City Bus Tracking System

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Abstract - *In this modern era, everyone wants to manage time and avoid wasting time on the journey to reach their destination. However, not everyone can afford a private vehicle, and thus, most people depend on public transport. Among all the public transport services available, the bus transport service is the most used by the public. But we know that the ongoing system does not provide complete information of local buses like the arrival/departure time of local buses. This leads to wastage of time waiting for buses at the bus stop, which is unreliable. Therefore, we proposed a system capable of solving this issue of bus transport. In this paper, we have come up with the city bus tracking system that not only provides all information about buses like arrival and departure time, current location, schedule but also stores the travel history of all passengers. The system is based on GPS technology employed for live tracking of the bus. The web-based application displays the approximate arrival and departure time, and also the bus location on Google Maps.*

Key Words: **GPS, real-time, Google Map, Bus Tracking, web application, Travel History**

1. INTRODUCTION

Public transportation facilities have to be well-established and active. The major transport facility used by the people in rural areas, also in cities, is the bus service system. Most people choose to travel by bus daily, and thus, this can reduce fuel consumption, air pollution, and traffic. Although many buses are available for various routes, yet no appropriate information about the timing is available. Even if the user knows the arrival time, the movement of the buses is unknown, which can be affected by various circumstances like traffic congestion, weather, and randomness in passenger demand and many more incidents. Due to insufficient information, people waste their time at the bus stop waiting for the bus. To reduce the waiting time and making the bus transport more attractive and convenient, we have developed a client-service based application that displays real-time information about the buses which includes the arrival and departure time, the bus schedule, and its live location on the map.

To track the bus, GPS (Global Positioning System) is used. Our proposed system requires an Android phone with a built-in GPS receiver in it. The GPS location of the bus is uploaded in the server, and then the user can access it via a web application using the internet. Our system is interfaced with Google Maps, which displays the live location of the buses on the map. By using the web application, the user can check the timing and location of buses at their home or workplace itself and can plan their departure accordingly.

Additionally, our system stores the travel history of all the passengers. As we know, the city buses do not store the data of passengers, so there is no travel history available. In case of emergency, storing the travel history of the passengers becomes vital. Our system helps to store the travel history of the passengers, which is carried out by the conductor of the bus. The conductor must enter the details of the passengers during their journey, and any authorized person can only access this information. Therefore, the bus details are made available without causing any inconvenience to the passengers.

2. LITERATURE SURVEY:

PAPER 1: Shubham Jain et al., "Application-based bus tracking system", 2019 International Conference on Machine Learning, Big Cloud and Parallel Computing, 14-16 Feb 2019.

This paper is based on a bus tracking system, in which a GPS Tracking application is used to track the bus. The passengers are unaware of the information regarding bus timing and therefore waste their time waiting for the bus on their particular route. GPS technology is user-oriented, to receive the navigating instructions at any instant of time. Here, the location of the bus is received from the satellite and then with the help of cellular networks, it is further processed and sent to the web-server. The coordinates received are processed through Google Maps API. Google Maps API helps to collect data like latitudes and longitudes, locations, etc.

The data received is processed in the user's device, to display the real-time information.

PAPER 2: Sharmin Akter et al., "A Cloud- Based Bus Tracking System based on Internet of Things Technology", 2019, 7th International Conference on Mechatronics.

In this paper, a Cloud-based bus tracking system based on IoT is proposed. The combination of cloud computing and the Internet of Things enables monitoring the bus services, which need to be stored, processed, and assessed. This paper proposed a mobile application, through which the passengers can track the location of the bus and estimate the arrival time of the bus. It is also provided with the nearest stoppage from the current location. Therefore, passengers with no worry can utilize their waiting time by choosing the nearest route.

PAPER 3: Priyanka V. Narkhede et al., "Bus Tracking System based on Location-Aware Services", International Journal of Emerging Technologies in Engineering Research, Volume 6, Issue 3, March 2018.

In day-to-day life, people travel from one place to another and most of the population use Bus as a medium to reach their destination. This paper mainly focuses on the problem with the buses, that the passengers do not know the exact timing of the arrival of buses. The location of the bus and routes taken by the buses could be easily tracked on a smartphone. Global Positioning System and Google Maps are used for navigation. An application based on the android is used, which includes information of all routes and bus details. The application is updated occasionally so that all the changes in bus routes and timings are noted. The user could merely request for the location of the bus, and the details stored in the database via a GPS device fitted on the bus can be retrieved whenever needed.

3. NEED FOR BUS TRACKING:

The public transportation system provides many benefits to the people and also the local economy as it reduces air pollution, increases fuel efficiency, reduces traffic congestion, saves money, ensures safety, etc. But despite that, people cannot completely depend on bus transportation as there is no proper information available regarding its timing. So, the main objective of the city bus tracking system is to provide the passengers the real-time location of the bus as well as bus arrival time so that passengers can completely rely on bus transport.

