International Journal of Computer Engineering in Research Trends
Multidisciplinary, Open Access, Peer-Reviewed and fully refereed
Research Paper Volume-8, Issue-11, 2021 Regular Edition E-ISSN: 2349-7084

Transportation System Using Integrated GPS

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Available online at: http://www.ijcert.org

Received: 22/11/2021, Revised: 25/11/2021, Accepted: 29/11/2021, Published: 01/12/2021

Abstract: - Bus tracking is an application that tracks a bus and gathers the distance to each station along its route. Tracking System involves the installation of an electronic device in a vehicle, with an installed Android App on any SMART phone to enable the Administrator/User to track the vehicle's location. There are two applications one for server and the other for the client. Buses carry GPS devices• to track their positions. By these positions to server are periodically updated. Client application displays map showing the position of bus. It shows where buses are on a map and provide users the updated information at different time interval. The server will monitor location and will store its data in the database. It is a real-time system as this method automatically sends the information on the GPS system to a central computer or system/SMART phone. At the Bus Arrival the User gets an alert/notification. Since this is an android application we use SQLite, SQL server database for the backend. The users can get flexibility of planning travel using the app, to decide on when to catch the bus. The waiting time of the user can be reduced. Simple mode of communication is the key feature of the Bus Tracking system.

Keywords: Global Positioning System, Model View Controller, Transport Management System, Global System for Mobile communications, Google Maps, Application Programming Interface.

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1. Introduction

The Transport Management System (TMS) has developed integrated GPS/GIS for collecting on-road traffic data from a probe vehicle. This system has been further integrated with the engine management system of a vehicle to provide time tagged data on GPS position and speed, distance travelled, acceleration, fuel consumption, engine performance, and air pollutant emissions on a second-by-second basis. All GPS/GIS tracking systems use the Global Positioning System to determine and regularly record the location of an object and it can be used to calculate the targeted objects speed. The systems are popular with government and law enforcement officials, and have many civilian applications. Transportation data, in common with many other data sets in civil engineering and the social sciences, often have spatial attributes. For example, traffic counts come from specific sites, travel time data refer to particular routes, and origin destination data apply to a given area[1] generally, this fall into the following areas: tracking, mapping, navigating, locating and obtaining precise timing[2].

A key element of the TMS is the use of GPS data to determine locations, for both static observations and dynamic recording of vehicle positions over time. The GIS takes on the central role in data management, in terms of data entry and integration, data management, and some aspects of data analysis and display[3].

The GPS is a network of satellites placed into orbit by the U.S. Department of Defense. There are 24 satellites available in space and it is guaranteed that at any given time, there will be at least three satellites available anywhere under the sky[4] But now many countries like European union and Japan are doing similar project of their own system.

Receivers can catch the signals at least from these three satellites to guarantee the accuracy of signals caught from them. GSM (Global System for Mobile communications) technology is used to transmit this and display the geographical position of the vehicle at the base station[5] and special sensitive cameras distributed at the road sides.

The integration of GIS-GPS technologies can be achieved in many ways. GIS-GPS integration has numerous applications in various fields [6,7]. One of them is vehicle tracking, which is one of the most developing field, by vehicle tracking in addition we mean vehicle speed check tool[8] . In this paper, we would like to present the TMS depending on vehicle tracking and speed check system for vehicle (object) navigation, which is depends on online mode.

GIS and GPS technology have brought some breakthrough in the area of transportation monitoring and management. One of the most useful applications is a vehicle tracking system to determine and trace the position of the mobile vehicle1 and to avoid road congestions. The system locates vehicles using GPS satellites, GPS receivers and other auxiliary equipment's display the geographical coordinate of the vehicle position on a digital road map of the monitoring system

Conventional database systems cannot make much use of the spatial or locational attributes of a data set, other than hold reference details for it. Geographical Information Systems (GIS), on the other hand, can absorb a database, relate its spatial attributes to maps of the region, and offer spatial integration with other pertinent databases for that region.

