

ANDROID APPLICATION FOR SMART PARKING SYSTEM

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Abstract—This project focuses on the development of a Smart Parking System Android application aimed at revolutionizing traditional parking management. The application utilizes various sensors and IoT technology to provide real-time parking space availability information to users. Through this system, users can effortlessly locate and reserve parking spaces, reducing the time spent searching for a spot and minimizing traffic congestion. The Android application employs intuitive user interfaces to display parking availability, guiding users to vacant spaces within designated parking lots. It integrates with backend servers to store and manage parking data, ensuring efficient communication between the app and the physical sensors deployed in the parking areas. The development involves utilizing Android Studio for app creation, integrating APIs for mapping and navigation services, and establishing secure payment gateways for transactions. The Smart Parking System Android application aims to enhance convenience for drivers, optimize parking space utilization, and contribute to reducing environmental impact by minimizing unnecessary vehicle movements in search of parking, ultimately leading to a more efficient and eco-friendly urban environment.

Keywords—Android Studio, Firebase, Google Map, Cloud

Database, Speech-to-text

project. This paper explores the evolution of smart parking systems, their key components, and the pivotal role of Android applications in revolutionizing urban mobility. Through an in-depth analysis, it examines the methodologies, technologies, and design principles employed in the development of these Android applications for smart parking systems. The primary aim of this survey is to provide a comprehensive understanding of the functionalities, features, and usability aspects of Android applications in smart parking systems. It investigates user-centric design strategies, real-time data integration, user authentication, payment gateways, and seamless interface experiences for enhanced convenience and efficiency. Moreover, this survey paper assesses the impact of smart parking systems on reducing traffic congestion, improving environmental sustainability, and enhancing the overall urban living experience. It examines case studies and research findings to illustrate the effectiveness and challenges faced in implementing such systems. Ultimately, this paper aims to contribute valuable insights into the design, implementation, and impact of Android applications in smart parking systems, fostering advancements in urban mobility and shaping the future of smart cities.

II. OBJECTIVES

I. INTRODUCTION

In recent years, urban congestion has become a pressing issue, with parking challenges adding to the chaos of city life. To address this, the integration of smart technologies into parking management systems has emerged as a promising solution.

This survey paper delves into the realm of smart parking systems, focusing on Android application development for an innovative Smart Parking System

"The primary objectives of the Android application for our smart parking system are to provide users with real-time information about available parking spaces, enable seamless booking and payment processes for parking slots, offer navigation assistance to locate reserved spots within the parking facility, and facilitate communication between users and parking management for any assistance or issue resolution.

Additionally, the application aims to optimize parking space utilization through data analytics, enhance user experience with intuitive interface design, and ensure security and reliability of transactions and personal information. Ultimately, the application seeks to alleviate parking woes, reduce congestion, and promote efficient utilization of urban parking infrastructure."

III. LITERATURE SURVEY

[1] Parmar, J.; Das, P.; Dave, S.M. Study on demand and characteristics of parking system in urban areas: A review :2020. Problems related to and due to the parking, various parking characteristics and their applications, parking choice behavior of drivers, development of demand models considering various factors and review of parking policies as an integral part of the urban transport system are discussed in detail. Linear regression, least square regression, unit graph technique, logistic models, principal component analysis, random utility and game theories, Gaussian mixture model, and gray correlation analysis. It discusses different methods for estimating demand for parking space.

[2] Internet of Things (IoT): Opportunities, issues and challenges towards a smart and sustainable future-2020. The focus of the conference was directed towards key conference tracks such as Smart City, Energy/Environment, e-Health and Engineering Modelling. This contributed to the better understanding of current technological progress in IoT application areas as well as the environmental implications linked with the increased application of IoT products.

[3] S Ahemad;;MS Rehman;; MS Rehaman;;in 2019 IEEE International Conference on Pervasive Computing and Communication Workshops (PerCom Workshops)IEEEExplore-2019 Blockchain-Based Architecture for Integrated Smart Parking Systems-2019. In smart parking system is prone to tempering while a massive amount of data is shared among different parties which raise concerns related to trust and performance. a blockchain-based architecture specific to the integrated smart parking systems.we present a set of design principles which shows the applicability of our proposed blockchain-based integrated parking system.[3]1.Sudeep Tanwar;;2.Sudhanshu Tyagi;;3.Meetu patel;;4.Vatsal Chouhan;;in 2020 IoT Enabled real-Time urban

transport management system-2020. A challenging task to find a suitable parking slot in modern societies across the globe.a system named as iERS which reduces the user's effort to find the nearest available parking slots in real-time. iERS provides better guidance to the users to reserve the available parking slot in compaSudhanrison to the other existing solutions.

