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DESIGN, IMPLEMENTATION AND EVALUATION OF OJOO BUS TERMINAL SMART PARKING MANAGEMENT SYSTEM, IBADAN METROPOLIS, NIGERIA

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Abstract

This research focuses on designing Ojoo Terminal Parking System using HTML, CSS, PHP, and MySQL. This is targeted to streamline and automate the parking process in order to improve the efficiency of the utilization of the limited space available at Ojoo motor-park. The system facilitates the management of parking spaces, including real-time monitoring, modules dedicated to location, kilometers (km), time and current amount [redacted] management. HTML and CSS are employed to create a user-friendly and responsive web interface, ensuring accessibility across various devices. PHP is utilized for server-side scripting to handle user requests, process data, and interact with the MySQL database. MySQL is chosen for its robust data management capabilities, enabling efficient storage and retrieval of parking-related information. The system was evaluated by

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testing for functionality, performance, security, and usability in which users' feedback is collected to assess satisfaction and identify areas that deserve improvement. Hence, the designed Parking Management System demonstrates significant potential in reducing manual efforts, minimizing parking congestion, and enhancing overall operational efficiency.

Introduction

Most of the metropolitan areas are facing different kinds of challenges and among these challenges are parking congestions. This parking congestion stands out as a significant issue that is affecting both residents and visitors. Thus, the proliferation of vehicles combined with limited parking spaces not only leads to frustration but also contributes to traffic congestion, environmental pollution, and wasted time and fuel (Rahman, 2020). This then calls the attention of researchers to look for way out of this all-important environmental challenge for everyone to live comfortably and conveniently in our settled area.

A parking management system is a comprehensive solution that employs a combination of hardware and software components to efficiently manage and monitor parking areas. It involves a network of interconnected devices, sensors, cameras, and parking management software applications to automate various parking processes, including entry and exit control, payment collection, space allocation, and security monitoring (Shoup, 2005). According to Komninos (2015), a parking management system aims to optimize the utilization of available parking spaces, reduce congestion, and enhance the overall parking experience for users. By digitizing and automating manual tasks, the system eliminates the need for traditional paper-based ticketing systems and manual monitoring, leading to increased efficiency and accuracy. The system's hardware components include access control devices such as barriers, gates, ticket dispensers, license plate recognition systems, and payment kiosks. These devices work together to control access to the parking area, issue tickets or digital passes, and facilitate payment transactions.

The development and implementation of the Ojoo Bus Terminal Parking Management System represent a significant milestone in the field of parking management and technology integration. Meanwhile, efficient parking systems are essential for alleviating traffic congestion, enhancing user convenience, and optimizing resource utilization in today's fast-paced urban environments,. Thus, this study is driven by a comprehensive set of research objectives aimed at transforming the parking management landscape at the Ojoo Terminal. This implies that the system endeavours to design and develop a user-friendly web interface for the Parking system, ensuring that users can effortlessly

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navigate the system, locate available parking spaces in real-time to improve overall parking system. The study seeks to maximize parking space utilization within the terminus. By achieving this objective, there will be alleviation of congestion and reduction of waiting times for users which will ultimately enhance the efficiency of parking operations. The study places relevant emphasis on gathering and analyzing data regarding vehicle movements, specifically kilometers (km) traveled by parked vehicles. This data-driven approach not only benefits users by providing transparency but also empowers decision-makers with insights into parking patterns and resource optimization. In addition to these, the study is committed to ensuring the scalability and reliability of the parking system. Implementation will prevent redundancy, produce fault-tolerant mechanisms and the system to be well-prepared to accommodate future expansions of the Ojoo Terminal and meet the growing demands of users.

Statement of the Problem

The Ojoo Terminal is recognized as one of the most popular Terminals in Ibadan metropolis because it is the terminal that links South-western to the Northern part of this country, Nigeria. Ibadan, being the largest city in Nigeria deserves a bus terminal that will enable people to have free transportation from this part of the nation to the northern part of the nation. However, this Ojoo bus terminal is currently facing several pressing challenges in its parking management system which include inadequate space and under utilization of the available space, lack of real-time visibility into parking availability, manual and error-prone billing processes, and the absence of a comprehensive tracking system for kilometers (km) traveled by vehicles within the terminal premises. As a result, users often encounter frustration due to long wait times and difficulty in finding parking spots. Moreover, to optimize resource allocation, and adapt to evolving passenger needs is highly imperative. Thus, to address these critical issues and enhance the overall parking experience for Ojoo Terminal users, there is need to design, implement, and evaluate a cutting-edge parking management system with specialized modules focusing on location tracking in kilometers (km) and precise billing in terms of cost implication.

