Mathematical Modelling and Optimization for Efficient Parking Space Allocation

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Presentation Outline

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Introduction

Many cities are experiencing rapid growth, leading to an increased number of vehicles in urban areas.

There has been a significant rise in personal vehicle ownership.

Despite the increase in vehicles, the growth in the number of parking spaces has not kept pace.

The increasing gap between the number of vehicles and available parking spaces leads to parking scarcity

In dense urban environments, efficiently utilizing limited space becomes critical.

Problem

The Parking Space Allocation (PSA) problem is centred on the efficient distribution of available parking spaces among users.

Models for PSA can be categorized based on user class (single or multi-class) and the type of community (open or closed) they serve.

The basic primary objectives:

- ▶ Minimizing parking space misuse - ensuring optimal utilization of available spaces.
- ▶ Reduce the walking distance for each user from their parking spot to their destination.

This problem is critical in urban environment, our focus will be in campus environments where parking is limited and in high demand.

Problem

Addressing the basic primary objectives of the parking space allocation problem alone is not sufficient

There is a significant imbalance between the high demand for parking and the limited availability of spaces.

A balanced parking policy is essential: allocating permanent spaces to some, while others share or face variability in availability.

Careful definition of parking policy is crucial. An ineffective policy can lead to suboptimal usage of parking spaces and create significant management challenges.

The objectives

Our goal is to develop an optimization model that maximizes the efficiency of existing parking spaces in a competitive, policy-driven urban environment.

▶ Explore different models for formulating parking space allocation policies.

▶ Focus on minimizing parking space misuse to ensure optimal utilization.

▶ Prioritize reducing the walking distance for each user from their parking spot to their destination.

Further, we aim to investigate key constraints and parameters that are essential for achieving optimal parking management.

The aims

Develop and solve the parking space allocation problem for campus environment.

▶ Study the existing parking space allocation model.

▶ Formulate mathematical optimization model for the problem.

▶ Develop an appropriate solution approach to the model.

▶ Analysis the solutions and draw appropriate conclusions.

Modelling and Optimization techniques

The problem can be formulated as a linear optimization programme.

Heuristic methods can be used to solve the resulting optimization model.

Modelling and optimization can assist with complex decision-making in parking space distribution:

- ▶ Cost efficiency and space optimization.

- ▶ User flexibility and alternative exploration.

- ▶ Revenue generation and technological advancement.

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Thank you.