

EL Inteligente Parque Smart Parking System

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Abstract - India's motorization rate is lower in absolute terms and proportional to population size than that of many other developing countries, but during the past 10 years, it has increased at one of the world's quickest rates. In the fiscal year 2019, there were 295.8 million vehicles registered in India, which has the third-largest road network in the world. As more automobiles enter the city, the few parking spots that are already available become more and more scarce, and the amount of time spent looking for these slots. This report presents the development of a parking system for Android devices that enables users to register, add vehicles, and track their location in real-time. The system leverages geofencing technology to detect when a user enters the parking area of a college and updates a database to analyze available parking spots. By providing guidance on where to park, the system aims to improve parking management and reduce frustration for users. The report discusses the system's technical architecture, challenges encountered during development, and potential future improvements. Overall, the project showcases the potential of technology to improve everyday experiences and enhance quality of life.

Key Words: Database, Geofencing, Real-time, Location, Parking area, GPS, Android, Parking System.

1. INTRODUCTION

The number of users of motor vehicles is increasing significantly on a daily basis around the globe, resulting in an increase in the need for adequate parking space. However, the issue of parking is a persistent problem faced by many. Finding a parking spot can be a daunting task, leading to congestion, delays, and frustration. This is particularly true for educational institutions, including colleges, which have an ever-increasing number of students, staff, and visitors. To address this issue, we propose a Smart Parking System specifically designed for our college that utilizes GPS technology to help drivers find available parking spaces quickly and efficiently. Our system aims to provide a seamless user experience and enhance parking management in general. By leveraging cutting-edge technologies, such as GPS and geofencing, we are able to detect when a user enters the parking area and provide guidance on where to park. We believe that our parking system has the potential to significantly improve the parking experience for users and reduce congestion, delays, and frustration. Additionally, our system can help improve parking management by analyzing available parking spots and providing guidance on where to park. Overall, we believe that our Smart Parking System has the potential to revolutionize the parking experience and enhance parking management in educational .

2. LITERATURE REVIEW

[1] An IOT based Smart Parking Management System

As the number of vehicle users is increasing tremendously in this quickly expanding economy, necessitating more parking space. The widespread use of smartphones pushes people to favor solutions based on mobile applications. The development of the Internet of Things has made it possible to integrate mobile applications, wireless communication technologies, and gadgets. In this study, a smart parking system built on the Internet of Things is suggested. Both the user and the owner of the parking space can benefit from the entire parking solution it offers. The proposed system includes a network of sensors that are installed in each parking space, which detects the presence or absence of a vehicle in real-time. The information is then transmitted to a central server, which analyzes the data and provides information on parking availability to drivers through a mobile app or other interface. The system also includes a reservation feature that allows drivers to reserve a parking space in advance. This feature is especially useful for busy areas or events where parking spaces are in high demand. In addition to providing real-time parking information, the system can also help parking lot operators optimize the use of parking spaces. By analyzing data on parking utilization, parking lot operators can identify areas where parking is underutilized and take steps to better utilize those spaces .

[2] A low cost smart parking system for smart cities which was based on open hardware and software

This paper's goal is to demonstrate a prototype of an integrated cost-effective system based on free and open-source software and hardware components and created to meet the needs of cities that need to monitor and measure not just parking lots but also other urban areas. Inclusion of additional environmental information, such as movement, temperature, pollution and humidity. The hardware used in the system is based on open-source technology, which makes it more affordable and accessible to cities with limited budgets. The system is also designed to be scalable, so it can be easily expanded to accommodate additional parking spaces as needed. The software used in the system is also open-source, which means it can be customized and modified to meet the specific needs of different cities. The open-source nature of the software also promotes collaboration and knowledge-sharing among developers and cities. Additionally, the system is designed to be affordable and scalable, making it accessible to cities with limited budgets and contributing to the development of smarter and more sustainable cities.

