

# **Performance Optimization in Parking Lot Management System**

**Date:** *May 7, 2025*

## **Efficient DB Operations**

- Indexes on `spot_id`, `license_plate`, `entry_time`
- Optimized SQL queries
- Connection pooling for concurrent access

## **Caching**

- Redis for real-time availability
- Browser/localStorage for static data

## **Asynchronous Processing**

- Queue system for email alerts & image processing
- Debouncing to limit request frequency

## **Front-End Optimization**

- Lazy loading of map data & images
- Minified assets, responsive design

## **Content Delivery Network (CDN)**

- Accelerates static asset loading
- Reduces server strain

## **Scalable Infrastructure**

- Dockerized deployment with Kubernetes
- Load balancing for high traffic hours

## **Monitoring & Metrics**

- Grafana & Prometheus used for system metrics
- Error tracking & system health dashboards

## **Load Testing**

- Tools: Locust, JMeter
- Simulates peak-time traffic