4. METHODOLOGY:

The proposed system is operated by the Android platform smartphone, with the built-in GPS receiver. The bus location is tracked using GPS, which is based on the trilateration mathematical principle. The location of the GPS can be determined as it is capable of receiving data from at least three satellites. To receive the signal from the satellite, the conductor should turn on the GPS in his Android smartphone. The device receives the GPS data and sends the latitude and longitude values of the location of the bus to the server at regular intervals.
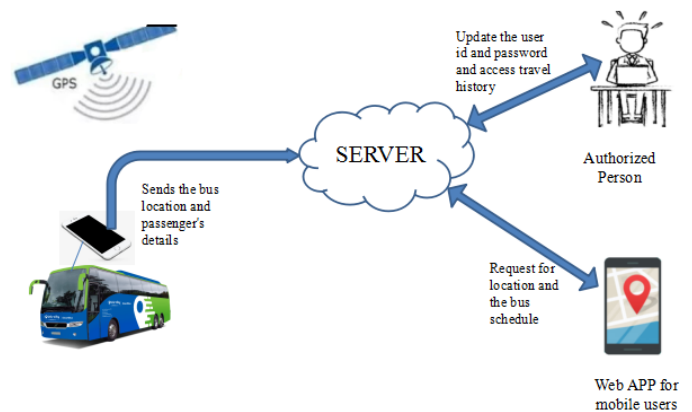

Fig -1: Architecture of proposed system

In this system, the server is the most important module and acts as the central repository of the system. It acts as the intermediate between the bus module and the user module. Here, the whole information is stored and maintained in the MySQL database. A web application is used to facilitate the submission and request of information to the database server. In MySQL, tables are created to store various types of data. Each table comprises the username and password of the conductor or the authorized person, live coordinates of GPS, route ID, bus number of all the buses, bus schedule, passenger details, longitude, the latitude of all the buses and distance between them and also the order of bus stops for various routes.

To distinguish each bus among the various buses, it is thus, provided with a particular ID that is unique and is stored in the database. Additionally, along the routes in which the bus travels, points are set up at the closest bus stops. These points are stored in the database and are necessary to calculate the distance between the passenger and the bus. This increases precision in obtaining the data. To depict the route in which the bus is traveling, each route is provided with a route ID and the order of bus stops on that route are stored. The order of bus stops, and the route id helps to depict the direction of bus, and also to provide the longitude and latitude values of bus to calculate the distance. Google Maps are used to plot the location of the bus. To increase the accuracy in locating the real-time location of the bus on the map, real-time coordinates of the current bus are uploaded to the server where it is compared with the coordinates of the closest bus stop and the distance between them is calculated.

Bing Maps Distance Matrix API is used as it provides the distance and travel time for a set of origin and destination. To calculate the distance and arrival time, we consider longitude and latitude values of bus location as origin and location values of the bus stop as the destination. It calculates the arrival time based on predictive traffic information, mode of transportation, start and end time, and more. Moreover, it has the advantage of calculating the speed

automatically. The map retrieves information from the database using PHP and JavaScript. PHP is used to export the bus location and other details from the database and to display it on the web application.
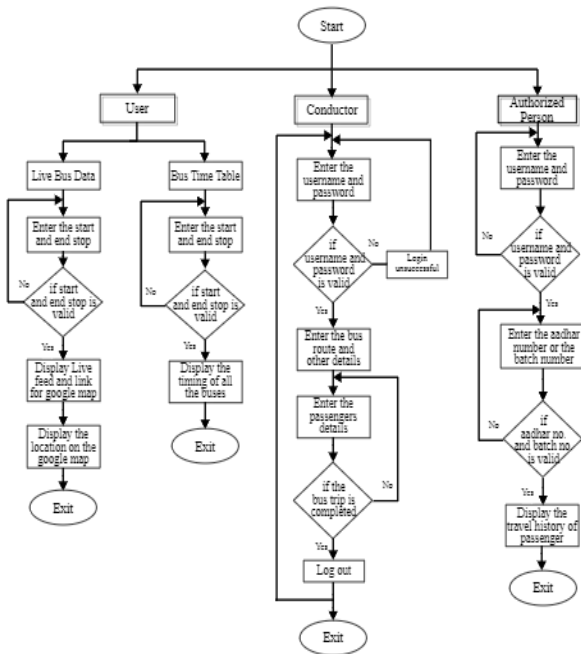
4.1 How the application works:

Fig -2: Working structure of Web Application

The above flowchart shows the structure of bus tracking system. There are three modules in the proposed structure,

a)   Authorized person

b)   Conductor/driver

c)   User

a) Authorized person

This module is designed for an authorized person to fill and update the bus information. Initially, the administrator has to provide the login credentials to the conductor. The administrator has to enter the bus timing of all the buses on the web app in advance so that it could be available to the user whenever he/she wants to check the bus timetable. The travel history of the user can only be accessed by the administrator. The authorized person has to login to the web app using the username and password. After login, the person has to enter the passenger's Aadhar number to get the details of a particular person or the batch number to get the details of all people who traveled in that batch.

