A Review on E- Parking system for Smart Cities based on an IoT

Achal M. Talase[1], Lowlesh N. Yadav[2], Vijay M. Rakhade[3]

B. Tech Final Year Student, Computer Science and Engineering, Shri Sai College of Engineering and Technology,

Bhadrawati, Maharashtra, India[1]

Assistant Professor, Computer Science and Engineering, Shri Sai College of Engineering and Technology,

Bhadrawati, Maharashtra, India[2]

Assistant Professor, Computer Science and Engineering, Shri Sai College of Engineering Technology,

Bhadrawati, Maharashtra, India[3]

Abstract: The increasing range of vehicles on the road on with the direction of accessible car parking zone results in the parking connected issues yet as inflated holdup in urban areas. therefore, it's extremely needed to develop an automatic smart parking management system that will facilitate the motive force to find out some appropriate car parking zone for his/her vehicle very quickly. idea enough aggregate of survey struggle on the development of sensible parking system exist in literature, but most of them haven't addressed the matter of period detection of incorrect locating and impulsive bundle of parking amount. In this paper, an example of internet-of-thing based mostly E-parking system is planned. The planned E-parking system uses AN integrated element known as timer to handle the abovementioned issues yet on give sensible parking management throughout the town.

Keywords: Smart parking system(sps), parking iot, parking meter (PM), internet-of-thing (IOT), E-parking.

I.   INTRODUCTION

The huge proliferation within the variety of vehicles on the road alongside direction of the accessible heap parking zone automobile parking space car parking zone} has created parking connected issues [1] similarly as inflated the traffic jam in urban areas. Thus, it's needed to spread an impulsively excellent positioning operation technique. [2] that might not solely facilitate a driver to find an appropriate parking space for his/her vehicle, however conjointly it might scale back fuel consumption similarly as pollution. it's been found that a driver0 s look for an appropriate parking facility takes virtually fifteen minutes that will increase the fuel consumption by the vehicle, traffic congestion and pollution.

A powerful capacity of examination effort survives inside the area of style and development of good parking system. Various features of good parking system area unit listed below.

- Inquiry on accessibility of automobile parking space and reservation of automobile parking space.
- time period parking navigation and route steering
- Vehicle occupancy detection and management of parking lots

Most of the good parking systems (SPS) planned in literature over the past few years provides resolution to the design of parking accessibility data system, parking reservation system, occupancy detection and management of parking lot, time period navigation at intervals the parking facility etc. However, only a few works have paid attention to the Realtime detection of improper parking and automatic assortment of parking charges.

Thus, this paper presents associate internet-of thing (IoT) based mostly E-parking system that employs an integrated component referred to as timer (PM) to handle the subsequent issues.

- period detection of improper parking
- Estimation of every vehicle's length of heap parking zone automobile parking space car parking zone} usage
- Automatic assortment of parking charges

The E-parking system projected during this paper conjointly provides city-wide good parking management answer via providing parking facility convenience info and car parking zone reservation system and it's named as timer (PM) based mostly E-parking (PM-EP).

II.   RELATED WORK

(RFID), wireless sensing element network (WSN), Bluetooth, Wi-Fi, ZigBee etc. as well as agent based mostly technologies and image process techniques are projected within the literature over the past few years. Among these, an epitome of RFID-based good sparking application that implements machine-controlled arrival and leave approach of the vehicle from car parking area space by corruption RFID reader is conferred in [3].

On the opposite hand, either the sensing element node or WSNs have been used to style many SPSs [4, 5, 6, 7, 8]. Among these, an epitome of wireless sensing element network based mostly] intelligent car parking Significant variety of good parking systems supported various technologies like oftenest identification system is conferred in [4]. The projected system deploys inexpensive sensing element node at every car parking zone inside some parking field to discover and monitor the standing of every parking lot. The locate existence of assorted parking loads is periodically reported to an info via WSN entryway deployed at the parking field. except observance the parking field, the system projected in [4] conjointly provides alternative services like auto-toll, security management etc. good parking (SPARK) management system projected in [6] conjointly uses wireless sensing element networks to perform varied functionalities like remote monitoring of lot, reservation of car parking zone, automated steerage to the car parking zone etc. The supersonic sensing element node based mostly SPS conferred in [6] provides varied practicality that embrace vacant sparking house detection, detection of improper parking, show of accessible parking areas, payment facilities etc. The SPS and automotive parking management system planned in [7, 8] combined WSNs and RFID technology.