Aim and Objectives of the Study

The primary aim of this study is to design and implement Ojoo Bus Terminal Parking Management System.

The specific objectives are:

- To design and develop a user-friendly web interface for the Parking system.
- To maximize parking space utilization within the terminal, reducing congestion and wait times for users.

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- To explore the system's architecture, functionality, and the modules dedicated to location, kilometers (km), time and current amount management.
- To gather and analyze data on vehicle movements (kilometers or km travelled)
- To ensure that the system can accommodate future expansions of the Ojoo Terminal and increasing user demands.

Scope of the Study

This study will encompass the entire process of designing and implementing of Ojoo Terminal in Ibadan Metropolis, Oyo state. It includes the development of modules dedicated to location tracking in kilometers (km), time required and current billing (amount) for passengers.

Significance of the Study

This study has the potential of transforming the present parking experience at the Ojoo Terminal by producing an efficient and user-friendly parking management system that can not only benefits travelers but also contribute to the overall success and reputation of the metropolis. Moreover, it can serve as a model for other transportation hubs and parking facilities looking to enhance their services and operations.

In addition to improving the parking experience, the data collected and analyzed by the system can provide valuable insights for city planners and decision-makers. It can also help optimizing traffic flow and consequently enhance revenue generation for the terminal and the state government at large.

Review of Related Literature

According to Byrne (2023), a Parking Management System (PMS) is a comprehensive set of hardware and software solutions designed to efficiently and effectively manage parking facilities, whether they are in urban areas, commercial lots, airports, or other locations where parking is a necessity. PMSs are deployed to streamline the entire parking process, from entry to exit, with the primary objectives of maximizing space utilization, improving traffic flow, enhancing user experience, and generating revenue. Due to the relevance of parking system in every town, several researchers had worked on this all-important area. To review some of them, Wahab & Maguire (2019) examined the integration of IoT and block chain for secure and efficient parking services. Elsonbaty & Shams (2020) focused on IoT-based parking management using Arduino, sensors automation, and android applications for parking reservation system and monitoring. Biyik, *et al;* (2021) focused on smart parking architecture, IoT Technologies, Sensors and future research directions. Ditta *et al;* (2025) investigates IoT-enabled parking

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management using automatic number plate recognition for vehicle identification, automated billing and improved security. Amusan, Ogunleye & Ibhaze (2024) in their study focused on the development of a digital twin-enabled smart car park management system for improving parking efficiency. It addresses problems such as inefficient parking space utilization, lack of real-time parking information and long vehicle search times. The research also examines how smart parking solutions can reduce traffic congestion, vehicle emissions and improve urban mobility. Jakhar *et al;* (2025) focused on combining IoT and Image-processing techniques for vehicle detection and automated parking-space management. Kamarudin *et al;* (2025) explored real-time parking monitoring, unauthorized parking detection, QR-code identification and automated alerts. Lin, Rivano & Le Monel (2025) reviewed digital transformation in parking service, including AI, IoT sensors, mobile applications and data-driven parking management. Channamallu *et al*; (2023) examined research trends in smart parking including digital transformation, real-time parking detection, space optimization, emerging smart parking solutions and digital payment system. Khanna & Anand (2021) considered parking allocation and reviews parking allocation methods, mobile applications, sensors and intelligent decision-making techniques. Fahim, Hasan & Chowdhury (2021), comprehensively reviewed smart parking system based on various aspects such as space limitations, monitoring of the parking users as well as detection unauthorized parking space. Mackey, Spachos & Plataniotis, (2020) based their own research on smart parking system on bluetooth low energy beacons with particle filtering. Afolabi & Gbadamosi (2017) revealed the demand of those who fully engage in driving business in the parking of commercial vehicles to meet the need of their customers and the challenges that the park managers are facing in the management of bus parking most especially in Developing Urban Areas in Nigeria. Hadi, George & Ahmed (2024) reviewed camera-based parking detection and computer vision applications in intelligent transport system. Lastly, Lubrich (2021) presented a classification framework for smart parking data and management approaches. Ojo & Ahmed (2020) carried out work on the evolution and development of Ojoo Bus Terminal as a case study of transportation infrastructure in Oyo State, Nigeria. These researchers went into the background and evolution of Ojoo Bus terminal which has been in existence many years back even before the present government gets into the governance of the state. Aderibigbe & Akinyemi (2019) considered parking management strategies and urban mobility challenges in Nigeria cities. Afolabi & Gbadamosi (2017) researched on parking demand and management challenges in developing urban areas in Nigerian cities like Ibadan, Lagos, Kano and Abeokuta.

