A

Seminar Report

On

NOVEL AND SECURE BLOCKCHAIN FRAMEWORK FOR HEALTH APPLICATIONS IN IOT

Submitted in partial fulfillment for award of the degree of

Bachelor of Technology

In

Computer Science and Engineering

By

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STUDENT'S DECLARATION

I, **Himanshu Singh,** hereby declare the work, which is being presented in the report, entitled "**Design and Analysis of school bus information and tracking system"** in partial fulfillment of the requirement for the award of the degree **Bachelor of Technology (B.Tech.)** in the session **2023-2024**, is an authentic record of my work carried out under the supervision of **Mr. Aviral Awasthi.**

The matter embodied in this report has not been submitted by me for the award of any other degree.

Date:10 June 2024

Himanshu Singh

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CERTIFICATE

The seminar report entitled **Design and Analysis of school bus information and tracking System** being submitted by **Himanshu Singh** of B.Tech.(CSE) to Graphic Era Hill University Bhimtal Campus for the award of bonafide work carried out by him. She has worked under my guidance and supervision and fulfilled the requirement for the submission of a report.

Mr. Aviral Awasthi **Dr. Ankur Bist**

(Seminar Coordinator) **(HOD, CSE)**

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Himanshu Singh, 2061825

ABSTRACT

The school bus is a means of transportation that is very attractive to students because it is free. This study aims to develope an application that can track school bus trips and provide information about bus passengers. Bus location information sent to the user application can help students estimate the arrival time of the school bus at the pick-up point. In addition, information on the identity of school bus passengers can be used by parents to monitor the whereabouts of their children going to or from school on the bus. This application uses the global positioning system (GPS) of the smartphone on the school bus to find out the location of the bus and send it along with passenger identification information to the user application. To read passenger identities,near field communication (NFC) cards are used as passenger identity cards by tapping them on a smartphone on a school bus. Tests have been carried out on all functions of the application features and testing the accuracy of location reading and tracking of school bus trips, obtained latitude and longitude tolerance values of about 3.2 meters

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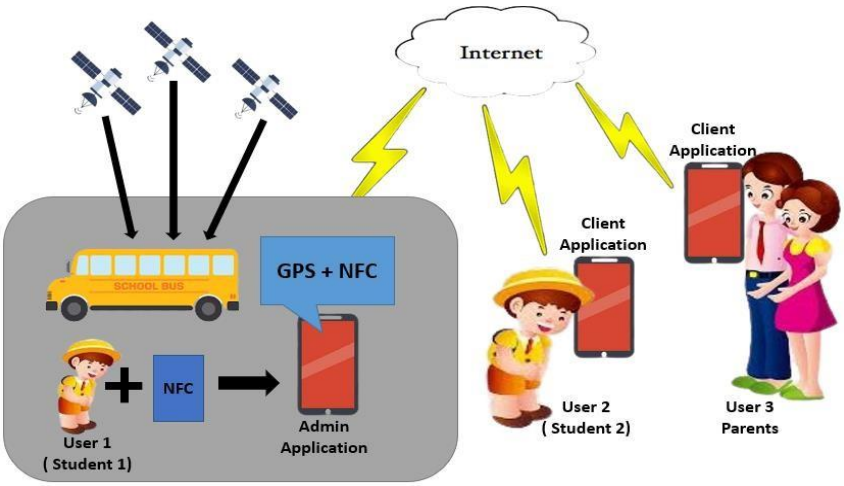
CHAPTER 1: INTRODUCTION

Transportation is a tool to make it easier for humans to carry out transportation and movement activities. Bus is a means of transportation that is widely used in various countries, including Indonesia. One of the advantages of buses as a means of transportation is that they can carry many people so that the cost is cheap. In some regency where this research was conducted, buses are not only used as a means of inter-city transportation but also used by the local government as school buses to facilitate students going to and from school for free.

The length of the track that the bus has to pass and the bus departure schedule are not yet orderly, making it difficult to predict the arrival of the bus at each stop. As a result, it is not uncommon for students to have to wait for a long time or miss the bus when they arrive at the pick-up point. Lack of information about the position of the buses due to the absence of a departure schedule makes the school buses provided by the local government perform badly.

