Public Bus Transport Location Monitoring System

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Abstract - Every day large numbers of people travel by bus. In *recent year's coaches have played a vital part in cities and rural areas. But they aren't always on time. So, when a bus isn't at its regular ti*me, you have no idea if it is stuck in traffic or has broken down. An individual eagerly waiting for the bus may want to know about the exact position of the coach he/she intends to travel on. Public discussion on group chats and voice calls is not always possible due to traffic disturbances and costs due to the frequent calls. Tracking of public transport buses moving within cities is of utmost importance due to the vital role public buses play in the life of the citizens nowadays. This article presents an economical and user-friendly bus tracking system. The idea of live vehicle positioning is something we usually infer as a sophisticated and somewhat tricky idea to implement. But it not if we eliminate the hardware aspect in the entire process. In India, in this day and age, almost everyone is equipped with a handset capable of transmitting data at lighting fast speed thanks to the cheap internet made available to the masses in recent years. This complete software solution is designed by retaining in mind the features like being easily updatable, scalable, and which allows a diversity of users using phones from different operating systems to take advantage of the proposed method to the fullest.

Key Words: Keywords: Bus Tracking; Global Positioning System; General Packet Radio Service

Global System for Mobile Communications; iPhone Operating System; Android.

1. INTRODUCTION

We use technology in almost every part of our lives now. We are solving a problem which thousands of city commuters face daily with the present technology available, so we developed the project "Bus Tracking System" only using the GSM capabilities of smartphones. The movement of buses is unknown to an individual waiting for the bus at the bus stop as the buses are generally affected by different uncertain circumstances throughout the day, such as traffic, unforeseen delays, and randomness in commuter demand, uncertain dispatching times, and many more disruptions. With the emergence of new technologies like GPS and the ubiquitous cellular network, real-time bus tracking for better transport management has become achievable. The increased waiting time and the ambiguity in bus arrival make the public transportation system displeasing and unreasonable for customers to manage their everyday transportation. The real-time bus tracking system utilizes GPS technology to get data. It displays the data using software, letting the user control a particular bus on a specific route. When this data is sent to the customer via wireless media or online web media, they can manage their time effectively and arrive at the bus stop just before the bus comes, or take an alternative means of transportation if the bus is delayed. This will make the bus system smooth and customer-friendly. Bus Tracking System is utilized to find the position of a bus using methods like GPS and other radio navigation systems working through satellites and ground-based stations.

With this project, we desire to build a GPS tracking system that will track the current position of the bus and show it to the user who wants to travel on the bus. This way, the system will reduce the waiting time for passengers. The GPS device will send the current location of the bus to the server. The server, on request from a user, will show the current position of the bus with Google Maps. Using the GPS and the bus number, we plan to highlight the route of the bus that it will operate on and traffic on the route. The system is divided into two modules. Module 1 gives information about the bus route from source to destination and gives maps for the same. Module 2 provides information about the buses with the bus number, bus stops, tracks the location of the bus and sends the information with the estimated time required for the bus to reach. This is achieved using Client-Server technology. The system consists of modern software components running on smartphones, enabling them to track the bus online. Traditionally, any vehicle tracking system consists of mainly three parts Vehicle unit, Admin panel and, user's software system on the phone. However, in our system, we replace the functionalities of a Vehicle unit with a mobile app that will be handled by the conductor, and in this way, we plan on eliminating the use of hardware.

There are bus applications available on the play store for the passengers to track the information of the buses and their movement, but they're not very accurate. The intention is to develop an app which has every single detail about a bus which include bus numbers, routes, bus timings, the routes taken by a particular bus, time is taken to complete a stretch would assist the passengers greatly and most importantly track the exact position of the bus on Google maps using Google Maps API. The proposed idea deals with the above problem statement in the mentioned manner. The mobile system for the end user will be initially developed on the

Android platform; if possible, in the nearby future, the development of an IOS application would be considered.

2. LITERATURE SURVEY

For bus tracking, various ideas have been submitted and executed. In the case of implementation or the case of the system design, all proposed designs and implementations are different in their ways.

Manini Kumbhar [1] is trying to solve the same issue, but instead, they proposed to use hardware components on the buses to track them. Having a hardware component increases the expenses of the project, and hardware components seem to be impractical as all smartphones these days are sold with GSM sim cards, which are easy to track and are cost-effective as well. Their project operates in a way where a user requests the location of a particular bus, and the request is sent to a central control unit, which in turn requests the database to send the current location of the bus, which is to be located. The control unit sends the user the location of the bus.

