

Parking harmony: A case study of Dayalbagh university campus

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Abstract

The issue of comfortable parking has become a significant problem in the campus area of Dayalbagh University Agra, as the increasing number of vehicles coupled with limited parking spaces has led to congestion. This research paper investigates parking management at Dayalbagh campus premises, aiming to optimize traffic efficiency and address current challenges using a mixed-methods research approach, combining surveys, traffic flow analyses, and on-site observations to comprehensively evaluate the existing parking situation. It offers insights into urban planning and transportation strategies, guiding local authorities, urban planners, and the community for better decisions to improve traffic and parking management in similar spiritual and educational hubs like Dayalbagh University.

Keywords: Parking management; traffic regulation; urban planning

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1. Introduction

The issue of parking management within educational institutions is a multifaceted challenge that significantly impacts the daily experiences of students, staff, and visitors (Parmar, Das & Dave, 2020). The efficient management of parking facilities within the institute's premises is crucial not only for ensuring smooth vehicular movement but also for enhancing the overall experience of individuals accessing the campus. However, achieving parking harmony in such a dynamic environment requires a comprehensive understanding of the diverse factors influencing parking dynamics, including user satisfaction levels, environmental considerations, and the implementation of effective solutions to address emerging challenges (Nadimi, Afsharipoor & Mohammadian Amiri, 2021).

Dayalbagh, located in Agra, Uttar Pradesh, serves as the headquarters for the Radha-Soami faith. The area is renowned for its spiritual significance, attracting followers from across India and beyond. The Dayalbagh campus is characterized by well-planned architecture, including structures like the Soami Bagh Temple, and it is home to educational institutions like the Dayalbagh Educational Institute (DEI).

With the growth in population and increasing vehicular traffic, managing traffic and parking has become crucial for maintaining the functionality and livability of Dayalbagh. As a spiritual and educational hub, effective traffic and parking management are essential to ensure the area's smooth flow of visitors, residents, and students. The significance of addressing these issues extends beyond mere convenience, impacting the overall harmony and accessibility of Dayalbagh. Recognizing Dayalbagh as not only an educational hub but also a residential area, this research takes a holistic approach by evaluating the current parking infrastructure and proposing solutions for optimized utilization. Central to our investigation is a survey designed to capture the perspectives of the community regarding existing parking facilities. By engaging with the residents and stakeholders, we seek to understand the nuanced requirements and preferences that will guide the formulation of effective parking strategies.

This research aims to examine the intricate aspects of parking management at Dayalbagh Educational Institute, focusing on two-wheelers, four-wheelers, and bicycle parking for staff, students, and visitors. By conducting a survey that encompasses various parking-related attributes and environmental factors, this study seeks to identify key issues affecting parking harmonies, such as challenges during extreme weather conditions like rain and extreme heat. Subsequently, the research aims to propose viable measures to tackle these issues and enhance parking facilities to promote a more seamless and satisfactory experience for all users within the institute's community. Through this investigation, we aspire to contribute valuable insights that can inform effective strategies for optimizing parking management and fostering a harmonious environment within educational institutions like Dayalbagh Educational Institute.

The current parking situation in Dayalbagh faces challenges such as insufficient parking spaces, improper utilization of available spaces, and a lack of organized parking infrastructure. These challenges contribute to congestion, inconvenience for residents and visitors, and potential safety hazards. Inadequate parking not only leads to traffic congestion but also affects the overall urban planning of Dayalbagh. Unregulated parking can lead to haphazard development, compromise pedestrian safety, and hinder emergency services. Therefore, addressing parking issues is crucial for maintaining a well-organized and sustainable urban environment. Figure 1 shows the parking facilities at Dayalbagh campus and figure 2 shows parking area for both two-wheelers and four-wheelers.

Figure 1

Parking facilities at Dayalbagh Campus



Figure 2

Parking area for both two-wheelers and four-wheelers



1.1. Literature review

Barde et al., (2022), acknowledged the parking problem as a current issue, so their research aimed at enhancing the College Campus Parking System. Challenges faced by students, teaching staff, and stakeholders due to a shortage of parking space at SSCET College prompt the need for improvement. Barde et al., (2022) identified that implementing a proper parking management system is a key solution to address the improper parking arrangements for students, teaching staff, and visitors. The research focused on resolving parking issues through the restructuring of arrangements and the implementation of an efficient parking facility system at the SSCET campus, guided by a thorough survey of the campus area to determine required parking space and suitable arrangements for both two-wheelers and four-wheelers.

Shang et al., (2007), presented a case study of the parking problem at the Beijing University of Aeronautics and Astronautics. The study analyzed the inflow and outflow of vehicles on campus, as well as the location and usage of parking lots. The survey data was used to compute the average parking duration and the turnover of parking lots.

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Vianna et al., (2004), introduced a methodological procedure supporting the feasibility of implementing an integrated parking system using telematics resources, including the development of a logical architecture for data processing and transfer. The proposed procedure was tested in Niterói, a medium-sized Brazilian town in the Rio de Janeiro Metropolitan Region, focusing on a specific two-square-kilometer area with numerous parking facilities. Errouso et al., (2024), Li et al., (2020), and Shimi et al., (2022) further introduced the anticipated benefits of Intelligent parking solutions to detect vacant spots that potentially reduce traffic congestion and air pollution in the analyzed area.

