

Efficient and Smart Car-Parking System Using Internet-of-Things

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ABSTRACT: This paper introduces a novel algorithm that increases the efficiency of the current cloud-based smart-parking system and develops a network architecture based on the Internet-of-Things technology. This paper proposed a system that helps users automatically find a free parking space at the least cost based on new performance metrics to calculate the user parking cost by considering the distance and the total number of free places in each car park. This cost will be used to offer a solution of finding an available parking space upon a request by the user and a solution of suggesting a new car park if the current car park is full. This simulation results show that the algorithm helps improve the probability of successful parking and minimize the user waiting time. We also successfully implemented the proposed system in the real world.

KEYWORDS: Smart-parking system, performance metrics.

I. INTRODUCTION

Moving towards smart city application, smart parking is a good example for a common citizen of how the Internet-of-Things (IoT) will be effectively and efficiently used in our daily living environments to provide different services to different users. Any citizen may use his mobile device, a computer having Internet to access the smart city application from anywhere in the world to find a free parking spot in the city and get to know the which parking spot is still available. It provides efficient car parking management through remote parking spot localization and fast car retrieval. Presently, Car parking system is based on reservation basis, but this system has a drawback in terms of time and space.

This project management system can be grouped into multi-parking management which can be used to manage both outdoor and indoor parking area and single-parking management which usually targets indoor parking lots [6]. The focus and objective of this project work lies on mono-parking management architectural system which works on real-time basis. Data-driven intelligent transportation has drawn significant attention in recent years: provided a special session on big data services and computational intelligence for industrial systems, including ITS applications. Furthermore, a special issue highlighted the most recent research progress in big data. The traffic is the main problem that occurs in the major cities. It will affect many of the people's day to day life and may cause major problem to heavy vehicles to reach the destination on time. Many problems that will make the traffic flow difficult such as Weather, Road works, Accidents, vehicles that was repaired and make the traffic jam on the road. So, the future the world is going to face traffic problem which is the major problem for the normal people. Many of the Projects are also available to control these kind of the traffic problems and still the research is going for these control traffic on Intelligent Traffic System (ITS). And our aim is to predict the traffic for frequent interval of time and also to give the suggestion to the people to reach the destination quickly. In other countries they have already some uses these type of prediction technique to help the people to reach the destination and also to reduce the traffic that occur in the cities. Some project the traffic signals are recorder with the cameras and sensors to know the Number of vehicles.

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II. RELATED WORK

The Smart Parking System is designed by making use of some IOT supportable hardware's such as raspberry pi, arduino boards etc. here we focusing on less power consumption and more performance device so raspberry pi is the suitable microcontroller for our implementation. And NOOBS installer is loaded into the storage device of microcontroller. This installer which consists of various hardware supportable operating systems such as mac os, tiny os, openelec, raspbianos etc. where these operating systems which basically consumes less power. Algorithm to schedule the online problem of a parking system into an offline problem. Second, they set up a mathematical model describing the problem as a linear problem. Third, they designed an algorithm to solve this linear problem. Finally, they evaluated the proposed algorithm using experimental simulations of the system. The experimental results indicated timely and efficient performance. However, these papers do not mention the resource reservation mechanism

