Smart Parking System for Monitoring Vacant Parking

Ndayambaje Moses[1], Y. D. Chincholkar[2]

Department of Electronics & Telecommunication Engineering, Sinhgad College of Engineering [1, 2]

Abstract: Worldwide, vehicles have become a very significant means of transport in which results into a huge number of cars that are owned in various cities, in turn traffic congestion and pollution leads. At top of all, parking has become the sparking factor of the mentioned problems. This paper puts an eye on various techniques as far as the smart parking system (SPS) is concerned which are already implemented. In looking after this parking issue, big number of authors contributed a lot in monitoring SPS and management of SPS with the help of various technologies including wireless sensor network, Bluetooth, Zigbee, RFID, GSM, Cameras, Image processing, IoT accompanied by a number of software solutions based on mobile application. Following this survey will enhance researcher's thought on SPS which will result in a real solution of the technique and algorithms for ultimate SPS.

Keywords: Smart parking system, wireless sensor network, Reservation, IoT

I.INTRODUCTION

A quick development of the world today is accompanied by the movement of both things and people; this paved the way for many cars to be manufactured and every one in every city use either private or public transport in which significantlyresults into high pollution and traffic congestion as well as time consumption all over the world, This problem is exacerbated by searchers of the vacant parking mostly in rushing hours. As per recent survey [13] more than 30% of traffic congestion in big towns, drivers who are looking for vacant parking space come at the top of the sparking factor. Previously, huge numbers of techniques have been used in hindering such problems including wireless sensor network, Bluetooth, Zigbee, RFID, short massages (SMS),GSM,GPS, Image processing, Arduino, Raspberry pi ,Cloud-based server as well as Android. Soh Chun Khang [1] proposed a Wireless Mobile-based Car Parking System using low cost SMS service. The implementation of SMS service into the car parking system, enable the drivers to receive information regarding the availability of car parking spaces. In this system, the driverscan resend SMS to request for new assignment of car parking spaces if they fail to get the previous assigned destination. However this system did not included the concept of central web server. First, the driver arrives at entrance and takes the parking ticket. Then, the driver may follow the assigned parking spaces (with parking lot ID) that printed on the ticket to park his vehicle [2]. If there is available, means there is an empty parking space, driver may park their vehicle and proceed to the shopping mall. However, if the driver arrive at the assigned parking space and found out the parking space is already occupied, driver may send a SMS to WMCPS (Wireless Mobile-based Car Parking System) [2]to get new assigned parking spaces which may result into conflicts. The author [9]proposed An Automatic car parking Monitoring and management system called (CPMMS) with help of automatic number plate

recognition cameras hardware and parking management as well as android application on side of software.As shown in figure 1 below, the scheme is used to effectively manage, monitor and protect the parking facilities, Android application is used to facilitate the drivers in remembering their parking slot, however, No facilities for searchers of vacant parking space and the system is limited in short distance since it doesn't give any information to the incoming drivers about the current situation of the parking lots.
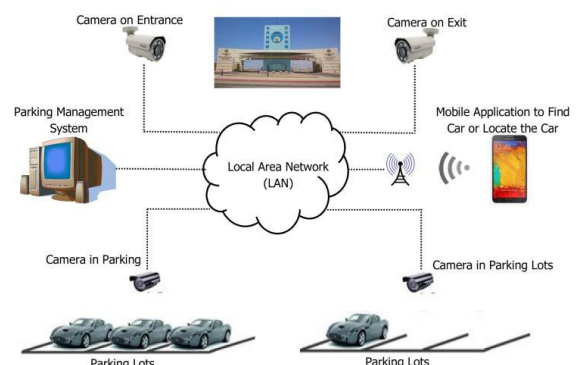

Figure 1.Design of the proposed Automated Car Parking Management and Monitoring System (CPMMS)

The author [13] proposed "Park Here! A Smart Parking System based onSmart-phones' Embedded Sensors and Short RangeCommunication Technologies" to ease searching for vacant parking lots which is cheap since it doesn't require infrastructure,easy communication due to android application as shown in the figure 2, the application is simple to be used however, it is only used when the two uses are in the same proximity area, no reservation is provided in this system,Access to geo-location of the parking lots is not provided.
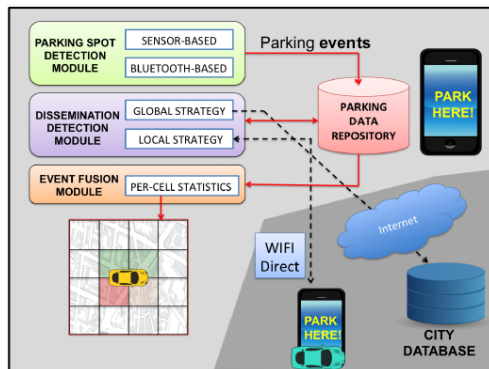
Figure 2.The architecture of park here application

II. LITERATURE SURVEY

Many researchers in their various works elaborated significantly the problem of implementing reliable parking guidance and information systems (PGIS), by locating the vacant space in parking lots as well as conveying such information to the car owners. The existing works can be broadly categorized in two areas, Wireless sensor network- based systems and Camera-based systems.

