# College Bus Location Tracking and Stop Notification System using Lora WAN
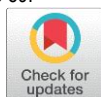
## Abinash M [1], Mohanram S [2], Vinodhan G [3], Dr. Bala subramaniyan K[4]

*[1,2,3] Students, E.G.S. Pillay Engineering College, Nagapattinam, Tamilnadu, India.*
*[4]Assistant Professor, E.G.S. Pillay Engineering College, Nagapattinam, Tamilnadu, India.*

***Abstract:*** *The advanced environment is recommended by a variety of technology day byday. Often the associated changes in technologies are improving advanced business methods. Several technologies have been exhibited in the system for growing people's life more comfortable and healthier day by day. Android is the newest and rapidly developing technology available for all users or users in today's business. A tremendous rise in end- user assent has been encountered in the past few years. The plan is based on the latest GPS technology using IoT which permits the college students to track the movement of the college buses and maintain a schedule as well as implement real-time bus locations for the users. Unique and stunning conditions on the roads affect the smooth operation of thebus system and the change of vehicles. Also, daily difficulties such as traffic, sudden delays, broken vehicle dispatching incidents take place, and as an outcome of which the program of the students is affected and they necessarily have to wait for the arrival of their particular bus and also attempt to miss their bus. 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. Management and College Bus Operation teams access real-time fleet tracking with live vehicle locator. Monitor operational performance by run, route, driver, time of day, day of week, and length of travel times. Track ridership statistics and usage data to make informed decisions about routes needs and frequency of service Create canned messages for students using the CTGo app to advise of stop changes due to road construction and/or temporary street closures. With ourinnovative College bus tracking system students can track their bus using CTGo Apps or receive SMS notification just 5-10 minutes before bus reaches their designated stop.*

***Key Word:*** *Google Map API; CTGo app; IoT; College bus*

## I.INTRODUCTION

### 1.1. Overview

A college bus is a type of transportation that is specifically used to transport students to and from college or university campuses. These buses are usually operated by the college or university itself or by a third-party transportation company hired by the institution.



*Fig-1*

College buses are typically equipped with features that cater to the needs of college students, such as comfortable seating, air conditioning, and WiFi connectivity. They may also have a specific schedule and designated pick-up and drop-off locations to accommodate the various class schedules and campus locations. In some cases, college buses may also be usedfor extracurricular activities such as sports teams traveling to and from games, or for field trips to off-campus locations for educational purposes.

### 1.2. Problem Statement

The current transportation system for college students is inefficient and lacks proper tracking mechanisms. Students often face difficulties in tracking the location of the college bus, leading to delays and missed classes. Moreover, the absence of an automated stop notification system causes students to miss their stops, resulting in inconvenience and safety concerns. The mobile application or website used to access the bus's location and estimated time of arrival may have a poor user interface,

making it difficult for students to use and navigate. This can result in frustration and reduced usage of the system. The system may face technical glitches, resulting in delays or incorrect information being displayed to users .Implementing a College Bus Location Tracking and Stop Notification System can be expensive, and maintenance costs can be high, making it difficult for some colleges to implement and sustain such a system. The existing College Bus Location Tracking and Stop Notification System may have limited coverage, such as only tracking buses on specific routes or only providing notifications to students at certain stops. This can result in students not having access to real-time location information or not receiving notifications for all stops, which could lead to delays or missed stops. Therefore, there is a need to develop aCollege Bus Location Tracking and Stop Notification System that can provide real-time information about the bus's location and notify students of upcoming stops.

### 1.3. Web Design and Development

Web design and development are two separate but interconnected processes that involve creating a website from scratch ormodifying an existing website to meet specific requirements.



*Fig-2*

Web design refers to the process of creating the visual appearance and layout of a website. This includes deciding on color schemes, typography, images, and other design elements that will make the website visually appealing and user-friendly. Web designers use various tools like Adobe Photoshop, Sketch, or Figma to create mockups or prototypes of the website before it is developed.

