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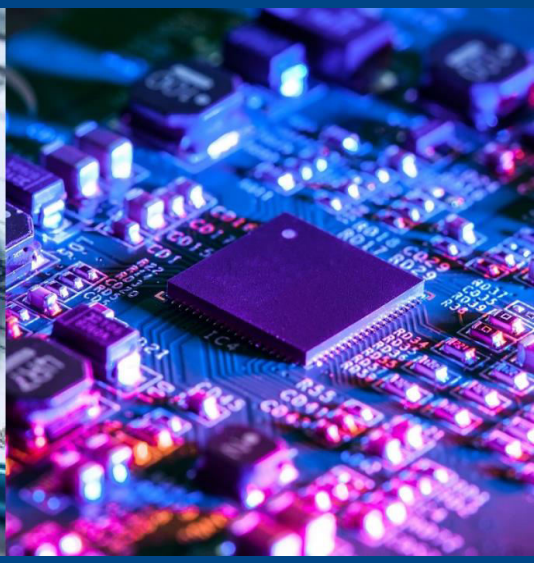

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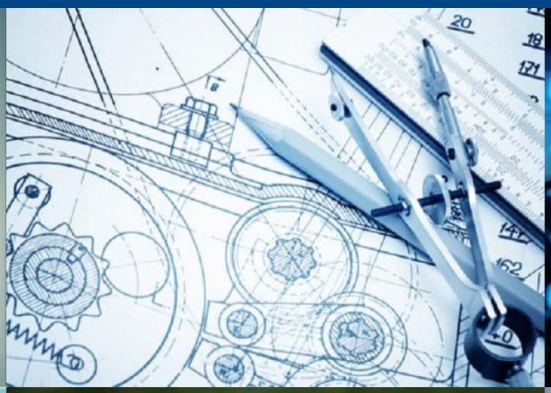

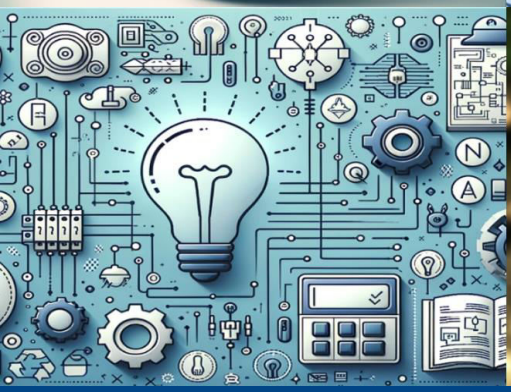

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A Review of Location Alert System using Virtual Geo Fencing

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ABSTRACT: This project presents the design and implementation of a school bus attendance and notification system based on an Arduino Uno microcontroller, RFID technology, GPS, and GSM communication. The primary objective of this system is to enhance the safety and convenience of school bus operations by automating student attendance, notifying parents about bus arrivals, and providing real-time bus location updates. The system operates by sending SMS alerts to parents as the bus approaches each designated pick-up point. Students are required to scan their RFID cards for attendance when boarding, and the system records their status accordingly. The real-time location of the bus is tracked using a GPS sensor and displayed on an LCD screen, with missed call functionality allowing parents to track the bus's location via SMS. The system is designed to ensure that only parents of students who are present on the bus receive arrival notifications when the bus reaches its final destination at the school. The system is powered by a 12V battery installed in a protective box at the entry gate of the bus, ensuring continuous operation during the entire journey. This innovation aims to improve communication between parents and school authorities while optimizing the bus operation process, reducing the risk of accidents, and enhancing student safety.

KEYWORDS: GPS , GSM , RFID , Geofencing

I. INTRODUCTION

Transportation safety and efficiency are fundamental concerns in ensuring a smooth educational experience for school-going children. The school bus system plays a vital role in addressing these concerns, yet traditional methods often fall short in providing adequate tracking, communication, and attendance management. Many schools rely on manual attendance tracking, which is prone to errors, inefficiencies, and delays. Additionally, parents are often left in the dark about the real-time location of their child's school bus, leading to anxiety and logistical inconveniences. The lack of effective communication between schools, transportation systems, and parents highlights a critical gap in existing transportation management frameworks.

