A Survey on Car Parking Systems

Pramod Bide, Sachin Pandey, Gitang Karnam, Krutika Patil

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. Most of these techniques are based on the use of wireless sensor agents, image processing techniques, Global Positioning System(GPS) to gather the information from the external environment for processing.

II. RELATED WORKS

A. Iris net

Irisnet[1] is composed of a potentially global collection of Sensing Agents (SAs) and Organizing Agents (OAs). SAs collect and process data from their attached webcams or other sensors, while OAs provides facilities for querying recent and historical sensor data. Irisnet proposed a wide-area architecture for pervasive sensing networks which enables users on their ways to retrieve the information about available car parking space via distributed accessing methods. In this system, the video cameras (Webcams), microphones, and motion detectors are employed to detect and recognize the automobiles. The sensory data, for example parking field images captured by Webcams, will be processed in a

 Pramod Bide, Department of Computer Engineering, Ramrao Adik Institute of Technology, Nerul, India.
 Sachin Pandey, Department of Computer Engineering, Ramrao Adik Institute of Technology, Nerul, India.
 Gitang Karnam, Department of Computer Engineering, Ramrao Adik Institute of Technology, Nerul, India.
 Krutika Patil, Department of Computer Engineering, Ramrao Adik Institute of Technology, Nerul, India.

networking environment. The processed data will be published on the web. Then, the user can acquire the interesting information by using the web access technologies.

Figure taken from [1].

We discovered that this technology has a huge potential to become an accurate system to manage wide environments. But due so serious technological and resource constraints the system is not resource friendly. In the above mentioned use of the irisnet to manage parking , the video cameras will generate a large amount of data. The transmission and process of these data will consume a great deal of resources, including communication bandwidth, processing cycles, and energy, which are very limited in a wireless sensor network.

B. Smart Car Parking System using Wireless Sensor Network

In the Wireless sensor network system[2], the author, proposes and implements a car parking management system using wireless sensor network. In the system each mote is equipped with only one passive ambient light sensor, to detect the presence or absence of a car. Apart from detecting the car the sensor mote also provides additional information like the amount of time the car has been parked. The system displays the availability status at strategic locations and sends the information such as slot allotted, time parked, billing information and directional details to the user's mobile phone via SMS (Short Message Service).
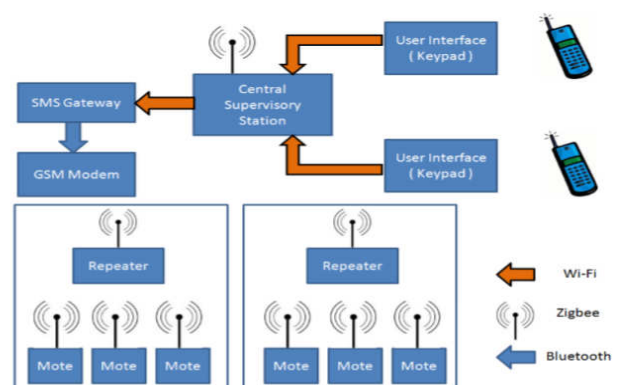

Figure taken from [2].

In this system the author does not only implements the system effectively but also ensures that the energy efficacy of the system is high. The author introduces sleep functionality in the radio modules which will save a lot of energy. Furthermore, the system proves to be completely paperless and therefore eco-friendly. Despite being a well designed system it suffers of some drawbacks. The modern age is the age of growing use of internet. Internet has conquered almost everything. In this system the use of SMS relies on the performance of GSM . The SMS service is expensive and has limited capability to display data. In contrast the internet facility has more flexibility and mode information can be displayed and processed.

