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**“REAL TIME BUS TRACKING SYSTEM BASED ON GPS USING ANDROID APPLICATION”**

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**ABSTRACT:** *In today's running life, anyone does not want to waste their single minute. People are always in hurry. But, while travelling from one place to another through public transport, passengers have to face lot of problems because of spending much time on the bus stops. It is not always feasible to wait for longer time. Moreover, they do not know that the bus will come or not. There are many people who are mainly dependent on public transport. So, keeping their problems in mind, we have developed real time bus tracking system to help the passengers to locate the exact position of the bus on the Google Maps that is pre-installed into their android device. Also, there is no need to install a GPS device in the bus, which will save the installation and the maintenance cost. The system is designed in such a way that the driver or conductor of the bus just have to enter the source and destination stops and press a allow location button to share the live location of bus. The android app, with the help of GPS service, automatically sends driver or conductors location to the server continuously in interval of five minutes. The location details are then shown on Google Map to the passenger. This application thus enable passenger to find exact position of public transport bus and save the time spent in waiting at bus stops and thus will not get late or arrive early at stops. Also, it helps in finding his distance from bus stop, time required for the bus to reach the stop. Here, a web-application has been developed in order to maintain all records such as bus details, driver and conductor details of the bus, managing routes, etc. For this, MySQL database along with Php PDO has been used.*

**Keywords:** Android, GPS, Google Map Api, Bus Tracking, MySQL, Php PDO, Tracking unit, Monitoring Unit.

## **1. INTRODUCTON**

Today, the fastest developing industry is the mobile industry. Mobile phones now as smart phones have become most essential part of human life. These are getting integrated with various and multiple features that help in communicating with others, throughout the world in seconds, organize our lives and document events. One of the most important features provided by these smart phones is the location based services. One of them is GPS .The GPS uses satellites for getting exact position of the smart phone in terms of latitude and longitude. With the help of these longitudes and latitudes, the position can be seen on the map. The applications in android have the facility to navigate through the maps. Tracking buses is always been a problem for all. The GPS device is costly, complicated and requires maintenance. The application need to be developed in such a way that it resolves all of these issues.

Buses are one of the most used ways of public transport used by the people. Various organizations like schools, companies, universities, companies, business firms, banks, etc. use them as main medium of transportation. Because of the increase in population, the number of vehicles have also increased which cause traffic on roads, due to the bus arrives late at the stops. There might be some other reasons as well. The people have to wait for longer period of time on bus stops due to this and thus suffer problems. Thus, an effective transportation system with tracking mechanism can solve this problem and lead to better life of people and society. Hence, the developed real time bus tracking system will be helpful for the people that will provide the exact location of the bus on the Google Map API and also let them know in how much time the bus will arrive to the stop so that they do not have to spend much time in waiting on stops.

For building such application, we have used android based GPS and GSM service to continuously send the

location information in terms of longitudes and latitudes of the driver or the conductor to programmed server and then stored the values into MySQL database. When the user enters source and destination stops, a list of buses is shown running on that particular route. When user selects particular bus, its live location is shown on Google Map API using the latitude and longitude coordinates fetched from the server. Also, the time required for the bus to reach source and destination is shown to user. The web application is designed to be used by authorities to manage bus details, route details, driver and conductor details, depot details, etc. Also a functionality of searching throughout the database is provided to manage details. Along with it, an option of edit and delete is also provided for managing records.

## **2. LITERATURE REVIEW**

The proposed technology allows organizations to track real-time information about their organizational vehicle during travel. The system contains single android mobile that is equipped with GPS and GSM modems along with processor that is installed in vehicle. During vehicle motion its location update can be continuously reported to a server using GPRS service. This location information will be plotted using Google Maps on monitoring device [1]. The proposed system's application helps the admin to find the location of bus drivers/conductors. This application helps the admin to find the location of various drivers. The project scope is enhanced to allow users to track one vehicle rather than all vehicles at once [2].

