

Real Time Bus Tracking System

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Abstract: *In today's world where everything happens fast, public transportation systems are still slow and it's the need of the hour to make them efficient. A large number of people use public transportation like buses as it's inexpensive. But, buses arrive at their respective stations at random timings. Random timings sometimes cause commuters to wait longer than they expect. Waiting results in bad customer experience, which causes customers to drift away from the public transport to online cab-services. Therefore, to make the bus transport efficient there is a need for a smart system which can provide real time location information about the bus. Thus we are proposing a new system to solve the problem of random arrival timings of the bus. The system will manage all the data required to provide the real time location of the bus. We will be using technologies like GPS (Global Positioning System), Mapbox Map API, Android mobile application, Flutter framework and Internet are used for developing the solutions. Our system provides a mobile based application, which shows real time location of buses to remote users. This will improve the customer experience and encourage more people to use public transportation.*

Keywords: GPS, Mapbox, Direction API, Geocoding API, Coordinates, Location, Real-Time, Bus Routes.

I. INTRODUCTION

The project deals with tracking location of buses in real-time, showing the location of the buses to users and informing the users about the arrival time of the buses at the bus stations of their choice (if the bus is supposed to arrive at that bus stop). The main motive here is efficient tracking of locations for which the project depends on the existing infrastructure like GPS and third party API's.

Tracking a single bus is easy, it can be done using GPS and third party API. But it is difficult to track a large number of buses running on different routes in the same way as a single bus. To track a large number of buses a system is required to control the flow of data of different buses across different routes. Also, bus tracking is not just about tracking the location of the buses on the road, but about drivers who drive, bus stations where the buses stop and routes on which the buses running are also required to track buses. Along with all this a single bus runs on different routes depending on the demand of buses on the different routes during different timings. So the buses should also be able to change the route they run on.

So the idea for this project is to create a system that collects data about the buses, drivers and bus stations. Create different routes which pass through different sets of bus stations. While the buses are running on the route they will continuously send the location information of the bus along with the route they are running on to the system.

Now, the system can use the GPS and third party API's to get location information of the buses to track the buses based on the routes they are running on, by doing this the system can tell the wait time and distance that is required by the bus to reach a particular bus station.

II. LITERATURE REVIEW

This section will describe the methodology previously used by different research groups to solve the problem.

[1]Authors-"MRS.SWATI CHANDURKAR,SNEHA MUGADE, SANJANA SINHA, MEGHARANI MISAL,POOJA BOREKAR" - implemented the proposed system "Implementation of Real Time Bus Monitoring and Passenger Information System" track the current location of bus and indicate the normal user about the current location and notifies general user about the natural delay caused during transportation considering any kind of natural calamity. These messages regarding the arrival of the bus are updated on a back-end server, this information is notified to the commuters via a Smartphone app so that commuters can opt for a different route. The inference drawn by this system is that the main focus is on the location of the buses and the delay because of any calamity. They also do not provide an interface to change the bus routes which is usually done by the bus service providers.

[2]Authors-"SURAJ PHADATARE, PRATHAMESH KUDTARKAR, JIGNESH SETH, ASST. PROF. VAISHALI YEOLE" authored "Bus Monitoring System using Android Application" paper. In this paper, The proposed system has 3 tools or interface, 1)web interface in which users can directly search for bus and route of bus and can see only maps of bus routes and stops. 2)android application provides a location-aware application for quickly accessing real-time arrival information for nearby public transit stops, using sensor data from GPS, WiFi, and cell-tower localization to quickly get a location fix on a user's phones. It has a lot of the same features available in the other interface: a map view, recent stop views, and search for stops by routes, and stop numbers. 3)TheAPI, an android app is powered on the backend by web-based API's, a standard technique for providing dynamic data to mobile apps. This paper only focuses on getting real time location of buses,time required to reach at station and all but not on security purposes.

[3]Authors-"AJINKYA SARNOBAT, SARTHAK THAKUR, PRATIK TILEKAR, RAHUL RACHAMADUGU" have created a 'Mobile Application For Bus Tracking System' in this system is a real time bus tracking system which uses one database and three sub-systems for tracking the location of the buses. Three subsystems are namely 1) Admin App, 2)Conductor App and 3) Client App. The Admin App registers buses, bus stops,etc.The Conductor App sends location of the bus to the central server and Client App retrieves the location of the bus according to the source and displays it on the App. But this system has some confusing things to it. It gives the privileges to add bus routes, update bus status and manage bus routes to the client app that should only be given to the admin.

III. PROPOSED SYSTEM

3.1 Objectives

- To create a mobile application that provides real time location and arrival time of buses.
- To create a bus management system to aid us track the buses.
- The sub-objective of the bus management system:
 - To develop a system to register bus routes based on their unique serial number.
 - To register all the buses in this system.
 - To collect real-time data of the bus location and send it to the user.
- To develop a bus module application which will send the bus's real-time location to the server and display the travel route to the driver.