Isler et al., (2005) presented a study of parking management practices in undergraduate and graduate universities located in small or medium-sized cities. Based on the survey responses of 34 universities, the research found that new parking facilities were mainly built on the land previously used for surface parking. The study suggested that permits, meters, and cooperative efforts with the local authorities were the most effective ways to manage parking demand. They further said that expanding parking options to include short-term parking and guaranteed ride-home programs can also help reduce parking demand and the amount of land required for vehicle storage.

1.2. Purpose of study

The primary objectives of this research are to assess the current state of parking in Dayalbagh, identify challenges and shortcomings, and propose effective strategies for improved parking management. The research aims to provide data-driven insights into the existing parking dynamics, traffic patterns, and their implications for the overall urban environment. The study recognizes the intrinsic connection between parking management and traffic flow and proposes recommendations for enhancing parking management strategies, including the implementation of innovative solutions to promote parking harmony and improve the overall campus experience for staff, students, and visitors.

2. Methods and materials

2.1. Data collection instrument

The methodology employed for investigating parking harmony at Dayalbagh Educational Institute, Agra, involved the utilization of a survey conducted through Google Forms. This survey was designed to encompass various parking-related attributes, including but not limited to, parking fees and users' satisfaction levels concerning parking spaces. Furthermore, the form incorporated inquiries about environmental factors such as sunlight and rain, which often pose challenges for parking arrangements. By leveraging this comprehensive survey instrument, the research aimed to gain insights into the multifaceted dynamics of parking management and environmental considerations within the institute's premises, thereby facilitating a holistic understanding of parking harmony in this educational setting.

2.2. Participants

The majority of respondents were students and staff who spent a significant amount of time on campus, indicating that they were directly affected by the parking situation. Daily visits suggest that parking is a recurring concern for these individuals, emphasizing the need for effective solutions.

2.3. Ethical consideration

All necessary precautions were taken by the researchers to minimize any potential harm or discomfort to participants. Study design and implementation were conducted in accordance with ethical considerations, with particular attention being paid to minimizing adverse effects on participants.

3. Results

The analysis of the survey data regarding user satisfaction levels with the current parking conditions at the Dayalbagh Educational Institute campus resulted in a diverse range of sentiments among parking users. Among the respondents, 41.1% expressed a neutral stance towards the existing parking facilities. However, it is noteworthy that a substantial proportion of users exhibited dissatisfaction, with 21.8% expressing satisfaction and an equal percentage expressing dissatisfaction. Additionally, 9.2% of respondents expressed a high level of dissatisfaction with the current parking conditions. These findings highlight the mixed nature of user perceptions regarding parking facilities, emphasizing the need for targeted interventions to address specific areas of concern and enhance overall satisfaction levels among parking users within the institute's premises.

Figure 3
Sample survey questions

Willingness to Pay More for Secure Parking *

- Yes
- No
- Maybe

Optimization Initiatives *

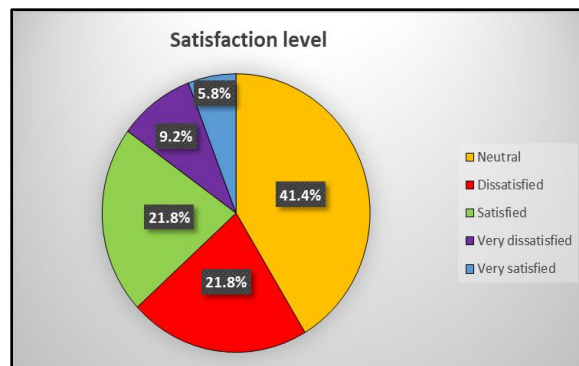
- Smart meters
- Dynamic pricing
- Multi-level parking
- Encouraging alternatives
- Others

Problem of Present parking Area *

- Slippery surface in rains
- Dust in summer
- No shade for sunlight
- Single Entry Exit Door

Have parking challenges discouraged you *

Figure 4
Satisfaction level of users



The investigation into the willingness of parking users to pay more for improved and secure parking facilities unveils diverse perspectives among respondents. Approximately 41.1% of users expressed their reluctance to pay more, suggesting potential constraints such as financial limitations or perceptions that the current parking fees are already substantial. Moreover, a notable portion of respondents (37.9%)

remained undecided about their readiness to pay additional fees, indicating a need for further deliberation or clarification regarding the perceived benefits of enhanced parking security. Conversely, a minority of users (20.7%) indicated their willingness to pay more for improved parking security, underscoring a segment of the user base that values enhanced safety measures. These findings underscore the importance of carefully balancing the provision of secure parking facilities with affordability concerns, suggesting that enhancing parking conditions within the existing fee structure could effectively meet users' expectations and promote overall satisfaction with the institute's parking facilities.

