

INTELLIGENT SMART PARKING MANAGEMENT SYSTEM WITH DYNAMIC SLOT ALLOCATION AND DIGITAL PAYMENT INTEGRATION

Safa Kulsum .K.S

M.Sc. Data Science and Business Analytics
Department of Advanced Computing and
Analytics

Guide:Dr.R.DURGA,MCA,PGDCA,M.Phil.,Ph.D

Abstract- This project introduces a web-based application developed to manage parking spaces more efficiently. Users can sign up, log in, and check available parking zones and can book the parking slots according to their needs. The system has different zones: Zone A, Zone B, VIP Parking, and Two Wheeler Parking with different pricing policies. Users can do the payment through Google Pay and Cash. The admin can manage the users, zones, booking, and payment through the admin panel. The system is implemented using PHP, MySQL, HTML, CSS, and JavaScript technologies. This system minimizes manual effort and improves overall efficiency of the parking management system.

I. INTRODUCTION

As urban populations continue to grow, the number of vehicles is also growing significantly, making parking management one of the most important issues that need to be solved in modern cities. A significant amount of time is wasted by drivers searching for parking spaces, causing traffic congestion, fuel consumption, and environmental pollution. Conventional parking systems lack real-time availability updates about parking slot availability, causing inconvenience to both the parking users and the parking administrators. The proposed parking management system allows the

user to see the parking slot availability and reserve the parking slot in advance by using the digital payment method. The parking area is divided into different zones, including Zone A, Zone B, VIP Parking, and Two-Wheeler Parking, with different pricing structures for different parking zones. The proposed parking management system, also known as the Smart Parking Management System, helps to improve parking management by providing convenience to the parking users as well as the parking administrators.

A. Objective

The main aim of this project is to develop a web-based parking management system where users can easily find and book parking slots.

The objectives of this project include:

- Develop a digital platform for booking parking slots
- Reduce traffic congestion due to searching for parking slots
- Ensure no double booking of parking slots
- Improve the management of parking areas and payments

B. Motivation

The motivation for this project is based on the increased parking challenges in various cities. Due to an increase in the number of vehicles, parking slots have become limited and difficult

to manage. This has led to increased time and fuel consumption for those searching for parking slots. The current parking system is not automated and does not offer real-time parking slot availability. This project aims to develop an automated system where users can easily book parking slots in advance.

II. PROJECT DESCRIPTION

The proposed Smart Parking Management System aims to ease the process of parking space management by developing a web-based application that allows users to register and login to the system. Once the user logs in to the system, they are able to see the parking zones and parking slots that are available for parking. The user can then book the parking slot for the desired date by simply selecting the parking slot.

A. Project Scope and Objectives

The scope of this project includes the development of a web-based parking management system. The main objectives of this project are as follows:

- To develop a system for managing the parking zones/slots
- To enable the user to book a parking slot online
- To implement a secure login/authentication system

B. Key Project Deliverables

- The project includes the development of the following important features:
- A web-based parking management system

- A user interface for booking a parking slot
- A separate interface for managing the system (admin interface)

III. TECHNICAL SPECIFICATIONS

The system is developed using modern web development technologies.

I. Core Libraries and Frameworks

The technologies used in the system include:

- **PHP – Backend programming language**
- **MySQL – Database management system**
- **HTML – Web page structure**
- **CSS – User interface**
- **JavaScript – User interaction**
- **XAMPP – Server environment**

IV. PROPOSED METHODOLOGY

The proposed methodology assesses courses on the basis of various factors, which impact the course and its subsequent career.

A. Approach Overview

The Smart Parking Management System implements a systematic approach to efficiently manage parking activities. The system processes user input such as parking area and booking date. Based on the parking area, it determines the parking cost.

B. Dataset Preparation and Preprocessing

Step 1 – Requirement Analysis

System requirements are identified, which include user roles, parking zones, and booking.

Step 2 – System Design

System architecture and database design are included in this step, where the database includes the following tables:

- Users
- Parking Zones
- Parking Slots
- Bookings
- Payments

Step 3 – Implementation

Implementation of the system using the programming languages, which are PHP, MySQL, HTML, and JavaScript.