[4]Walsh, D. Smart car parking system model for urban areas-2021. In view of the expansion in a huge number of vehicles, the requirement for parking spots is a need.This includes a system that incorporates an ultrasonic sensor, raspberry pi 4, wifi-module, and a led show outside the vehicle parking entryway.our system's looking through an ideal opportunity to locate a free spot is more productive than some other existing system.

[5]1.P Sotres,J.Lanza;;L.Sanchez;;j.Santana;;C.Lopez and L.Munoz. sensors 19(2);229-in 2019 Breaking Vendors and City Locks through a Semantic-enabled Global Interoperable Internet-of-Things System: A Smart Parking Case-2019.The current IoT landscape is suffering from large fragmentation with many platforms and vendors competing with their own solution.The application that has been developed seamlessly consumes data from them for providing parking guidance and mobility suggestions at the five locations.

[6]1.Goutamee Gopal;;2.Nitish Chooramun;;Smart Parking and Mapping System Using Aerial Imagery-2020. This system comprises of a mobile application which allows users to view and select available parking slots on an interactive map based on aerial imagery.QR technology has been used to allow users to check-into and out of the parking lot.

The features implemented are aimed at alleviating the difficulties in parking identification and allocation, thereby minimizing congestion in and around parking lots.

[7] 1.Abrar Fahim ;;2.Mehedi Hasan ;3. Muhtasim Alam Chowdhury;;Smart parking systems: comprehensive review based on various aspects-2021. Parking allocation has become a major problem in modern cities. The extensive comparison among multiple aspects of SPSs would enable researchers, designers, and policymakers to identify the best suited SPS

[8]An Elaborative Study of Smart Parking Systems-2021. we come across two major issues-parking space shortages and traffic congestion. With increase in population, the demands for vehicles are increasing day-by-day. Due to the same, unavailability or mismanagement of available parking spaces, heavy traffic in crowded cities is obvious.

we have developed an intelligent and efficient way so that there is no wastage of time, cost and fuel. Specifically about parking, need of safe and smart parking system is vital.

[9]1.Jeffrey Adler;;2.Goutham Satapathy;;3.V.Monikonda;;4.Betty Bowless;;the Smart Parking Management System With growing, Car parking increases with the number of car users. With the increased use of smartphones and their applications, users prefer mobile phone-based solutions. The smart parking system can be connected wirelessly to easily track available locations

[10]1.Keerthan Satya Devineni;;2.D.Rohin Sri Kumar;;3.K.N.V.Srinesh Chowdary;;4.RK.Anirudh Varma;;

International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075 (Online), Volume-9 Issue-2, December 2019 Smart Parking System-2019. If vehicles enter into the parking area and time waste for searching for a vacant parking slot. Sometimes it creates blockage. Conditions become worse when there are multiple parking lanes. Use of automated system for car parking monitoring will reduce the efforts. So the man entering parking area can view using IoT module involved and can decide which slot to enter so as to park the car.

IV. TECHNOLOGIES USED

Android studio: Android Studio is the official Integrated Development Environment (IDE) for Android app development. It's based on JetBrains' IntelliJ IDEA software and tailored specifically for creating Android applications. It offers a comprehensive set of tools for designing user interfaces, coding, debugging, testing, and deploying apps on various Android devices. Android Studio includes features like a visual layout editor, code editor, emulator for testing apps, performance profiling tools, and integration with Google's Android SDK, making it a powerful and essential tool for Android developers.

Google map: Google Maps is a widely-used online mapping service developed by Google. It offers detailed maps, satellite imagery, street views, and real-time traffic conditions for locations across the globe. Users can get directions for driving, walking, biking, or using public transportation, along with estimated travel times. It also provides information on local businesses, points of interest, reviews, and ratings, making it a versatile tool for navigation, exploration, and planning journeys.

Firebase: Firebase is a comprehensive mobile and web development platform developed by Google. It offers various tools and services to help developers build, improve, and manage apps more effectively. Firebase includes services for authentication, real-time database, cloud storage, hosting, cloud functions, machine learning, analytics, and more. It allows developers to focus on app development by providing scalable infrastructure and ready-to-use features, minimizing backend management and allowing for faster development and iteration of applications.

XML: In developing the Android application for our smart parking system, XML serves critical objectives. It facilitates intuitive user interface design, enabling the creation of visually appealing layouts for displaying parking availability, booking forms, and navigation interfaces. XML allows for customization of UI elements, ensuring consistency and responsiveness across different devices.

