GPS Based Bus Tracking System

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***Abstract*—In this fast life, most are in a hurry to succeed in their destinations. During this case waiting for the buses isn't reliable. For folks that depend upon public transport, their major concern is to understand the real-time location of the bus for which they are looking ahead and therefore the time it'll take to reach their bus stop. This information helps folks in making better traveling decisions. This paper gives the foremost challenges within the transport system and discusses various approaches to intelligently manage it. Our system handles all the info like the current location of the bus, management of buses, routes, etc. For development purposes technologies like GPS(Global Positioning System), MQTT, and google maps are used. Location-based services are increasingly important for contemporary mobile devices like the smartphone. A vital feature of a contemporary mobile device is that it can position itself. Not just for use on the device but also for remote applications that need tracking of the device. Furthermore, tracking must robustly deliver position updates when faced with changing conditions like delays because of positioning and communication and changing positioning accuracy. The realized system tracks folks targets equipped with GPS-enabled devices.**

***Keywords*—GPS; MQTT; Pub/Sub; REST.**

I. INTRODUCTION

Effective transportation has an effective movement of products and other people which lead to better quality of life and better social and economic growth of the society. The transportation system forms the heart of the system. The vehicle population is additionally rapidly increasing which is further resulting in heavy traffic jams. The optimal solution to the current problem is that the use of public transport. However, conveyance schedules are unreliable, and anticipating bus for long results is a waste of your time. But a system that gives complete information namely the number of buses that move to the desired stop, bus numbers, bus timings, time is taken for the bus to reach, the routes through which the
the real-time bus placement(location) coordinates and finding correct time the bus will take to reach its bus stop.

GPS technology is often used in bus tracking systems to locate the bus. These systems are especially popular in big cities. Operators typically use this tracking system for services like as tracking, routing, onboard information, dispatching, and security. These are useful in everyday situations such as traffic congestion, unexpected delays, erratic vehicle dis-patching times, and other problems. It gives the public more convenience by providing real-time bus location information, ensuring that they do not miss their bus. Being on time for his or her everyday regular employment is really beneficial to him or her. Globally, GPS tracking technologies are commonly employed. This application tracks and collects the most recent position as well as other customizable vehicle parameters, and then informs the end-user with the most up-to-date bus information. By assisting travelers in transitioning from single-occupancy vehicles to public transportation, it is possible to lessen traffic congestion as well as environmental impact. Our goal is to improve public transportation usage and happiness among present riders, as well as to encourage additional people to travel. If distant users who wish to use public transit had a simple way to know in real-time which bus is closest to them and the estimated time it would take to arrive at the actual stop, they would be able to make more accurate decisions about whether or not to wait at a stop. This convenience will be provided by our proposed system. The bus's location is determined using GPS, and the data is subsequently relayed. Terrestrial radio or cellular link, satellite from the bus to a radio receiver, satellite, or adjacent cell tower will be used for transmission. Once the location data, as well as other custom data, has been acquired, a wireless communication system is used to transmit it.
bus goes, maps that guides the passengers and most significantly tracking.

II. LITERATURE REVIEW

A navigation system complying with those design requirements enhances the experience of users of public transport networks(PTN) in a very cost-effective way. Visitors and sporadic users are target user groups because the system is particularly helpful for people unfamiliar with the PTN. But also normal users would profit, being guided to destinations out of their current and known parts of the transport network, as an example visiting an area for the primary time in any locality they were not familiar with. In this way, the navigation system enhances the urban mobility experience and makes using the PTN more attractive to people unacquainted with it.

It's critical to consider the target market while developing any application. In this scenario, we may divide transit riders into two groups: new or infrequent riders who are unfamiliar with the local transit system and frequent riders who utilize it on a daily basis. New or infrequent riders are less familiar with available routes and rarely require additional trip-planning assistance, whereas frequent riders typically already know which sequence of stops and routes will get them to their destination the fastest, and all they need to know is when the next bus will arrive. The device discussed in this article is largely aimed at this second category of frequent transit riders.

