Real Time Image Processing Based Vacant Car Parking Occupancy Information System

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Abstract*:* In recent years, parking a car has become a serious problem in large cities with increasing rate of private vehicles. The current system does not provide any information about the available parking areas. These systems would get the drivers to search the parking areas on their own thus consume more time. For such cases, information on empty lots needs to be passed to the drivers. The proposed work gives out a novel approach for detecting the empty parking lots. And improper parking This method utilizes techniques like background subtraction, shadow removal and morphological operations to remove shadows.. From the results it is evident that this technique is very accurate and requires only minimal computing power for the occupancy detection and classification facilitating for commercial applications. This project is simulated in MATLAB R13 software.

Key words: Color, gradient based background subtraction, dilation.

I.INTRODUCTION

In this phase of fast moving world, the car parking issues are one of the top most in creating delays while negotiating commercial areas. Although many methods have been developed and still developing each of it has its own demerits especially with respect to the computational complexity.
In the year 2008 there are 558,796 new vehicles have been registered compared to the year 2000 where only 227,456 vehicles almost more than 50% of the vehicles have been increased this will become a major problem at the vehicle parking space. It is very difficult to find out the empty slot to park the vehicle is a difficult task at the peak hours, even It is very difficult for the driver to know vacant space, imagine a driver going inside the parking area finding no place for parking. A solution to reduce the drivers searching time for vacant car park lots will greatly save time, reduce cost and improve the traffic flow in the car park areas.

This project work is used to reduce the time for the driver to search for a vacant space to place the car in large parking areas. The purpose of this project is to build a real time application which recognizes cars at a gate, for example at the entrance of a parking area. The system, based on regular PC with video camera, catches video frames which include visible cars. This project is based on MATLAB programming which is used for monitoring the operations between the camera and the personal computer. The basic algorithms used are object detection and edge detection is used for identifying the empty slots in the parking.

This project finds weather the vehicle is present or not in the parking area with the help of the sensor and it is interfaced to the micro controller, But the major problem is the sensor shows the slot is filled when a man is present there and the other major problem is interfacing the sensors and microcontroller makes the system very complex and the cost constraints goes high. To decrease the complexity and reduce the cost constraints this project comes up with an idea identifying the parking space with the image processing. In this, a source image is taken when the vehicles are not present at every time and it will take which is known as present image. Both the images are taken object detection algorithm are applied and the outputs are shown in graphical user interface and on it the number of empty slots are also shown.

This paper is organized as follows: Section 2 describes the Literature survey. Section 3 Proposed work. Section 4 Result and discussion. Section 5 gives the conclusion.

II.LITERATURE SURVEY

In this section, detailed literature review is done that aims to review the critical points of current works. Here the information collected about researches and innovations carried out on the related technologies have been done. This section will highlight the recent trends and innovations in the concerned technology.

B.L. Bong, K.C. Ting and K.C. Lai [1] in 2008 states that In large parking areas such as those at mega shopping malls or stadiums, drivers always have difficulty to find vacant car park lots especially during peak periods or when the parking lots are almost full. A solution to reduce the drivers' searching time for vacant car-park lots will greatly save time, reduce cost and improve the traffic flow in the car park areas. In this paper, a research project which was developed to acquire car-park occupancy information using integrated approach of image processing algorithms is presented. Motivation for developing this system came from the fact that minimum cost is involved because image processing technique is used rather than sensor-based techniques. Security surveillance cameras which are readily available in most car parks can be used to acquire the images of the car park. In 2010, Ananth Nallamuthu and Sandeep Lokala [2] described that the problem of Vacant Parking space detection from static images using computer vision based algorithms such as color histogram classification, car feature point detection has been recently proposed by a few researchers. In this project we implement some of the suggested approaches and also use additional techniques such as background subtraction and some improvised methods to classify the state of a parking space.

Abbas Saliimi B. Lokman [3] stated that this innovative method is proposed that Nowadays parking area is an important place for customer parks their vehicles conveniently. For instance, shopping mall and recreations park also have their own parking area. Mostly car park management system faced problem regarding on identifying vacant space in the parking area. Reason for this prototype system being researched and developed is to identify better technique involving image processing in order to improve the effectiveness of current parking process.

S. Funck, N. Mohler and W. Oertel [4] stated that we propose a system to estimate the occupancy of a car-park using a single image of a single camera. Very often car-parks are already equipped with CCTV-cameras for surveillance purposes which may be used for automatic detection systems as well. Our system is targeted on cases where occupancy values are sought, but exact solutions like automatic gates or induction loops are too costly and where estimate values are acceptable for the operator. The image processing for the vehicle classification basically works by constructing a reference image of the empty car-park given in the input image and then comparing those two. The occupancy estimate is determined by the vehicle to car-park pixel area ratio, where perspective distortion and occlusion is compensated.

