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# IoT based Smart Parking System

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***Abstract:*** ***The number of vehicles keeps increasing each passing day and due to the limited parking space, parking has been a real nuisance. Our project which is based on the technology of "Internet of things", aims to make parking vehicle easy and efficient. The benefit of our approach is that it allows us to find a parking space in parking area efficiently. Our project can also collect useful data like the amount of vehicle in the parking area, peak parking time etc. Parking will be digitalized and human efforts can be greatly reduced.***
***Keywords: Vehicle Parking, IoT Systems, Cloud, Microcontroller, Sensors***

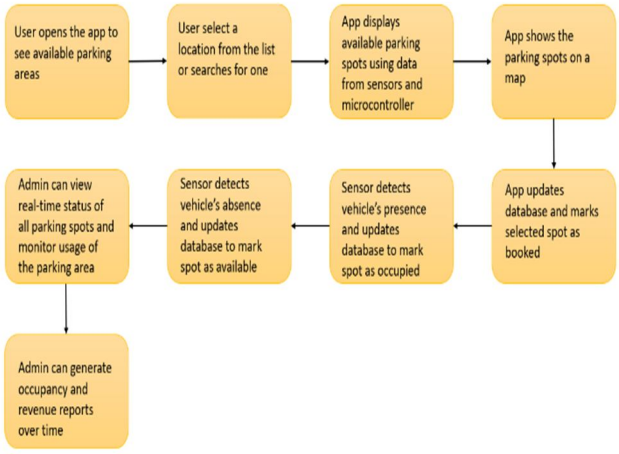
## I. INTRODUCTION

With the increasing number of automobiles on the roads, the scarcity of available parking spaces has become a major predicament. To address this issue, our project leverages the cutting-edge technology of "Internet of Things" (IOT) to provide a seamless and efficient parking experience. This innovative approach greatly reduces the time required to locate a parking spot within the designated area. In addition, our project is capable of gathering valuable information pertaining to the number of vehicles present in the parking space, as well as the peak parking hours. The digitalization of the parking process enables significant reduction in human effort and streamlines the entire process.

## II. METHODOLOGY

The proposed parking management system is developed on the Android Studio platform, which serves as the primary tool for building the Android app that interacts with the infrared sensors and end-users. The Android Studio platform offers a diverse set of tools and features for creating high-quality mobile applications, supporting Java programming language and the Android operating system. This makes it an ideal platform for developing the parking management app, which delivers a user-friendly and intuitive experience.

The system employs a cloud-based database, Firebase, to securely store and manage the data generated by the system. Firebase provides a scalable and secure platform that ensures the system's data is always accurate and up-to-date, eliminating the need for manual updates. Additionally, Firebase offers real-time data syncing and flexible querying, enabling easier access and analysis of the data produced by the system. The Firebase database management system is an efficient and reliable way to manage and store large amounts of data, making it ideal for the parking management system.




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In order to optimize power consumption, the system includes a feature that reduces the frequency of infrared sensor transmission after two minutes of detecting an object. The sensor lowers its transmission rate to one transmission per 30 seconds to conserve power, but if no object is detected, the sensor returns to continuous transmission. This design conserves power while ensuring the system operates efficiently over a prolonged period.

In addition to gathering information on the number of vehicles present in the parking space, the proposed parking management system collects and stores a wealth of data related to the parking space's usage patterns. This data can be analyzed to optimize the parking management system's efficiency and improve the parking experience for end-users.

The system collects data on the number of vehicles present in the parking area at different times of the day, allowing parking managers to identify peak periods of usage. The system can also provide information on which parking spots are most frequently used, allowing parking managers to optimize the allocation of parking spaces to accommodate the demand.

The parking management system also collects data on the duration of time vehicles spend parked in the area. This data can be used to optimize parking space turnover and ensure that more vehicles can use the parking space within a given time.

The system can also gather information on the types of vehicles using the parking space, such as cars, trucks, and motorcycles. This information is useful in optimizing the parking space's layout and ensuring that all vehicles can be accommodated efficiently.

The data collected by the parking management system is stored in a cloud-based database, such as Firebase, which enables easy access and analysis of the data through the Android app. This allows parking managers to make data-driven decisions and optimize the parking management system's performance.

## III. COMPONENTS USED

The components used in this system are

*1)* Microcontroller (Rudra board)
*2)* IR Sensor
*3)* Arduino
*4)* Firebase
*5)* Android studio

The IR Sensors used for vehicle detection are connected to the microcontroller which uploads it to firebase. The android studio takes the data as real time database from firebase then updates the app. The system updates the availability of parking spaces in real time, which provides the drivers with the required information. Greatly reduces the human efforts. Ensures the information provided to user is accurate and reliable. The android app is used to accessed and analyze the information to improve the efficiency of the system.

## IV. CONCLUSION

In summary, the proposed parking management system is an integrated solution that uses cutting-edge technology to address the challenges of managing parking spaces in open areas. The system's key components - infrared sensors, an Android app developed using Android Studio, and a cloud-based database Firebase - work seamlessly together to provide a comprehensive and reliable parking management solution.

