Public Bus Tracking System for Sri Lanka

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Abstract: *The COVID-19 pandemic has put an entire world on lockdown for the first time. People are afraid to go to crowded places like bus stops during this situation. Further today, public transportation services are in a lot of trouble facing people. such as traffic congestion, unexpected delays, and irregular vehicle dispatching times. Manually, the system has encountered the security problem of the data and lost the records. Due to those issues, automated systems have developed for public bus transport. These systems can solve some problems, but they are not yet finished with all of the issues in public bus transportation. due to a variety of advantages, most people choose to take public transportation rather than drive their own vehicles. If people know the schedule for their route bus through their mobile devices, they can arrive at the bus stop in plenty of time to avoid waiting and reduce time wasted. High technology has a major impact on human life and allows us to significantly simplify and automate daily activities. General computerization allows for easier access to all kinds of information needed in daily life, as well as more specialized ones. The proposed system is to develop web-based and mobile based applications for public people because they waste money and time in daily life. Global Positioning Technology System (GPS) technology use for system development. It can be easily tracking the location. Therefore, people can reduce their difficulties and be enabled to access and manage the system easily.*

Keywords: *Bus Tracking system, Android application, GPS*

1. Introduction

Sri Lanka is still a developing country, both culturally and economically. The government should provide a lot of facilities for Sri Lankans. Buses and railways are used to provide public transportation in Sri Lanka. The Sri Lankan Transport Board and numerous private bus companies operate passenger bus services. Around half of the model's modes of transportation are public transportation. The operation and improvement of public transit are prioritized in transportation master plans and government budgets. Public bus transport is most public people's day-to-day transport. Today, public transportation services are in a lot of trouble facing people. As a result, many public buses people are having difficulty in daily life because buses are not working at the right time, drivers are violating the rules and regulations, and due to increased traffic, they waste time. Timetables, bus routes, and services are all available under the existing system, but people can make some progress in resolving their transportation issues.

In the existing system, people can access the management system and see the timetable of buses and routes. Furthermore, that the management system has bus fares, the comment section is included. Additionally, that system was developed after developing and managing the mobile application. These existing systems offer a lot of advantages for people attempting to resolve some issues. However, not all issues in public bus transportation have been resolved. Until now, there has been no efficient mechanism for tracking bus delays, bus location at the time, drivers, conductors, and bus details and expected time. There is no way to know if disciplinary procedures have been followed. As a result, people are dissatisfied with public transportation, particularly the bus. Due to those issues, automated systems have developed for public bus transport. While these systems can help with some issues, they are far from solving all of the problems in public transportation. Therefore, the purpose of this public bus tracking management system in Sri Lanka.

There may be some human and environmental consequences because of the software project. However, because this is a software endeavor, human and environmental concerns were minimal. There should be a plan in place to minimize any complications that may arise during the process. To safeguard people and the environment from risks. The system developer should protect the system record from unauthorized access. Implement the system for strong authentication. Sharing the location is most important. As a result, better technology should be used to safeguard geo-information. The proposed system includes web-based applications and mobile application approaches, which save time and money, as expected. It facilitates the management of outpatient data and allows for quick and easy access to information. In that system, you can access three parties. There are admin, drivers, and public passengers. Admin can modify the timetable, bus conductor, driver, and bus details, as well as the bus fare and respond to the disciplinary procedure section. That section includes what rules and regulations

