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COLLEGE BUS SECURITY AND MANAGEMENT SYSTEM

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Abstract—The management of college bus transportation is a challenging task that requires addressing various variables affecting bus arrival times and locations. This paper aims to provide an overview of the current state of security measures and bus tracking systems in college bus transportation. College students rely heavily on bus transportation for daily commuting and it is crucial for the safety and security of these students to have adequate measures in place. Here it evaluates various studies on the implementation of GPS tracking, RFID or biometric sensors-based attendance systems, and vehicle speed detection in bus transportation. It is seen that the existing system does not track the driving pattern of the bus so in this paper study of methods to add driving pattern analysis in college buses is also conducted. The paper also evaluates the use of cloud storage in college bus management. The findings suggest that the use of these measures has improved the overall safety and security of the bus transportation system. Also, it is found the addition of driving pattern analysis in college buses will help in further enhancing student safety. It also highlights the need for further research in this area to continuously improve the safety and security of college bus transportation.

Keywords—GPS; Bus Tracking; Attendance system;

I. INTRODUCTION

College bus transportation is an essential aspect of campus life as it ensures the safe and efficient movement of students, staff, and faculty. With the increasing concerns over campus security and the need to optimize driving patterns, there is a need to review the current state of college bus security and driving pattern analysis. This paper provides a comprehensive introduction to the existing system, challenges, and opportunities in this field. It will cover many technologies and methodologies used for improving college bus security and analyzing driving patterns, including both hardware and software solutions. The purpose is to provide insights into best practices and identify areas for future research and development in the area of college bus security and driving pattern analysis. Here it covers many fields such as RFID and biometric-based attendance system, GPS technologies, Cloud servers, and methods for driving pattern analysis.

DOI:

The paper reviews the introduction of raspberry pi and its potential applications. Also, we study the existing bus tracking system. Here many existing system in bus tracking is studied. There are different systems in which some just try to find the location of the bus while some also include bus attendance. The studies show that the systems use either Arduino or raspberry pi board as the main computational device. Some systems will send data to the mobile by SMS while some use a website or mobile app. The usage of OBD sensors and systems using OBD sensors to track driving behavior as well as systems attempting to use RFID or biometric sensors for attendance were also covered. It will also review the use of breath analyzers in vehicles and the uses of cloud storage in storing the data.

II. OBJECTIVES AND SCOPE

- A. To study the existing bus tracking and management system.
- B. To study about existing measures taken to ensure the safety of students in college buses.
- C. To study the scope of adding new technologies to the existing bus management system.

III. LITERATURE REVIEW

Now, when we were studying, we discovered various tools and technologies that would enable us to build a productive device that would deliver the results we were looking for. The difficulties that emerged in finding the major component of the system, hardware for calculation and computation, will be improved by the raspberry pi's most recent versions. Similarly, the article also provides an overview of certain technology that will be useful for the projects, including GPS, optical fingerprint sensors, and EOB sensors. Bus tracking and vehicle data monitoring will be made easier by this technology. So we studied some of the techniques that can be used in bus security and management system as well as some of the existing bus management systems.

A. Existing Systems and Existing Safety Measures.

Bus management systems aim to improve transportation efficiency and passenger experience. However, with the wide range of bus tracking technologies available, it can be challenging to determine which system is the most effective for a given situation. This paper examines the existing bus-tracking systems to understand their features. Also by examining the existing system, we will be able to understand the existing measures taken to ensure the safety of the students.

The paper "GPS Based Vehicle Tracking System" written by Zohari, Mohd Hakimi & Zohari, Bin & Bin, Mohd & Nazri, Mohd published in the International Journal of Scientific & Technology

Research in 2021 presents a study on the implementation and benefits of a GPS-based vehicle tracking system[1]. The paper examines the current state of technology and available solutions for vehicle tracking, highlighting the advantages and limitations of GPS-based systems. The paper provides insights into the key features and functionalities of a GPS-based tracking system, including real-time location tracking, speed monitoring, and route optimization. The authors also discuss the importance of data security and privacy, outlining the potential risks and challenges associated with implementing such a system. It can conclude that a GPS-based tracking system can improve vehicle management, reduce operating costs, and enhance safety and security. The paper also suggests possible future developments and improvements to the system. Overall, the paper provides a valuable reference for those interested in implementing a GPS-based tracking system for vehicle management. The insights presented by the authors can help organizations make informed decisions regarding the selection and implementation of vehicle tracking technologies.