(all parking requirements are derived immediately and are placed in the queue), the mechanism for assessing their resources system, the mechanism to guide vehicles to the parking space, the mechanism for handling situations when the request for service is denied and do not calculate the average waiting time and average total time that each vehicle spends on the system. In another study, the authors propose an SPS based on the integration of UHF frequency, RFID and IEEE 802.15.4 Wireless Sensor Network technologies. This system can collect information about the state of occupancy of the carparks, and can direct drivers to the nearest vacant parking spot by using a software application. However, in this work, the authors have no mathematical equations for the system architecture and do not create a large-scale parking system. The results of this paper only implement the proposed architecture; they do not mention the performance of the parking system. In [5] author proposed an innovative system including the parking guidance service. A parking space can be reserved by a Smartphone via Internet access. Upon entering the car park, the reserved parking space will be displayed on a small map using wireless transmission for vehicles under the dedicated short-range communication protocol DSRC. An inertial navigation system (INS) is implemented to guide the vehicle to the reserved space. The system will periodically update the status of the parking space in real time to help ensure system accuracy. System performance is measured through the accuracy of the inertial navigation systems run in an indoor environment and the system implementation is evaluated by considering the accuracy of the GPS. In this paper, we have not evaluated the performance of the parking services, they do not provide any mathematical model of the system, and do not consider the waiting time of each vehicle for service. Other researchers have designed architecture for parking management in smart cities [6]. They proposed intelligent parking assistant (IPA) architecture aimed at overcoming current public parking management solutions. This architecture provides drivers with information about on-street parking stall availability and allow drivers to reserve the most convenient parking stall at their destination before their departure. They use RFID technology in this system. When a car parks or leaves the IPA parking spot, the RFID reader and the magnetic loop detect the action and send this information to the unit controller to update the information on the car park status. This study uses only some simple mathematical equations for the system architecture and does not create a large scale parking system. In other works, authors have designed and implemented an SPS [7] to solve the parking problem. A part of this system is implemented in the Zigbee network which sends urgent information to a PC through a coordinator and then updates the database. The application layer can quickly pass the parking information over the Internet, and use the advantages of a web service to gather all the scattered parking information for the convenience of those who want to find a parking space. This paper simply reports the design and implementation of an SPS and does not evaluate the system performance.

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III. PROPOSED SYSTEM

A. System Overview:

The system is derived from the idea of IoT. The system uses the sensors and GPS system technology to monitor car parks.

