

# Sophisticated Parking Availability Prediction System in IoT Network

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**Abstract**— Internet of Things (IOT) plays fundamental role in connecting the surrounding environmental things to the network and made easy to access things from any distant location. Sophisticated Parking Availability Prediction (SPAP) system is becoming important part of intelligent transportation system due to rapid increase in vehicle density particularly during the peak hours of the day. It is a difficult task for the drivers to find a parking space to park their vehicles. In this paper, we study parking availability and prediction techniques which provide most favorable solution for parking problem in metropolitan cities. SPAP system enables the user to find the nearest parking area and gives availability of parking space in that respective parking area. It mainly focuses on reducing the time in finding the parking space and also it avoids the unnecessary travelling through overflowing parking area. Thus it reduces the fuel consumption which in turn reduces carbon footprints present in the environment.

**Keywords**—IOT, SPAP System, ETA, RFID, PRA Algorithm

## I. INTRODUCTION

The usage of vehicles got increased due to increased population in the metropolitan cities. It causes problem for parking vehicles which leads to traffic congestion, driver aggravation, and air pollution. When we visit a variety of public places like multiplex cinema hall, Shopping malls & hotels during the carnival time or weekends it creates more parking difficulty. In the recent investigation found that a driver takes approximately 8 minutes to park his vehicle because he spend more time in searching the parking lot. This searching leads to 30 to 40% of traffic congestion.

Traditional way for searching parking space is manual where the driver typically finds a space in the street through luck and experience. This process takes time and efforts and may lead to the worst case of failing to discover any parking space, if driver is driving in a city with high vehicle density. The alternative is to park car with high capacity. However, this is not favorable solution because the car park could usually be far away from the user destination.

In recent years, several research efforts and progressions have been carried out regarding smart parking system [1,2,3,4,5,6,7,8,9]. Studies show that the availability of parking space and traffic condition information to the users lead to a reduction in searching time for parking locations and consequently to a reduction in air pollution, fuel consumption and in walking distances [5], [6].

A SPAP system is designed to help out drivers in finding parking space more effectively, by acquiring the necessary data from the infrastructure, processing acquired data, and

communicating the results to the driver [4]. SPAP system typically helps us to search parking space with the help of immersing IOT technology. Recently in the development of Smart City, IOT is the emerging technology used for smart and quick operations. With the help of IOT it uses low cost sensors, real time data collection, and mobile phone enabled automated payment systems that allow people to very accurately predict where they will likely find a spot for parking.

### Need of Work

Traffic congestion caused by vehicle is an alarming problem at a global scale and it has been rising exponentially. Car parking problem is a foremost contributor and has been still a major problem with increasing vehicle size in the luxurious segment and restricted parking spaces in urban cities. Finding for a parking space is a routine and often annoying activity for many people in cities around the world. This search burns about one million barrels of the world's oil every day [1].

Now days in the development of smart cities, IoT is the immersing technology. IoT is the network that can be applied to living things and non living things i.e. people, infrastructure and every other entity on globe. Unique identifiers are provided to every entity using IPV6 addressing so that they can be able to shift data over the network without requiring any human to human interaction or human to computer interaction. Therefore, with the help of IoT we can precisely predict and sense spot which is used in SPAP system.

## II. RELATED WORK

In the past few years, there have been so many research efforts and advancements taken regarding parking systems. A parking system is designed to assist drivers in finding parking space more effectively. Research shows that, availability of parking space and traffic condition information to the users lead to a reduction in searching time for parking locations.

Tooraj Rajabioun, Petros A. Ioannou, in “On-Street and Off-Street Parking Availability Prediction Using Multivariate Spatiotemporal Models” [1] implemented a vector spatiotemporal autoregressive model that can be used to predict the parking availability for on-street and off-street parking locations at the estimated arrival time of the driver. The proposed model considers temporal correlations of parking availability data, as well as spatial correlations. But the accuracy of predictions depends on the time horizon ahead

T. Rajabioun in “Intelligent parking assist” [2] implemented a parking system which uses 4G cellular networks to communicate with vehicles. The use of these technologies alone however will not achieve the best possible result with respect to parking availability when needed. One problem which arises in the on-street parking guiding systems is that the real-time parking availability data is useful only when the driver is very close to the parking location. This kind of data does not help in recommending a parking location at the start of the driver’s trip or even in the scheduling of the trip.

P. Miranda in “Prediction of parking space availability in real time” [3] proposed a prediction system for parking garages which involves probabilistic models as well as simulations

J. Sahoo in “Agile urban parking recommendation service for intelligent vehicular guiding system” [4] proposed a prediction algorithm based on autocorrelations between different time lags. These studies are focused on the parking lots data, where the data is available and predictable. While parking data used have multi-dimensional dependencies and correlations. Applying these algorithms to the on-street parking case results in considerable errors, mainly due to the fact that the variance in parking availability for on-street parking is relatively higher than the variance for off-street parking.

