

# Implementation The College Bus Location Tracking System using GPS for College Student and Developing Android Application

Ankita Rekkawar  
Electronics & Telecommunication  
Engineering Department  
Swaminarayan Siddhanta Institute of  
Technology,  
Nagpur, India

Amit Gedam  
Electronics & Telecommunication  
Engineering Department  
Swaminarayan Siddhanta Institute of  
Technology,  
Nagpur, India

Harsha Waghmare  
Electronics & Telecommunication  
Engineering Department  
Swaminarayan Siddhanta Institute of  
Technology,  
Nagpur, India

**Abstract** - This project is centered on developing and implementing a custom bus tracking system for college students using Android. The system's main function is to offer real-time data transfer, monitoring, visualization, and notifications through a mobile application. Students can track buses in real-time using GPS, similar to Uber's ride-sharing features, by following the arrival and departure times on a map through the app. Students and administrators can access an Android interface to view the vehicle's location through the app, which keeps track of its updates on a regular basis. Along with real-time tracking, the system also aggregates vehicle safety inspections, emergency alerting and driver monitoring onto a single mobile platform. Additionally, the system includes smart seat occupancy monitoring that utilizes sensors to identify vacant or occupied seats on buses. By updating and notifying the mobile app once a seat is filled, both students as well as administrators can ensure that boarding is done in real-time by checking if seats are available.

**Keywords** - Android Application, Bus Location Tracking System, Real-Time Global Position System Tracking, Smart Transportation, College Bus Monitoring, Seat Occupancy Detection, IoT-Based Monitoring, Mobile Notification System.

## I. INTRODUCTION

The provision of transportation systems in educational institutions is crucial to facilitating efficient movement between campuses and residential areas for both students and staff. Even so, traditional college bus systems often encounter significant operational difficulties such as irregular departure schedules, ineffective communication channels between drivers and staff, and inefficient scheduling [1] [2]. Long waiting times and scheduling difficulties are a common result of uncertainties, which have repercussions on students' academic performance and campus environment [2] [3].

Recent advancements in the Internet of Things (IoT) and mobile computing have opened up new possibilities for smart transportation to tackle these issues. Real-time vehicle tracking systems that link GPS with mobile devices enable users to track the current location and condition of their vehicles. Because of their popularity, flexibility, and ability to present real-time information [3] [4], Android apps have become the primary means of utilizing these systems. Like modern ride-

hailing services like Uber, these apps enable students to monitor the actual location of buses on a map and receive estimated arrival times (ETA), which can help reduce commuting time and increase transparency [1] [2].

In addition to tracking vehicle location, a complete transportation system for an institution must have safety and monitoring tools.' Driver monitoring and vehicle safety checks are now included in modern systems to ensure student safety and compliance with regulations [3][8]. The implementation of intelligent seat tracking has also facilitated efficiency. To determine if seats are available in real time, these systems utilize sensors such as infrared counters or force-sensitive resistors that are linked to microcontroller. The central cloud system receives data and displays it on an Android app, enabling students to identify whether there are empty seats on a bus before it arrives at their destination [4] [5].

Our research is centered on developing and setting up an Android-based system for tracking buses that would be particularly advantageous to college students. Real-time GPS tracking, driver safety checks and automatic seat filling display are all features included in one of the mobile applications. By providing live updates, information on seat availability, and emergency alerts, the system is designed to be safer, more transparent, and more efficient for both school administrators and students.

## II. LITERATURE REVIEW

TABLE 1. LITERATURE REVIEW OF PREVIOUS RESEARCH PAPER

Sr. No.	Proposed System / Method	Key Features	Advantages	Limitations
1	IoT-Based Smart Inventory Management System for Perishabl	Integrates sensor data with cloud analytics to monitor product condition	Reduces spoilage, enables real-time monitoring, minimizes manual tracking.	Requires continuous connectivity and sensor infrastructure, leading to high implementation costs

	e Goods [9]	s and expiry status in real time.		for small retailers and MSMEs.
2	RFID-Based Product Expiry Monitoring System [10]	Uses RFID tags and readers for non-line-of-sight detection and automated expiry alerts.	Improves accuracy, scalability, and automated inventory tracking.	High cost of RFID tags and readers limits adoption among small and medium enterprises.
3	Smart Shelf System Using Computer Vision [11]	Employs image processing and computer vision techniques for automatic expiry date detection	Reduces human intervention and enhances monitoring efficiency.	Sensitive to lighting conditions, font variations, and requires significant computational resources.
4	Smart Refrigerator with IoT Sensors [12]	Tracks expiry dates and monitors food conditions using embedded IoT sensors.	Effective real-time monitoring in controlled environments.	Limited scalability and poor integration with enterprise-level inventory systems.
5	Automated Alert System for Food Product Expiry in Supermarkets [13]	Generates timely notifications for products approaching expiry.	Helps reduce food wastage and improves inventory management.	Does not incorporate predictive analytics for demand forecasting or stock optimization.
6	Barcode-Based Expiry Date Management System [14]	Uses barcode scanning to manage and track product expiry dates.	Cost-effective, simple to implement, and widely compatible with existing systems.	Relies heavily on manual scanning, limiting automation and real-time monitoring capabilities

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### III. RESEARCH GAP

Various methods for tracking expiry dates are demonstrated by the reviewed studies, including IoT, RFID, computer vision, barcode systems, and automated alert mechanisms. Even so, existing solutions commonly have some or all limitations: high costs of deployment, specialized hardware and software requirements, limited scale (employee rotation), the absence of predictive analytics, tolerance to environmental conditions, or reliance on manual intervention. Therefore, an expiry management system that is both cost-efficient, scalable, and intelligent that offers: automated detection, real-time monitoring, predictive analytics, integration with enterprise inventory systems to improve operations and reduce food waste.