A transport accidental network (VANET) based mostly good parking system for big lot is projected in [9] and this proposed parking theme provides the drivers 3 necessary services that square measure period parking navigation, intelligent anti-theft protection and dissemination of friendly parking information. A reservation-based based totally SPS planned in [10] uses 802.15.4 little strength wireless technology, Bluetooth and Wi-Fi to change the driving force to look out and reserve the vacant parking areas. associate intelligent parking steering and information system that uses camera to note free parking slot and provides SMS based totally reservation service to the driving force is proposed in [11]. Image method technique is applied to design some intelligent parking system [12]. A sharp and reliable parking restriction process contribute to GSM technology is planned in [13]. associate automatic parking system that uses Bluetooth technology as a technique of communication is planned in [14]. The researchers in [15] have given associate intelligent parking negotiation and steering method that uses mobile medium to make ready discussion between the vehicle and parking facilities and to boot to chop back the amount of knowledge to be transmitted over wireless networks. The cloud-based platform has been used as a service to vogue the SPS by the researchers in [16].

On the alternative hand, IoT based totally automotive parking management system are planned [17, 18]. A location-centric iCloud based totally on-street automotive parking violation management system has been planned in [19]. The planned parking violation management system assists the authoritative officers to seek out the vehicles improperly place on street and to boot recommends the officers some minimum value route to reach those vehicles in order to chop back travel value conjointly as average quantity of parking violation detection.

An energy economical automatic automotive parking system that assigns some free parking spot nearest to entry of the parking area thus on avoid wasting parking time conjointly on utilize automobile automobile parking space expeditiously, has been planned in [20]. The planned system [20] saves energy by switch the lights on just some automotive is in motion at intervals the parking area. a wise automotive parking system supported economical resource allocation, reservation and valuation is planned in [21]. The researchers in [21] have tried to produce secure parking reservations with lower cost and smaller looking moment for the drivers because higher income and resource utilization for the managers of the park. The planned system utilizes mixed-integer applied math to meet its objective.

III. PLANNED TIMER(PM) BASED TOTALLY E-PARKING(PM-EP)

The E-parking system planned throughout this paper consists of the following parts. These are timer, a WLAN or Wi-Fi integrated laptop/workstation observed as native parking management server in conjunction with some Wi-Fi access points (APs) deployed at intervals each parking facility and a central server for providing parking accessibility

information throughout the city and receiving automobile automobile parking space reservation request from the driving force of a vehicle. The specification of the planned e-parking system is shown in fig. 1.

According to the planned PM-EP system, each parking lot is supplied with a PM that's positioned at the middle of the rear finish of the car parking zone as shown in fig. 1.
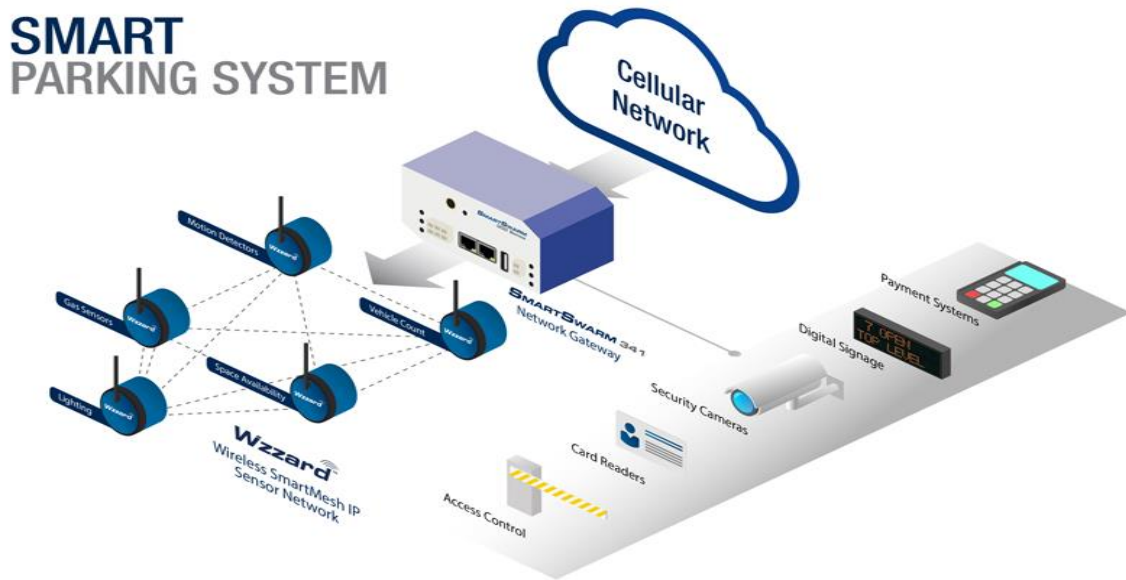