In response to these challenges, the proposed School Bus Attendance and Notification Management System seeks to modernize school transportation by integrating innovative technologies such as RFID (Radio Frequency Identification), GPS (Global Positioning System), and GSM (Global System for Mobile Communications). This system is designed to address two primary objectives: automate the student attendance process and provide real-time tracking and communication to parents and school authorities. By combining hardware and software solutions into a compact and cost-effective platform, the system enhances safety, transparency, and efficiency in school transportation.

The development of this system emphasizes simplicity, cost-effectiveness, and adaptability. By leveraging widely available components and modular design principles, the system can be easily deployed in schools with minimal

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technical expertise. The modular nature of the system also allows for future scalability, enabling the addition of advanced features such as app-based monitoring, biometric verification, or integration with school management systems.The implementation of the School Bus Attendance and Notification Management System has significant implications for improving the safety and efficiency of school transportation. It addresses key concerns such as manual attendance errors, lack of real-time updates, and insufficient communication with parents. By automating processes and providing real-time location updates, the system alleviates parental anxiety and ensures a smoother transportation experience for students. This feature offers a practical solution for parents who may not have access to constant internet connectivity. Furthermore, the system ensures that only the parents of students present on the bus receive notifications, thereby avoiding unnecessary alerts for absent students.

II. LITERATURE REVIEW

1.Enhancing Emergency Response in Transit Using Cloud-Connected Bus Tracking for Safety and Medical Assistance (2024).

Raman and Gurpur (2024) proposed a cloud-based system to enhance passenger safety and enable medical assistance in emergency situations for bus passengers. This system integrates cloud computing, GPS technology, and IoT for real-time bus tracking. The system involves GPS-enabled devices that relay real-time bus location data to a cloud server, which is accessible via a mobile application. This provides passengers the ability to monitor bus locations and plan their routes accordingly. Key features include speed monitoring, geo-fencing, emergency alerts, and a panic button that connects users with emergency medical services. The system collects and analyzes GPS data while responding to emergencies through a centralized cloud server, enhancing safety protocols on buses. Notably, system accuracy depends on GPS calibration and signal strength, making real-time data comparisons critical for continuous improvement. The overall goal of the system is to improve transit safety by offering timely medical assistance during emergencies.

2.Fleet Tracking and Geofencing using the Internet of Things (IoT) (2023).

Raikar et al. (2023) introduced an IoT-based fleet tracking and geofencing system designed for vehicle management. The system relies on GPS data provided by the Neo 6m module to track vehicle locations within predefined geographical zones. Fleet managers receive alerts if vehicles exit these zones,
facilitating real-time fleet monitoring. The mobile application developed with the MIT App Inventor collects real-time data, enabling managers to monitor fleet status through Firebase databases. The paper emphasizes the potential applications of geofencing in areas such as transportation, agriculture, 6 and healthcare. Future enhancements include the integration of RFID sensors for driver identification, as well as alcohol and drowsiness detection sensors to improve driver safety.

3.Track N Go: A Cost-Effective Solution for Real-Time Bus and Taxi Tracking (2023).

Takyiwa and Debrah (2023) presented "Track N Go," a system designed to offer a cost-effective solution for real-time monitoring of public buses and taxis by leveraging mobile phone location data. The system integrates GPS via the Map Box API and Firebase database for location tracking, offering passengers a convenient and reliable solution to monitor transit systems. This web-based solution features a userfriendly interface developed with Java and React.js and provides accurate bus and taxi tracking data in real time. The study suggests the future inclusion of features such as geofencing and route optimization. Despite minor issues with scalability and network connectivity, the system has been successful in improving urban mobility and streamlining public transportation.

