Abstract

Public street parking in areas with high vehicle density faces a persistent challenge: the mismatch between the demand for parking spaces and the available supply. Traditional parking meter systems fail to accurately align paid time with actual occupancy. To address this issue, we propose a computer vision–based management approach that estimates zone-level occupancy and enables charging based on actual usage time, without the need for intrusive hardware that could contribute to urban visual pollution.

Commercial RTSP cameras provide visual data, which is transmitted to edge processing devices responsible for real-time detection and tracking. This allows inference of individual space status, duration of presence, and anonymous usage records. Spatio-temporal heatmaps aggregated by street, block, and time slot reveal conflict zones and support selective enforcement and dynamic pricing.

The pilot design covers 2 to 5 streets and evaluates operational, financial, and urban impact outcomes. Key success criteria include automatic identification of at least 90% of critical points (defined as top decile occupancy per time slot), and a 10% reduction in average high-concentration time caused by parking searches, following heatmap-guided interventions.

By replacing manual controls with continuous edge detection and publishing results via a low-latency API for operations and policy enforcement, the system improves turnover and availability, increases revenue efficiency, reduces traffic congestion, and avoids introducing new physical obstacles in the public right-of-way.

system boundaries:

- Edge computing.
- Vehicle detection and tracking.
- Generation of aggregate data and heat maps.