Step 4 – Testing

Testing ensures that the system works as expected, which includes the following:

- User registration and login are successful
- Parking slots are displayed correctly
- The booking process works correctly

Step 5 – Deployment

Deployment of the system using the XAMPP server environment

V. ARCHITECTURE DIAGRAM

The architecture of the Smart Parking Management System is a description of how the different components of the system work together for efficient parking management. The

system has a three-layer architecture, which is the User Interface Layer, Application Layer, and Database Layer.

The Application Layer is built with PHP, which handles all the logic of the system, including user authentication, parking slot booking, payments, and parking availability updates.. All these components help in providing an efficient and well-organized Smart Parking Management System.

A. User Module

This module allows registered users to use the parking management system. After booking, they can proceed with the payment process for the booked slot.

Functions of User Module:

- View the available parking slots
- Book the parking slot
- Make payment
- View booking history
- View payment history

This module enables users to easily book a parking space without using much effort.

B. Owner Module

The Owner Module is used for higher-level management of the parking facility. This module ensures that the owner can efficiently use the parking facility.

Functions of Owner Module:

- View parking slots
- Monitor booking details

- View payment records
- Manage parking activities

This module ensures efficient supervision of the parking facility.

C. Parking Zone Module

The Parking Zone Module is responsible for the different parking zones that are present in the system. Each zone has different parking slots.

The parking zones present in this system are as follows:

- Zone A
- Zone B
- VIP Zone
- Two Wheeler Zone

D. Payment Module

The Payment Module is responsible for handling the payment for the booked parking slot. The payment amount for the parking slot will be automatically generated according to the selected parking zone.

Payment methods that can be used are as follows:

- Google Pay
- Cash

After making the payment, the status of the booking will be updated as Confirmed. Functions of Payment Module:

- Processing payment for parking
- Selecting payment mode

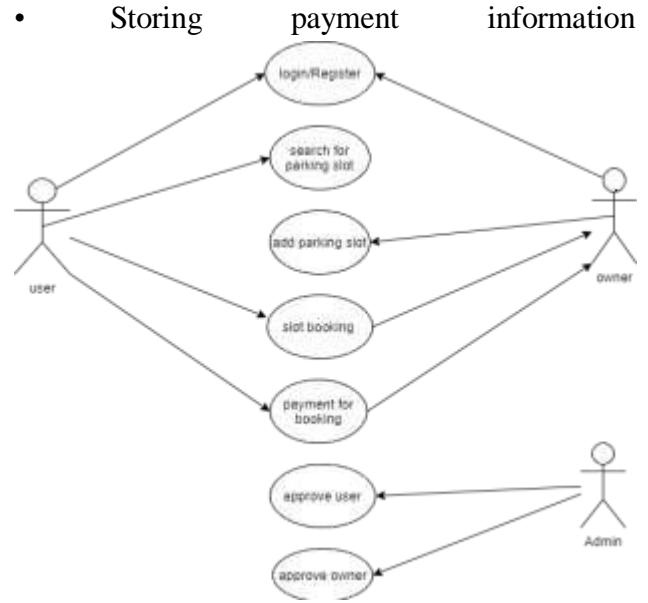


Fig1: Flowchart Representation of Smart Parking Allocation

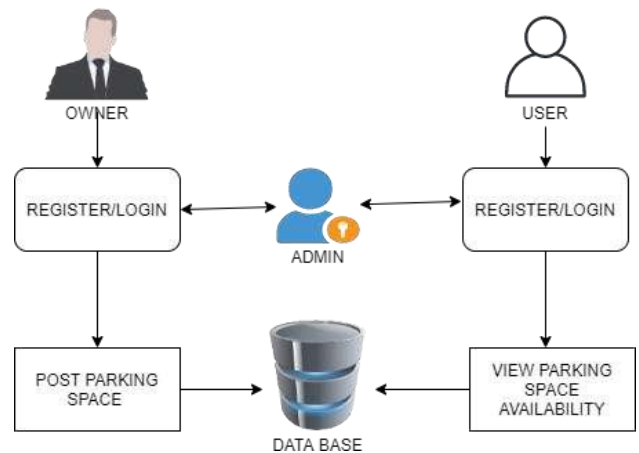


Fig2: Architecture Diagram of parking and space sharing system

VI. INPUT DATA DESCRIPTION

The Smart Parking Management System utilizes structured input data for parking management, including user registration, parking slot booking, and payment processing. The system processes different types of information provided by users and system administrators through the web

