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Real Time College Bus Tracking System

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ABSTRACT: A variety of technologies is recommending the sophisticated environment more and more often. Modern business practises are frequently improved by the corresponding advancements in technology. The most recent and quickly evolving technology available to all consumers or users in today's industry is called Android. Over the past few years, there has been a significant increase in end-user assent. The proposal is based on the most recent GPS technology using the Internet of Things, allowing college students to monitor the movement of the college buses, keep a timetable, and provide real-time bus positions for users. The seamless running of the bus system and the switching of vehicles are impacted by the exceptional road conditions. Additionally, daily challenges like traffic, unexpected delays, and dispatching events involving damaged vehicles occur. As a result, the student's schedules are impacted, and they are forced to wait for their specific bus to arrive as well as make an effort to miss it. This application's main goal is to display the precise position of each user's individual buses on Google Maps. It also has the unique feature of alerting the driver if the user is close to the bus stop. It is a real-time system since the latitude and longitude coordinates of the bus's current location are updated every single second and sent to the user's application via the Google Map API. The user can view the estimated arrival time of the bus at their designated stop. This could be particularly useful for students who need to plan their schedules in advance. If the bus is running behind schedule, users could view the delay time to see how long they will need to wait for the bus to arrive. Users could have the option to pay their bus fees directly through the college bus tracking system. This could be done using a variety of payment methods, such as credit card or through Net banking.

I. INTRODUCTION

The Internet of Things (IoT) refers to the connection of devices, systems, and services through the internet, allowing them to communicate with each other and exchange data. This can be applied to a wide range of industries and situations, from transportation to healthcare to manufacturing. By connecting devices and systems to the internet, it is possible to create a network of interconnected objects that can share information and perform tasks automatically, without the need for human intervention. One example of how the IoT can be used is in the transportation industry. By connecting buses to the internet, it is possible to track their locations in real-time and provide this information to passengers through a smartphone app or other means. This can help individuals make more informed decisions about when to leave for the bus stop and which bus to take, reducing confusion and frustration.

The real-time tracking and notification system is designed to help individuals better understand the location and availability of buses in their area. By using a mobile application connected to Google Maps, the system is able to display the location of the bus on a map in real-time. This allows individuals to track the movement of the bus and receive notifications about its location and availability, helping them to plan their transportation and be on time for their bus. The system uses GPS technology to track the location of the bus and send this information to a server. The server then processes this information and makes it available to users through the mobile application. The mobile application displays the location of the bus on a map, allowing individuals to see where the bus is in relation to their current location.

The system also includes a buzzer that can be activated by the user to alert the driver to wait for them at the bus stop. This can be useful if the individual is running late and needs a few extra minutes to get to the bus stop. Overall, the real-time tracking and notification system helps individuals track the movement of buses and receive notifications about their availability, allowing them to better plan their transportation and be on time for their bus. It is powered by IoT technology, which involves the use of sensors and other tools that communicate with each other through the internet to provide real-time updates and automatic actions.

By using the GPS module and the Google Maps API, the system is able to continuously track the location of the bus and provide this information to the user through an android application.

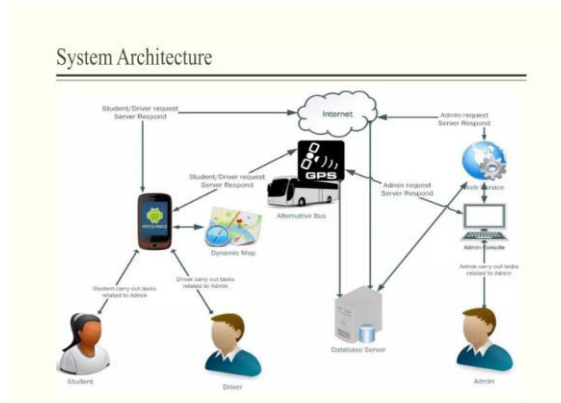


Fig 1: System Architecture

The user can access the location of the bus on a map by opening a webpage on their computer or mobile device, which will contain a link to Google Maps with the location coordinates of the bus. When the user clicks on this link, it will open Google Maps and show the location of the bus in real-time. This feature helps the user to better plan their transportation and reduce the risk of missing the bus. The proposed system includes a notification feature that allows the user to send a notification to the driver if they have missed their stop. By using the alarm option in the android application, the user can alert the driver to wait for them at the next stop or to make an additional stop to pick them up. This feature can be useful if the user has missed the bus or if they are running late and need to catch the bus at a different location. By providing the user with the ability to send a notification to the driver, the system helps to improve the efficiency and convenience of the college journey for all users.