Gogri, Kushal (2020) in his paper "Real Time Bus Tracking System" presents a real-time bus tracking system that uses GPS technology and cloud computing to track the location and movement of buses in real-time[2]. The paper describes the design and implementation of the system, which consists of GPS modules installed on buses, a cloud platform for data storage and analysis, and a web interface for users to access the bus location information. The paper explains how the system works by collecting real-time location data from GPS modules installed on buses, transmitting this data to the cloud, and processing the data to determine the location of each bus. This information is then made available to users through the web interface. This paper also discusses the advantages of using a real-time bus tracking system, including improved efficiency and reliability of bus services, reduced travel time for passengers, and increased safety and security for both passengers and drivers. This paper concludes by summarizing the main contributions of the study and highlighting the potential for further development and improvement of the real-time bus tracking system. Overall, the paper provides a comprehensive overview of the real-time bus tracking system, its design, implementation, and benefits.

The article by Vishaka Asundkar and S. P. Godse, titled "A Survey On Enhance Security and Tracking System for School Bus and Children," was published in the International Journal of Trend in Research and Development in December 2015[3]. The article discusses the need for improved security measures

DOI:

and tracking systems for school buses and children. The authors present an overview of existing systems and propose a new system that incorporates GPS tracking and real-time monitoring of the school bus. The proposed system also includes a panic button for children in case of emergencies. The article concludes that the proposed system can improve the safety and security of school buses and children.

The article by R. Mohan Raj, P. Renga Rajesh, K. Harish, and Mr. M. Raja, titled "Automated School Bus Tracking System," published in the International Journal of Engineering Research and Technology, proposes a new system for tracking and monitoring school buses[4]. The paper presents a system that includes GPS tracking and real-time monitoring of the school bus. The proposed system also includes a mobile application that provides real-time information to parents about the bus's location, expected arrival time, and any delays. Additionally, the system includes a panic button for children in case of emergencies. The article concludes that the proposed system can improve the safety and security of school buses and children. The article is concise and presents a useful contribution to the existing literature on this topic, particularly with its focus on a mobile application for real-time tracking and monitoring.

Kamble, Pravin and Vatti, Rambabu. (2017) in the paper "Bus tracking and monitoring using RFID" focuses on the development of a bus tracking and monitoring system using radio-frequency identification (RFID) technology[5]. The paper describes the design and implementation of a bus tracking system that uses RFID technology to track the location of buses in real-time. The system is designed to provide real-time information on the location and status of buses, which can be used to improve the efficiency of bus transportation services. The paper also covers the various challenges faced during the implementation of the system, such as the accuracy of the RFID technology and the security of the data transmitted over the network. The paper suggests that these challenges can be addressed through the use of advanced RFID sensors and secure data communication protocols. The paper concludes that the bus tracking and monitoring system using RFID technology is a low-cost and effective solution for improving the efficiency of bus transportation services.

The paper "Bus Tracking System" written by, Loganathan T., Kamal Kishore S., Navaneeth N., Krishnasamy N., and Prof. Thamaraimanalan T, published in the International Journal of Scientific Research in Computer Science, Engineering and Information Technology in 2017 presented a study on

the development and implementation of a bus tracking system[6]. This paper highlights the importance of such a system in improving the efficiency and reliability of public transportation services. This paper provides insights into the key features and functionalities of the proposed system, including real-time location tracking of buses, route optimization, and passenger information display systems. The paper also discusses the technical aspects of the system, including the hardware and software components required for its implementation. This paper concludes that the proposed system can enhance the passenger experience, improve bus management, and reduce operating costs.

The paper "Real Time E-City Bus Tracking System" published in the International Journal of Emerging Technology and Innovative Engineering in 2019 presents a study on the development and implementation of a real-time bus tracking system[7]. The authors, K. Ramya and R. Anu Mangai and J, Asha Jency, highlight the importance of such a system in improving the efficiency and reliability of public transportation services. This paper provides insights into the key features and functionalities of the proposed system, including real-time location tracking of buses, route optimization, and passenger information display systems. This paper also discusses the technical aspects of the system, including the hardware and software components required for its implementation.

From the examination of the existing system, it can also be understood the existing measures are taken to ensure the safety of the students. The study's findings show that the majority of systems use real-time location tracking as their primary security mechanism. Additionally, there are systems and facilities to inform parents when the bus will arrive close to their stations. Additionally, one system uses technologies like RFID to track passenger attendance. Therefore, the research came to the conclusion that the primary security measures currently in place for safeguarding student safety are listed above.

