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Bus Tracking System using IoT

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Abstract: ***Unusual and unexpected conditions on the roads affect the smooth operation of the bus system and the movement of vehicles. Also, everyday problems such as traffic congestion, unexpected delays, randomness in passenger demand, irregular vehicle dispatching times take place and as a result of which the schedule of the passengers are affected and they have to wait for the arrival of their respective bus. The inconvenience of the passenger can be avoided by introducing a system which provides real-time information about the location and estimated time of arrival of the buses. This project focuses on the implementation of a Real-Time bus Tracking System (RTBTS), by installing GPS (Global Positioning System)-module devices on college buses which will transmit the current location on the GPS Receiver. The GPS Receiver will be interfaced with a computer and an interface driver will auto save data in a dot text file which will continue to do until the GPS module is connected to a bus. From here the application will retrieve data and store it in web server from where the system will display real-time information of the bus. The real-time bus tracking system is a standalone system designed to display the real -time locations of the buses provided by the college.***

Keywords: Global Positioning System(GPS), Bus tracking, Android phone, Internet.

I. INTRODUCTION

One of the fastest and most dynamic business sectors today is the mobile phone industry. The need to communicate efficiently and instantaneously is always a necessity. The market sector, ever-growing and demanding consumers always wants to have better than ever. Mobile phone makes our life easier. We cannot avoid it because communication is a part of our daily life. The invention of mobile phone has gone tremendous leaps in innovation and new applications. Originally, it was intended to be a telephone that can be carried wirelessly at greater distances.

Advancement in communications, upgradation in radio frequency and developments on the internet had given mobile phones ore sophisticated but easy to use in applications. For instance, authors in propose an accurate map-matching algorithm for location tracking of a mobile user that can be potentially used by privacy adversaries to accurately reconstruct a user's actual trace. Mobile phones are now equipped with navigation systems such as GPS that aids travelers, tourists, adventurers and navigators for getting the most accurate view of their present location. It also assists them in searching for the nearest establishment such as restaurants, hotels, malls, bank, police station and other places of interests.

We are going to track the bus using GPS to get the exact location of bus. There is an Android Application for public or bus user which will help to track bus and get the exact location of bus. The application will also tell the estimated arrival time (ETA) of bus to the user .

ETA is calculated when user is standing on bus stop and the nearest bus coming towards the bus stops at which user is standing. This paper presents a system for college bus transportation which is successful in producing an intended or desired solution or result. Real time tracking of the bus allows the user to have more time for activities instead of waiting for a delayed bus and the notification system ensures the individual safety of each student.

The tracking is achieved by reading the geographic coordinates of the bus from the GPS module and uploading it to a MySQL database in the remote server. This information can then be accessed by a user base that includes the students, bus drivers and college administration through a mobile application which takes the location from the database and plots it on a map. One of the fastest and most dynamic business sectors today is the mobile phone industry. The need to communicate efficiently and instantaneously is always a necessity.

II. LITERATURE SURVEY

System proposed system, an Android application is developed to maintain the student details and to track the bus location. By using this application the student can get the location of the bus and if any changes occur in the bus number immediately the notification is send to the student to alert that the bus number was changed. When the student login to this application they can see the available notification and the bus location in the Google Map. Further when the people waiting for the bus at the bus stop and if any bus route changes then immediately the notification is sent to the particular person who are waiting for boarding thebus. So that, the particular person can takes necessary actions to reach their destination without any time delay. The web server utilize the technology of

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Location Based Services, which helps to track the current location of the bus and it estimates if any deviation occurs in the bus route using the Client-Server technology. Each bus sends its current location to the web server. This information is stored on the server database. The students who installed the college bus tracking application can track the bus routes, bus number, bus location and the arrival time of the bus using Kalman filter algorithm. The bus location is tracked by using global positioning system and the location information is send to the students in the Google map which reduces their waiting time.[1] Proposes an Android mobile phone application that gives information about buses, bus numbers as well as bus routes both online and offline. Reason for Android platform Android requires an open source development which is probably the most feasible and a present user friendly approach. This paper also deals with Location Based Services, which are used to track the current location of the bus as well as give an estimate remaining time for the tracked bus to reach its destination using the clientserver technology. Also It display the required maps with the help of GPS. The two Android applications designed are: One for the Driver to start uploading the buss location to the server and the other for the user to retrieve the location of the bus and check how much time the bus takes to reach a particular stop and also to see the location of the bus on the Google Map. We have also designed a web portal for the admin to manage the bus routes and the stops they cover.[2]

The Bus Coming system provides bus location in formation to passengers taking into consideration the location of the bus as well as the location of the passenger. For rural areas this is an improvement over current bus stop based systems, given that bus stops are few in rural areas and many stops and pick-ups are made away from
bus stops.

