International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 10 | October - 2023 SJIF Rating: 8.176 ISSN: 2583930

Car Parking with Empty Slot Detection Using Software

Ms. Jadhav S.N[1], Ms. Wavare S.S[2], Mr. Wadkar. S.B[3]

[1]*S. B. Patil College of Engineering, Indapur*
[2]*S. B. Patil College of Engineering, Indapur*
[3]*S. B. Patil College of Engineering, Indapur*

Abstract - The efficient management of parking spaces in urban environments has become increasingly critical with the growing number of vehicles on the road. This paper presents a novel approach to car parking management using softwarebased empty slot detection. Traditional parking systems often rely on manual checks or rudimentary sensors, leading to inefficiencies and frustration for drivers and operators. Our proposed system leverages computer vision and machine learning techniques to detect empty parking slots within a parking facility automatically. By strategically placing cameras and utilizing image processing algorithms, the system continuously monitors parking spaces, providing real-time information to drivers via a mobile application or electronic displays. This technology enhances the overall parking experience by helping drivers locate available spots quickly and optimizes parking facility usage, reducing congestion and pollution caused by vehicles circling in search of parking. Moreover, the system can collect valuable data on parking patterns and occupancy rates, enabling parking operators to make informed decisions for space allocation and pricing strategies. The software-based approach offers scalability, affordability, and adaptability to various parking environments, making it a promising solution for modern urban mobility challenges. With the integration of our system, cities can move one step closer to a smarter and more sustainable transportation infrastructure.

***Key Words*:** Automatic car parking, Empty slot detection, software applications, Urban transportation

1.INTRODUCTION

In an era of rapid urbanization and increasing vehicular density, efficient car parking management has become a paramount concern for cities worldwide. Traditional parking systems often fall short of meeting the demands of modern urban life. To address these challenges, software applications equipped with empty slot detection capabilities have emerged as a promising solution.

2. Body of Paper

1. **Urban Congestion and Parking Woes**. Urbanization has led to a proliferation of vehicles, exacerbating traffic congestion and parking difficulties. Traditional parking methods are often inefficient, leading to wasted time and fuel, increased pollution, and frustrated drivers.
2. **Role of Software Applications.**

Software-driven solutions offer real-time data and connectivity, improving parking efficiency. The integration of empty slot detection technology enhances the user experience and optimizes space utilization.

3. **Objectives of the Survey.**

This survey paper aims to comprehensively examine car parking systems using software applications. It focuses on the critical aspect of empty slot detection and its impact on traffic management, sustainability, and convenience.

Paper Structure.

Section 1: An overview of state-of-the-art technologies and methodologies in car parking systems, with an emphasis on software applications.
Section 2: The importance of empty slot detection and its implications for urban mobility and sustainability.
Section 3: A detailed review of existing software-based car parking systems, categorized by detection mechanisms, highlighting strengths and weaknesses.
Section 4: Discussion of challenges and considerations, including privacy, security, and infrastructure.
Section 5: Exploration of future trends and emerging technologies in the field.
Section 7: Conclusion summarizing key findings and the potential of software applications in parking management.

Significance of the Survey.

This survey paper serves as a valuable resource for researchers, policymakers, and industry professionals interested in advancing parking management solutions. It underscores the transformative potential of software applications in addressing the pressing challenges of urban parking.

BLOCK DIAGRAM

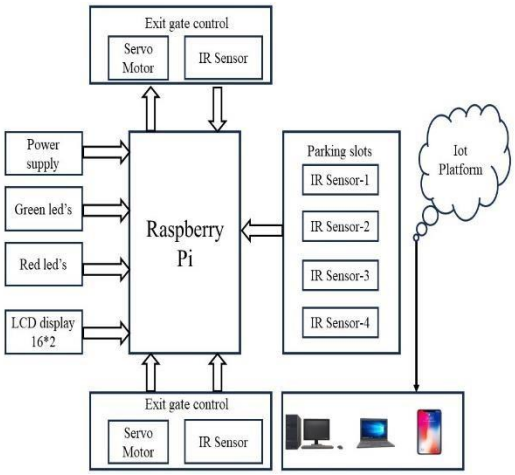

Figure 1Block Diagram of car parking with empty slot detection using the software.