are accepted for the driver and conductor, and how to get the action for violating those rules and regulations. All buses have a unique number and the driver enters that number into their mobile. Then the driver can track the Global Positoning System (GPS) and a passenger can connect to the bus and get bus details. The proposed system has a payment gateway feature. It can be useful for passengers to pay for their tickets. Passengers can share their location through Whatsapp. That feature is useful for students because parents know about the current location in real time. Both applications use the database as firebase. Systems are mainly expected to improve public transport reliability and quality, operational cost, investment, and overall system performance. Furthermore, drivers and passengers with good relationships can expect these web-based applications and mobile applications. The Global Positioning System (GPS), the applications are the basis of the solution, which is to provide Sri Lanka with a smart real-time bus tracking device to upgrade the real - time bus tracking system. The built-in GPS module locates the bus with the greatest accuracy and transmits the information. The Bus Dispatcher can make informed decisions regarding the direction of the bus because of the availability of this data. By using maps that give a clear representation of the buses' location, location data can be further analysed to include visual positioning. The administration can notice potential safety issues utilizing contact and respond swiftly by combining positioning data with bus speed. Sri Lanka is still a technologically advanced developing country. Additionally, automation is becoming more and more common in Sri Lankan institutions. As a result, Sri Lanka Bus System continues to use outdated technology. Additionally, Sri Lanka has a fragile economy. Therefore, expensive systems cannot be included in the design of real-time bus tracking systems for Sri Lanka. It should consist of inexpensive devices like GPS and efficient and simple payment methods. The bus tracking system can overcome existing systems issues. Because this bus tracking system give effective and efficiently payment method, most accurate information about bus tracking system through GPS. Therefore, this bus tracking system very useful persons and it can be low-cost budget. This paper provides a review of the background research, which also includes public transportation tracking systems.

The literature review, methodology, and conclusion are the three main sections that are covered in this essay. A comparison of similar papers that have already been published is included in the first section. The development process involving the selection of components and the system architecture diagram and User interface design are discussed in methodology.

2. Related Work

The ever-increasing need for transportation is one of our society's most pressing issues today. The days of simply building new roads and other transportation infrastructure to meet demand in the transportation sector are long gone. Through careful planning, administration, and maintenance, transportation development is increasingly geared toward maximizing the utilization of existing infrastructure.

According to CTrack [1] is an energy-efficient, GPS-free system for trajectory mapping based on cellular tower fingerprints. The most important lesson we learned was that sequencing cellular fingerprints before matching them is critical to achieving good accuracy. CTrack implementation consumes almost no extra energy while achieving high mapping accuracy, making it a good way to distribute collaborative trajectory-based applications such as traffic monitoring to many users without worrying about energy consumption or battery drain. A GPS-free approach to trajectory matching also allows for more fine-grained location services to be provided on the world's most popular, cheapest phones that lack GPS but do have GSM connectivity. [2] Location Based Services system offer subscribers personalized services based on their current location. LBS provide tools for effective management and continuous control.[3] The mobile application called AS-OJEK use to development phase GPS, GIS, Mobile, Web applications. RAD was used because this methodology was designed to be more adaptable to changes and to accept new inputs, such as features and functions, at all stages of the development process. [4] A worker cell and advanced cells make up the framework. The framework can demonstrate its performance by following school transportation from any location. That is a less expensive. [5] The system describes the Vehicle Tracking System in detail under the Android operating system. The future of mobile phones is bright, especially smart phones with Android systems. Overall, this application is easy to use and performs well.[6] The paper could be improved by attaching a more sensitive GPS shield to provide the precise location. Furthermore, if an application is developed to receive SMS messages from SIM808 and directly take the coordinates and show the location in Google map, the tracking will be simplified.

According [7] The application has been designed and tested, and the users are confident that it provides real-time service and is very useful to them. [8] Users of the system can keep an eye on the public transportation vehicle in real-time. Users can view the schedule and cost of their trip while selecting their preferred mode of public transportation. The positioning device installed on each vehicle allows for the app to track the location of the vehicle in real time. Future work will involve utilizing and integrating a separate database with the current app. [9] AVL systems are a diverse group of systems that deal with the spatiotemporal information obtained from moving objects of the point type. The main parts of these systems are those responsible for determining the vehicle's geographic location and for using wireless telecommunication to send this information to the control center. Today's systems almost completely rely on satellite-based positioning (GPS) to determine vehicle location and packet data transfer over cellular networks to

send that information to the control center. This design proved to be the most dependable as well as the most cost-effective. Custom sensors for detecting bus stops and an independent wireless telecommunication network are not necessary for city services implementing bus tracking. [10] Goo-Tracking system utilizing open-source software and affordable hardware. The viability of using the Goo-tracking system for fleet management has been demonstrated. When used in conjunction with a car alarm system, it can also be used for lost vehicle tracking.[11] Intelligent Transport System measures that have undergone modelling exercises and the anticipated outcomes based on the modelling exercises.[12] The system made up of a server and mobile devices. The system can show off how well it works by tracking college buses from any location. Our system is also inexpensive because it doesn't need any additional hardware to track a user's location. According to [13] conclude that a method can improve the effectiveness of transportation network design by utilizing the advantages of theoretical research and commercial software.