The useful information provided in cities about buses with respect to a bus stop like buss distance away, estimated time of arrival of bus, current location of the bus etc. can now be given to passengers of rural areas with the results being personalized to the passengers current location.

Bus Coming acquires both bus and passenger locations through the use of relatively cheap GPS location capable, internet connected mobile devices (mainly smart phones) which cannot be relied upon for accuracy. Bus Coming uses a Reference Point system to compensate for the inevitable inaccuracies of the locations received from the mobile devices. The accuracy of the association of raw location data received from the mobile devices to appropriate Reference Points is critical to the usefulness of the Bus Coming system.

The core communication technology behind the system is based on Web Services and results demonstrate that this simple approach is accurate and appropriate for rural areas in Trinidad. The Bus Coming tracking system proposed in this paper has shown to be capable of effectively compensating for the inaccuracies associated with raw location data generated by consumer level mobile devices (smart phones). Thus even very low cost devices without accurate location capabilities can be used within the Bus Coming system to extract accurate location data. Given the accuracy of the Bus Coming system, rural areas should look first to a bus and passenger based bus tracking system thereby providing more useful information than a bus and bus stop based bus tracking system.[6]

System proposed smart bus tracking system that any passenger with a smart phone or mobile device with the QR (Quick Response) code reader can scan QR codes placed at bus stops to view estimated bus arrival times, buses current locations, and bus routes on a map. Anyone can access these maps and have the option to sign up to receive free alerts about expected bus arrival times for the interested buses and related routes via SMS and e-mails. We used C4.5 (a statistical classifier) algorithm for the estimation of bus arrival times to minimize the passengers waiting time. GPS (Global Positioning System) and Google Maps are used for navigation and display services, respectively. we have presented a smart bus tracking system. It is based on GPS, GSM, QR coding and Googles map technologies.

The proposed system, basically tracks the busses, estimates their arrival times at specific bus stops and informs the users through prevents passengers unnecessarily to wait at bus stops and enables them to use their time more efficiently. In the future, we plan to enhance the system with some other estimation tools and statistical analysis. This mig used not only by public users but also by decision makers in the local municipalities. Moreover, since the system is developed
with open standards and open sources, it is easily extended with future technologies.[8]

III. PROBLEM STATEMENT

To implement an application to track the location of the
bus using GPS so that the system provides a single platform for students as well as staff as well as a web application for admin who can make updations and necessary changes by logging it into their account.

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IV. PROPOSED SYSTEM

We are making a system which is an Android application which can be used by users as well as driver to take them on a single platform. In our application we are going to track the real time location of the buses. We are going to provide functionality such as ratings and review system, search bus information, etc. The major benefit of proposing this system is that the user will be able to save time and can easily track the accurate location of the bus. As for the next step, we plan to improve the overall GUI of the application as well as extend more functionalities to the proposed application.

V. MODULES

A. User Module

The user will do registration process on the mobile then after the registration they will login. If the user want to track the location of allocated bus then they just have to enter the source from the current location as well as destination location, where they want to reach. The destination location will be same for every student as it is specifically made for the college purpose. Whenever the user will register, the data will get automatically updated into the database of the admin section. If new user join the college and want to take bus then they firstly have to sign up into the page then they can login using his mail or the number.

B. Driver Module

In this module the mobile device will have the switching mode in the user application only so that the driver can switch into his mode and then can see the location. There is no separate application for driver to reduce the use of resources.

C. Admin Module

In the admin module the database of the administration section will be updated as the user logs in into their account. The admin will login using their username and password and can delete, update and make necessary changes as per the requirements. The college admin can also add the location and buses as per the future requirement.