K Sujatha and her group [2] use GPS and GSM technologies to track a bus that the user has requested for. They use the GSM capabilities of a smartphone on a bus to track the bus and use GPS to display the bus's location on Google Maps. There are two users in this system. The customer and an admin, both users have to authenticate themselves before using the program. Upon login, the user can either track a bus or give feedback about a bus. The admin panel is a JSP application that can handle the modules of the system. The admin can even add or delete or update-modules.

Bhushan's [3] project includes a hardware tracking component that is placed in buses which tracks the buses to provide the user with accurate information. In his system, the user enters the bus number. An algorithm thereby helps to find a bus near to the user. The application next determines the approximate time the bus will take to arrive at the bus stop. They also show the location of the bus using Google Maps. They have also added some extra features like the occupancy inside the bus, the driver's name, and the bus stop the bus takes. This project shares the same problem as the first one, using a hardware component to track the bus, but the hardware component is too large to fit on a bus.

Dhruv Patel's [4] project also suggests a hardware component fixed on a bus that tracks the bus. The GPS module on the bus keeps sending its latitude and longitude at all times, which is stored in a server. On the other hand, a user enters their starting and ending points to find a bus. The server finds the nearest bus to the user, and if the bus is in-between, the user entered stops. Then the server calculates the distance from the GPS module in the bus to the user's device and calculates the approximate time the bus will arrive at the stop. With the help of Google Maps, it displays the exact location of the bus. With this information, the user gets to know if the bus is late or is stuck in traffic. This project also uses a hardware component that is harder to set up. If any of the components fail, there is no way of knowing what caused the problem as it can only be fixed manually. Whereas in a software-based project, an admin can easily detect a problem and fix it without needing the bus to be out of order.

3. OVERVIEW OF THE SYSTEM

3.1 WORKING

The main objective of the presented system is to put the GPS locating technology in effect into the bus transportation system. The proposed system intends to equip the driving staff with mobile phone applications to facilitate real-time position tracking during the working hours. The bus position data in terms of coordinates will be sent to the central server and will also process route traffic information to generate an ETA to the nearest bus stop, which is needed by the bus users. This real-time position tracking system, it aims to increase the precision of bus timetable scheduling. In the proposed system, a real-time platform is developed between the general public and the bus-management team. With this platform, the general public will be able to check on real-time bus arrival time for a particular bus stop and latest or updated bus traffic information. Furthermore, the bus depot team will be capable of updating the latest bus ETA information to bus users through the real-time platform developed for mobile systems. Besides, the development of a smooth operating bus tracking system ensures to reduce the major workload of the bus management team. First of all, a real-time bus position tracking system will automatically calculate the arrival time; in other words, it will generate an ETA for the next bus stop for the particular selected bus. Second, this system turns into a platform that allows the bus scheduling team to update the bus schedule through the lighting fast speed of the Internet instead of the slow, tiresome, inefficient posting of paper form on the bus depot's notice broad. By reducing this workload of the bus management team, they can utilize the time in other matters in order to enhance the quality of the bus service.

