



# Smart Parking System using IOT

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With the development of road infrastructure, there is a significant increase in number of private vehicles which results in traffic congestion, directly effecting the flow of traffic, and life of citizens. Parking becomes a significant problem in the urban areas (Cao & Menendez, 2015). The research paper proposes a smart parking system to solve the current parking problem at affordable cost. Previously automatic car parking system were proposed to reduce the space or size required for parking especially in crowded places with few spaces, such as a multi-story car park providing cars with parking on multiple levels stacked vertically to increase the number of parking spaces (Ibrahim, 2017). The proposed system utilizes the latest advancement in the Information and Communication Technologies and consists of four layers: Application, Middleware, Networking, and sensor layer. It offers environmental friendly, reduces harmful emissions during parking, and is a computerized system pre-programmed without human intervention. The research paper highlights the comparison of traditional parking system with smart parking system using IoT. The paper also proposes a framework for smart parking system.

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## Introduction

Smart parking system using IoT to identify vacant positions and occupied positions without the need to waste time in finding a suitable position for the cars. The status of the parking slot detected by the wireless sensor is sent to the database via a gateway and car information is transferred to a database to save and store (Fraifer & Fernström, 2016). The system allows the date and time of entry to the parking area, the date and time of exit from the parking space (LeBeau, Contreras Albuja, Altavilla, & Li, 2018).

Proper and balanced planning based on automatic and intelligent system to organize parking and provide it with sensor system to detect available, occupied, and reserved parking slots. Streamlined entry and exit of parking, no need to lose time and fuel in order to get parking, smart parking feature and the presence of surveillance cameras. To ensure the safety of the vehicle and passengers and the presence of fire extinguishers throughout the parking. Smart parking does not cause traffic jams as the time is not wasted to find the available parking space in the parking area and the driver of the vehicle is aware about the location of available parking slot and.

## Problems Statement

The number of cars is increasing day by day (Guerra, 2016). The main problem is to find a parking slot, whether in the shopping mall or companies or at the airport or in hospitals. An average, people spent 20 minutes to find a suitable parking for the car (Litman, 2018). Most of the people park their cars in places not designated for parking, and parking in places not reserved for parking slots. This results in the disruption of the traffic and sometimes in the movement of people. Usually, there are reasons to park people in places not reserved for parking such as the area designated for parking is not enough to cater the needs. This is due to the weak planning and not thinking of solutions to keep pace with the large increase in the number of cars, and most people park the car for long times without thinking. Drives looking for parking space is a major cause of traffic congestion and accounts for 30% (Tsakalidis, Julea, & Thiel, 2019).



## Traditional parking System

In recent years, number of car owners are increasing day by day, when someone tries to find a position to stop his car after a long day of work surprised by the lack of parking to stop his car and see the driver passes positions more than once to find him a position. Traditional parking consists of only two passages to enter and exit port. In some parking only one entrance to enter and out of space, while parking spaces are small for a small car, while the big vehicle takes more than one position, which makes things worse, sometimes the car stands but when it is not possible to open the door (Zhou & Li, 2016). The car is scratched with the next car because the parking is too small and cannot take up enough space between cars for the parking, but when you exit take a lot of time to get out of the car for fear of bumping any car near-by.

## Smart parking system

The traditional parking has been developed to a parking system that helps the driver to know the occupied and available positions through a display that contains the number of available parking spaces and where they are located (Pham, Tsai, Nguyen, Dow, & Deng, 2015). Vacancy in a car cannot take this position, and in the case of the car out of the position goes light green and gives an update of the screen the presence of a vacant position can any car can stand in that position (Fraifer & Fernström, 2017), this system is used in many places and solve the problem of random parking and not to stand in places not available to stand up (Pham et al., 2015).

Smart parking consists of two networks, an external network and an internal network, the external network is that the user connects to the Internet and enter the application of smart parking to reserve a position and be booking anywhere available in a data network, and the user enters the server of smart parking to be able to reserve the desired position without the need to access parking Through the application the user can know any vacant positions and available and places parking , The internal network of parking is the process of connecting all devices smart parking When the server is sending a signal to the cloud and the role of the cloud send this signal to the display screen and from the display screen to the sensor and the sensor to the top of the position and vice versa and this communication is done internally without the intervention of any employee or user.