The area occupied [1],by the vehicle in the parking slot is calculated. The below formula can calculate the Percentage area occupied.

$$\text{Area Occupied} = \frac{\text{Area Occupied by Car}}{\text{Area Occupied by the Parking Slot}}$$

Figure 2. Snap of Dataset

We are using 10,209 images for training the model and 2,208 images for testing and validating the model. The model is made robust by training it over . all weather conditions so that it will be able to detect the cars even in noisy environments we have annotated the images with the help of VGG Image Annotator HTML version and fitted the vehicles in a polygon so that it can be trained using our Mask R-CNN model. Fig.3. shows the Snapshot of a dataset. Driving distance[2]is the distance between the current position and the target parking space, and walking distance is the distance between the target parking space and the destination. The above-related works are conducted from t h e driver's point of view, where the search time, walking distances and

Notations	Meaning
p_i	the th parking area, where $1 \le i \le n$
P	the set of parking areas p_i
$N(x)$	the number of parking spaces in the parking area x
$A(x)$	the current number of available parking spaces in parking area x
$D(t, x)$	the distance from parking area t to parking area x
δ	the tolerable distance
Ct	the set of candidate parking areas (given target area t), where $C_t \subseteq P$
St	the suggested parking area (given target area t)

Table I shows the notations used in the proposed suggesting schemes. For a given target parking area t, candidate parking area C_t can be expressed as

$$C_t = \{x | x \in P \ \wedge D(t, x) \le \delta \wedge A(x) > 0\}. (1)$$

The major task of each suggesting scheme is to select the suggested parking area S_t from the set C_t. Based on the above definitions, the SDF scheme can be expressed as

$S_t = \arg\min_{x \in C_t} D(t, x)$.

The LAF scheme can be expressed as

$$S = \arg\min \frac{N(X) - A(X)}{N(X)}$$

For practical [3] use in transport, the use of particular types of sensors depends in particular on their properties and capabilities in relation to the purchase price and the requirements for their installation. In this respect, there is usually an effort to use sensors as cheaply as possible at a higher density of installation or vice versa, to use more expensive ones that provide more detection capabilities (traffic cameras). Part of sensor functions - especially the calculated ones - is fundamentally dependent on the number and location of the detectors used and also - above all - on the quality of the calculation methods and the algorithms used.

The advantages and benefits or limitations of the most frequently used types of sensors are represented in the following overview.

Pyca l principleof the sensor / Measured value,/unit	Induction loop	pressure detector	Piezoe lectric detector	Magneto meter	Radar	Infra detector	Acoustic Imaginior	Video detection
Traffic intensity	YES	YES	YES	YES	YES	YES	YES	YES
Presence (moving vehicle)	YES	YES Note 3	YES	YES	YES	YES	YES limited	YES
Occupancy (standing vehicle)	YES	NO	NO	YES	NO	YES	NO	YES
Vehicle classification	YES Note 1	YES Note 3	YES (Note 3	YES	YES limited	YES	YES limited	YES
Speed	YES Note 2	YES NOTE 2	YES-Note 2	YES (Note 2	YES	YES (Note 2	NE	YES (Note 4
Informative price comparison	1	2	3	3-4	2	2-4	3-4	3-4

Note 1: - if speed data is available

Note 2: - if two consecutive sensors are used

Note 3: - can be calculated, derived from measured values

Note 4: - lower precision with the use of a single camera; high precision with the use of two cameras at entrance and exit to/from the section and recognition of license plates of the vehicles

Table 1Comparison of detectors

From the above, it follows that, to supervise the traffic situation in the city, or to control stationary vehicles, it is necessary to select a suitable type of sensor in the monitored area and carefully consider their location and types of data to collect. Parking management systems require both data from access road monitoring systems as well as specific parking place occupancy monitoring data, or monitoring of parking lanes, in order to control both designated and unmarked street parking.

