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# Transportation System Incorporating Integrated GPS Technology

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**Abstract:** *Using "bus tracking" software, buses are tracked and their stop distances calculated. The administrator or user may track the vehicle by installing an electronic device in the automobile and downloading an Android app to any SMART phone. Two applications client and server. GPS trackers are on buses. These ranks are updated regularly for the server. Client application displays bus position on map. It shows bus whereabouts on a map and updates clients at different intervals. The server will monitor location and save data in a database. GPS data is transferred automatically to a central computer, system, or SMART phone, making it real-time. The user is notified of bus arrival. This Android app uses SQ Lite on a SQL Server for its backend. Customers may plan their trips and pick bus times using the app. User wait times may be reduced. The Bus Tracking system relies on simple communication*

**Keywords:** Vehicle management, Real-time monitoring

## I. INTRODUCTION

Transport Management System (TMS) integrated GPS/GIS to collect on-road traffic data from probe vehicles. This system is coupled to a vehicle's engine management system to provide second-by-second GPS position, speed, distance traveled, acceleration, fuel consumption, engine performance, and air pollution emissions. All GPS/GIS tracking systems employ the Global Positioning System to detect and register an item's location, which may be used to calculate its speed. Government and law enforcement enjoy the technology' civilian usage. Transportation data, like other social science and civil engineering data, is typically geographical. Travel time information connects to routes, origin-destination information to regions, and traffic counts to locations[1]. These include discovering, tracking, mapping, navigating, and timing[2].

The TMS relies on GPS data for static observations and dynamic vehicle tracking. GIS plays a vital role in data entry, integration, administration, analysis, and display [3].

The US Department of Defense launched satellites to construct GPS. Every instant, three or more of the 24 satellites in orbit will be accessible beneath the earth [4]. Japan and the EU are now developing systems similar to theirs.

Receivers may receive signals from at least three satellites to assure accuracy. GSM (Global System for Mobile Communications) technology sends this and shows the vehicle's location at the base station [5] and on sensitive roadside cameras.

GIS and GPS may be connected several ways. GIS-GPS integration has various industrial applications [6, 7]. One of the fastest-growing sectors is vehicle monitoring, which includes vehicle speed check tools [8]. We will present the online-mode TMS based on vehicle tracking and speed check for vehicle (object) navigation in this research.

GIS and GPS have improved transportation management and monitoring. Vehicle monitoring systems are ideal for tracking mobile vehicles and minimizing traffic congestion. The system locates cars using GPS satellites, receivers, and other equipment. Display the vehicle's geographic coordinate on the monitoring system's digital road map. Conventional database systems can only hold reference data, therefore geographical or locational attributes are usually worthless. GIS can link a database's geographical attributes with regional maps and spatially integrate it with other relevant databases for that area.

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advantages include: If the client and server are connected online, the client benefits those without other information channels; the server receives street traffic information from the clients, and the base station receives such information in text format corresponding to the spatial data stored in the spatial database.

**Background**

**Spatial Data Processing Methodology**

Spatial data processing using a client/server paradigm may solve this difficult problem. Each client is monitored by a monitoring station and the server is in a control center [9]. Any public transportation agency, business organization, or Traffic Control Police Station may use it. Since the server solely maintains geographical data and conducts client-requested actions, the recommended structure may guarantee data integrity and cost-effective database maintenance. Among major GPS may be used in many GIS applications. These include sending GPS data to create new geographical databases and fully integrating GPS technology into GIS systems for on-the-spot spatial analysis [6]. GIS-GPS integration might be technology-, position-, or data-focused. Each solution relies on the user's field-based operations needs, GPS dependence, and, most critically, if a comprehensive system is available to meet those needs.

**GIS-GPS and Its Integration**

The GPS locates the device using satellites and ground receivers. GPS receivers compare time signals from numerous satellites in direct line of sight to calculate their location. Three satellites are needed to determine the receiver's latitude and longitude. Height information requires four or more satellite signals. As they orbit the earth, the 24 satellites relay radio messages twice daily from 12,000 miles overhead. GPS can quickly, impartially, and maybe more ethically measure contextual exposure in a population where behavioral data may be scarce. Many applications utilize GPS to measure activity and exposure. GPS technology has expanded space-time analysis by capturing route trajectories as well as origins and destinations. GPS has been used in several smart phone devices. GPS devices may send, receive, or both geolocation data.