	Traditional parking system	Smart parking system
Planning	Without planning	With planning
Right parking	Parking any where	Parking in right area
Using IOT	NO	YES
Secure	No	Yes
Comfortable	No	Yes

Table 1. Comparison of Traditional and Smart Parking System

## Smart parking in UAE

The United Arab Emirates is one of the Gulf countries faced the problem of finding parking. this problem was associated with the exceptional growth in the large number of cars, buses and trucks, before a period is finding a parking for the car was a real challenge because of the lack of sufficient parking (Gossling, 2017), and the random planning in the management of parking. The reasons that resulted in the problem of parking, has been a new application of parking and regulating the movement of parking and exit. The UAE is the forerunner in the field of smart parking, and the Emirate of Dubai and Abu Dhabi more than interested in smart parking.



## **Advantage of smart parking system**

- Accommodating many cars
- Car parking is organized and easy
- Easy access to vacant positions
- Prevent vehicle theft and vandalism

## **Smart parking in Japan**

It is considered one of the developed countries in the field of smart parking, where in the early nineties was established more than 40,000 parking attributable to the fact that Japan suffers from narrow areas and estimated only 20% of its land is suitable for housing and population and living and the rest mountains and volcanoes (Axhausen, Chikaraishi, & Seya, 2015). The 20% were exploited creatively and wonderful Problems arising from the lack of parking spaces are becoming more susceptible to traffic congestion, particularly in densely populated areas. Therefore, urges the government to use other means Such as trains and bicycles minimize the use of cars to preserve the environment from pollution.

## **Smart Parking System Using IOT**

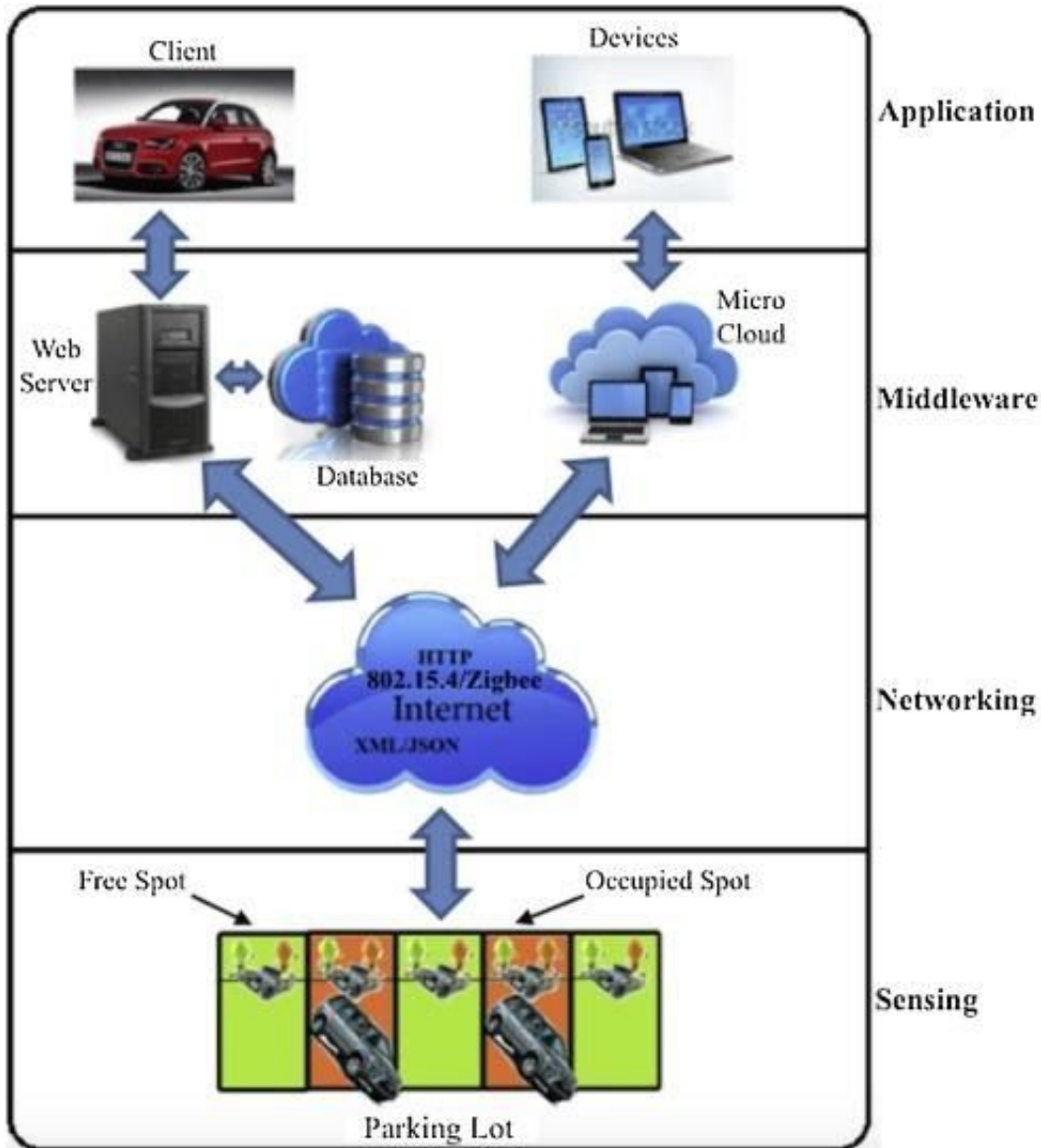
With the growth of smart cities, there is a constant demand for smart solutions to the problem of attitudes