The ETA (estimated time of arrival) algorithm is a mathematical formula that is used to calculate the estimated arrival time of a vehicle at a specific location. The algorithm uses information about the current location and speed of the vehicle to estimate its arrival time at different locations along its route. In the proposed system, the ETA algorithm is used to calculate the estimated arrival time and location of the college bus. By providing accurate and up-to-date information about the location and status of the bus, the ETA algorithm helps to improve the efficiency and convenience of the college journey for all users. To use the ETA algorithm in the college bus monitoring and notification system, the GPS module must continuously send location data to the NodeMCU. The NodeMCU then calculates the ETA for the bus at different points along its route, using the current location, speed, and other relevant information. The ETA data can then be transmitted to the local server and displayed on the android application or a webpage accessed by the user.

One of the benefits of using an ETA algorithm in the college bus monitoring system is that it allows users to plan their journey more effectively. For example, if a user knows the estimated arrival time of the bus at their location, they can plan their journey accordingly and arrive at the bus stop at the right time. This can help to reduce delays and improve the overall efficiency of the college bus system. Another benefit of the ETA algorithm is that it can be used to optimize the routing of the bus. By constantly updating the estimated arrival times at different locations along the route, the system can adjust the route to ensure that the bus is running on time and minimizing delays. This can help to improve the overall efficiency of the college bus system and provide a better service for all users.

II. LITERATURE SURVEY

A. Real Time Bus Tracking System

It uses the Google's distance matrix algorithm, it is a service that provides travel distance and time for a matrix of origins and destinations. It allows developers to specify a list of origins and a list of destinations, and the API will return a matrix of travel times and distances between the pairs of origins and destinations. This information can be used to show the user the approximate time taken by the bus to reach their location. Overall, the Google Maps Distance Matrix API is a useful tool for developers who want to provide their users with information about the travel time and distance between different locations. By using this API in a college bus tracking system, developers can help users to plan their journeys and anticipate the arrival time of the bus at their location.

One potential disadvantage of the Google Maps Distance Matrix API is that it may not always provide accurate or up-to-date information about the travel time and distance between locations. Another potential disadvantage is that the

Google Maps Distance Matrix API is subject to usage limits, which may restrict the number of API requests that developers can make within a certain time period. If developers exceed these limits, they may need to purchase additional API credits or upgrade to a higher-tier pricing plan.

B. Real Time Web Based Bus Tracking System

It uses GPS, Google Maps, and GPRS technologies to provide real-time location information of buses to users through a web-based application. The system may allow users to access a web-based interface that displays the location of the buses on Google Maps, using data from GPS and GPRS to track the location of the buses in real-time. This can provide users with up-to-date information on the location and movements of the buses, allowing them to better plan their travel and know when to expect the bus to arrive at their stop. It decreases the time remote users must wait for a bus. The bus may be tracked at any time and from any location using a system.

Android apps can work offline, while web-based apps require an internet connection to function. This can be beneficial for users in areas with poor or unreliable internet connectivity, as they can still access the app and its features. Android apps can often offer faster and more responsive performance compared to web-based apps, as they run directly on the device and do not require loading data over the internet. Android apps can more easily access and utilize the features of the device, such as the camera, GPS, or accelerometer. This can allow for more interactive and engaging app experiences.

