracy and timeliness. To bridge this gap, we introduce an innovative bus tracking application poised to revolutionize the market. Our application functions as a sophisticated digital assistant, seamlessly integrating real-time bus location data into the familiar interface of Google Maps. It aims to provide users with precise bus positioning information and sending alerts in case of emergency. Central to its functionality is the utilization of Google Maps and its robust Application Programming Interface (API).

The development process of our application focuses on creating a mobile app that empowers users with effortless access to real-time bus tracking. By leveraging user location data, our app enables seamless tracking of buses, accessibility to route information seamless integration with Google Maps and a user-friendly interface. Designed with user experience

in mind, our app allows users to easily navigate through bus routes, track buses.

The development of this application is grounded in a robust methodology that incorporates the utilization of Java and Kotlin programming languages for backend and frontend development, respectively. Firebase serves as the backend infrastructure, offering real-time data synchronization and storage capabilities. The integration of the Google Maps API enables seamless visualization of bus routes and locations on an interactive map interface.

## II. RELEVANCE

A bus tracking application developed with Java, Kotlin, and Firebase holds significant relevance in modern transportation systems. By providing real-time tracking capabilities, passengers gain immediate access to bus locations, enabling efficient journey planning and reducing wait times. This application enhances operational efficiency for transit authorities by leveraging Firebase for real-time data synchronization. This ensures accurate and up-to-date information for both passengers and administrators, leading to improved fleet management and rapid response to any disruptions.

The user-friendly interface developed using Java and Kotlin fosters high user engagement, with features such as interactive maps and personalized notifications enhancing the overall experience. Firebase's scalability ensures the application can accommodate large user bases and data streams efficiently, vital for urban areas with high transit demand.

## III. MOTIVATION

This app aims to enhance the commuter experience by providing accurate and real-time information on bus locations and routes. Traditional bus schedules often lack reliability, leading to inconvenience and uncertainty for passengers. By offering real-time updates, the app reduces wait times and empowers commuters to plan their journeys more efficiently. The app contributes to the efficiency of public transportation systems. By optimizing bus routes, improving fleet management, and minimizing delays, it encourages more people to use public transport, ultimately reducing traffic congestion and environmental impact.

#### IV. LITERATURE SURVEY

This paper [1], 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. 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.

In the paper [2], the current position of the bus is acquired by integrating GPS device on the bus and coordinates of the bus are sent by either GPRS service provided by GSM networks or SMS or RFID. GPS device is enabled on the tracking device and this information is sent to centralized control unit or directly at the bus stops using RF receivers. This system is further integrated with the historical average speeds of each segment. This is done to improve the accuracy by including the factors like volume of traffic, crossings in each segment, day and time of day. People can track information using LEDs at bus stops, SMS, web application or Android application. GPS coordinates of the bus when sent to the centralized server where various arrival time estimation algorithms are applied using historical speed patterns.

In the paper [3], Bus Tracking system is introduced which is the integration of three techniques: 1. GPS, 2. GSM, 3. RFID. The Bus Tracking System is a dynamic mobile System. The main focus of our work is on GPS. There is need of accurate estimation of Bus location. There are many research solutions proposed recently for efficient estimation of Bus Locations and position, but suffered from the limitations of scalability and efficiency. In this project, we proposed novel approach for location estimation called B-T-S (Bus Tracking System) based on adaptive location estimation method and GPS approach. We first designed novel GPS based location estimation method. The experimental evaluation of proposed approach is done using java simulation tool by considering both simulation and real time analysis. Both results claimed that proposed Advanced Bus Tracking System is achieved the improved accuracy and performance as compared to existing Bus Tracking System.