The project android app based vehicle tracking using GSM and GPRS mainly focuses in tracking the location of the vehicle on which the device has been installed. It will then send the data in the form of latitude and longitude coordinates through SMS on the user's mobile where the coordinates will be plotted in the android app automatically. Initially, the GPS installed in the device takes input from the satellite and stores it in the microcontroller's buffer. In order to track the vehicle, the mobile user has to call on the SIM number that is registered in the GSM module of the device. Once the call is received, the device authenticates the calling number. If authenticated, the location of the vehicle is sent to the registered mobile number in the form of SMS. After sending the message, the GSM is deactivated and the GPS is activated again. The coordinates of the location received in the SMS can be viewed on the android app. The hardware part described in the paper comprises of GPRS, GSM module, LCD to view the coordinates, ATmega Microcontroller MAX 232, Arduino, RS232 and Relay [3].

The proposed system provides better service and cost effective solution for users. A vehicle's geographic coordinates obtained from an in-vehicle device. A cell phone has been used to display location of vehicle on Google map. The system was able to experimentally demonstrate its effective performance to track a vehicle's location anytime from anywhere. This is easy to make and inexpensive compared to others [4].

The authors, Nusrath Jahan, Kamal Hossen and Muhammad Kamrul Hossain Patwary introduced an android application for tracking live location of CUET bus. This application mainly makes use of GPS, Google Map, SMS

gateway, web server and database server. With this application, students can get location information of the bus in both situations where internet connectivity is available and where it is not available. However, the system has limitations in some respects. Here, the authors used the network provided location information where there is problem of getting information from GPS. But network provided location is not more accurate than GPS. Again, there is no time prediction about arriving of bus at a specific location. And, there is no automatic notification system when the bus arrives at chosen location [5].

The authors Jisha R.C, Aiswarya Jyothindranath, Sajitha Kumary L in school bus monitoring system developed a system capable of providing productive services through emerging technologies like Internet of Things (Iota). The proposed IOT based system tracks students in a school bus using a combination of RFID/GPS/GSM/GPRS technologies. In addition to the tracking, a prediction algorithm is implemented for computation of the arrival time of a school-bus [6].

In development of an android based real time bus tracking system, the authors proposed a real-time bus tracking system for the students using Android smartphones which can be used for tracking and positioning of the buses by using Global Positioning System (GPS). This android based real time application enables the students to find out the exact location of the buses so that they will not get late or will not arrive at the bus stop too early. It provides the exact location of the student's respective buses which can be viewed on the google map [7].

The authors Majd Ghareeb, Athar Ghamlous, Hawraa Hamdan, Ali Bazzi and Samih Abdul-Nabi presented a mobile and web application that is designed to address this issue. The system will help parents, the school and the bus to communicate automatically and easily via the application in order to detect kids' arrival time. The bus application side will notify parents few minutes before its approaching to their home. Furthermore, the system will allow parents to inform the school and hence the bus application side about the absence of their kid [8].

The authors in application based bus tracking system proposed a system that works in three parts. In the first part, the bus location is received from the satellite and then further it is processed through the Kalman filter and then it is sent to dedicated web servers with the help of cellular networks. In the second part, the coordinates received is processed through the Google Maps API. In the third part, the data received from Google Maps API is processed in users device to show real-time location [9].

In real time bus tracking and location updating system, the authors developed a project that aims in automating the services of the system that can provide the real time tracking experience of the public transport buses. The buses have RFID tags within them and RFID readers are placed in every bus stop. Arduino serves as the central controller for this system. GSM module is used to send the tracking messages to the authorized persons for continuous monitoring. GPS is used for getting the location of the buses. Users get the bus tracking details as notifications in their mobiles through IOT. The inputs from RFID readers are continuously updated to Arduino for processing the data. The processed data is sent to the cloud

which serves as the interface between the user and the system [10].

The authors developed a system that consists of an Internet enabled android application which will interact with a server. Authentication, attendance monitoring, vehicle tracking are the other features provided by the system. Driver, Faculty/Teachers, Parents, and Administrators are the end users of the application. The application uses wireless technologies like GPS and GPRS/GSM. With this android application parents can watch all the movements of the bus and monitor their child's presence [11].

To determine precise location of object Abid Khan And Ravi Mishra have proposed tracking unit which it is attached and using GSM modem this information can be transmit to remote user. This system contains GPS and GSM modems along with ARM processor that is setup in the vehicle. Through SMS the location of vehicle can be reported. A GSM & GPS technology helps to track the vehicles exact information. Real time control is provided by SMS system. You can monitor the location from anywhere using this system [12].

