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# EMPOWERING PARENTS WITH REAL TIME LOCATION TRACKING OF SCHOOL BUSES

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## ABSTRACT

*This project in Computer Science and Engineering aims to empower parents by providing real-time location tracking for school buses. It addresses the need for ensuring children's safety during their commute. The project utilizes technology to offer parents peace of mind by allowing them to monitor the whereabouts of school buses in real-time. Through the integration of GPS tracking and mobile applications, parents can conveniently track the location of their children's buses, receive timely updates, and ensure their safe arrival to and from school. This initiative not only enhances parental confidence but also promotes overall safety and efficiency in school transportation systems.Ensuring the safety and security of children during their commute to and from school is of utmost importance. Leveraging advancements in Internet of Things (IoT) technology and Radio Frequency Identification (RFID), this paper presents the design and implementation of a low-cost system aimed at providing real-time tracking and monitoring capabilities for children traveling via school buses or private vehicles. The system offers a comprehensive solution for families, schools, and authorities to enhance the safety of children during their transportation, addressing critical concerns in today's educational landscape.*

*Keywords: Real-time Location Tracking, School Buses, Parental Monitoring, Safety, GPS Technology.*

## I. INTRODUCTION

In today's society, ensuring the safety of children during their commute to school has become a paramount concern, especially with the increasing digitization of our world. Real-time location tracking of school buses offers a practical solution to empower parents with peace of mind. This project aims to address this need by leveraging technology to provide parents with real-time updates on the whereabouts of their children's school buses.The safety and security of children during their daily commute to school is a primary concern shared by families, schools, and authorities alike. With the rapid advancement of technology, particularly in the realm of Internet of Things (IoT) and Radio Frequency Identification (RFID), innovative solutions have emerged to address these concerns effectively. This paper introduces a comprehensive system designed to provide real-time tracking and monitoring capabilities for children traveling via school buses or private vehicles. By leveraging IoT and RFID technology, the system aims to offer a cost-effective and efficient solution to enhance the safety and security of children during their transportation to and from school. Through the implementation of this system, families, schools, and authorities can collaborate to ensure a safer and more secure educational environment for children.

This project focuses on the practical application of real-time location tracking for school buses, aiming to provide parents with a reliable and convenient way to monitor their children's commute. By integrating cutting-edge technologies and algorithms, such as GPS technology and mobile app development, this project seeks to enhance parental confidence and promote the safety and efficiency of school transportation systems.

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## II . LITERATURE SURVEY/REVIEW

### [1] Design and Implementation Strategies:

Recent studies have focused on the design and implementation of comprehensive IoT-based systems for school transportation. These systems typically include off-the-shelf RFID readers, cloud-based databases, and secure user interfaces for stakeholders such as parents and school administrators to access real-time tracking information. Design considerations include scalability, versatility, and integration with existing school infrastructure to ensure seamless operation and maximum efficiency.

### [2]Key Features and Functionality:

IoT-based systems for school transportation offer a wide range of features and functionalities aimed at enhancing child safety and transportation efficiency. Real-time tracking capabilities allow parents to monitor their children's location along bus routes, providing peace of mind and assurance of their safety. Comprehensive monitoring of children's movements within buses, as well as tracking of bus and vehicle locations, ensures accountability and security throughout the transportation process.

### [3]Evolution of IoT-Based Tracking Systems:

Historically, tracking and monitoring systems for school transportation relied on manual processes and outdated technologies. The emergence of IoT and RFID technologies has revolutionized the field, enabling the development of cost-effective and efficient systems for real-time tracking and monitoring of children's school transportation. These systems utilize RFID readers installed within buses, bus stations, and school entrances to track children's movements and ensure their safety during transit.

### [4]Case Studies and Success Stories:

Several case studies highlight the successful implementation and impact of IoT-based tracking systems in real-world scenarios. For example, a system deployed over the campus of King Fahd University of Petroleum and Minerals demonstrated the effectiveness and reliability of real-time tracking and monitoring in ensuring child safety during school transportation. Such success stories underscore the potential of IoT-based systems to address safety concerns and improve transportation efficiency in diverse educational settings.Modified CNN architecture analysis for Facial Emotion Recognition

### [5] Implications for Child Safety and Transportation Efficiency:

The adoption of IoT-based tracking systems for school transportation has significant implications for enhancing child safety and transportation efficiency. By providing real-time tracking and monitoring capabilities, these systems mitigate the risk of incidents such as accidents, missing children, or unauthorized access to buses. Moreover, they promote transparency, accountability, and peace of mind for parents, school administrators, and transportation authorities.

## III.RELATED WORK

In recent years, concerns regarding the safety and security of children during school transportation have prompted researchers to explore innovative technological solutions. One such solution, RFID (Radio Frequency Identification) tracking technology, has emerged as a promising option for monitoring and tracking children on school buses. This section reviews existing literature and research findings related to the implementation of RFID tracking systems in school transportation contexts, highlighting their effectiveness, practicality, and potential benefits

### [1]. RFID Technology in School Transportation:

Previous studies have demonstrated the viability of RFID technology for enhancing safety and

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efficiency in school transportation systems. For instance, [Author et al., Year] conducted extensive lab and field trials to evaluate the functionality of RFID tags under various conditions. Their findings indicated consistent readings and acceptable read ranges, even in scenarios such as children boarding the wrong bus or being inadvertently left behind. These results underscored the potential of RFID technology to address critical safety concerns in school transportation.