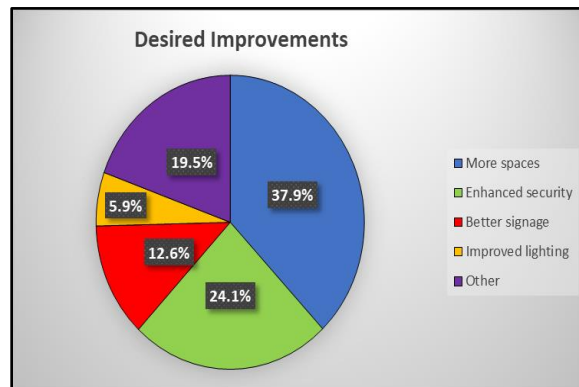
Figure 5
Willingness to pay more for secure parking



A significant majority of respondents expressed the desire for more parking spaces within the campus, indicating a pressing need to address the shortage of parking infrastructure to accommodate the growing demand. Furthermore, a notable percentage of respondents emphasized the importance of enhanced security measures for parking facilities, reflecting concerns about the safety of vehicles while parked on campus. Additionally, a smaller yet noteworthy portion of respondents underscored the significance of improved lighting in parking areas, suggesting a need to enhance visibility and safety during nighttime parking. Improving the parking road by adding permeable pavement would mitigate the challenges posed by dirt and mud accumulation, particularly during the rainy season. For congestion control, it was suggested that there should be an entry as well as exit gate which will help students and staff a lot for easily moving in and out. These findings underscore the multifaceted nature of user requirements and preferences regarding parking facilities, emphasizing the importance of incorporating diverse perspectives to develop comprehensive strategies for improving parking conditions and enhancing user satisfaction within the institute's premises.

Based on the responses provided in the survey, several improvements can be suggested for better parking management at the university:

Figure 6
Desired improvements



4. Discussion

Increase Parking Capacity: Given the frequent mention of the need for more parking spaces, expanding the existing parking facilities or creating new ones could alleviate congestion and make it easier for students, staff, and visitors to find parking.

Enhance Security Measures: Implementing enhanced security measures, such as installing surveillance cameras and increasing the presence of security personnel, can improve safety and provide peace of mind for individuals using the parking facilities.

Improve Signage: Better signage within parking areas can guide users more effectively to available spaces, entrances, exits, and other key locations, reducing confusion and streamlining the parking experience.

Real-Time Availability Information: Introducing real-time availability information through mobile apps or digital displays at parking entrances can help users quickly locate available parking spaces, reducing the time spent searching for parking.

Environmental Features: Implementing dynamic pricing mechanisms can incentivize off-peak parking and encourage alternative modes of transportation, reducing congestion during peak hours. Investing in multi-level parking structures can maximize space utilization and minimize the environmental footprint of parking facilities.

Infrastructure Improvements: Addressing issues such as the lack of shaded areas and slippery surfaces during rains can enhance user comfort and safety, making the parking facilities more user-friendly and accessible year-round.

Technology Integration: Promoting the use of parking apps with features such as real-time availability updates, digital payment options, and navigation assistance can improve the overall parking experience and encourage the adoption of sustainable transportation practices.

Community Engagement: Involving students, staff, and other stakeholders in the planning and decision-making processes related to parking management can foster a sense of ownership and ensure that solutions are tailored to meet the needs of the university community.

The common desire for more parking spaces suggests that current capacity may not adequately meet demand, leading to congestion and difficulty finding parking. Enhanced security and better signage are important for ensuring safety and ease of navigation within parking areas (Yan et al., 2023). Real-time availability information is valued as it enables users to plan their parking more efficiently, reducing time spent searching for available spaces.

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Environmental features such as dynamic pricing and encouraging alternatives indicate a broader concern for sustainability and efficiency in parking management (Zong et al., 2023; Friesen et al., 2024). The identified challenges, such as the lack of shaded areas and slippery surfaces during rains, highlight the need for infrastructure improvements to enhance the user experience and ensure safety. Observations of unfair parking practices indicate potential issues with enforcement or regulation that may need to be addressed.

5. Conclusion

The survey specifically targeted the parking needs of two-wheelers, four-wheelers, and bicycles for all staff, students, and visitors at the institute. Analysis of the responses highlighted a recurring issue faced by users during the rainy season due to accumulated dirt, which adversely affects parking conditions. Consequently, it became evident that proactive measures must be adopted to address this challenge and ensure optimal parking conditions. Similarly, the survey revealed a significant challenge during extreme heat weather conditions, particularly concerning the parking of two-wheelers under direct sunlight. This issue was identified as a major concern affecting users' comfort and the safety of their vehicles. Accordingly, it is imperative to implement measures to address this issue by providing shaded parking facilities. By acknowledging and addressing the impact of extreme weather conditions on parking comfort and safety, the institute can enhance user satisfaction and promote a more conducive parking environment for all users.

The varied opinions on parking costs indicate that perceptions of affordability differ among respondents. This could be influenced by factors such as personal financial situations or comparisons with parking costs in other areas. The range in time spent searching for parking reflects the diversity of experiences faced by individuals. Those spending more time searching may encounter greater frustration and inconvenience, potentially impacting their overall satisfaction with the parking situation.

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