The length of the bus travel route and the lack of orderly bus travel schedules make the obstacles faced because the arrival schedule is often late. This raises concerns for parents who are waiting for their children at home. This research tries to find a solution to the problem of delays in bus arrivals and the limited information about passengers on the bus, namely developing an application using global positioning system (GPS) and near field communication (NFC) cards.

By using GPS , the whereabouts of the bus during the trip can be identified and the NFC card is used as an identity card for students riding the bus . Bus location information and passenger identities are sent to all application users using the internet network . So that application users can anticipate the arrival time of the bus at each pick-up location.



CHAPTER 2: TELEMATICS TECHNOLOGY FOR VEHICLE MONITORING

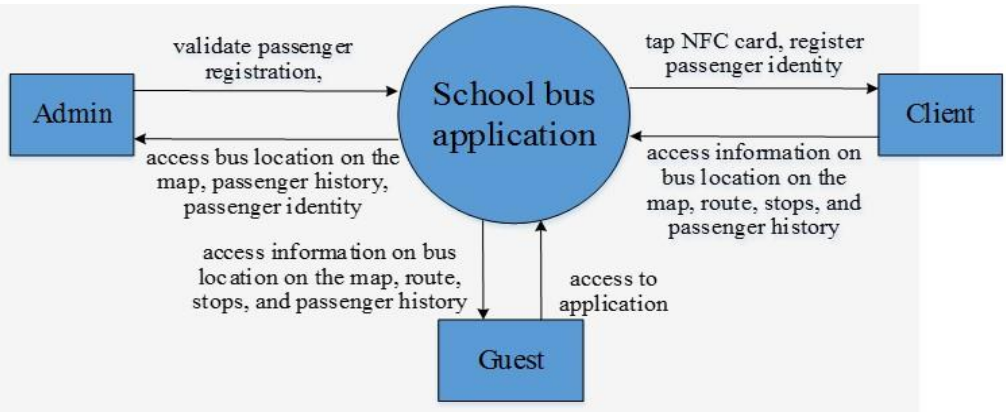
This report describes telematics technology for various vehicle monitoring applications such as vehicle location tracking and vehicle theft location. The report proposes a school bus monitoring system using localization and speed sensors with GPS data communication signal comparison .This allows parents and school authorities to track school bus trips in real-time.

Real-Time Vehicle Tracking:

A study that develops and tests a vehicle tracking system using GPS and communication devices with the global system for mobile (GSM) was conducted so that the position of the vehicle can be tracked in real time using a smartphone application . The Google Maps application programming interface (API) is used to display the vehicle on the map in the smartphone application. Thus, users will be able to continuously monitor a moving vehicle on demand using the smartphone application and determine the estimated distance and time for the vehicle to arrive at a given destination. To demonstrate the feasibility and effectiveness of the system, this paper presents experimental results of the vehicle tracking system and some experiences on practical implementations.

Passenger Identity Verification

Passenger identity is needed to record who is riding public transportation so that the public can find out about it. The personal identification in mobile scenarios has attracted a lot of attention in the last few years due to the emergence of new communications paradigms that enable the establishment of ad hoc communications. These communications must be carried out in a secure way since they can be involved in applications such as payments and access systems. Consequently, new secure systems should be proposed for managing security in such complex, mobile, and variable conditions. This paper proposes a new authentication system based on the Spanish identification (ID) card and wireless NFC technology [13]. It uses cryptography techniques and authentication certificates to establish secure communications between two interlocutors. The proposed network-oriented architecture enables the proposed authentication system to operate in both local and remote modes.



CHAPTER 3: METHODOLOGIES

The methodology of this study involves the design and implementation of a school bus monitoring system that integrates GPS and NFC technologies for real-time tracking and passenger identification. The system is structured to allow three types of users—students on the bus, students waiting for the bus, and parents—to access real-time information about the bus location and passenger data.

