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Review on Automatic Car Parking Indicator System

Mr. Amit A. Kamble[1]
[1]Dept. of Computer Technology,
Priyadarshini College of Engineering,
Nagpur, India
akamble1310@gmail.com

Mrs. Archana Dehankar[2]
[2]Assistant professor
Dept. of Computer Technology,
Priyadarshini College of Engineering,
Nagpur, India
archana_dehankar@rediffmail.com

Abstract— Parking is costly and limited in almost every major city in the world. An Automatic car parking systems for meeting near term parking demand are needed. There is need to develop a vacant parking slot detection and tracking system. Around view monitor (AVM) image sequence makes it possible with 360-degree scene Bird's eye view camera. Around view monitor (AVM) captures the image sequence and on combining of each images empty slot is detected. The Ultrasonic sensor is useful to determine the adjacent vehicle. Hierarchical tree structure based parking slot marking method is used to recognize the parking slot marking. After combining sequentially detected parking slot, empty parking slot is recognized and the driver has to select one of the empty parking slots and drive into it.

Key Words— *Around View Monitor (AVM), Ultrasonic sensor, The Hierarchical tree structure of the parking slot marking, parking slot marking detection and tracking, recognition of the empty parking slot.*

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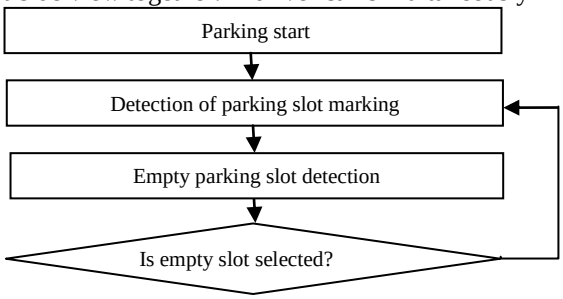
I. INTRODUCTION

Now a day, There is a rapid growth in the parking system. So, The is need to research an automatic parking system which will be useful for the careful parking of car and other vehicle [9]. Various approaches which we were using in parking system: user interface-based approach, free space-based approach, parking slot marking-based approach, infrastructure-based approach. The fusion of AVM system and an ultrasonic sensor is used to detect and track the vacant parking slot in the automatic parking system. The Around View Monitor (AVM) provides a virtually 360^0 scene of the car in bird's-eye view. The Around View Monitor (AVM) is a support technology that assists drivers to park more easily by better understanding the vehicle's surroundings through a virtual bird's-eye view from above the vehicle. The Around View Monitor (AVM) helps the driver visually confirm the vehicle's position relative to the lines around parking spaces and adjacent objects, allowing the driver to maneuver into parking spots with more ease [1].

Through The Around View Monitor (AVM) makes parking easier because (1) Through the bird's-eye view, a driver can check for obstructions around the vehicle, (2) The system can display the bird's-eye, front and rear views, making it possible to check the vehicle's 360-degree surroundings simultaneously with either the fore and back, (3) It is possible to display the rear view
and front-side view together. A driver can simultaneously check the rear and front-side views of the vehicle, the points of most concern when parallel parking [1] [2] [3].



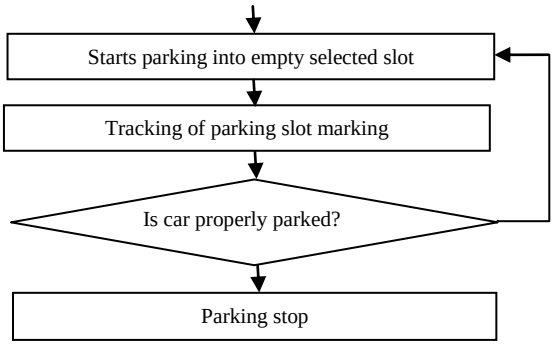


Fig.1. General Flow chart of car parking system. [1]

Ultrasonic sensors is also known as transceivers when they both send and receive. It is also called as Transducers. Transducers evaluate attributes of a target by interpreting the echoes from radio. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object [4]. Fig.1. shows Flow chart of proposed system. Once a driver starts parking, the system continuously detects parking slot markings and classifies their occupancies. First, the parking slot marking detected in the AVM image sequence. A tree structure-based method detect the parking slot marking using individual AVM image sequence and image registration technique. Second, empty slot is detected using ultrasonic sensors. The probability of parking slot occupancy is calculated utilizing ultrasonic sensor data acquired while the vehicle is passing by parking slots. And Finally, the selected empty parking slot is tracked and the vehicle is properly parked in selected parking slot [1] [2] [3] [4].