Song Xuehua, Ding Yan, Gen Jianfeng [5] states that shadow removal plays an important role in the moving object detection and retrieval of surveillance system. In order to remove shadow effectively, a detailed data analysis about shadow attribute is given after a brief introduction about how shadow comes into being. It is concluded that compared with the same field in background, the luminance of the shadow decreased a little, while each chroma per centum does not change a lot in RGB model. However, each chroma per centum of the moving object does change a lot. According to it, the paper proposes an easy algorithm which first picks up the front moving object, and detects the shadow in good use of the different properties between the shadow and object, and finally removes it successfully. The experiment shows that the algorithm could indeed remove the shadow coming from moving object effectively.

H. D. Chon, D. Agrawal and A. El Abbadi [6] with the advances in wireless communications and mobile device technologies, location-based applications or services will become an essential part of future applications. We have developed a location-based application called NAPA (Nearest Available Parking lot Application) that assists users to find the nearest parking space on campus. NAPA is an example of an application which combines a number of new features, such as location-based, wireless communication and a directory service like LDAP (Lightweight Directory Access Protocol)

J. P. Benson, T. O'Donovan [7] proposed that complete wireless sensor network solution for car park management is presented in this paper. The system architecture and design are first detailed, followed by a description of the current working implementation, which is based on our DSYS25z sensing nodes. Results of a series of real experimental tests regarding connectivity, sensing and network performance are then discussed. The analysis of link characteristics in the car-park scenario shows unexpected reliability patterns which have a strong influence on MAC and routing protocol design. Two unexpected link reliability patterns are identified and documented. First, the presence of the objects (cars) being sensed can cause significant interference and degradation in communication performance. Second, link quality has a high temporal correlation but a low spatial correlation. From these observations we conclude that a) the construction and maintenance of a fixed topology is not useful and b) spatial rather than temporal message replicates can improve transport reliability

M. Caliskan, D. Graupner, and M. Mauve [8] proposes a topology independent, scalable information dissemination algorithm for spatio-temporal traffic information such as parking place availability using vehicular ad hoc networks (VANET) based on Wireless-LAN IEEE 802.11. The algorithm uses periodic broadcasts for information dissemination. Broadcast redundancy is minimized by evaluation of application layer information and aggregation. Due to the spatio-temporal characteristics of parking place information, the spatial distribution of information is limited by utilizing techniques, which take the local relevance and age of information into account.

S. C. Hanche, P. Munot, P. Bagal, [9] states that an innovative electronic parking payment system that provides the ultimate solution for drivers, municipalities and private parking lot owners. This enables the drivers to be charged for the exact period of time parked, while simplifying the monitoring and collection of parking fees. This powerful RFID card functions as an in vehicle parking meter, eliminating the need to search for coins when finding a parking place. This project also provides an efficient alternative to coin operated meters and pay and display ticketing systems. Simple and cost effective to implement, this project operates as a standalone system or alongside traditional parking payment systems to eliminate fraud and reduce cash handling.

Y. Hirakata [10] One of main issues of developing big parking space for shopping complexes, office complexes and other types of building that requires large parking space is to notify the visitors of occupied and non-occupied parking space. Most of the visitors might spending up to 30 to 45 minutes just to find an empty parking space. In most recent technology, some parking lot system offered a system that could automatically count when the car entering the empty car space and blocking an infrared signal thus notify the system to count for it. However, this type of sensors actually has an increase of budgeting in order to install and to be maintained. In this project, we have developed a unique solution by providing cost effective solution by using Zigbee technology in parking lot system technology. Instead of using and maintain cable that need to be installed at the ceiling of the parking lot, we developed a system that use wireless technology of Zigbee and it could notify the visitors of empty and non-empty parking lot.

In 2012, T. Huang, [11] proposed that at present, with the rapid proliferation of vehicle availability and usage in recent years, finding a vacant car parking space is becoming more and more difficult, resulting in a number of practical conflicts. Parking problems are becoming ubiquitous and ever growing at an alarming rate in every major city. Lot of research and development is being done all over the world to implement better and smarter parking management mechanisms. Widespread use of wireless technologies paired with the recent advances in wireless applications for parking, manifests that digital data dissemination could be the key to solve emerging parking problems.