In the paper [4], a system which could track the current position of buses and the dynamic arrival and departure time and inform the passengers via display boards at the terminus or through an App installed in the smart phone has been proposed. It has a GPS system that tracks the position of a particular bus and the data is transmitted by a GSM modem to the bus terminus. The receiver part of the system which is installed at the bus terminus processes the received data and calculates the arrival time and delay time of a particular bus. The initial testing shows that it will be a boon for the commuters who often meet with boredom and anxiety without knowing when the buses will arrive. For best

tracking result, GPS and GSM technology can be used. The GPS and GSM based system can provide all specifications that are necessary for tracking a vehicle.

In the paper [5], author has proposed this project which aims in automating the services of the system that can provide the real time tracking experience of the public transport buses. The buses will be having RFID tags within them and RFID readers will be placed in every bus stops. Arduino serves as the central controller for this system. GSM module will be used to send the tracking messages to the authorized persons for continuous monitoring. GPS is used for getting the location of the buses. Users will be getting the bus tracking details as notifications in their mobiles through IoT. The inputs from RFID readers are continuously updated to Arduino for processing the data. The processed data is sent to the cloud which serves as the interface between the user and the system. Mobiles phones are chosen as the medium to communicate with the passengers that provides an easy access to them. In this paper the project focuses on tracking the buses, sending SMS to the authorized persons, updating the passengers through notifications and improving the accessibility to the system.

In the paper [6], a proposed smart school bus tracking system is an easy-to-use software, including both a web-based program and a mobile application, that mainly gives parents, students and school service firms the ability to track accurately the location of their school service vehicles. Such a smart school bus service information system is inevitable within the context of smart city features. In addition, bus service companies can easily register new students and determine the routes of the school buses dynamically. The system provides scalability, flexibility, low cost, security, and reliability. All shared location information and users' private data are stored encrypted; the parents may receive information about their related buses only. The system is based on both web and mobile platforms and it is implemented as an interactive application.

In paper [7], the foremost objective of this application is to render the specific location of the user's respective buses in Google Maps and also joined with the specialty of emitting an alarm signal to the driver if the user is beside the bus stop. It is the real-time system as the current location of the bus is renewed every moment in the form of latitude and longitude which is received by the user by their application with the help of Google Map API. Utilizing the IoT technology, highlights of the project are connected to the android application. An IoT method consists of sensors/tools which "interact" through the cloud in some set of connectivity. Once that information receives to the cloud, software manners also then force determine to act, before-mentioned as giving an alarm or automatically modifying these sensors/tools externally that necessary to the user. NodeMCU is used to combine the GPS module and buzzer for real-time location tracking and notification for the user.

In paper [8], the overall system is composed of two parts, an on-board tracking unit, and a tracking server unit. The on-board tracking unit is to be mounted in the bus to

register the boarding/disembarking status of students, which includes (boarding/ disembarking time, boarding/ disembarking location of students, and the realtime GPS location of the School bus). An on-board RFID reader reads the students RFID card number. The real time location is recorded using GPS tracking device. All the boarding and exiting data is uploaded to the tracking server to be stored in the database. The uploaded data is verified for authenticity by checking it with the student and bus information stored in the database. Once verified, the data is stored in the database.

In paper [9], Real-Time Campus University Bus Tracking Mobile Application is developed as a platform for user to receive the data transmitted from database. Other than that, Student will know the time arrival of the bus and the current quantity of people inside the bus to lead them avoid wasted time knowing that they wait for the bus that pack of passenger. The student also able to make complaint and feedback via the platform. Furthermore, this project using PhoneGap as a tool platform to develop the application. The GPS Tracker device using Arduino and IoT people counter using Raspberry PI to transmit data. Overall this project using the reusability techniques and Agile method to complete all the system which it is involved four interactions to make it full system work as expected.

In paper [10], a real-time bus tracking system for the students using Android smartphones which can be used for tracking and positioning of the buses by using Global Positioning System (GPS) has been proposed. This android based real time application enables the students to find out the exact location of the buses so that they will not get late or will not arrive at the bus stop too early. It provides the exact location of the student's respective buses which can be viewed on the google map. The user can track the location of buses controlled by a driver on Google map from the server using GPS. Admin maintains and updates all relevant information like bus routes, driver number, number of buses, etc. on the server.