3.2 Solution

The solution for the above mentioned idea is to create a Bus Tracking System using a stack of different technologies. The system will consist of three subsystems to properly manage the flow of information. Each sub-system will manage one aspect of the system, this will help us to break down the complex system into smaller systems which is easier to implement and will help the tracking of the buses in real time.

The three subsystems are as follows:

A. Bus Management System

This particular system is an Admin System for manual management of the entire system. This system will be used for registering, updating and deleting buses, drivers, routes and bus stations, though this system has a lot of privileges it does not have any power over the location information. This system will have an access to the map API and direction API for registering the location of bus station and creating bus routes.

B. Bus/Driver System

This system will be used by the driver driving the bus. It would require the driver to login, input bus registration number and route number information. This system will provide the driver with a real-time map of the route to follow and the system will send the location data to the backend server.

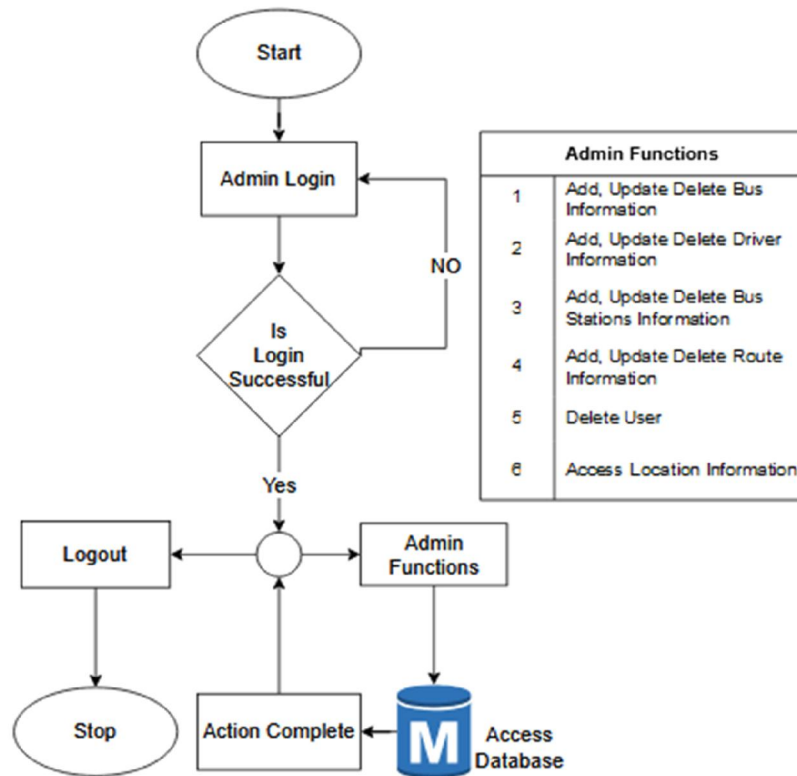


Figure: Bus Management System

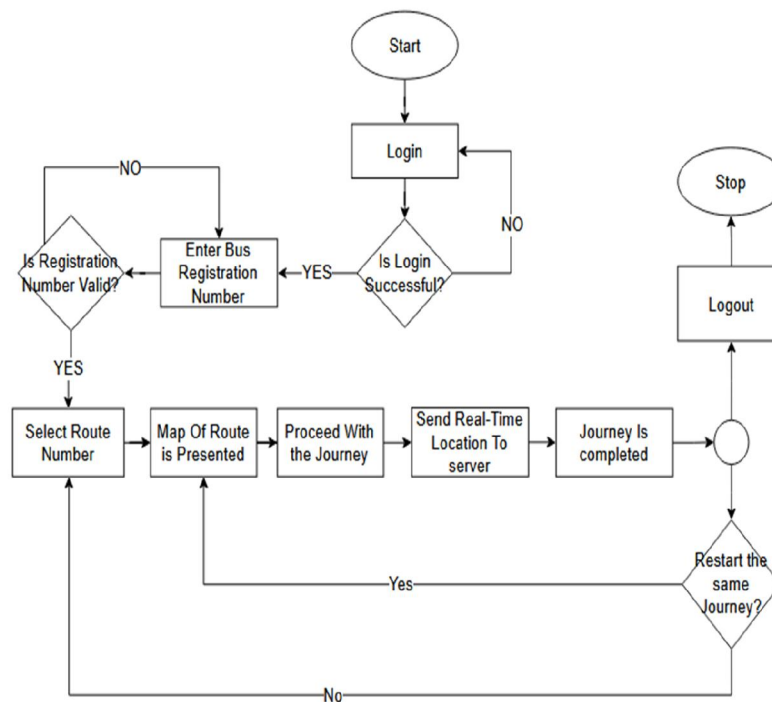
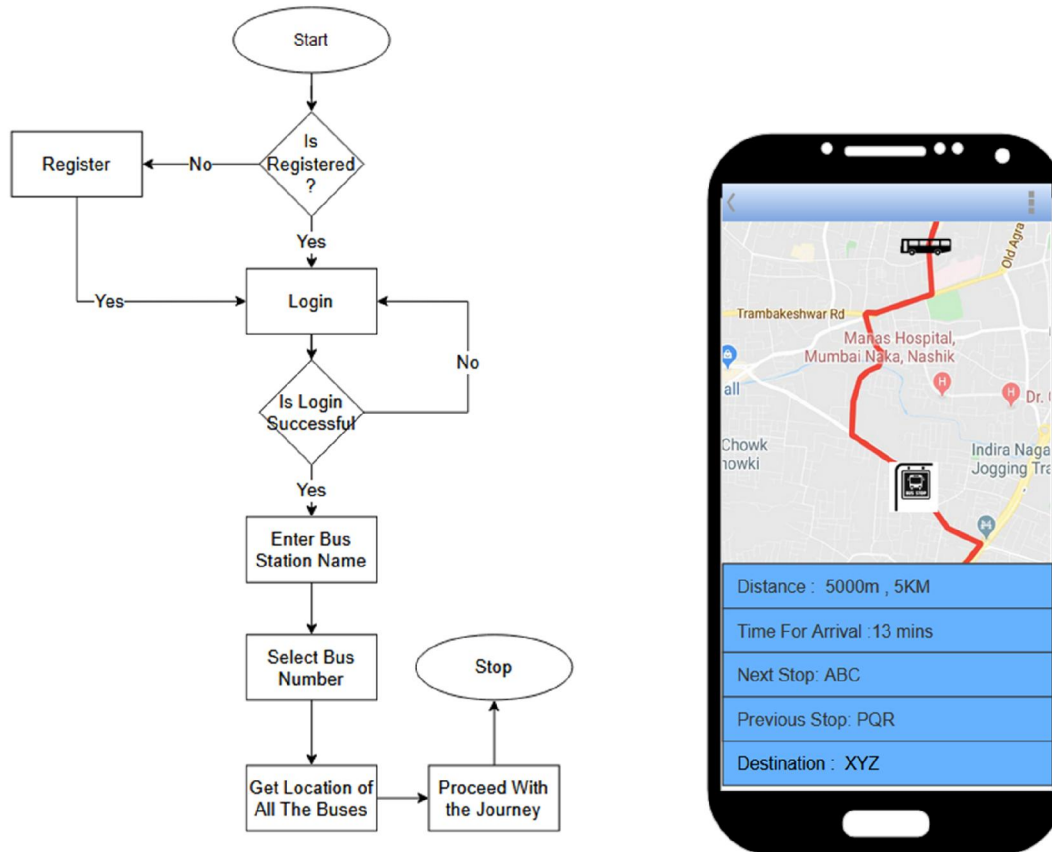


Figure: Bus/Driver System

C. User System

The User Application is for users to get information about location of the buses and the time for which they have to wait



3.3 Implementation

This subsection explains how the main functionalities of the system are implemented.

1. **Bus Stop Location:** The location of the bus stops is represented by their coordinates. To get these coordinates of the bus stop, the system uses a geocoding API from Mapbox. The administrator will first enter the name of the bus stop, the geocoding API will then find the coordinates of the bus stop and a marker will be placed on that location on the map. Then the administrator can tap on the map to pinpoint the bus stop's location until it is satisfactory.