Ajiboye & Akinyemi (2015) considered traffic congestion and parking management problems in Nigerian urban centres. The authors looked into various congestions due to

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traffic issues and series of problems of park managers in the management of their people to have free flow of transportation activities in urban centres.

Methodology

Design and Implementation of Ojoo Terminal Parking Management System involves creating the necessary conditions needed to achieve the required improvements. System investigation was carried out and some findings are gathered so that a system that can minimize or eliminate setbacks and inadequacies if possible is developed.

The following procedures are involved in designing the system:

- Input design
- Output design
- File design
- Access method
- Processing algorithm

Platforms and Tools Used for Designing

As earlier stated this system was built with PHP programming language and it was designed with HTML. The database software used was MySQL managed by phpMyadmin. These tools and others that were used during this work are stated below:

- **PHP**: It is a server-side scripting language, and is a powerful tool for making dynamic and interactive Web pages quickly. It was the best choice of scripting languages to use for a very flexible project as this. PHP was used to code the functionality of the system by leveraging the Sublime Text framework. PHP version 5.3.8 was the version used.
- **HTML and CSS**: Hypertext Markup Language and Cascading Style Sheet are tools used in development and creation of web pages that run mostly on web browsers. They were used to develop the frontend design and user interface of the system.
- **SQL:** SQL (structured query language) is a standard language for accessing databases which was used to access and manipulate data.
- **MySQL:** The MySQL database management system served as the database for building and testing the system. It also served as the platform where all data used in the application could be manipulated.
- **PHPMYADMIN**: This tool was used to manage the MySQL databases over the web and locally on your computer. It provided an easy interface to carry out SQL operations on the database and we worked with phpMyadmin version 3.2.4.
- **XAMPP**: Xampp is an Open-source web server solution comprises of basic components such as Apache HTTP, MYSQL, PHP or Perl languages. It was used in this project as the local server in developing the system.

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Hardware Requirements

These are physical components of computer that can be touched, seen or handled with higher configurations and stable electric current supply for the design of this software application.

Software Requirements

The package requires a PHP web Language platform to run which can be executed through web file extension platform. The Operating system is Window 10.

Running of the Program

To run this program the following steps need are considered;

- Switch on the UPS, the monitor and the CPU.
- Allow the system to boot.
- Double click on XAMPP application on the desktop.
- Once the Computer system display the XAMPP Control Panel, start Apache and MySQL
- Click on Browser
- Locate the Address Bar
- Type "http://localhost/OTPMS/page.php" and press Enter on the Keyboard

Processing Algorithm

Algorithm can be defined as the sequence/procedure of instruction for solving a particular problem.

It can also be defined as precise step-by-step plan of instruction for computation procedure that begins with an input value and yield an output value in a finite number of steps.

1.0 Started XAMPP Application Program
1.1 Select a browser
1.1.1 Locate the Address Bar
1.1.2 Type "http://localhost/OTPMS/" and press ENTER
1.2 Display Homepage
1.3 if Navigation = "Search for your Destination Here" Goto 2.0
2.0 display the search page.

Variable Used in System Designing

This represents a detail description of a program system which is a piece of write-up that describes what a system does and how it does it. The programming languages used are

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HTML (HyperText Markup Language), CSS (Cascading Style Sheet), PHP (Pre Processor Hypertext) Language and Javascript as earlier mentioned.