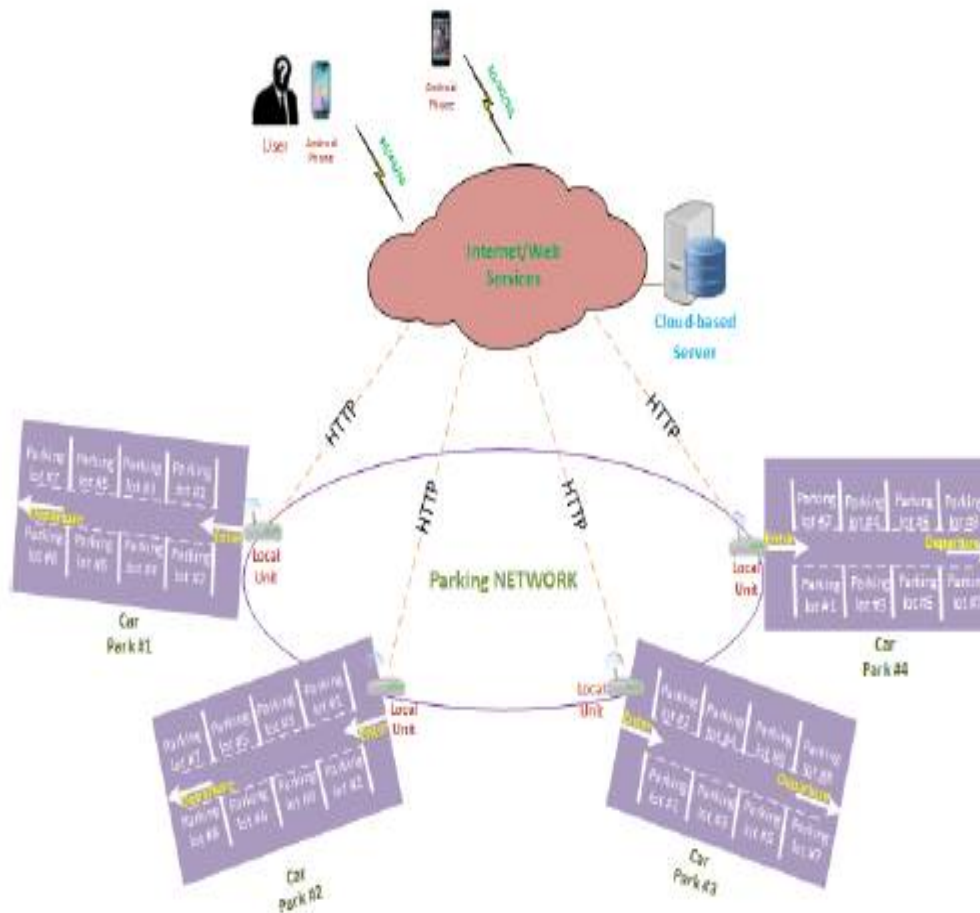


Fig.1 IOT Based Parking System

Sensors count the percentage of free parking spaces in each car park. The use of sensors facilitates implementation of a large-scale system at low cost. The system provides a mechanism to prevent disputes in the car park and helps minimize wasted time in looking for a parking space. After logging into the system, the user can choose a suitable parking space. Information on the selected parking location will be confirmed to the user via notification. Then, the system updates the status of the parking space to "pending" during which time the system will not allow other users to reserve it. If after a certain period of pending time the system determines that no car is parked in that space, then it changes the status to "available." The system will update the status from the WSN node (the status of car park spaces) when a new car joins in the system. Therefore, the status of the overall parking system is always updated in real time. The system will help plot the parking time for each parking space in real time and can support the business with hourly parking charges.)

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B. System Architecture:

Fig. 1 shows our smart IoT parking system. Elements in the system:

1. Cloud-Based Server: This is a Web entity that stores the resource information provided by local units located at each car park. The system allows a driver to search and find information on parking spaces from each car park without the need to directly access the local server node by directly accessing the cloud-based server.

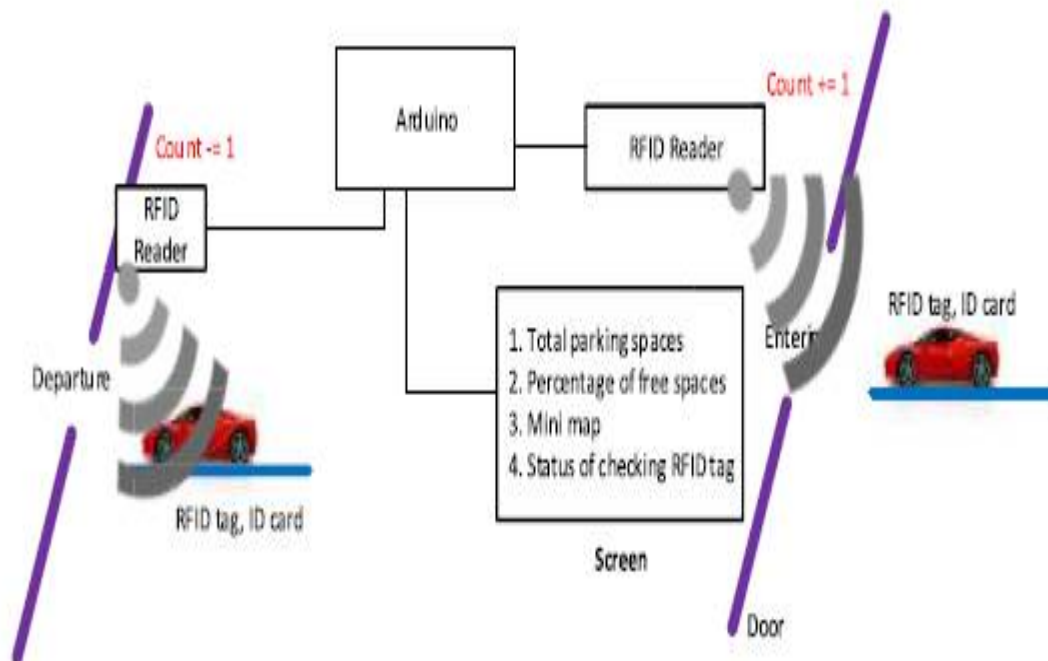


Fig. 2 System Architecture

2. Local Unit: This unit is located in each car park and stores the information of each parking space, as shown in Fig.2. The local unit includes the following:
 - Control Unit: This is an Arduino module, which is connected using an RFID reader. The card reader authenticates the user information and then displays this information on the screen. If the information of the RFID tag or card is correct, the Arduino module will control the opening of the door for the vehicle to enter. The Arduino module 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 on the capacity of the local car park, the total current percentage of free spaces, the status of the RFID tag check, the user card when entering, and a mini map of the local car park.
 - RFID Tag or ID card: This is used to check and authenticate user information and calculate the percentage of total free spaces in each car park.

