

# Automated Parking Lot Management System

**Dr. Choupiri Shivakeshi<sup>1</sup>, A Aslam Basha<sup>2</sup>, Abdul Rehman Belgaumi<sup>3</sup>, Anusha K<sup>4</sup>, Chandana UK<sup>5</sup>**

Assistant Professor, Department of Computer Science and Engineering<sup>1</sup>

Students, Department of Computer Science and Engineering<sup>2,3,4,5</sup>,

Rao Bahadur Y Mahabaleswarappa Engineering College Ballari, India

**Abstract:** *Automated parking management system, utilizing machine learning for license plate recognition, has simplified the ticket generation and parking space allocation process in large parking areas. It offers a user-friendly experience by swiftly recognizing license plates upon vehicle entry. Furthermore, the system efficiently guides vehicles to the most suitable parking spaces, optimizing usage and alleviating congestion. This innovative approach streamlines these procedures, enhancing user convenience. It also plays a part in creating a more sustainable urban environment by reducing fuel consumption and emissions. To sum it up, our integration of machine learning for license plate recognition provides an efficient and eco-conscious solution to urban parking challenges, making parking hassle-free and environmentally friendly*

**Keywords:** car parking, Arduino Uno, parking lot management System, Ticket generation, license plate, alpr, OCR, Yolov5, License plate recognition system, Parking lot, Parking space automation

## I. INTRODUCTION

In an age marked by escalating urbanization, the management of parking has emerged as an essential Endeavor. The demands placed on modern parking facilities necessitate comprehensive solutions capable of surmounting contemporary challenges. Leveraging state-of-the-art License Plate Recognition (LPR) technology, this innovative approach seeks to redefine the parking experience. By addressing longstanding parking concerns, enhancing user convenience, and facilitating seamless operations, it aims to alleviate the frustrations associated with parking. With a commitment to user-friendliness, security, and efficiency, this solution endeavours to streamline vehicle entry and exit processes, promising to render urban parking more accessible, secure, and efficient than ever before.

## II. LITERATURE SURVEY

The paper "Development of a QR-Code Based Smart Car Parking System: In today's arising paced of operational environment, drivers depend considerably on their automobiles to travel to their destinations. Automobiles include: motor vehicles, motor bikes, trucks and all kinds of vehicles that is used for transportation. On average 30% of traffic is searching for an available parking slot, which wastes a lots of gas [3]. Deploying these automobiles has increasingly posed a demand for a system to manage parking spaces. Because of this, large infrastructures like shopping malls, airports, or schools are required to provide parking spaces for drivers. They have difficulty pinpointing their vehicles in car parks have become expansive over the years. Another concern is the parking's security system. The owners are unable to monitor their vehicles all the time, and some parking areas don't have any security personnel to guard them. Even when some provide parking tickets that also contains the vehicle's plate number as proof of ownership, these tickets can easily be forged, making the vehicles vulnerable to compare who can easily exit the parking area without the awareness of security personnel and the drivers themselves. Understanding where, when and how drivers parked, Proposed a solution that will help drivers to have a secure and convenient parking space for their vehicles an automated parking system that can monitor all vehicles entering and leaving the parking area, which is generated by GPS Technology and Google Map APIs [2]. Also, immediate alerts for the driver and security, ensures that we have maximize security for parking areas. Through the use of Quick Response Code (QR Code) and Near Field Communication have automated the security checking of QR Codes which are encoded with vehicle's plate number and driver's cell phone number, and giving of parking tickets. The detection of vehicles along with their QR Code, and texting the driver and security personnel when prompted of suspicious activity is the vanguard of the whole parking security system. All of these security features, along with using the Cloud to find vacant parking spaces as well as the time-in and time-Out of the vehicle, are a revolutionary concept for parking management systems. Secure and

convenient parking for users will be one of the challenges that our country will face in near future. Tourist, nationals and vehicle users will come at that time and a secure parking space is a necessity. This study is a possible solution to oversee the anticipated problem to neutralize this kind of alarming incidences for parking. Some researchers introduce real time parking spot detection using smartphone applications [1], whereas others use Raspberry Pi [4] and microcontroller [5] as a local server. Wireless sensor network system [6], vision based system [7, 8] is also being presented by some researchers. No researchers worked with internet less QR code smart car parking system, which is the main advancement of our paper.