Fig. 1. Network architecture of proposed E- parking system

The hardware configuration of the timer is shown in fig. 2. The PM consists of associate degree unbearable device node used for detective work presence of auto inside the car parking zone, a led for indicating the standing of car parking zone (reserved or not reserved), microcontroller Arduino MEGA 2560, associate degree alarm IC module to make warning sound just in case of improper parking, a camera module for taking snap of the vehicle0 s license panel and IEEE 802.11 b/g/n appropriate wireless component for communicating with the native parking management server. The PM conjointly includes 2 smaller star cells to recharge the batteries as shown in fig. 2.

A GSM module [22] is connected with the native parking management server via some port for causation SMSs to the location officer likewise because the vehicle's driver. The code design and practical specification of planned e-parking system is given below.

A. Code Design of Planned PM-EP System

The planned PM-EP given during this paper consists of 4 different modules. These square measure car parking zone watching system (PLMS), native parking management system (LPMS), central parking management system (CPMS) and finally parking availability data and reservation user interface. The practical specification of every of those modules alongside work flow diagram on parking management done by this planned system is given during this section.

1)   car parking zone watching System (PLMS): This code module is utilized on microcontroller Arduino MEGA 2560. It will notice the presence or absence of a vehicle inside the parking lot supported time variations between the transmitted and received signal by the unbearable device node that emits sound wave every sixty milliseconds [6] Upon police work some vehicle's presence among the automobile parking lot consecutively three times, the occupancy of that automobile parking lot by some vehicle is confirmed. Then it takes a snap and sends the image to the LPMS for extra method over the Wi-Fi affiliation as depicted by the work programming language in fig. 3. If the vehicle is improperly place inside that case LPMS fails to extract license plate vary from the image then provides PLMS an instruction to discover alert sound onto alarm IC for improper parking of automobile. once it detects the vehicle's exit from the automobile parking lot, it'll calculate length of parking lot's inhabitation by the vehicle and present oneself it to LPMS as shown by work programming language in fig. 3. Fig 3 jointly shows that semiconductor device is turned on if PLMS be given restriction order for the associated automobile parking lot from LPMS.
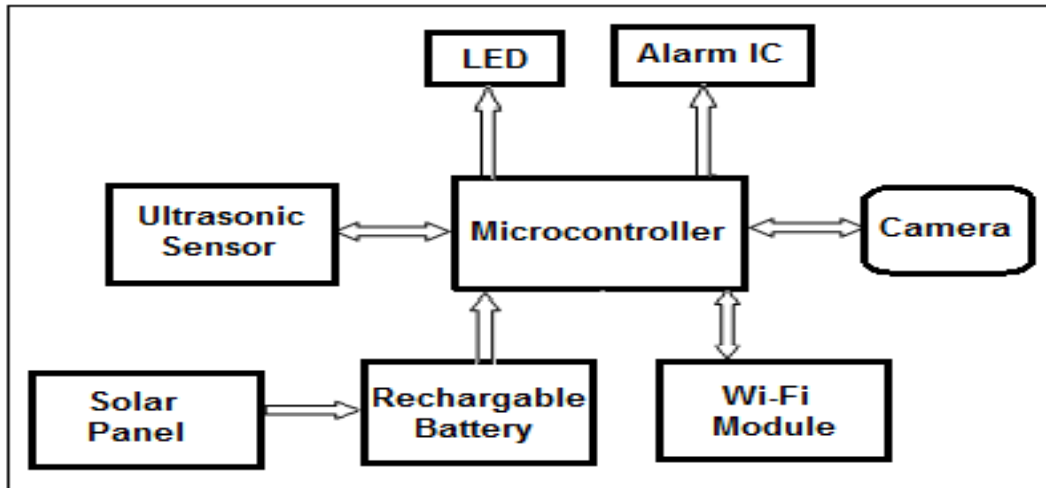
Fig. 2. Block diagram of parking meter (PM)

2)	native Parking Management System (LPMS): This module deployed onto the native parking management server available among each parking facility house. it's in control of monitoring the whole parking facility house. It maintains a record for each automobile parking lot to remain track of its standing that can be empty, reserved or occupied. The work programming language of LPMS is described in fig. 4. the various tasks accomplished by this method is listed below.

