

# A Hybrid Technique for Smart Parking Management System in a Smart City

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## Abstract

Considering the urban environment, we proposed a new model "Parking Management System". The complete model provides you the basic features of the parking system. The system designates an exact parking slot for the driver. On the basis of user requirement, it includes the proximity to destination and the cost of parking. The capacity of overall parking is utilized efficiently. The system approach solves the problem at individual decisions in a time driven sequence. This is the most favorable solution based on the allocation on present state affair and subject to the arbitrary incidents such as the request of the new user and availability of the parking space. At the next decision point, the allocation is updated ensuring that there is no conflicts in the resource reservation and the assignment of resource have the higher cost than the current cost of function value. The proposed system enables users to find out the free parking space on the cost on new performance metrics to calculate the cost of user parking under the consideration of distance and the total no of free places. The system show that the algorithm helps improves the probability of successful parking and the user waiting time is minimized. The proposed system is implemented by us in the real world successfully.

**Keywords:** Parking, Dynamic Resource Allocation, smart city.

## 1. Introduction

In the current decades, traffic authorities in countless built-up communities and cities are establishing Parking Guidance and Information (PGI) frameworks for efficient parking management system. PGI frameworks present drivers with effective data on parking inside supervised regions of the system and direct them to empty parking spaces. The traffic management system handles the cost of hiring people and optimal resources uses for the parking of the car. But in widespread when a driver penalized for a parking slot blue-collar in the thoroughfare by fortune and occurrence. This process is time consuming and it may lead the worst case of failing to detect any parking space.

Intelligent parking system was developed to reduce the cost of hiring people and optimal place for car parking to the owners. The option to provide the large parking place in real time scenario to avoid the parking problems. This system is the most optimal as compared to the previous one in the city. In any case, this isn't an ideal solution for the car park system.

In recent studies the researcher represents new technology in vehicle and infrastructure with the help of wireless sensor network. Using this system the driver can find information about the free slots in its nearby location. In this system the driver uses phones and table PCs.

This study aimed to provide information about the optimal parking area nearby with the real time data manipulation. The owner wants to buy the parking place with some time slots then they can use the smart phone or web sites to make the reservation.

Each vehicle consisting of RF ID which can be used for the authentication of the vehicle. But the current system in not efficient in optimal ways to find the available parking space. The system doesn't solve the problem of load management, doesn't give economic profit, and doesn't arrange for vehicle-refusal service [15-18].

Parking system is based open detection and monitoring the parking spaces and reservation of spaces by use of cellular network. This system is works on the help of sensors placed in their transmission range for detection and surveillance of object [5]. The PGI system is used to reductions in travel time and it helps little bits with some vehicle benefits in parking system [7],[8]. By the help of PGI system, Drivers can obtain parking information before and during the trip, and it also gives the benefit of reserve the parking spot [9]. Drivers can access the server of parking system by the help of cellular phone or Internet. The car can be recognized at the entry point of parking area by the help of Bluetooth technology and reserve the parking space and payment the parking price through this technology [10]. It has come to know the traffic management can be done by parking price factor in that system is defined in [4]. For example, in San Francisco there are already time-dependent or demand-dependent parking fees to achieve the right level of parking availability in different areas [11].

Current parking system increases the probability for viewing vacant place [13]. At first the drivers will be helpful for finding a suitable parking spot by checking the real time information [12]. Safety issues are also associated with it. Secondly it helps the drivers to park economically. Thirdly it increases the congestion

of the traffic and makes the system unbalanced. It makes the parking problem more badly and hence cannot solve the issue. In [13] [14], a new concept for smart parking has been described. Hence an optional space is reserved for the driver depending on the proximity and cost. It also ensures that the overall parking facility is utilized this problem has been resolved in [13] and a case study has been described in [14] for evaluating the performance.

In this paper detailed information has been represented to resolve the parking system in Bhubaneswar along with the four requirements.

In the rest of the paper it is organized as section 2 describes the allocation procedure & framework for the smart parking system. Section 3 represents the basic requirements to build a mathematical model of the system. Section 4 gives the details of proposed parking system & section 5 represents the conclusion & future scope.

## 2. System structure of Smart Parking and its implementation

The “Efficient Parking System” Proposed here uses the PGI structure and also requires a Parking Data Management Center (PDMC) along with the Central Data Processing Unit for Request (CDPUR). Figure 1 shows the outline, where the Efficient Parking Management System (EPMS) collects information & distributes via (MS).

It reserves space & allocates the parking spots for the drivers based on the demand.