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II. LITERATURE REVIEW

In the previous parking system driver manually selects the parking slot and drive into it. This method is useful as a backup tool for failure cases of automatic parking system methods. Manpower is needed for each car parking slot to select a parking slot manually and give direction to drive properly into the slot [1]. There is need of manpower, so this system is replaced by the ultrasonic sensor based system. In this system, two ultrasonic based sensors are mounted on both sides of the front bumper. Adjacent vehicles are detected by using ultrasonic sensor data. These ultrasonic sensor find the adjacent vehicles and driver properly drive into the free space between that adjacent vehicle. Using the multiple echo function, parking space detected more accurately in real parking environment. These method fail when there is no adjacent vehicles and in slanted parking situations where adjacent vehicle surfaces are not perpendicular to the heading directions of ultrasonic sensors [1] [4]. Another method is Parking slot Marking-based method. In this method vehicle mounted cameras, are used. It simply tracks the parking slot marking present on the road. The distance between point and line-segment is used to distinguish guideline from recognized marking line segments. Once the guideline is successfully recognized, T- shape template matching easily recognizes dividing marking line-segments. This method fails where parking slot marking are not present [1] [5]. Scanning Laser Radar-Based system is implemented between vehicles to recognize free space parking slot. This system consist of range data preprocessing, corner detection, and target parking position designation. The major disadvantage of this system is the expensive price of the sensor [7].

A Photonic-Mixer-Device (PMD) camera is used to scan parking-scene to detect free parking slot. PMD sensor allows referring to a large number of spatial point measurements detailed representing cuts of the observed scene [6]. So we moved onto Infrastructure based method. In this method, bird-eye view camera is used which helps to track the vacant parking slot [1] [8].

III. METHODOLOGY

The main concept behind the detection of free parking slot is to recognize the parking slot marking. The hierarchical tree structure based parking slot, marking method deals with the four most commonly appearing types of parking slot markings, i.e., rectangular, slanted rectangular, diamond, and open rectangular types. These four types of parking slot markings consist of four types of slots, i.e., TT-slot, TL-slot, YY-slot, and II-slot and each slot is composed of two junctions. These junctions can be categorized into T-junction, L- junction, Y-junction, I- junction. This method detects and classifies corner and produces junction by pairing two corners [1] [2]. AVM image sequence is useful to recognize the parking slot marking. Various images generated by AVM camera, and by combining them empty parking slot is detected. Parking slots are detected using Hierarchical tree structure. The corners are detected by the Harris corner dectector. The junctions are generated by combining two corners and slots are generated by combining two junctions. Sometimes, parking slots overlapped in real time situation.

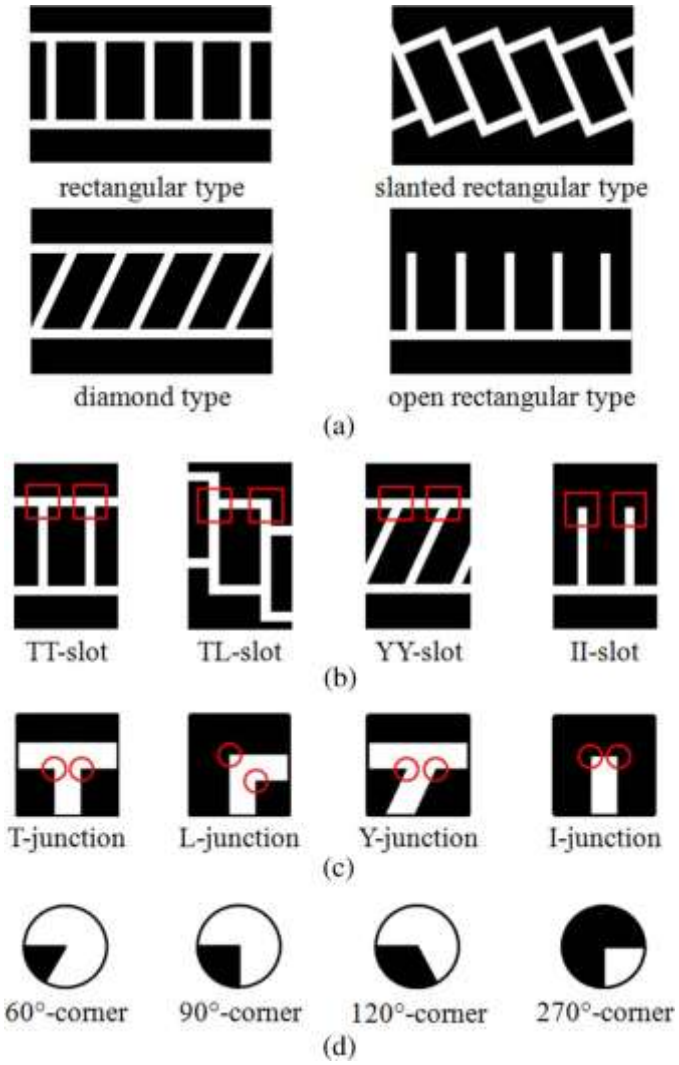

Fig.2. Hierarchical tree structure of parking slot marking. (a) parking slot marking (b) slots (c) junction [2]