Web development, on the other hand, refers to the process of creating the website's functionality and interactivity. This includes writing code in programming languages such as HTML, CSS, and JavaScript to create web pages, database connectivity, server-side scripting, and integrating various features such as contact forms, chatbots, and payment gateways.

Web developers also use various frameworks like React, Angular, or Vue.js to simplify the development process. Both web design and development are essential for creating a successful website that meets the needs of the users. Good web design helps to attract and retain visitors, while web development ensures that the website is functional, secure, and easy to use. The two processes often overlap, and a good web designer should have a basic understanding of web development, and vice versa.In summary, the College Bus Location Tracking and Stop Notification System requires both good web design and development to create a user-friendly and functional system that meets the needs of college students.

### 1.4. Objective of the project

The main objective of the Web Design and Development College Bus Location Tracking and Stop Notification System is to provide a solution for college students to track the location of their college bus and receive automated notifications about upcoming stops. The project aims to solve the problem of uncertainty and inconvenience that students may face whencommuting to college using public transport.

To achieve this main objective, the following specific objectives should be met:
1. **Real-time tracking**: Develop a system that can track the location of the college bus in real-time, using GPS technology or other reliable tracking systems.
2. **Notification system**: Design and develop an automated notification system that can alert students about upcoming stops and provide estimated arrival times.
3. **User-friendly interface**: Create a web interface that is easy to use, with clear labels and buttons for easy access todifferent features of the system.
4. **Security and scalability**: Build a secure and scalable system that can handle a large number of users, with robustbackend frameworks and database management systems.
5. **Mobile accessibility**: Design the system to be responsive to different screen sizes, ensuring that it is accessiblefrom mobile devices.
6. **Cost-effectiveness**: Develop the system using cost-effective technologies and techniques to keep the overallproject cost within budget.

By achieving these objectives, the Web Design and Development College Bus Location Tracking and Stop Notification System will provide an effective and convenient solution for college students to track their college bus and plan

their journeymore efficiently.

## 1.5. Scope of the Project

The scope of the Web Design and Development College Bus Location Tracking and Stop Notification System project includes the design, development, and implementation of a system that allows college students to track the location of theircollege bus and receive automated notifications about upcoming stops.

The project scope involves the following key elements:

1. System architecture: Define the system architecture and identify the technologies required to develop the system,including GPS tracking, notification systems, and backend frameworks.
2. User interface design: Develop a user-friendly web interface that is accessible from different devices, with clearlabels and buttons for easy navigation.
3. Real-time location tracking: Integrate GPS tracking technology into the system to allow real-time tracking of thecollege bus.
4. Automated notification system: Develop an automated notification system that can send notifications to students about upcoming stops and estimated arrival times.
5. Backend development: Build a robust backend system using frameworks such as PHP and MySQL to ensuresystem security and scalability.
6. Database management: Develop and manage the system's database to store and retrieve data efficiently.
7. Testing and quality assurance: Conduct thorough testing and quality assurance to ensure that the system is functioning as expected and meeting the project's requirements.

The scope of the project also includes the development of a project plan, including timelines, resource allocation, and budgeting. It is important to note that the project scope may be subject to change based on the project's requirements and constraints.

Overall, the scope of the Web Design and Development College Bus Location Tracking and Stop Notification System project aims to provide a reliable and user-friendly solution for college students to track their college bus and plan their journey more efficiently.

## II.MATERIAL AND METHODS

## 1. Hardware Requirements

- Processors: Intel® Core™ i5 processor 4300M at 2.60 GHz or 2.59 GHz (1 socket, 2 cores, 2 threadsper core), 8 GB of DRAM
- Disk space: 320 GB
- Operating systems: Windows® 10, macOS*, and Linux*

## 2. Software Specification

- Front End : PHP
- Back End : MYSQL
- Server : WAMP
- Operating System : Windows OS
- System type : 32-bit or 64-bit Operating System
- IDE : DREAMWEAVER
- DLL : Depends upon the title

## 3. Software Enviornment

## 3.1. Front EndPHP

PHP: Hypertext Preprocessor (or simply PHP) is a general-purpose programming language originally designed for web development. It was originally created by Rasmus Lerdorf in 1994 the PHP reference implementation is now producedby The PHP Group. PHP originally stood for Personal Home Page, but it now stands for the recursive initialism PHP: Hypertext Preprocessor.