As a part of Urbanization the cities are Congested with Vehicles during Peak hours. During these Hours driving is really a big task and to know the Status of the Bus we constantly keep calling the Driver which may lead to Accidents & Irritation to the Driver. We can know the Status even if the Driver doesn't answer the calls. So in this paper we develop To avoid this Inconvenience "Bus Track" Application was Designed. of the paper.

2. Background

2.1 Spatial Data Processing Methodology

Spatial data processing based on a client/server structure may be a methodology well-suited for tackling this burdening problem. The approach employs a server and multi-clients architecture in which the server exists in a control center and each client falls under one of monitoring stations [9]. available in any public transportation agents or private companies or Traffic Control Police Station. The proposed structure may achieve the data integrity and cost-effective maintenance of database, since the server manages exclusively the spatial data and deals with a series of processes requested from the client side. One of the big advantages is that if the server and clients are connected on-line, the server would obtain the traffic information occurring on the streets, the base station obtains the traffic information from the clients in text format corresponding the spatial data which stored in spatial database, the clients benefits those without any interconnection to other information channels.

2.2 GIS-GPS and Its Integration

The GPS uses a set of satellites and ground receivers to determine the location of the GPS enables device. A GPS's receiver location is calculated by comparing time signals from several satellites, of which each has to have a direct line of sight to the receiver. At least three satellites are necessary to determine the receiver's two-dimensional location (latitude and longitude). To achieve additional and more accurate information like altitude, four or more satellite signals are required. The 24 satellites orbit around the earth twice a day transmitting radio signals from approximately 12,000 miles above the earth. In a population where it is often difficult to assess accurate and reliable information on behaviors, GPS offers a timely, objective and potentially more acceptable method of evaluating contextual exposure. GPS technology has been used in variety of applications to measure exposure and activities. GPS technology has expanded the scope of space time analysis by allowing the recording of not only trip origins and destinations, but also the routes travelled. Using GPS technology many smart phone devices have been manufactured. A device with GPS enabled can send or receive or both of geo co-ordinates.

The integration of GPS technology into GIS activities can be achieved through a variety of means. These range from the transfer of data from GPS systems, for the building of new Spatial database, to the complete integration of GPS technology into existing GIS systems, to conduct spatial analysis directly in the field [6]. The GIS-GPS integration can be done in three categories: Data-focused integration, Position-focused integration, Technology-focused integration. The appropriateness of each method is dependent upon the requirements that a user has for field-based operations, the level of dependence the user has on GPS and, to a large extent, the availability of a complete system to meet the specific needs that the user has for a system.

2.3 Google Maps API'S:

As GPS is not static data which changes dynamically every second, Google must incorporate large number of servers. But placing these servers at single location increases the duration in delivery/receiving of data, accessibility becomes hectic task. To avoid such situations Google has incorporated servers in distributed environment (i.e.) at every place local servers are maintained which are maintained by their parent servers which follows the

hierarchy to root server. Google services provide us with location details such as latitude, longitude, directions, minimum time, distance, place details etc. The Google Maps API is used to generate the map with all the basic things like places, roads, colonies, hotels, malls etc. The Google Directions API used to generate the directions between source and destination. We access these API's by generating an API key and signing in SHA1 security credentials.

2.4 Problem Statement

One of the problems occurring to students of various colleges is that they do not know exactly where the bus is, but only know the scheduled arrival time. Students need to wait for a bus without knowing what time the bus will arrive actually. Sometimes, the student might feel anxious and impatient when they waiting for a bus if they do not know what time the bus will arrive especially when student rushing of time for certain reason. Additionally, this situation wasted a lot of time when waiting in the bus stop. There is dangerous situation when students call the bus drivers to find out where the bus. During these Hours driving is really a Big task and to know the Status of the Bus we constantly keep calling the Driver which may lead to Accidents & Irritation to the Driver.To design an application for the Users(Student/Lecturers) who want real time information about the buses in the college. Using a centralized server to share the calculated ETA to bus passengers.