4.Framework of Geofence Service Using Dummy Location Privacy Preservation in Vehicular Cloud Network (2023).

Takyiwaa-Debrah (2023) introduced TIET-GEO; a framework aimed at enhancing location privacy preservation within vehicular networks through geofencing technology. This system allows users to define geofences and triggers actions such as email notifications when devices enter or exit these virtual boundaries. A dummy location privacy preservation algorithm generates K-dummy locations to obscure users' real coordinates when interacting with Location-Based Services (LBS). The study highlights the importance of securing location data while providing reliable geofence services. The framework's flexibility is demonstrated through its successful integration with various IoT devices, and the use of token-based authentication ensures that only authorized users can access the system. This framework represents a step forward in securing vehicular cloud.

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Author(s)	Study Title	Key Features	Methodology	Main Findings/Implementation
Pulave et al. (2024)	Bus Location Tracking and Alert to Students	- Bus location tracking - Student identification	- Android - Mobile App	- Low-cost solution for bus tracking - Uses smartphone for tracking - Provides accurate real-time data
Jaya et al. (2021)	Geofence Alerts Application With GPS Tracking For Children Monitoring (CTS)	- View current location - View history route - Setup geofence - Notifications on geofence entry/exit	- GPS - Arduino Uno - RAD framework	- Successfully developed real-time tracking - Allows viewing past routes and setting geofences - Notifications and alarms for geofence violations
Kumari et al. (2020)	IoT Based Intelligent Real-Time System for Bus Tracking and Monitoring	- Real-time bus location - Passenger count - Estimated time of arrival	- IoT - GPS - RFID - QR codes	- Minimizes gaps between human and machine capabilities - Provides real-time bus location and passenger information - Reduces waiting time with accurate arrival estimates
Patil et al. (2019)	Advance School Bus Tracking and the Children Safety System	- Real-time tracking - Attendance management - Emergency alerts - Leave applications	- GPS - GSM - RFID	- Provides real-time bus tracking - Enhances student security - Facilitates attendance and emergency notifications
Ravindra et al. (2018)	Bus Tracking System using Geofencing	- Real-time bus tracking - Geofencing alerts	- GPS - GSM - RFID	- Effective real-time bus tracking - User-friendly application on Android - Ensures integrity of location data

III. PROPOSED METHODOLOGY

- **GPS-Based Bus Tracking:-**

1. A GPS module is installed in the school bus to continuously track the bus's location. The GPS communicates with satellites to acquire real-time positional data.
2. The GPS information is relayed to a central using GSM/GPRS for data communication over the internet, ensuring real-time location updates.

- **RFID-Based Student Monitoring:-**

1. Each student is provided with an RFID card operating at 2.4 GHz, which is read by an RFID reader installed on the school bus.
2. When students board or alight from the bus, the RFID reader logs their entry/exit using the unique RFID tag ID, allowing the system to track which students are on board.

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- **Data Transmission to Central Servers:-**

1. All GPS data and RFID log entries are transmitted via GSM/GPRS to centralized servers. These servers host communication, database (DB), and mapping services.
2. The servers process the data to manage and update the location of buses and track student attendance on the bus.

- **Parent and School Administration Interface:-**

1. The system is connected to an internet-based platform, accessible to parents and school administration.
2. Parents can check real-time bus location, receive alerts regarding arrival time, and know when their child has boarded or left the bus.
3. School administrators can monitor bus routes, student safety, and maintain attendance logs in real-time.

- **Notification System:-**

1. The system automatically sends SMS or app notifications to parents based on the GPS data when the bus is approaching predefined stops.
2. Alerts are also triggered for specific events, such as a student's boarding or disembarking, using RFID-based entry logs.

- **System Components:-**

1. GPS Module: Provides real-time bus location tracking.
2. GSM/GPRS Communication: Facilitates data. transmission between the bus and central servers.
3. RFID Reader: Logs student boarding/alighting based on RFID cards.
4. Central Servers: Manage communication, store data, and process requests from parents and administrator.
5. Parent and School Admin Interface: Web or mobile interface to access bus location and student attendance records in real-time.