- It tries to figure out the {license plate car place registration varies plate vehicle plate registration code} range of the place vehicle by applying automatic registration number plate recognition (ALPR) formula [23] to technique the image received from PLMS. If ALPR stop working to latent the license plate varies, it sends some SMS to the positioning officer via the GSM module connected to the LPMS for manual entry of license plate vary (LPN) into the system. ALPR fails if the vehicle is incorrectly positioned or improperly place in which case web site officer receives SMS for manual entry of LPN. Improper parking of the vehicle could also be merely detected if registration number plate is not visible among the image in which case manual entry of LPN fails then LPMS sends unacceptable parking signals to the PLMS for making warning sound of improper parking as described by the work programming language in fig. 3 and fig. 4. Fig. 3. Work programming language for automobile parking lot looking system.

- On the alternative hand, if {license plate car place registration varies plate vehicle plate registration code} range of some place vehicle is obtained successfully the associated parking
  lot's record is modified to vary its state from zero empty to occupied and jointly to include vehicle's data. When some vehicle exits from the automobile parking lot, it receives duration of occupancy of the automobile parking lot by that vehicle from PLMS. Then LPMS calculates the parking charges for that vehicle and sends SMS carry payment option to the actuation if payment is due.

- When it be given reservation demand for a parking lot from central parking management server (CPMS), at first It selects academic degree empty automobile parking lot if the parking area is not full then sends reservation command to the corresponding PLMS. If reservation is confirmed by the PLMS, the record of corresponding automobile parking lot is modified to create its standing reserved and jointly embrace information of reserving vehicle. later LPMS sends reservation confirmation message at the facet of vary of empty parking tons to the CPMS as described by the work flow diagram in fig. 4. just in case parking zone space is full, LPMS notifies CPMS regarding the non-availability of free parking extract that parking facility space.

3).	Central Parking Management System (CPMS): CPMS is deployed on central parking management server that is	a high-end server with a world information processing [24] to form CPMS available on web. therefore, it is often communicated over the Internet. It maintains a record for every parking facility to keep track of free parking tons at intervals that parking facility. Therefore, it will give info on offered parking facilities throughout the town together with range of free parking lots through the parking handiness info graphical user interface running at the driver's hand-held device. once it receives reservation request for a parking zone at intervals some explicit facility space from some vehicle's driver it moving ahead the demand to the corresponding LPMS related to that parking facility area. Once LPMS has reserved a parking zone and sends the reservation confirmation, CPMS will deliver it to the consumer application together with payment choices.

4). Parking handiness info and Reservation GUI: This is the consumer application deployed onto the driver's hand-held device. This consumer graphical user interface permits the motive force to get Information on handiness of varied parking facilities throughout the city furthermore on reserve a parking zone at intervals the appropriate parking facility space over the net. If reservation is such casual, driver is asked for creating payment supported period of reservation. once the payment has been created, the image of the parking facility space displaying reserved parking slot is delivered to the consumer application.

IV. CONCLUSION

This paper presents the image of associate E-parking system that provides novel parking management resolution for varied parking facility areas throughout the town. The planned Eparking system permits the drivers to get info on availability of automobile parking space and to order some parking lot via an appropriate graphical user interface meaning reservation primarily based parking management facility. This planned system will simply discover vehicle's improper parking at intervals the parking zone and estimate the period of the parking lots occupancy by some vehicle by mistreatment associate integrated element known as timer that's deployed at every parking zone. The planned system conjointly ends Ables the automated assortment of parking charges by providing smart payment choices to the motive force.

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REFERENCES

[1] M. Y. Dina Idris, N. M. Noor and Z. Razak, 00 Car Park System: A Review of Smart Parking System and Its Technology00 Information Technology Journal 8(2), pp. 101 113, 2009, ISSN 1812-5638.

[2] Faheem et al., 00A Survey of Intelligent Car Parking System,00 Journal of Applied Research and Technology, Volume 11, Issue 5, pp. 714-726.

[3] Z. Pala and N. Inane, 00Smart Parking Applications Using RFID Technology,00 2007 1st Annual RFID Eurasia, Istanbul, 2007, pp. 1-3. Doi: 10.1109/RFIDEURASIA.2007.4368108.