3.2 DETAILS OF DESIGN

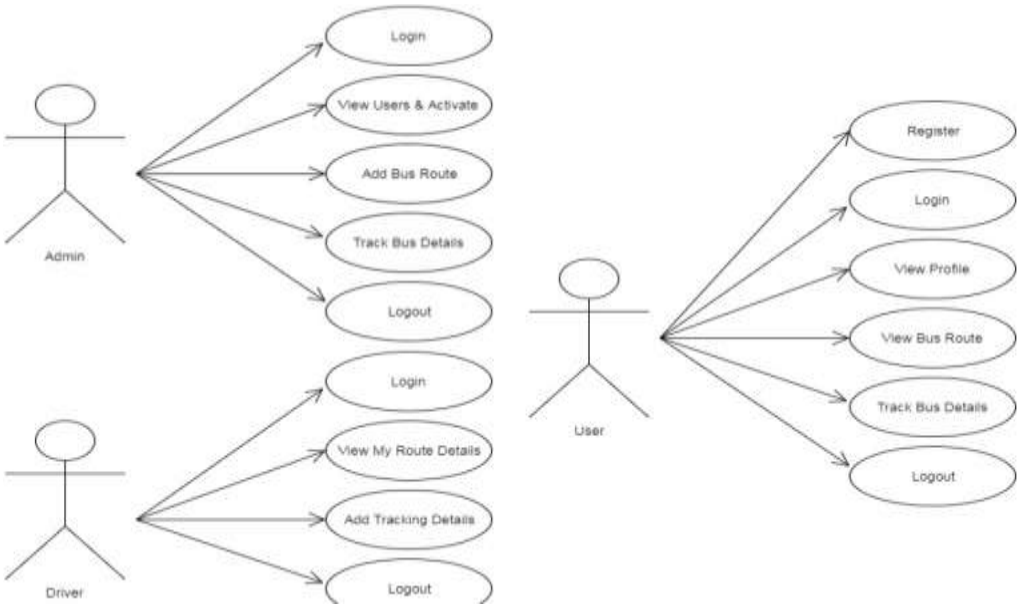

Fig. Use Case Diagram

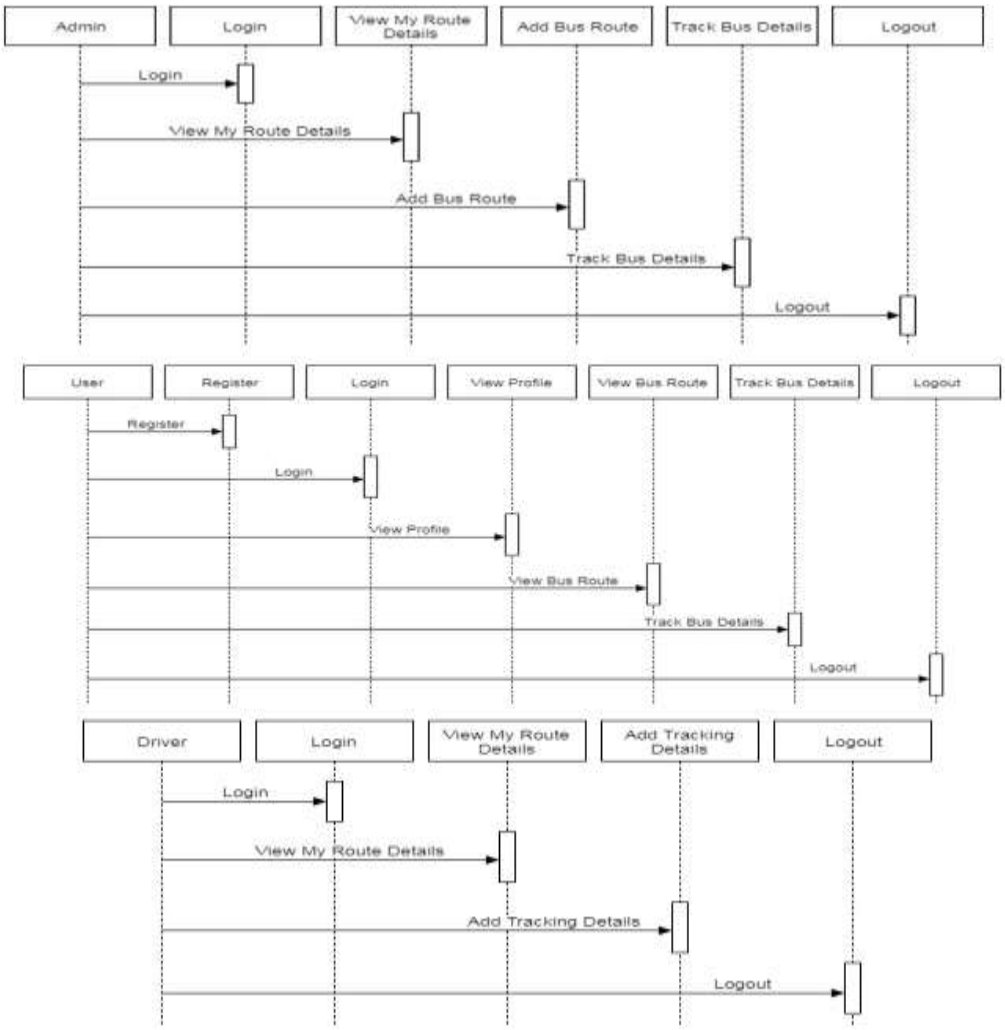

Fig. Sequence Diagram

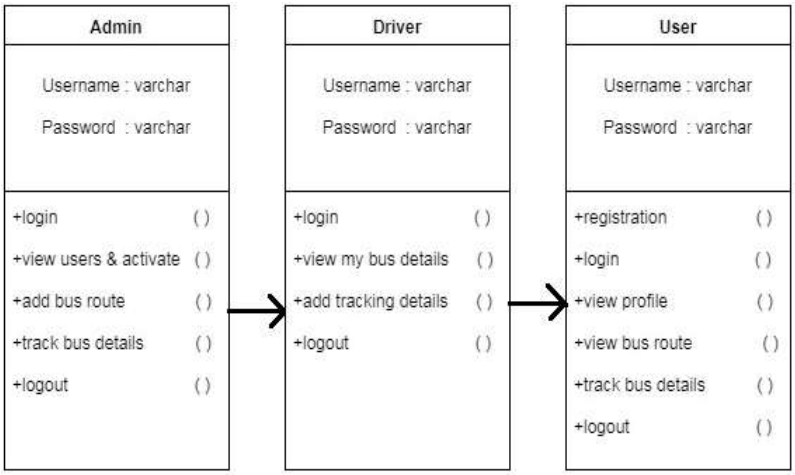

Fig. Class Diagram

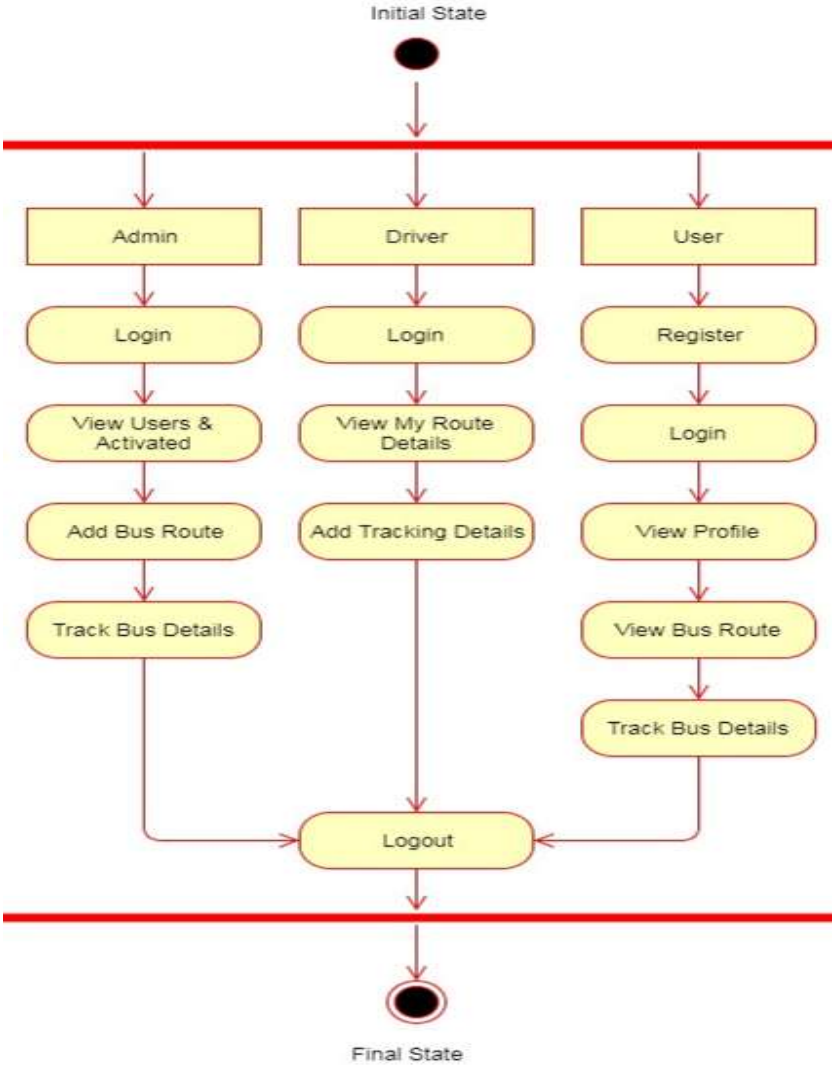

Fig. Activity Diagram

4. FUTURE SCOPE

- Implementation of some omnipresent hardware in place of a smartphone for completely automating the tracking functionality

  The product as per the current setup, uses the navigation system embedded in the mobile phone handled by the bus conductor as the reference to show the user the current location of the bus. This may not be suitable for some cases where smartphones aren't as easily obtainable or the availability of a strong network connection is not ensured. It may also cause other unwanted and unnecessary dependencies. To avoid this, we could use PNDs (Portable Navigation Devices) sold by companies like Garmin and TomTom, which would be wired to the bus itself. These provide optional user-interfaces, and the route will be pre-configured so any unusual routes taken by the bus will be immediately reported to the respective bus station. These PNDs also offer dead reckoning, i.e. temporary navigation when the vehicle is out of the line of sight of the satellites, using a gyroscope or a compass.

