

Smart Reserved Parking System using Internet of Things (IoT)

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Abstract: A recent survey shows that in most parking systems, the number of cars are always more than the number of available parking slots, thus to fix this problem we propose a “smart” parking system which reserves a space for parking the vehicles prior to arrival. The smart parking reserves space from private parking’s, inbuilt parking’s in malls etc and also you can utilize the garages of private house owners, provided they have signed up for the service. The user can reserve the parking system prior arrival from our app. The App will look for parking spots that are available within a 300m radius from the selected destination. The app locks a particular spot when the user is near the location and the ETA is less than 30 minutes. To achieve this process 3 different algorithms are used. There is also a “Prime” feature which has some upgraded features for premium users.

Keywords: Smart Parking, Iot, Dijkstra’s Algorithm, Prime Feature, Sensor, Parking Lot Reservation Algorithm, Rate Algorithm.

I. INTRODUCTION

This project is fuelled by the need for a proper and organized Parking system. A study conducted in the year 2013 tells us that one third of the traffic congestion is caused due to vehicles searching for parking spots, so there is a big necessity for a well organized, smart parking system. Since everything is digitalized nowadays, so the smart parking system also uses an app to carry out the operations using the smart reserved parking system, you can save time as well as you can traffic congestion, as well as saves some fuel in the process, but most importantly it is very convenient, and it should be future of car parking, mainly in places such as India where modern way of parking is much to come. the smart reserved parking system uses the app to book and monitor the whole process, and payment can also be done using the app. The mechanism in which this works is first the app searches for any parking spot within the 300 m radius of the specified location which was provided, and book a parking spot within that location when the users ETA is 30 minutes to the specified location. Information, communication and technology combined together to form a new network that increase the operational efficiency for the public which is now used by many smart cities. It provides a better platform for the citizens. [8] The use of IOT, Automation and machine language help in the improvement of smart cities. [8] Thus, any city which implements the following reforms can be considered as a smart city. [8] Vehicle leaving is a significant issue in present day clogged cities. There basically are such a large number of vehicles out and about and insufficient leaving spaces. Thus an IOT based framework which is productive needs to be created for

Revised Manuscript Received on November 15, 2019.

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a successful parking lot allocation. To implement this we use sensors to detect the space and motors to control the gateways. A wifi modem connecting the device to the application and a microcontroller to operate the system. [9] Thus sensors are used to confirm the occupation of lots and open the gate when a vehicle is detected. [9] The data is stored in a cloud server and the availability of lots is detected via online. [9] The users can access the data anytime anywhere. [9]

In this way the framework unravels the stopping issue for urban areas and get clients a proficient IOT based held stopping framework. The proper use of smart parking system is to find the parking easily thus reducing the time and fuel consumption. [8] The user books the lots using the mobile application and the payment is done online, the sensor then blocks the parking as reserved for parking. [8] Developing countries like India face problem for large free parking space management. The various parking management system that are present don’t specify any solution for open and closed parking allocation even though they use the same sensors and communication module. [8] The mobile application used to find parking lots use a GPS connection to find the parking spaces but does not show whether the parking lot is available or not. [8] Thus due to the low accuracy of these parking space detectors the system is inefficient. [8]

II. RELATED WORKS

These are the various systems implemented that help in enabling a smart reserved parking system -

- Cyber-Physical System (CPS)
- Bay Area Rapid Transit
- Parking Lot Detection
- Resource Allocation
- VANET-Based Smart Parking

A. Cyber-Physical System (CPS)

This system is also connected, monitored, coordinated and controlled operation along with computing and communication core also known as combinational system consisting of physical and engineered system. They focus on driving by reducing fuel consumption and driverless parking.

B. Bay Area Rapid Transit (BART)

The BART focuses on usage of data from three different servers from different location. They help in identify the profile of the driver, the route the driver needs to take and so on. It uses a two user interface using available information and a centralized intelligent reservation system.