The paper "Discussion on Parking Management System Based on Parking Behavior: The number of urban parking spaces the contradictions between supply and demand and the increasing number of vehicles has become increasingly prominent, have also increased the pressure on urban transportation. In order to ease the traffic pressure and improve the city's transportation efficiency, it is necessary to rationally plan and layout the original parking lot to solve the city the problem of "difficult parking" alleviates the pressure of urban traffic to a certain extent. The shortage of parking spaces will affect the development of the city's economy to a certain extent. Therefore, based on the study of driver parking behavior, on this basis, the existing parking facilities are staffed, managed and optimized, updated and matched. In order to improve the utilization rate and turnover of parking spaces to alleviate the growing parking pressure, it is particularly important to better solve the problem of car parking.

The paper "QR Code-based Real Time Vehicle Tracking in Indoor Parking Structures: Thanks to decades of efforts in GPS devices and systems, drivers know their outdoor locations at any time. The location is sensed by drivers to take correct decisions about feeling of control. When we experience the indoor condition like parking or underground parking structures where GPS signs may infiltrate then we lose our location awareness. Not exclusively do we get stirred up, confounded, in labyrinth like structures, we even fail to recollect where we parked the car, winding up circumnavigating in reverse and advances hunting down the vehicle [8]. By providing this application of vehicle tracking at indoor environment we can satisfy the constant cognitive and fundamental necessities of every driver to adapt themselves relative to a large and unknown environment. Knowing where they are produce a feeling of control and induces tranquility psychologically, both greatly increasing the driving experience [1]. Real-time vehicle tracking is made assert able by the reporting constancy of the real-time. When updates are sent frequently, a dispatcher can get an exact sense of where a vehicle is placed [3]. This feature is available on devices that utilize real time tracking. A dispatcher can know vehicles on the ground and recognize how weather or traffic crowding might be overcoming a track [7]. Tracking company vehicles stimulates keep driver's honesty. Another benefit of real-time truck tracking is that while vehicles over the span of the journey, the dispatcher can contact with clients to provide correct time for arrival. The clients can be kept refreshed of potential delays before the arrival time.

The paper "Research on parking lot management system based on parking space navigation technology: The scale of automobile production continues to expand, with the rapid increase of the number of automobiles. Finding a parking space has become a big problem for most people to go out. Most drivers search for parking spaces based on experience or luck. They often find that there is no extra parking space, or spend a lot of time looking for several parking spaces, which greatly wastes the driver's time and energy. And looking for a parking space will lead to the driver's inattention and speed decline, leading to traffic congestion and frequent traffic accidents. In addition, the large increase of vehicles makes the work of parking lot managers more and more complex, and managers need to spend a lot of energy to manage parking spaces and vehicles in and out constantly. This paper, according to the software development steps, that is, demand analysis, outline design, detailed design, coding, testing and maintenance, designs and implements a parking lot management system to meet the needs of drivers and parking lot managers, which solves the problems of parking difficulties and complex vehicle management. At present, drivers in most parking lots can't book the parking space online, or even if they can book the parking space, they can't know the environmental information around the parking space, which causes drivers to spend a lot of time looking for the straight ladder or rolling ladder to leave the parking lot. And the current parking lot route guidance is not very good to meet the needs of drivers to find parking space. Therefore, this paper designs a parking space module and path guidance module to solve the above problems. The user can select the target parking space according to the parking space status and surrounding environment information. At the same time, this paper analyzes Dijkstra algorithm, Floyd algorithm and ant colony

algorithm, decides to use Floyd algorithm in the parking lot, and Dijkstra algorithm based on heap optimization in the parking lot to guide the driver to reach the target parking space, which solves the parking problem well and meets the driver's demand for parking space.

### III. CONCLUSION

The studies underscore the potential of advanced technologies in revolutionizing parking management. Automated Parking Systems with QR code tracking promise improved security and efficiency, while QR Code-Based Vehicle Tracking offers cost-effective solutions adaptable to various parking structures. Moreover, the implementation of comprehensive Parking Lot Management Systems, integrating online booking and advanced navigation algorithms, demonstrates significant enhancements in user experience and operational efficiency. These findings herald a promising shift towards streamlined and user-centric parking solutions, addressing the challenges posed by increasing vehicle numbers and complex management tasks.

### IV. FUTURE RESEARCH DIRECTION

Future research could focus on improving the accuracy of license plate recognition systems through advanced machine learning algorithms. Additionally, exploring real-time data analytics for optimized parking space allocation and integrating emerging technologies like blockchain for secure transactions and renewable energy sources for sustainability could enhance automated parking management further. These advancements promise greater efficiency, convenience, and environmental benefits for urban parking systems.

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