In this allocated process drivers send request to PDMC for finding a parking spot. The order uses two activities i.e. cost of parking & walking distance between the destination & parking also it contains the information about drivers ID, License no, car no. etc. all the driver information are collected in EPMS and sent to PDMC over a network in particular time & optimizes the objective. Then all the assigned spaces are informed to the drivers through PDMC. Once the driver gets the information he can reserve a parking spot or can

modify it also. Then that spot becomes reserved & updated on the EPMS. If the driver wants a diff spot then he has to wait a little. Depending in the use of the parking system the drivers can change their position & parking cost. The details process is described in Figure 1.

The achievements of such a system depend on four main needs. First of all allocate center should be aware of all the parking spots along with the requesting vehicles. Secondly there should be an eff. Communicate system between the center and the vehicle. Thirdly it must provide a guaranteed parking spot. Finally it should be implemented ensuring the reservations & optimal allocations. The following implement the four main requirements.

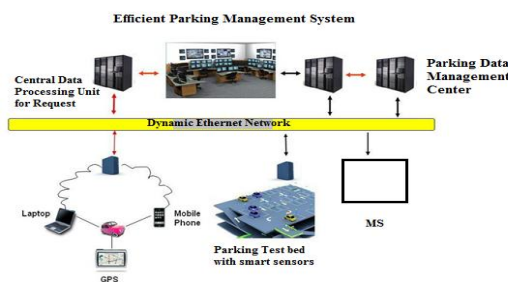


Figure 1.: Efficient parking system

## 3. Mathematically Efficient Allocation Model

The main advantage of this “Hybrid Technique for Smart Parking Management system” which provides the best parking for every driving individual this is guided by an algorithm at EPMS. This problem has been illustrated in [13] [14]. Here we concentrate on reducing the problem scale. At first we do the review on the dynamic parking resource problem formulation [13]. A model was adopted for the problem given in fig. The state of allocate system is defined at the decision point in the queuing model.  $P(\alpha)$  as given below.

$$P(\alpha) = \{A(\alpha), B(\alpha), F(\alpha)\} \quad (1)$$

Where  $A(\alpha)$  represents i no of user are in waiting state.

Where  $B(\alpha)$  represents i no of user are in Redy queue.

Where  $F(\alpha)$  represents as:

$F(\alpha) = \{F_1(\alpha), F_2(\alpha), \dots, F_N(\alpha)\}$  is the value set represents the state of the  $\alpha^{th}$  recourse with  $F_k(\alpha)$  of free space for the parking slots of resource  $k, k = 1, 2, 3, \dots, M$ . Here each resource has a specified location map which is denoted by  $P_k$  in two-dimensional (2D) space and its occupying capacity  $n_k$

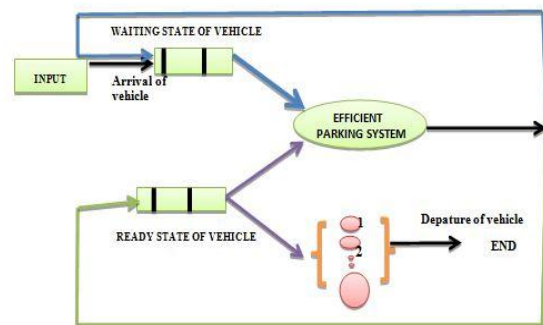


Figure 2 : Parking space allocation of vehicle

We represent the state value of  $i^{th}$  user  $T_i(\alpha)$  this can be described as :

$$T_i(\alpha) = \{u_i(\alpha), v_i(\alpha), w_i(\alpha), \beta_i(\alpha)\} \quad (2)$$

## 4. Proposed Method

The parking system has ‘n’ control site, which is connected to every site by logical channel. Parking of vehicle event computation can be an internal event of that site  $s_i$ , a message send over with send event to the central site. Events are assigned timestamps as per the server clock scheme. The parking model represent an algorithm with three folds Request for parking vehicle Acquire the park shots to parking. Figure 3 describes the procedure for efficient parking management system also represents Parking space management system during the vehicle is arriving. A The presented scenarios of research discusses the various possibilities of Intelligent Parking and its enhancement and a new view of Intelligent Parking in terms of Wireless Sensor Network. Parking control site  $s_i$  has the following local variable to record its events state Request and the test bed mechanism is defined in Figure 4 and Figure 5 The presented scenarios of research discuss the various possibilities of efficient Parking and its enhancement and a new view of Intelligent Parking in terms of Wireless Sensor Network. In proposed model it precisely forecast and experience spot/vehicle occupancy in actual-time. The procedure defines the vehicle and space management in efficient ways.