interface. This input data is helpful for parking management.

A. Dataset Overview

Smart Parking Management System utilizes a structured dataset, which is stored in a MySQL database. The dataset contains information about users, parking zones, parking slots, parking bookings, and payment processing. The dataset is helpful for parking management, including all required information.

B. Dataset Statistics

The dataset contains various attributes that represent different aspects of the parking system. The major attributes of the parking system are as follows:

- User ID
- Parking Zone
- Slot ID
- Booking Date
- Booking Status
- Payment Mode
- Payment Amount

These attributes allow the parking system to monitor parking slots, user bookings, and payments.

C. Class Distribution

In Smart Parking Management System booking records can be divided into different classes depending on the booking status. The major booking records of the parking system are as follows:

- Pending - The booking is not yet confirmed or completed.
- Confirmed - The booking is confirmed and completed.
- Cancelled - The booking is cancelled or deleted by the user or administrator.

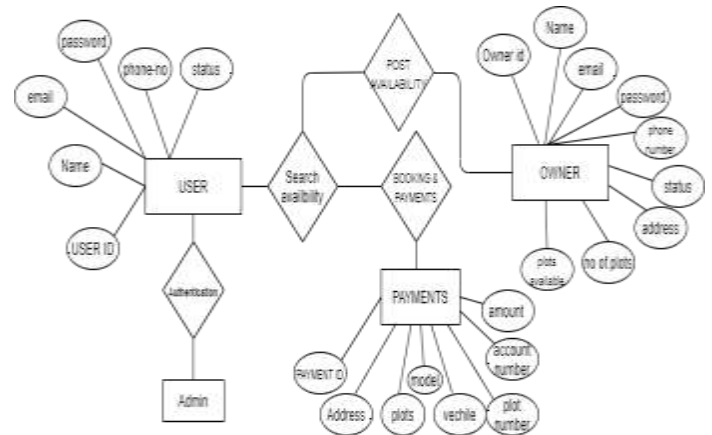


Fig:3 ER Diagram of online parking system

VII. PSEUDOCODE & IMPLEMENTATION

This section explains the algorithm and implementation process used in the Smart Parking Management System. The system processes user inputs such as parking slot selection, booking date, and payment details to manage parking reservations and update system records.

A. Dual Output Data Generator

The system processes user input data and generates two main outputs: booking confirmation and payment status. After the payment process is completed, the system updates the booking status and stores the payment details in the database. This dual output mechanism ensures that both booking and

payment information are processed and recorded correctly.

B. Model Architecture Implementation

The system architecture can be achieved through the use of a modular approach, where different modules are used for different functions. The different modules communicate with the MySQL database for storing and retrieving information. The system uses PHP scripts for handling server-side scripts and for controlling the user interface and database communication.

C. Training Pipeline

The system's processing pipeline has several steps for handling the tasks efficiently. Firstly, the system retrieves the input information from the user interface and stores it in the system. Finally, the system updates the booking information to confirmed after the payment is done.

D. Implementation

The Smart Parking Management System is implemented by using PHP for backend scripting and MySQL for database management. The user interface for the system is implemented by using HTML, CSS, and JavaScript for providing an interactive user interface. The system is implemented on a XAMPP server for controlling

VIII. OUTPUT ANALYSIS

The output analysis of the Smart Parking Management System assesses the effectiveness of the system in parking slot management, booking, and payment. The outputs of the system are parking slot availability, booking confirmation, payment status, and management monitoring. The outputs ensure proper system

efficiency and accuracy in providing users and management with reliable information.