C. Application Based Bus Tracking System

The Proposed System [3] uses kalman filter, It is being used in a system to improve the accuracy of location data. The Kalman filter algorithm is able to resolve problems related to the accuracy of the location data by using a prediction-correction approach to estimate the true state of the system based on a series of noisy and uncertain measurements. By combining the measurements with a model of the system, the Kalman filter is able to produce an estimate of the location that is more accurate than any of the individual measurements. The implementation of the Kalman filter algorithm is said to greatly improve the accuracy of the location data, likely by reducing the impact of noise and uncertainty on the measurements. The Kalman filter is a mathematical algorithm that can be computationally intensive to implement, particularly in real-time systems. This can make it challenging to use the Kalman filter in resource-constrained systems or in situations where processing power is limited. The Kalman filter combines measurements with a model of the system to produce an estimate of the state. If the model is not accurate or is incomplete, the Kalman filter may not produce reliable results. The Kalman filter is designed to work with linear systems. If the system being tracked is non-linear, the Kalman filter may not produce accurate results.

D. Smart Bus and Bus Stop Management System using IoT Technology

The bus tracking system using the Internet of Things (IoT) can help improve the efficiency and reliability of public bus transportation by providing real-time information on bus locations and availability to users. By connecting buses to the internet and using GPS technology, the system can track the movement of buses in real-time and make this information available to passengers through a mobile application or other means. This can help individuals make more informed decisions about when to leave for the bus stop and which bus to take, reducing confusion and frustration. The system can also be used to improve route planning and scheduling by using real-time data on traffic conditions and bus locations, which can help to reduce travel time and fuel consumption. Additionally, the system can enable the use of electronic ticketing, which can help to reduce the use of paper tickets and the associated environmental impacts. Overall, a bus tracking system using the IoT has the potential to improve the efficiency, sustainability, and user experience of public bus transportation.

E. Real Time Bus Tracking and Location Updating System

It aims to address the challenges of tracking, monitoring, scheduling, and providing alerts for public transportation by automating these services using the Internet of Things (IoT). Your system would use RFID tags and readers, Arduino, a GSM module, and GPS to track the locations of public transport buses in real-time and provide this information to users through their mobile phones. The RFID tags and readers would be used to gather data on the movement of buses, which would be processed by Arduino and sent to the cloud for storage and access by users. The GSM module would be used to send tracking messages to authorized personnel for continuous monitoring, and the GPS would be used to determine the location of the buses. Overall, your system aims to improve the efficiency and ease of access of public transportation by providing real-time tracking information to users through the IoT. One of the main benefits of the proposed public transportation tracking system is that it can help to improve the efficiency of the transportation network. By providing real-time tracking information, the system can help to reduce delays and optimize routes, making it easier for users to plan their journeys and arrive at their destination on time. In addition to improving efficiency, the public transportation tracking system can also be used to enhance safety and security. By continuously

monitoring the movement of buses, the system can detect any unusual activity or potential safety hazards and send an alert to authorized personnel. This can help to ensure that the transportation network is always operating safely and efficiently. Overall, the proposed public transportation tracking system has the potential to significantly improve the convenience and effectiveness of public transportation by automating tracking, monitoring, scheduling, and alerting services using the IoT.

III. PROPOSED SYSTEM

In the current system, if the user does not have accurate information about the location of the bus, it can be difficult for them to predict its arrival time. Without knowing the location of the bus, the user may not know how far away it is and how long it will take to reach the bus stop. This can make it difficult for the user to plan their transportation and be on time for the bus. In some cases, it may be difficult for the user to get accurate information about the location of the bus. For example, the user may have to contact the bus staff directly to ask for the location of the bus. This can be inconvenient and time-consuming, especially if the user is unable to reach the bus staff or if they are not able to provide the requested information. There is a risk that the user may miss the bus if they are not aware of its arrival time or if they are not at the bus stop when it arrives. This can be frustrating and inconvenient for the user, especially if they are relying on the bus for transportation.

If the location of the bus is not known, it can be difficult for the user to anticipate its arrival time or plan their transportation. In this case, the user may need to ask for information about the location of the bus from the bus staff or other relevant individuals. This can be inconvenient and time-consuming, especially if the user is unable to reach the bus staff or if they are not able to provide the requested information. If the user is unsure about the status of the bus, they may wish to contact a friend or a staff member to ask for information. For example, the user may want to know if the bus is running late or if it has been cancelled. Contacting a friend or staff member can provide the user with more accurate and up-to-date information about the status of the bus.