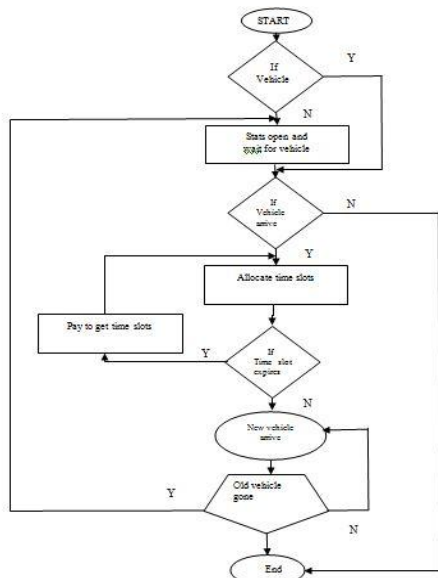


Figure 3 : Flowchart for parking space allocation of vehicle

4.1. Proposed Hybrid Parking System Model:

The proposed design represented in Figure 4. It describes that, the structure of the parking management system consists of Anchor node ,sensor device, parking data hub master node and LAN Network to create a smart parking system. The network is connected with wired links by help of I2C and Ethernet protocol. In the smart parking field master sensor node is used for identifying the presence or absent of car. The master node is deployed efficiently in parking area to collect the field information and send to the parking data hub. The proposed model describes the optimal ways of sensors are deployed in the sensor field to manage the parking area efficient ways. While the anchor nodes constitute the backbone of the sensor network. The hybrid parking system works on IOT level 6, where a centralized controller node is present as the master node and the anchor nodes as the monitoring node. The data are collected from the anchor node and the master node collects the data from the anchor nodes. The data are then forwarded to the main database for manipulation by using LAN.

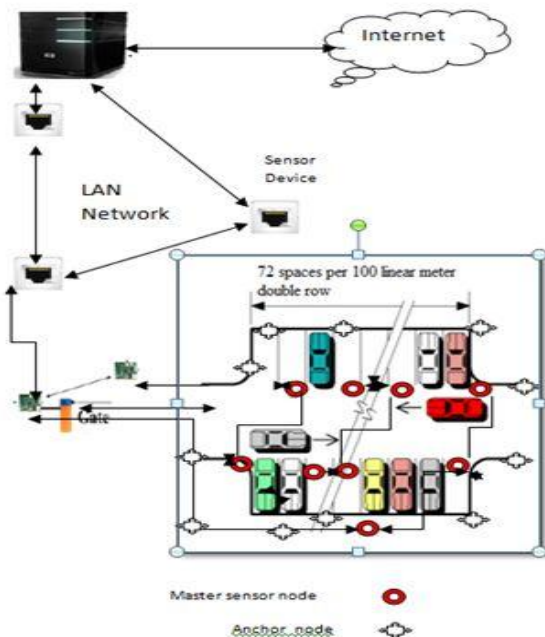


Figure 4:. Hybrid Parking management system



Figure 5:. Parking test bed

Algorithm-1(Parking System procedure)

Phase-1. Parking request phase

A parking control site  $s_i$  has the following local variable to record its events state Request

1. if the parking site  $s_i$  does not have the empty slot then it increments its site sequence number,  $pN_i[j]$  and send a message  $p_{message}(I, c_k)$  to server and all other sites.
2. When the server  $s_m$  and other site  $s_j$  receive that parking update message it set  $pn_j$  and send reply to server.

Phase-2. Parking the vehicle phase

3. Parking node only if parks when it receives the empty slot message from site  $s_i$ .

Phase- 3. Release the parking slot

After the node release the parking area, the node sends release(i) message to all the control sites.

Algorithm-2 (Parking management system)

1. Passing a message  $prob(a_i, T_i)$
- Where  $a_i = \text{space slot} \ \& \ T_i = \text{time}$
2. if  $((a_i, T_i) = 0)$
3. Free(  $a_i$  )
4. else
5. Check for the next tern (  $a_i+1$  )
6. Repeat for every  $T_i=0$
7. Exit

Algorithm-3(Alert System of parking )

```

int Alert(int place, float time)
{
    If(time= =0)
    {
        Slot [place]= =0;
    }
    Return 1;
    Message(place);
}
Else
{
    Time[place]=time-1;//millisecond
}
}
    
```

5. Conclusion

The proposed Hybrid Technique for Smart Parking Management system adopts the new technology to detect the parking space and vehicle in efficient manner. This system also allocates the free space in optimal manner in the park area. We represent the

proposed method to find the parking space in an efficient manner. The goal of the system is to searching the availability of free slots. The integration of image processing and the use of RF ID have made it a smart system.

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