C. Parking Lot Detection

The data related to the parking garages location and occupancy is sent via internet by the image taken by camera in garage. [4] The data is delivered to the online application after the image is processed via an image processing application. [15] Thus a mapped data of the available parking spaces are given with the help of available information. [4]

D. VANET-Based Smart Parking

Vehicular Ad-Hoc Network (VANET) uses wireless sensor technology to provide a better platform for smart parking systems. [3][5] The various needs for parking reservation such as service, monitoring and automated guidance are provided by this system. [4][2]

E. Resource Allocation

In this type of system the parking is allocated and a proper network is used to allocate resource. [5] It provides a pricing system and different classes of service. Different classes of services are the main goal for this system. [5]

III. ALGORITHM

The algorithm that is to be used has set definitions that enable the parking of vehicles to be smooth, fast and efficient.

A. Parking lot Reservation Algorithm

- 1) First checks the type of user namely Normal user and prime user
- 2) Then the selections of slots are selected into two namely closed and open parking. [1]
- 3) Then the parking availability is checked in the vicinity to the destination entered by the user (within 300 meter radius). [1]
- 4) Time of arrival is allotted prior to arrival at parking destination, i.e., within the app during reservation. [1]
- 5) The rate is decided by the application using the data bases entered using a rate algorithm
- 6) Extra features such as valet parking are also available during reservation.

B. Dijkstra's Algorithm

Let a node be allotted as the preliminary node. The distance of node Y be the gap among preliminary node and Y. This is a step by step process where the initial distance is allocated beforehand.

1. Initially mark all nodes present as unvisited and group them as an unvisited set.
2. Set tentative distance value for every node: set it to zero for our initial node and to infinity for all other nodes. Set the initial node as current. [7]
3. From the current node, consider all of its unvisited neighbors and calculate distance between them and assign the smallest value. [7]
4. Remove all unvisited nodes that are visited from the current node from the unvisited set. A visited node will never be checked again. [10]

5. If the destination node has been marked visited or if the smallest tentative distance among the nodes in the unvisited set is infinity, then stop. The algorithm has finished. [10]
6. If not, then select the unvisited node marked with the smallest tentative distance and set it as the new "current node", and repeat step 3.. [10]

C. Rate Algorithm

1. Check if normal customer
2. If existing lot the fee according to the lot structure plus 30 for reservation.
3. Otherwise reservation and fees for 1hr is Rs.70 and Rs.20 for each extra hour.
For 6 hours –Rs.120
12 hours –Rs.200 And
24 hours –Rs.500
4. Extra fee of Rs.20 for closed parking and Rs.30 for valet parking
5. If prime customer, the fee pattern same as normal - discount rate and free valet parking.

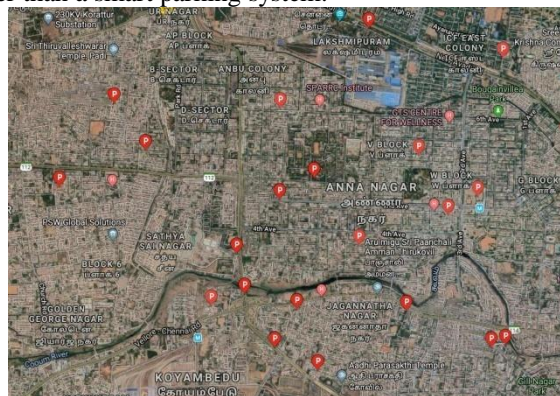
D. SENSORS

There are a variety of sensors used in order to make the smart parking work seamlessly, there are sensors required in three places, one to detect when the car has reached the main gate of the parking system, one for detecting that the car is near a gate in order to open the gate and another one to monitor the car when it is inside the gate. In order to detect when the car when it is outside the parking lot, a combination of cameras and proximity sensors are being used, there is a camera attached on top of the garage which is capable of object detection, and a proximity sensor near the lower end of the garage to detect the proximity of the car near the door, when it is detected the camera attached under the door will scan the number plate and using number detection using AI, it'll get the registration number and it'll check with the system if the given registration number has been registered for a slot, if it is registered it'll open up the door and allow the car to come in. After the car has passed the door, the user can park in any lot which is free and it is hence convenient for the user to do so. The Gate has a proximity sensor which will open up when the car is nearby, the proximity sensor attached near the gate need not scan for any registration number since only pre booked cars are allowed past the main gate anyways, once the car is placed inside the gate, there are infrared sensors attached along, inside the gate to make sure the car is inside the gate, and does not have any movements. Once it is inside the gate, the user can exit using the other side which locks as soon as the user exits the other side, once the car is parked, the camera inside monitors the car, the cameras feed is live only for PRIME users. Prime users can see a live feed of the parked car using the app. Once the user is ready to leave he can approach the gate and unlock the door using the app, the app will then open the gate and will calculate the time period the car has taken, once the car is started and has left the gate, the app will calculate the fare and will charge the user accordingly, after the car has left the gate, the gate will

