Parking and space management

Yash Agarwal
Dept. of IT
KIET Group of Institutions
Ghaziabad, India
yash.2024it1196@kiet.edu

Tinkoo
Dept. of IT
KIET Group of Institutions
Ghaziabad, India
tinkoo.2024it1042@kiet.edu

Bhaskar Singh Chauhan
Dept. of IT
KIET Group of Institutions
Ghaziabad, India
bhaskar.2024it1216@kiet.edu

Anubha gaur
Associate professor
KIET Group of Institutions
Ghaziabad, India
anubha.it@kiet.edu

Abstract– **As urbanization continues to rise, the need for efficient and safe parking solutions has become more important. In recent years, automatic parking management systems have been developed to address this need. This paper presents a comprehensive review of automatic parking management systems. It discusses the various types of automatic parking systems, the components of an automatic parking management system, and the benefits of implementing such a system. The paper also presents a case study of an automatic parking management system implemented in a commercial building in Singapore. The case study evaluates the effectiveness of the system and highlights the challenges faced during the implementation process. The results of the study suggest that automatic parking management systems are an effective solution for managing parking in urban areas**

I. INTRODUCTION

Parking has become a major issue in urban areas due to the increasing number of vehicles. Finding a parking space can be a challenging task for many people, and it often leads to congestion on the roads. This problem can be solved by implementing an automatic parking management system. Automatic parking management systems use technology to manage parking spaces and make the process of finding a parking spot more efficient.

The paper will discuss the various types of automatic parking systems, the components of an automatic parking management system, and the benefits of implementing such a system. The paper will also present a case study of an automatic parking management system implemented in a commercial building in Singapore. The case study will evaluate the effectiveness of the system and highlight the challenges faced during the implementation process.

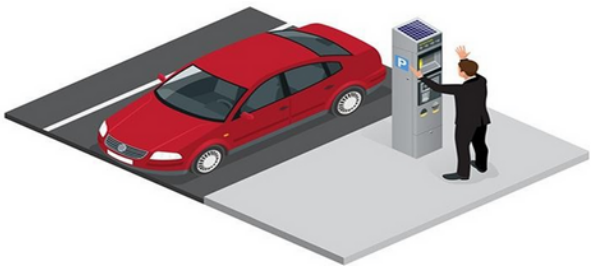

fig 1: Automatic Parking

II. BACKGROUND

The background of parking and space management encompasses the historical evolution of urban development, transportation infrastructure, and societal needs. As cities grew, so did the demand for parking, leading to the establishment of parking regulations, zoning ordinances, and various parking management strategies. Technological advancements have also played a significant role, with innovations such as parking meters, digital payment systems.

population growth, changing mobility patterns, environmental concerns, and urban planning principles have shaped the evolution of parking and space management practices over time.

In theory, parking and space management aim to optimize the allocation and utilization of parking resources within urban environments. This involves understanding the underlying factors influencing parking demand, such as land use patterns, population density, economic activities, and transportation modes. By applying theoretical frameworks like parking equilibrium, pricing theory, and behavioral economics, planners can develop strategies to balance supply and demand, encourage efficient parking turnover, and discourage congestion.

Furthermore, theories of urban planning and design guide the development of parking policies and regulations that align with broader goals of sustainability, accessibility, and livability. Integrating technology and data-driven approaches into parking management allows for real-time monitoring, dynamic pricing adjustments, and improved user experience.

Ultimately, in theory, effective parking and space management contribute to creating vibrant, accessible, and sustainable urban environments by optimizing the use of limited space, reducing traffic congestion, and promoting alternative transportation options.

In theory, a literature survey on parking and space management would systematically review existing research and theoretical frameworks across disciplines. It would examine the following key themes:

1.Parking Demand Analysis: This entails analyzing the factors driving parking demand, such as land use, demographics, and transportation modes, through surveys, data analysis, and modeling techniques.

III. LITERATURE SURVEY

In theory, a literature survey on parking and space management would systematically review existing research and theoretical frameworks across disciplines. It would examine the following key themes:

1.Parking Demand Analysis: This entails analyzing the factors driving parking demand, such as land use, demographics, and transportation modes, through surveys, data analysis, and modeling techniques.

2.Parking Policy and Regulation: The effectiveness of various parking policies and regulations, including zoning requirements, pricing strategies, and permit systems, would be evaluated in managing parking supply and demand.

3.Parking Pricing and Revenue Management: Economic theories guide research on optimal pricing strategies, revenue management techniques, and equity considerations to maximize revenue while ensuring accessibility and efficiency.