R.E. Barone,T.Giuffrè, S.M.Siniscalchi, M. A.Morgano, and G.Tesoriere in their research "Architecture for parking management in smart cities" [4]. They proposed intelligent parking assistant (IPA) architecture with the aim of providing public parking management solutions. This architecture provides drivers information regarding on-street parking stall availability and allows drivers to reserve the most convenient parking stall at their destination just before their departure.

They use RFID technology in this system. When a car parks or leaves the IPA parking lot, the RFID reader and magnetic loop detect the action after all send the information to the unit controller for information update on the car status. In this architecture, no large scale parking system that is created and only simple mathematical equations are used.

L. Lambrinos and L. Dosis, DisAssist: an author of SPS, "An Internet of Things and mobile communications platform for disabled parking space management," [5] described a smart parking system-based on the internet of things technology. Zigbeewireless sensor network were used in this architecture as well as internet of things middle layer and front-end layer as the final user interface which provides data reporting to the user. However, some disadvantages are there such as not using suitable application protocol, system performance isn't there as well as mathematical model for the system evaluation.

Shen-En Shih and Wen-Hsiang Tsai, Senior Member, IEEE proposed SPS,"A Convenient Vision-Based System for Automatic Detection of Parking Spaces in Indoor Parking Lots Using Wide-Angle Cameras" [7] with a number of advantages including that the system can be set up easily by a common user with no technical background, A wide-angle cameras are used to cover the whole area of the parking lots, Parking spaces can be detected precisely and Vacant parking spaces can be identified automatically for convenient car parking.

With all of the mentioned advantages, the system leaves behind some drawbacks like, No measures provided to deal with the weather condition which can affect the visibility, Reservation is not provided in the system, Cameras needs to be in a position where it's possible to monitor the whole parking lots.

D. J. Bonde, R. S. Shende, K. S. Gaikwad, A. S.Kedari, and A. U. Bhokre, ``Automated car parking system commanded by Android application,'' [8] aimed at automating the car and parking. The research presents a miniature model of an automated car parking system that can regulate and manage the number of cars which can be parked in a given area at any specific time based-on the availability of parking spaces. The automated parking is a method which facilitates in parking and exiting cars using sensing devices. Both entering and exiting the car parking is commanded by an Android based application.

This brings a difference from D. J. Bonde system and the others, which is the others intention. Where were aiming to design a system which is little depending to the human, they intended to automate the car and the entire parking contrary to various authors who never mind about automation. Not to forget much of the drawbacks of the system, such as the driver has to wait at the parking gate for identification of vacant lot and noreservation of parking lot which can facilitate car owners to save time.

Mohammed Y Aalsalem, WazirZadaKhan, Khalid Mohammed Dhabbah both proposed SPS "An Automated Vehicle Parking Monitoring and Management System Using ANPR Cameras" [9], An Automatic number plate recognition cameras are used to effectively manage, monitor and protect the parking facilities, Android application is used to facilitate the drivers in remembering their parking slot, however, No facilities for searchers of vacant parking space, The system is limited in short distance since it doesn't give any information to the incoming drivers about the current situation of the parking lots.

Thanh Nam Pham, Ming-Fong Tsai1, Der-Jiunn Deng2 are the author of "A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies" [10], Internet of things technology is applied to ease the communication as the authorsindicated, P

erformance is improved by reducing the number of users that fail to find a parking space, Minimizes the costs to the drivers of moving to the parking spaces. Irrespective of such merits, the system has also demerits since a Security aspect of the system is not clarified; besides, the system is implemented in short scales.