[3] A cloud-based IoT parking system to minimize parking delays on campus

Three systems make up this intelligent parking system, with one software system serving as the master and two hardware systems serving as slaves. Data transmission between systems and the cloud is handled by the master system. When a car is parked in the university parking lot, the first slave system, which is functioning, can detect the occupancy of a parking space using sensors. The second system is an embedded system that monitors traffic regulations outside on an LCD screen and collects data. The LCD panel at the parking lot's entrance shows the number of available open spots there as well as the general area in which they are located. Each device in the parking lot used a Token and Device ID to communicate with the cloud using packets of secure HTTP requests that were SSL-encrypted, creating a secure encrypted connection between the server and the device. A formula is used to show the connection between parking occupancy and points of interest. The smart parking system was successfully tested, and it was discovered that it could take a google map, produce an active node map, and then figure out the shortest path between two target nodes.. A network made up of multiple tiny sensor nodes connected together, each with a well-equipped antenna to enable effective wireless communication within their radio range, is known as a wireless sensor network. The proposed system also includes a reservation feature that allows drivers to reserve a parking space in advance. This feature helps to reduce the time and frustration associated with searching for an available parking spot on campus .

[4] An automated car parking system that utilizes IoT technology to detect empty parking slots and provide real-time information to users.:

The study highlights the importance of automated parking systems in reducing traffic congestion and enhancing the overall parking experience for users. The authors proposed a system that utilizes IoT sensors to detect empty parking slots and provide real-time information to users through a mobile application. The system uses a microcontroller-based circuit that controls the flow of vehicles in and out of the parking lot. Additionally, the system uses a camera-based system to generate images of the parking lot and detect empty parking slots. The study conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately detect empty parking slots and provide real-time information to users. The authors also discussed the potential benefits of the proposed system, such as reducing traffic congestion and improving parking management. This study provides valuable insights into the potential of IoT technology in developing automated parking systems. However, the proposed system has some limitations, such as the need for reliable internet connectivity and the high cost of implementation. Moreover, the study did not address potential privacy and security concerns related to IoT technology.

[5] A smart parking system that uses wireless sensor networks (WSNs) for monitoring parking spaces and providing real-time information on parking availability

The system includes a network of sensors that are installed in each parking space, which detect the presence or absence of a vehicle and transmit this information to a central server through a WSN. The proposed system uses various communication protocols such as ZigBee, Wi-Fi and Bluetooth Low Energy (BLE) to connect the sensors to the central server. The data collected by the sensors is analyzed by the server to provide information on parking availability to drivers through a mobile app or other interface. The paper also discusses the management of the smart parking system, including the allocation of parking spaces to different categories of users, such as disabled drivers or VIPs. The system is also designed to provide real-time information on the occupancy and status of parking spaces, enabling efficient management of the parking facilities. The proposed smart parking system has the potential to improve the parking experience for drivers and reduce traffic congestion in urban areas. Additionally, the use of WSNs makes the system scalable and cost-effective, while the integration with mobile apps and other interfaces makes it accessible to a wide range of users. The paper provides a detailed insight into the design and management of such a smart parking system, which can be useful for researchers and practitioners working in the field of smart cities and IoT applications. The paper proposes a three-layer architecture for the smart parking system, which includes the sensor layer, network layer, and application layer. The sensor layer consists of the parking sensors, which are responsible for detecting the presence or absence of vehicles in parking spaces. The network layer includes the communication protocols and gateways used to transmit data from the sensors to the central server. The application layer includes the software and interfaces used to manage and display parking availability information to drivers .

[6] A smart parking system that utilizes Arduino technology and a web server to detect available parking slots and provide real-time information to users

The study highlights the importance of smart parking systems in managing parking spaces and reducing traffic congestion. The proposed system utilizes Arduino technology to detect the availability of parking slots and a web server to provide real-time parking information to users through a mobile application. The system uses ultrasonic sensors to detect the presence of vehicles in parking slots and an SD card to store parking data. Additionally, the system uses an Ajax web server to provide real-time parking information to users. The authors conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately detect available parking slots and provide real-time parking information to users. The authors also discussed the potential benefits of the proposed system, such as reducing traffic congestion and improving parking management. This paper provides valuable insights into the potential of utilizing Arduino technology and web servers in developing smart parking systems. However, the proposed system has some limitations, such as the need for reliable internet connectivity and the high cost of implementation.

