

# Review Paper on Smart Parking System

[<sup>1</sup>] Adarsh Garg, [<sup>2</sup>] Anupama Kumari

[<sup>1</sup>] Department Of Electronics and Communication Engineering, Galgotias University, Yamuna Expressway Greater Noida,  
Uttar Pradesh

[<sup>1</sup>] adarsh.garg@Galgotiasuniversity.edu.in

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**Abstract:** The increasing number of vehicles on the road along with the mismanagement of available parking space leads to problems related to the parking as well as increased congestion in urban areas. It is thus highly necessary to develop an integrated smart parking management system that would allow the driver to figure out very quickly some suitable parking space for his or her vehicle. Although there is ample research on the development of smart parking system in the literature, most of them have not addressed the problem of real-time detection of unsuitable parking and automatic collection of parking fees. The Smart Parking System introduces an IOT-based smart parking system that provides an optimal solution to the problem of parking in metropolitan cities. Due to the rapid rise in vehicle density, it is difficult for users to find the parking space to park their vehicles, particularly during the peak hours of the day. The proposed smart parking system consists of a slot module deployed on-site to track and signal the availability status of each individual parking space. There is also a mobile application which allows the end user to test the availability of parking spaces and to book a parking space accordingly. Smart parking can increase the economy by reducing fuel consumption and pollution in urban cities.

**Keywords:** Arduino, Parking lot, Reservation, Smart parking system, Ultrasonic sensors.

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## INTRODUCTION

The Internet of Things (IoT)[1] is the network of physical objects devices, vehicles, buildings and other items, embedded with electronics, software, ultrasonic sensors and network connectivity that enable these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely through existing network infrastructure, creating opportunities for more direct incorporation of the physical world into computer-based systems, resulting in improved efficiency, accuracy and economic benefits; when IoT is increased with sensors and actuators, the technology becomes an example of a more general cyber-physical class; Everything can be identified uniquely by means of an integrated computing system, but can interact within the existing Internet infrastructure.

Smart parking can be regarded as one of the applications for the Internet of Things, a technology which first appeared in 1999. In particular, IoT can be considered as a concept under which a group of things or objects that can be connected through wireless and wired connections can interact with each other in order to create new services or

even applications. With population growth and economic growth, the number of on-road vehicles is increasing day by day. Parking is becoming one of the biggest city problems, and is becoming very expensive. It's challenging to find parking space[2] during the work, for example, searching for a parking spot in a car park is more frustrating for the users. In recent years many parking guidance systems have been proposed that try to improve the basic parking system to overcome this problem. All the systems require a mechanism for detecting whether a vehicle is in the parking place. The person can register to park his or her car in the car park slot. For registered user, a unique Id is created, and the time limit is set. The program will measure the vehicle's time in and out which is put in the parking lot and will monitor the amount from their account.

## BACKGROUND WORK

Robin Grodi et.al has done that how the vehicle will occupy in the particular allocated place. RFID sensors[3] detect the presence of a vehicle or other objects. Once a vehicle is detected, the system needs a way to notify drivers or a parking spot being occupied. The

disadvantage is, the parking place will be detected only to the nearby places there is no GPS sensor to search the parking slots from the far place. Alirezahassani *et al.* had implemented this system using a mobile application that is connected to the cloud. The user will set the time for when he is going to allocate the place. If he didn't occupy later the alarm will be given to the user. The app will show the number of allocated and the empty spaces in the parking slots. The disadvantage is, after allocating if another user request for the same place then he is unable to allocate that place so it is the waste of space if the first user cancels later, waste of time and money.

DharminiKanteti *et.al* has developed a Smart Parking System, in the case of pre-registered users IP cameras would capture the vehicle registration number and they can proceed without interruptions as per details like parking time estimate, their place of visit etc. For preregistered users, the amount will be deducted from E-wallet and there by users will be notified. A similar pricing system will be followed for new users but the payment is offline. The disadvantage is the system could serve all the parking requests but beyond 80 it couldn't accommodate more cars since the parking is full. Georgios Tsaramirsis *et.al* makes use of the wired sensors systems. There are two categories intrusive and non-intrusive sensors. Intrusive sensors are most commonly installed directly on pavement surfaces or holes in the roads surface. In turn, on-intrusive sensors can also be described as above ground sensors, which are mounted above the traffic lane and are monitoring on either side of the road. The disadvantage is, intrusive sensors types are the decreases of pavement life due to the requirement of pavement cut for installation.

### PROPOSED SYSTEM

The proposed system is used by the customer for parking slot reservations. Here the customer can book the car park slot. When he reaches the slot, the later user must exit the slot he wants to pay for the time his car is put in the slot field.

#### System Design:

The system architecture[4] explains the system structure, behavior and more system and analysis views. The design goal is to produce a system module which is used to build the system. In the proposed system, he can initially view the real-time parking slots that are available for parking

once the user logs into the application. After viewing the slot based on FIFO method, the parking will be allocated to the users, so once the parking slot has been selected by entering all the required information, the parking area can be reserved. So once he reaches the parking area his parking period will start, if the person does not take the car with him in the specified time the message of warning will be issued. Then later he leaves the area the time in and time out will be calculated and the amount will be paid. If the person does not take the car with him in the selected, his parking time will start once he enters the parking area.

