A Smart, Synchronized & Revolutionize Car Parking Platform based on IOT and Cloud Computing for Indian Roads

[#1]Prof. Deshmukh S.C., [#2]Mahesh Gawali, [#3]Vidya Boob, [#4]Mayur Kompelli, [#5]Nikita Kakade

[1]sandesh.deshmukh@avcoe.org,
[2]maheshgawali941998@gmail.com,
[3]vidyaboob27@gmail.com,
[4]mayurkompelli143@gmail.com,
[5]nikitakakade19@gmail.com

[#1]Assistant Professor (Information Technology)
[#2345]Student, Information Technology
Amrutvahini College of Engineering, Sangamner, India

ABSTRACT

Driving on Indian roads is not easy and even worse is the struggle to get a parking space. With the growing population of vehicle in the country, the alarming parking issues have highlighted the importance of smart parking solutions that India seriously needs now. The Union Minister for Urban Development and Housing, Venkaiyya Naidu, recently said that registration of vehicles would be allowed only after production of parking space availability certificate to the authorities. The Smart Parking System should involve the use of technology (low-cost sensors, real-time data and applications) for efficient management of parking spaces. In rural areas, system should enable drivers to identify parking spots via smartphones. Features like online payments, parking time notifications and even car searching functionalities should be included. Any event (e.g. sport event, Temples etc.) sees a huge crowd coming and exiting at same time. This makes parking around event venue an unavoidable hassle, unless you are using smart parking system. Smart android application should have State-of-the-art functional and useful designs which can be handled by any user.

Keywords: RFID, Internet of Things and Android.

ARTICLE INFO

I. INTRODUCTION

In recent era in metropolitan cities along with increase in population there is increase traffic on roads. Hence this leads to annoying issue for the drivers to park their vehicles as it is very difficult to find a parking slot. The drivers usually waste time and effort and end up parking their vehicles finding a space on streets through luck. In worst case, people fail to find any parking space especially during festive seasons and tourism place.

However, in current parking system a better but not an optimal solution is being provided. It does not provide economic benefit, vehicle refusal services and there is no resource reservation mechanism leading to queuing system which is again time consuming. It also lacks to provide large scale parking system. There are android applications available where the cost is calculated from the time the parking slot has been booked which is not economically beneficial for the users. Parking Guidance and Information (PGI) systems for better parking management is also available. PGI systems will provide the drivers with effective information on parking within controlled areas and lead them to empty parking slots [2][3].

To resolve the above mentioned issue, further we propose a cloud based smart parking system which uses Internet of Things [1][5]. In this system, all the physical objects like smartphone, GPS location and cloud based servers and all car parks are connected to form network architecture and it is an automatic system where we use a Radio Frequency Identification (RFID) technology. We use RFID reader which is a sensor that reads the RFID tag and authenticates the user information. All the car parks in the intended area are connected to form a parking network. Here, each car park in the parking network is connected to

its neighboring car parks through WiFi [1]. First, the parking manager should register his car park in the portal (cloud server), if he wants to provide the service in smart parking system and then login to the portal. The user has to register first to get the service from the smart parking system which returns him the RFID tag which contains a unique number.

After the registration is done, the user has to download the android application for booking a parking slot. The user books the parking slot using the android application by specifying his destination and the type of vehicle which is updated to the cloud. The cloud finds the shortest path which is the distance between the car park and the vehicle and allocates the parking space and this information is sent to the user. When the user starts from his place to destination, the GPS location is updated to cloud server periodically. Then, when the user reaches the car park the RFID tag is read and authenticated by the RFID reader after which the user is allowed to use the parking space. This information is updated to the cloud and to the neighbor car park. When the user exits the car park the RFID tag is read again by the RFID reader which is further updated to the cloud. Then billing process will take place in the cloud server and this information is sent to the user.

