

A Survey on “Smart Parking” System

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ABSTRACT: People owning vehicles face parking problems in most metropolitan area, especially during peak hours. The difficulty roots from not knowing where the parking spaces are available at the given time, even if this is known; many vehicles may pursue a small number of parking spaces which in turn leads to serious traffic congestion. This paper focuses on different smart parking techniques developed to overcome said problem using various wireless sensor network and providing real-time data analysis from the sensors, some papers include system based on resource allocation and reservation of parking lot which have various problems in efficiently achieving the goals. The given paper would be useful for new researchers for study of various guided parking and information techniques and algorithms which are covered in this paper.

KEYWORDS: Smart Parking, Wireless Sensor Network (WSN), Reservation, Resource Allocation, parking guidance and information (PGI).

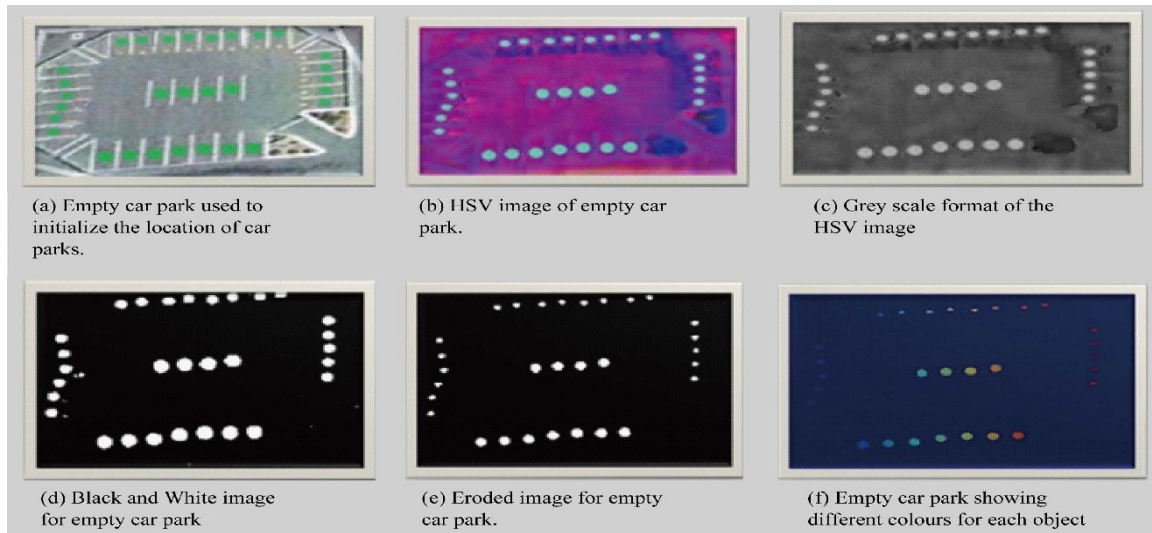
I. INTRODUCTION

In today parking lots there are no standard system to check for parking spaces. The system heavily relies on human interaction with the physical space and entity. This leads to wastage of human manpower and also parking spaces at times. These parking lots are dependent on Human-to-Human Interaction (HHI) which is not efficient. Previously, various techniques have been proposed to overcome such problems. Smart parking with help of short messaging service(SMS) was devised to provide an entry and exit password which would allow the person to authenticate himself/herself at the entry/exit point [9]. The ZigBee wireless sensor network along with global system for mobile (GSM) used a data from each node to show if the parking space is available and the data was available only at the entry point and at the administration end [11].

The author Jihoon Yang introduced a new system with global positioning system (GPS) which helped user to locate parking space remotely. The sensors however, could not be stacked over one another [12]. Artificial Intelligence (AI) provided a background for image processing using camera sensor which helped identify occupied parking spaces to the administrator[15].

The ManjushaPatil proposed a system which works with passive radio frequency identification (RFID) tags which helps identifying individual cars and then booking a slot at the entrance. The image show how the system works [16].

The author presents an idea to use wide angle camera as a sensor which will read only free parking spaces and records them. They are marked with grey spots on the screen. These records are then used to assign parking space to the incoming user [18].

