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Engineering Clinics

**IoT Smart Parking using RFID Scan and Parking Slot Availability on
Android App
ECS201**

BACHELOR OF TECHNOLOGY
Artificial Intelligence and Data Science



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Oct 2025

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Introduction

1.1 IOT smart parking using RFID scan and parking slot availability on android app

Parking is the act of stopping and disengaging a vehicle and usually leaving it unoccupied. Parking on one or both sides of a road is often permitted, though sometimes with restrictions. Parking has become one of the most frustrating parts of modern urban life. With the growing number of vehicles and limited infrastructure, finding a suitable parking space often consumes more time than the actual journey. According to studies, nearly 30% of city traffic is caused by drivers searching for parking spots. This not only wastes valuable time and fuel but also increases air pollution and driver stress.

1.2 PARKING FACILITIES

Parking facilities can be divided into public parking and private parking.

- Public parking is managed by local government authorities and available for all members of the public to drive to and park in.
- Private parking is owned by a private entity. It may be available for use by the public or restricted to customers, employees or residents.

1.3 FINDING PARKING

When the supply of kerbside parking in a particular area is less than the demand for parking, a phenomenon known as cruising occurs, where drivers drive on streets in search of a parking space. It can also occur where there is supply of kerbside space, but parking restriction or payment costs discourage drivers from parking there.

Automated Parking Guidance systems present drivers with dynamic information on parking within controlled areas (like parking garages and parking lots). The systems combine traffic monitoring, communication, processing and variable message sign technologies to provide the service.

Mobile apps and parking booking platforms that help drivers find parking take different approaches have emerged.

Some connected cars have mobile apps associated with the in-car system, that can locate the car or indicate the last place it was parked. Cars with Inter-navigation communicate to each other indicating recently vacated spots.

Parking guidance and information system provides information about the availability of parking spaces within a controlled area. The systems may include vehicle detection sensors that can count the number of available spaces and display



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the information on various signs. There may be indicator lights that can lead drivers to an exact available spot

1.4 Why there is need to find a parking?

Due to rapid urbanization, insufficient infrastructure, a lack of effective regulation and enforcement common parking problems rise like space scarcity, leading to increased traffic, pollution, and driver frustration, as well as illegal and haphazard parking that obstructs roads and sidewalks, damages urban aesthetics, and hinders pedestrian movement.

1.4.1 Common problems while finding a parking

- Vehicle congestion: Roads get blocked as cars queue up or circle around searching for parking.
- Environmental impact: Wasted fuel increases CO₂ emissions.
- Infrastructure and space strain
- Increased journey times
- Safety and emergency access: Emergency vehicles face difficulty when roads are blocked by haphazardly parked cars.
- High costs and financial strain: Inefficient parking leads to financial strain for both citizens and facility managers.
- Misuse of parking spaces
- Conflicts and accidents



Brief Literature survey

When the supply of kerbside parking is less than the demand, a phenomenon known as **cruising** occurs, where drivers drive on streets searching for a space.

2.1 How these problems can be solved?

To solve all these problems innovations like smart parking systems, which use sensors and mobile apps to show real-time parking availability, and are crucial for meeting this need in modern cities. By making the search for a space quicker and more efficient.

It can solve many problems like:

- Reduces congestion and delays
- Ensures public safety and order
- Manages urban resources
- Promotes quality of life
- Enables sustainable urban planning

Now we came across the problem and we can clearly say that there is a proper need of an innovative idea which can solve all these problems.

So we can make use of some IOT knowledge paired with RFID scanners to create an app for parking availability slot.

- **IOT**: Internet of Things, in other words it is a network of devices(physical) equipped with sensors and software that connects to the internet to collect and exchange of data with other devices and systems, which enables a smooth communication and automated actions with minimal human input.
- **RFID**: Radio Frequency Identification, a wireless technology that uses radio waves to automatically identify and track tags or “smart labels” attached to objects. An RFID

System consists of a tag and a reader, which captures data encoded in the tag without needing a direct line of sight. Applications for RFID technology are widespread, including inventory and asset tracking, healthcare, manufacturing, logistics and retail.



Problem Formulation

- In developing countries some Citi Centre, Multicomplex building, Rich Societies have already introduced digital parking displays, but most still rely on manual tokens, which are inefficient.
- Keeping the data of the index, the average traffic speed can be determined of the city's traffic.
- Some countries use new technologies like:
 - Adopted IoT-enabled smart parking with in-ground sensors, leading to a 30% reduction in congestion.
 - Uses a project called SFpark, which dynamically updates parking availability and pricing.

3.1 Benefits

- Reduced Traffic Congestion: Drivers no longer circle around looking for spots.
- Time-Saving: Parking becomes faster and less stressful.
- Environmental Impact: Reduced fuel consumption and emissions.
- Organized Management: Facility managers get automated reports of slot usage.
- Scalability: Can be used in malls, airports, hospitals, offices, and smart cities.



Objective

4.1 The main goal of this project is to create a system that:

- Provides real-time information about available parking slots.
- Uses RFID scanners to automate entry and exit without human intervention.
- Reduces congestion and driver frustration.
- Improves urban mobility through better parking management.

4.2 Future improvements

- Automated Payments: Integration with digital wallets for cashless transactions.
- AI & Machine Learning: Predict parking demand based on patterns.
- License Plate Recognition: Use cameras instead of RFID for faster processing.
- Smart City Integration: Connect with traffic management systems for complete urban mobility solutions.
- If there is no power at all (main and backup), it will automatically save all the previous data before losing it. But this problem will be resolved in the future for more optimization.

Parking might seem like a minor issue, but it has a huge impact on traffic, pollution, and daily stress. Our project aims to provide a practical, affordable, and scalable solution through IoT and RFID. With real-time slot updates, smoother entry and exit, and reduced congestion, this system is a step toward smarter and greener cities. By combining simple technology with smart design, we can make parking less of a nightmare and more of a seamless part of urban living.



Methodology/ Planning of work

5.1 How it works:

1. Vehicle Entry – As soon as a vehicle enters the parking lot, the RFID scanner reads the RFID tag or number plate. The system immediately updates the central database, marking one slot as occupied.
2. Slot Allocation & Display – The Android app shows available slots in real time. A digital display at the parking gate also indicates free slots.
3. Parking – The driver parks the vehicle in the allotted spot. Data is continuously synced between RFID readers, the database, and the app.
4. Vehicle Exit – When the car leaves, the RFID system scans the tag again. The slot is marked as free, and the app updates accordingly. This simple process eliminates confusion, reduces waiting time, and ensures smooth traffic flow within the parking facility.

This system consists of three components:

1. IoT – RFID tags, RFID readers, and slot detection sensors.
2. Communication – Data transfer via Wi-Fi/4G/5G to the server.
3. Application – Mobile app interface (Android) for drivers, and display boards at parking entries.



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