A. Training Performance Metric

The system performance can be evaluated by analyzing how accurately it processes user requests such as registration, login, booking, and payment operations. Performance metrics include the successful creation of user accounts, correct display of available parking slots, and accurate processing of booking and payment transactions. These metrics help determine whether the system functions reliably under different user inputs.

B. Validation Performance

Validation performance is responsible for ensuring that the system is able to validate user input and prevent errors. This is done by checking the user's login credentials, validating booking information, and ensuring that parking slots are available prior to booking. This will help prevent problems such as duplicate booking, incorrect data entry, and invalid transactions.

C. Visualization Results

Visualization system is responsible for providing visual output, which is usually in the form of a dashboard and a table that shows parking availability, booking, and payment records. Visualization also improves the readability of data in the system.

D. Streamlit Interface Output

Finally, the output of the system is shown through a user-friendly interface that enables users to access the system without any difficulties. Through the interface, users are able to access different types of information, such as

available parking slots, booking confirmations, payments, and history of bookings.

IX. RESULTS AND DISCUSSION

The Smart Parking Management System was successfully developed as a web-based application that enables the efficient management of available parking spaces. Through the system, users are able to register, log in, and book parking slots without any difficulties. The system also enables users to book parking slots, which are not available for booking by other users once they have been reserved. This prevents users from booking the same parking slots twice. The system also provides a payment option for users, which enables them to make payments through available means, such as Google Pay and Cash. After a user has successfully paid for a parking slot, the system updates the status of the booking, which is recorded in the database. Through the system, the admin.

X. SCREENSHOTS AND GRAPHS



Fig 4: REGISTER PAGE



Fig 5: LOGIN PAGE



Fig 6: USER DASHBOARD



Fig 7: ADMIN DASHBOARD



Fig 8: PARKING ZONE



Fig 9: PAYMENT

IX. CONCLUSION

The Smart Parking Management System offers an effective solution for managing parking spaces with a web-based system. It allows users to easily register, view available parking slots, book parking spaces, and pay for them using a simple interface. By dividing parking spaces into different zones with unique pricing schemes, the system offers organized parking space management. The administrator interface of the system offers efficient management of user and parking space activities. It also eliminates duplicate bookings by updating available parking slots once a booking is confirmed.

X. REFERENCES

- [1] L. Welling and L. Thomson, *PHP and MySQL Web Development*, 5th ed., Addison-Wesley, 2017.
- [2] R. Nixon, *Learning PHP, MySQL & JavaScript*, O'Reilly Media, 2018.
- [3] H. E. Williams and D. Lane, *Web Database Applications with PHP and MySQL*, O'Reilly Media, 2004.
- [4] T. A. Powell, *HTML & CSS: The Complete Reference*, McGraw-Hill Education, 2017.
- [5] D. Flanagan, *JavaScript: The Definitive Guide*, O'Reilly Media, 2020.

[6] Oracle Corporation, "MySQL Documentation," Available: <https://dev.mysql.com/doc/>

[7] PHP Group, "PHP Official Documentation," Available: <https://www.php.net/docs.php>

[8] Apache Friends, "XAMPP Documentation," Available: <https://www.apachefriends.org>

[9] W3Schools, "PHP Tutorial," Available: <https://www.w3schools.com/php/>

[10] W3Schools, "MySQL Tutorial," Available: <https://www.w3schools.com/mysql/>

[11] W3Schools, "JavaScript Tutorial," Available: <https://www.w3schools.com/js/>

[12] MDN Web Docs, "HTML Documentation," Available: <https://developer.mozilla.org/en-US/docs/Web/HTML>

[13] MDN Web Docs, "CSS Documentation," Available: <https://developer.mozilla.org/en-US/docs/Web/CSS>

[14] A. Silberschatz, H. Korth, and S. Sudarshan, *Database System Concepts*, McGraw-Hill Education, 2019.

[15] I. Sommerville, *Software Engineering*, 10th ed., Pearson Education, 2016.