B. Technologies

It has seen the steps taken to ensure the students' safety from our analysis of the current system. So, in order to improve the functionality of the bus management system, it is now planned to research some technologies which can be added.

I. Raspberry Pi

DOI:

Raspberry Pi is a small single-board computer designed to teach computer science and promote experimentation in electronic projects. It was developed in the UK by the Raspberry Pi Foundation and has gained popularity for its versatility, affordability, and ease of use in a wide range of applications.

The paper "A Review Paper on Raspberry Pi and its Applications" by Ghael and Hira provides a comprehensive overview of the Raspberry Pi platform and its various applications in different domains[8]. While the paper does not explicitly discuss a bus management system, it does provide insights into the use of Raspberry Pi for building various types of embedded systems and IoT applications, which could be relevant to the development of a bus management system. This paper highlights the versatility of Raspberry Pi as a low-cost, credit-card-sized computer that can be used for a wide range of applications, including home automation, robotics, security systems, and multimedia devices. From the paper, we can see about the various features of Raspberry Pi, such as its GPIO pins, camera module, and Wi-Fi connectivity, which make it suitable for building embedded systems with various sensors and actuators. Raspberry Pi could be used to build a low-cost, real-time monitoring system that tracks the location of buses, monitors passenger traffic, and provides real-time information to passengers about bus schedules and delays. With its GPIO pins and sensors, Raspberry Pi could also be used to detect and report mechanical issues and other problems with the buses. Finally, with its connectivity options, Raspberry Pi could enable remote access and monitoring of the bus management system, allowing administrators to track performance and make adjustments as needed.

II. Fingerprint Security System

A fingerprint sensor is an electronic device that captures and reads the unique patterns and ridges on a person's finger to identify them. It is used in various applications such as security systems, access control systems, time and attendance systems, and mobile devices. To study more about fingerprints and their application in bus management systems we referred to the below papers

The paper "Overview of Fingerprint Recognition System" written by Ali, Mouad et al. provides an overview of fingerprint recognition technology and its applications[9]. The paper discusses the different types of fingerprint recognition systems, such as optical, capacitive, and ultrasonic, and their advantages and disadvantages. The paper also discusses the various applications of fingerprint recognition systems, including security and access control systems, time and attendance systems, and mobile devices. In a bus tracking system, a fingerprint sensor can be used to verify the identity of the driver or bus attendant. The fingerprint sensor can be installed on the bus dashboard or near the entrance, and the driver or attendant would have to scan their fingerprint to log in to the system. The system can then record the driver or attendant's attendance and track their movements using GPS. The use of a fingerprint sensor in a bus tracking system provides several benefits. Firstly, it ensures that only authorized personnel are driving or attending the bus, improving security. Secondly, it provides an accurate and reliable method of recording attendance and tracking personnel movements, reducing errors and disputes. Finally, it can be used to generate reports on driver and attendant performance, helping to improve overall bus management.

The paper "IoT Assisted Fingerprint based Security System using Raspberry Pi 3" was written by Abdul Muqet, Mohd, Akbar, Fabia, and Hussaini, Syed. (2019) describes the design and implementation of a security system that combines fingerprint recognition technology with Internet of Things (IoT) capabilities using a Raspberry Pi 3[10]. The system is designed to provide access control to a building or room, allowing only authorized individuals to enter. The user would scan their fingerprint using a fingerprint sensor connected to the Raspberry Pi, and the system would verify their identity and unlock the door if they are authorized. The paper also incorporates IoT capabilities into the system, allowing authorized users to remotely access and control the security system using their mobile devices. The system can also send notifications to the user's device when someone attempts to access the system with an unauthorized fingerprint. From the paper,

DOI:

it can be seen that the fingerprint system helps to monitor the authority of people entering the building. So a fingerprint recognition system could be installed on the bus, allowing the driver or bus attendant to log in to the system using their fingerprint. This would ensure that only authorized personnel are driving or attending the bus, improving security. The system can also record the driver or attendant's attendance and track their movements using GPS, which can be helpful in monitoring their activity and ensuring they follow designated routes and schedules. The IoT capabilities of the system could allow the bus company to remotely access and control the security system using their mobile devices. This would enable them to monitor the location and status of the bus in real time, ensuring that it is operating as expected and alerting them to any potential issues or incidents.

In addition, when using fingerprint sensors we must ensure security in the data transfer of these details. So we referred to the below paper to know about security-related issues.