This overlapping of two slots is determined by Jaccard coefficient.

$$J(S_i.S_j) = \frac{|Si \cap Sj|}{|Si \cup Sj|} \qquad (1)$$

where, $J(S_i, S_j)$ is the Jaccard coefficient between two rectangles formd by the i^{th} slot S_i and j^{yh} slot S_j. If this value is larger than a predetermined threshold ($T1$), two slots are considered as overlapped. If there are overlapped slots then we have to calculate Normalized average intensity value (NAIV) of two slots and is given by

$$NAVI_i = \frac{1}{MAX(I)} \{\frac{1}{N} \sum_{(x,y)=Si} I(x,y)\} \qquad (2)$$

where, $NAVI_i$ is the NAVI of S_i , *MAX(I)* is the maximum intensity value of image *I*, *N* is the number of pixels in the skeleton of the parking slot entrance and *(x, y)* are the location of pixel in the x and y axes [1] [2].

Hough Transform

To determine the current position of previously detected parking slots, the Hough transformation is used. It transforms the wide-angle lens image into a bird's eye view image. The input undistorted image is transformed into a bird's eye view image with homography. Homography is one-to-one relation between two coordinate system. In parking system, the camera is placed at some constant height and a particular tilt angle.

$$E(x,y)=\left|\sum_{i=-1}^{1}\sum_{j=-1}^{1} Sobelverti\ (i,j) * B(x+i,y+j)\right| + \left|\sum_{i=-1}^{1}\sum_{j=-1}^{1} Sobelhori\ (i,j) * B(x+i,y+j)\right| \quad (3)$$

where, *E(x,y)* denotes a pixel value of the edge image and *B(x,y)* denotes a pixel value of the Bird's eye view image. Edge image is generated from Bird's eye view image using Sobel edge detector [3].

After the detection and prediction of parking slots, the correction is conducted by combining all the detected and predicted parking slot. First check the parking slot are overlapped or not using Jaccard coefficient. Overlapping situation is classified into the following three cases according to the Jaccard coefficient and two predetermined thresholds, i.e., $T1$ and $T2$ ($T1 < T2$).

Case I: $J(Si, Sj) < T1$: If the Jaccard coefficient between the *i*th slot (*Si*) detected in the current image and the *j*th slot (*Sj*) predicted from a previous image is less than $T1$, two slots are considered to be nonoverlapping. If *Si* does not overlap with any previously detected slots, *Si* is identified as a newly detected slot.

Case II: $J(Si, Sj) \geq T2$: If the Jaccard coefficient is greater than or equal to $T2$, it can be considered that the same slot is repetitively detected in sequential images. In this case, the position of this parking slot is corrected by NAVI

Case III $T1 \leq J(Si, Sj) < T2$: If the Jaccard coefficient is between $T1$ and $T2$, two slots are considered to be overlapping, but they are not a repetitive detection of the same slot. Since two different parking slots are unable to overlap in real situations, only one of the two slots should be selected.

After combining the sequentially detected parking slot, the empty parking slots are determined. This empty parking slot is free space and non-overlapping marking slots. The driver has to select a particular parking slot and drive into it [1] [2].

IV. CONCLUSION

In this paper we have discussed about the various types of parking system that are used to recogniz the empty parking slot. Around view monitor (AVM) is one of the best system in the parking slot marking detection and tracking system. All sequentially captured AVM image sequence are combined and finds the empty parking slot. This system is efficiently in use and solving the common problem of allocating parking space in busy areas in big cities such as shopping complexes, stadium and other popular places, especially during their peak hour.