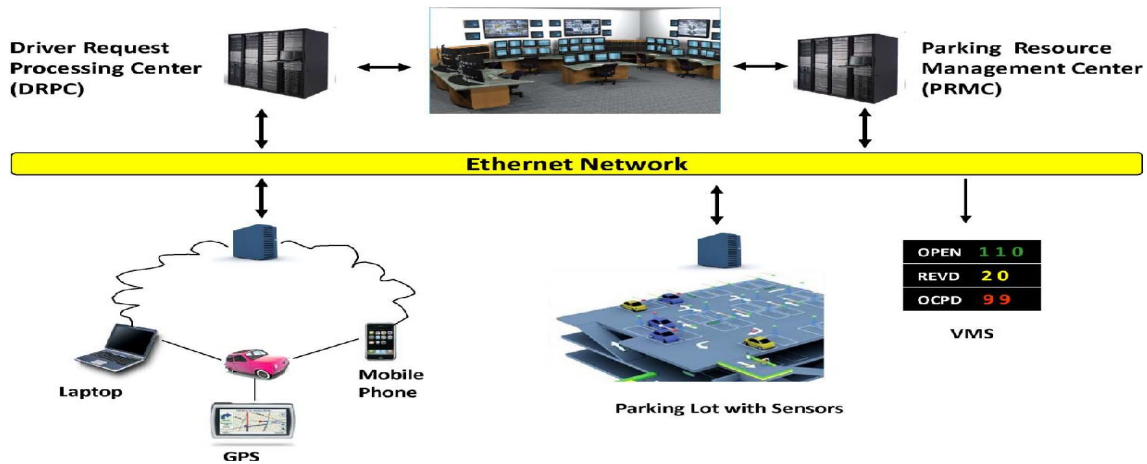


Intelligent Transport System (ITS) and Electronic toll collection (ETC) using optical character recognition (OCR) creates a record for all entering vehicle. A universal OCR algorithm is not available, making it difficult to create said records [17].



The author proposes robotic garage (RG) using Bluetooth to park the car. The system identifies the unique registration number in the Bluetooth chip to check whether the new vehicle needs to be parked. This system is a stack parking arrangement for the vehicles with sensors that confirm placement of the car. Other sensors are used to confirm that there are no passengers in the vehicles and then the system moves the vehicle to storage area employing rack and pinion (RaP) mechanism [19]. The author proposes upgraded system to the above, which is deployed with active radio frequency identification (RFID) to authenticate at the gate management service (GMS) to assign a slot. The system provides an additional feature to monitor parking lot over the internet [20].

The author proposes mixed-integer linear programming (MILP) along with Driver request processing center (DRPC) provides infrastructure to vehicle (I2V) communication for assigning and reserving parking spaces using smart parking allocation center (SPARC) from parking guidance and information(PGI) [14].



II. LITERATURE SURVEY

In today's world parking lots have become redundant and needs lot of manpower to handle and maintain it. These parking lots are not user friendly and do not provide data regarding availability of free spaces. Many researchers have contributed to this issue and formalized with various methods to better optimize the parking lot to serve the needs. The author proposed smart parking reservation system using short message services (SMS), for that he uses Global System for Mobile(GSM) with microcontroller to enhances security[9]. The ZigBee technique is used along with the GSM module for parking management and reservation [11]. The author uses Global Positioning System(GPS) and Android platform to show available parking spaces. However, reservation for the same is not available [12].

The author uses Artificial Intelligence (AI) techniques to process images, which recognizes the parking occupied only by vehicles. The system provides guidance images towards the assigned slots, thus making it intelligent [15]. Inter integrated circuit (I²C) protocol is used along with car parking framework(CPF) to assign radio frequency identification (RFID) to each car which will be used to identify car parked over a slot. Variable message screen(VMS) shows car parked over a given floor [16]. The system assigns and reserves an optimal parking space based on drivers cost function that combines proximity to destination and parking cost. Driver request processing center (DRPC) provides infrastructure to vehicle (I2V) communication for assigning and reserving parking spaces using smart parking allocation center (SPARC) [14].

The author uses wide angle camera as a sensor which detect only free parking spaces and records them. These records are then used to assign parking space to the incoming user [18]. Intelligent Transport System (ITS) and Electronic toll collection (ETC) using optical character recognition (OCR) creates a record for all entering vehicle. This creates tag less entry for all vehicles in the parking lot, but it does not assign a slot to the user. A universal OCR algorithm is not available, making it difficult to create said records [17].

The author proposes robotic garage (RG) using Bluetooth which would be used to fully automate the placement of a car in the slot without the aid of the driver. The system automatically checks the unique registration number stored in the Bluetooth chip to check if the new vehicle needs to be parked. This system is a vertical parking arrangement for the vehicles with sensors that confirm placement of the car. Various other sensors are used to confirm that there are no passengers left in the vehicles and then the system moves the vehicle to storage area employing rack and pinion (RaP) mechanism [19]. The author proposes upgraded system to the above, which is deployed with radio frequency identification (RFID) to authenticate at the gate management service (GMS) to assign a definitive slot. The system provides an additional feature to monitor parking lot over the internet [20].