b) Conductor/driver

This module is designed for the conductor/driver. The driver acts as an intermediate between bus and user. The application is installed on the Android platform of the smartphone of the conductor, whose GPS position is used to track the bus. At the beginning of the route, the conductor logins to the web application and initializes it with the static information about the bus, i.e., the bus number, route ID, starting stop, and destination stop. The username and password that are provided to all the conductors are unique and are provided by the administrator, and so that the data cannot be accessed illegally. This data is uploaded to the server. To track the GPS location, the application requests the conductor to turn on the GPS. Once the tracking has been initiated, GPS sends the coordinates frequently to the server, and these coordinates are used to track the live location of the bus. During the journey the conductor also has to enter the details of all the passengers in the web application like passenger name, Aadhar number, the stop name where he/she entered and where he/she will get down from the bus so that the travel history of all the passengers can be stored. After a trip is completed, the conductor has to log out from the app and again login when a new trip has to be started.

c) User

The user side module is provided with an interactive web-based application that renders different functions to the user. This application is installed by the passenger in his Android smartphone, to assist him to track the location of the bus and also the estimated arrival time of the bus. The passenger can thus, select the starting stop or the nearest stop as per his/her convenience and the destination stop to where he/she intends to go. As soon as the user sends a request to the application to get the information that is stored in the database, a list of all the available buses for that specific route is displayed. Now, the user can select the specific bus number to know the real-time information of the bus.

The location coordinates of all the bus stops are stored in the database. Therefore, the approximate distance between the current bus's location and the bus stop is calculated, and then based on the distance the arrival time is calculated.

The website is provided with a facility to display the bus time table. If the user wants to check the timetable of the buses, he/she has to enter the starting stop and the destination stop. This information is stored in the database by the administrator in advance. After getting the request from the user, the server sends the data and timetable/schedule based on the user input will be displayed on the web app.

5. RESULTS:

The following section shows the screenshots of the various modules of the web application. The system takes input from the conductor side and also the user side. Results are sent to the passenger side web application.
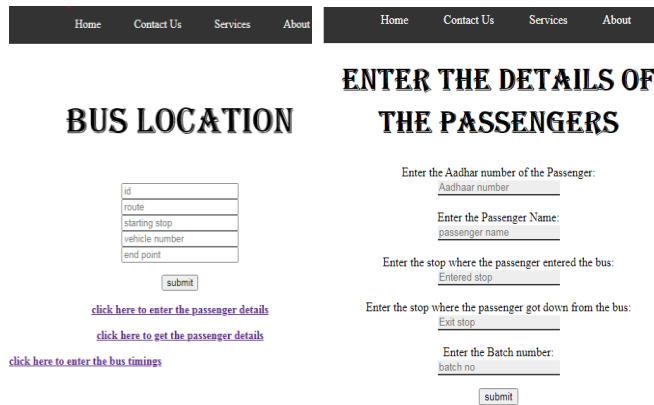

Fig -3: Conductor Module

The conductor logins to the application in his smart phone and enters the details like route id, bus id, start stop and destination stop and also the passenger's details.
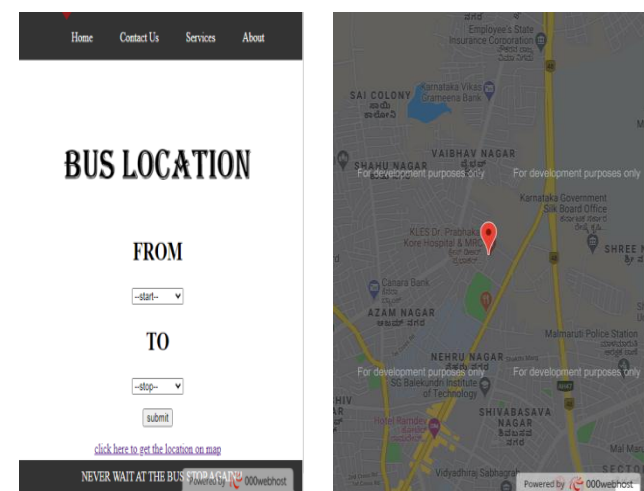

Fig -4: Passenger Module

The passenger can install the application or simply browse on the website in his smart phone and submit the start stop i.e., from where he wants to take the bus and the destination stop i.e., where he wants to go. If passenger clicks on the link to view the map the location of bus is displayed on the Google Map.

Fig -5: Authorized Person Module

If the authorized person wants to check the travel history of any passenger then he has to enter the Aadhar number of that passenger or if wants to check the details of the all the passengers travelled in a batch he has to enter the batch number. After submitting, the travel history will be displayed on the web application.

6. CONCLUSION

This proposed system helps to create a systematic bus transportation service, especially in a town or a city that enables the passengers to travel without any difficulties. Due to the fact that no information such as bus arrival/departure time, location of the bus, etc. are available, people tend to waste their time waiting at the bus stop. This system is implemented using an application, which displays the necessary information including the distance between the bus and the passenger, and benefits the passengers to plan their journey accordingly.

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