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

IV. EXPERIMENTAL RESULTS

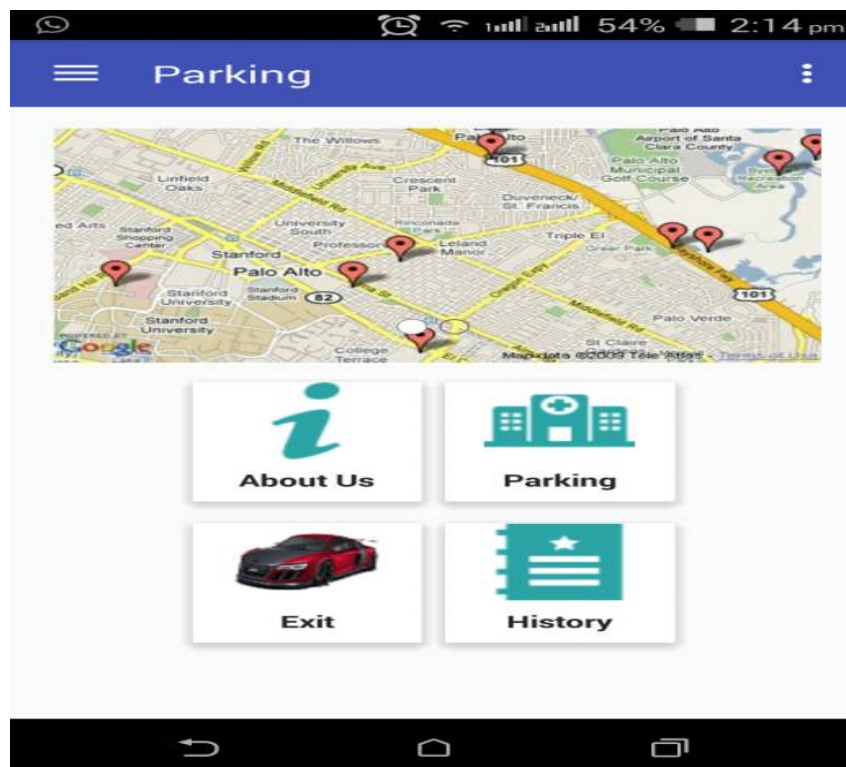


Fig3. Parking distance show on map.

V. ADVANTAGES

1. Efficiency

Smart Car Parking System provides car parking solutions accommodating maximum cars in minimum space.

2. Cost effective

Smart Car Parking System improves financial viability of commercial and residential developments

3. Saves Time

Smart Car Parking System reduces parking and retrieval time. Saves time spend in searching for empty parking slots and time spend is searching the parked car. Retrieval on average is 2 to 3 minutes

4. Easy and cost effective maintenance

Smart Car Parking System is cost effective in terms of maintenance over the conventional parking systems.

5. Car Safety

Smart Car Parking System provides improved security, safety for the cars. Cars parked are free from theft and damages that can be caused while parking and retrieving.

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7. Environment Friendly

Smart Car Parking System is environment friendly. As the car driver doesn't need to travel to search the parking slots hence is no pollution.

8. Aesthetics

With Smart Car Parking system android application State of the art modular design makes the system look very attractive

VI. CONCLUSION

This designed automatic smart parking system which is simple, economic and provides effective solution to reduce carbon footprints in the atmosphere. It is well managed to access and map the status of parking slots from any remote location through web browser. Thus it reduces the risk of finding the parking slots in any parking area and also it eliminates unnecessary travelling of vehicles across the filled parking slots in a city. So it reduces time and it is cost effective also. The simulation of our system achieved the optimal solution when most of the vehicles successfully found a free parking space. The average waiting time of each car park for service becomes minimal, and the total time of each vehicle in each car park is reduced. In our future study, we will consider the security aspects of our system as well as implement our proposed system in large scales in the real world.

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