[7] A smart parking system that utilizes IoT technology and a visual-aided smart vehicle presence sensor to detect available parking slots and provide real-time information to users

The study highlights the importance of advanced sensors in developing smart parking systems that can accurately detect the presence of vehicles. The proposed system utilizes a visual-aided smart vehicle presence sensor to detect the presence of vehicles in parking slots and an IoT platform to provide real-time parking information to users. The system uses a machine learning algorithm to analyze the images obtained from the smart sensor and detect the presence of vehicles. Additionally, the system uses an IoT platform to provide real-time parking information to users through a mobile application. The authors conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately detect the presence of vehicles and provide real-time parking information to users. The authors also discussed the potential benefits of the proposed system, such as reducing traffic congestion and improving parking management.

[8] An Intelligent Vehicle Parking System (IVPS) that utilizes wireless sensor networks (WSNs) to monitor and manage parking spaces

The proposed system includes a network of sensors that are installed in each parking space, which detect the presence or absence of a vehicle and transmit this information to a central server through a WSN. The IVPS system is designed to improve the parking experience for drivers by providing real-time information on parking availability and guiding them to available parking spaces. The system uses machine learning algorithms to predict the availability of parking spaces based on historical data, and provides this information to drivers through a mobile app or other interface. The proposed system also includes features such as automatic billing and payment for parking fees, and the ability to reserve parking spaces in advance. The IVPS system is also designed to be scalable and customizable, allowing it to be tailored to the specific needs of different parking facilities.

3. PROBLEM STATEMENT

The rapid increase in the number of motor vehicle users worldwide has led to a significant rise in the demand for parking spaces. This growing demand has created a persistent and widespread parking problem, causing congestion, delays, and frustration, particularly in areas with high vehicle traffic, such as educational institutions. Colleges, in particular, face challenges with accommodating the ever-increasing number of students, staff, and visitors, leading to inefficient use of available parking spaces and difficulties in finding suitable spots.

In response to this issue, there is a pressing need for an innovative solution that can streamline parking management and enhance the overall parking experience. The current parking system often lacks real-time data and fails to provide guidance to drivers about available parking spots, resulting in time-consuming searches and exacerbating congestion. This problem calls for the development of a Smart Parking System that utilizes modern technologies, such as GPS and geofencing, to improve the efficiency of parking space utilization and provide real-time assistance to drivers in locating available spots.

The goal is to create a solution that not only alleviates the parking woes of users but also optimizes parking management for institutions, reducing frustration and enhancing the overall user experience. By leveraging cutting-edge technologies, the Smart Parking System aims to address the parking challenges faced by educational institutions and offer a scalable solution for similar environments.

4. PROPOSED SYSTEM

The purpose of this project report is to document the development of an Android application that is designed to assign parking slots to vehicles entering a designated area. The application is intended to be stand-alone and inexpensive, providing an easy-to-use solution for users who need to find a parking spot quickly and efficiently. The report will describe the main features of the application, including user login and registration, location tracking, geofencing, and slot assignment. Additionally, the report will detail the technical aspects of development, such as the use of Firebase authentication, OpenStreetMap for location tracking, and Firestore for the database. Overall, this project aims to provide a practical and user-friendly solution to the common problem of finding a parking spot.

Here are six key modules for the Android application designed to assign parking slots:

1. **User Authentication Module:** This module handles user login and registration, ensuring that only authorized users can access the system. **Key Features:** SUPA Base for secure login (email/password, Google login, etc.). User registration and profile management. Forgot password and account recovery features.
2. **Location Tracking Module:** This module tracks the user's current location in real time to identify their proximity to available parking spots. **Key Features:** Integration with GPS and OpenStreetMap for accurate location tracking. Real-time updates of the user's location on the map. Distance calculation from the user's current location to available parking spots.
3. **Geofencing Module:** This module defines virtual boundaries (geofences) around the parking area to detect when a user enters or exits the designated area. **Key Features:** Real-time detection of user entry/exit within the geofenced area. Notifications when the user enters or leaves the parking zone. Trigger parking slot assignment when the user is within the geofence.
4. **Parking Slot Assignment Module:** This module automatically assigns available parking slots to users based on their location and availability. **Key Features:** Real-time data on available parking spots. Dynamic slot assignment based on the user's current position and preferences. Ability to display assigned parking slots on the map.
5. **Database Management Module:** This module manages all data related to users, parking slots, and transactions, ensuring data consistency and security. **Key Features:** Integration with Firestore for storing user profiles, parking slot details, and

transaction history . Real-time updates and synchronization of parking slot availability . User data management and parking slot history tracking