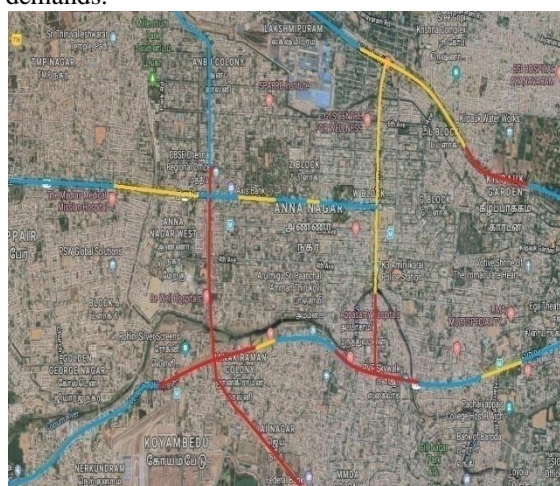
detect and make sure there are no obstacles and will close the gate.

IV. SIMULATION RESULTS

The area near a particular radius of Anna Nagar has been surveyed for the parking spots available in the area. The parking spaces that have been located are marked in the map with a red marker and have been displayed below. These Red Markers are lots that already exist such as private parking spots. These lots are owned by other private parking's and are not exclusive for this type of parking system, meaning they could be booked by others means other than a smart parking system.^[6]



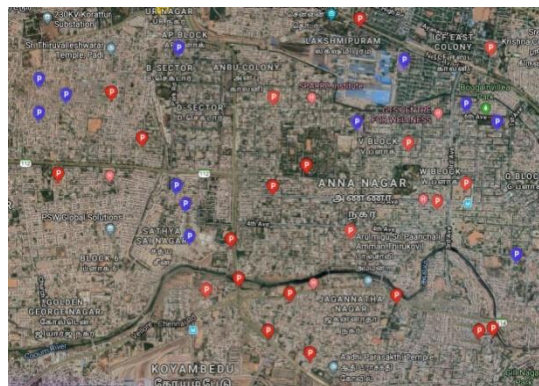
The below image indicates the traffic caused due to high demand for the smart parking system.^[6] The demand range is represented using different colours. The Red colour indicates that there is a heavy traffic in that area which was caused due to the higher demand for parking spots in that radius which means it will take a longer time for the user to get their slot booked. The yellow coloured lane indicates there is a medium demand for the given area, and the blue colour indicates that the particular area is completely free of any demands.



- Heavy Traffic
- Medium Traffic
- Normal Traffic

In Addition to the Smart reservation of private parking system, our system also proposes a new method which will

give us more parking lots to use. This system proposes that in case the private parking's are unavailable due to any reasons such as the private parking being used. The smart system books a parking lot from a residential house which has a garage/parking space which can be used as a parking lot temporarily, provided that the house owner has signed up for the service. The system books a lot within a 200-300m radius from the destination. The Blue markers in the below diagram indicate the parking lots which are available from residential houses.



- P - Existing Parking Lots
- P - Lots Allocated using Smart Parking

V. CONCLUSION AND FUTURE WORK

Population development and expanding the quantity of vehicles are causing a wide range of financial and ecological issues. One of the urgent ones is finding a parking spot. So as to manage this issue, we can develop new parking areas or enhancing the old ones. Truth be told, fabricating new stopping costs a great deal and will annihilate nature. More often than not there isn't sufficient space to construct another one in urban communities. Hence a system which does not need new construction must be found. So in this paper we have proposed a method which does not involve the construction of new parking spaces but solves the parking space problem in a smart way. This mechanism also provides the user with extra convenience at the same time while solving the parking problem. In addition to all this, this mechanism significantly decreases the traffic levels because of the fact that there is a significant increase in traffic levels due to vehicles not finding a parking spot and aiding in finding the spots easily gives a significant benefit. So this project solves many problems simultaneously.

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