PHP code may be executed with a command line interface (CLI), embedded into HTML code, or used in combination with various web template systems, web content management systems, and web frameworks. PHP code is usually processed by a PHP interpreter implemented as a module in a web server or as a Common Gateway Interface (CGI) executable. The web server outputs the results of the interpreted and executed PHP code, which may be any type of data, such as generated HTML code or binary image data. PHP can be used for many programming tasks outside of the web context, such as standalone graphical applications and robotic drone control.

The standard PHP interpreter, powered by the Zend Engine, is free software released under the PHP License. PHPhas been widely ported and can be deployed on most web servers on almost every operating system and platform, free of charge.

The PHP language evolved without a written formal specification or standard until 2014, with the original implementation acting as the de facto standard which other implementations aimed to follow. Since 2014, work has gone on to create a formal PHP specification.

## 3.2. Back End
## What is MySQL? – An Introduction To Database Management Systems

Database Management is the most important part when you have humungous data around you. MySQL is one of the most famous Relational Database to store & handle your data. In this **What is MySQL** blog, you will be going through the following topics:

- What are Data & Database?
- Database Management System & Types of DBMS
- Structured Query Language (SQL)
- MySQL & its features
- MySQL Data Types

**What are Data & Database?**

Suppose a company needs to store the names of hundreds of employees working in the company in such a way that all the employees can be individually identified. Then, the company collects the **data** of all those employees. Now, when I say data, I mean that the company collects distinct pieces of information about an object. So, that object could be a real-world entity such as people, or any object such as a mouse, laptop etc.

**Database Management System & Types of DBMS**

A **Database Management System** (**DBMS**) is a software application that interacts with the user, applications and the database itself to capture and analyze data. The data stored in the database can be modified, retrieved and deleted, and can be of any type like strings, numbers, images etc.

**Types of DBMS**

There are mainly 4 types of DBMS, which are Hierarchical, Relational, Network, and Object-Oriented DBMS.

- **Hierarchical DBMS:** As the name suggests, this type of DBMS has a style of predecessor-successor type of relationship. So, it has a structure similar to that of a tree, wherein the nodes represent records and the branches of the tree represent fields.
- **Relational DBMS (RDBMS):** This type of DBMS, uses a structure that allows the users to identify and access data *in relation* to another piece of data in the database.
- **Network DBMS:** This type of DBMS supports many to many relations wherein multiple member records can be linked.
- **Object-oriented DBMS:** This type of DBMS uses small individual software called objects. Each object contains a piece of data, and the instructions for the actions to be done with the data.

**Structured Query Language (SQL)**

SQL is the core of a relational database which is used for accessing and managing the database. By using SQL, you can add, update or delete rows of data, retrieve subsets of information, modify databases and perform many actions. The different subsets of SQL are as follows:

- **DDL** (Data Definition Language) – It allows you to perform various operations on the database such as CREATE, ALTER and DELETE objects.
- **DML** (Data Manipulation Language) – It allows you to access and manipulate data. It helps you to insert, update, delete and retrieve data from the database.
- **DCL** (Data Control Language) – It allows you to control access to the database. Example – Grant or Revoke access permissions.
- **TCL** (Transaction Control Language) – It allows you to deal with the transaction of the database. Example – Commit, Rollback, Save point, Set Transaction.

