Vehicle Management System based on NFC Technology

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Abstract - **Vehicle Management System (VMS) is a system that helps to management traffic and related records. Managing records consist of collecting information of vehicle entered in an organization or any other place. This system helps to collection information without physically entering any data. This system helps to track records of vehicle and can be access from anywhere on earth, because this system makes use of Google Sheet to store data which can be accessed from anywhere. It helps to skip paper work or store any physical records. Security of system helps to keep data accessible to authorize user only. It is completely based on NFC (Near Field Communication) that helps to transfer data securely.**

Keywords: NFC, Vehicle Management System, ESP32, Access Control, Smart Parking, RFID, Automation, Security.

I. INTRODUCTION

In today's situation, efficient vehicle management is very important for improving security, reducing congestion, and enhancing automation in various sectors such as parking facilities, corporate campuses, and residential areas. Traditional or old vehicle access systems, which rely on manual verification or outdated RFID-based mechanisms, to counter these challenges, this paper presents an NFC-based Vehicle Management System, utilizing Near Field Communication (NFC) technology to streamline vehicle authentication and tracking. This NFC-based Vehicle Management System is cost-effective, scalable, and highly efficient approach to vehicle tracking and access control, setting a foundation for future advancements in intelligent transportation systems.

1.1 Connection and Communication

An NFC-based Visitor Management System (VMS) facilitates seamless connection and interaction between visitors, authentication systems, and databases. When a visitor taps an NFC-enabled card, key chain on the NFC reader, the system instantly connects to a Google Sheet database via Wi-Fi to upload data. This real-time communication ensures smooth authentication, granting or denying access based on predefined rules. This process helps to enhances system of check-ins, and reduces the need for manual registration, making visitor management more efficient and contactless.

1.2 Contactless

The contactless feature increase convenience, security, and efficiency by removing the need for physical entries in these applications. It enables fast and seamless authentication using NFC cards, and Key chain reducing wait times and improving user experience. By reducing manual input, it also significantly lowers the chances of human mistake. Additionally, contactless systems enhance security through encryption and tokenization, preventing fraud and unauthorized access. With no physical touch points, they reduce wear and tear on devices, ensuring longevity and reliability while promoting a hygienic, modern, and hand free interaction. Admin / user can update and monitor data anywhere from earth. This feature makes it more user friendly and advance at same time.

Figure 1: Vehicle Management System
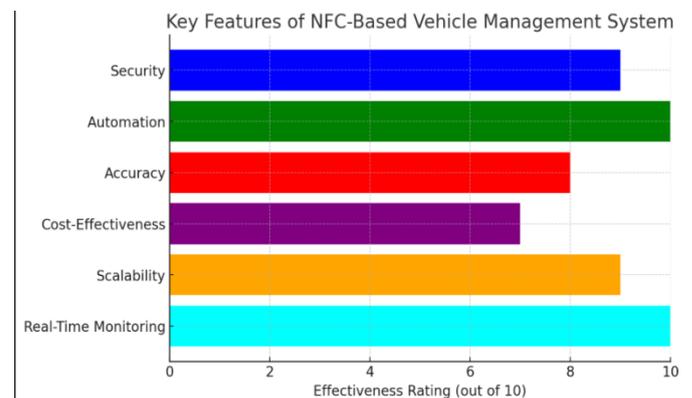
II. USAGE AND LIMITATION

Chart 1: Effectiveness Chart

The NFC-Based Vehicle Authentication System offers give benefits, making it a great solution for secure and automated vehicle access control. One of its key advantages is enhanced security, as it prevents unauthorized access through encrypted NFC Card. The system is fully automated, eliminating the need for manual verification and reducing human errors. Additionally, high accuracy ensures seamless vehicle authentication, while contactless operation enhances hygiene and user convenience. Another major benefit is real-time monitoring, allowing administrators to track vehicle movements instantly through cloud integration. Moreover, NFC technology is energy-efficient, consuming minimal power for smooth operations.

Figure 2: Usage and Limitation image

However, the system also has some disadvantages. One limitation is NFC's short range, which restricts its usage to close-range scanning. Additionally, the initial setup cost can be a concern, as it requires NFC readers, tags, and a database system. While NFC security is strong, there is still a risk of tag duplication if proper encryption measures are not implemented. The system also depends on hardware compatibility, requiring NFC devices for further operation. Environmental factors like metal surfaces or electromagnetic interference can affect NFC signal transmission and if the system relies on cloud-based monitoring, it becomes dependent on an active internet connection.

III. CONCLUSIONS

The NFC-Based Vehicle Management System is a secure, efficient, and simple solution for vehicle access control, offering many benefits such as enhanced security, high accuracy, real-time monitoring, and cost-effectiveness. Its contactless operation improves hygiene and user convenience while ensuring seamless authentication. However, limitations like short-range scanning, initial setup costs, hardware compatibility, and potential signal interference should be considered. Despite these challenges, its scalability and energy efficiency make it an ideal choice for smart parking. Many improvements can be made in various section

of system, when we will have feedback from many user. This will lead to better application in future.

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