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A Survey on Smart Car-Parking System Using On Internet-of-Things

Samrudha Y. Jondhale[1], Nikhil Supekar[1], Aditya Garud[1], Adwait Jagtap. V[2]

B.E. Students, Dept. of Computer Engineering Shri Chatrapati Shivaji Maharaj College of Engineering, Nepti , Maharashtra, India[1]

Asst. Professor, Dept. of Computer Engineering Shri Chatrapati Shivaji Maharaj College of Engineering, Nepti, Maharashtra, India [2]

ABSTRACT: Internet of Things (IOT) plays a vital role in connecting the surrounding environmental things to the network and made easy to access those un-internet things from any remote location. It's inevitable for the people to update with the growing technology. And generally people are facing problems on parking vehicles in parking slots in a city. In this study we design a Smart Parking System (SPS) which enables the user to find the nearest parking area and gives availability of parking slots in that respective parking area. And it mainly focus on reducing the time in finding the parking lots and also it avoids the unnecessary travelling through filled parking lots in a parking area. Thus it reduces the fuel consumption which in turn reduces carbon footprints in an atmosphere.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. The simulation results show that the algorithm helps improve the probability of successful parking and minimizes the user waiting time. We also successfully implemented the proposed system in the real world.

KEYWORDS: Smart-parking system, performance metrics.

I. INTRODUCTION

In the development of traffic management systems, an intelligent parking system was created to reduce the cost of hiring people and for optimal use of resources for car-park owners. Currently, the common method of finding a parking space is manual where the driver usually finds a space in the street through luck and experience. This process takes time and effort and may lead to the worst case of failing to find any parking space if the driver is driving in a city with high vehicle density. The alternative is to find a predefined car park with high capacity. However, this is not an optimal solution because the car park could usually be far away from the user destination. In recent years, research has used vehicle-to-vehicle and vehicle-to infrastructure interaction with the support of various wireless network technologies such as radio frequency identification (RFID), wireless mess network and the Internet. This study aimed to provide information about nearby parking spaces for the driver and to make a reservation minutes earlier using supported devices such as smartphones or tablet PCs. Furthermore, the services use the ID of each vehicle in booking a parking space. However, the current intelligent parking system does not provide an overall optimal solution in finding an available parking space, does not solve the problem of load balancing, does not provide economic benefit, and does not plan for vehicle-refusal service. To resolve the aforementioned problems and take advantage of the significant development in technology, the Internet-of-Things technology (IoT) has created a revolution in many fields in life as well as in smart-parking system (SPS) technology. The present study proposes and develops an effective cloud-based SPS solution based on the Internet of Things. Our system constructs each car park as an IoT network, and the data that include the vehicle GPS location, distance between car parking areas and number of free slots in car park areas will be transferred to the data centre. The data centre serves as a cloud server to calculate the costs of a parking request, and these costs are frequently updated and are accessible any time by the vehicles in the network. The SPS is based on

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several innovative technologies and can automatically monitor and manage car parks. Furthermore, in the proposed system, each car park can function independently as a traditional car park. This research also implements a system prototype with wireless access in an open-source physical computing platform based on RFID technology using a smartphone that provides the communication and user interface for both the control system and the vehicles to verify the feasibility of the proposed system.Internet of things was first introduced in 1999 at auto-ID center and first used by Kevin Ashton. As evolving this latest burning technology, it promises to connect all our surrounding things to a network and communicating with each other with less human involvement. Still internet of things is in beginning stage and there is no common architecture exists till today. There is lot of researches and implementations are currently being going on in all the respective areas. Thus there is no guidelines or boundaries exists to define the definition of internet of things. So depending on the context, application the internet of things has different definitions. Shortly it is defined as the things present in the physical world or in an environment are attached with sensors or with any embedded systems and made connected to network via wired or wireless connections. These connected devises are called as smart devices or smart objects. And it consists of smart machines which communicating interacting with other machines, environment, objects etc. And also it incorporates to connect any two machines, machine to human and vice-versa etc. this communication is called as M-M communication. As M-M communication is developing by the various standardization bodies such as Open Mobile Alliance (OMA), European Telecommunication Standards Institute (ETSI), Institute of Electrical and Electronic Engineers (IEEE), 3rd Generation Partnership Project (3GPP) organization have performed some activities on M-M communication [4]. It makes daily life things to equip with transceivers, sensors, actuators and microcontrollers etc. for communication. Some important benefits of internet of things includes 1) tracking behaviours; 2) enhanced situational awareness; 3) sensor driven decision analytics; 4) instantaneous control and response. Etc.