3. System Study

3.1 Existing System

A Prediction System known as K-Means is used to predict the average velocity of bus using clustering and back propagation method. K-Means is one of the unsupervised learning algorithms to make clusters in data and classifies the data set into clusters. The distance between the latitude and longitude is calculated using Haversine formula as it provides greater accuracy.

Pitfalls of the study

In the daily operation of bus transport systems, mainly that of buses, the movement of vehicles is affected by the different uncertain conditions as the day progresses such as: • traffic congestion • unexpected delays • irregular vehicles dispatching times • Many students are late for classes because they decide to wait for the bus instead of just simply using a alternate transportation.

3.2 Proposed System

Our proposed system demonstrates the Application demonstrates the bus tracking using smart phones. The application uses the GPS built-in mobile. The GPS is used to transmit the location (Latitude & Longitude) and vehicle status information to the server. The receiver is the user who can view the details regarding the bus location using his smart phone via Maps integrated in the Application.

3.2.1 System Architecture

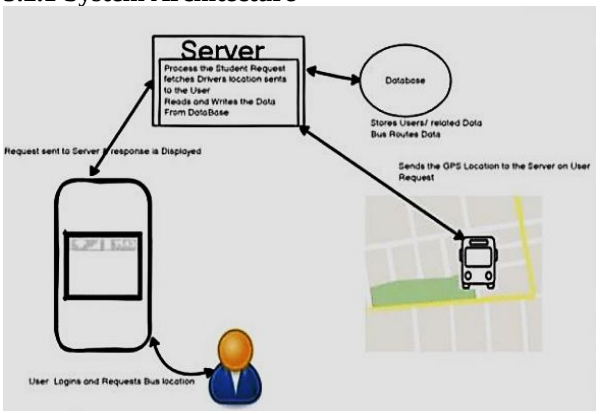

Figure 1. Proposed System Architecture

Proposed Flow model

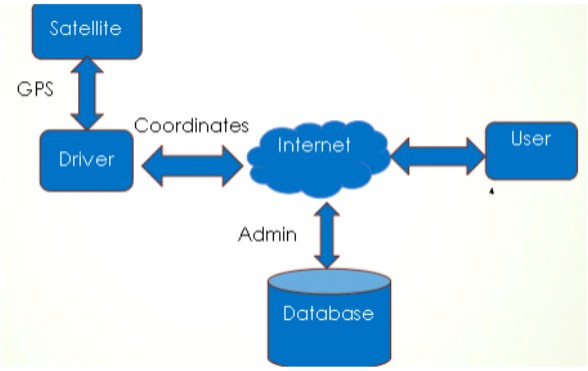

Figure 2. Proposed Flow model

3.2.2 Description

1. Client will ask for the location of the bus through his Android device. Request to the server is made automatically.
2. Bus driver is equipped with GPS device
3. Through GPS it will find its location and deliver it to server.
4. Server will handle the locations and client will fetch the bus details.

5. In this project, the application is using Google APIs to show the maps.

6. The bus allotment and bus details are maintained by the admin.

7. For this purpose, we have used Microsoft SQL server for the database.

8. Now when client makes request for the bus information it will be fetched from the database and delivered to client through server-side API.

9. Once the bus location is fetched it is sent to the Google maps API along with the user location.

4. Result and Analysis

Application was developed in under following system specifications: Xamarin Forms, Microsoft SQL Server:

Xamarin Forms: It is an open-source cross platform framework from Microsoft for building Android, iOS and Windows apps with .NET from a single shared code base.

Microsoft SQL Server: Microsoft SQL Server is a SQL database. As a database server, it is a software product with the primary function of storing and retrieving data as requested by other software applications—which may run either on the same computer or on another.