#### System Architecture:

The goal of design is to produce a module of the system which is used to build the system.

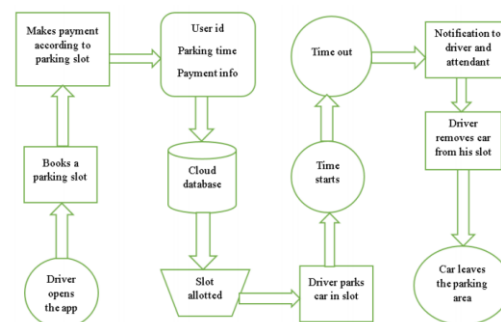


Fig. 1: Proposed System Architecture

- The user will register to the application, then he get login into the application by entering the user name and password.
- Initially in the homepage user is able to view the real time slots that are available.
- By viewing the availability of the slots user selects the particular slot area and enters the required information such as vehicle number, parking slot number[5], in time and outtime.
- The data is sent into the cloud and the slot gets allocated to the user.
- Once the selected out time is going to finish, if the person did not receive back his car the alert message will be sent to the user.
- Later the user leaves the parking slot area and pays for the respective time period.
- Later the availability of the slots will get updated in the homepage to view.

*Algorithm:*

Algorithm can perform calculation, data processing and automated reasoning tasks. As an effective method, an algorithm[6] can be expressed within a finite amount of space and time and in a well-defined formal language for calculating a function.

Algorithm 1 describes about the user and the staff relationship about allocating the parking slot.

**Algorithm 1: Algorithm of System Operations.**

Step 1: Start

Step 2: If user not registered

User registers into the system

**Else**

Login into the system

Step 3: User sends the request

Step 4: Staff will receive the request

Step 5: If parking space is not available

Staff will send the message that slot is not available(try another Park! Unavailable space)

Go to step 3

**Else**

Staff will send the reserve parking slot number to the user

Step 6: User enters the car parking

Step 7: End

When a user tries to find a parking lot, he should register to find a free parking lot by using the system, and then he sends a request through the application[7]. The system will get the request and check the table of available parking to receive the message and to check the park using table. When a car reaches a parking lot, the drivers should be verified by staff. This verification process is achieved via checking the parking website. If the information is correct, the driver received a receipt and enters the park. Later, the driver checks if the lot is empty. If so, then he will park and the change the state from reserved to park. If the current car parking space is full, the system will send a new message that includes, Try

another Park! Unavailable Space, as shown in algorithm 1.

**Algorithm 2:update staff table**

Step 1: Start

Step 2: detects the vehicle using the ultrasonic sensor

Step 3: update the staff table

Step 4: If the vehicle is leaving

Update the staff table

Go to step 2

**Else**

Go to step 2

Step 5: End

The ultrasonic sensors[8] detect the shift in signal after the car has been stopped. For update the table case, the machine updates the condition of each lot every 2-3 minutes; Achieved by setting the system as shown in algorithm 2; Updating the new vehicle park urgent data contains a new address. The new message will be selected based upon the current vehicle's reserved parking lot.

*Working Process of Parking Slot:*

When the ultrasonic sensor senses the vehicle's presence the signal will be sent to the Arduino. Arduino will then convey the signal to the relay [9]. Relay is connected to the bulbs which he led. When it receives the signal sent by the Arduino, it will either on or off the bulb based on that signal. Ultrasonic sensor works by transmitting sound waves then waiting to reflect back the sound [10]. The sound waves sent by the ultrasonic sensor when the car enters the respective slot hit the car and reflected back and sensed the car's presence.

**RELEVANT APPLICATIONS**

The importance of smart parking is:

1. Accurately sense and predict spot or vehicle occupancy in real-time.
2. Guides residents and visitors to available parking spot.
3. Optimize parking space usage.
4. Simplifies the parking experience and adds value for parking stakeholders, such as merchants and drivers.

5. Helps the free flow of traffic in the city leveraging IoT technology.
6. Enables intelligent decisions using data, including realtime status applications and historical analytics reports.
7. Smart Parking plays an important role in creating better urban environment by reducing the emission of CO<sub>2</sub> and other pollutants.
8. Smart Parking enables better and real time monitoring and managing of available parking space which results in significant revenue generation.
9. Provides tools to optimize workforce management.

### CONCLUSION

The proposed parking system allows drivers to obtain information on parking space availability and to reserve some parking space via a suitable GUI, which means parking management facilities based on reservation. This proposed system will easily detect unsuitable parking within the parking lot of the vehicle's and estimate the period of the occupancy of the parking lot by some vehicle using an integrated feature called a parking meter which is deployed at each parking lot. The proposed system also allows for automated parking fees to be obtained by supplying the driver with smart payment options. It has been described the problems that would arise while working with the smart parking system as well as the solutions that give all users a good platform. It ensures the ease of life for individuals struggling in their day-to-day daily routines with the implementation of a smart parking system. The framework we are proposing provides information about the availability of parking spaces in a parking area in real time. By using our mobile application users can book a parking slot for them. Thus users can save time searching for parking slots.

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