II. RELATED WORK

A. A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies.

This paper provides a unique algorithm which increases the capability of the current cloud based smart parking system [5] and it also develops a network architecture based on the Internet of Things technology. This system helps the users to find a free parking space with minimal cost based on new performance metrics which is automatic. This metrics will calculate the user spaces in each car park. To enhance the parking management, an intelligent parking system was developed which reduced the purpose of hiring people to maintain the parking system [1]. In this paper it proposes an effective cloud-based Smart parking system based on the Internet of Things. The data that includes the vehicle GPS location and distance between car parks and number of free parking space in car parks will be sent to the data center. Here the data center is presented as a cloud server which calculates the costs of a user parking request and this information is regularly updated and is made available to the vehicles in the network at any time. In this proposed system, each car park is an IoT network and it operates independently as a regular car park. This paper implements a system model with wireless access in an open-source physical computing platform based on Arduino with RFID technology. It uses smartphone that acts as a user interface between the cloud and the vehicles to check the feasibility of the proposed system [4].
Advantages:
 1. Better performance.
 2. Low Cost.
 3. Includes resource allocation mechanism.
 4. Provides large scale parking system.

Disadvantage:
 1. Car park should be registered in the smart parking system to provide service.
 2. The service cannot be provided if there is no smartphone.

B. Smart Routing: A Novel Application of Collaborative Path finding to Smart Parking Systems

In this paper smart parking system provides guidance to the drivers to find available parking spaces to avoid increasing parking issue. Traffic authorities in many metropolitan cities have initiated parking guidance and information (PGI) systems [2], providing drivers with up-to-date information on the available parking spaces and direct the drivers accordingly. The information is provided to the driver over the internet. The systems provide the location of the available car park spaces based on the driver's current location in intended area or his final destination. Global Positioning system (GPS) is used to trace the driver's route to the parking destination, after the parking space is reserved [3]. This results in traffic congestion as multiple users are being directed toward the same parking area at the same time. In this paper, a standard A-star path-finding algorithm is been implemented to trace multiple users concurrently, while taking into account one another's nearest distance to the parking area in their respective routes . In this approach the user avoids over occupying the same parking space by taking different decision on the respective shortest route. A selection technique is used to identify and provide the most efficient solution for all users at any particular time. A Smart routing scheme which will use a PGI system is beneficial which provides less congestion and journey times for users are also reduced [2]. This approach is also economically beneficial and efficient.
Advantages:
 1. It improve efficiency of smart parking systems
 2. It reduces traffic congestion in metropolitan environments, while increasing efficiency of parking areas.

Disadvantages:
  1. It is a complex system protocols to domains of commercial interest.

C. A New "Smart Parking" System Based on Optimal Resource Allocation and Reservations In this system a new smart parking system is implemented for cities.

This system assigns and reserves a parking space for a user (driver) based on the users distance from the parking area and parking cost and also ensures that the overall parking capacity is effectively utilized. Their approach solves a Mixed Integer Linear Program (MILP) problem at each decision point in a time-driven sequence [3]. For each MILP there is a solution which gives an optimal allocation based on user's current state information and also supports random events such as new user requests and parking space availability. The allocation is updated at the next decision point which ensures that there is no parking slot reservation conflict and that no user is ever assigned a parking slot with higher than the current cost function value. This mechanism ensures a better response from the system along with assured reservations.

Advantages:
  1. They can receive a quick response from the system and have guaranteed reservations.
  2. An upper bound on the cost this user is willing to tolerate for the benefit of reserving and subsequently using a resource.

Disadvantages:
  1. This parking system is efficient for urban environment only.

D. **The Smart Parking System is built rapidly using available platforms on the cloud**

   How to increase development of IOT based smart parking system rapidly with cloud server. The adoption of this approach to gain rapid development of smart-parking system. Furthermore, the integration of parking sensor with IOT middleware and frontend dashboard is also highlighted in this paper. The cloud-based platform for developing IOT solution are:
• Time: - reduce development time.
• Cost: - reduce development cost and maintenance.
• Flexible: - one platform can flexible collaborate with another platform using Restful communication and common JSON data format