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

The hardware used for the development of this project are INTEL i5 processor or above, 8GB RAM , 200 GB Memory

The project is divided into two parts server side and client side.

4.1 Server Side:

Server side is written using ASP.NET MVC and Microsoft SQL Server ASP.NET.MVC WEB API: ASP.NET MVC 5 is a web framework based on Mode-View-Controller (MVC) architecture. Developers can build dynamic web applications using ASP.NET MVC framework that enables a clean separation of concerns, fast development, and TDD friendly. MVC stands for Model, View, and Controller. MVC separates an application into three components - Model, View, and Controller.

Model: Model represents the shape of the data. A class in C# is used to describe a model. Model objects store data retrieved from the database.

View: View in MVC is a user interface. View display model data to the user and also enables them to modify them. View in ASP.NET MVC is HTML, CSS, and some special syntax (Razor syntax) that makes it easy to communicate with the model and the controller.

Controller: The controller handles the user request. Typically, the user uses the view and raises an HTTP request, which will be handled by the controller. The controller processes the request and returns the appropriate view as a response.

ASP.NET Web API is a framework for building HTTP services that can be accessed from any client including browsers and mobile devices. It is an ideal platform for building RESTful applications on the .NET Framework.

4.2 Client Side:

Xamarin.Forms: Xamarin.Forms is an open-source cross-platform framework from Microsoft for building iOS, Android, & Windows apps with .NET from a single shared codebase. Use Xamarin. Forms built in pages, layouts, and controls to build and design mobile apps from a single API that is highly extensible. Subclass any control to customize their behavior or define your own controls, layouts, pages, and cells to make your app pixel perfect. C#: C# (C-Sharp) is a programming language developed by Microsoft that runs on the .NET Framework. It is an object-oriented programming language. C# has roots from the C family, and the language is close to other popular languages like C++ and Java. C# is used to develop web apps, desktop apps, mobile apps, games and much more. It is used on both Server Side & Client Side.

Registration Page:

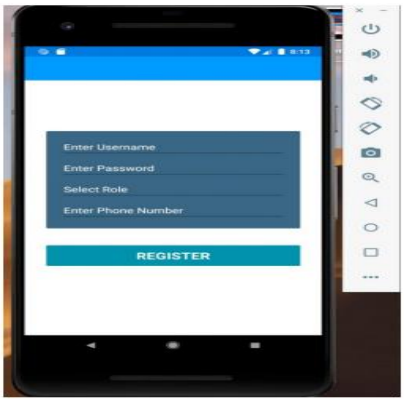

Figure 3. Registration page

The user has to register in the app if he is new. There are 4 entry fields as shown in figure 3. And one button which are the username, password, role and phone number. The first three fields are mandatory and phone number is optional. The role field is a dropdown box where he has to select if he/she is a student/lecturer/driver.

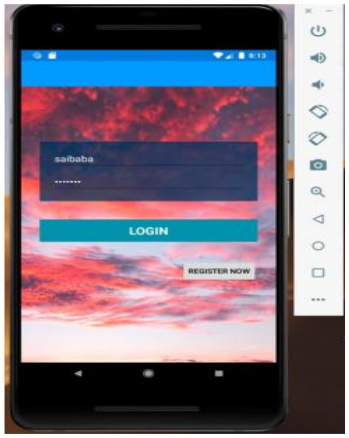

Figure 4. Login Page

Login Page: First the user has to enter his username and password. These details are compared with the details in the database. If correct, it then redirects to students page or drivers page depending on his role else he need to register for the app.

Students Page: If the user is a student or lecturer, it navigates them to the student's page where they can view list of available buses. The user can select any of the bus from bus list view and track the bus details such as location as shown in figure 5 and 6.