C. Parking System Based on Image Processing

In this system of managing a parking area, the author uses a unique technique of image processing and provides desired results. In this system, the author makes use of a single camera to show the status of car parks. The main advantage of this system is that it detects presence of many cars at once unlike in the wireless sensor network wherein each parking spot had an individual sensing device. This makes the system very effective. The idea behind processing the image is by comparing two consecutive image frames . In this system each car parking space is colored with a green rounded image and the parking space detection is done by identifying these green rounded images.
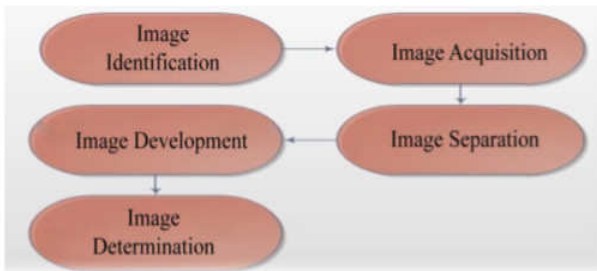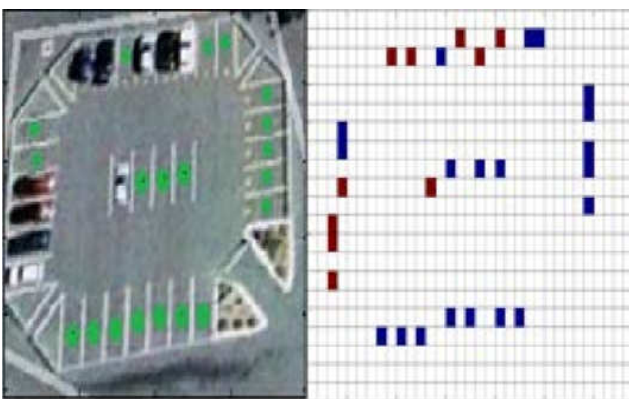

Figure taken from [3].

Figure taken from [3].

D. Car Park Management with Networked wireless sensors and Active RFID.

The advance services of the internet, which enables us to carry out the latest technology of Internet of Things (IOT) is used in this project for the integration of radio frequency identification (RFID) technologies and networked actuators/sensors. Based on this concept, an expandable and fair-cost parking framework is proposed by the author.

The devices can be equipped with the IP address and suited up with an object to the smart parking and its infrastructure to create smart objects in return. This can be interconnected in the available IoT platform having embedded sensor devices which are used for locating empty spot in the parking area, while the RFID devices are used for the authorization of the parking spot, locating car and theft avoidance. Integration of the sensor devices and the RFID devices produces a heterogeneous environment.

The obstacles associated with such project may require Quality of Service (QoS) routing and complex routing architecture. In this the network of hybrid sensor and RFID devices are layered upon other hybrid network of wired or wireless networks.
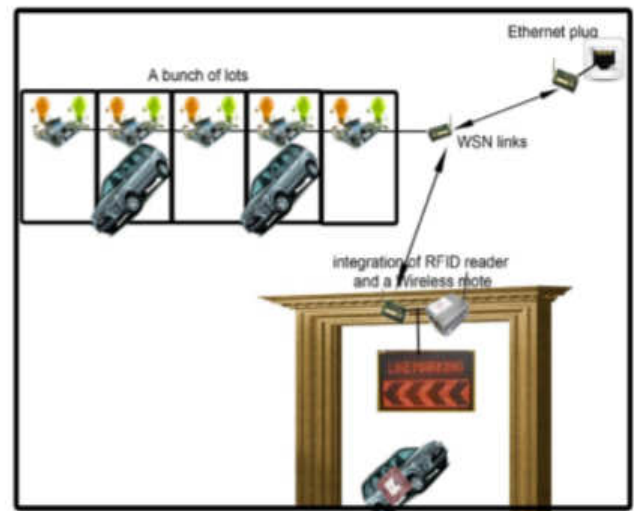

Figure taken from [4].

E. Automatic Car Parking Management System and Parking Fee Collection Based on Number Plate Recognition.

In this system, the author proposes an automatic car parking system and electronic parking fee collection based on number plate recognition, which is done by using image processing .