Internet of Things has witnessed a significant and significant development in many sectors. Internet of Things addressed technological constraints such as storage, processing and energy. Internet of Things is able to use devices heterogeneous in nature and allows different devices to communicate and exchange data in an acceptable format. The Internet of Things consists of a large number of information sources.

The proposed system consists of smart parking using the Internet of things to monitor any nearby parking and reference to parking. There will be an application for phones allows the user to search and check the availability of parking and reserve parking for a limited time without loss of time and effort.

Smart Parking system will combine technology and human innovation to minimize the use of resources such as space, time and fuel. The goal of this research is to achieve faster and easier parking and organize less time in finding a position.

In each position there are two of the red and green. Red light indicate that the position is not vacant while green position represent vacant parking slot. In each position there is a sensor and a horizontal range of a meter to send the signal to the server that this position is not available. The position is reserved and one number is decreased from the total number. The users can use the mobile application for free and can reserve any parking space. Reserve any position of choice by the day and by hour and the amount is deducted from the credit/debit card and the discount is immediately upon parking in the specified position.



**Figure 1.** Smart Car Parking System Using IoT

## Database

In smart parking database is necessary to work the parking easily and conveniently. The database acts as an intermediary between the internal network and the external network represented in the application. The database includes the data of each car booked position such as the car number, color and driver name and the last time the parking was reserved and the number of hours reserved. Payment is also done, and this method is done with all cars that have reserved parking, the database must also have a reference copy of the data be a reference in case of damage or loss of data. The database will be available individually in case someone wanted to see his data when entering the parking.

## Sensing

Sensors are a critical component of smart parking system. Smart parking is a sustainable and intelligent way of working, by integrating all of its structure. Infrastructure, services and smart devices to monitor and control the parking to ensure sustainability and efficiency. The sensor is



located at the heart of smart parking system to monitor and work smartly. Sensors deployed in smart parking to monitor the movement of cars inside and outside the parking. Sensors are interconnected with each other and operate through a network. Sensor sends the signal to the devices deployed in the parking enters or exits, which sends a signal to the database. The display updates the data of the vacant positions and the occupied positions. It is red and green based on the signal that the green light is available and the red color is occupied. Arduino is an electronic piece to connect the sensors with each other and used with Arduino piece called Node mcu This widget helps to connect to Wi-Fi, real time clock connected to the sensors to see the time reserved by the user and the hour of exit from positions and be linked to the application to give an alarm near the end of the specified position reserved, the display screen of reserved positions and available positions and be connected with the Arduino to know the status of positions and work continuously update For positions.

## Using cloud

The cloud provides the processing and storage of data for the parking service. It stores a lot of information about the available and occupied parking, and the time of entry and exit. It also provides the location of the parking, and give the cloud update in the case of entering a new car in the parking or exit the car from the parking.

## Server and database

The server works with the database as a bridge between mobile applications and the cloud, where if a person wants to reserve a position in a certain period of time, the server asks the cloud information about the available positions and positions occupied and presented to the consumer to search for a position that suits him. The server sends an update to the cloud that this consumer has chosen a position and set the time of entry and exit, and then sends a signal to the display screen to reserve the position, and the server is connected to a database of all consumers who have booked by mobile phone and entry and exit times.

## Application

Mobile application can be used to reserve a parking position or search for positions that are close to the intended location of the visit. Most applications require an Internet to work efficiently and explore the best places to stand, the user can book by computer or laptop or mobile phone (Kahn, Kinsolving, Vogel, & Christensen, 2018). The application sends a message to the user about the location of the position, the hours of parking, and billing information.

## Conclusion

IoT based Smart parking system has been proposed in this paper to avoid traffic congestion, random parking, and obstruction of traffic in the parking area as well as to search and wait for a parking space. The proposed system described in this paper is built with four layers: Application, Middleware, Networking, and sensor layer. The research paper highlights the comparison of traditional parking system with smart parking system using IoT. The paper also proposes a framework for smart parking system.

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