### IV. OBJECTIVE

The objectives of the proposed system are as follows:

1. For creating an android app that provides students and administrators with real-time bus tracking through GPS technology.
2. To improve student waiting times by offering an estimated arrival time and status updates.
3. To use an eye-blink sensor to detect drowsiness in drivers and help prevent crashes caused by fatigue.
4. To install an alcohol detector so that the driver isn't under the influence of alcohol while driving.
5. To create instant alerts and email notifications on android mobile devices for abnormal conditions if they become noticeable.

### V. METHODOLOGY

An Android app for real-time tracking and safety is incorporated in the integrated Bus Location Tracking and Safety Monitoring System, which incorporates GPS, embedded systems, IoT, cloud computing, and an Android application. The system consists of three primary components: an internal bus hardware unit, a cloud-based messaging system, and an Android app utilized by students, parents or school staff to monitor the bus continuously and ensure safety [16]. The system is designed for real-time monitoring through apps and other software. Among the hardware on the bus are GPS sensors, an eye-blink sensor, alcohol sensors and ultrasonic sensors [18]. These sensors are linked to a microcontroller such as Arduino Uno or NodeMCU ESP8266, which is responsible for collecting, processing, and transmitting sensor data. This data is sent to Firebase or Blynk on Wi-Fi/GSM networks via NodeMCU ESP8266 and then to cloud services [17]. Using the Android app, users can access real-time information like location, sensor data, vehicle status, and safety warnings stored in a cloud database. Utilizing Google Maps API and Android Studio, the app can display real-time bus locations, forecast its arrival time, and monitor the condition of the bus [19]. If there are any problems, such as a driver being sleepy due to alcohol consumption or engine temperature changes while in motion, the system sends push notifications and emails to alert the appropriate personnel [20]. To ensure accuracy, sensor quality, cloud communication reliability, and alert delivery rates of the entire system were tested in different scenarios. Once everything is in order, the parts are assembled into one

platform which can track buses in real time, monitor drivers, check the health of vehicles and issue emergency alerts. This approach creates a safe, transparent, reliable and efficient system for tracking school transportation [21].

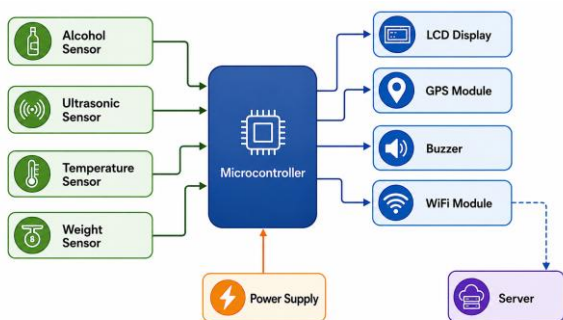


Fig 1. Block diagram of college bus tracking system

A Vehicle Tracking System is developed using NodeMCU ESP8266, Firebase Realtime Database, GPS module and weight sensor for real-time vehicle monitoring and load analysis. To program the NodeMCU microcontroller, it is necessary to install and configure the Arduino IDE with the ESP8266 board package from the Board Manager. Connecting the GPS, weight sensor, Wi-Fi module, and power supply to the vehicle is necessary for communication with the cloud platform. All other hardware components are also connected. This is complemented by the weight sensor, which can monitor not only the vehicle's position but also its load conditions. The system functions effectively.

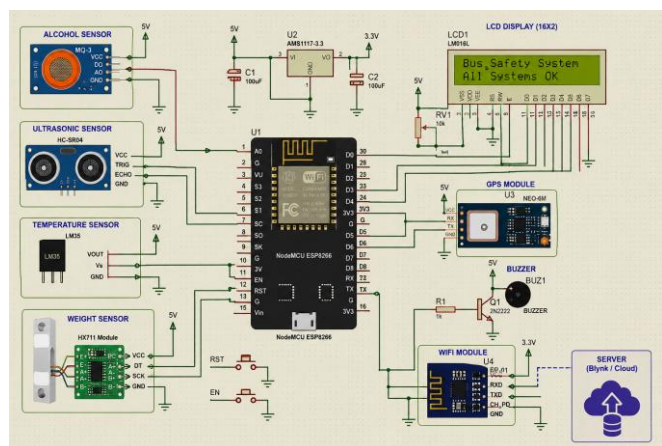


Fig 2. Schematic circuit diagram of bus tracking system

## VI. RESULT

Utilizing NodeMCU ESP8266, GPS technology and IoT communication as well as cloud services and an Android app for real-time bus tracking and passenger safety [22], the Bus Location Tracking and Safety Monitoring System was successfully built. By combining hardware and software components, the system provides real-time monitoring of buses, safety updates, and emergency alerts for different transportation scenarios [23]. The system was found to function effectively with reliable communication between the hardware, Firebase/Blynk cloud server, and Android app through tests.