In 2012 A. Kianpisheh [12] With the increase in vehicle production and world population, more and more parking spaces and facilities are required. In this paper a new parking system called Smart Parking System (SPS) is proposed to assist drivers to find vacant spaces in a car park in a shorter time. The new system uses ultrasonic (ultrasound) sensors to detect either car park occupancy or improper parking actions. Different detection technologies are reviewed and compared to determine the best technology for developing SPS. Features of SPS include vacant parking space detection, detection of improper parking, display of available parking spaces, and directional indicators toward vacant parking spaces, payment facilities and different types of parking spaces (vacant, occupied, reserved and handicapped) through the use of specific LEDs. This paper also describes the use of an SPS system from the entrance into a parking lot until the finding of a vacant parking space. The system is designed for a four-level parking lot with 100 parking spaces and five aisles on each floor. The system architecture defines the essential design features such as location of sensors, required number of sensors and LEDs for each level, and indoor and outdoor display boards.

Z. Pala [13] Parking plays an important role in the traffic system since all vehicles require a storage location when they are not being used to transport passengers. Whether it is a parking lot or on-street parking there is a problem of parking revenue convenience. Implementation of the RFID technology could be a good solution for this problem.

R. Panayappan [14] states that searching for a vacant parking space in a congested area or a large parking lot and preventing auto theft are major concerns to our daily lives. In this paper, we propose a new smart parking scheme for large parking lots through vehicular communication. The proposed scheme can provide the drivers with real-time parking navigation service, intelligent antitheft protection, and friendly parking information dissemination. Performance analysis via extensive simulations demonstrates its efficiency and practicality.

III.PROPOSED WORK

Flow Chart:

The captured image is cropped first in the image acquisition unit and passed through gray scale conversion where the input image is converted in to black and white image by converting the original image from gray image to B/W image. The image extracted by threshold and also with the edge detection method the object is detected then both are AND functioned to give the exact object present in the parking lot. Here the median filter is used to smoothening the shadow. The flow chart for this project is shown below.

The proposed methodology performs a sequence of image processing steps over the input query image taken at that instant. This goal is achieved by constructing a Background image of empty car park. The block diagram in Fig.1 depicts the system which identifies vacant parking space and check the perfectness of the parked vehicle. The integrated approach covers initial setup and normal running operation of the system. The following modules explain the analysis and the proposed vision based parking space classification system. Input image is obtained by positioning the camera such that it faces the front or rear side of the parking lot thus acquiring a fixed clear view of the parking lot .In addition he images are taken at different illumination conditions. Assumptions like camera is fixed, no tilt, zoom; pan in the camera are considered. Parking lot is considered to be an open area. Now comes the process of system initiation. Here a onetime manual seeding procedure is performed using the image without cars. The seed points are detected eroded to one pixel and using their coordinates lines separating the parking lots are drawn and their spatial coordinates are defined. Fig 2 shows the flow diagram of the initialization process. This process does not reduce the efficiency of the system as it is done only once to find out the exact locations of the lots.