Rodrigo R. Oliveira, Felipe C. Noguez, Cristiano A. Costa, Jorge L. Barbosa and Mario P. Prado has proposed a model to get the exact position of vehicle. The device used for tracking the location of vehicle is named as SWTRACK. The distributor companies use this model to get the location of their respective vehicles. It also provides the mechanism to monitor the detours coming in the planned route and sends a alarm message through the device [13].

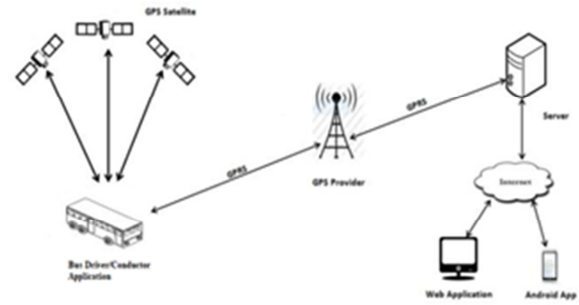
### 3. PROBLEM STATEMENT

To design a system that can automate the process of tracking, monitoring and location updating services of public transport system in a cheaper manner. Existing system has majority of functions that are manually operated which is error-prone. This project also aims in developing an optimal solution by instant updating system to decrease the chances of errors.

### 4. PROPOSED METHODOLOGY

Real time bus tracking system uses the GPS technology, GSM service and android mobile. As per shown in Fig. 1 this system has four main modules transmitting unit, monitoring unit, server and managing unit. Transmitting side performs tracking functionality. It tracks the bus through GPS and GSM and then transmits its current location to the server. The main function of monitoring side is to provide login interface to user, provide list of buses available between the routes selected and to show the google map with live bus location. The function of the managing unit is to manage details of driver and conductor, bus details, route details, depot details, bus stop details, etc. Here, MySQL server works as a central connector for transmitting unit, monitoring unit and managing unit. The transmitting side, monitoring side and managing side communicate with each other through Server only. As shown in Fig. 1, mobile application communicates with server and access the remote database. Whereas, transmitting side tracker application obtains its current

location through GPS and GSM technology and then updates it to MySQL server.



**Figure 1: System Architecture**

#### A. Project Component :

It consists of three units:

##### a) Transmitting Unit:

Android device has inbuilt GPS, GSM functionalities. So, the android mobile is used at transmitting side.

##### 1) GPS :

GPS stands for Global Positioning System. GPS is a radio navigation system. It uses radio waves between satellites and a receiver inside your phone to provide location and time information to any software that needs to use it. You don't have to send any actual data back into space for GPS to work; you only need to be able to receive data from four or more of the 28 satellites in orbit that are dedicated for geolocation use. Your phone's GPS receiver uses the data from these signals to triangulate where you are and what time it is. Four satellites are required for GPS to work.

As bus is tracked using GPS technology, it is a main module in this real time bus tracking system. We have used it to get the exact location of respective buses. So to get exact location, it needs to be in a focus of four satellites. The fourth signal is used to determine altitude so you can get your geolocation data on a map with only three signals.

##### 2) GSM :

The Global System for Mobile Communications (GSM) is based on the phone's signal strength to nearby antenna masts. GSM localization uses multi-lateration to determine the location of GSM mobile phones, or dedicated trackers, usually with the intent to locate the user.

A GSM modem is wireless modem that works with a GSM wireless network. It behaves like a Dial-up modem. The working of GSM modem is based on commands; The Commands always start with <AT> (ATention) and finish with a <CR> CRacter. The AT Commands are given to the GSM Modem with the help of PC or Controller [1].

In real time bus tracking system, GSM service is used for communication between all three modules. When GPS is unable to send location, GSM is used.

**b) Monitoring Unit :**

Monitoring unit is an android application through which user will come to know the actual position of the bus. This android application provides the user interface through which user can interact with the system. It provides login to the user. After login, user will see google map with exact location of bus.

**c) Managing Unit**

Managing Unit is a web application developed for administrators to manage all the data and information about the bus details, driver details, route details, depot detail, etc.

**B. Work Flow**

**a) Driver & Conductor Module**

This module is designed only for the bus driver and conductor. Only the authorized bus drivers and conductors can use this module by providing their unique login credentials. They need to start their location services before driving by clicking start tracking button. The current location of them i.e. the bus will automatically be updated from their Android mobile to the server within every five minutes of interval in the form of latitude and longitude. Fig. 2 shows the flow diagram of the driver module.

