Android-Based Transport Tracking and Monitoring System

Athira Krishnan T. R.*, Neha R., Sreehari C., Zenaani, Krishna Kumar Kishor, V. Balamurugan

Dept of ECE, Ahalia School of Engineering and Technology, Palakkad, India

*Corresponding author's e-mail: athira.krishnan@ahalia.ac.in

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ABSTRACT

Today's world is driven by technological changes every day. Various technologies have been developed in the world to facilitate and improve people's lives on a day-to-day basis. The primary goal of this paper is to develop a Global Positioning System (GPS)-tracking application that can track buses with greater accuracy and efficiency than existing bus-tracking systems. The application provides information about the bus's location, designated routes, and estimated time of arrival. The proposed model includes a comprehensive monitoring system that continuously tracks the college bus in real time and sends notifications to the driver when passengers miss the bus. In the event of a fire or accident, an alert message is sent to the nearest hospital with the vehicle's location. Any engine faults can be monitored by higher authorities who can take necessary actions. The GPS module connected to the ESP8266 WiFi module provides the bus's location, which is then sent and stored in a real-time Firebase database. The Android app retrieves this data and displays it on a map in real time, utilizing the Google Maps API. Additionally, an On-Board Diagnostics (OBD) is connected to the vehicle to detect any engine faults, and this information is displayed on the Android app. By enabling students to monitor the coordinates of their bus, they can avoid being late, resulting in time savings for both students and staff. This system is designed to be user-friendly and can be deployed in both rural and urban public transportation systems.

Keywords: GPS module, OBD, RFID

1 Introduction

Global Positioning System has become an essential part of our daily lives, be it for location tracking or locating the nearby taxi. We present a bus-tracking application with the potential for significant market penetration. This application can be utilized as a digital personal assistant. Using this method, users of Google Maps can find the bus's location [1], [4].

In essence, this application provides a quick overview of bus locations, routes, expected travel times, and other vehicle information to the user with real-time data. This prototype is entirely based on Google Maps and its API. For this, we are creating an Android app and a website with the same feature [3], [2].

This application's ability to do several functions in one place can be useful for college students. With the location access feature, people can quickly check the bus's location, acquire its current location, and receive the ideal time alerts for its scheduled arrival and departure [5].

An alert message with the vehicle's position is transmitted in the case of a fire or accident to the closest hospital. Higher authorities can keep an eye on any engine problems and take the appropriate action [6]-[10].

2 Proposed System

The proposed system consists of two modules:

- Sensing module
- Android Application

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The sensing module comprises a NodeMCU WiFi module, GPS module, OBD, Flame sensor, RFID, and LCD as in Figure 1.

An Android application is integrated within this project that offers a user interface and provides location updates to the passenger.

Advantages of the Proposed System:

- It helps students avoid unexpected delays.
- Real-time monitoring of college buses.

It is based on client-server technology along with the use of databases.

This application can be used a lot by college students and staff because Android mobile phones have become popular and ubiquitous. In addition, it also increases security because the passage of college buses is always available.

These are the functions done by the system such as:

- Store the student information in database.
- Store the bus information in database.
- Update location in database
- Retrieve the results from database.