Variables are clearly written with their respective meaning the steps and procedures that are contained in the new system for easy usage and understanding. This will assist someone on how to use the new system to solve problem for which it was developed.

VARIABLE NAME	MEANING
$con	To Connect to the Server and Database
Session_start()	Function that verify the user login session
$row	Variable that call for database table row
$_SESSION	Function that test for data in a database table
$password	Variable that use to save password

TABLE NAME: user

Field name	Type	Description
Id	Int	It is used to store the Admin Identity
Username	Varchar	The username of the admin
Password	Varchar	The password of the admin

TABLE NAME: description

Field name	Data Type	Description
Id	Int	It is used to store the description Identity
from_d	Varchar	Used to store initial destination which is Ojoo Terminal
to_d	Varchar	Used to store final destination
kl	Varchar	Kilometer
ba	Varchar	Current Billing Amount

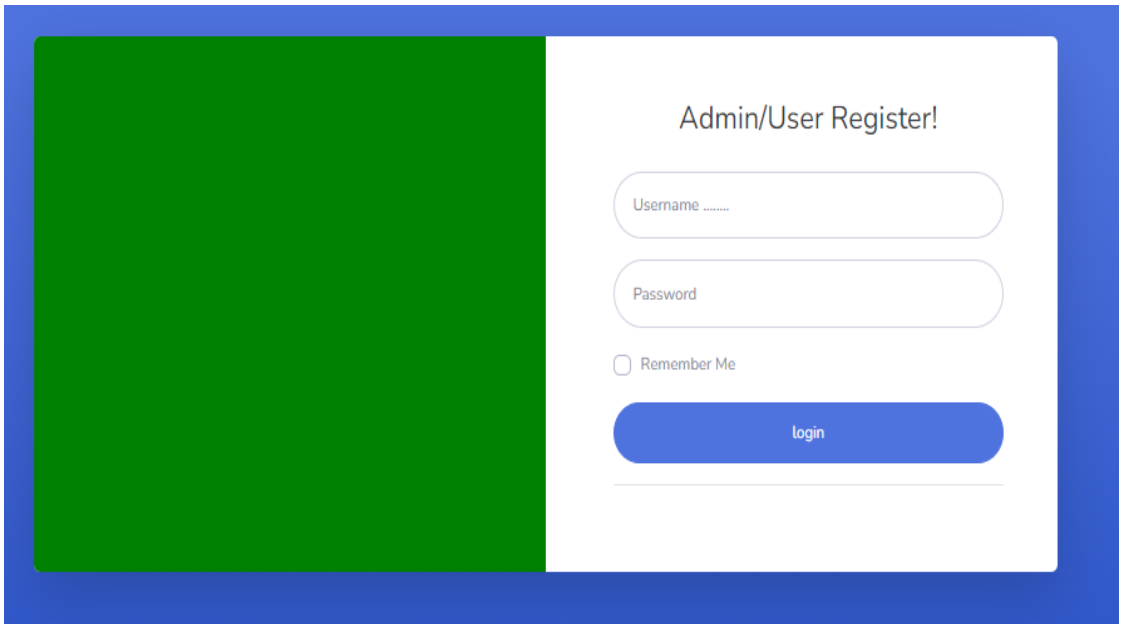
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Input Design

This is concerned with the data fed into the computer in order to generate the required output on the screen. it includes the followings:

The User Registration/Login Interface

Registering an administrator staff and user.



The Registration/Login Interface for the Ojoo Terminal Parking Management app serves as the gateway for users to access and utilize the app's features. Here's an explanation of how such an interface might function and what it entails:

Registration Process:

Users who are new to the Ojoo Terminal Parking Management app would need to register an account. This typically involves providing necessary information such as name, email address, phone number, and creating a password. Optionally, the registration process might include additional steps such as verifying the email or phone number through a verification code sent via email or SMS to ensure the authenticity of the user's contact information. Upon successful registration, users would receive a confirmation message or email indicating that their account has been created.