- Live tracking model of the project can be put to use in currently operating local bus navigation systems

  Some local bus systems like in Mumbai, have already built a navigational system wherein the system detects the next bus stop and announces the name of the stop by playing a pre-recorded audio file. This navigational system can be mapped to our product to utilize it to its full extent. This if possible, to implement would save much time from the users' perspective and monetary resources for the already in loss local bus system in Mumbai.

- Support for online ticket purchasing can be integrated into the product

  This would include purchasing a ticket from the mobile application itself, using e-wallets and other payment methods. This simple feature could help save paper and avoid usage of plastic tickets, while being convenient for the regular commuters.

- We can interface this product to universal navigation applications (like Google Maps)

  Applications like Google Maps allow the user to enter the destination address and often succeed in indicating the correct bus(local) to board but often misses the mark when it comes to information related to the whereabouts of the bus. It predicts the time taken for the bus to arrive based upon rough estimates which more than often result in disappointment. Our product's live tracking system, on the other hand, gives the exact location of the bus to the user. Our product if integrated with a navigation application like Google Maps would not only provide the user with live-tracking and ETAs but also which route to choose to on the basis of road closures and traffic-jams.

- We can implement a more economic tracking system using inertial navigation

  To make a more budget-friendly product we can use inertial sensors (a collection of gyroscopes and accelerometers) in bus stops. These sensors will detect the arrival and departure of buses and transfer the information to a central unit which will calculate the ETA for the following stops. Live tracking in this case would not be possible, so not a viable choice nonetheless.

- Alerts, and distress signaling mechanisms can be added to the software.

  Bus breakdowns are a common occurrence especially in the case of local transport buses. To avoid wasting time in such cases the bus conductor can request for help through the mobile application itself, which will automatically search for the nearest bus station and request for a repair van. Mechanisms for emergencies like fire, accidents, etc. can also be integrated into the product.

5. CONCLUSION

With the execution of this venture, a total track can be kept of the transports of the public bus services. The Interface at the traveler's end goes about as helping to save time. Because of this, a perfect arrangement of bus transport is built up by us for general public purposes. By implementing our system, a passenger can plan their journey more efficiently before time as the waiting time at the bus depot is diminished vastly. This system also throws light on the frequency of the buses on the same route. The main features of the system are the efficient usage of time, real-time information on the availability of buses, traffic acknowledgment, and commuter satisfaction. A question we end up asking ourselves is whether the bus is stuck in traffic or its broke down somewhere in the middle and how our system will answer this question. The answer to this problem is that when a user queries database, the server will show the same location and ETA of the bus as previous so by this method, it is self-explanatory that the bus must have got stuck in traffic or there might be an undiscovered problem with it. This framework is easier to use for users to get information outwardly appeared on Google Map. Users can openly get this online application for real-time tracking of buses, which gives the user an intuitive interface environment. So, by using this application, remote-client can simply wait, or they can reschedule their trip as per the availability of the bus. Hence in this system, we have demonstrated that travel data gathered progressively can be displayed on the server for tracking and monitoring. Internet-enabled mobile phones can receive real-time transit information and will help the passenger to monitor their time more effectively and precisely. With the implementation of the project, a complete track of the buses can be kept around the city through the web application [6]. The application will be facilitated on our web server, which will decrease the expense of membership charges

accommodated by the tracking services. This also protects the integrity of the location data of the buses as the servers will be accessible only through the local domain's network. This system has high practical value and is cost-efficient. The conclusion of this study suggests that knowledge of a specific domain improves the results. Also, various ascribes have been added to the project, which will end up being worthwhile to the system. The requirements and specifications have been listed above. Using the GPS system, the application will automatically display the buses on the map and its routes to the different locations and also track the bus location using client-server technology and forward it to the client device. It uses latitude & longitude as measurements to calculate the distance between two locations and provides necessary details of each and every route for people to easily catch-up with the buses or any other conveyance possible on the specified route [5]. Specific bus details are provided to the user along with the bus location so that the person can identify the bus correctly. It uses a remote server as its database. Due to this, the records can be easily presented on the user's device itself so that the server burden gets reduced.

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