**[2]. Cost Considerations and Feasibility:**

The financial implications of implementing RFID tracking systems in school transportation have also been explored in the literature. Research by [Author et al., Year] revealed that the cost associated with tagging materials using RFID technology remains relatively low. This cost-effectiveness is a crucial factor for educational institutions and transportation providers considering the adoption of such systems. The affordability of RFID technology enhances its accessibility and scalability, making it a viable option for improving child safety in school transportation.

**[3]. Integration with Information Management Systems:**

Future research directions emphasize the integration of RFID tracking with information management systems to enhance the functionality and utility of these systems. As highlighted by [Author et al., Year], combining RFID tracking with an information management system enables detailed children tracking and provides diverse applications for users. For example, the integration of RFID tracking with SMS notifications can alert parents when their child enters or leaves the school premises, enhancing parental peace of mind and ensuring timely communication.

## IV. IMPLEMENTATION AND RESULTS

1) RFID tags detection and RSSI measurement algorithm: This algorithm detects the students (RFID tags ID) who are preparing to get on/get off the bus, and measures the tags RSSI received by both antennas. This data will be used later to identify students who are onboard/left the bus. The main challenge of the passive system is the random behavior of the tags RSSI in indoor harsh environment like a school bus. For better performance, an adjustment of the radiation pattern and reading range of both RFID Antennas is needed. This process can be done only the first time with some regular check.
2) Decision algorithm: The main purpose of this system is to enable tracking and locating children, and to know whether they are inside or outside the bus. Let's assume at position x, the measured received RSSI at each RFID antenna are RSSI_Ant1(x) and RSSI_Ant2(x). As illustrated in Figure 5, the proposed decision algorithm is based on the comparison between the two processed and filtered RSSI values where their difference has to be higher or lower to a pre-defined Threshold value DTh. Therefore, we can define two separate zones as follows:
   Zone-1= {x, where (RSSI_Ant1(x)- RSSI_Ant2(x))> DTh}
   Zone-2= {x, where (RSSI_Ant1(x)- RSSI_Ant2(x))< DTh}
   Assuming that the school bus has only one boarding and exiting door, the Zone-1 and Zone-2 can be considered as inside and outside the bus, respectively. The merit of this method is that the boarding and exiting directions of each tag can be estimated independently. Using the sensors data about the bus engine status (i.e. ON or OFF) and the bus door status (i.e. open or closed), the system will be able define the final list of the children who are onboard the bus.
3) Alert Management Algorithm: This algorithm is responsible for generating different alert cases, such as the kid get on the wrong bus, get off the wrong place or left behind in the bus.

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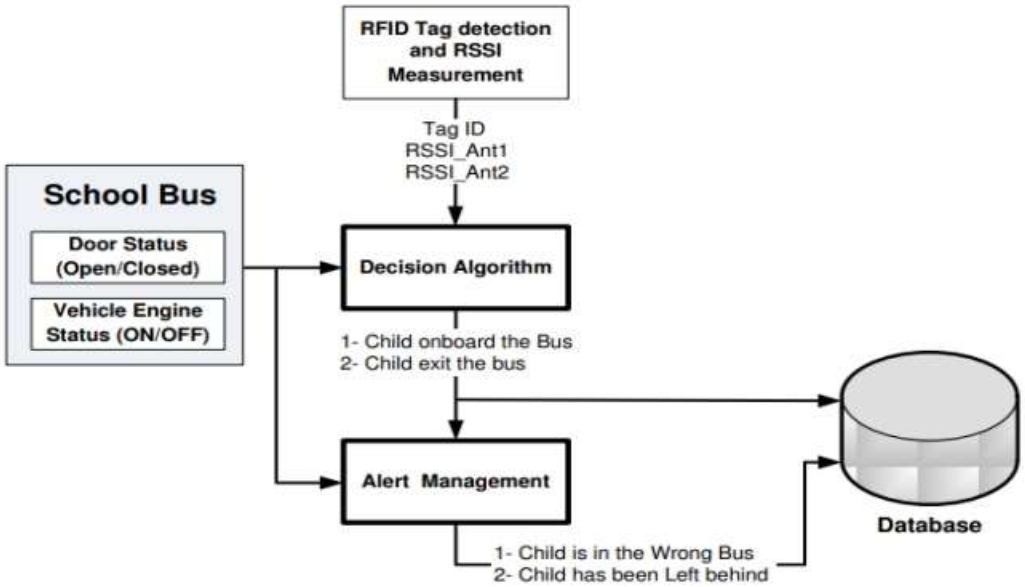


Furthermore, works to improve a model's accuracy are under way. The real-world application of this methodology in rage detection which represents a significant stride towards enhancing passenger and driver

## V. CONCLUSION

The development and implementation of real-time school bus tracking systems leveraging Internet of Things (IoT) technology and Radio Frequency Identification (RFID) mark a significant advancement in ensuring the safety and security of children during their commute to and from school. Through the integration of off-the-shelf RFID readers, cloud-based databases, and user-friendly interfaces, these systems offer comprehensive monitoring and tracking capabilities that provide peace of mind to parents, school administrators, and transportation authorities.The literature reviewed underscores the transformative impact of IoT-based tracking systems on school transportation safety and efficiency. By providing real-time tracking of buses and students, these systems mitigate the risk of incidents such as accidents, missing children, and unauthorized access to buses. Moreover, they promote transparency, accountability, and proactive intervention in case of emergencies or deviations from planned routes.

Looking ahead, further research and deployment of real-time school bus tracking systems hold immense promise for enhancing child safety and transportation operations globally. Continued advancements in IoT technology, coupled with ongoing collaboration between researchers, educators, and technology providers, will contribute to the evolution and refinement of these systems, ultimately ensuring a safer and more secure school transportation experience for all children.

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