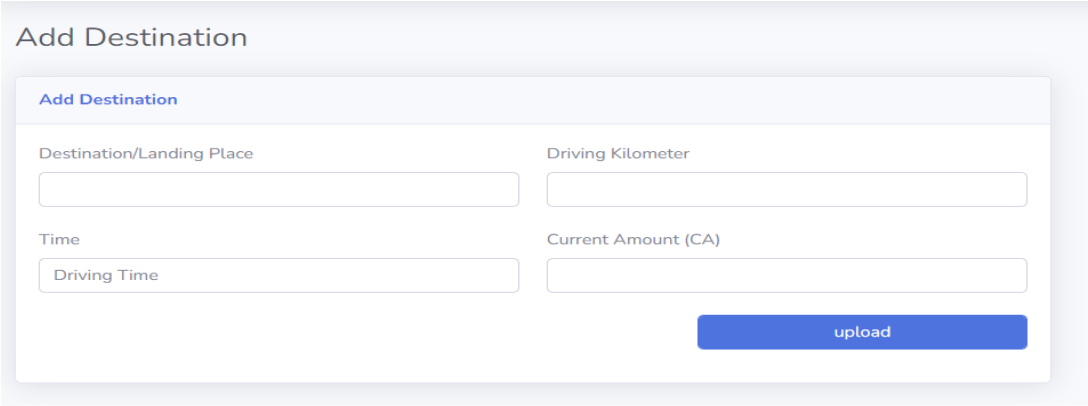
Login Process:

Registered users can access the app by logging in with their credentials (usually email/username and password). The login interface should include fields for users to input

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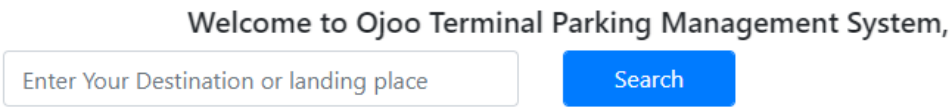
their credentials securely. Optionally, the app may offer features like "Remember Me" to allow users to stay logged in on trusted devices for convenience. Additionally, there might be an option for users to reset their password in case they forget it, typically involving a password reset link sent to their registered email address.

Registering Destination details interface



The Destination Details Registration Interface, where you can conveniently input crucial information regarding your destinations for effective planning and monitoring purposes. To begin, kindly provide the name or location of your destination under the "Landing Place" section. Next, indicate the total distance you anticipate driving to reach the destination in kilometers within the "Driving Kilometer" field. Following that, specify the estimated duration required for the drive in the "Driving Time" section, ensuring to format it in hours and minutes (e.g., 2 hours 30 minutes). Finally, input the current amount available or allocated for this particular destination in the "Current Amount" field. Once all the required details have been accurately filled out, simply click the submit button to register the destination. Your cooperation in providing precise information is greatly appreciated as it contributes to efficient planning and resource management. Thank you for utilizing our interface.

Searching for the different Destination interface



At this point; Destination Search Interface, a tool designed to simplify the process of discovering diverse destinations based on specific parameters. In this interface, you can

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explore various destinations by specifying criteria such as landing place, driving distance, driving time, and available budget. Begin your search by entering the desired location or the name of the destination you wish to explore under the "Landing Place" category.

Output Design

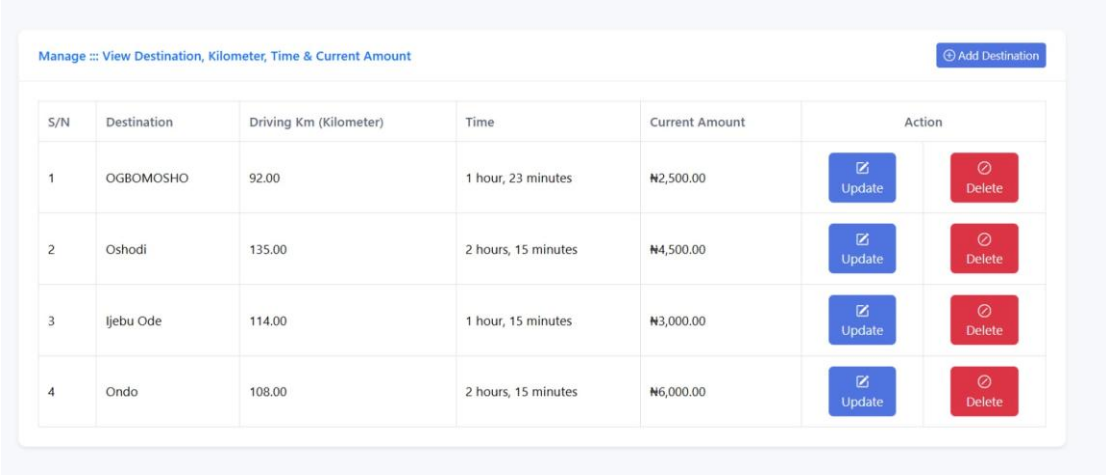
Output design is the most essential part of this research work. It gives the Description of on how the result of the research would look like. This output is produced from the memory of the computer based on the execution of the application or package.