In this the author introduces us with the parking guidance system, which will route the user towards an empty parking slot. The system is ran by a pre-programmed controller for reducing the human involvement in parking system and ensure access control to restricted areas. The vehicles are automatically stored in the database by extracting the license plate, with the use of license plate recognition algorithm in which image processing and character recognition techniques are used. In the Optical Character Recognition (OCR) technique, which is used to recognize the characters, a rule of no or very little noise in the image background is followed.

Figure taken from [5].

Figure taken from [5].

There are few notable limitations to this system. Firstly, the number plate is differed in terms of colour, size and type from country to country. Thus different algorithms must be applied

for different type of plates. And secondly, the algorithm used is applied only on a one-row number plate.

III. CONCLUSION

The system proposed by various authors helps us to evaluate and compare performances of the different system of car parking management. An effective reservation, fair bill calculation, reduction of human interference in parking system and search of empty parking slot is productively carried out with these mentioned systems. The different needs of drivers and service providers are satisfied by using different dynamic arrangement schemes, which is based on continuous updation of parking information. Thus we can conclude that with the help of these research papers, the introduction of new techniques can be established by keeping in mind the drawbacks or the limitations faced by the studied papers.

IV. PERFORMANCE REVIEW TABLE

Table I. Table Styles

Ref. No.	Research Paper Details		
	Name and Year	**Advantage**	**Disadv.**
1	IrisNet: An Architecture for Internet-scale Sensing Services	IrisNet provides simple APIs for orchestrating the SAs and OAs to collect, collaboratively process and archive sensor data. Iris Net handles issues of query routing, semantic caching of responses and load balancing in a scalable manner for all services.	The system is not resource friendly. A large amount of data will be produced, thus the transmission and process of these data will consume a great deal of resources including communication bandwidth, processing cycles, and energy.
2	Smart Car Parking System using Wireless Sensor Network [2009].	Strengthened security due to password necessity. System is adaptable to most of the environment thus can be established and used anywhere.	Cost of implementation is high. SMS charges are more than the internet charges. GSM feature creates congestion.
3	Parking System Based on Image Processing [2014].	The information of the empty car parking system is produced by capturing and processing rounded image of the parking lot. The occupancy of the car park is captured by camera which is used as a sensor.	The visibility of the system can be affected by the various weather conditions occurring in the environment. Even the camera position plays an important role. It should be placed in a way which is free from any obstacles.
4	Car Park Management with Networked wireless sensors and Active RFID [2015].	It requires low cost and is simpler as compared to other management systems. In the Gate management service, the gate can be automatically operated using RFID devices (reader and tags). Thus reducing human resources.	No driver guidance systems to help the user to guide towards the parking lot.
5	Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition [2014]	Magnetic cards and its devices are used, thus the parking system will have less human interaction. The vehicles are automatically stored in the database by extracting the license plate, with the use of license plate recognition algorithm in which image processing and character recognition techniques are used.	The number plate is differed in terms of color, size and type from country to country. Thus different algorithms must be applied for different type of plates. The algorithm used is applied only on a one-row number plate.

REFERENCES

1. "IrisNet: An Architecture for Internet-scale Sensing Services" , Suman Nath, Amol Deshpande, Yan Ke, Phillip B. Gibbons, Brad Karp, Srinivasan Seshan.
2. Noor HazrinHanyMohamadHanif, Mohd Hafiz Badiozaman, HanitaDaud, "Smart parking reservation system using short message services (SMS)." , IEEE 2009
3. Hilal Al-Kharusi, Ibrahim Al-Bahadly, "Intelligent Parking Management System Based on Image Processing", World Journal of Engineering and Technology, 2014, 2, 55-67.
4. El Mouatezbillah Karbab, Djamel Djenouri, Sahar Boulkaboul, Antoine Bagula, CERIST Research Center, Algiers, Algeria University of the Western Cape, Cape town, South Africa ,"Car Park Management with Networked WirelessSensors and Active RFID" ',978-1-4799-8802-0/15 ©2014
5. M. M. Rashid, A. Musa, M. Ataur Rahman, and N. Farahana, A. Farhana, "Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition.", International Journal of Machine Learning and Computing, Vol. 2, No. 2, April 2012, Published 2014