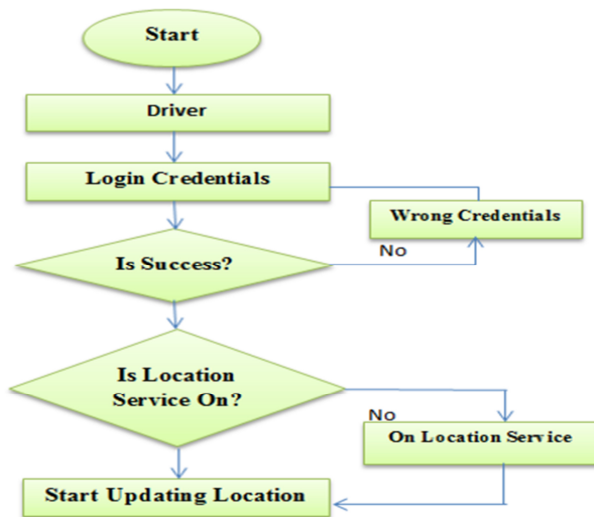


Figure 2: Driver/Conductor Module

**b) User Module:**

This is the most important module and the soul of the system. Users of this module need to enter source and destination stops. A list of available buses will be displayed from which after selecting a particular bus, they can access the details of all the bus through their smartphones. Here, the user will get all the buses and driver-related information. Users can track the location of their buses from any location. Users must make sure that their location service is active. Fig. 3 represents the flow diagram of user module.



Figure 3: User Module

**c) Admin Module**

This module is designed for the bus administrator for updating the information. Administrator can log in to the admin account after authentication and authorization. He can create new user, new admin, enter bus details, depot detail, enter new route details and also he has the options to add or remove a route. The admin has the right to update the driver's name, driver's contact number, routes, stops, etc. Fig. 4 shows the flow diagram for the admin module.

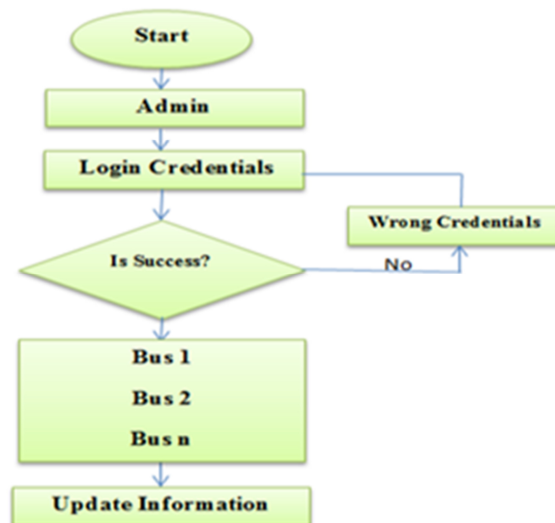


Figure 4: Admin Module

**5. IMPLEMENTATION**

Monitoring unit, managing unit, tracking unit and MySQL server are the four main pillars of real time GPS based bus tracking system. In this system GPRS service is used to perform communication between monitoring and tracking unit to server. We have used android platform and Php PDO

language for implementation of monitoring as well as tracking unit. Monitoring side consist of Login page, Register page and Google Map Api with the location of required buses. As user can easily use this application by sign up and he will get all login rights.

Google Map is obtained by using Google APIs. We have created online MySQL database server to stores the information receiving from tracking and monitoring units. The database operations are performed through the MySQL along with Php-PDO. Tracking device will continuously communicate with GPS satellites and it will provide the current location of bus. If GPS tacking is unavailable, GSM functionality will be used. The tracking device will receive its current location in the form of longitude and latitude and it will send the update to server by using HTTP post method. On the Google map, the tracked location of bus will get plotted by using the Java Script.