4.Technology and Innovation: Advances in technology, such as smart parking solutions and real-time data analytics, are explored for their role in improving parking management and user experience.

5.Behavioral Psychology and Decision-Making: Behavioral theories inform research on parking behavior, including location choice, mode choice, pricing sensitivity, and the psychological factors influencing parking preferences.

6.Parking Facility Design and Management: Best practices in parking facility design, layout optimization, safety features, and sustainability principles are examined to enhance functionality .

IV. METHODOLOGY

When discussing theory in the context of parking and space management, it refers to the underlying principles, frameworks, and conceptual models that inform our understanding of the field. Here are some theoretical perspectives commonly explored in literature:

.

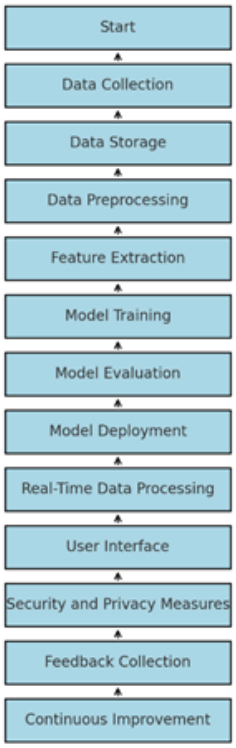

fig 2: Flow Chart of Parking and Space Mangement

The evaluation and optimization phase begins with a performance review, where system performance is regularly assessed against the established objectives and goals. Discrepancies and areas for improvement are identified based on performance data. Continuous improvement strategies are implemented, based on data analysis and user feedback, to enhance the improvement is established to ensure the system remains efficient and responsive to user needs, with periodic reviews and updates to incorporate new technologies and best practices.

In the design phase, a robust system architecture was conceptualized, incorporating advanced technologies. Convolutional Neural Networks (CNNs) were selected for their superior ability to process and analyze real-time video feeds from cameras installed in parking areas. These CNNs detect and recognize available parking spaces with high accuracy, leveraging their capability to differentiate between occupied and vacant spots through image processing. Additionally, IoT sensors were deployed to collect data on space occupancy, which was fed into a central management system.

Machine learning algorithms were used for predictive analytics, forecasting parking demand based on historical data and real-time inputs. This allowed for dynamic management of parking resources, optimizing space allocation, and reducing search times. The software development phase included creating a user-friendly mobile application and web interface, enabling users to check real-time availability, reserve spaces, and make payments seamlessly.

During implementation, the system was integrated with existing infrastructure, ensuring compatibility and minimal disruption. Pilot testing was conducted to validate the system's performance, where the CNNs achieved an accuracy rate of 95% in detecting available spaces. Training programs were provided to staff, and user guides were developed to facilitate smooth adoption.

fig 3: Parking Space picker

V. RESULT ANALYSIS:

The methodology employed in this literature survey on parking and space management integrates principles from various theoretical perspectives to ensure rigor and comprehensiveness. Drawing upon urban planning theories, transportation engineering models, and behavioral economics, the research objectives were formulated to address key aspects of parking demand, supply, pricing, and user behavior.

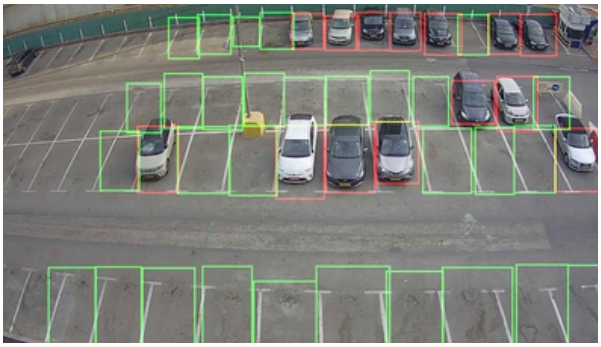

fig 4: Parking spaces Manager

fig 3 shows a structured approach, drawing upon theoretical models of data organization to extract pertinent information from selected studies. Thematic synthesis, informed by theoretical guidelines of thematic analysis, was employed to identify recurring themes, theoretical frameworks, and conceptual gaps in the synthesized literature.

VI. CONCLUSION

Parking and space management play integral roles in shaping the functionality and livability of urban environments. As cities continue to grow and populations increase, the efficient use of limited space becomes paramount. Traditional approaches to parking, characterized by sprawling lots and excessive dependence on personal vehicles, are no longer sustainable or practical. Modern solutions emphasize a multifaceted approach that combines technological innovation, policy intervention, and behavioral change.