VI. SCOPE

This Document plays a vital role in the development life cycle (SDLC) and it describes the complete requirement of the system. It is meant for use by the developers and will be the basic during testing phase. Any changes made to the requirements in the future will have to go through formal change approval process.

A. Location Monitoring.
B. Internet requirement.
C. To make this data available to the common man.
D. To set a danger limit on that server and inform authorities to take future actions for wellbeing.

VII. COMPONENTS

The proposed prototype of the system use the following components:

A. MYSQL

MySQl is an open source relational database management system(RDBMS). MySQL is free and open source software under the terms of the GNU General Public License, and is also available under variety of proprietary licenses. MySQL is used by many database driven web applications, including Drupal, Joomla and Wordpress. MySQL is used by many popular websites, including google, youtube, etc.

B. NET

NET framework is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large class library named as Framework Class Library(FCL) and provides language interoperability across several programming languages. Programs written for .Net Framework execute in a software environment named Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management and exception handling.

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C. HTTP Protocol

The Hypertext Transfer Protocol (HTTP) is an application protocol for distributed, collaborative, hypermedia information system. HTTP is the foundation of data communication for the World Wide Web, where hypertext documents include hyperlinks to other resources that the user can easily access for example by a mouse click or by tapping the screen in a web browser. HTTP was developed to facilitate hypertext and the World Wide Web. HTTP functions as request-response protocol in the client-server computing model.

D. Global Positioning System(GPS) Sensor

GPS sensor is a global navigation satellite system that provides geo location and time information to a GPS receiver anywhere on or near the earth where there is an unobstructed line of site to more than four GPS satellites. Hindrances like mountains and buildings block the relatively weak GPS signals. The GPS does not require the user to transmit any data and it operates independently of any the internet reception, though these technologies can enhance the usefulness of the GPS positioning information.

E. Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

F. Android Based Mobile

Mobile application will allow us to view the user interface. It will help the user to login and get the related bus information using GPS sensor. It is user friendly device and it is cost effective.

VIII. SOFTWARE SPECIFICATION

In this prototype, the front end development was done using Java and embedded C in Android Studio and .Net in Visual Studio where in the android application was built using Android Studio and web functionality using Visual Studio respectively. The backend database were developed using MySQL. The push notification service was implemented using URL requests to the Firebase Cloud Messaging service.

A. Abbreviations and Acronyms

GPS: Global Positioning System
ETA: Estimated Time Arrival
SQL: Structured query language
URL: Uniform Resource Locator

IX. ALGORITHM

A. Map Matching Algorithm

The algorithm uses the following steps:

1) *Step 1:* Find the closest node from the first GPS point (i.e., initial point).
2) *Step 2:* In this step we have to check whether the next point is an outlier. If the point is not an outlier, then select all the road segments that pass through the closest node, otherwise take this point as the initial point and go to step-1.
3) *Step 3:* Using the weighting formula, choose the correct link. The initial point and its next point should be matched to this link.
4) *Step 4:* Determine the vehicle position on the correct link for each of the two points.
5) *Step 5:* Check whether the next point is an outlier. If it is true, then go to step-1 and take it as the initial point. If not, map this point on the same link and determine its position and continue this process until the above conditions are true, otherwise go to step-1.
6) *Step 6:* Repeat step-5 until all points has been matched.

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Flowchart

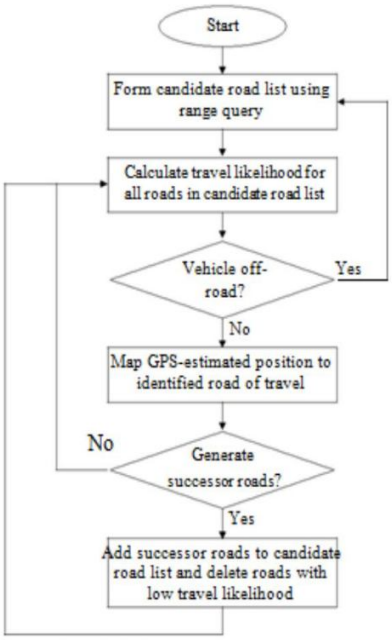


Figure 5. The map-matching algorithm.