## V. FUTURE SCOPE

The future scope for real-time bus tracking applications is promising, with opportunities for integration with emerging technologies like IoT, AI, and ML to enhance functionality and accuracy. Multi-modal integration will enable seamless connections between different modes of transportation, while enhanced passenger engagement features and accessibility improvements will prioritize inclusivity and user satisfaction. Integration with smart city initiatives will optimize urban mobility and promote sustainability, while robust privacy and security measures will safeguard passenger data. Overall, real-time bus tracking applications will continue to evolve, playing a crucial role in shaping the future of urban transportation towards efficiency, sustainability, and accessibility.

## VI. CONCLUSION

In conclusion, the development of the bus tracking app represents a significant step forward in enhancing public transportation services. By providing real-time bus tracking, accurate route information, and improved user experiences, this project offers a valuable solution for both passengers and transit authorities. The app's potential to reduce waiting times, enhance efficiency, and contribute to urban mobility planning makes it a key driver of progress in the realm of public transportation. With a user-centric approach, robust data integration, and a commitment to security, the bus tracking app aims to redefine the way commuters engage with and benefit from public transit. There is the potential for integration with Smart City initiatives, aligning with the trajectory of urban development towards digitalization. By providing real-time data to city planners and policymakers, the application can contribute to optimizing transportation routes, alleviating congestion, and enhancing overall efficiency.

## REFERENCES

- [1]. Shubham Jain, Adarsh Trivedi, Shweta Sharma. Department Of Computer Science And Technology International Institute of Research And Studies (2019), "Application Based Bus Tracking System"
- [2]. K. Sujatha. CSE Department ,P.V. Nageswara Rao CSE Department, GITAM University, Visakhapatnam, India (2019), "Design and development of android mobile based bus tracking system"
- [3]. Khalid Ammar Ajman University .UAE, Mohammad Jalmoud Etisalat Network technology Lab, UAE, (2018), "A Real-time School Bus Tracking and Monitoring System"
- [4]. Rajesh Kannan Megalingam, Nistul Raj. Department of Computer Science, National Chiao Tung University, Taiwan (2016), "Smart, public buses information system"
- [5]. Jay Lohokare ;Reshul ,Dani;Sumedh Sontakke ,Rahul Adhao. Department of Computer Science .Mumbai (2014), "Scalable tracking system for public buses using IOT technologies"
- [6]. Ilker Korkmaz,Alp ,Camci,Cihangir ,Cengiz,Dogan, Dirik,Emre, Cekci,Fatih Mehmet. Akbaba.Department of Computer Engineering Izmir University of Economics Izmir, Turkey (2019), "A Smart School Bus Tracking System"
- [7]. K. Premkumar; Pavithra K.; Presiela J.; Priyadarshini D.; Priyanga P. Department of Information Technology, Manakula Vinayagar Institute of Technology Pondicherry, India (2020), "College Bus Tracking and Notification System"
- [8]. Khalid Ammar ,Mohammad Jalmoud ,Abdulrasul Boushehri , Khalid Fakhro (2019), "A Real-time School Bus Tracking and Monitoring System"
- [9]. Shafri A. Sharif, Mohd S. Suhaimi, Nurul N. Jamal, Irsyad K. Riadz, Ikmal F. Amran, Dayang N. A. Jawawi .Faculty of Computing Universiti Teknologi Malaysia Johor, Malaysia, (2018), "Real-Time Campus University Bus Tracking Mobile Application"

- [10]. Mohammad Nazmul Hasan, Md. Sharif Hossen.  
Department of Information and Communication  
Technology Comilla University, Comilla, Bangladesh  
(2019), “Development of An Android Based Real Time  
Bus Tracking System”