BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg

RESOLVING PARKING PROBLEMS IN URBAN TRANSPORT PLANNING

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Abstract. This study examines the key challenges related to parking management in urban transport planning and explores modern approaches for resolving parking problems. It highlights the impact of inadequate parking infrastructure on traffic congestion, fuel consumption, environmental pollution, and travel delays in urban areas. The research focuses on smart parking systems, Park & Ride strategies, automated payment solutions, multi-storey and underground parking facilities, and enforcement mechanisms for illegal parking control. The findings suggest that integrating intelligent technologies with sustainable urban planning significantly improves traffic flow efficiency, reduces congestion, and enhances the overall performance of urban transport systems.

Keywords: Urban transport planning, parking management, smart parking systems, Park & Ride, traffic congestion, illegal parking, urban mobility, transport infrastructure, ITS, parking optimization.

Urban parking infrastructure plays a crucial role in the effective planning of urban transport systems. In many cities, the shortage or improper spatial distribution of parking spaces leads to increased traffic congestion and environmental problems. Therefore, the following strategies are applied in the transport planning process.

Today, parking problems in urban areas are increasing. According to statistical data, drivers in city centers spend 30–40% of their time searching for parking spaces. As a result, 20–30% of congestion in commercial areas is caused by vehicles circulating in search of parking.

In addition, each vehicle consumes an average of 0.3–0.5 liters of fuel while searching for a parking space. This leads to excessive fuel consumption, environmental pollution, and time loss, as well as economic losses. Consequently, traffic congestion increases, harmful emissions rise, and driver stress levels also grow.

Table 1

Main causes of the parking problem

Problem	Description
Shortage of parking spaces	With the increase in the number of vehicles, existing parking facilities fail to meet the growing demand.
Improper placement	Parking facilities may be located far from the main traffic flow points.
Impact on traffic flow	Improperly organized parking facilities in central areas lead to road congestion.

Problem	Description
Limited availability of land resources	It is difficult to allocate space for parking facilities in areas with high population density.
Unregulated parking and illegal parking areas	Vehicles illegally parked along streets slow down traffic movement.

Strategies for Solving Urban Parking Problems and Optimal Solutions in Urban Transport Planning. In urban areas, several optimal solutions are proposed for addressing parking problems within transport system planning. One of the most effective approaches is the implementation of automated smart parking systems. In this context, the use of intelligent sensors is of critical importance. Smart sensors provide real-time information about available parking spaces in each parking facility.

Mobile applications enable drivers to locate available parking spaces and reserve them in advance. They also allow users to accurately identify the exact location of their parked vehicles. Multi-storey and underground parking facilities enable space-efficient utilization in large urban centers.

For example, in Singapore, smart parking systems are integrated with both available space detection and payment systems. To reduce traffic flow in city centers, the development of the “Park & Ride” system is highly important. The “Park & Ride” concept allows drivers to leave their vehicles in parking areas located outside the city and continue their journey using public transportation. This helps reduce the number of private vehicles entering city centers, thereby decreasing traffic congestion. Such parking facilities are typically located near metro or bus stations on the outskirts of cities. For instance, in London, Berlin, and Amsterdam, the “Park & Ride” system is well integrated with public transport networks.

To improve the efficiency of parking space utilization, several approaches are applied:

1. **Differential pricing system** – higher parking fees are set for locations in city centers. This system is currently being implemented in Tashkent.
2. **Time-based pricing system** – parking fees increase during peak traffic hours.
3. **Smart payment systems** – payment through RFID, mobile applications, and digital cards.

For example, in Tokyo, a time-based pricing system has been implemented, which contributes to reducing traffic congestion.

Due to limited land availability in central urban areas, vertical parking structures play an important role. Expanding underground and multi-storey parking facilities is considered necessary. Multi-storey parking structures allow efficient use of land resources, while underground parking systems increase parking capacity without affecting the urban landscape. For example, in Paris and Dubai, multi-storey parking facilities are being developed as an integral part of urban infrastructure.

Reducing and controlling illegal parking also plays a significant role in preventing traffic congestion. In city centers, illegal parking remains a major issue, and strict enforcement measures such as high penalties should be applied to prevent unauthorized parking.