City traffic is crowded at peak hours due to urbanization. Driving is tough during these hours, and we have to call the driver to check the bus's condition, which might create accidents and frustration. We can check the status even if the driver doesn't answer. In this research, the "Bus Track" app was created to avoid this.

**Google Maps API'S**

Given the dynamic nature of GPS data, which undergoes changes every second, Google is compelled to deploy a substantial number of servers. However, centralizing these servers in a single location lengthens the time required to deliver and receive data and complicates accessibility. In order to prevent such circumstances, Google has implemented servers in a distributed environment, where local servers are maintained everywhere. These servers are maintained by their parent servers, which are arranged in a hierarchy that culminates in the root server. Location information provided by Google Services includes latitude, longitude, directions, minimum time, distance, and other specifics about the location. Using the Google Maps API, the map is generated with all the essential features, including locations, roads, colonies, hotels, and shopping centers. The Google Directions API was utilized to generate source-to-destination directions. In order to access these APIs, an API key is generated and SHA1 security credentials are signed in.

**Problem Statement**

A challenge faced by students from different institutions is that they are unable to determine the precise location of the vehicle; rather, they are solely informed of its expected arrival time. Students are required to wait for a transport without knowing its exact arrival time. When students are in a haste to catch a bus for whatever reason, they may experience anxiety and impatience if they are unable to determine when the bus will arrive. This is especially true when they are awaiting the bus at a specific time. Furthermore, a substantial amount of time was squandered while waiting at the bus station. When passengers inquire about the whereabouts of their bus with the bus conductors, a perilous circumstance arises. During these hours, driving is a tremendous undertaking, and we are continually contacting the driver to inquire about the bus's whereabouts, which could result in accidents and driver annoyance.Develop an application catering to the needs of users (students and lecturers) seeking up-to-date information regarding college vehicles. A centralized server is utilized to provide bus passengers with the computed ETA.

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**System Study**

**Existing System**

by employing the clustering and backpropagation techniques of the K-Means Prediction System to forecast the mean velocity of buses. K-Means is an unsupervised learning algorithm utilized for the purpose of classifying a given data set into clusters. Using the Haversine formula, the distance between latitude and longitude is computed due to its superior accuracy.

**Pitfalls of the study**

The daily operation of bus transport systems, particularly buses, is influenced by various uncertain conditions that arise throughout the day. These conditions include traffic congestion, unforeseen delays, and irregular vehicle dispatching times. • A considerable number of students arrive tardy to class as a result of choosing to wait for the bus rather than utilizing an alternative mode of transportation.

**Proposed System**

The application utilized by our proposed system illustrates transit monitoring through smart phones. The application utilizes the mobile device's GPS. Location (Latitude & Longitude) and vehicle status data are transmitted to the server via the GPS. The recipient is the user whose smart phone is equipped with Maps and through which he can access information pertaining to the location of the bus.