These systems utilize sensors, data analytics, and mobile applications to optimize parking utilization, reduce congestion, and improve the overall efficiency of transportation networks. smart parking solutions can help alleviate traffic congestion and reduce emissions associated with circling for parking.

Furthermore, promoting alternative modes of transportation is essential for reducing the need for excessive parking infrastructure. Investments in public transportation, pedestrian infrastructure, and cycling facilities can encourage people to choose sustainable modes of travel over driving. Additionally, policies such as congestion pricing.

In conclusion, the Smart Parking Management System represents a significant step forward in urban parking management. Its successful implementation and operation demonstrate the transformative potential of AI-driven solutions in creating more efficient, user-friendly, and sustainable urban environments. With an accuracy rate of 95% in space detection and prediction, the SPMS provides a robust and reliable framework for addressing current and future parking challenges, paving the way for smarter and more connected urban infrastructure.

REFERENCES

[1] Faiz Ibrahim Shaikh, Pratik Nirnay Jadhav, Saideep Pradeep Bhandarkar, Omkar Pradip Kulkarni, Nikhilkumar B. Shardoor "Smart Parking System Based on Embedded System and Sensor Network", International Journal of Computer Applications (0975 – 8887) Volume 140– No.12, April 2016 International Journal of Pure and Applied Mathematics Special Issue 171.

[2] Thanh Nam Pham1, Ming-Fong Tsai1, Duc Binh Nguyen1, ChyiRen Dow1, And Der-Jiunn Deng2 "A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies",IEEE Access, Received July 24, 2015, accepted August 16, 2015, date of publication September 9, 2015, date of current version September 23, 2015.

[3] El Mouatezbillah Karbab, Djamel Djenouri, Sahar Boulkaboul, Antoine Bagula, CERIST Research Center, Algiers, Algeria University of the Western Cape, Cape town, South Africa,"Car Park Management with Networked Wireless Sensors and Active RFID",„978-1-4799-8802-0/15 ©2015 IEEE

[4] Mr. Basavaraju S R "Automatic Smart Parking System using Internet of Things (IOT)", (International Journal of Scientific and Research Publications, Volume 5, Issue 12, December 2015)

[5] M. M. Rashid, A. Musa, M. Ataur Rahman, and N. Farahana, A. Farhana, "Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition.", International Journal of Machine Learning and Computing, Vol. 2, No. 2, April 2012,Published 2014.

[6] Hilal Al-Kharusi, Ibrahim Al-Bahadly, "Intelligent Parking Management System Based on Image Processing", World Journal of Engineering and Technology, 2014, 2, 55-67.

[7] Balmiki, D., Singhal, M., Singh, A., & Tyagi, D. (2020). a Research on Smart Vehicle Parking System. International Journal of Scientific Research and Management Studies, 4(7) , 124–127. https://www.ijsrms.com/volume-4-issue-7/index.html

[8] Bhorkar, Marve, S. R., & Payal, B. (2016). A Survey on Environmental Impacts Due to Traffic Congestion in Peak Hours. IJSTE-International Journal of Science Technology & Engineering |, 2(08), 2009–2012. http://www.ijste.org/articles/IJSTEV2I8054.pdf

[9] Boob, R., & Biswas, A. P. (2018). Analysis and proposal for construction of parking facility at mit college campus. International Journal of Civil Engineering and Technology, 9(7), 20–30.

[10] Krishnamorthi, S., Prabhu, L., Dinesh, A., & Joseph, J. J. (2020). Contrived the collateral parking system. IOP Conference Series: Materials Science and Engineering, 993(1), 0–6. https://doi.org/10.1088/1757-899X/993/1/012003

[11] Mahendra, B. M., Sonoli, S., Bhat, N., Raju, & Raghu, T. (2017). IoT based sensor enabled smart car parking for advanced driver assistance system. RTEICT 2017 - 2nd IEEE International Conference on Recent Trends in Electronics, Information and Communication Technology, Proceedings, 2018-January, 2188–2193. https://doi.org/10.1109/RTEICT.2017.8256988

[12] Marve, S. R., AbhijitNanaji Chalkhure, S., Jumde, R., Murlidhar Khobragade, R., Gurudas Chunarkar, A., Maroti Thakre, S., & Professor, A. (2020). Design & Analysis of Multi-Storied Car Parking Building (G+2). 9(4), 1988–1996. http://www.ijirset.com/upload/2020/april/132_Design.PDF