In the United States, illegally parked vehicles are detected using automated surveillance cameras. In Uzbekistan, particularly in Tashkent city and regional centers, monitoring systems for illegal parking are being strengthened.

Several initiatives are being planned and implemented to address parking issues in Uzbekistan’s urban transport system:

1. **Implementation of smart parking systems** – automated payment systems have already been introduced in some large shopping centers in Tashkent.
2. **Construction of underground and multi-storey parking facilities** – such projects are planned in new residential areas.
3. **Development of the Park & Ride system** – special parking areas are being established near transport hubs in Tashkent to encourage the use of public transport.
4. **Mobile application-based parking reservation systems** – pilot projects are being tested.

At present, scientific research on smart parking system design is being conducted at Karshi State Technical University.

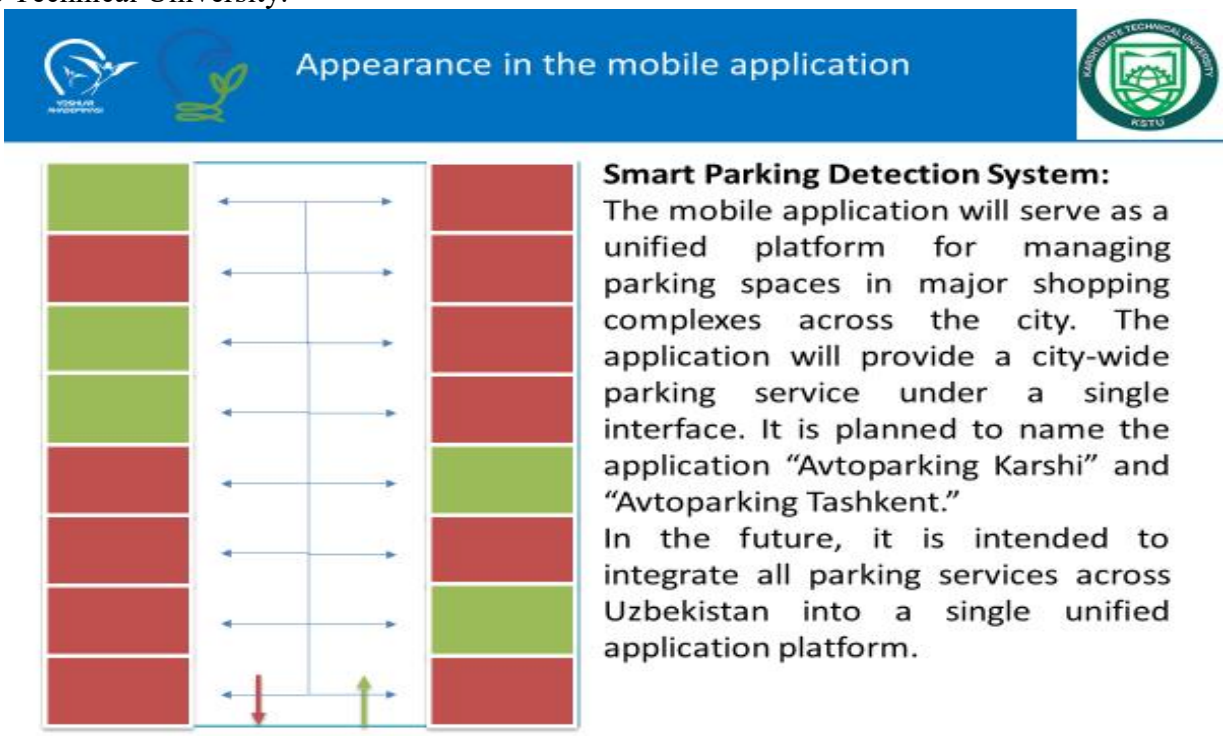


Figure 1. Mobile Application View of the Smart Parking System

In developing an urban transport plan, the main methods for addressing parking problems include the implementation of smart parking systems, the development of the "Park & Ride" system, the introduction of automated payment systems, the construction of underground and multi-storey parking facilities, and the reduction of illegal parking. In addition, the large-scale implementation of smart parking solutions can further support the development of urban transport infrastructure. These measures contribute to improving the urban transport system, reducing traffic congestion, and expanding public access to convenient transport services.

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