The system provides real-time updates on the availability of parking spaces, allowing drivers to quickly find a suitable parking spot without having to drive around aimlessly, thus reducing traffic congestion and making the parking experience more efficient. The system's Android app is intuitive and user-friendly, enabling drivers to access parking space availability information and directions to available parking spots with ease.

Furthermore, the system has a unique feature that helps to conserve power by reducing the frequency of infrared sensor transmission. This feature allows the system to operate efficiently over extended periods of time, thereby reducing maintenance requirements and overall operating costs.

Finally, the system's cloud-based database stores a wealth of data related to parking space usage patterns. This data can be analyzed to optimize the parking management system's efficiency, improve the overall parking experience for end-users, and make data-driven decisions about future parking space requirements.

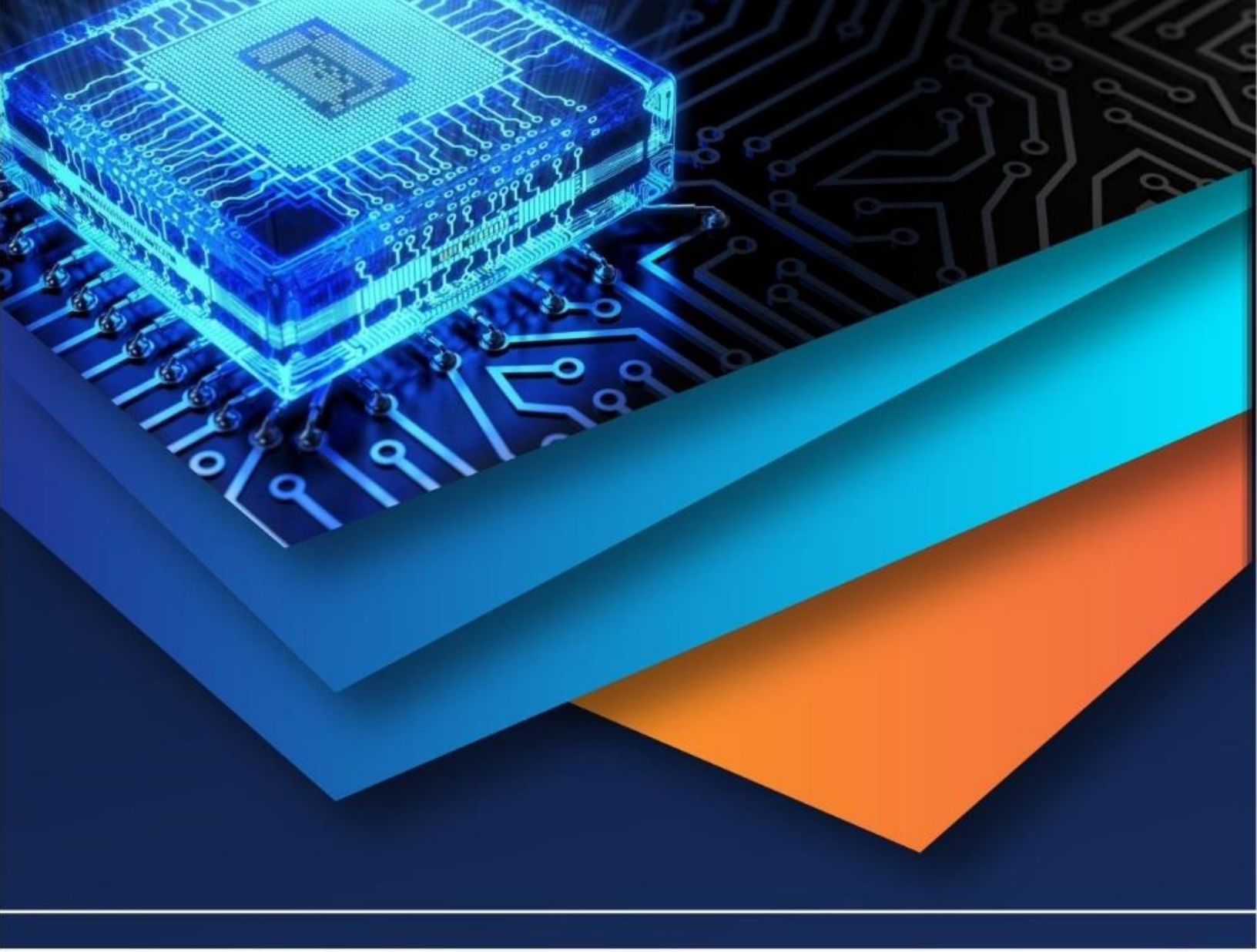
Overall, the proposed parking management system is a scalable and flexible solution that can be easily adapted to different parking scenarios. Its innovative technology and powerful data analytics capabilities make it an ideal solution for a wide range of parking requirements, helping to improve the efficiency and convenience of parking management in open areas.

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