6. User Interface (UI) Module: This module provides a user-friendly interface for interaction with the application, making it easy to use for drivers seeking parking. Key Features: Intuitive map view to show available parking spots . Easy navigation for slot selection and parking guidance . Notifications, alerts, and updates for parking slot assignment and status .

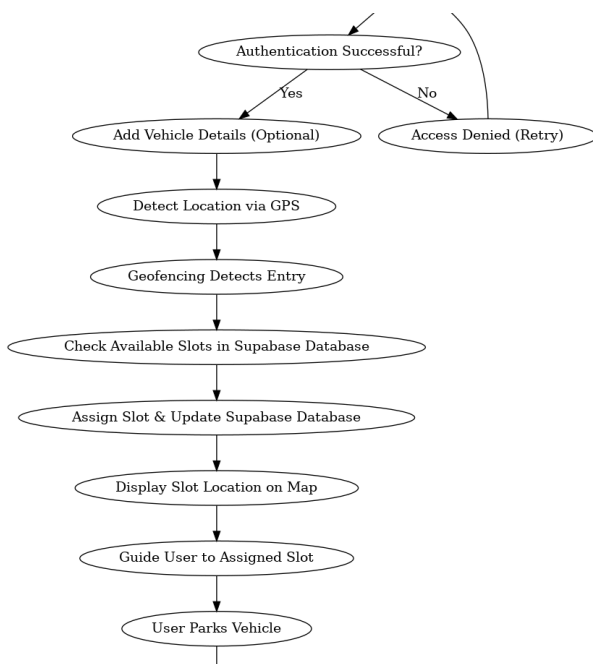
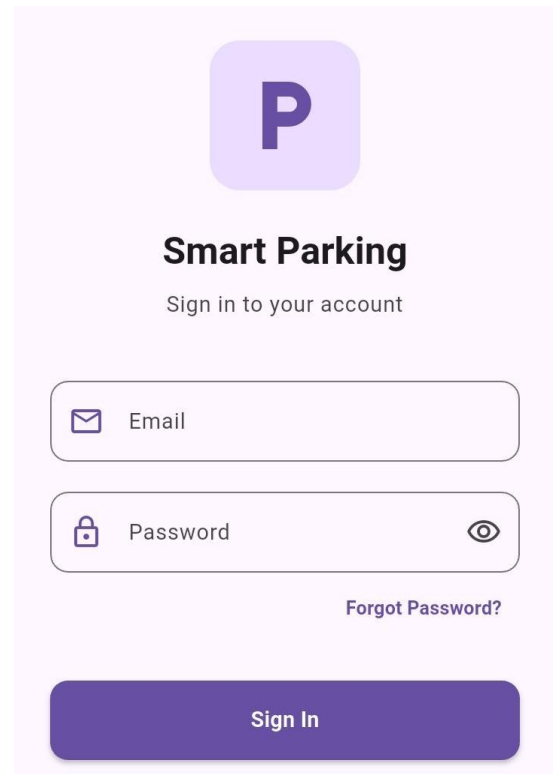


