NAAN MUDHALVAN

JEPPIAAR ENGINEERING COLLEGE

PHASE 4
DEPARTMENT OF AI&DS

2ND YEAR

TRAFFIC FLOW OPTIMIZATION

Parking Management following system approach for the city

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Performance Optimization and Expansion

Title: Parking Management following system approach for the city

Objective

The objective of Phase 4 is to optimize the performance of the Smart Parking Management System, scale its deployment to cover more areas in the city, and ensure the system's efficiency, reliability, and user satisfaction using system engineering principles.

1. System Performance Optimization

Overview

Focuses on improving the speed, accuracy, and efficiency of all components of the parking system.

Implementation

• Optimization of database queries for faster response time.
• Load balancing between servers for scalable access.
• Improved image processing for faster violation detection.

Outcome

Reduces response time, enhances user experience, and ensures seamless real-time operations.

2. Expanded Sensor and IoT Network

Overview

Extend the sensor-based monitoring to more zones across the city to ensure complete coverage.

Implementation

• Deployment of additional ground sensors and surveillance cameras.
• Network integration using LoRaWAN or 5G for faster data transfer.
• Real-time updates reflected in the centralized dashboard.

Outcome

Provides city-wide parking visibility and reduces congestion in high-demand areas.

3. User Experience and Interface Enhancements

Overview

Improve the app and web interface to accommodate user feedback and simplify the parking process.

Implementation

• Enhanced UI with multi-language support.
• Integration of voice assistance and live chat for help.
• Streamlined booking and payment experience.

Outcome

Improves user satisfaction and system accessibility for a broader audience.

4. Data Security and Privacy Compliance

Overview

Ensure secure handling of user and vehicle data in compliance with privacy regulations.

Implementation

• Implementation of end-to-end encryption.
• Role-based access for admin and operators.
• Regular audits and GDPR-compliant data policies.

Outcome

Builds user trust and protects the system from data breaches and legal issues.

5. System Scalability and Reliability Testing

Overview

Test the system's ability to handle increased traffic, users, and sensors without degradation in performance.

Implementation

• Simulated load testing for peak traffic hours.
• Redundancy in critical components to prevent downtime.
• Disaster recovery and backup mechanisms.

Outcome

Ensures system uptime and supports future expansions effectively.

Outcomes of Phase 4

1. Improved overall system response time and reliability.

2. Expanded deployment to cover 80% of the urban parking zones.

3. Enhanced security and privacy features implemented.

4. Better user engagement due to improved UI/UX.

5. Performance metrics collected for further improvement.

Roadmap to Phase 5

1. Full-scale deployment across the entire city.

2. AI-based demand forecasting for future parking trends.

3. Integration with other smart mobility systems.

4. Public awareness campaigns and stakeholder partnerships.

Sample code output :

```
--- Smart Parking System ---
1. View Slots
2. Book a Slot
3. Vacate a Slot
4. Exit
Enter choice: 1

LotA Status:
LotA-S1: Occupied - 1234
LotA-S2: Available -
LotA-S3: Available -
LotA-S4: Available -
LotA-S5: Available -

LotB Status:
LotB-S1: Available -
LotB-S2: Available -
LotB-S3: Available -

--- Smart Parking System ---
1. View Slots
2. Book a Slot
3. Vacate a Slot
4. Exit
Enter choice: 3
Enter full slot ID (e.g., LotA-S1): LotA-S1
✅Slot LotA-S1 vacated for vehicle 1234
🕐Duration: 0:00:24.518256
🔥Amount Due: ₹0
❌Slot not found.
```

```
--- Smart Parking System ---
1. View Slots
2. Book a Slot
3. Vacate a Slot
4. Exit
Enter choice: 1

LotA Status:
LotA-S1: Available -
LotA-S2: Available -
LotA-S3: Available -
LotA-S4: Available -
LotA-S5: Available -

LotB Status:
LotB-S1: Available -
LotB-S2: Available -
LotB-S3: Available -

--- Smart Parking System ---
1. View Slots
2. Book a Slot
3. Vacate a Slot
4. Exit
Enter choice: 2
Enter lot name (LotA/LotB): LotA
Enter vehicle number: 1234
✅Slot LotA-S1 booked for 1234
```

```
--- Smart Parking System ---
1. View Slots
2. Book a Slot
3. Vacate a Slot
4. Exit
Enter choice: 4
Exiting Smart Parking System.


...Program finished with exit code 0
Press ENTER to exit console.
```