

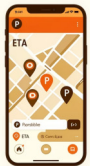
# Smart Parking Management System

Real-time occupancy • Online bookings • Reduced congestion



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# Customer Experience — Mobile Front End



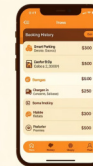
## Find & Reserve

Map view • Real-time availability • Instant booking



## Check-in / Check-out

QR access • Automated time logs



## Dashboard

Booking history • Payment receipts • Vehicle profiles



# Admin Portal — Operations

## Slot Management

View / Reserve /  
Release slots

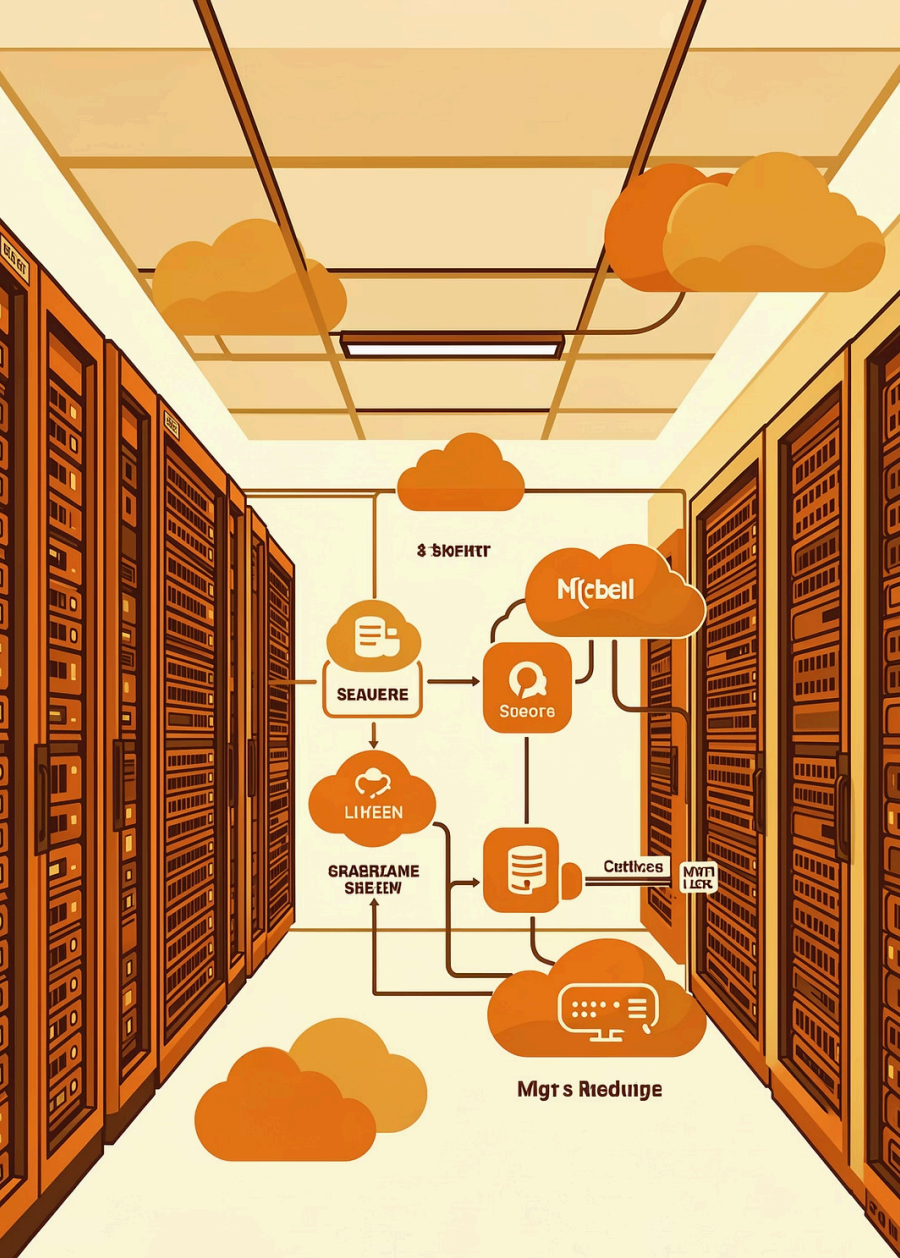
## Pricing

Dynamic charges •  
Time-based rules

## Reports

Utilization,  
revenue, incidents

Integrates with sensors, payment gateway, and enforcement tools



# Backend Architecture



## Database

MongoDB — flexible, geo-indexed parking data



## Auth

Firebase Authentication — secure logins



## API Layer

Java Spring microservices • REST / WebSocket for real-time updates



Detect Occupancy

Send to Gateway

Update Database

Push to App

End-to-end real-time pipeline. Low-latency updates via WebSocket.

