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Advanced Car Parking and Billing System

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Abstract: ***The objective of this paper is to solve the issue of the car parking system in our country. We have proposed a system where we give the solution for management of parking space and how we can utilize the current space more effectively. This would lead to decrease in chaos and would help people to choose their parking space in advance and we would give them a choice to cancel their reservation of parking space. In this paper we intend to build a centralized system where all the non reserved and non-occupied spots for parking that are available can be used in a better way. We also looked at a few of the current systems and highlighted their shortcomings. Our framework differs from the ones that are currently in use in that we aim to make our solution as less people- dependent as possible, dependent as feasible by automating both the cars and the parking lot, but the majority of current frameworks necessitate that personnel leave the actual vehicle.***
Keywords: EM18 RFID, ESP32 Microcontroller, Wireless sensor network, Internet Of Things (IoT)

I. INTRODUCTION

An Advanced Car Parking System builds on various IOT techniques and technologies of connected devices to facilitate enhanced car parking systems. With the fast passed urbanization and increasing number of vehicles worldwide, the necessity for efficient parking solutions has become paramount. Traditional parking systems often fall short in accommodating the escalating number of vehicles, leading to congestion, inefficiency, and environmental concerns. In response to these challenges, advanced automated car parking systems have emerged as promising solutions.

This paper presents a comprehensive review of advanced automated car parking systems, exploring their design, functionality, benefits, and technological innovations. By leveraging robotics, IoT (Internet of Things), AI (Artificial Intelligence), and other cutting-edge technologies, these systems offer methodical utilization of space, reduced emissions, enhanced user experience, and improved traffic flow.

Through an examination of existing literature and case studies, this paper elucidates the evolution of automated parking technologies, highlighting their potential to revolutionize urban mobility and address the pressing challenges associated with conventional parking infrastructures. Furthermore, it discusses the integration of smart sensors, data analytics, and cloud computing to optimize parking operations and provide real-time insights for both users and operators.

The insights presented in this paper aim to contribute to the ongoing discourse on urban transportation and sustainable urban development. By understanding the capabilities and implications of advanced automated car parking systems, policymakers, urban planners, and industry stakeholders can make informed decisions to create smarter, more efficient, and environmentally friendly parking solutions for the future.

II. LITERATURE SURVEY

A. Automatic Parking System

With computer-controlled mechanisms, automated parking enables customers to pull up to the bay, lock their automobiles, and let the machines park them automatically in the designated spot. Because it is machine operated, as opposed to traditional parking lots where room is required for vehicle navigation, this form of parking lot maximises available space. Among its advantages is that, because of its structure, it is well-suited for application in lobby areas, where space for growth is at a premium. In addition, the Automated Parking System enables efficient automobile storage by enabling car stacking and obviating the requirement for the customer to enter the parking lot, so indirectly supplying additional safety precautions. which covers both the vehicles and patrons (Shaheen et al., 2005)

Automated parking systems, such as those developed by companies like Automotion Parking System (Automotion, n.d.), Robotic Parking (Robotic Parking, n.d.), and Fata SKYPARKS (Fata SKYPARKS, n.d.), as well as commercial systems reviewed in countries like Japan, Canada, and the United States (Shaheen et al., 2005), typically use computer-controlled mechanisms to place the vehicles in their storage bay within the parking facility. Conventional parking lots can also incorporate automated parking by installing supplementary equipment, such as that created by Fata SKYPARKS (Fata SKYPARKS, n.d.).

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The automated parking system can be implemented in a variety of ways, depending on the layout of the parking lot, how the computer-controlled docks and lifts operate, and where the cars are parked to maximize user participation.

The safety elements are designed with the car in mind, and it's crucial to make sure that during the computer-controlled mechanisms' handling, the car stays secure and unharmed. To ensure proper and effective storage of automobiles in a safe manner, Mathijssen and Pretorius's 2007 research presented a three-level software design that consists of the Hardware Abstraction Layer (HAL), Safety Layer (SL), and Logical Layer (LL). Conveyor belts, rotatable lifts, and shuttles are all part of the parking facility's architecture, so it must be coordinated to guarantee the vehicle's successful and secure placement and retrieval.