A lot of systems are developed by only using Android applications. However, other systems have been developed to manufacture using the Internet of Things.[14] The system, which makes use of a wireless RFID module, is designed to give users all the information they need to customize their schedules for public transportation. To improve the system's dependability, some changes can be made for upcoming projects. The addition of a mobile app for users of Android and iOS can enhance this system. Being ready for natural calamities is essential as population density rises. People should be led to safe regions in the event of a natural disaster, such as an earthquake. In the immediate aftermath of the earthquake, it is simpler to locate missing persons and provide for people's needs when survivors are directed to a specified gathering location. To maintain safety, silence while working, and to ease admission and leave from the area, persons should be directed to the assembly places when in the impacted regions.[15] Due to this, it is crucial to carefully research the accessibility of the Emergency Evacuation and Meeting Area (EEMA). The article [16] explains how to use the GPS module and Android SDK on an example public transportation scheduling service. Developed application is an illustration of how an Android-powered smartphone with a GPS receiver built in may be used as a tool for quick schedule searches of public transportation. Two programs that operate on a client-server architecture have been created for this aim. The first is a mobile application, whose function is to gather location-related data, provide coordinates over a REST web service, receive an XML response with the required information, and display data using Google Maps. The second program is a web application created in Java that updates timetable information and searches for connections and the next bus stops.

Many existing systems have been developed to be high-tech, with high budgets and high security. The proposed bus tracking system can develop too easily, so it can get more accurate information. Further systems connect with firebase. Firebase is a high-security database and it can be developed very easily. Therefore, the proposed system is different from other systems.

3. Methodology

The proposed solution is a web-based application that will allow the user to check the status of the bus as well as estimate how long it will take the bus to arrive at the user's current position. The system's Web-based application and mobile applications will be interfacing with the updated database to provide the real-time data to the user, hence enhancing the user experience.

A. Data Collection

Collecting the data is the most important part because previous timetables, drive details, and bus details are needed to implement the system. In data collection, anticipate the gathered data in district. because it can be useful to develop a public bus tracking system.

B. Data Analysis

This system is developed to track the location. Google Map can track the location and it can give the bus shop, public places, and private places. That data can be useful to track the Global Positioning System (GPS). Get the survey details one by one, check and solve the problem in the system in that analysis data. These are all stored in the database. It is very useful for securing data and easily implementing and managing data.

C. Process

Admin can access management system and edit and upload the system details. Further admin should response the Disciplinary procedure section. System have chatbot it can be useful passenger because solve some issues in the transport. Passenger can be accessing the public bus tracking system and see the timetable, route of bus details. But them did not can see the driver and bus details see. Their want to see that driver and bus detail install the mobile application. Then registration to the application. After their already access application. Register the application their can see the detail and track to the bus and expect time of it. Buses have unique number. Driver can access to the mobile application and track the location. Google Map support to the find the location. The Mobile Application have New Features. Passenger can share the location with another person through Whatsapp. Passenger can pay the bus ticket through the Payment Gateway.