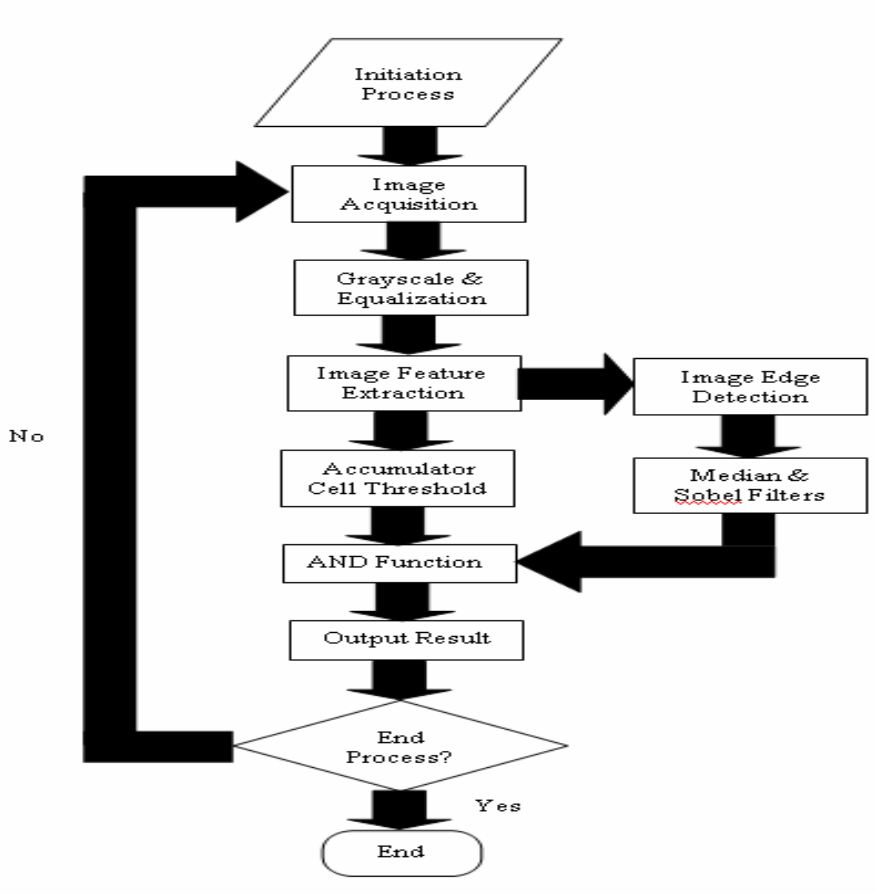

Figure 1: Flowchart

Background Subtraction:

Next step is the Background subtraction, which is used to extract the dynamically varying regions, the simplest method for achieving this goal is to compute the difference between the adjacent images on assumption that intensity variation is maximum on the pixels where there are moving objects.

Background Subtraction under various illumination:

Quick illumination changes completely alter the color characteristics of the background, and thus increase the deviation of background pixels from the background model in color or intensity based subtraction.

Color Based Subtraction:

A slightly modified mixture of Gaussian method is used for background subtraction. In this method, a mixture of K Gaussian distributions adaptively models each pixel color.

Gradient based subtraction:

In this method, $\Delta = [\Delta m, \Delta d]$ is used as the feature vector for gradient based background differencing, where i.e$\sqrt{fx}$ 2 + fy 2 is gradient magnitude and i.e $tan{-}1\ fy/fx$ is gradient direction. The gradients are calculated from gray level parking images.

Number of Vehicle Detection:

In this paper, thresholding is performed on the background subtracted image. Mean of the image is calculated for Red, Green and Blue bands individually as in following equation and this mean is chosen as threshold.

IV.RESULTS AND DISCUSSION

Input image:

The input image is taken from the camera by ensuring that all the parking lots are empty. Only parking lots with boundaries are cropped from the image for perfect alignment. Then the cropped image runs through Mat lab program for identifying the empty parking lots.

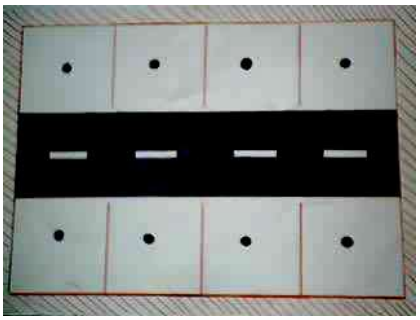

Fig.2: Input image with empty lots

Fig.3: Input image with 3 car filled lots

The figure 2 represents the input images without any car occupied lots and fig.3 represents with few cars occupied lots .When the Mat lab runs the program ,the output is displayed as 8 vacancy positions with sound that as “there are eight vacancies” even with parking lot numbers in the output window which is created using mat lab program as fallows.

Output window:

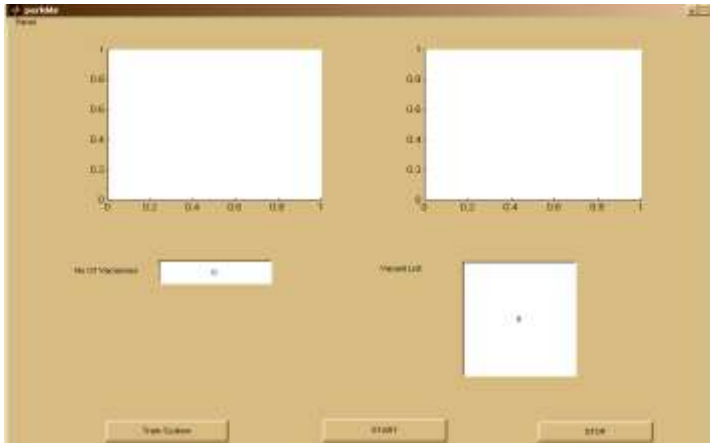

Fig.4: Output window

The output window consist four blank block areas to give output .the input image will be taken in to right most top block and cropped empty lots image is taken in to the left most top block then output Starts give the result when a car is occupied in parking lot as number of vacancies in parking lots in left middle block and the correct position of vacancy is given in right middle block with the sound.