**System Architecture**

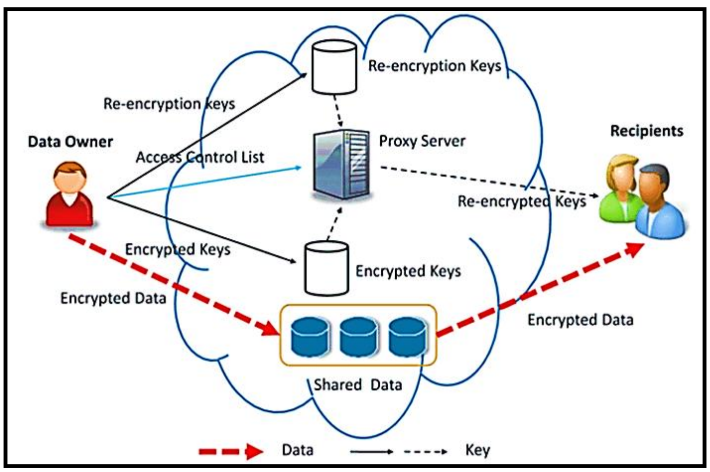


**Figure 1. Proposed System Architecture**

**Proposed Flow model**

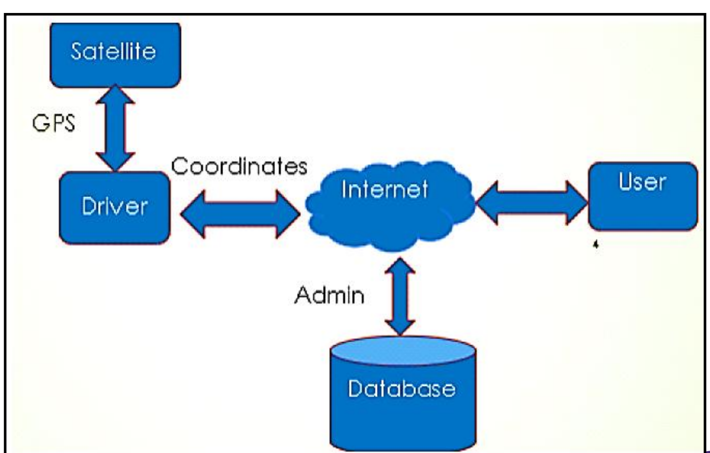


**Figure 2. Proposed Flow model**

**Description**

In order to determine the whereabouts of the vehicle, the client shall utilize his Android device. The server receives requests in an automated fashion.

A GPS device is mounted on the bus conductor.

It will locate itself via GPS and transmit that information to the server.

While the server manages the locations, the client retrieves the transit information.

The application utilizes Google APIs to display the maps in this project.

The bus allocation and information are managed by the administrator.

We have implemented Microsoft SQL Server for the database in order to accomplish this.

Whenever a client submits a request for transit information, the server-side API will retrieve the data from the database and return it to the client.

Once the bus location is retrieved, it is transmitted alongside the user's location via the Google Maps API.

**Result and Analysis**

The application was created in accordance with the subsequent system requirements: Xamarin Forms, Microsoft SQL Server:

**Xamarin Forms:** It is a Microsoft cross-platform open-source framework for developing.NET applications for Android, iOS, and Windows from a single shared code base.

**Microsoft SQL Server:** Microsoft SQL Server operates as a SQL database engine. In its capacity as a database server, this software product facilitates the storage and retrieval of data in response to requests from other software applications, which may operate on separate computers or the same one.

**Languages used:** C#,.NET Concepts and IDE'S & Tools used: Visual Studio and Postman

The hardware utilized in the construction of this undertaking comprises an Intel i5 processor or higher, 8GB RAM, and 200GB Memory.

The project is composed of server-side and client-side components.

**Server Side:**

Microsoft SQL Server ASP.NET and ASP.NET MVC are utilized to develop the server side.Web MVC API: The ASP.NET MVC 5 is a Mode-View-Controller (MVC) architecture-based web framework. The ASP.NET MVC framework facilitates developers in constructing dynamic web applications by promoting clear separation of concerns, accelerating development, and being TDD-friendly. MVC represents a controller, view, and model. MVC divides an application into Model, View, and Controller components.

**Model:** The model represents the structure of the data. A class in C# serves to describe a model. In model objects, data that has been retrieved from the database is stored.

**View:** View is the user interface in MVC. View presents model data to the user and grants them the ability to edit it. The View component of ASP.NET MVC is composed of HTML, CSS, and Razor syntax, which facilitates communication between the controller and model.

**Controller:** The user contact is managed by the controller. In general, when a user interacts with the view, they initiate an HTTP request that the controller subsequently processes. The controller executes the request and provides the response containing the requested view.

ASP.NET Web API is a framework for developing HTTP services that are accessible from browsers and mobile devices, among other clients. It is the optimal platform for developing RESTful.NET Framework applications.