The paper "Security on Fingerprint Data Transfer System" written by Modi, Hinal & Mistry, Dr. (2014) presents a method for securing fingerprint data transfer in a system that uses fingerprint recognition technology[11]. While the paper does not specifically discuss a bus tracking system, we can apply some of the principles discussed in the paper to understand how fingerprint data transfer can be secured in such a system. To secure fingerprint data transfer, the paper suggests using encryption to protect the data during transmission. The paper proposes using the Advanced Encryption Standard (AES) algorithm, which is a widely accepted and secure encryption algorithm. This can be implemented in the bus tracking system by encrypting the fingerprint data as it is transmitted between devices or servers, making it difficult for unauthorized parties to access and use the data. The paper also suggests using biometric authentication in addition to encryption to further enhance security. This involves using a secondary form of authentication, such as a password or PIN, in addition to fingerprint data to verify the identity of the user. This can be implemented in the bus tracking system by

requiring authorized personnel to enter a password or PIN in addition to scanning their fingerprint to access the system.

III. Dual Authentication

Dual authentication, also known as two-factor authentication, is a security process that requires two forms of authentication to access an account or system. It typically involves a password and a second factor, such as a fingerprint, a security token, or a one-time code sent via text message or email.

The paper titled "Dual Door Lock System Using Radio-Frequency Identification and Fingerprint Recognition" is a comprehensive study of the implementation of a new security system[12]. The authors, Tshomo, Karma & Tshering, Kencho & Gyeltshen, Dorji & Yeshe, Jigme & Muramatsu, Kazuhiro, present a dual-door lock system that combines both radio-frequency identification (RFID) and fingerprint recognition technologies. The paper also provides a detailed explanation of the hardware and software components used in the system, which will be helpful to readers looking to implement a similar system. However, one potential limitation of the paper is the limited scope of the experimental results presented. While the authors provide some details on the system's accuracy and reliability, they do not discuss its effectiveness in real-world scenarios, which would be valuable information for potential users. But as mentioned in the paper we can use two types of identification methods, namely RFID and fingerprint recognition, to grant access to the bus. The RFID system works by transmitting an ID code from a tag attached to the passenger's card, which is then compared to the authorized user list stored in the system. On the other hand, the fingerprint recognition system uses a scanner to match the passenger's fingerprint with the stored fingerprint data. This may help in increasing the security of college bus.

IV. OBD sensor

OBD sensor stands for On-Board Diagnostics sensor, which is used in vehicles to monitor and report the status of various systems, such as engine performance, emissions, and fuel efficiency. It can detect and report issues with the vehicle's

DOI:

performance, allowing for easier and more accurate diagnosis and repair. To understand more about OBD sensors we referred to the following papers.

The paper "Cloud-Based Driver Monitoring and Vehicle Diagnostic with OBD2 Telematics" written by Bandara, Dilum & Amarasinghe, Malintha & Kottegoda, Sasikala & Liyana Arachchi, Asiri & Muramudalige, Shashika & Azeez, Afkham(2015) presents a cloud-based system for driver monitoring and vehicle diagnostics using OBD2 telematics[13]. The system consists of a mobile app, an OBD2 device, and a cloud server. The app provides real-time feedback to drivers on their driving behavior, such as speed, acceleration, and braking, and alerts them to any unsafe behavior. The cloud server collects and analyzes the data from the app and OBD2 device to provide vehicle diagnostic information to drivers and mechanics, such as engine faults, fuel efficiency, and battery health. Overall, the system presented in this paper has the potential to improve driver safety and vehicle maintenance, by providing real-time feedback and diagnostic information. So we can use the above system in a bus tracking system which will improve its security.

Rimpas, Dimitrios, Papadakis, Andreas, and Samarakou, Maria (2019) in the paper "OBD-II sensor diagnostics for monitoring vehicle operation and consumption" focus on the use of On-Board Diagnostics (OBD-II) sensors for monitoring vehicle operation and fuel consumption[14]. This paper describes the importance of OBD-II sensors in providing real-time information on the performance and fuel efficiency of vehicles. It discusses the various types of data that can be collected using OBD-II sensors, including engine speed, coolant temperature, throttle position, and fuel consumption. This paper also covers the challenges faced in implementing OBD-II sensor diagnostics systems, including the accuracy of the sensors and the complexity of the data collected. The authors suggest that these challenges can be addressed through the use of advanced OBD-II sensors and data analysis tools. This paper concludes that OBD-II sensor diagnostics can provide valuable information for improving the fuel efficiency and performance of vehicles fuel efficiency and

performance sensors can lead to significant cost savings by reducing fuel consumption and maintenance costs.