Simulation model:

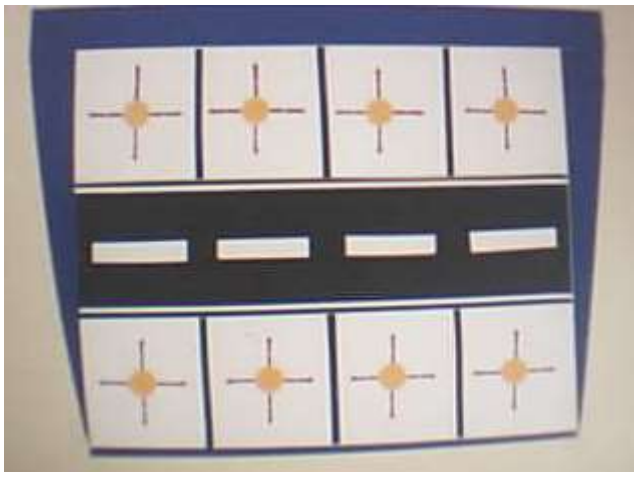

Fig.5: Simulation model

The figure 5 gives a simulation model which runs on real time scenario with a simple stationary to explain the operation of the project. Here the web camera is used to capture the image and send to run on Mat lab work shop .The captured input image is send to grey level threshold then converted in to black and white, So that the image feature is extracted using threshold grey levels. The image is again send to edge detection and also operated through median filter for smoothening and to eliminate the random noise which is affected from shadow.

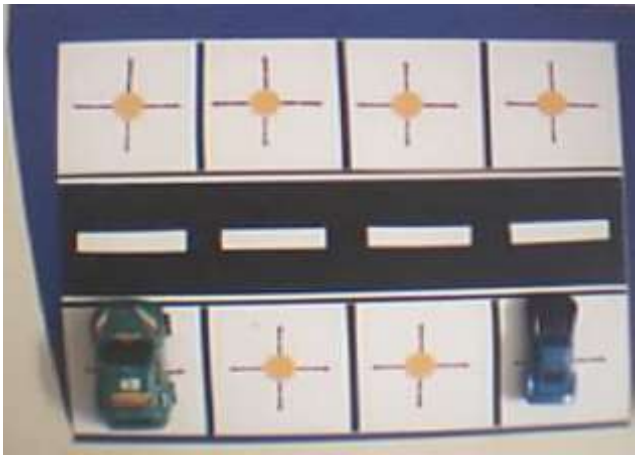

Fig.6: Parking lots occupied with two cars

The figure 6.4 give the output as “there are 6 vacancies” even with the sound and also the position where actual vacancy position is there (1,2,3,4,6,7).

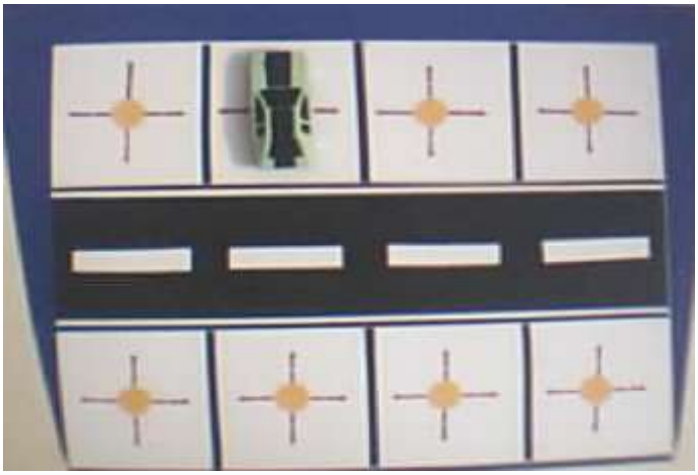

Fig.7:Parking lots occupied with only one car

The figure 7 represents the parking space with only one lot is occupied and remaining 7 lots are shown as empty (1,3,4,5,6,7,8) except the second lot due to it is occupied by the car.

Fig8.8: Result of sobel edge detection

The figure 8 represents the result of sobel edge detection of the parking lots with only one car occupied and shown in figure 7 and also it is the output image from the edge detection operation and it operated through the median filter to smoothen the shadow .the grey level of the shadow is less than 5% of the threshold so that it can be neglected.

Fig.9: Input image with all car filled lots

The figure 9 Is the input image with all occupied parking lots for this image the output is obtained as “there is no vacancy” in sound and in the output window the empty parking lots are given as number as ‘0’.

V.CONCLUSION

This project presents a novel computer vision based parking vacancy detection system. Using the combination object detection and vehicle feature detection the system achieves good results. One of the major weakness of this is same pixel value of the vehicle and background are same than the vehicle is not detected. It does mean that any real world implementation of the system requires more cameras to cover the parking area. At the time of the telling the slot the number plate of the vehicle is extracted using the detection algorithms and the extracted number can be used for the security purposes.

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