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III. PERFORMANCE REVIEW TABLE

Pp · No	Paper Name	Author Name	Year	Advantages	Disadvantages
1	Smart parking reservation system using short message services (SMS). [9]	1.Noor HazrinHanyMohamadHanif 2.Mohd Hafiz Badiozaman 3.Hanita Daud	2009	1. Enhanced security due to password requirement. 2. System can be used and applied anywhere due to ease of usage.	1.Cost of implementation is high. 2.GSM feature creates bottlenecks 3.The microcontroller will have to take a lot of load which can crash the system.
2	ZigBee and GSM based secure vehicle parking management and reservation system. [11]	1.Ashwin Sayeeraman 2.P.S.Ramesh	2012	1.Parking lot vacancy module uses ZigBee along with PIC. 2.Security Feature: The exit password must be entered else the user is not allowed to get out of the parking bay as the barrier gate will not get open until correct exit password is entered.	1. The GSM and SMS module makes the system expensive. 2. The SMS contains entry/exit password to the parking lot may not be received due to network congestion.
3	Smart Parking Service based on Wireless Sensor Networks. [12]	1.Jihoon Yang 2.Jorge Portilla 3.Teresa Riesgo	2012	1. Use of android application provides ease of usage and better interface. 2. GPS helps in max coverage of available area, displaying various options for parking.	1. Reservation feature is not available for the user. 2. Multilevel parking inside an infrastructure is not available.
4	An Intelligent Parking Guidance and Information System by using image processing technique. [15]	1.P.DharmaReddy 2.A. RajeshwarRao 3.Dr. Syed Musthak Ahmed	2013	1. By using image processing technique it identifies car only but if any object other than car is at parking slot it doesn't considered that slot is booked. 2. Shows real time information.	1.High cost of implementation 2. User will have to inquire for every slot available. 3. GSM system creates bottlenecks.

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5	Wireless Sensor Network and RFID for Smart Parking System. [16]	1.Manjusha Patil 2.Vasant N. Bhonge	2013	1.It provides information of the slot available as well as guides the driver to the particular spot 2. There is no need to change the existing parking system and it is compatible with the existing wired networks.	1. Reservation of available slot is not provided. 2. Use of RFID increases the cost. 3.Node-to-node implementation requires more time
6	New “Smart Parking” System Based on Resource Allocation and Reservations. [14]	1.Yanfeng Geng 2. Christos G. Cassandras	2013	1. Reservation of the desired parking slot is available. 2.Efficient resource allocation and management using MILP	1. A parking spot is reserved by a driver, but it is occupied by a different driver. 2. A parking spot is reserved by a driver. The driver parks his vehicle but forgets to confirm. The system requests confirmation and until the driver says YES.
7	Intelligent Parking Management System Based on Image Processing. [18]	1.Hilal Al-Kharusi 2. Ibrahim Al-Bahadly	2014	1. The system captures and processes the rounded image drawn at parking lot and produces the information of the empty car parking spaces. 2. A camera is used as a sensor to take photos to show the occupancy of car parks 3.Single camera can detect the presence of many cars at once.	1. The weather conditions affect the System i.e. in terms of visibility. 2. The camera should be in a position where it can see all the car parks and not be obstructed by any objects. 3. No guidance is provided to the parking lot.
8	Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition. [17]	1.M. M. Rashid 2.A. Musa 3.M. AtaurRahman 4.N. Farahana	2014	1. The auto parking system will have less interaction of humans and use magnetic card and its devices. 2.License plate recognition applies image processing and character recognition technology to identify vehicles by automatically reading the license and its used	1. Number plate is differed in term of color, size and type from country to country. Different algorithm has to be applied for different type of number plates. 2. No way a user can reserve a parking lot in

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9	Automated Parking System with Bluetooth access. [19]	1.Harmeet Singh 2.Chetan Anand 3.Vinay Kumar 4.Ankit Sharma	2014	1. The system uses the user mobile's Bluetooth for identification and registration. 2. The vehicle is transported to the parking location with the help of a rack and pinion mechanism for linear motion. 3. It automatically detects the unique registration number stored in the Bluetooth chip to check if the new vehicle is to be parked.	1. Cannot be used in existing parking system. 2. The whole parking lot is to be designed with mechanical components such as rack and pinion mechanism.
10	Car Park Management with Networked Wireless Sensors and Active RFID. [20]	1.ElMouatezbillah Karbab 2. DjamelDjenouri 3. SaharBoukabol 4.Antoine Bagula	2015	1. The main advantage of the gate management model is its low cost and simplicity over lot management model. 2. Gate management service: Another use of RFID tags is gate management. As example, a gate can be opened automatically using an RFID reader and the vehicle's tag at the gate.	1. No driver guidance systems to guide towards the parking lot.

IV. CONCLUSION AND FUTURE SCOPE

The systems proposed by various authors help us effectively in reserving as well as eliminates the need for searching of a parking space in private parking lot. Many researchers have implemented systems which have dynamic arrangement scheme for satisfying the different needs of drivers and service providers, which is based on real-time parking information. Hence, we conclude that this paper is very useful for new researcher for innovation of new techniques to manage the problem faced by drivers on day to day basis. The table contains advantages and disadvantages of various systems implemented by researchers. In future work, we innovate this system which is not only used in a particular parking area available, but can be extended and also be implemented on various other platforms such as railway stations, airports, mall parking spaces. This will make the management of the parking spaces efficiently, by eliminating need of manual labor work.

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