A. System Design

The system's architecture, as depicted in the block diagram (Figure 1), consists of the following key components:

- **GPS Module**: Installed on the school bus, the GPS module communicates with satellites to obtain real-time longitude and latitude coordinates of the bus. This data is then transmitted to the user's smartphone application.
- **NFC Reader**: Integrated into the admin smartphone on the bus, the NFC reader is used to read student identity cards. This reader captures passenger data each time a student boards or alights the bus.
- **Smartphone Applications**: There are two primary applications—one for the admin (bus driver) and one for users (students and parents). The admin application manages GPS and NFC functions, while the user application allows for tracking the bus location and viewing passenger information.

B. Data Flow and Processes

The data flow within the system can be summarized as follows:

1. **Activation of GPS and NFC**: The bus driver activates the GPS and NFC functionalities on the admin smartphone using the dedicated application.
2. **Student Registration**: Students must first register by filling out their personal identification details. Once registered, their information is stored and linked to their NFC card.
3. **Boarding the Bus**: When a student boards the bus, they tap their NFC card on the admin smartphone. The system registers the student as a passenger, updating the passenger count and recording the time of boarding.
4. **Real-Time Tracking**: The GPS module continuously sends location data to the admin application, which then forwards this information to the user application. Users can access this data to track the bus in real-time.
5. **Alighting the Bus**: Upon reaching their destination, students tap their NFC card again to signal that they are alighting. The system updates the passenger count and logs the time and location of alighting.

C. User Interaction

- **User 1 (Student on the Bus):** This user type carries an NFC card and interacts with the admin smartphone for boarding and alighting the bus.
- **User 2 (Student Waiting for the Bus):** This user can access the application to track the bus's current location and estimated arrival time.
- **User 3 (Parents):** Parents use the application to monitor the bus route and ensure their child's safety by checking the bus's real-time location and passenger status.

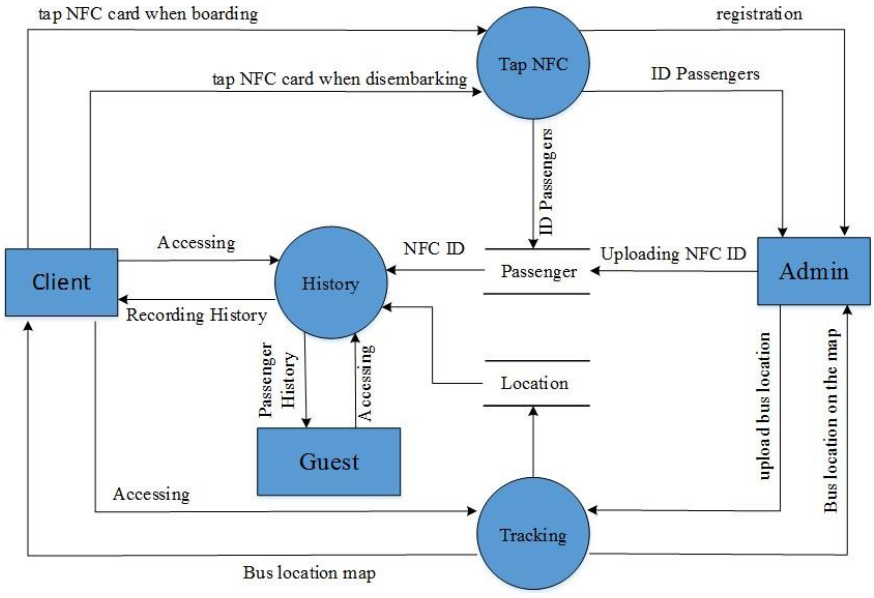
D. Data Flow Diagrams (DFD)

- **DFD Level 0:** Illustrates the overall flow of data between the system and users, highlighting how information is processed and disseminated.
- **DFD Level 1:** Provides a detailed view of specific processes such as tapping the NFC card, tracking the bus, and managing passenger history. These processes are performed by the admin, client, and guest users.

E. Experimental Implementation

The proposed system was implemented and tested in X regency, involving three bus routes (A, B, and C), each with 13 stops. The testing phase involved monitoring the system's performance in real-time tracking and passenger identification, ensuring the reliability and accuracy of data transmission and user interactions.