While set schedules and timetables are useful tools for riders, the reality is that transport vehicles do not always run on time. Traffic congestion, severe weather, accidents, and passenger concerns are just some of the reasons why a transit vehicle may fail to meet its schedule. As a result, several recent transit traveler data system advancements have focused on providing real-time arrival information. The navigation system was designed on a set of assumptions that set it unique from others.

The navigation system was built around a set of assumptions that set it apart from other navigation systems.

- The service should be deployable in the near future, not in the far future.
- The service provider's deployment costs should be low.
- In light of current communication expenses, the cost of usage should be cheap.
- The service should be easily adaptive and expandable to a rapidly changing environment.

Many design solutions are proposed and implemented for bus tracking. All recommended methods and implementations are unique in the case of implementation or within the case of system design. On the driver's smartphone, the android application is installed. The driver presses a button at the start of the voyage, allowing the gadget to track the real-time location of a bus using GPS. This bus location can be obtained by the user based on their requirements. Instead of using an external device for tracking, we use our smartphone, which makes our application more cost-effective.

III. PROPOSED SYSTEM

A. Product Features

The movement of vehicles is slowed in the everyday operation of bus transportation systems, particularly buses, due to a variety of uncertain conditions that arise as the day continues, such as:

- Congestion in the roadways
- Unexpected delays
- Unpredictable vehicle dispatch times

Those who rely on public transit and prefer to wait for the bus rather than taking alternative modes of transportation. Our application focuses on making bus schedules more convenient for them. It gives real-time bus location information so that they don't get behind schedule.

B. System Architecture

Figure 1 depicts the architecture of the systems. The system composed of three components.

- Mobile application
- MQTT Broker
- REST service

Mobile application is supposed to be used by the traveler, bus driver, or administrator. REST APIs are used to make communication between the frontend and backend. The location data is shared between the bus and also the traveler through the MQTT broker. The bus and users are MQTT clients. The device with the bus publishes a message to the MQTT broker. MQTT Broker dispatches the message to subscribers.

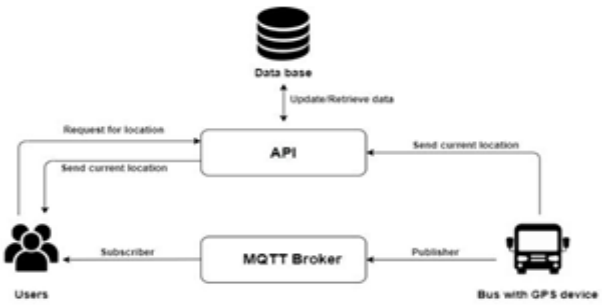

Fig. 1. System Architecture

C. System Modules

1) Passenger Module: This module is a component of the android application. The android application is installed by the passenger who wants to trace the location of the bus and get its arrival time. The essential requirement of this application is that GPS and internet connectivity. The time of arrival is predicted with relevant gap distance between the bus's current location and also with the stop. The passenger selects the Bus name from the list and a request is sent. After processing gets the arrival(point) time also passenger can locate the bus's current location on the map. Figure 2 shows few screens within the Android application specific for traveler.

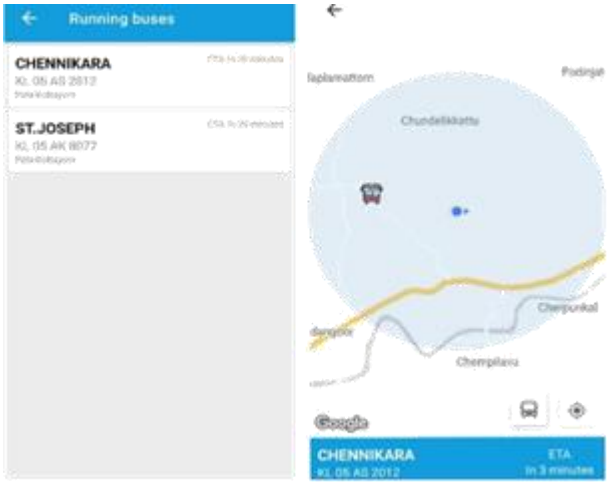

Fig. 2. Some screens of passenger module

2) Bus Module: Bus Module is another client-side of the android application. This application is installed on the android platform smartphone which is placed on the bus whose position is to be tracked. The requirement for this application is GPS and internet connectivity. At the beginning of the journey, the bus driver initializes the application bus module submits its coordinates frequently, every 5 seconds to the server. These frequent submissions are used to track the current location of the bus on the route. Figure 3 shows few screens within the android application-specific for the driver.