Kotlin: In employing Kotlin for our Android application dedicated to smart parking systems, we aim to leverage its concise syntax and readability to enhance code maintainability and developer productivity. Kotlin's null safety features will be pivotal in minimizing null pointer exceptions, ensuring robustness in handling user input and external data sources. By utilizing coroutines, we can streamline asynchronous tasks, such as network requests and database operations, ensuring smooth user interactions without blocking the UI thread. Extension functions and properties will facilitate code modularity and reusability, while sealed classes will enable clear state management in complex workflows like reservation and payment processing.

Algorithms Used

Parking Space Allocation Algorithm: This algorithm determines the optimal allocation of available parking spaces to incoming vehicles. We have used various techniques

First-Come-First-Served (FCFS): Assigns parking spaces to vehicles in the order they arrive.

Optimal Parking: Finds the nearest available parking space to minimize the walking distance for the user.

Dynamic Programming: Considers factors like space availability, distance to destination, and user preferences to allocate parking spaces efficiently.

Machine Learning: Utilizes historical data to predict parking space availability and optimize allocation based on real-time demand.

Dijkstra's Algorithm: It finds the shortest path from the present location to the nearest available parking space.

A Algorithm*: Enhances Dijkstra's algorithm by considering both the actual distance and an estimated distance to the destination.

Real-time Traffic Analysis: Incorporates real-time traffic data to dynamically adjust route recommendations based on current conditions

Fixed Pricing Algorithm: Instead of dynamically adjusting parking fees based on demand, a fixed pricing algorithm charges a constant rate for parking.

Steps:

1. Define fixed parking rates based on factors such as parking duration or location.
2. Display the fixed rates to users when they book a parking space.
3. Calculate the parking fee based on the predefined rates.

While not as flexible as dynamic pricing, this approach simplifies fee calculation and

V. SYSTEM ARCHITECTURE

Client Application (Android App):

This is the front-end part of the system that runs on Android devices and interacts with users.

It provides functionalities like finding parking spots, reserving spots, making payments, and navigating to the parking location.

Server-side Application:

Backend services manage the business logic, data processing, and communication with external services. It includes:

Authentication Service: Handles user authentication and authorization to ensure secure access to the application.

Parking Spot Management: Manages information about available parking spots, including their locations, availability, and pricing.

Reservation Service: Handles the reservation process, ensuring that users can reserve parking spots and releasing them after a certain period if not claimed.

Payment Gateway Integration: Integrates with payment gateways to facilitate secure payment processing for parking reservations.

Data Storage: Stores information such as user profiles, reservation history, parking spot data, etc.

Database:

Stores persistent data required by the application, including user profiles, parking spot details, reservation information, etc.

Can be implemented using a relational database management system (e.g., MySQL, PostgreSQL) or a NoSQL database (e.g., MongoDB) depending on the specific requirements.

External Services:

Integration with external services like mapping and navigation APIs (e.g., Google Maps API) to provide directions to the parking spots.

Integration with IoT devices or sensors installed in parking lots to monitor spot availability in real-time.

Security Layer:

Implements security measures such as encryption, secure communication protocols (e.g., HTTPS), and input validation to protect user data and prevent security breaches.

Cloud Infrastructure (Optional):

Deploying the application on cloud platforms (e.g., AWS, Azure, Google Cloud) can provide scalability, reliability, and easier management of resources.

introduced the concept of Smart Parking System which will be able to reduce traffic congestion, which will improve the quality of life of the citizen. Android mobile application called smart parking system a driver can find the available parking spaces in a given area and get the parking fees. The Smart Parking Application addresses urban parking challenges by providing real-time space availability, user-friendly features, and seamless QR code reservations. With Firebase Cloud Database ensuring reliable data management, the app aims to revolutionize the parking experience, easing frustration for drivers in growing cities.

Future Scope: Moreover, while artificial intelligence (AI) can enhance certain aspects of such systems, its absence doesn't detract from the fundamental advantages and practicality of the technology. Looking ahead, the versatility of this innovation opens doors to a multitude of potential applications across various domains, promising to reshape the way we interact with our surroundings. Whether it's optimizing healthcare delivery with telemedicine or revolutionizing education through immersive learning experiences, the impact of such technological advancements is boundless. Thus, while AI undoubtedly offers exciting possibilities, the current iteration of smart parking systems on Android platforms already delivers tangible benefits that enhance our daily lives.



VI. CONCLUSION

This article summarizes an efficient way to park a vehicle using recent technology. This app allows the user to take control of the parking decision unlike the traditional method of physically trying out multiple parking spots. Using this application on a large scale would benefit the user even if a user is in a new place. The app is user-friendly and convenient have

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