**Client Side:**

**Xamarin.Forms:** Xamarin, in fact. Microsoft's Forms is an open-source, cross-platform framework that enables the development of.NET applications for iOS, Android, and Windows from a single shared codebase. Employ Xamarin. Forms integrated into pages, layouts, and controls for developing and designing mobile applications via a solitary, highly extensible API. Customize the behavior of any control by subclassing it, or create an application with pixel-perfect controls, layouts, pages, and cells by defining your own. C#: C# (C-Sharp) is a Microsoft-developed programming language that is implemented within the.NET Framework. It implements object-oriented programming principles. The language C# originates from the C family and is related to well-known programming languages such as

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C++ and Java. C# is used to create desktop and mobile applications, web applications, games, and much more. It is implemented on both the server and client sides.

**Registration Page:**

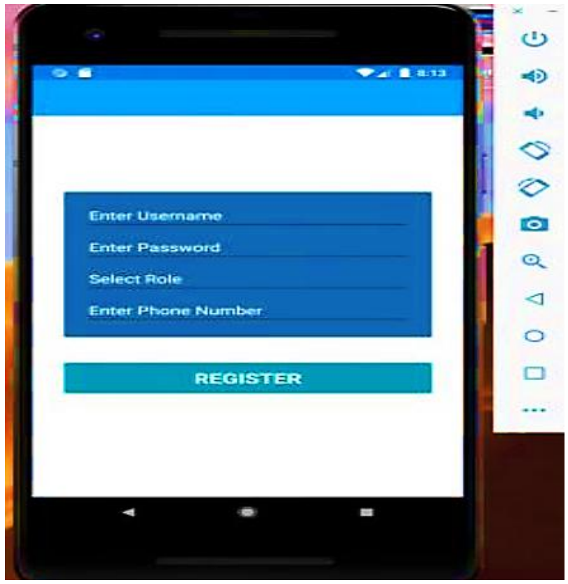


**Figure. Registration page**

If the user is not already registered, they are required to do so. Each of the four entry fields is illustrated in Figure 3. In addition, a single icon containing the user name, password, role, and phone number. The following fields are required: phone number, while the remaining field is not. In the duty field, which is a drop-down menu, the user must indicate whether they are a chauffeur, pupil, or lecturer.

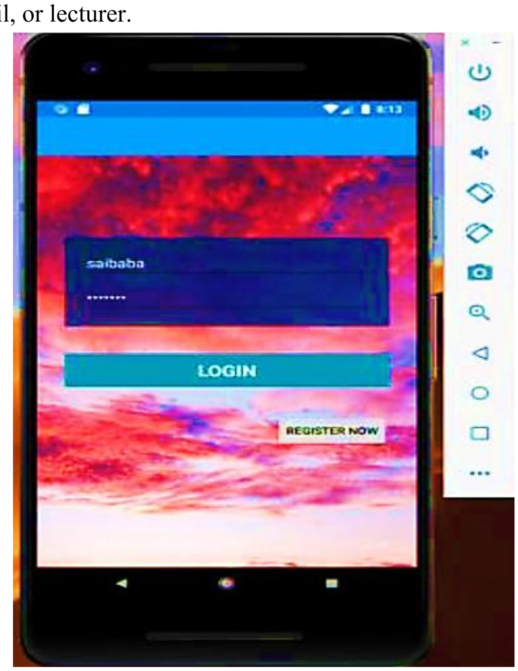


**Figure Login Page**

**Login Page:** The user is required to input his username and password initially. The information is compared to the data in the database. If accurate, the user is redirected to the chauffeurs' page or the students' site, corresponding to his function. If not, they are required to register for the application.

**Students Page:** It directs the user to the student's page, where they can view an inventory of available buses, if they are a lecturer or student.