According to the study, the Raspberry Pi board is a more effective alternative to the Arduino board, which is used in many existing systems. A fingerprint-based attendance system can be added in addition to the RFID-based system, which boosts security. Additionally, the bus management system can make use of technology like OBD sensors.

IV. CONCLUSION

In conclusion, the reviewed papers highlight the importance of implementing advanced technologies for college bus security and management systems. The college bus security and management system offers several benefits to educational institutions and their students. The real-time GPS tracking, CCTV cameras, biometric identification, and automated attendance tracking features improve the safety and efficiency of the transportation system, while also reducing costs and enhancing the student experience. From GPS-based tracking systems to real-time passenger information displays and fingerprint recognition software, these technologies may significantly improve the efficiency, safety, and security of college bus transportation. Although there are challenges associated with implementing these technologies, including privacy concerns, cost, and the need for proper infrastructure and training. However, the benefits of implementing these systems far outweigh the challenges, and proper planning and implementation can lead to better transportation services and a safer environment for students. Overall, the reviewed papers provide valuable insights into the different techniques that can be used in the system. Also, many existing systems were also studied. Future research can build on these findings and explore new ways to enhance these systems to meet the evolving needs of college campuses and the wider public transportation industry.

DOI:

References

- [1] Zohari, Mohd Hakimi & Zohari, Bin & Bin, Mohd & Nazri, Mohd. (2021). GPS Based Vehicle Tracking System. International Journal of Scientific & Technology Research. 10. 278-282.
- [2] Gogri, Kushal. (2020). Real Time Bus Tracking System. International Journal of Engineering Research and. V9. 10.17577/IJERTV9IS060545.
- [3] Vishaka Asundkar , S. P. Godse "A Survey On Enhance Security and Tracking System for School Bus and Children" Published in International Journal of Trend in Research and Development (IJTRD), ISSN: 2394-9333, Volume-2 —Issue-6 , December 2015, URL: <http://www.ijtrd.com/papers/IJTRD1315.pdf>
- [4] R . Mohan Raj, P. Renga Rajesh, K . Harish, Mr. M. Raja, 2019, Automated School Bus Tracking System, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) ETEDM
- [5] Kamble, Pravin & Vatti, Rambabu. (2017). Bus tracking and monitoring using RFID. 1-6. 10.1109/ICIIP.2017.8313748.
- [6] Loganathan T., Kamal Kishore S., Navaneeth N., Krishnasamy N., Prof. Thamaraimanalan T(2017), "Bus Tracking System", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT) ISSN : 2456-3307, Volume 2, Issue 2, pp.399-401, March-April-2017.
- [7] K, Ramya and R, Anu Mangai and J, Asha Jency, Real Time E-City Bus Tracking System (May 23, 2019). International Journal of Emerging Technology and Innovative Engineering Volume 5, Issue 5, May 2019, Available at SSRN: <https://ssrn.com/abstract=3411956>
- [8] Ghael, Hirak. (2020). A Review Paper on Raspberry Pi and its Applications. 10.35629/5252-0212225227.
- [9] Ali, Mouad & Mahale, Vivek & Yannawar, Pravin & Gaikwad, Ashok. (2016). Overview of Fingerprint Recognition System. 10.1109/ICEEOT.2016.7754902.
- [10] Abdul Muqet, Mohd & Akbar, Fabia & Hussaini, Syed. (2019). IoT Assisted Fingerprint based Security System using Raspberry PI 3.
- [11] Modi, Hinal & Mistry, Dr. (2014). Security on Fingerprint Data Transfer System. International Journal of Advance Computer Technology,. III. 783-787.
- [12] Tshomo, Karma & Tshering, Kencho & Gyeltshen, Dorji & Yeshe, Jigme & Muramatsu, Kazuhiro. (2019). Dual Door Lock System Using Radio Frequency Identification and Fingerprint Recognition. 1-5. 10.1109/I2CT45611.2019.9033636.
- [13] Bandara, Dilum & Amarasinghe, Malintha & Kottegoda, Sasikala & Liyana Arachchi, Asiri & Muramudalige, Shashika & Azeez, Afkham. (2015). Cloud-Based Driver Monitoring and Vehicle Diagnostic with OBD2 Telematics. International Journal of Handheld Computing Research. 6. 10.4018/IJHCR.2015100104.
- [14] Rimpas, Dimitrios & Papadakis, Andreas & Samarakou, Maria. (2019). OBD-II sensor diagnostics for monitoring vehicle operation and consumption. Energy Reports. 6.10.1016/j.egy.2019.10.018.