### 6. RESULT

After successful implementation of Real-Time Bus Tracking System, we have obtained the following results:

At transmitting side, driver or conductor will have to register themselves first to admin. Then they have to login into the tracking application with the login id and password provided by admin. If Login credentials are wrong, error message will be displayed and will be redirected to again Login page. Else he will be redirected to bus selection page where the details about the route and bus has to be selected as shown in Fig.5

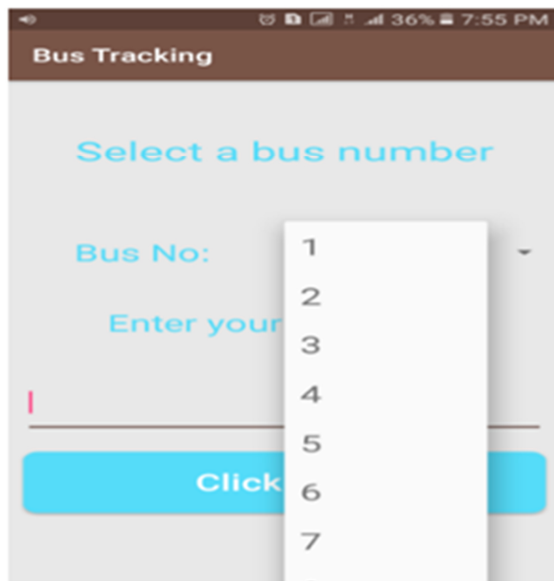


Figure 5: Driver’s Bus Selection

After submitting proper bus and route details, a screen will appear showing the current location in the form of latitude and longitude .The Driver/Conductor then have to start their location sharing by clicking on start service button as shown in Fig.6. When the journey is complete, they should click on

the stop service button. The location will be sent continuously to the MySQL server within interval of five minutes.

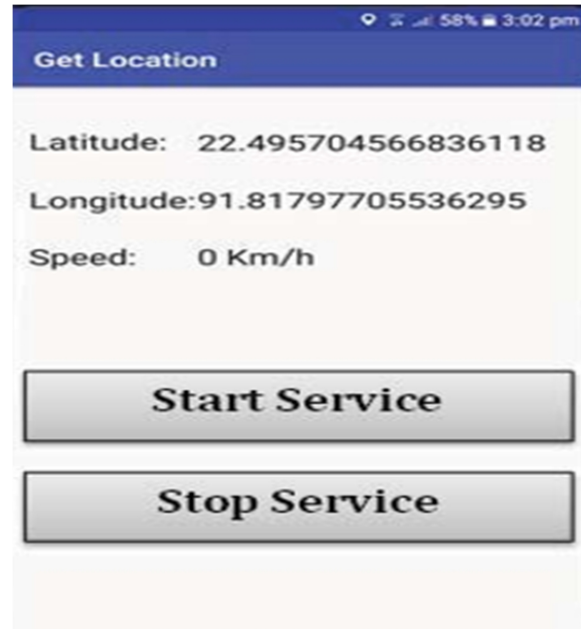


Figure 6: In-App Location Sharing

At the monitoring side, the user has to register first in real time bus tracking android application. Later he has to successfully login into it. After that, the search between stops screen opens up as shown in Fig. 7. In that, user has to select source, destination, via stops from list and click on search.

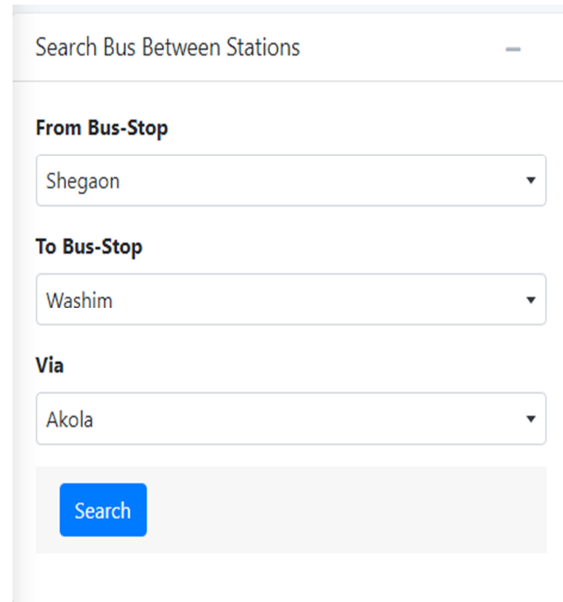


Figure 7: User’s Bus Search Feature

After clicking on search, a list of available buses will be shown to user from which after selecting a suitable bus from the list, the real time location of the bus will be shown to user as shown in Fig.8.