Global Positioning System (GPS) is a popular and effective way to track the location of an object, such as a bus. GPS is a hardware system that uses satellites to determine the location of an object. The accuracy of GPS is typically around 80%, and it is expected to improve in the future as the software and hardware are further developed. In the case of tracking a bus, GPS is used to gather data from multiple satellites and determine the position of the bus. This information is then sent to a server and made available through an application or other means. The application can use this information to track the location, arrival, and departure time of the bus, and display this information on a map using the Google Maps API. Overall, GPS is a useful tool for tracking the movement of objects and providing real-time updates about their location and status.

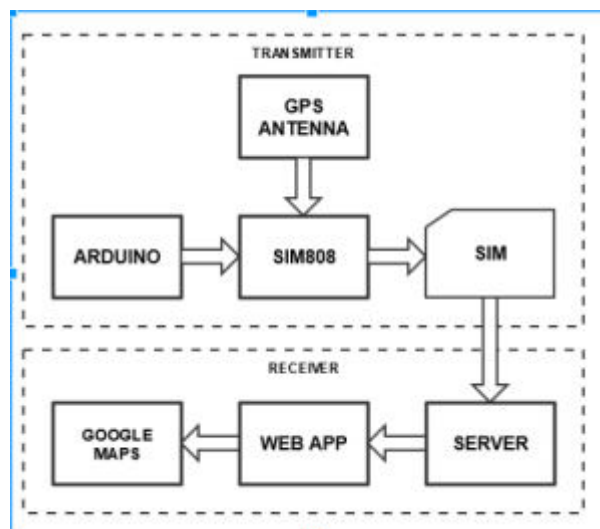


Fig 2: Work Flow

The proposed system is a bus tracking and monitoring system that is designed to make the college journey more efficient and convenient for users. The system includes a real-time tracking and notification system that continuously tracks the location of the bus and provides this information to the user through an android application. The application

includes three different types of user accounts: administrator, users, and drivers. Users can login to the application using their roll number and password and view the location of the bus on a map using the Google Maps API. They can also send a notification to the driver through the application if they have missed the bus. The driver's login allows the driver to view the number of students who should board the bus, their pick-up location, and the route to be followed. The route may change due to road or weather conditions, which will also be reflected in the student login. In the administrator login, the administrator can view the arrival time of the bus, the route, the number of students to be on board, and the driver details. The system uses ETA (estimated time of arrival) algorithms to calculate the location and speed of the bus. These algorithms use information about the location and speed of the bus to estimate its arrival time at different locations along its route. Overall, the proposed system aims to provide more accurate and up-to-date information about the location and status of the bus, helping to make the college journey more efficient and convenient. By tracking the location of the bus in real-time and providing updates to users, the system helps users to better plan their transportation and reduce the risk of missing the bus. It also provides important information to the driver and administrator, allowing them to more effectively manage the bus route and schedule.

IV. RESULT ANALYSIS

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.

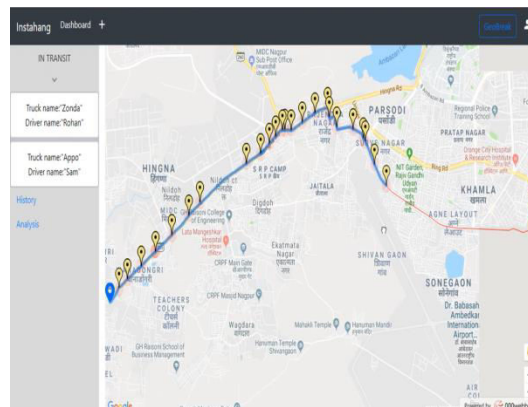


Fig 3: Bus Track Result Analysis

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.

V. CONCLUSION

The proposed system is successfully designed and tested and the following conclusions are made. It enables the user to catch the bus on time, provides an alternate bus and the shortest route till the bus. Also keeping track of the number of students registered and the current location of the bus at regular time intervals. It is better in terms of other applications, it enables the driver to select which bus he is driving, the technique used is unique. This application can be used in



transport system of any institutions, industries, companies to know the current status of the buses. It can also be used to keep track of number of students and faculty registered and travelling by bus.

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