**Using MySQL**

Of course, there's not a lot of point to being able to change HTML output dynamically unless you also have a means to track the changes that users make as they use your website. In the early days of the Web, many sites used "flat" text files to store data such as usernames and passwords. But this approach could cause problems if the file wasn't correctly locked against corruption from multiple simultaneous accesses. Also, a flat file can get only so big before it becomes unwieldy to manage—not to mention the difficulty of trying to merge files and perform complex searches in any kind of reasonable time. That's where relational databases with structured querying become essential. And MySQL, being free to use and installed on vast numbers of Internet web servers, rises superbly to the occasion. It is a robust and exceptionally fast database management system that uses English-like commands. The highest level of MySQL structure is a database, within which you can have one or more tables that contain your data. For example, let's suppose you are working on a table called users, within which you have created columns for surname, first name, and email, and you now wish to add another user. One command that you might use to do this is: INSERT INTO users VALUES('Smith', 'John', 'jsmith@mysite.com'); Of course, as mentioned earlier, you will have issued other commands to create the database and table and to set up all the correct fields, but the INSERT command here shows how simple it can be to add new data to a database. The INSERT command is an example of SQL (which stands for Structured Query Language), a language designed in the early 1970s and reminiscent of one of the oldest programming languages, COBOL. It is well suited, however, to database queries, which is why it is still in use after all this time. It's equally easy to look up data. Let's assume that you have an email address for a user and you need to look up that person's name. To do this, you could issue a MySQL query such as: SELECT surname, first name FROM users WHERE email='jsmith@mysite.com'; MySQL will then return Smith, John and any other pairs of names that may be associated with

that email address in the database. As you'd expect, there's quite a bit more that you can do with MySQL than just simple INSERT and SELECT commands. For example, you can join multiple tables according to various criteria, ask for results in a variety of different orders, make partial matches when you know only part of the string that you are searching for, return only the nth result, and a lot more. Using PHP, you can make all these calls directly to MySQL without having to run the MySQL program yourself or use its command-line interface. This means you can save the results in arrays for processing and perform multiple lookups, each dependent on the results returned from earlier ones, to drill right down to the item of data you need. For even more power, as you'll see later, there are additional functions built right into MySQL that you can call up for common operations and extra speed.

**The Apache Web Server**

In addition to PHP, My SQL, JavaScript, and CSS, there's actually a fifth hero in the dynamic Web: the web server. In the case of this book, that means the Apache web server. We've discussed a little of what a web server does during the HTTP server/client exchange, but it actually does much more behind the scenes. For example, Apache doesn't serve up just HTML files—it handles a wide range of files, from images and Flash files to MP3 audio files, RSS (Really Simple Syndication) feeds, and more. Each element a web client encounters in an HTML page is also requested from the server, which then serves it up. But these objects don't have to be static files, such as GIF images. They can all be generated by programs such as PHP scripts. That's right: PHP can even create images and other files for you, either on the fly or in advance to serve up later. To do this, you normally have modules either precompiled into Apache or PHP or called up at runtime. One such module is the GD library (short for Graphics Draw), which PHP uses to create and handle graphics.

Apache also supports a huge range of modules of its own. In addition to the PHP module, the most important for your purposes as a web programmer are the modules that handle security. Other examples are the Rewrite module, which enables the web server to handle a varying range of URL types and rewrite them to its own internal requirements, and the Proxy module, which you can use to serve up often-requested pages from a cache to ease the load on the server. Later in the book, you'll see how to actually use some of these modules to enhance the features provided by the core technologies we cover. About Open Source Whether or not being open source is the reason these technologies are so popular has often been debated, but PHP, MySQL, and Apache are the three most commonly used tools in their categories. What can be said, though, is that being open source means that they have been developed in the community by teams of programmers writing the features they themselves want and need, with the original code available for all to see and change. Bugs can be found and security breaches can be prevented before they happen. There's another benefit: all these programs are free to use. There's no worrying about having to purchase additional licenses if you have to scale up your website and add more servers. And you don't need to check the budget before deciding whether to upgrade to the latest versions of these products.

**What Is a WAMP, MAMP, or LAMP?**

WAMP, MAMP, and LAMP are abbreviations for "Windows, Apache, MySQL, and PHP," "Mac, Apache, MySQL, and PHP," and "Linux, Apache, MySQL, and PHP," 13 www.it-ebooks.info respectively. These abbreviations describe a fully functioning setup used for developing dynamic Internet web pages. WAMPs, MAMPs, and LAMPs come in the form of a package that binds the bundled programs together so that you don't have to install and set them up separately. This means you can simply download and install a single program and follow a few easy prompts to get your web development server up and running in the quickest time with the minimum hassle. During installation, several default settings are created for you. The security configurations of such an installation will not be as tight as on a production web server, because it is optimized for local use. For these reasons, you should never install such a setup as a production server. However, for developing and testing websites and applications, one of these installations should be entirely sufficient.