III. PROPOSED SYSTEM

The proposed system reduces the number of vehicles failing to parking space and minimizes the costs of moving to the car park. Users automatically find a free parking space at the least cost. If car parking is full then they give suggestion of another near parking system. It improves the probability of successful parking and minimizes the user waiting time.
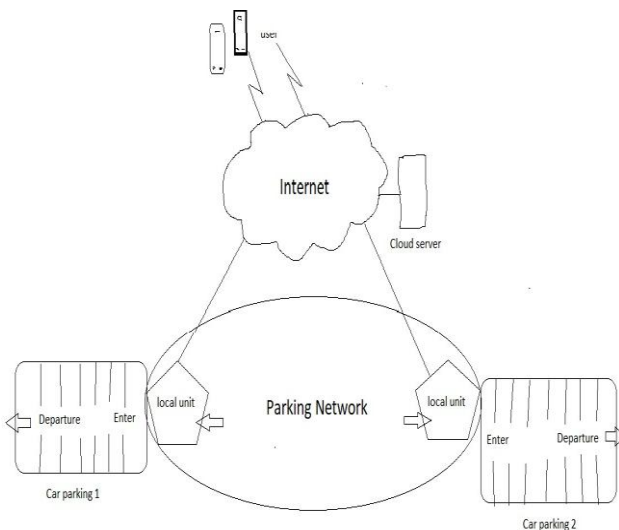

Fig. System Architecture

Cloud Server
   Stored the all information on the cloud using NodeMCU or Arduino controller.
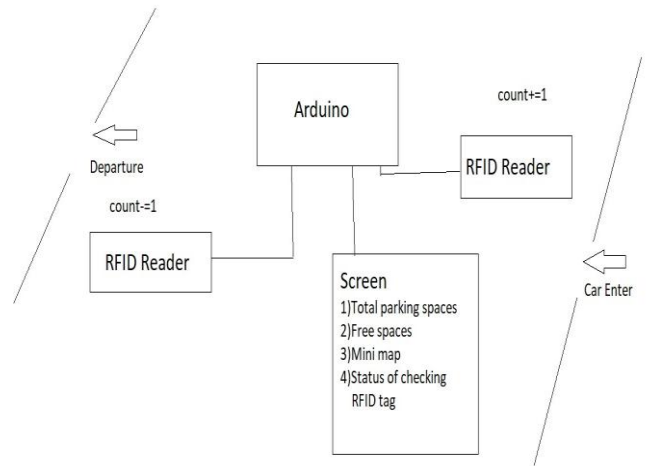
Local Unit

Fig. Local Unit

Stored the information of each parking space.it is located in each car park.it include:

Control Unit:-
   This is controller, which is connected using an RFID reader. The card reader check the user information and then displays this information on the screen. If the information of the RFID tag is correct, then controller will control the opening of the door for the vehicle to enter. The Arduino module (controller) connects with the cloud server through an Internet connection to transfer data from the local car park to the cloud server database.

Screen:-
   This displays information of the capacity of the local car park, the total current free spaces, the status of the RFID tag check, and a mini map of the local car park.

RFID Tag and RFID Reader:-
   This is used to check and authenticates user information and calculate the total free spaces in each car park. RFID Tag and RFID Reader This is an application software system. Running on Android operating system, the users will install it on their smartphones and use it to reserve parking spaces. The users access the system via 3G/4G mobile connections.

Software Client
   This is an application software system. Running on Android operating system, the users will install it on their smartphones and use it to reserve parking spaces. The users access the system via 3G/4G mobile connections.

Innovation Solution we proposing and we will to develop to address the problem.
   Managing parking is a dominant factor in Indian roads and perhaps the biggest single obstacle to a sustainable form of development. We can serve all stakeholders involved for better car mobility by planning, designing, integrating, executing, and maintaining smart, synchronized and revolutionized car parking system suitable to that place.
Our innovative car parking system contains Infrared sensors for identification of specific car which is connected to LED

system in parking field. After car arriving LED will glow for that car with specific color which is also displayed in android app. This system makes more ease to stakeholder to park the car.

Before entering to any parking, android app will suggest you total parking space, percentage of free space, mini map, status of checking RFID tag, nearest available parking, their distance, cost of parking and traffic for that route as well. These sensors and devices are connected to small single board computer called Raspberry PI which is having on board processor, ram, networking, real time clock, USB and video slot. Raspberry PI send all information to android app which is stored in synchronized cloud servers. All parking systems data can be collected in real time with these synchronized cloud servers.