Manage ::: View Destination,Kilometer,Time & Current Amount

S/N	Destination	Driving Km(Kilometer)	Time	Current Amount	Action	
1	OGBOMOSHO	92	1 hour, 23 minutes	1,500	Update	Delete
2	Oshodi	135	2 hour, 15 minutes	3,000	Update	Delete
3	Ijebu Ode	114	1 hour, 15 minutes	2,000	Update	Delete
4	Ondo	108	2 hours, 15 minutes	4,000	Update	Delete
5	Kaduna	522	8 hours, 51 minutes	11,500	Update	Delete

The above output was the initial output designed before the present increment in the price of fuel to indicate the evaluation and updating whenever there is need for it.



Manage ::: View Destination, Kilometer, Time & Current Amount

Add Destination

S/N	Destination	Driving Km (Kilometer)	Time	Current Amount	Action	
1	OGBOMOSHO	92.00	1 hour, 23 minutes	₦2,500.00	Update	Delete
2	Oshodi	135.00	2 hours, 15 minutes	₦4,500.00	Update	Delete
3	Ijebu Ode	114.00	1 hour, 15 minutes	₦3,000.00	Update	Delete
4	Ondo	108.00	2 hours, 15 minutes	₦6,000.00	Update	Delete

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The capacity of our Parking Management App

Our app allows administrators or users with appropriate permissions to delete or remove items that are no longer useful or have expired. This feature ensures that the system remains organized and relevant, streamlining the user experience and optimizing resource management. Thus, users can access and print a comprehensive log of all items/destination within the app. This feature provides an overview of past and upcoming destination, facilitating better organization and communication within the Parking Management System.

Summary

The design, implementation, and evaluation of the Ojoo Terminal Parking Management System represent a comprehensive approach to address the challenges associated with parking in busy terminals. The system incorporates Object-Oriented principles to ensure scalability, flexibility, and efficient management of parking spaces. Through a well-thought-out design, the implementation phase successfully brings the conceptual framework into a functional reality. The evaluation process focuses on key performance indicators, user satisfaction, and system reliability, providing insights into the system's effectiveness.

Recommendations

Based on this research work, the following recommendations are made:

1. There is need for state government to implement Ojoo smart Terminal Parking Management System to optimize space utilization.
2. Necessity to introduce a reservation and pre-booking feature for parking spaces to ensure availability and enhance user convenience.
3. Implementation of automated payment system within the parking management system to enable cashless transactions and reduce waiting times at payment office.
4. Installation of surveillance cameras and implementation of advanced security protocols in order to ensure the safety of vehicles and belongings as well as the peace of mind for the customers.

Conclusion

The implementation of this developed Ojoo Smart Terminal Parking Management System offers a comprehensive solution to address the challenges associated with parking management at terminal facilities. This is achieved by incorporating efficient space utilization, reservation systems, navigation integration, payment automation, security measures, sustainability initiatives, user feedback mechanisms and accessibility features.

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The system thus aims to enhance and optimize operations as well as promote environmental sustainability. Through continuous improvement and adaptation based on user feedback and data analytics, the Ojoo Terminal Parking Management System stands firm to deliver a seamless and efficient parking system for all users for customers' service satisfaction and sustainability of transportation activities in Ibadan metropolis.