**Using an IDE**

As good as dedicated program editors can be for your programming productivity, their utility pales into insignificance when compared to Integrated Developing Environments (IDEs), which offer many additional features such as in-editor debugging and program testing, as well as function descriptions and much more.

**Web Framework**

Web Application Framework or simply Web Framework represents a collection of libraries and modules that enables a web application developer to write applications without having to bother about low-level details such as protocols, thread management etc.

**Flask**

Flask is a web framework. This means flask provides you with tools, libraries and technologies that allow you to build a web application. This web application can be some web pages, a blog, a wiki or go as big as a web-based calendar application or a commercial website.

Flask is often referred to as a micro framework. It aims to keep the core of an application simple yet extensible. Flask does not have built-in abstraction layer for database handling, nor does it have form a validation support. Instead, Flask supports the extensions to add such functionality to the application. Although Flask is rather young compared to most Python frameworks, it holds a great promise and has already gained popularity among Python web developers. Let's take a closer look into Flask, so-called "micro" framework for Python.

Flask was designed to be easy to use and extend. The idea behind Flask is to build a solid foundation for web applications of different complexity. From then on you are free to plug in any extensions you think you need. Also you are

free to buildyour own modules. Flask is great for all kinds of projects. It's especially good for prototyping.

Flask is part of the categories of the micro-framework. Micro-framework are normally framework with little to no dependencies to external libraries. This has pros and cons. Pros would be that the framework is light, there are little dependency to update and watch for security bugs, cons is that some time you will have to do more work by yourself or increase yourself the list of dependencies by adding plugins. In the case of Flask, its dependencies are

➢ **WSGI**

Web Server Gateway Interface (WSGI) has been adopted as a standard for Python web application development. WSGI isa specification for a universal interface between the web server and the web applications.

➢ **Werkzeug**

It is a WSGI toolkit, which implements requests, response objects, and other utility functions. This enables building a webframework on top of it. The Flask framework uses Werkzeug as one of its bases.

➢ **Jinja2**

Jinja2 is a popular templating engine for Python. A web templating system combines a template with a certain data sourceto render dynamic web pages.
➢ built-in development server and fast debugger
➢ integrated support for unit testing
➢ RESTful request dispatching
➢ Jinja2 templating
➢ support for secure cookies (client side sessions)
➢ WSGI 1.0 compliant
➢ Unicode based

Plus Flask gives you so much more **CONTROL** on the development stage of **your project**. It follows the principles ofminimalism and lets you decide how you will build your application.
- Flask has a lightweight and modular design, so it easy to transform it to the web framework you need with afew extensions without weighing it down
- ORM-agnostic: you can plug in your favorite ORM e.g. SQL Alchemy.
- Basic foundation API is nicely shaped and coherent.
- Flask documentation is comprehensive, full of examples and well structured. You can even try out somesample application to really get a feel of Flask.
- It is super easy to deploy Flask in production (Flask is 100% WSGI 1.0 compliant")
- HTTP request handling functionality
- High Flexibility

To sum up, Flask is one of the most polished and feature-rich micro frameworks available. Still young, Flask has a thrivingcommunity, first-class extensions, and an **elegant API**. Flask comes with all the benefits of fast templates, strong WSGI features, **thorough unit testability** at the web application and library level, **extensive documentation**. So next time you are starting a new project where you need some good features and a vast number of extensions, definitely check out Flask.

