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Track The Center of Colored Circular Objects Using Image Processing Techniques

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Abstract: **-- Computer Vision plays a major role in developing autonomous systems, surveillance, traffic systems and many more Space Applications. Robotic process automation (RPA) is the application of technology, that allows capturing and interpreting existing real world for processing applications like operations, manipulating data, triggering responses, simulated perception and communicating with other digital systems. The present work deals with Object detection and segmentation. The image is changed from the RGB color space to L*a*b* space. The three channels of L*a*b* color space are separated, and a single channel is selected depending upon the color under consideration. Next, genetic based color segmentation is performed on the single channel image to obtain the object of interest. This is the important and challenging fundamental task of computer vision. It is a critical part in many applications such as image search, scene understanding, etc. However, it is still an open problem due to the variety and complexity of object classes and backgrounds. The way to detect and segment an object from an image is the color based methods. The object and the background should have a significant color difference to successfully segment objects using color based methods. An attempt is made to develop a general flexible routine to track center of colored circular object using image processing technique. MATLAB image processing tool used to develop a general routine for the significant interface to the real world.**

Keywords: **Robotics Color Based Segmentation, Center, Tracking, Routine, MATLAB.**

I. INTRODUCTION

The Object tracking with definite region of Interest has a great deal of interest in computer vision. Object tracking is the first step in surveillance systems, navigation systems and object recognition. Robotic process automation [1][2]Image segmentation process divides an image into distinct regions with property that each region is characterized by unique feature such as intensity, color etc [3]Color is a powerful descriptor in image segmentation that simplifies object identification and extraction from a scene. Color models facilitate the specification of a color in a standard way. A subspace with in a color model gives a single point to represents the color. CIELab color model is perceptual uniform color model where L component of color model represents the human perception of lightness and a,b components represents an amount of a color present[4].

II. METHODOLOGIES

A) Background Modelling

Background subtraction includes preprocessing, background subtraction, post processing. In preprocessing video frames captured from a camera are given as input to the background subtracted. Preprocessing stages are used for filtration and to change the raw input video into a process able format. In background subtraction moving object is detected and its extreme sensitivity to dynamic scene changes due to lighting and extraneous events is also detected. The main objective is to obtain the objects that keep the user attention in accordance with a set of pre-defined features, including gray level, motion and shape features. [5]This approach defines a method for the generation of an active attention to monitor dynamic scenes for the purpose of surveillance. The idea is to build the background model in many background variations, i.e., background motion cycles which is seen as trajectories of pixels in time. Based on the background model through a map of motion and stationary patterns, this algorithm can detect motion and selectively update the background model In post processing, foreground detection is done in which the pixels with a significant difference to those in background model are noted as foreground. