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AN IMPROVED ADAPTIVE BACKGROUND MODEL FOR REAL TIME TRACKING AND DETECTION OF VACANT PARKING

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Abstract-This paper proposes a vacant parking slot and tracking system that uses the appearance based approach using video surveillance system. The proposed system consists of various stages: Histogram analysis, Background subtraction, Parking slot marking detection, Slot allocation and Decision process. Adaptive Background detection is chosen for more VCA applications because of the limitations of non adaptive methods. Background modeling is a technique for extracting moving objects in video frames. The parking slot is tracking stage continuously estimates the position of the selected slot while the vehicle is moving into it. The parking slot occupancy is probabilistically calculated by treating each slot region as a single cell of the occupancy grid. The proposed system is expected to recognize the positions and occupancies of parking slot marking and stably track them under practical situations in a real time manner. This method is expected to help the drivers conveniently select one of the Available parking slots and support the parking control system by continuously updating the designated target positions.

Index terms-Video content Analysis(VCA), is the capability of automatically analyzing video to detect and determine temporal events not based on a single image.

I. INTRODUCTION

This paper presents a robust approach for detection of available car parking spaces. With low quality of video camera as webcam and dynamic change of light around the car parking, it is hard to accurately detect or recognize the cars. Moreover the proposed appearance-based approach is efficient than recognition-based approach because it do not need to learn a huge of multi-view objects. In this paper, we propose adaptive background model-based object detection with dynamic mixing features of masked-area and edge orientation histogram (EOH) density. The average variance of variance of intensity change for dynamic background model is used to change ratio of mixing features dynamically. The masked-area density is density of predefined area of a parking slot that is weighted by Gaussian mask to robust density computation and the edge orientation histogram (EOH) density is density of the EOH in the predefined area that can be used under low contrast image as night scene. The experiments are performed both in simulation model and real scenes. The results show the proposed approach can handle dynamic change of light efficiently. The video surveillance system is an important system and can find in many areas both in parking lot or public areas. Most video surveillance systems are passive system. They always monitor events from recorded videos. With development of computer vision technology, the system can do some functions automatically. In this paper, we focus on the available space detection that is an important function of automatic video surveillance. Frequently, we have to look for the car space that it is not easy in busy time. We might spend more time and car energy to look for an available car space. Automatic car parking space detection can save time and car energy, and also make satisfying and impression to drivers.

The proposed system has the following advantages:

1) Robust against background movements such as rain, snow Shadows etc.2) Handy to use 3) User friendly and cost effective 4)Time management 5)Error free technique.

The rest of the paper is as follows: Section 2s explains about the existing system. Section 3 tells about the proposed system and the algorithm. In section 4, results are discussed. And finally section 5 gives the conclusion.

II.SENSOR BASED APPROACH

There are some reports in the task of the available car space detection. The ultrasonic-based approach uses network of ultrasonic sensors. The ultrasonic sensor is installed at top of a slot of the parking space by using one sensor per the slot of the parking space. The available space detection is performed by detecting reflection distance of the ultrasonic sensor. They learn cropped car pictures and build the classifier by using fuzzy c-means based classifier and fine tune the parameters by using Particle swarm optimization. We can categorize this approach as recognition based available car parking space detection. AVM images by exploiting a hierarchical tree structure of parking slot markings and combines sequential detection results. The parking slot occupancy classification stage identifies vacancies of detected parking slots using ultrasonic sensor data. During tracking, AVM images and motion sensor-based system are fused together in the chamfer score level to achieve robustness against inevitable occlusions caused by the ego-vehicle. The free space-based approach designates a target position by recognizing a vacant space between adjacent vehicles. This is the most widely used approach since adjacent vehicles can be easily recognized by various range-finding sensors. However, its performance depends on the existence and poses of adjacent vehicles. A variety of sensors have been utilized, and the ultrasonic sensor-based method is the most popular among them. Usually, two ultrasonic sensors are mounted on both sides of the front bumper. Free spaces and adjacent vehicles are recognized by registering ultrasonic sensor data via vehicle motion sensors. However, this method fails in situations where there is no adjacent vehicle and in slanted parking situations where adjacent vehicle surfaces are not perpendicular to the heading directions of ultrasonic sensors.

III.APPEARANCE BASED APPROACH

We propose appearance-based approach that can be used to detect available car parking space. The overall system is shown in Figure 1. The background subtraction with adaptive background model is used as the object (cars) detection module. We performed foreground regions detection by using background subtraction with the adaptive background model.

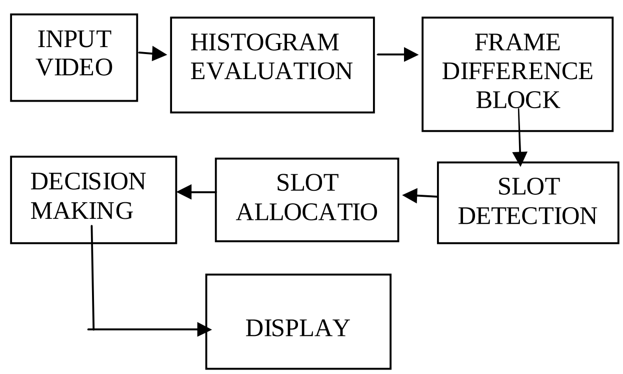

Figure 1 Block diagram of the proposed system

a) HISTOGRAM ANALYSIS

Histogram is a graphical representation of the distribution ofdata. Histograms are used to plot the density of data and often for density estimation.

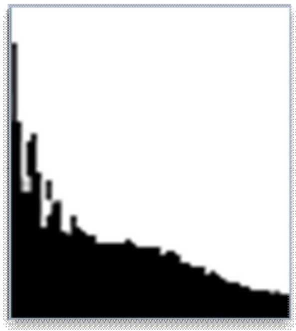

Figure 2 Histogram analysis

In an image processing context, the histogram of an image normally refers to a histogram of the pixel intensity values. This histogram is a graph showing the number of pixels in an image at each different intensity value found in that image. For an 8-bit grayscale image there are 256 different possible intensities, and so the histogram will graphically display 256 numbers showing the distribution of pixels amongst those grayscale values. Histograms can also be taken of color images --- either individual histograms of red, green and blue channels can be taken, or a 3-D histogram can be produced, with the three axes representing the red, blue and green channels, and brightness at each point representing the pixel count. The exact output from the operation depends upon the implementation --- it may simply be a picture of the required histogram in a suitable image format, or it may be a data file of some sort representing the histogram statistics. We are collecting the histogram analysis report for detection of objects and for eliminating the other objects with lesser histograms.

b) FRAME DIFFERNCE BLOCK

Background subtraction is a computational vision process of extracting foreground objects in a particular scene. A foreground object can be described as an object of attention which helps in reducing the amount of data to be processed as well as provide important information to the task under consideration. Often, the foreground object can be thought of as a coherently moving object in a scene. Intension of different background subtraction algorithms is use to detecting, tracking moving vehicles and pedestrians in traffic video sequences. Nearby stray pixels identified as "moving" due to image noise, group the pixels belonging to each vehicle and to compute and track a smoothed convex hull. Background subtraction method succeeds not only in detecting moving vehicles, but also their shadows. Shadows is the most serious problems for video-based traffic surveillance. Slow moving means that the time of traversal is non-negligible compared with the $1/\alpha$. The time constant of exponential forgetting process. When this happen the background image becomes corrupted and object detection fail completely. By using a probabilistic classifier and a stable updating algorithm problem will be solved as shown in Eq. (1)

$$B(x, y, t) = (1 - \alpha) B(x, y, t - 1) + \alpha I(x, y, t) \quad .(1)$$

Parameter is $I(x, y, t)$- instantaneously pixel value, (x, y) pixel at time t, $B(x, y, t)$ background, $1/\alpha$ -time constant forgetting process, variance can be computed. Moving object can be identified by thresholding is the distance between $I(x, y, t)$ & $B(x, y, t)$.

Consider a single pixel and the distribution of its values over time. Some of the time it will be in its "normal" background state-for example, a small area of the road surface. Some of the time it may be in the shadow of moving vehicles, and some of the time it may be part of a vehicle.

Thus, in the case of traffic surveillance, we can think of the distribution of values I x, y of a pixel (x, y) as the weighted sum of three distributions R x, y(road), S (x, y) (shadow), and V (x, y) (vehicle)as shown in equation (2)

I x, y = W x, y. (r x, y, sx, y, Vx, y) (2)

These distributions are subscripted to emphasize that they differ from pixel to pixel; R x,y is a probability distribution for the way that this specific pixel looks when it is showing

Un shadowed road at the corresponding physical location. It is essential to have different models for each pixel, because, for example, some parts of the image may correspond to white road markings, others to dark streaks in the centers of lanes, and still. Some of the features used while detecting the moving object such as intensity, color, shape of the region texture, motion in video, display in stereo image, depth in the range Camera temperature in Far infrared, mixture relation between region and stereo disparity.

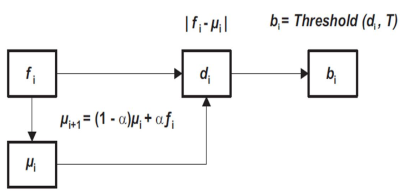

Figure 2: Frame difference block diagram

Where fi :

A pixel in a current frame, where i is the frame index.

μ : A pixel of the background model (fi and m are located at the same location).

di: Absolute difference between fi and m.

bi: B/F mask - 0: background. 0 x ff: foreground.

T: Threshold

α: Learning rate of the background

c) SLOT DETECTION AND ALLOCATION

Slot is detected by assigning some specific values for
each slot which specifies the dimensions required for
the matrices. For providing a clear specification about
image which is already filtered we are using the
threshold values and eliminating the odd parts. Slot is manually
separated from the captured area and Allocation
is done if the slot is detected. Time delay provided
for allocation is15frames. If empty slot is detected then filled(Red signal)is displayed. If it is free(green signal)
is displayed. Depending on this database is updated.

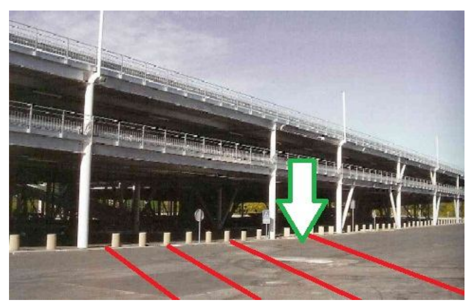

Fig 3 slot detection is done in the parking area.

IV. INTERFACING WITH JAVA SERVELETS

For providing a user friendly approach we have interfaced Image processing domain with Java servlets. A **Java servlet** is a Java Program that extends the capabilities of server. Although servlets can respond to any types of requests, they most commonly implement applications hosted on Web servers. Here we are using Tomcat servers as an application oriented server because updation processes such as booking through application and other future requirements can be fulfilled. It has also added user- as well as system-based web applications enhancement to add support for deployment across the variety of environments. It also tries to manage sessions as well as applications across the network.

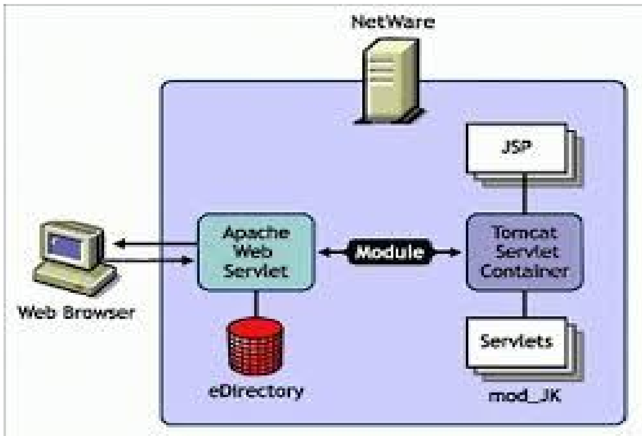

Figure 4: Tomcat architecture for better understanding.

V .CONCLUSION

This method proposes vacant car space slot detection that uses an appearance based approach which uses webcam and security camera footages .This system proposes [1] Efficient utilization of resources.[2]It also manages to provide user friendly environment.[3]Less complexity in nature.[4]We can implement in Outdoor environments and underground environments due to the illumination changes. Further more it is revealed that the proposed system can operate in Real time. Camera footages can evolve over time. Thus the system can be implemented for public usage.

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