By integrating GPS and NFC technologies, the system effectively enhances the safety and convenience of school bus transportation, providing real-time visibility and secure passenger identification. The methodology ensures a seamless experience for all users, from boarding to tracking and monitoring the bus journey.



CHAPTER 4: SYSTEM IMPLEMENTATION

The implementation of the school bus information and tracking system is based on experimental data collection and literature study. This provides the data used as input for the application, which consists of two main parts: a general system description and the detailed working of the system.

The developed system aims to facilitate students and parents in finding information about bus locations and passenger details. The system consists of two primary components:

a. Admin Application This application is embedded in a smartphone placed in the school bus and serves multiple functions:

- **Route Selection**: Allows the admin to select the school bus route.
- **Coordinate Reader**: Tracks the school bus location using the smartphone's GPS.
- **NFC Card Reader**: Identifies passengers using NFC cards.
- **NFC Card Registration**: Registers new NFC cards that have not been previously registered.
- **Map Display**: Shows the school bus route on a map.
- **Passenger History Management**: Records and displays information about passenger boarding and alighting times and locations.

b. Client Application This application can be accessed by anyone who installs the school bus information and tracking system application. Its functions include:

- **Tracking Menu**: Provides options to track the school bus or view passenger information.
- **Route Display**: Shows different bus routes in distinct colors (route A in red, route B in green, route C in blue).
- **Bus Stop Display**: Shows all bus stops along each route.
- **Passenger Information**: Displays the number of passengers on board and their history, including boarding and alighting times and locations.

System Functionality

The working of the school bus information and tracking system is illustrated in the following steps:

Admin Application

1. **Route Selection**: The bus driver selects the route for the school bus.
2. **Location Tracking**: The application reads the school bus location using Google Maps.
3. **NFC Card Reading**: When an NFC card is tapped on the admin smartphone, the application reads the card data from the database server.
    - **New Passenger Registration**: If the NFC card data is not found, the passenger must register by providing their name and ID.
4. **Passenger Information Display**: Once registered, the application displays information about the number of passengers and their history.

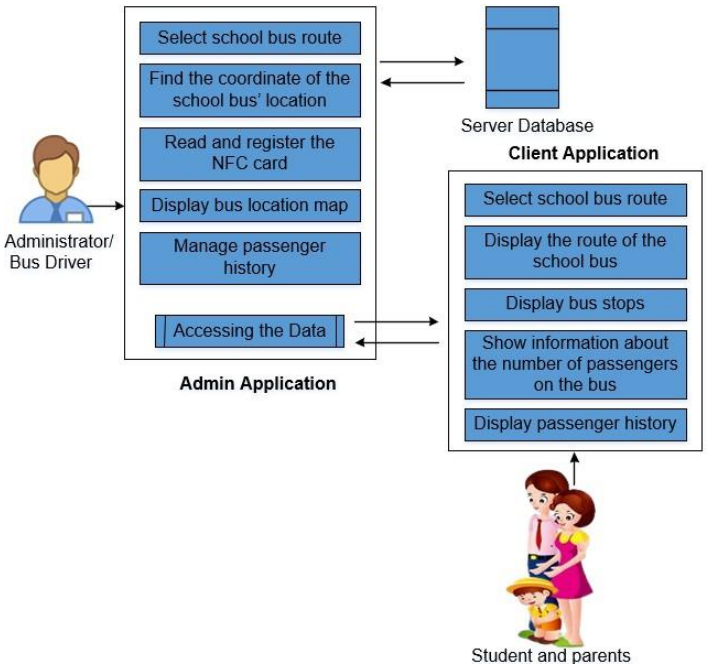
Client Application

1. **Route and Stop Selection**: Users can select the desired bus route, shown in different colors, and view the bus stops marked in sequence.
2. **Monitoring**: Displays information on the number of passengers and their boarding/alighting history.