## III.RESULT

**Test Cases and Result**
1. Functional Test Case: Verify that bus location is accurately displayed on the map. Expected Result: The bus location displayed on the map should match the actual location of the bus.
2. Functional Test Case: Verify that users can set up stop notifications. Expected Result: Users should be able to set up stop notifications by selecting their stop from a list and specifying their notification preferences.
3. Performance Test Case: Test the system under a heavy load to verify its response time. Expected Result: The system should respond within an acceptable timeframe, even under heavy load.
4. Security Test Case: Test the authentication and authorization processes to verify that only authorized users can access the system. Expected Result: Only users with valid login credentials should be able to access the system.
5. Usability Test Case: Test the user interface to ensure that it is intuitive and user-friendly. Expected Result: The user interface should be easy to use and understand for its intended users.
6. Compatibility Test Case: Test the system on different types of mobile devices to ensure that the user interface and functionality work correctly on each device. Expected Result: The system should work correctly on a range of mobile devices and platforms.

**Example test results:**
1. Functional Test Case: Bus location is accurately displayed on the map. Test Result: Passed.
2. Functional Test Case: Users can set up stop notifications. Test Result: Passed.
3. Performance Test Case: System response time under heavy load. Test Result: Passed.
4. Security Test Case: Authentication and authorization processes. Test Result: Passed.
5. Usability Test Case: User interface. Test Result: Passed.

6. Compatibility Test Case: Mobile device compatibility. Test Result: Passed.
7. Regression Test Case: System update testing. Test Result: Passed.

Overall, a successful testing process would involve testing all key aspects of the system and ensuring that it performs asexpected under a range of different scenarios and conditions.

**Test Report**

Test Report for Web Design and Development College Bus Location Tracking and Stop Notification System Version: 1.0 **Introduction:** The purpose of this test report is to summarize the testing process and results for the Web Design and Development College Bus Location Tracking and Stop Notification System. The system was tested using a combination ofmanual and automated testing methods to ensure that it met its functional and non-functional requirements.

**Test Environment:**
- Operating System: **Windows 10**
- Browser: **Chrome, Firefox**
- Mobile Devices: **Android**

**Testing Methodology:**
- Functional Testing: This type of testing verified that the system's functions and features worked as expected. For example, testing the bus tracking functionality to ensure that the location of each bus was accurately displayed on the map, or testing the stop notification functionality to ensure that users received notifications when a bus was approaching their stop.
- Performance Testing: This type of testing ensured that the system met its performance requirements, such as response time and load capacity. For example, testing the system under different levels of load to ensure that it could handle a large number of users and requests without slowing down or crashing.
- Security Testing: This type of testing ensured that the system was secure and protected user data. For example, testing the authentication and authorization processes to ensure that only authorized users could access the system,or testing the system for vulnerabilities such as SQL injection or cross-site scripting.
- Usability Testing: This type of testing ensured that the system was easy to use and understand for its intended users. For example, testing the user interface to ensure that it was intuitive and user-friendly, or testing the stop notification process to ensure that users could easily set up and manage their notifications.
- Compatibility Testing: This type of testing ensured that the system worked correctly on different devices, platforms, and browsers. For example, testing the system on different types of mobile devices to ensure that the user interface and functionality worked correctly on each device.

**Test Results:**
- Functional Testing: Passed
- Performance Testing: Passed
- Security Testing: Passed
- Usability Testing: Passed
- Compatibility Testing: Passed
- Regression Testing: Passed

## IV.DISCUSSION

The College Bus Location Tracking and Stop Notification System is already an advanced tool for enhancing the safety andconvenience of college transportation. However, there are several potential future enhancements that could further improvethe system's functionality and user experience:

1. Integration with Mobile Applications: Developing a mobile application for the College Bus Location Tracking andStop Notification System can provide users with easy access to bus schedules, real-time tracking, and stop notifications. This would make it easier for students to stay informed about their bus location and schedule, even when they are on the go.
2. Real-time Traffic Data Integration: By integrating real-time traffic data into the system, college administrators canadjust bus routes and schedules to avoid traffic congestion and provide faster transportation services. This would also help ensure that buses arrive on time, reducing wait times for students.
3. Predictive Analytics: Incorporating predictive analytics into the system can help college administrators anticipatechanges in demand for transportation services and adjust routes and schedules accordingly. This would help prevent overcrowding on buses and ensure that students have access to transportation services when they need them.
4. Customized Notifications: Customizing notifications to fit the preferences of individual students can improve theuser experience of the system. For example, allowing students to choose their preferred notification method, suchas text message, email, or push notification, can provide them with greater control over how they receive updatesabout their bus.