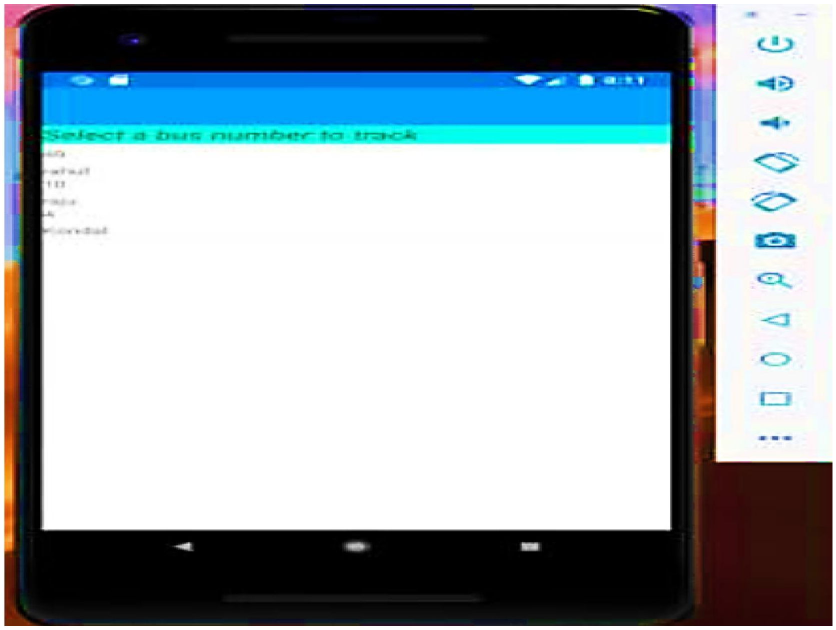


**Figure Check available buses**

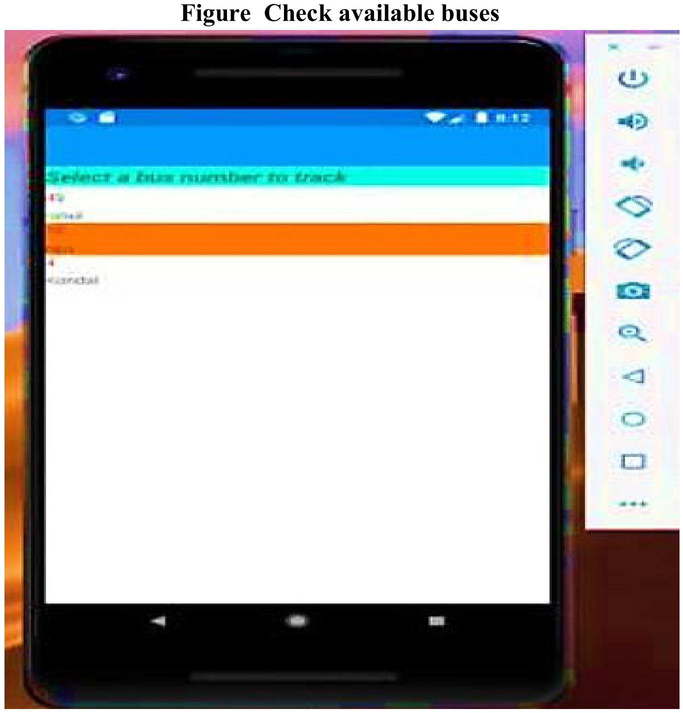


**Figure Track bus details**

**Driver Page:** Upon logging in, the driver will be directed to the driver page, where they can manually input the latitude and longitude coordinates into the emulator to determine the location. However, in a real-time scenario, the GPS functionality on their device will request permission to trace the bus's whereabouts. An update is made to the bus's location.

**Track the location of the selected bus:** The user is able to monitor the whereabouts of the designated bus and predict its arrival time. Additionally, when the bus approaches their current location, they will receive an alert notifying them of its approach. On the map, both the user point and transit position are visible.

## II. CONCLUSION

This paper presents a novel application that utilizes smart phones for the purpose of bus monitoring. The application utilizes the mobile device's GPS. Location (Latitude & Longitude) and vehicle status data are transmitted to the server via the GPS. The application provides users with the ability to observe bus location details on their smart phones through the integration of Maps. This functionality offers users convenience and flexibility in trip planning, enabling them to make informed decisions about when to board the bus. The duration of the user's delay can be decreased. Communication simplicity is the defining characteristic of the Bus Tracking system. Further efforts will be made to integrate a user profile into the application so that it can be enhanced with functionality such as user deactivation and profile updates. Additionally, an administration portal will be developed to facilitate bus driver enrollment and bus allocation. Through integration with a cloud framework, all smartphone users will have access to it.

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