The technology and Intellectual property right component involved in your proposed innovative solutions in the process of developing the technology prototype.

1) **Raspberry Pi –**
   - GPIO Pins
   - UART – Transfer the serial data in the forms of text and useful for converting debugging code
   - Displays- HDMI and Composite display (LCD, HD TV with audio connection)
   - GPU – speed up the operations
   - Ethernet port – Router and internet connection
2) **Infrared Technology**
   - Connection to night vision devices
3) **RFID scanner**
   - A RFID Reader is a device that uses radio-frequency waves to wirelessly transfer data between itself and a RFID **tag/label** in order to identify, categorize and track cars
4) **Mini LED Glowstick**
   - Uses replaceable batteries for endless hours of nighttime and Daytime Parking zone visibility.
5) **A cloud server**
   - A cloud server is a logical server that is built, hosted and delivered through a cloud computing platform over the Internet. Cloud servers possess and exhibit similar capabilities and functionality to a typical server but are accessed remotely from a cloud service provider. Android application will reside on this server
6) **Nearest Neighbor Algorithm allowing nearest parking, nearer parking distance, parking cost and traffic on the road.**

Our system will included in industrial property (Patent) not in copyright. If we will get patent then incentives and protection can be gain for the innovation. New characteristics like Traffic, Glowing LED for parking, Neighbor parking and cost at real time can lead to the patent right.
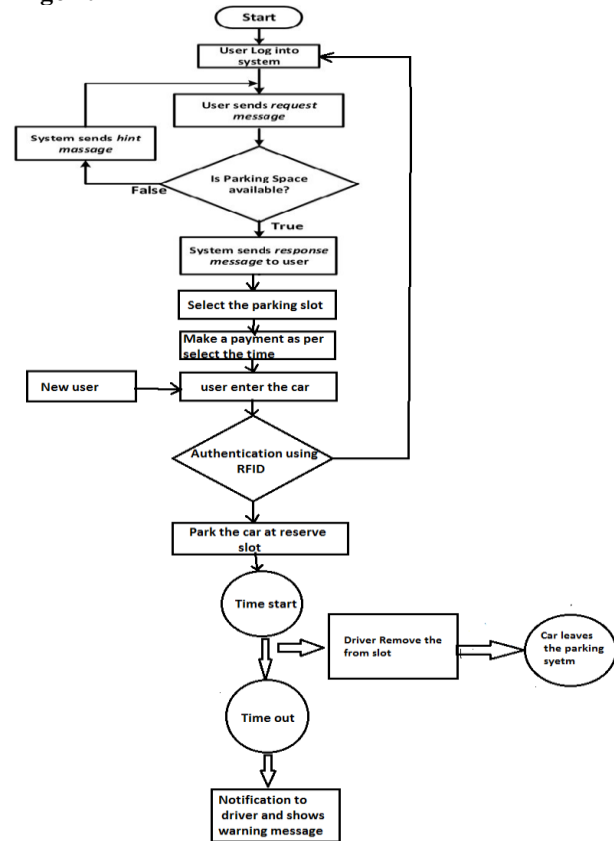
Algorithm

Fig. Algorithm for updating the status of the car park

IV. RESULT ANALYSIS

To analysis the performance of the proposed system, we determined the parameter for system performance as the cost in terms of user time in the system the cost to the user is the time that the user spends in the parking system for service and man power. If this cost can be minimized, we can reduce the other costs such as monetary, fuel. We reduce the environmental pollution. The time in this study is the average waiting time for the service to the user and the average total time of the user in the system, including the waiting, travel, and service times. A smaller cost value leads to better system performance. This propose system reduce the user waiting time, cost and pollution. It give the better performance about the above all things.

V. CONCLUSION

In this paper, the implementation of cloud based smart parking system using Internet of Things is discussed. This system includes RFID technology with Android application which provides user interface for control system and vehicles. The average waiting time of users for parking their vehicles is effectively reduced in this system. The optimal solution is provided by the proposed system, where most of the vehicles find a free parking space successfully. This smart parking system provides better performance, low cost and efficient large scale parking system. Security measure to ensure that the users do not misuse the parking system can be implemented.

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