IOT technology grows in various fields of smart applications but we have not yet found boundary constraints of this technology. Some smart applications which it has implementing currently such as on smart grids, smart lighting, smart energy, smart city, smart health etc. This is broadly classified into three categories such as sensing, processing and connectivity. Whereas sensing includes sensing the speed of vehicles and humans or any objects (accelerometer), sensing of temperature, pressure etc. [9]. And these can be processing by using some processors such as network processor, hybrid processor MCU/MPU etc. And the devices are connected by using some technologies called GPS, Wi-Fi, BT/BTLE, and RFID.

II. RELATED WORK

The Smart Parking System is designed by making use of some IOT supportable hardware's such as raspberry pi, auridino 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, raspbian os etc. where these operating systems which basically consumes less power.Algorithm to schedule the online problem of a parking system into an ofine problem. Second, they set up a mathematical model describing the ofine 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 efcient 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 the 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 car parks, 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

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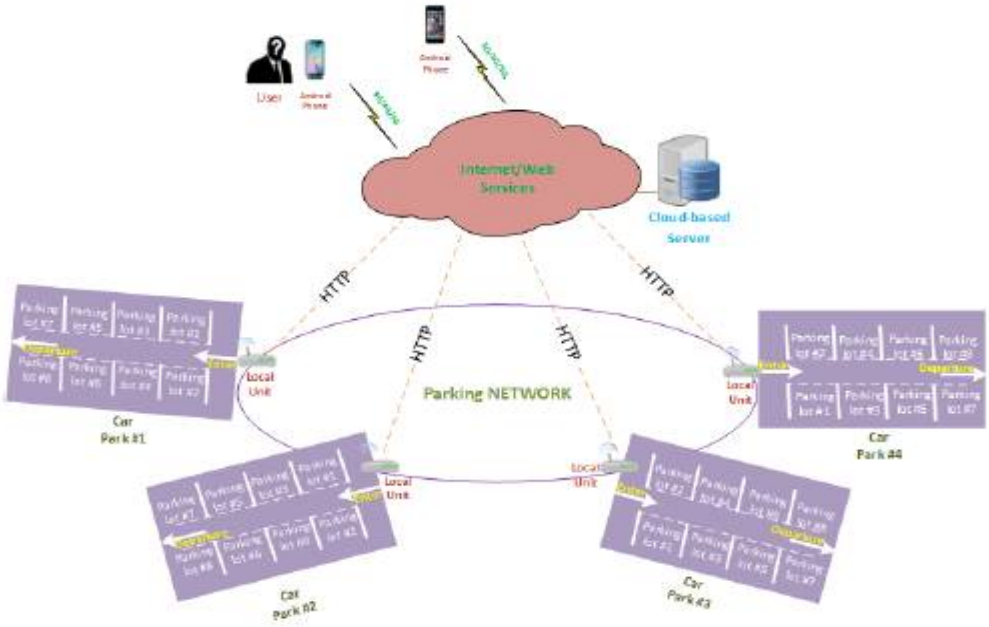
reserved space. The system will periodically update the status of the parking space in real time to help ensure system accuracy. System performance is measured through the accuracy of the inertial navigation systems run in an indoor environment, and the system implementation is evaluated by considering 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.

III. PROPOSED ALGORITHM

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.



An sensor counts 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

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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.)

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.

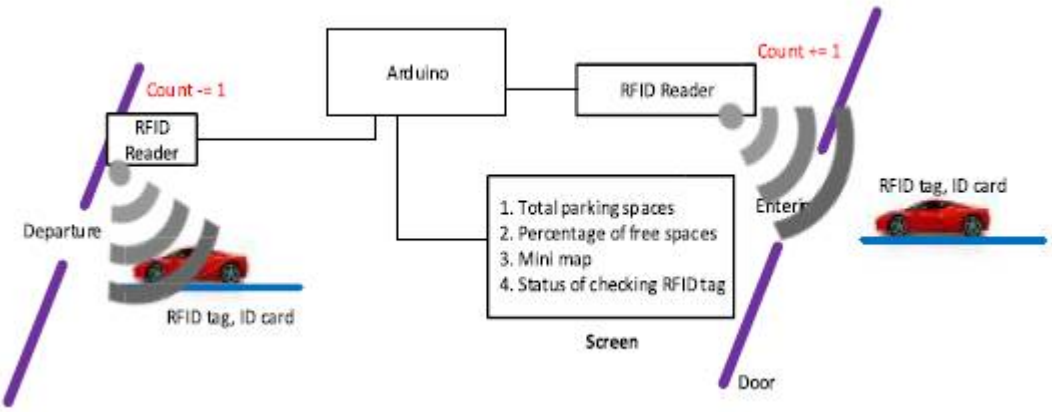

Fig. 2 System Architecture

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.

3. 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

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IV. 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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