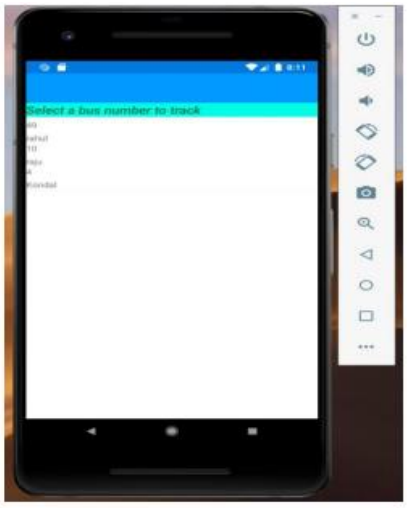

Figure 5 Check available buses

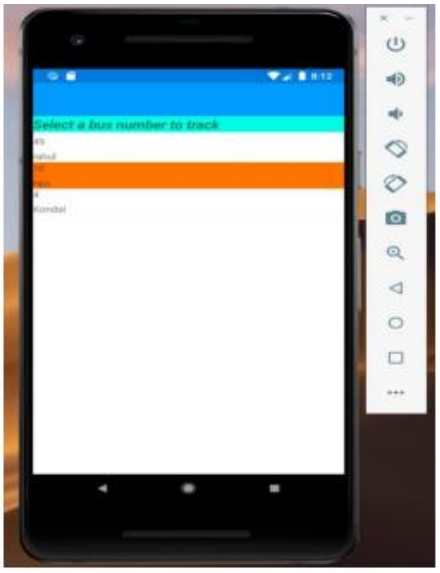

Figure 6. Track bus details

Driver Page: If the driver logins he will be navigated to the driver page where he can set the location by entering the latitude and longitude manually in the emulator but in real time scenario the GPS enabled in his device asks for permission to track the location of the bus. The location of the bus is updated.

Track the location of the selected bus: The user can track the location of the selected bus and can arrive at the location within the time he will also get an alert when the bus is nearby his location saying that the bus is arriving. Both the user point and bus point can be located on the map.

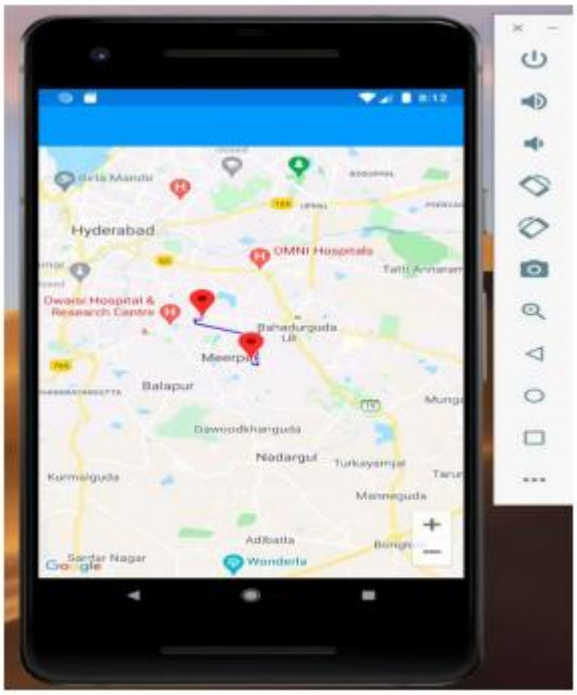

Figure 7. Track the location of selected buses

5. Conclusion

In this paper we demonstrate a novel application i.e bus tracking using smart phones. The application uses the GPS built-in mobile. The GPS is used to transmit the location (Latitude & Longitude) and vehicle status information to the server. Where the receiver is the user who can view the details regarding the bus location using his smart phone via Maps integrated in the Application, this application is helpful to the users and flexibility of planning travel using the app, to decide on when to catch the bus. The waiting time of the user can be reduced. Simple mode of communication is the key feature of the Bus Tracking system. Future work is try and implement a user profile to enhance the application to implement features like user logout and user profile update and also try to create an admin portal who plays a major role in bus driver enrollment and bus allotment. By integrating with cloud framework it will be accessible by every smartphone user.

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