## III. METHODOLOGY

SPAP system is developed for creating parking system better, supple and secured, for this we developed a frame work. This proposed system architecture having a Raspberry pi board, which is small in size but it works like a master computer. The entire central processing unit replaced by this simple small atm card sized board and it is available for cheap prices in market. This will uses Raspian which is tiny OS, similar to Linux based environment. It will act as a

server for smaller applications. This system uses IoT technology with the help of which we can access, control and communicate the things remotely.

This system consists of different modules to perform management of parking system. Those are ‘online booking of parking space’, ‘parking entry system’, and ‘parking exit system’ and ‘sophisticated parking management’. User faces the problem to find the parking place in and around the city for solving this problem we developed the module ‘online booking of parking space’ using which user can book the parking spaces in advances that is shown in Figure 1.

When the car appears at parking spot then it deals by sophisticated parking management module. Here RFID technology is used to detect the number plate, details of car can be checked first with database for predicting that car robbed or not. If the number plate matches then we will send SMS to nearer police station. For which we are using IPv6 protocol, used for internet association and we can connect our own smart things with rest of the world. This makes IoT employing anywhere.

The address space difficulty in IPv4 is overcomes with IPv6, and for client no need to move towards any server because they gives permanent address by this protocol. Here version is 6, traffic class generates packet priority, flow label maintains sequence flow of packets, payload length describes how much information contains in each and every packet, next header field contains address of next packet, hop limit tells that how many nodes can passes this data, after that packet vanishes and address contains (128 bits) of source and destination in hexadecimal format. RFID unique code (96 bits) can send through this protocol, it also consists RFID tag particulars like that RFID is active or passive determined by RFID type and type of message and message data also included with solitary code. After that it’ll assign the slots based on availability and that is discussed in Figure 2.

Sometimes user confuses to park his car in a given portion, he may mistakenly park and while parking his car he can damages others cars also that makes proprietor angry and we can’t find him at all, for solving such problem we developed parking management system that is shown in Figure 3. From which user can pay attention to park perfectly and if injured that will predict from database. If the user wants to depart the parking space, user need to pay the parking fee either in online or offline that will be managed by parking exit system.

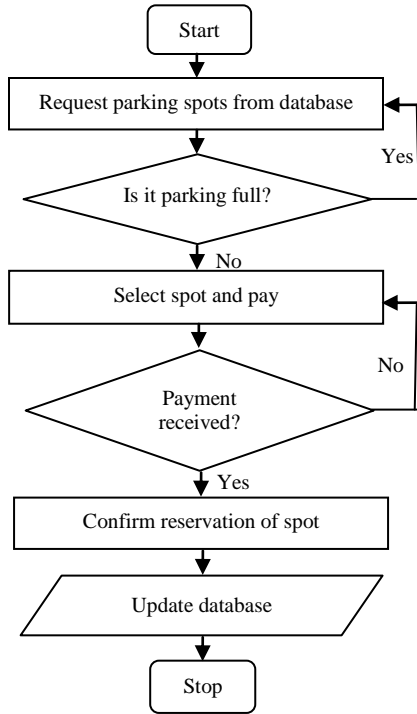


Figure 1: Flowchart of Online Booking of Parking Space

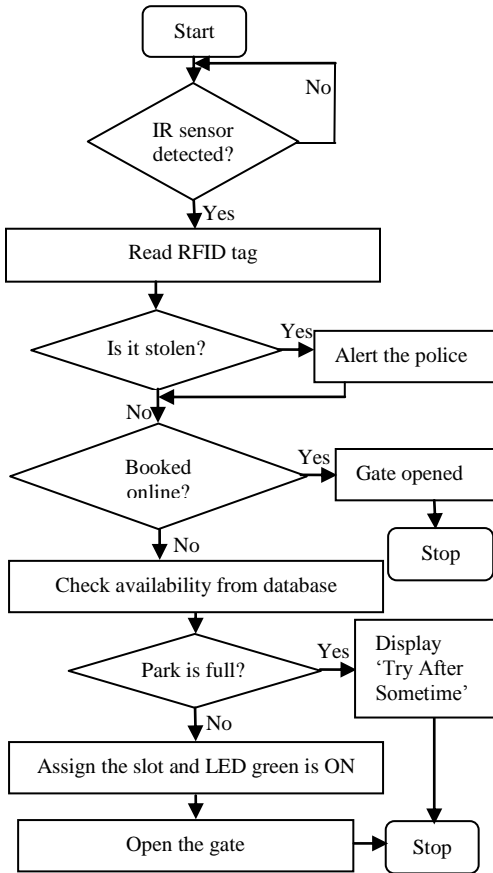


Figure 2: Flowchart of Parking Entry System

, as shown in Figure 4. These all data constantly updated in database using internet. The system admin can see the database using admin login in web portal and also user can book the slots by login to the web portal.