There are two types of object detection: those that use sparse sets of object suggestions (e.g., selective search) and those that use dense sets (e.g., DPM). The distribution of conflicting opinions is a type of cascade in which the initial offer rejects many candidates and leaves a small number for consideration. This step increases detection accuracy when used for DPM detection. We found evidence that the proposed classification stage also improves the accuracy of Fast R-CNN. Using a well-chosen search method, we scan 1k to 10k suggestions per image and re-introduce and reestimate model M each time. If the quote is only responsible for counting, increasing the count for each requested image should not harm the map.

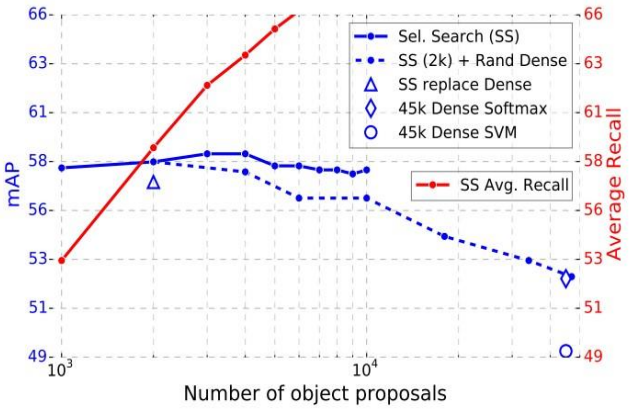

Figure 3VOC07 test map and AR for various proposal schemes

A. Smart Phone App.

The first step is that the user has to install the car parking management app on the smartphone. When the user is near the parking place, the user has to log into the smartphone app and place the request for the parking space. The user has to provide the vehicle type and vehicle registration number for security purposes then the user has to verify and proceed to the next step, after verification the request for the parking lot will be placed on the server.

B. Architecture and Usage of Smartphone App

The development of smartphone apps is on Android, IOS, and Windows. The smartphone app has two major security levels that include: Admin and user level. Admin is responsible for managing the whole procedure of the car parking management system including verifying the vehicle information. At the user level, the user has to create an account to log into the application and has to provide the vehicle registration number. After logging user can request the available slot for parking the vehicle.

C. Centralize server

The centralized server is responsible for the communications between the user and the sensor. It manages to allocate a free slot of car parking and inform the user. The app server has the application server and the web server has the web application running on this centralized server. Once the web application receives the request, the schedule will run against this request and the system will automatically search for the available parking lots. On finding the available parking lot, the system will send the information back to the user. The system will also send the map to the user, hence the user is able to specify the place easily.

D. Web server

The web server has a web application running on it and it is the first interface to get a request from the user. The basic functionality of the scheduler is to check the request after every minute and process the request. After looking for slots in the database, it sends a request in the work queue to the application. The application server is responsible for carrying all information from the user and web server and entertaining all requests from the system. The web application sends a request. to the app server that will be viewed by different users who will confirm of allocation slot after doing some basic checks.

E. Sensor with microcontroller

Sensor-equipped with a microcontroller that senses the vehicle entering the parking lot, converts these analog signals to digital signals, and transmits them to the server. The web application will check the registration number of the vehicle and update the record accordingly.

3. CONCLUSIONS

The emergence of "Car Parking with Empty Slot Detection Using Software Applications" represents a significant leap forward in the realm of urban parking management. As cities continue to grow and the demand for parking spaces intensifies, innovative solutions are essential to optimize the use of limited resources, reduce traffic congestion, and enhance the overall urban living experience.