Fig. 3. Some screens of driver module

3) Admin Module: The admin module manages the buses, routes etc. The admin module can add update or delete buses, routes, stops and also provides login credentials for bus driver. Figure 4 shows few screens within the android application specific for admin.

Server Module: This module is the server-side of the android application where most of the processing is completed. Web service is employed that facilitates the submission and request of information to the database server. MySQL is employed where tables for all the buses, routes, locations are present. The situation(location) table comprises the latitude and longitude of locations. These latitude and longitude are essential for easy calculation of the gap between the bus and in it, which is extremely easy to use and explore maps with simple gestures like pinch to zoom tap to point etc. It will make tracking the bus very easy for the user.

Fig. 4. Some screens of admin module

The location is plotted on maps.

GPS (GLOBAL POSITIONING SYSTEM)

It's a technique in which satellites block radio signals that GPS receivers and units use to determine their present location. The GPS system works as follows: At any given time, there are 24 operational satellites circling the globe. A GPS navigator or GPS tracker looks for a transmission signal from three satellites at a minimum.

IV. METHODOLOGY

The application gives the live location of the bus to the user. The commuter can, not only fetch the bus location but also know the estimated time taken by bus to achieve its destination. The situation information is fetched from the web database which receives the data regarding the different locations from the application employed by drivers/conductors on the bus. This helps in maintaining the distinctiveness of the bus while displaying its location on the map. The request made by the client for the bus information is fetched from the database and delivered to the client through a server. The driver/conductor will send its coordinates continuously to our server where data are going to be stored. When the user selects that exact bus id, its location is going to be retrieved from the server and shown on the map. Since the coordinates are going to be changing, the object on the map will continue moving, hence the user can see the live location of the chosen bus. Also, we are going to use google's approximate linear algorithm to indicate the user the approximate time taken by bus to arrive at the user. The application is developed using an android studio which includes a very simple user interface to use it. Google Maps API is that the core component that may be utilized.

V. RESULTS AND DISCUSSIONS

The system takes the input at both the client sides and does the processing at server side. Results are sent to the passenger side android application. Passenger installs the application on android platform and choose two locations. When passenger clicks on search button they get a list of running buses. When a passenger selects a bus then current position of bus displayed on the google map. when client makes request for the bus information it'll be fetched from the database and delivered to client through server.

VI. FUTURE SCOPE

The main goal of the proposed work is to improve the bus tracking system by adding the necessary features to our project, like projecting accurate bus timings, presenting correct bus numbers, and by adding a GPS module into it for accurate locations. This can be enhanced to incorporate in a vehicle monitoring system using GPS and GSM module with the high-speed processor. The system could also be installed in buses, cars, and trucks, hence this project is having good scope. Also, the system can be enhanced by creating a bus ticketing system, within which the app takes the current location of the user provide the destination and calculate the fare we'll also provide payment options from various third-party apps like Paytm, PayPal, etc. This system can be extended to non-public agencies to trace their bus.

VII. CONCLUSION

The GPS Based Bus Tracking System is a client-side application that runs on the Android platform. The app is free to download and install on your smartphone.

People may feel inconvenienced while waiting for the bus if they do not know when the bus will arrive. This is addressed with the GPS-based bus tracking system. Passengers benefit from a more convenient travelling experience when they use this method.

The precision of this system is based on GPS coordinates given by satellites, while the system's dependability is based on internet connectivity. When the internet is available, the system works well. By including the concept of direction, the database's size was decreased by half, preventing the server and database from becoming overburdened with comparable sets of data in various tables.

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