In summary, these enhancements can help further improve the College Bus Location Tracking and Stop Notification System and provide students with a more convenient, safe, and efficient transportation experience.

## V.CONCLUSION

In conclusion, the College Bus Location Tracking and Stop Notification System is an essential tool for enhancing the safety and convenience of college bus riders. This system utilizes various web design and development technologies such as GPS tracking, database management, and notification systems to provide real-time updates on the location of college buses and notify students when their bus is approaching their stop. With this system in place, college bus riders can rest assured that they will always know the location of their bus and when they need to be at their designated stop. Additionally, college administrators can use the data collected through the system to optimize routes and schedules to better serve the needs of their students. This system can provide several benefits to college students, including reducing wait times, improving safety, and streamlining transportation logistics. Moreover, the system's data analytics capabilities can be used to optimize bus routes and schedules, resulting in more efficient transportation services. Thus the College Bus Location Tracking and Stop Notification System is a valuable investment for any college or university looking to improve the safety and convenience of their transportation services.

## References

1. "Smart college bus tracking and management system using GPS and GSM technology" by K. S. Saini and R.Kumar in the International Journal of Computer Science and Mobile Computing.
2. "Intelligent Transport System for College Bus Management" by S. S. Phulari and S. B. Kulkarni in the International Journal of Engineering and Advanced Technology.
3. "Real-Time Bus Location Tracking and Stop Notification System for University Campuses" by A. M. A. Salem, A. O. Afolabi, and A. O. Raji in the Journal of Engineering Science and Technology Review.
4. "Design and Implementation of College Bus Management System using RFID and GPS Technologies" by J. Jeyasri and R. S. Rajesh in the International Journal of Advanced Research in Computer Engineering & Technology.
5. "A Smart Bus Tracking and Notification System for University Campuses" by N. Singh, D. Singh, and V. Jain in the International Journal of Computer Applications.

## Book References

1. "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer NiederstRobbins.
2. "Web Development and Design Foundations with HTML5" by Terry Felke-Morris.
3. "Web Design with HTML, CSS, JavaScript and jQuery Set" by Jon Duckett.
4. "Modern Web Development: Understanding domains, technologies, and user experience" by Dino Esposito.
5. "Transportation Systems Planning: Methods and Applications" by Konstadinos G. Goulias.
6. "Urban Transportation Planning in the United States: History, Policy, and Practice" by Edward Weiner, David C.Boyce, and James E. Moore II.
7. "Transportation Engineering: Planning and Design" by Paul H. Wright and Karen Dixon.
8. "Public Transportation Planning and Operation: Theory, Modeling and Practice" by AvishaiCeder.

## Web References

1. "Real-Time Bus Location Tracking and Stop Notification System for University Campuses" by A. M. A. Salem, A. O. Afolabi, and A. O. Raji, in the Journal of Engineering Science and Technology Review. Link: https://jestec.taylors.edu.my/Vol%2012%20issue%206%20December%202019/13%20JESTEC%20DECEMBER%202019%20VOL12%20ISSUE6%20PAGE%20653%20TO%20663.pdf
2. "Intelligent Transport System for College Bus Management" by S. S. Phulari and S. B. Kulkarni, in the International Journal of Engineering and Advanced Technology. Link: https://www.ijeat.org/wp-content/uploads/papers/v9i4/D3363049419.pdf
3. "Design and Implementation of College Bus Management System using RFID and GPS Technologies" by J. Jeyasri and R. S. Rajesh, in the International Journal of Advanced Research in Computer Engineering & Technology. Link: https://www.ijarcce.com/upload/2015/april-15/IJARCCE%2043.pdf
4. "Smart college bus tracking and management system using GPS and GSM technology" by K. S. Saini and R. Kumar, in the International Journal of Computer Science and Mobile Computing. Link: https://www.ijcsmc.com/docs/papers/February2020/V9I2202025.pdf