2.1 Block Diagram

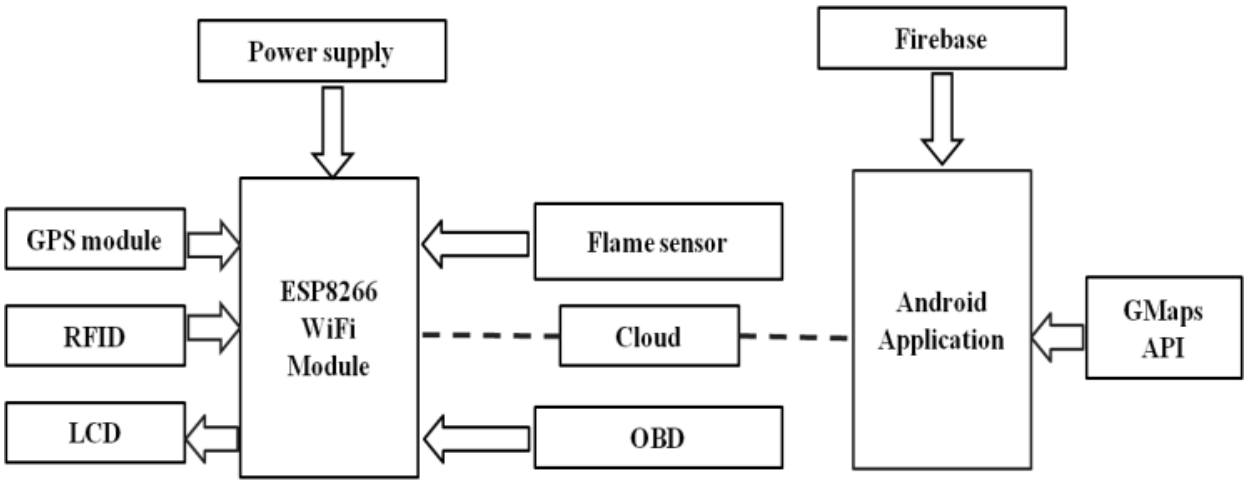

Figure 1: *Proposed System Block Diagram*

2.2 Hardware Requirements

The required hardware included in the sensing module as shown in Figure 2 of this prototype are:

- ESP8266 WiFi module
- GPS module
- EM-18 RFID
- Flame sensor
- ELM327
- LCD display

- Bread board
- Jumper wires

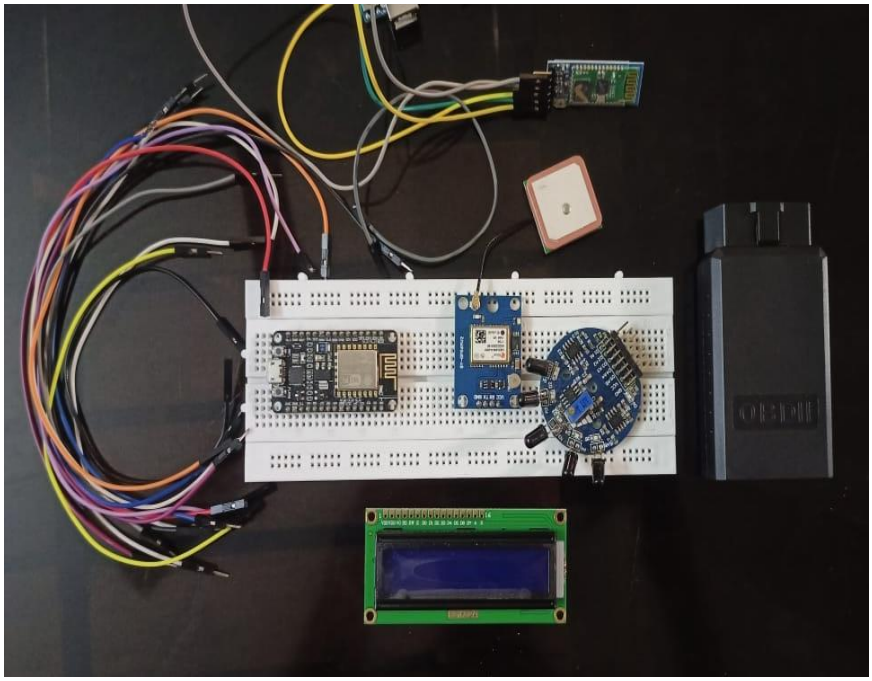

Figure 2: *Hardware used*

2.3 Software Requirements

2.3.1 For NodeMCU:

- IDE: Arduino IDE
- Languages: C programming language

2.3.2 For Android Application:

- IDE: Android Studio
- Languages: Kotlin

2.3.3 For Website:

- IDE: Visual Studio Code
- Languages: HTML, CSS, JavaScript

3 Working

3.1 Sensing Module

An ESP8266 microcontroller is used in the proposed system to connect RFID and GPS technologies to a remote firebase database over WIFI. The Android app which is incorporated with this firebase shows vehicle parameters such as live location, speed, and number of passengers.

Each student is identified as they board using the EM-18 RFID reader and a Neo 6M GPS module to determine the location coordinates. The information is uploaded by this system using an ESP8266 microcontroller, and users may access it via a mobile application to efficiently track their buses.

ELM327 module is paired with an HC-05 Bluetooth module which is connected to the ESP8266 microcontroller. This sensor provides access to various data of the vehicle such as rpm, throttle, coolant, etc. This module also informs us about the engine faults through self-diagnosis of the vehicle.