In this paper, we have explored the multifaceted landscape of automatic car parking with empty slot detection, shedding light on the transformative potential of this technology. We have examined the technical intricacies, operational benefits, and real-world applications, providing a comprehensive understanding of its current state and future possibilities. The integration of software applications into parking management systems has revolutionized the way we interact with parking facilities. Drivers now have the power at their fingertips to effortlessly locate available parking spaces, saving time, reducing frustration, and minimizing environmental impact. Such ease of access not only enhances the convenience of urban living but also aligns with the broader objectives of sustainability and efficient resource utilization.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to all those who have played a significant role in the completion of this survey paper. First and foremost, we would like to thank our advisors, [(Prof.U.N.Bodhale)], for their unwavering support, guidance, and invaluable insights throughout the research and writing process. Their expertise and encouragement were instrumental in shaping this survey paper. We extend our appreciation to the authors of the research papers and publications that we have surveyed. Without their groundbreaking work and dedication to advancing the field, this survey paper would not have been possible. We are grateful to our colleagues and peers for their constructive feedback and discussions, which helped refine our understanding of the subject matter and improve the quality of this paper. We also acknowledge the libraries, online databases, and institutions that provided access to a wealth of research materials, making it possible for us to comprehensively survey the literature in our field of study.

Lastly, we would like to express our gratitude to our families and friends for their unwavering support and understanding during the long hours and late nights devoted to this research This survey paper is the result of collective efforts, and we acknowledge the contributions of all those who have played a role, however small, in its completion.

Thank you all for your support and encouragement.

[Shamal.N.Jadhav].
[Sudiksha S. Wavare].
[Shubham.B.Wadkar].

REFERENCES

[1] Chia-Ying Lin, Yi-Lung Lu, Meng-Hsun Tsai, Hui-Ling Chang, "Parking use as a smart city proposal", Consumer Communications and Networking Conference (CCNC)) 2018 15th IEEE Yearbook, pages 1-6, 2018.

[2] Wu, Qi and Yi Zhang. "Find a parking spot." Machine Learning, Issue 6, Fall (2006).

[3] S. Wu, C. Huang, S.-y. Wang, W.-c. Chiu and T. Chen, “Robust station detection for spot correlation,” in, IEEE International Conference on Multimedia and Expo,. IB, 2007, page 17. 659-662.

[4] Zhu Qianqian, Liu Sen, Guo Weiming. "Car-like recognition study based on Mask R-CNN". Journal of Physics: Conference Series, Vol. 1335, no. 1 second. 012026 one. IOP Publishing, 2019.

[5] Chia-Ying Lin, Yi-Lung Lu, Meng-Hsun Tsai, Hui-Ling Chang, "Usage-based proposal of smart city parking lot", Consumer Communications and Networking Conference (CCNC) 2018 The 15th IEEE Yearbook, pages 1-6, 2018.

[6] C.Y. Lin, J.-T. Sue, W.-P. Tsai, M.-H. Tsai, "Detection of parking spaces near the road", 27th IPPR Conference on Computer Vision, Graphics and Image Processing (CVGIP), 2014.

[7] Svítek Miroslav, Přibyl Pavel. Intelligent Systems: BEN Technická Papers, 2002. 80-7300-029- 6.

[8] Cikhardtová K., Boyarkin I., Bělinová Z., Tichý T., "Implementation of new management changes in urban areas", 2018.

[9] Merritt, H.E., 1971 , Gear Engineering, Pitman, New York, p. 173. 82-83: İ. Text.

[10] Stewart, R. M., 1977, "Some Data Analysis for Transmission Diagnostics", Proceedings of the Time Series Analysis Conference, ISVR, University of Southampton, Southampton, UK. paper.

BIOGRAPHIES

Shubham.B.Wadkar
Students of S.B.Patil college of Engineeriingng ,Indapur

Sudiksha S.Wavare
Students of S.B.Patil college of Engineeriingng ,Indapur

Shamal.N.Jadhav
Students of S.B.Patil college of Engineeriingng ,Indapur