B. Mathematical Model

1) System S=Android Application For Bus Module System

S1 ={S1 ', I, δ , O} S1 ' = {GPS, GPRS} I = {Bus Route, Bus number}

δ →{Function to determine current GPS location using

Location based services}

O = {Latitude, Longitude, Speed}

2) System S2 = Server side System

S2 '= {S2' ,I', δ',O'} S2 ' ={ Internet, Database server} **I'=** { Longitude, Latitude, Speed, Route, Bus number} **δ'** → Cal Let, F(M) =∑ i=1 n Cal

Cal = {R, Dist, Va} [R = Routes, Dist = Distance,

Va = Average velocity] R = {R1, R2, R3, ……..,Rn}

R1 = {Source, L1, L2, L3,……..,Ln}

where L1,L2,L3…….Ln are intermediate

Geographical points

Dist = {D1, D2, D3,……,Dn}

where D1, D2, D3……Dn are distances between

these points

Va= Average velocity from prediction system

Time= Dist/Speed {Dist, Time, average velocity of the current segment}

3) System S3=Android Application for user Module System

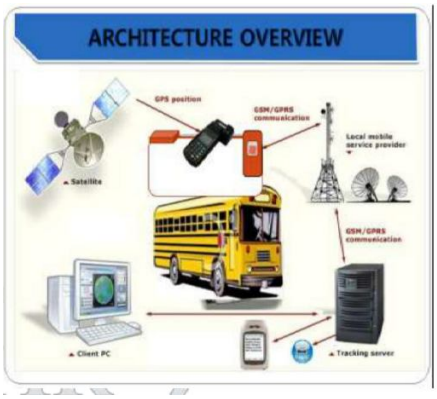
S3={S3 ', I'', δ'' , O''} S3 ' = {GPS, GPRS} **I'' =** {Bus Route, Bus number}

δ'' →{Function to determine current GPS location using Location based services and sent to web service} **O'' =** {Distance, Arrival Time of bus}

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X. ARCHITECTURE



The project is about college bus tracking system and this application enables the user to find out the bus location information so that user does not get delayed. The main aim is to collect the data from GPS and deliver it to server from where it will be fetched by android application and bus real time location can be viewed on google map which is integrated on to the android application.
The user can log on to the application and can know about the scheduled routes of the college bus. From the users perspective we are doing this project so as to save time. Bus tracking application is a application for smart phones that works on android operating system. This application at a specific pick up point will send the current location of the bus to students when they request. This app generates prediction of bus arrivals at stop along the route.
The objective is to provide that the system will help the user to know if a bus is on scheduled or has been cancel due to technical or weather issues. System will also tell the users whether they have missed a bus so that they don't have to wait for the bus.

XI. CONCLUSION

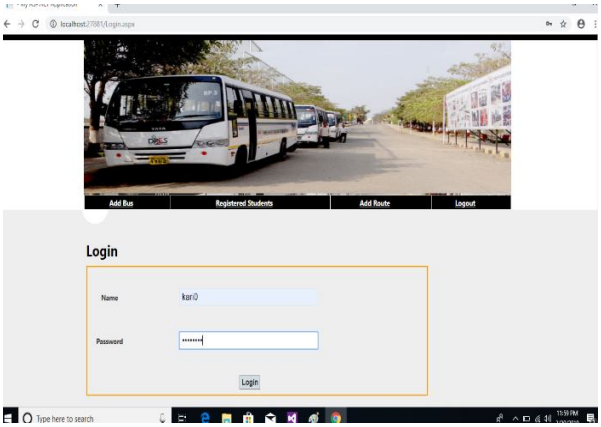
In this paper the design and implementation of an interactive, affordable, simple, flexible and scalable adaptive interactive bus transportation system are stated. Our system contains different technologies together such that it contains IoT unit to send the bus information to the application server and the application server has MYSQL database which provides the required information. The project is user friendly and cost effective and this software can also be used for and type of public transportation services

XII. FUTURE SCOPE

The software can be modified and developed as per the users requirement in future use. This application can be used to predict the location of any traffic congestion that will occur. It is flexible, simple, user friendly and easy to use.