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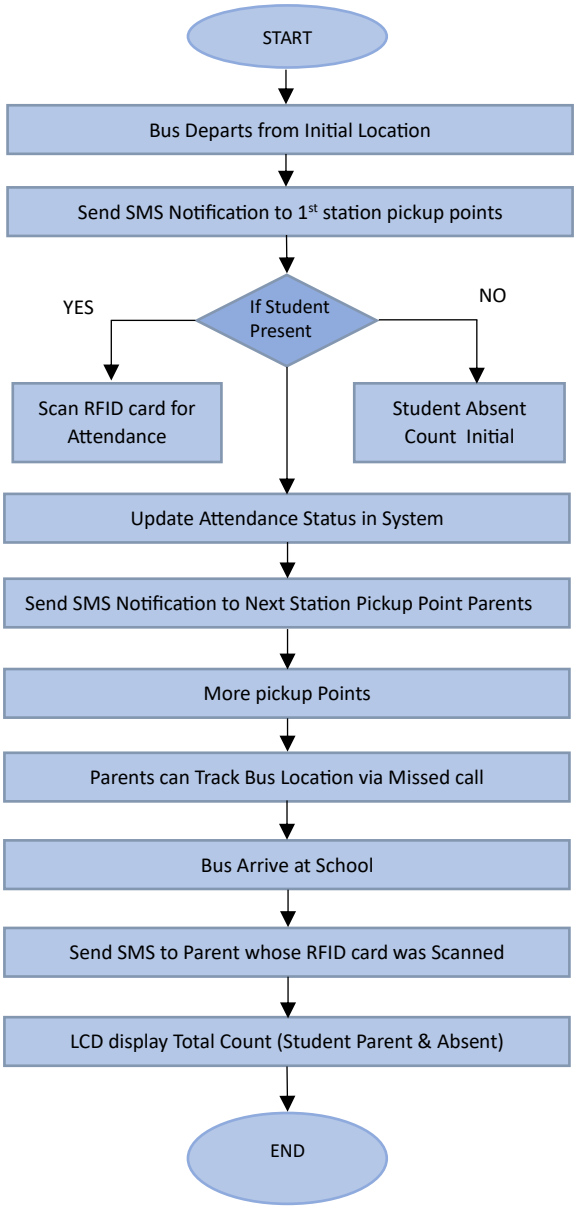
FLOW -DIAGRAM :-



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IV. RESULT

Fig(i) Project Model

Fig(ii) RFID Card Scanning by Student for Attendance Management

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Fig(iii) Encloser Box with System Hardware Assembly and Battery Power Source.

The system demonstrated high reliability and accuracy in real-world testing. The RFID module effectively identified individual students, ensuring error-free attendance records. The GPS module provided precise location tracking, with an error margin of less than 5 meters, ensuring timely SMS notifications to parents. The distance-based notification system successfully alerted parents when the bus was within 50 meters of predefined spots or the school, ensuring timely updates.