Figure 8: Real-Time Bus Location

At the managing side, a web application is present where only authorized administrators can access the application. The admin has modules to create, modify, delete, store new driver/conductor details, create new routes, modify them, etc. as shown in Fig.9.

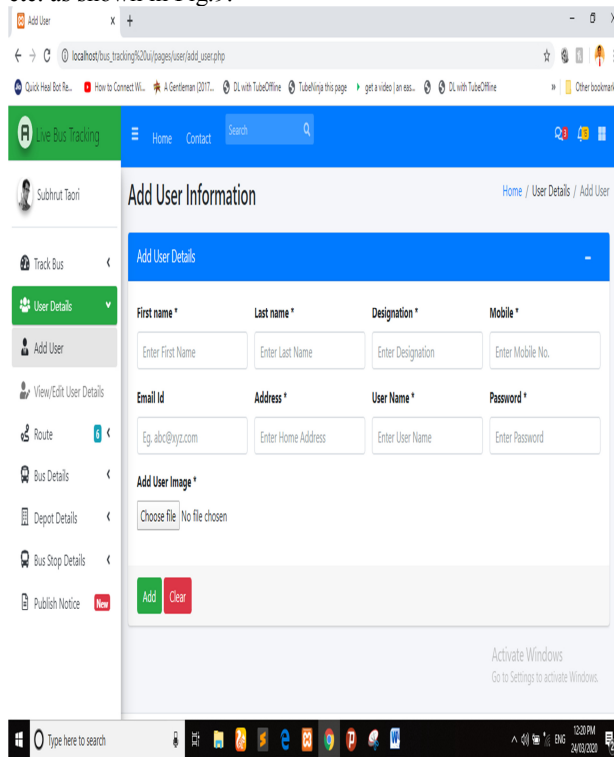


Figure 9: Driver/Conductor detail management

Also the admin has options to create, modify, delete bus details, depot details, publish notices, etc. as shown in Fig.10.

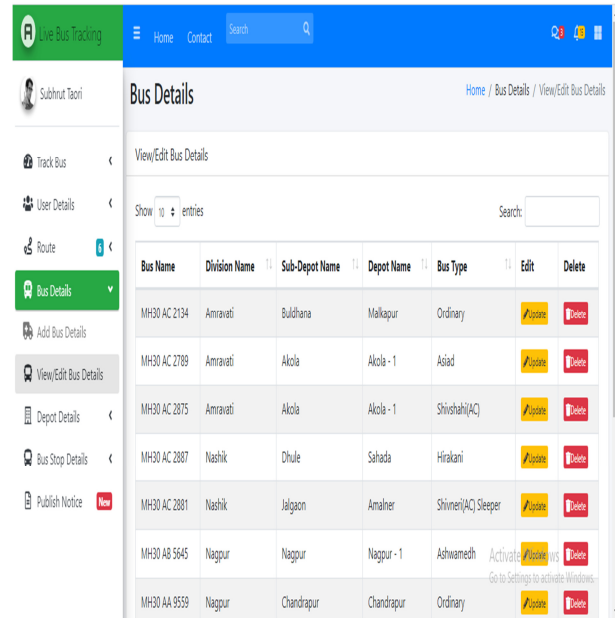


Figure 10: Bus Details View/Edit Module

## 7. CONCLUSION

Android based live public bus transport tracking system is an advanced method that can locate and track the buses. The success of the tracking system lies in providing easy interface and exact location via android application to the user. The designed system can be deployed in every rural and urban area which provides a user friendly environment to the passengers. The bus-side, server-side and client-side modules provide all the expected functions. Since this application does not need any external hardware except a smartphone which is available to anyone in the world, the overall cost is very low or no cost needed for tracking the bus location. It provides nearly accurate data in real time that makes possible for the user to track the buses.

## 8. FUTURE SCOPE

In the proposed system, we can add features like online bus seats booking and availability, live seat vacancy in bus, etc. This will help users by providing ease of availing facilities from a remote place. Also, it will help bus department by increasing the count of passengers traveling daily and thus will be economically beneficial without any large investment.

Moreover, a facility of publishing Notices regarding special buses, holidays, temporary stoppage of services, etc. can be helpful for people and can be provided to them in the form of SMS or notifications. This application can be also useful to schools, colleges, companies, private transport systems, etc. to track their buses with zero investments except for the server charges to track their buses.

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