Table 1.Merits and Demerits of the Recent Proposed Smart parking system

Year	Paper names	Advantages	Disadvantages
2011	Reservation-based smart parking system [3]	1. Reservation service is affected by the change of physical parking status. 2. System requires conformation after the arrival of the driver.	1. Reservation service is affected by the change of physical parking status. 2. System requires conformation after the arrival of the driver.
2012	SPS Architecture Using Ultrasonic Detection[4]	1. Parking space detection. 2. Improper parking detection is employed.	1. Sensitivity to temperature changes. 2. Affected by extreme air turbulence. 3. Cost effectiveness.
2013	A Multi-Classifier Image Based Vacant Parking Detection System [5]	1. A robust vacant space detection system at low computational cost. 2. Low cost for the system to work.	1. No reservation provided. 2. Visibility can be hindered by weather condition.
2014	Intelligent Parking Management System Based on Image processing [6]	1. Single camera can detect at once the presence of many vehicles. 2.The captured image is used to give out information	1. The system can be hindered once obstruction happens. 2. Weather condition is the main factor of this system's drawbacks.
2014	A Convenient Vision-Based System for Automatic Detection of Parking Spaces in Indoor Parking Lots Using Wide-Angle Cameras [7]	1. The system can be set up easily by a common user with no technical background. 2. A wide-angle cameras are used to cover the whole area of the parking lot 3. Parking spaces can be detected precisely. 4. Vacant parking spaces can be identified automatically for convenient car parking.	1. No measures provided to deal with the weather condition which can affect the visibility. 2. Reservation is not provided in the system. 3. Cameras should be in a position where it's possible to monitor the whole parking lots.
2014	Automated Car Parking System Commanded By Android Application [8]	1. The system is automated which relieve human dependence. 2. Android system is applied as a current technology.	1. A driver has to wait at the parking gate for identification of vacant lot. 2. No reservation of parking lot which can facilitate car owners to save time.
2015	An Automated Vehicle Parking Monitoring and Management System Using ANPR Cameras [9]	1. Automatic number plate recognition cameras are used to effectively manage monitor and protect the parking facilities. 2. Android application is used to facilitate the drivers in remembering their parking slot.	1. No facilities for searchers of vacant parking space. 2. The system is limited in short distance since it doesn't give any information to the incoming drivers about the current situation of the parking lots.
2015	A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies [10]	1. Internet of things technology is applied to ease the communication. 2.Performance is improved by reducing the number of users that fail to find a parking space 3. Minimizes the costs to the drivers of moving to the parking spaces.	1. Security aspects of the system are not clarified. 2. The system is implemented in short scales, large scales is desired.
2015	Design and Management of an Intelligent Parking Lot System by Multiple Camera Platforms [11]	1. Lend the drivers to record their parking spot number and location easily. 2. Provides remote end monitoring and offer parking spot leading service when driver forget his parking lot.	1. Update rate of the parking spot may be slow during high traffic load. 2. Raspberry pi needs more extension for upholding more features as per this system.
2015	An Approach To Iot Based Car Parking And Reservation System On Cloud [12]	1. Android application is used to ease the performance of the system 2. Reservation of the parking lot is provided. 3. The payment is to be done through payment wallet, no need to wait.	1. No monitoring mechanism for free parking lots provided. 2. When parking lot is reserved, there's no interval time limit for delayed car.
2015	Park Here! A Smart Parking System based on Smart-phones' Embedded Sensors and Short Range Communication Technologies [13]	1. It's cheap since it doesn't require infrastructure. 2. Easy communication due to android application. 3. The application is simple to be used in a participatory way.	1. It's only used when the two uses are in the same proximity area. 2. No reservation is provided in system. 3. Access to geo-location of the parking lots is not provided.

III. CONCLUSION

In various researches of Smart parking systems, different authors implemented numerous systems which have dynamic arrangement scheme for helping in different needs of drivers and service providers, which are based on real-time parking information however, as indicated in the tables of merits and demerits in this paper, more innovation is still needed to clear the gap as far as SPS is concerned. Conclusively, this paper is extremely significant for new researchers in innovationof new techniques to manage the problems which are faced by drivers nowadays. In future work, real-time parking lots streaming through android application are highly recommended in which will easily helps the drivers to allocate the vacant parking lots. This will make the management of the parking spaces effectively, by eliminating need of manual labor work.

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BIOGRAPHIES

Ndayambaje Moses received B.E degrees in Electrical Engineering and Telecommunication from Kigali institute of science and technology (KIST), Rwanda in 2012 and pursuing his M.E. in Electronic and Telecommunication since 2014, at Sinhgad College of Engineering, Pune-India.

Y. D. Chincholkar received B. E degree in Electronics and telecommunication (E & TC) from Sant Gadge Baba Amravati University, India in 1997 and M.E degree in E & TC from Mumbai University. Presently, He is working in Sinhgad College of Engineering, Pune, India. His area of interest is signal processing and antenna.