# Key Features — At a Glance

Real-time Availability



Online Booking



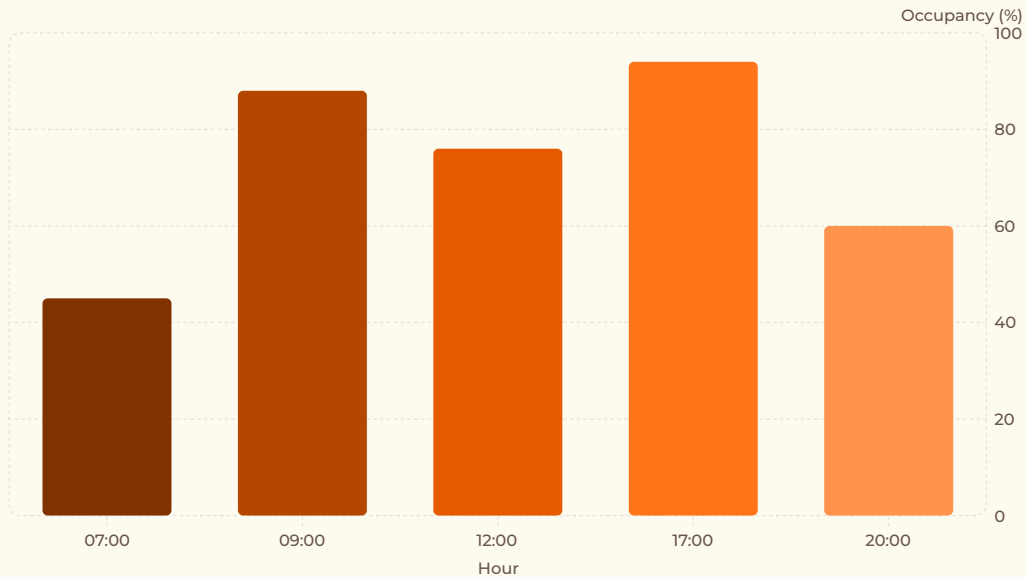
Utilization Analytics



Guidance & Routing



Designed for city-scale deployment and operator control



## Utilization Pattern — Peak Hours

Data informs dynamic pricing, enforcement scheduling, and transit planning. Target: smooth peak congestion.

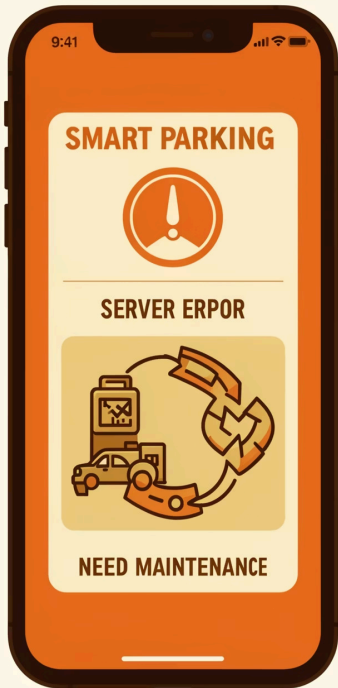




# Benefits for Cities & Users

- Saves time & fuel — lower emissions
- Reduces cruising traffic and congestion
- Improves space utilization and revenue
- Digital records → fewer manual errors





## Risks & Limitations

### Connectivity

Requires stable internet / cellular coverage

### Costs

Installation & ongoing maintenance

### Reliability & Security

Redundancy, backups, and data protection needed

Mitigations: offline caching, SLA-backed connectivity, encrypted data storage

# Next Steps & Recommendation

## Pilot

Small district deployment • 3 months

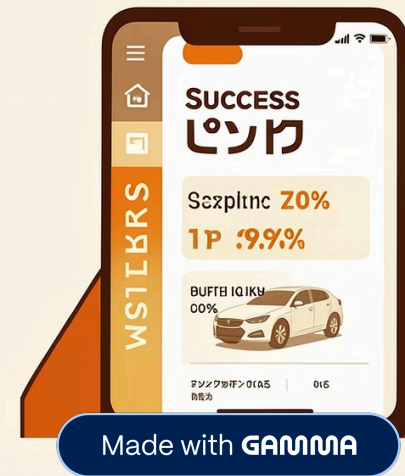
## Scale

Phase rollout • integrate enforcement

## Optimize

Dynamic pricing • analytics-driven policy

- Proposal: pilot with 200 sensors, operator dashboard, and public app. Budget estimate and timeline available on request.



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