Fig 1: Activity Diagram

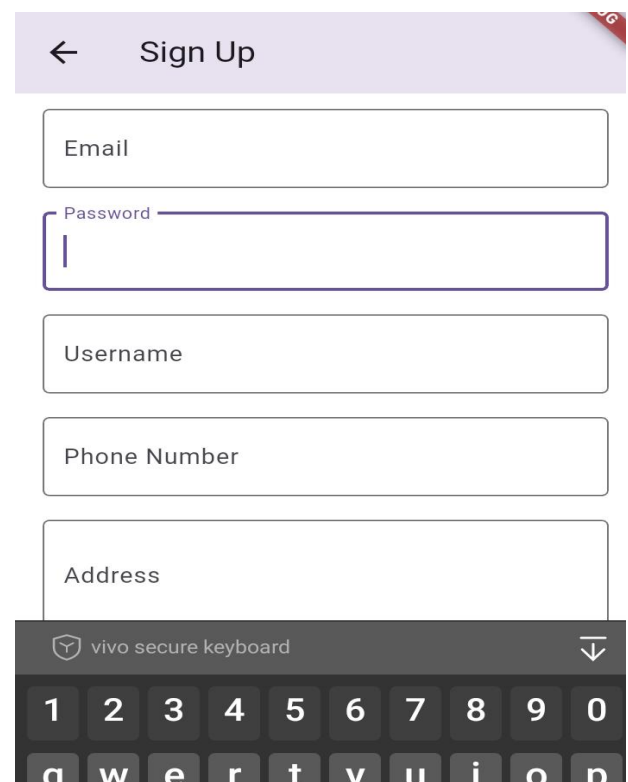
RESULTS AND DISCUSSION

The proposed system, a mobile application developed using Flutter, was designed to assign parking slots to vehicles entering the premises of a designated area. The application utilizes various technologies such as SUPA Base, GPS tracking, and mapping technology to provide real-time information about parking availability and to assign a parking slot to the user. In this section, we will discuss the results of the project and its implications.



The login page features a purple header with a large 'P' icon. Below the icon, the text 'Smart Parking' is displayed in a bold, black font. Underneath, the instruction 'Sign in to your account' is shown. The page contains two input fields: 'Email' with an envelope icon and 'Password' with a lock icon and a toggle eye icon. A 'Forgot Password?' link is positioned to the right of the password field. At the bottom, there is a prominent purple 'Sign In' button.

Fig 2: Login Page



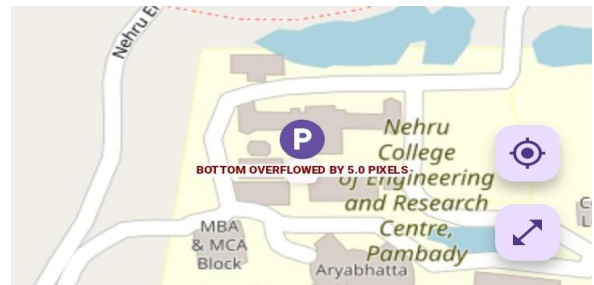
The registration page has a purple header with a back arrow and the text 'Sign Up'. It includes five input fields: 'Email', 'Password' (with a strength indicator bar), 'Username', 'Phone Number', and 'Address'. At the bottom, a 'vivo secure keyboard' is visible, showing a numeric keypad and a QWERTY keyboard.

Fig 3: Registration Page

Vehicle Information



Fig 4: vehicle Page



OR

Nehru College
18 slots

Nehru College Campus, Main Road

Fig 6: Location page

P Active Bookings

P

No active bookings

Your Vehicles

KL19B4726
honda
bike

Fig 5: Main menu

B4	A4	D2
C5	A5	A2
A1	D3	C4

Or enter manually ☐

Duration (hours)

Fig 7: Alloted slots Page

6. CONCLUSION

In conclusion, the proposed system is an android application developed using Flutter that provides a seamless and efficient solution for assigning parking slots to users entering the premise of a designated area. The application utilizes various technologies such as GPS tracking, geofencing, mapping technology, and secure user authentication to provide accurate and real-time information about parking availability and to assign a parking slot to the user. Throughout the development of the proposed system, several challenges were faced, including managing state in the application and ensuring accurate and real-time GPS tracking. However, with the use of various technologies such as Flutter Provider Package and Flutter Geolocator Plugin, these challenges were successfully addressed. The proposed system has the potential to improve parking management in designated areas and reduce traffic congestion. It provides a user-friendly and cost-effective solution for assigning parking slots to users, which can be further improved with additional features such as payment integration and notification systems. Overall, the proposed system demonstrates the potential of Flutter as a mobile app development framework and the importance of utilizing various technologies to provide a seamless user experience.

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