B. Vehicle detection technology

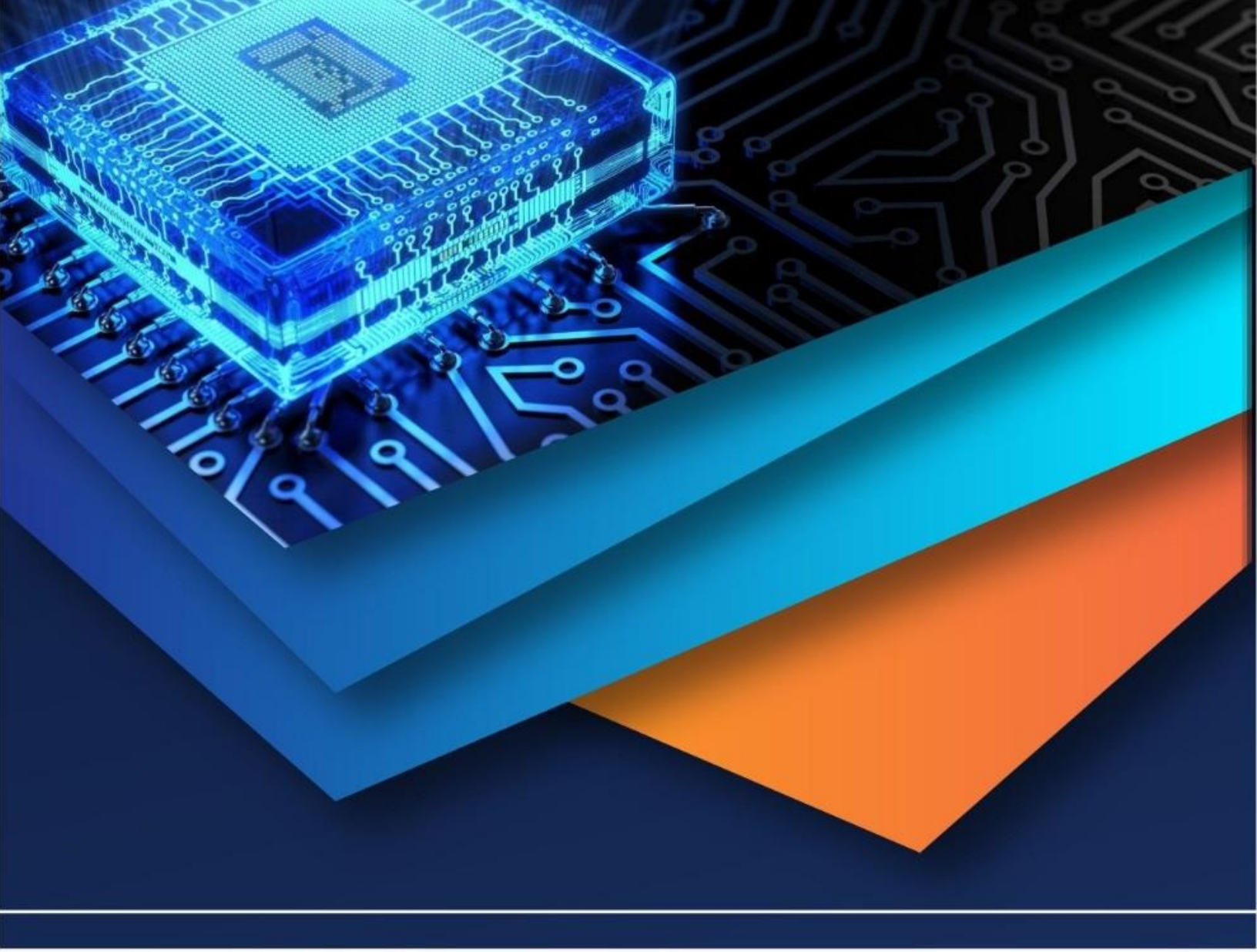
According to Mimbela and Klem (2007), there are two basic types of vehicle sensors and detector systems: intrusive and non-intrusive. While sensors that are installed in holes in the road surface, by tunneling under the road surfaces, or by anchoring to the surface of the road require invasive installation procedures, sensors that are installed on the ground or in the ceiling of a parking lot can be installed with ease. Due to the wide range of sensors available, selection of the sensors would require considering a number of aspects, including cost, environmental conditions, implementation scale, and system design.

Active infrared sensors, inductive loops, magnetometers, magneto-resistive sensors, pneumatic road tubes, piezoelectric cables, and weigh-in-motion sensors are a few examples of invasive sensors. As implied by their name, installing intrusive sensors usually involves cutting into the pavement, which shortens the lifespan of the pavement. Lane closures would be necessary for installation and maintenance on the road, which would impede vehicles (Chinrungrueng et al, 2006; Lenz and Edelstein, 2006; Mimbela and Klein, 2007; Mouskos et al., 2007).

C. Smart payment system:

By reimagining the parking metre payment technique and introducing new technology, the smart payment system is intended to address the limitations of the traditional payment methods. This is due to the fact that using the traditional way, which requires dealing with cash, delays and annoys customers. Additionally, it lessens the need for maintenance and personnel for traffic control and payment handling (Chinrungrueng et al., 2007). Generally speaking, contact method, contactless method, and mobile devices make up the Smart Payment System that was put into place in countries like Finland, Italy, London, and the United

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