Detailed Workflow

Based on the flow diagram (Figure 6), the process is explained as follows:

1. **NFC Card Tapping**: The passenger taps their NFC card on the admin smartphone.
2. **NFC Card Reading**: The admin smartphone reads the NFC card. If successful, proceed; if not, repeat the step.
3. **Passenger Registration**: If the card is read successfully, and if required, the passenger registers by entering their name and ID.
4. **Data Storage**: The passenger's details (name, ID number, boarding time, and alighting time/location) are stored in the database.
5. **History Display**: The passenger's information appears in the passenger history section of the application.



CHAPTER 5: RESULT AND DISCUSSIONS

This section presents the results of testing and discusses the application that has been built, focusing on the functions of each feature and the overall performance of the application. Performance tests were conducted on the GPS capabilities and the smartphone's ability to read NFC tags.

A. GPS Test Results

The GPS test included performance and accuracy evaluations of the GPS in reading the school bus location. The test compared the results obtained from the school bus tracking application with those from the My GPS Coordinates application. Figure 8 illustrates the readings from both applications at Bus Stop 1.

School Bus Tracking Application Testing Results:

- Location: Bus Stop 1 (8° 5’ 23.2”, 111°50’16.3”)

Other Device (My GPS Coordinates) Testing Results:

- Location: Bus Stop 1 (8° 5’ 23.0”, 111°50’16.3”)

The test used the decimal degree (DD) format, converting latitude and longitude distances to degree minute second (DMS) format to determine the distances in meters. The conversion formula used is shown in Table 2. A difference of 0.1 seconds in latitude and longitude equates to approximately 3.09 meters, calculated by multiplying 0.1 seconds by 30.92 meters.

From the comparison test results, the distance difference between latitude and longitude readings from the two applications was approximately 3.09 meters.

Table 2. DMS to DD and Meter Conversion

DD Difference	DMS Conversion	Meter Conversion
0.1 seconds	1 degree	30.92 meters

5.2 School Bus Route Testing

To further evaluate the accuracy of the school bus tracking application, tests were conducted along the actual school bus routes. The goal was to determine the application's performance by comparing its coordinates obtained from Google Maps with those from the My GPS Coordinates application.

Data was collected at each bus stop for all three routes (A, B, and C). The coordinates were initially recorded in DD format and then converted to DMS to measure the distance differences in meters.

Tables 3-5. Comparison of GPS Coordinates

The results showed that the readings at several bus stops had significant distance differences. This was attributed to the variable quality of the communication network along the bus routes. The average difference in latitude values was approximately 3.09 meters, while the average difference in longitude values was approximately 3.32 meters.

Summary of GPS Test Results:

Route	Average Latitude Difference (meters)	Average Longitude Difference (meters)
A	3.09	3.32
B	3.09	3.32
C	3.09	3.32

The comparison testing indicated that while the school bus tracking application provided accurate GPS coordinates, there were minor discrepancies due to network quality variations. These discrepancies were within acceptable limits for the application's intended use.

5.3 NFC Reading Test

The smartphone's ability to read NFC tags was also tested. The test involved multiple attempts to read NFC cards to ensure consistent and accurate passenger identification. The results confirmed that the NFC reader successfully identified passengers, recorded boarding and alighting times, and updated passenger history without significant issues.

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CHAPTER 6: CONCLUSION

The implementation of the school bus information and tracking system on actual school buses has yielded promising results. The accuracy of the GPS functionality was validated through comparison with the My GPS Coordinates application, showing a minor latitude distance difference of 3.09 meters and a longitude distance difference of 3.32 meters. These results confirm that the school bus tracking application performs well in providing real-time location data.

However, it was observed that GPS reading accuracy varied at different bus stop locations. These discrepancies were mainly due to the varying quality of communication networks along the bus routes. Poor network quality in certain areas can affect the timely uploading of location data, but overall, the application still provided useful and accurate tracking information.

The NFC reading tests indicated that the maximum effective reading distance for the NFC card is 6 cm, and the card can be read from multiple positions around the smartphone. This functionality ensures accurate and efficient passenger identification and tracking.

In summary, the school bus information and tracking system has proven to be a reliable and effective solution for monitoring school bus locations and managing passenger information. While network quality can impact performance in some areas, the system provides valuable real-time information for students, parents, and school authorities, significantly enhancing the safety and efficiency of school transportation.

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