[4] V. W. S. Tang, Y. Zheng, and J. Cao, 00An Intelligent Car Park Management System based on Wireless Sensor Networks,00 Pervasive Compute. Appl. 2006 1st Int. Sump., pp. 6570, 2006

[5] S. V. Srikanth, P. P. J., D. K. P., T. S., M. U. Patil and S. C. B. N., 00Design and Implementation of a Prototype Smart Parking (SPARK) System Using Wireless Sensor Networks,00 2009 International Conference on Advanced Information Networking and Applications Workshops, Bradford, 2009, pp. 401-406. Doi: 10.1109/WAINA.2009.53

[6] A. Kanwisher et al., 00Smart Parking System Architecture Using Ulf transonic Detector,00 Intern0 l Journal of Software Engineering and its Applications, Vol. 6, No. 3, July 2012, pp. 51-58.

[7] Patil, M., Bhonge, V. N, 00Wireless sensor network and RFID for smart parking system,00 International Journal of Emerging Technology and Advanced Engineering, Vol. 3, No. 4, pp. 188-192.

[8] Karbab, E., Djenouri, D., Boulkaboul, S., Bagula, A. (2015, May). Car park management with networked wireless sensors and active RFID. In 2015 IEEE International Conference on Electro/Information Technology (EIT) (pp. 373-378). IEEE.

[9] R. Lu, X. Lin, H. Zhu and X. Shen, 00SPARK: A New VANET Based Smart Parking Scheme for Large Parking Lots,00 IEEE INFOCOM 2009, Rio de Janeiro, 2009, pp. 1413-1421. doi: 10.1109/INF COM.2009.5062057

[10] Hongwei Wang and Wenbo He, 00A Reservation-based Smart Parking System,00 2011 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS), Shanghai, 2011, pp. 690-695. doi: 10.1109/INFCOMW.2011.5928901

[11] P. Dharma Reddy, A. Rajeshwar Rao, Syed Musthak Ahmed, 00An Intelligent Parking Guidance and Information System by using image processing technique,00 In International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 10, October 2013.

[12] H. Al-Kharusi and I. Al-Bahadly, 00Intelligent Parking Management System Based on Image Processing00 World Journal of Engineering and Technology, 2014, 2, pp. 55-67.

[13] Y. Rahayu and F. N. Mustapa, 00A secure parking reservation System using gsm technology,00 International Journal of Computer and Communication Engineering, 2(4), 518.

[14] H. Singh et al, 00A. Automated Parking System with Bluetooth Access,00 International Journal of Engineering and Computer Science ISSN, 2319- 7242.

[15] W. Longfei, C. Hong, L. Yang, 00Integrating Mobile Agent with MultiAgent System for Intelligent Parking Negotiation and Guidance00, 4th IEEE Conference on Industrial Electronics and Applications, pp.1704- 1707, 25- 27 May 2009.

[16] Z. Suryady et al, 00Rapid development of smart parking system with cloud-based platforms,00 In IEEE Fifth International Conference on Information and Communication Technology for The Muslim World (ICT4M), 2014, pp. [17] S. R. Basavaraju, 00Automatic Smart parking System using Internet of Things (IOT),00 International Journal of Scientific and Research Publications, Volume 5, Issue 12, December 2015

[18] B. M. K. Gandhi and M.K. Rao, 00A Prototype for IoT based Car Parking Management system for Smart cities,00 Indian Journal of Science and Technology, 9(17).

[19] T. Dinh and Y. Kim, 00A novel location-centric IoT-cloud based onstreet car parking violation management system in smart cities,00 Sensors (Switzerland), vol. 16, no. 6, 2016.

[20] V. Sumathi, N. V. Pradeep Varma, and M. Sasank, 00Energy efficient automated car parking system,00 Int. J. Eng. Technol., vol. 5, no. 3, pp. 28482852, 2013.

[21] A. O. Kotb, Y. C. Shen, X. Zhu, and Y. Huang, 00IParker-A New Smart Car-Parking System Based on Dynamic Resource Allocation and Pricing,00 IEEE Trans. Intell. Transp. Syst., vol. 17, no. 9, pp. 26372647, 2016.

[22] Y. C. Ma and Y. H. Huang, 00General Application Research on GSM Module,00 Applied Mechanics and Materials 151, pp.96-100. January 2012 DOI: 10.4028/www.scientific.net/AMM.151.96.

[23] C. N. E. Anagnostopoulos et al., 00A License Plate-Recognition Algorithm for Intelligent Transportation System Applications,00 IEEE Transactions on Intelligent Transportation Systems, vol. 7, no. 3, September 2006, pp. 377- 392. [24] V. Corts, Y. Ruiz, S. Fernndez, D. Lozano, D. Gonzlez and P. Dez, 00Global IP Services Delivery,00 2009 13th International Conference on Intelligence in Next Generation Networks, Bordeaux, 2009, pp. 1-6. doi: 10.1109/ICIN.2009.5357103