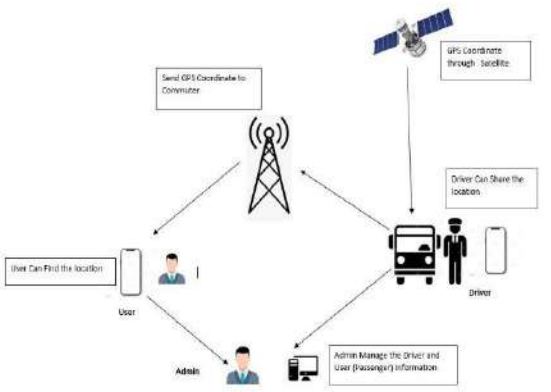

Figure 1. System Architecture
Source: KDU IRC 2022

D. System Development

The proposed system develops web applications and mobile applications. Both the main objectives of both applications are administrative (monitor the timing and routes), tracking the location, analysis (planning and scheduling of services), database management, high security and emergency situations can be informed. These objectives are more important to develop with both applications. The Wednesday application was created with Front End for HTML, CSS, JavaScript, and Backend for PHP, and it was linked to Firebase. Users of Firebase's apps can easily store their photos and videos on the cloud thanks to the Firebase Cloud Storage feature. The Firebase SDK integrates cloud storage technology, enabling quick uploading of files to the cloud. Firebase using the proposed system is most reliable and can be secure to users' data in the event of unauthorized access. Furthermore, Firebase Connect works with both web applications and mobile applications. Therefore, it can easily manage both applications. Mobile Application created this app with Android Studio and the Flutter Framework. Figma Mobile Application User Interface Preferences Connect to GPS using the Google API. Programmatic interfaces to Google Cloud Platform services are provided by Google Cloud APIs. They are an essential component of the Google Cloud Platform, enabling you to quickly and easily add the power of everything from computing to networking to storage to machine learning-based data analysis to applications. The Google API Key can be used to track the location of the driver and passengers. A passenger can share the location with another person.

Google API keys are unique to each other. That key comes with share options. It has benefits for mobile application development. payment gateway used for passengers. They can pay the ticket through the payment option. Passengers pay the ticket automatically. The system provides payment details through the IPG File. LankaQR is used for payment options. It can be visibility and trackability of their money, the ability to scan and pay any LankaQR enabled merchant, all key banking services in one place, and the ability to manage multiple bank accounts and cards in one place. In different interfaces, a mobile application was developed for Passenger (Figure 2) and Driver (Figure 3). It is possible for them to be user-friendly with each other.

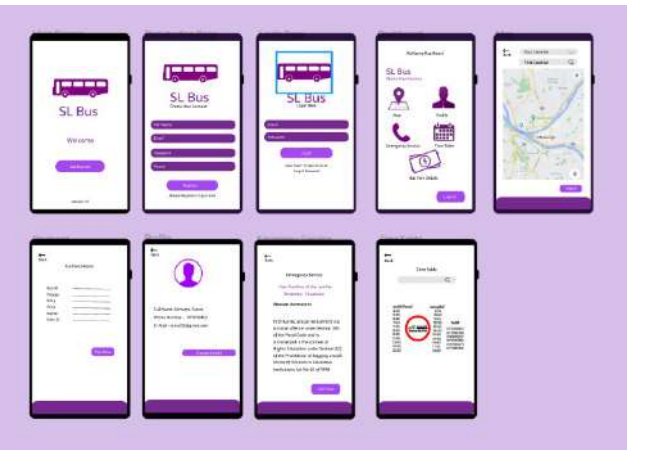

Figure 2. Passenger User Interface
Source: KDU IRC 2022

Figure 3. Driver User Interface
Source: KDU IRC 2022

4. Discussion

The proposed System was developed with the passengers' safety and social distance in mind, in order to make it easier to transport people in these vehicles during pandemic situations. Consequently, one of the preferred options for both adults and children is the tracking system. Public Bus Tracking System develop to increase the reliability, data accurate, Track the location for passenger and Bus Drivers for manage their busy life and protectively finish their Transport. Use the GPS technology to track the location. It can easily track the location. Identify their responsibilities and Rules and Regulations. Both Web Application and Mobile Application are better communication and Relationship between driver and Passenger, Reduce the Time and Money waiting, Investment and improve the

facility of System, Operational Cost of System, Less the system problem and manage easily, User Friendly Environment and Reliability and Accurate Information include the proposed System. Several systems on the buses can be incorporated into one of these systems. This Real-Time Bus Tracking System can be very successful. But, before referring to such a system, it should provide an understanding of how to use this system. This is due to the fact that a lot of elderly people did not understand technology and reported that they did not understand the system. Sri Lanka Bus will be able to achieve a number of facilities by operating as such a system and application. Furthermore, the proposed system requires future work to develop the seat booking system.

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