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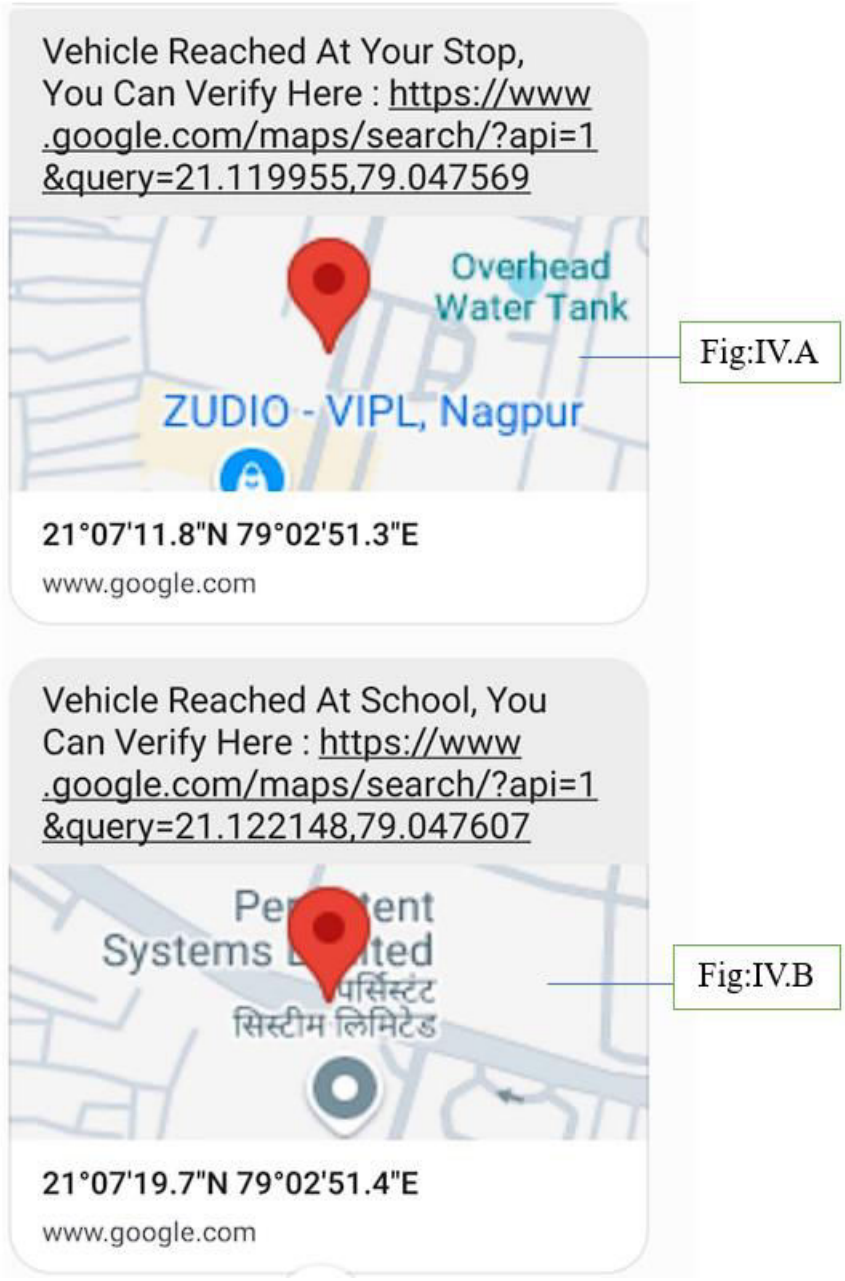

Fig(iv): Register Student Parents Received SMS Notifications with location URL Link

The LCD display effectively presented real-time data, including the number of students onboard and the bus's location relative to key points. The SMS notification system showed a latency of less than 5 seconds from location verification to message dispatch, highlighting its efficiency in communication. Parents reported high satisfaction with the system's accuracy and timeliness, and the modular design allowed seamless integration with existing transportation frameworks.(Fig: IV.A)

The system effectively streamlined the school bus attendance and notification process by integrating hardware and software components. The implementation of RFID cards for student attendance ensured accurate and timely recording,

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with real-time updates displayed on the 16x4 LCD screen. The GPS and GSM modules provided reliable location tracking, enabling the timely transmission of bus location alerts to parents via SMS. (Fig: IV.B)

The accuracy and responsiveness of the system were validated through multiple test scenarios, demonstrating the following outcomes:

- **Attendance Management:** Students' attendance was promptly recorded upon scanning their RFID cards, ensuring zero manual errors.
- **Location Updates:** Real-time bus location was communicated effectively to parents, reducing the anxiety and uncertainty associated with pick-up and drop-off schedules.
- **System Efficiency:** The hardware components operated seamlessly under varied conditions, showcasing the robustness and reliability of the design.