The GPS module correctly marked the bus's real-time latitude and longitude as it moved and transmitted this data to the cloud platform via Wi-Fi communication [24]. The Android app was able to retrieve data from the cloud and display the bus's current position on Google Maps, along with an estimated time of arrival, the status, and route taken, making it more accessible and understandable for students, parents, and school officials [25].

The Android application GUI was designed with multiple interfaces including login, live tracking, safety monitoring, and alert notification pages. The user-friendly interface enabled efficient monitoring with minimal delay in data transmission [26].

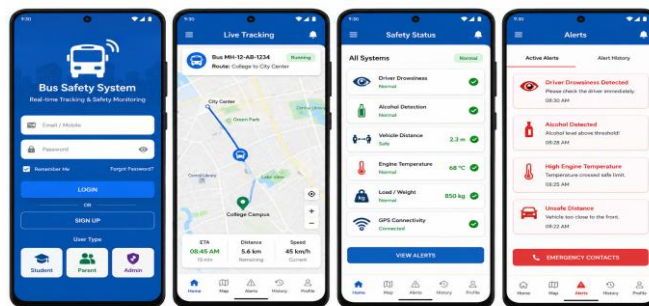


Fig 3. Mobile application of bus tracking system with other information

The figure 3. developed Android application provides live vehicle tracking, safety monitoring, and emergency alert notifications, inspired by similar IoT-based vehicle tracking and safety monitoring systems proposed in previous research as shown above [32], [33]

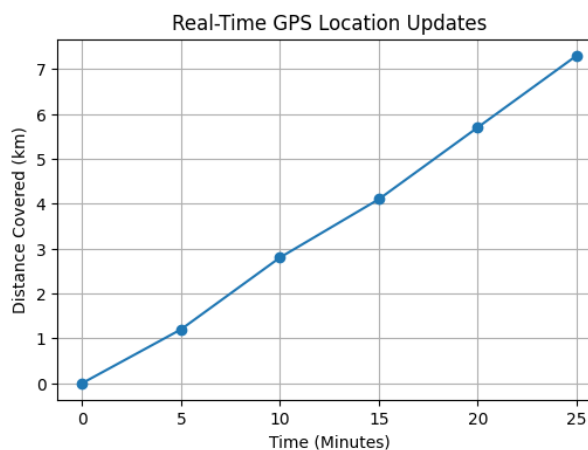


Fig 4. Real time GPS coordinate data send by GPS with NodeMCU ESP8266

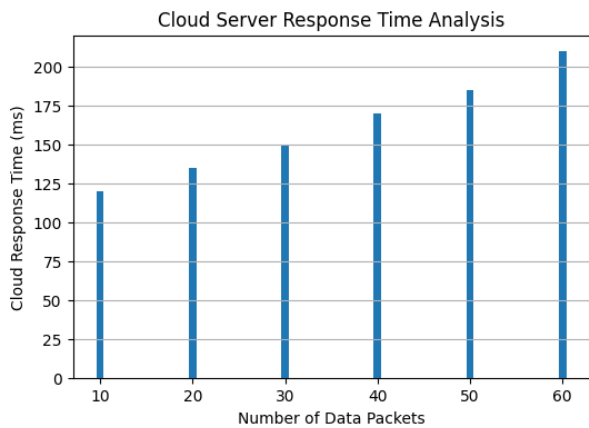


Fig 5. Time to time cloud server response

The above figures demonstrate the effectiveness of the proposed IoT-based Bus Location Tracking and Safety Monitoring System. The results show accurate real-time GPS tracking, reliable cloud data transmission, and efficient sensor monitoring performance using Firebase/Blynk servers. Experimental analysis confirmed stable communication, low response delay, and continuous real-time monitoring for smart transportation applications [34]– [36].

## VII. CONCLUSION

This study presents a clever, effective method to improve the safety, reliability and efficiency of transportation with the new Bus Location Tracking and Safety Monitoring System. It integrates real time bus tracking and vehicle safety monitoring into one user-friendly Android app, giving users current information on bus services.... Through the use of GPS technology, inside-vehicle sensors, Firebase cloud services, and mobile networks it provides a seamless data transmission between vehicles and users.

The system's significant achievement is its ability to display bus locations in real-time on Google Map. Students, parents, and school staff can track the bus's location, travel to its destination, or arrive at a specific time with the help of this feature. The availability of such devices improves accessibility, reduces waiting time, and increases people's confidence in bus transportation. By using the main dashboard, school managers can monitor all transportation activities and quickly resolve any issues that arise..

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