2. **Bus Route Creation:** The bus route is a collection of bus stops arranged sequentially. When creating a new bus route, the number of bus stops in that route is selected, then the bus stops are selected sequentially, the coordinates of those bus stops are then used to send a request to the directions API of Mapbox. The result of this request is one or more optimized routes. The administrator will then select the route that is most suitable for the bus. The geometry route is then stored in the database and is used to recreate the route whenever needed. Storing route geometry will also help reduce direction API calls after every user request to Mapbox, these calls are costly.
3. **Real-Time Location:** The real-time location is the current location of the bus/driving which is running/driving on a particular route. This location is given by the bus/driver system. When a driver logs into the bus/driver system, he/she has to enter the bus registration number and the bus route number. The location of the bus/driver is then stored in the database based on the bus registration and bus route numbers and the location is updated when the bus moves. When the user asks for the location of the bus, the user is shown a map with the bus route created from the route geometry stored in the database along with the location of the bus/driver as a marker.

3.4 Future Scope

This project has a wide future scope. The system can further be improved by adding new features like online ticket and pass booking. Cameras can be used to provide the commuters a close estimate of passengers on board by using image processing techniques. The system can be used for analyzing the performance of individual drivers, passenger traffic on route, etc.

IV. CONCLUSION

Thus along with Real-Time bus location tracking, the proposed system also provides a scalable model to create large scale bus tracking systems with proper management of every participant i.e. buses, bus stops, bus routes and drivers. The proposed system can also be further extended to track the performance of the drivers which can be used to properly reward hard working drivers, track maintenance cycles of the buses, etc. Thus, this paper has accomplished its goal of creating a Real-Time bus tracking system.

ACKNOWLEDGMENT

We would like to thank Asst. Prof. Vikas Baloda for encouraging our team to progress further and improve our project work. His guidance helped us to reach completion point in the project. We would also like to thank all the people who provided guidance. This was a difficult project and we were able to complete this project with our hard work so we would like to express appreciation for ourselves.

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