REFERENCES

[1] Jae Kyu Suhr and Ho Gi Jung, "Sensor Fusion-Based Vacant Parking Slot Detection and Tracking," IEEE transactions on intelligent transportation systems, vol. 15, no. 1, pp. 21-36, February 2014

[2] Jae Kyu Suhr and Ho Gi Jung, "Fully-automatic Recognition of Various Parking Slot Markings in Around View Monitor (AVM) Image Sequences," 2012 15th International IEEE Conference on Intelligent Transportation Systems Anchorage, Alaska, USA, pp. 1294-1299, September 16-19, 2012

[3] Ho Gi Jung, Dong Suk Kim, Pal Joo Yoon, Jaihie Kim "Parking Slot Markings Recognition for Automatic Parking Assist System," Intelligent Vehicles Symposium 2006, pp. 106-113, June 13-15, 2006, Tokyo, Japan

[4] Wan-Joo Park, Byung-Sung Kim, Dong-Eun Seo, Dong-Suk Kim and Kwae-Hi Lee, "Parking Space Detection Using Ultrasonic Sensor in Parking Assistance System," 2008 IEEE Intelligent Vehicles Symposium Eindhoven University of Technology Eindhoven, The Netherlands, pp. 1039-1044, June 4-6, 2008

[5] Ho Gi Jung, Yun Hee Lee, and Jaihie Kim, "Uniform User Interface for Semiautomatic Parking Slot Marking Recognition," IEEE transactions on vehicular technology, vol. 59, no. 2, February 2010

[6] Ullrich Scheunert, Basel Fardi, Norman Mattern, Gerd Wanielik, Norbert Keppeler, "Free space determination for parking slots using a 3D PMD sensor," Proceedings of the 2007 IEEE Intelligent Vehicles Symposium Istanbul, Turkey, pp. 154-159, June 13-15, 2007

[7] Ho Gi Jung, Young Ha Cho, Pal Joo Yoon, and Jaihie Kim, "Scanning Laser Radar-Based Target Position Designation for Parking Aid System," IEEE transactions on intelligent transportation systems, vol. 9, no.3, pp. 406-424, september 2008

[8] Kyounghwan An, Jungdan Choi, and Dongyong Kwak, "Automatic Valet Parking System Incorporating a Nomadic Device and Parking Servers," 2011 IEEE International Conference on Consumer Electronics (ICCE), pp. 111-112

[9] Gongjun Yan, Weiming Yang, Danda B. Rawat Stephan Olariu, "Smart Parking:Secure and intelligent parking system," IEEE intelligent transportation systems magazine, pp. 18-30

[10] Cheng Hua ZHU, Kiyot & HIRAHARA, and Katsushi IKEUCHI, "Street-Parking Vehicle Detection Using Line Scan Camera," Institute of Industrial Science, The University of Tokyo, Tokyo, Japan, pp. 575-580

[11] H. Ichihashi, A. Notsu, K. Honda, T. Katada, M. Fujiyoshi, "Vacant Parking Space Detector for Outdoor Parking Lot by Using Surveillance Camera and FCM Classifier," FUZZ-IEEE 2009, Korea, August 20-24, 2009, pp. 127-124

[12] H. Ichihashi, T. Katada, M. Fujiyoshi, A. Notsu, K. Honda, "Improvement in the Performance of Camera Based Vehicle Detector for Parking Lot," IEEE, 2010

[13] Ms.Sayanti Banerjee, Ms. Pallavi Choudekar, Prof. M.K.Muju, "Real Time Car Parking System Using Image Processing," IEEE, 2011

[14] Kairoek Choeychuen, "Available car parking space detection from webcam by using adaptive mixing features," 2012 Ninth International Joint Conference on Computer Science and Software Engineering (JCSSE), pp. 13-16

[15] Diana Delibaltov, Wencheng Wu, Robert P. Loce, and Edgar A. Bernal, "Parking Lot Occupancy Determination from Lamp-post Camera Images," Proceedings of the 16th International IEEE Annual Conference on Intelligent Transportation Systems (ITSC 2013), The Hague, The Netherlands, October 6-9, 2013, pp. 2387-2392

Mr. Amit A. Kamble has received his B.E degree in Electronics and Telecommunication from J. D. college of Engineering, Nagpur. He is currently a postgraduate student of wireless communication and computing field with the department of Computer Technology, in Priyadarshini College of Engineering, from Nagpur University, Nagpur. His research interests include Wireless Communication, Electronics and Telecommunication, Image processing.

Prof.A.V.Dehankar received her Graduate Degree in 1991 from Amravati University and Master's degree from Amravati University, Maharashtra, India. She is working as Asst. Prof. in Department of Computer Technology in Priyadarshini College of Engg, Nagpur. Her areas of interest include Artificial Intelligence, Computer Graphics, Neural network , Image processing, Expert System and Mobile computing.