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In order to detect flame in a greater region (above 120 degrees), a 5-channel Flame Sensor Module is used. This sensor is more exact than other flame sensors thanks to the high-precision resistors and the 5 LED indicators, which are useful for troubleshooting. Flame and radiation sensitivity exist in this module. It can also identify regular light sources with wavelengths between 760 and 1100 nm. 80 cm is the distance at which a lighter flame is tested; the greater the flame, the greater the test distance. In the event of a fire or accident, an alert message is sent to the nearest hospital with the vehicle's location.
An LCD display is connected to the NodeMCU to display the necessary information to the driver.

3.2 Application Module

The Android application is built using Android Studio which uses a jetpack compose framework for the user interface.
The proposed system will provide students from their respective districts with a direct bus to their destination. Therefore, and offers the following features:

- Information such as bus number, contact details of driver, bus route, stops, etc.
- Authentication of system administrator, driver, and registered college students.
- Both the student and the driver have the option to report any emergency to the system administrator.

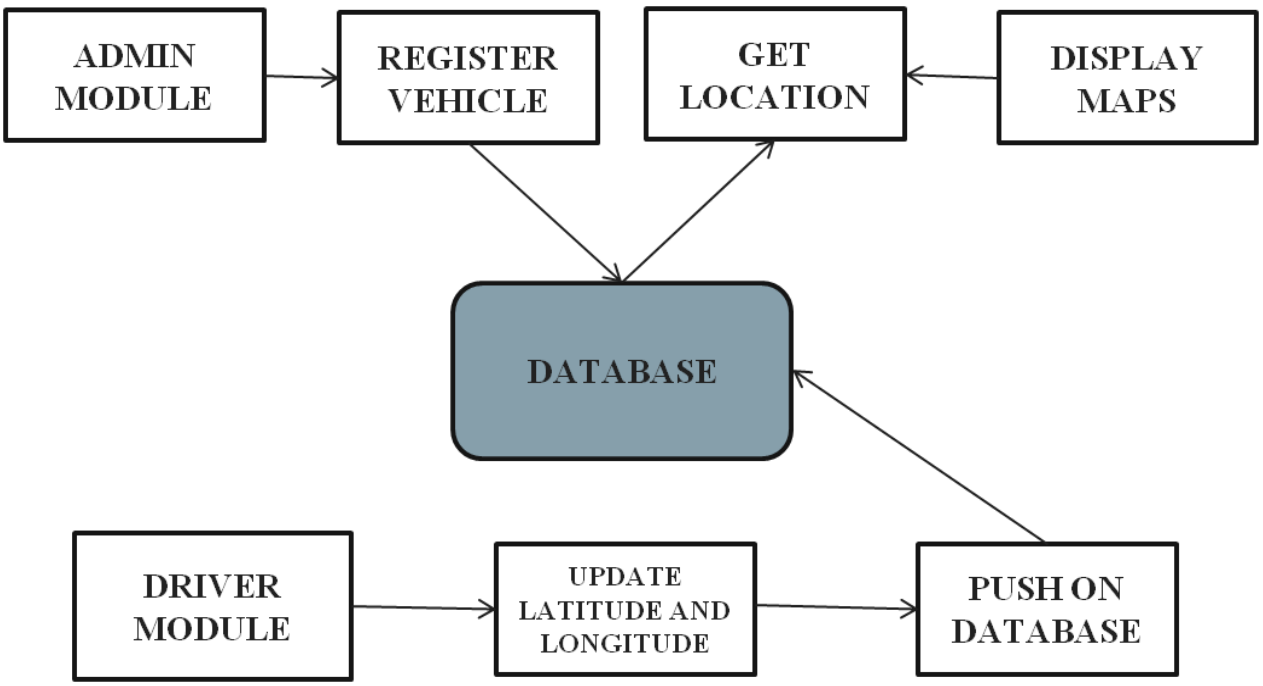

Figure 3: *Architecture of Application module*

The coordinates and speed of the bus is obtained from the neo 6m gps module connected to the NodeMCU. This data is uploaded to the firebase database using FirebaseESP8266 library. The data obtained from OBD such as rpm, coolant, engine condition is also updated in real time in the database. All this data is fetched from the firebase and displayed on the Android Application as in Figure 3.
The authorized bus driver and student must log in to the application using credentials provided by the system administrator. After logging in, the user must select the bus number from the drop-down menu. After choosing the bus number, he must start uploading the location before starting the ride. The real-time location of the vehicle is updated on the android application.

