Project Report: Online Vehicle Parking Management System

- **Group Number:** 07
- **Members:**
    - MD Emran Hussain (C231066R)
    - Mohammad Shahariar Mostafa Sharif (C233284)
    - Mohammad Montasir Mahmood Khan (233119)
- **Instructor:** MD MIZANUR RAHMAN,

<div align="center">Lecturer, DEPT. OF CSE, IIUC</div>

Introduction

The growing urbanization and increasing number of vehicles have led to significant challenges in managing parking spaces efficiently. Traditional manual parking systems are often slow, prone to errors, and unable to handle the dynamic nature of parking operations. To address these issues, we developed an Online Vehicle Parking Management System that automates parking processes, optimizes space utilization, and enhances user convenience.

This system is designed to streamline parking operations for various entities such as shopping malls, office complexes, and public parking facilities. By leveraging modern technologies like PHP, MySQL, and frontend frameworks, the system ensures real-time tracking, accurate payment processing, and efficient management of parking slots.

Objectives

The primary objectives of this project are:

1. **Simplify Parking Operations**: Automate check-in, check-out, and payment processes to reduce manual intervention.
2. **Improve Space Utilization**: Dynamically allocate parking slots based on availability and vehicle type.
3. **Enhance User Experience**: Provide a seamless interface for users to book, park, and pay for their parking.
4. **Support Analytics:** Generate reports and analytics to help administrators make data-driven decisions.
5. **Ensure Security**: Implement role-based access control to protect sensitive data.

Background

Parking management systems play a critical role in urban areas by ensuring smooth traffic flow and efficient use of limited parking resources. Traditional systems rely heavily on manual processes, which can lead to inefficiencies, errors, and long wait times. With the rise of technology,

there is a need for automated solutions that can handle large volumes of data, provide real-time updates, and integrate with modern infrastructure.

Our project aims to address these challenges by developing a robust online parking management system. The system leverages database management concepts to store and process data efficiently, ensuring reliability and scalability.

Requirement Analysis

Functional Requirements:
1. **User Management:** Support registration and login for different user roles (e.g., admin, customer).
2. **Vehicle Registration:** Allow users to register their vehicles with details such as license plate number and vehicle type.
3. **Slot Management:** Manage parking slots, including their availability, zone, and vehicle type compatibility.
4. **Booking System:** Enable users to select and book available parking slots.
5. **Payment Processing**: Calculate parking fees dynamically based on duration and vehicle type.
6. **Real-Time Tracking**: Track entry and exit times, calculate parking duration, and update slot status in real time.
7. **Reporting and Analytics**: Generate reports on parking usage, earnings, and other metrics.

Non-Functional Requirements:
1. **Performance:** Ensure fast response times and efficient data processing.
2. **Security:** Implement secure authentication and authorization mechanisms.
3. **Scalability**: Design the system to handle increased loads as the number of users and parking facilities grows.
4. **Usability**: Provide an intuitive and user-friendly interface.

Hardware/Software Requirements:
- **Software:** XAMPP (for local development), MySQL (database), PHP (backend), Bootstrap/JQuery/Ajax (frontend).
- **Hardware**: Standard desktop/laptop with internet connectivity.

Design

- **Database Schema:** The system uses a MySQL database with the (users, vehicles, parking_slots, bookings, payments) following core tables:
- **ER Diagram:** The Entity-Relationship (ER) diagram illustrates the relationships between the tables:

  users → vehicles: One-to-many relationship (a user can own multiple vehicles).

  users → bookings: One-to-many relationship (a user can make multiple bookings).

vehicles → bookings: One-to-many relationship (a vehicle can be booked multiple times).

parking_slots → bookings: One-to-many relationship (a slot can be booked multiple times).

- **Block Diagram:** The block diagram outlines the system architecture:

  Frontend: Handles user interactions using HTML, CSS, JavaScript, Bootstrap, and Ajax.

  Backend: Processes requests and manages server-side logic using PHP.

  Database: Stores and retrieves data using MySQL.

  Parking Sensors: Update slot statuses in real time.

  Users: Interact with the system via the frontend.

Implementation

Technology Stack

- Frontend: Bootstrap, JavaScript, HTML, Ajax, jQuery
- Backend: PHP (handling server-side logic and APIs)
- Database: MySQL (storing essential data)

Key Features:

- User management with role-based access control

- Vehicle category and parking slot management

- Dynamic rate calculation for parking fees

- Real-time parking tracking (in/out time, duration, earnings)

- Reporting and analytics

Result

The Online Vehicle Parking Management System was successfully implemented and tested. It meets the following goals:

Simplifies parking operations by automating check-ins, check-outs, and payments.

Ensures accurate payment tracking through dynamic rate calculation and real-time updates.

Optimizes parking space utilization by dynamically allocating slots.

Supports different vehicle types efficiently through category-based management.

The system has been hosted locally using XAMPP and tested thoroughly to ensure functionality and performance.

Conclusion

The Online Vehicle Parking Management System effectively addresses the challenges of traditional parking systems by providing a robust, automated solution. By leveraging MySQL for reliable data management and PHP for efficient backend processing, the system ensures accuracy, scalability, and security. The implementation of real-time tracking, dynamic rate calculation, and reporting features enhances user convenience and operational efficiency.

This project demonstrates the practical application of database management concepts and highlights the potential of technology in solving real-world problems.