References

Aderibigbe, A.A., and Akinyemi, E.O. (2019). Parking Management Strategies and Urban Mobility Challenges in Nigeria Cities. *Journal of Transportation and Logistics,* 4(1), 45-56

Afolabi, O.J. and Gbadamosi, K.T. (2017). Parking Demand and Management Challenges in Developing Urban Areas: Evidence from Nigerian Cities. *Transportation Research Procedia,* 25, 4325-4337.

Ajiboye, A.O. and Akinyemi, E.O. (2015). Traffic Congestion and Parking Management Problems in Nigerian Urban Centres. *International Journal of Engineering Research and Technology,* 4(6), 230-236.

Amusan, A., Ogunleye, G. A. and Ibhaze, A. E. (2024). A digital twin-enabled smart car park management system: Architecture and Impact on emission reduction. *FUOYE Journal of Engineering and Technology*, 9(4), 629-635.

Biyik, C., Allam, Z., Pieri, G., Moroni, D., O'Fraifer, M., O'Connell, E., Olariu, S., and Khalid, M. (2021). Smart Parking Systems: Reviewing the Literature, Architecture and Ways Forward. Smart Cities, 4(20, 623-642.

Byrne, A. (2023). Parking Management Systems: Enhancing Efficiency and User Experience. Journal of Urban Technology, 30(4), 35-52.

Channamallu, et al (2023). A review of Smart Parking Systems. *Transportation Research Procedia, 72,* 2525-2532.

Ditta, A., Ahmed, M. M., Mazhar, T., Shahzad, T., Alahmed, Y. and Hamam, H. 92025). Number Plate Recognition Smart Parking Management System Using IoT. *Measurement Sensors,* 37, 101409.

Elsonbaty, A. A., and Shams, M. (2020). The smart parking management system. Internet of Things, 12, Article 100291

Fahim, A., Hasan, M., and Chowdhury, M. A. (2021). Smart Parking Systems: Comprehensive Review based on Various Aspects. *Heliyon,* 7(5), e07050. https://doi.org/10.1016/J.heliyon.2021.e07050.

Hadi R. A., George, L. E. and Ahmed, Z. J. (2024). Computer Vision-based Approaches, Datasets and Applications of Smart Parking Systems: A Review.

Jakhar, S., Chouhan, L., Kanojiya, M., Tiwari, V. and Namdev, M. (2025). Smart Parking System Using IoT and Image Processing. *International Journal of Engineering Trends and Technology, 73(12), 34-51*

Kamarudin, A.S., Zainal, Z., Baharom, M. N. and Che Ros, Z. (2025). IoT-based Smart Parking System with Real-time Violation Detection Alarm. *Multidisciplinary Applied Research and Innovation,* 6(4),310-316.

Khanna, A., and Anand, R. (2021). Smart Parking Systems and Comprehensive Review based on various aspects. International journal of Computer Applications, 182(36), 1-7.

Lin, T., Rivano, H., and Le Monel, F. (2025). Smart Parking Systems: A Comprehensive review of digitalization of Parking Services. *Green Energy and Intelligent Transportation,* 5(1).

Lubrich, P. (2021). Smart Parking Systems: A Data-oriented Taxonomy and a Meta-data model. *Transport Research Record*, 2675(8), 713-725.

Mackey, A., Spachos, P. S., and Plataniotis, K.N. (2020). Smart Parking system based on Bluetooth Low Energy beacons with Particle Filtering. *IEEE Systems Journal.* https://doi.org/10.48550/arViv.2001.07266 .

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Ojo, K., & Ahmed, M. (2020). Evolution and Development of Ojoo Bus Terminal: A Case Study of Transportation Infrastructure in Oyo State, Nigeria. Journal of Urban Transportation Planning, 38(2), 75-88.

Rahman, M. S. (2020). Urban parking management: A review. Transportation Research Part A: Policy and Practice, 134, 117-134.

Sharma, R. and Mittal, M. (2020). Smart Parking Management System: A review. *International Journal of Advanced Science and Technology*, 29(7), 4586-4595.

Shoup, D. (2005). The high cost of free parking. Chicago, IL: Planners Press.

Wahab, A. and Maguire, G. Q. (2019). Smart Parking: IoT and blockchain proceedings of the 2019 IEEE international conference on internet of things and intelligence system (IoTaIS)/ 1-6

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