4 Results and Discussion

4.1 Login Screen

This page serves the purpose for the users to log into the application using your provided username and password as shown in Figure 4. The login credentials are provided by the administration to the students. The app can also be logged in by using your google account.

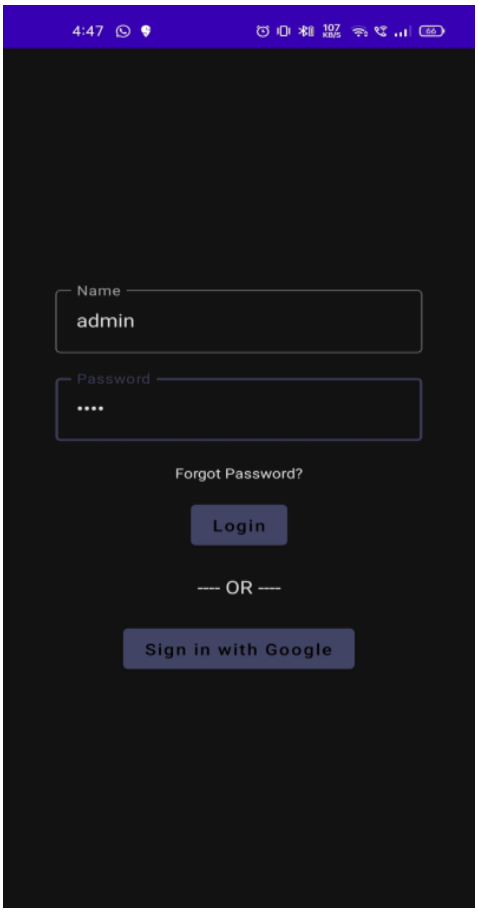

Figure 4: *User Registration*

4.2 Bus Management Screen

This page is displayed after signing in with the app. In this page the bus route can be selected, and the real time coordinates of the exact vehicle is updated in the application as shown in Figure 5. In this implementation at a time the coordinates of approximately 10 vehicles can be updated without any time delay.

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Figure 5: *Bus route selection*

4.3 Live location Screen

In this page we are using Google Maps API to display the latitude and longitudes of the vehicle which is updated using the ESP8266 module as shown in Figure 6. The engine condition, rpm, coolant, fuel level is displayed in this page which updates every second.

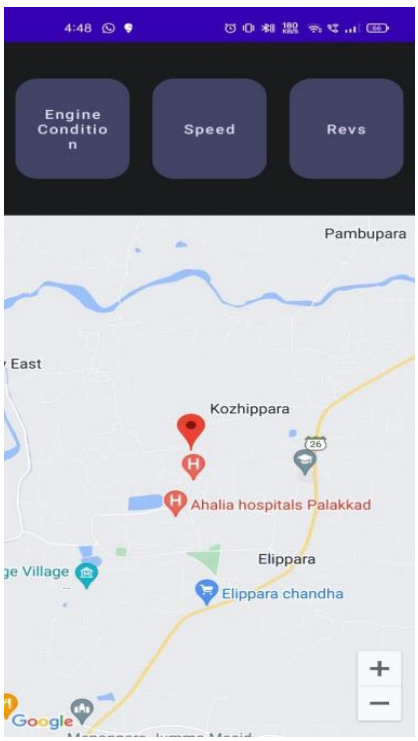

Figure 6: *Google Map*

5 Conclusion

We were successful in building an Android based transport tracking and monitoring system which is easy to use and monitor the buses effectively by the administrator. The students can see the real time location of the buses and commonly utilizes gps technology to track and monitor the movement of vehicle , delivering up to the minute location data. This system is more customized and integrated with other systems such as the ecu of the vehicle using OBD. Receiver is the user who can see the location information of the bus through Google map on his/her smartphone. This system can be implemented in the public transport system. Also, the nearby hospitals are notified if an accident is detected. Thus, it will play an important role in our daily life in the coming years. The success of this tracking system lies in providing the user with a simple interface through an Android application.

6 Publisher's Note

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