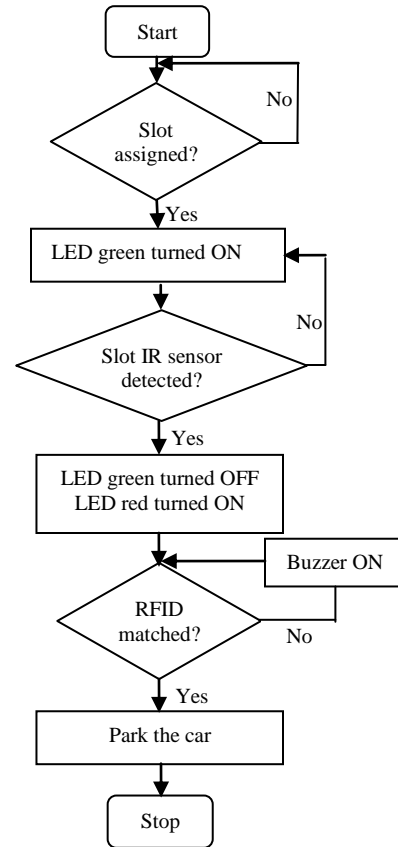


Figure 3: Flowchart of Sophisticated Parking Management

**Online Booking of Parking Space**

In urban areas finding parking space is difficult in hurry hours. So here we developed online booking system by using which we can book the parking slots in advance. We can book the parking spots by using android mobile app or web portal. The booking procedure explained in the above flow chart. Database provides sophisticated parking availability information; if there are any empty slots available then we can book the concerned slot and complete the payments. When we finish booking, the database is updated with present availability.

**Parking Entry System**

This parking entry system uses DC motor, IR sensor, LCD display and a RFID reader. IR sensor is used to know the occurrence of car for parking, DC motor is used to open the obstacles, LCD is used to display. The parking information and RFID reader is used to notice the car details like number plate, owner name and so on. After detecting the number

plate, it will check with robbery list, robbery list will be provided by police and list will be maintained in database. If it matches with the present number plate then SMS sent to the police. If the user booked online parking space then gate is opened

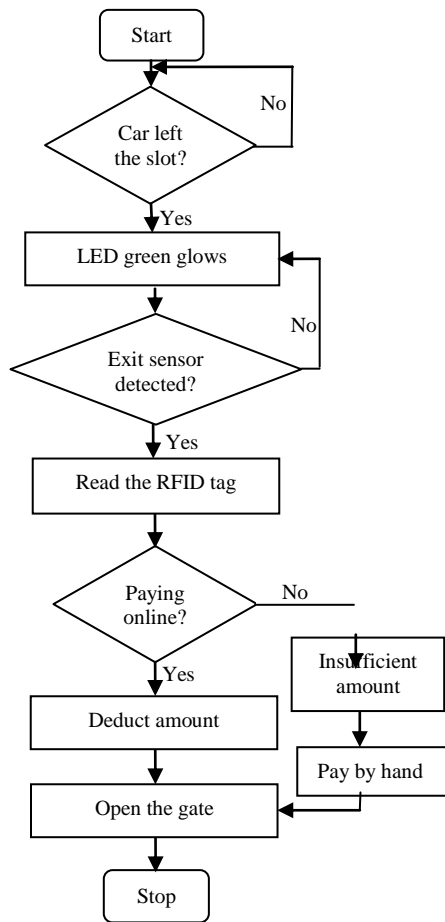


Figure 4: Flowchart of Parking Exit System

and can move inside. The LCD displays the allotted parking place and parking status too. These allotment details of parking place can be continuously updated into the database.

### Sophisticated Parking Management

Sophisticated Parking Management provides directions to the owner to park their car properly. Here each spot selected by one IR pair, three LEDs, one RFID reader and a buzzer. Initially it will check the spot which is assigned or not, if it's assigned then LED green turns 'ON'. If any car entered in the parking slot then IR sensor detects, LED red turned 'ON' and LED green goes 'OFF'. Now RFID reader reads the car's RFID tag, if allotted car RFID is not matched with present detected car RFID then buzzer is 'ON' otherwise park the car. If buzzer 'ON' user can understand he parked his car incorrectly then he can left the spot and goes to his allotted slot. This data continuously updated in the database.

### Parking Exit System

Parking exit system contains peripherals similar to parking entry system. If the car exit from the parking space then LED green turned 'ON' and at the same time LED red turns 'OFF'. At exit, the RFID reads the car particulars and shows the parking fee. Payment is users choice, he can pay either online or offline. Since we finished the payment then gate opens and the data all uploaded to server.

## IV. CONCLUSION AND FUTURE SCOPE

The proposed sophisticated parking availability prediction system takes into account all possible attributes that is expected from it. This system uses IoT model that predicts parking availability at the estimated arrival time which will enhance the performance and improve the acceptance of parking systems. The proposed model is used to recommend the parking location in minimum time and with the highest probability

The main purpose of system is to develop parking system using Internet of Things. IoT is the present trending area in internet, used to access the information remotely. In recent days everyone uses smart phones and internet, so online booking can be provided to the predicting parking space problem and user can pay parking fee online. RFID technology is used to detect the car identity i.e. number plate within fraction of seconds and the main issue of robbery recovery has been overcome. We can send messages through internet, if we achieve that then it reduces cost of the hardware.

The SPAP system provides solution to the perfect parking and reduces man power. This system can be employed in airports, corporate offices, multiplexes etc. Still it has consequences, if number of spots increases controller cannot handle for that wireless sensor networks need to be replaced in order to make SPAP system more reliable, also we can develop an android application and collect all other parking spaces information accurately

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