V. CONCLUSION

The proposed system represents a comprehensive solution to the challenges associated with school transportation. Its innovative integration of RFID, GPS, and GSM technologies offers significant advancements in automation, communication, and safety. By streamlining operations and bridging the communication gap between schools, transportation systems, and parents, the system sets a benchmark for modernizing school transportation management.
The system provides a scalable and adaptable solution that can be implemented across various bus routes, allowing for better management of school transportation networks. With timely alerts, realtime updates, and enhanced safety features, this system addresses many of the challenges associated with traditional school bus transportation, ensuring a smooth, stress-free experience for both students and their guardians. Ultimately, this system creates a more secure, efficient, and user-friendly environment for school bus transportation, setting a new standard for student travel safety and parental peace of mind.

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REFERENCES

[1] H. Stuckey, L. Escamilla, L. R. Garcia Carrillo and W. Tang, "Real-Time Optical Localization and Tracking of UAV Using Ellipse Detection," in IEEE Embedded Systems Letters, vol. 16, no. 1, pp. 1- 4, March, doi: 10.1109/LES.2023.3234871, 2024.

[2] H. Fu, W. Yao, C. Peng and Y. Wang, "Model Predictive Control with Block Matrix for Unmanned Surface Vehicles Trajectory Tracking," 2023 IEEE International Conference on Mechatronics and Automation (ICMA), Harbin, Heilongjiang, China, pp. 1379-1384, doi: 10.1109/ICMA57826.2023.10215974, 2023.

[3] Y. Zhou, Y. Yang and M. Hecht, "Real-time predication of railway track curvature using gyroscope and GPS sensors," 2023 DGON Inertial Sensors and Systems (ISS), Braunschweig, Germany, pp. 1-6, doi: 10.1109/ISS58390.2023.10361925, 2023.

[4] M. S. Rudramurthy et al., "Real Time Vehicle Tracking System for Smart Cities," 2023 International Conference on Data Science and Network Security (ICDSNS), Tiptur, India, 2023, pp. 1-6, doi: 10.1109/ICDSNS58469.2023.10245776.

[5] R. Vyas, H. Soni and M. Patel, "AI based Real Time Institutional Vehicle Tracking System through Mobile Application," 2023 Second International Conference on Augmented Intelligence and Sustainable Systems (ICAISS), Trichy, India, pp. 272-276,dio:10.1109/I10.1109/ICAISS58487.2023.10250502, 2023.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

[6] Z. Wang, X. Zhao, H. Tan, X. Zhang and Y. Sun, "Research on Realtime Monitoring and Tracking Method of Ship Trajectory," 2022 International Conference on Applied Physics and Computing (ICAPC), Ottawa, ON, Canada, pp. 171-174, doi: 10.1109/ICAPC57304.2022.00039, 2022.

[7] Cho S. and Kim H., "Privacy Preserving Authenticated Key Agreement Based on Bilinear Pairing for Uhealthcare," The International Arab Journal of Information Technology, vol. 18, no. 4, pp. 523-530, 2021.

[8] Benarous L., Bitam S., and Mellouk A., "CSLPPS: Concerted Silence-Based Location Privacy Preserving Scheme for Internet of Vehicles," IEEE Transactions on Vehicular Technology, vol. 70, no. 7, pp. 7153-7160, 2021.

[9] Ullah I., Shah M., Khan A., and Jeon G., "Privacy preserving Multilevel Obfuscation Scheme for Vehicular Network," Transactions on Emerging Telecommunications Technologies, vol. 32, no. 2, pp. e4204, 2021.

[10] Yu H., Li G., Wu J., Ren X., and Cao J., "A Location-based Path Privacy Protection Scheme in Internet of Vehicles," in Proceeding of the IEEE INFOCOM-IEEE Conference on Computer Communications Workshops, Toronto, pp. 665- 670, 2020.

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