XIII. RESULTS

The output of the bus tracking system is provided using a mobile application as well as web application. The system displays the current location of the user as well as estimated time arrival in the real time world. The real time monitoring will allow the users to know about the bus failure or any such things. This application can be used for private as well as public transportation.



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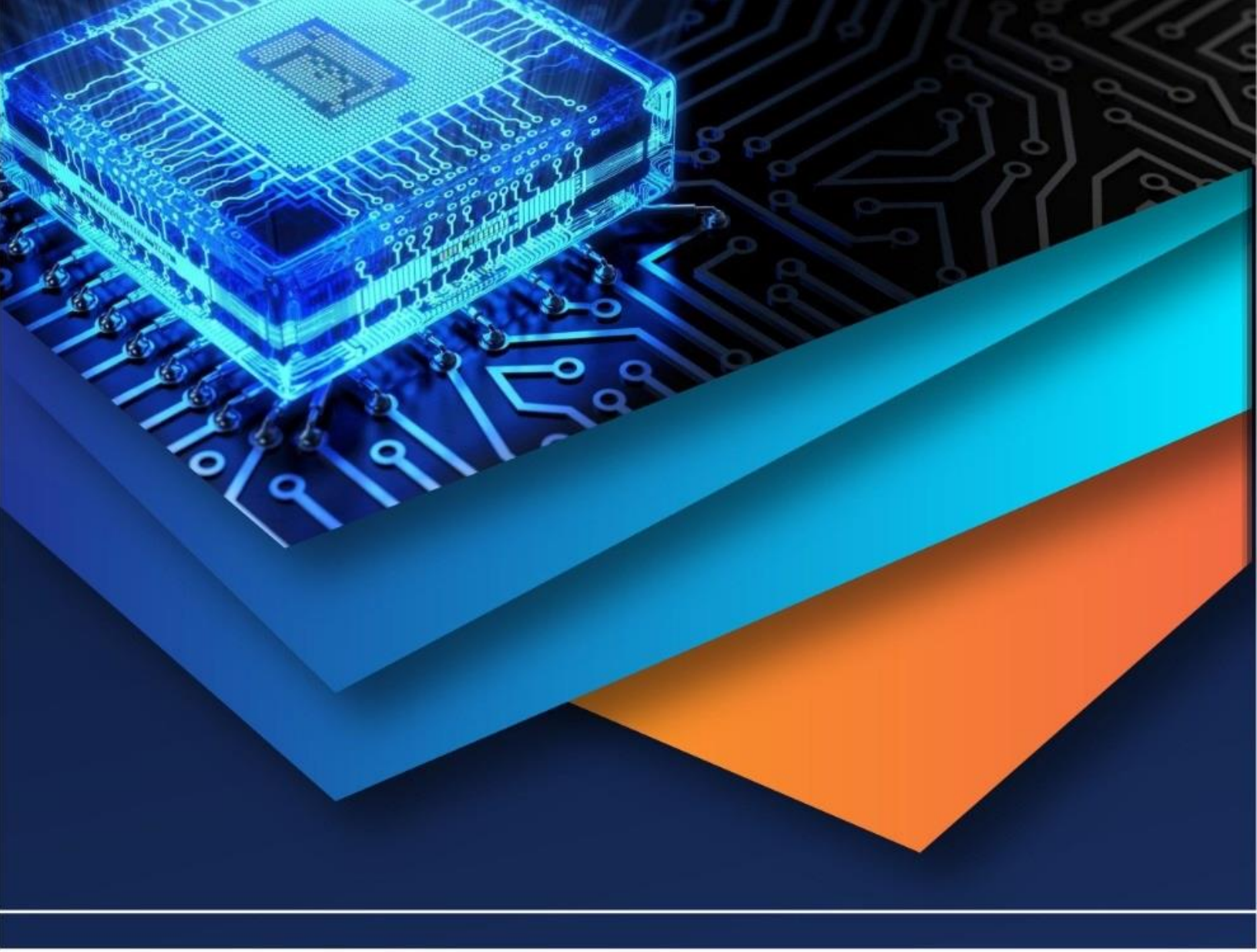
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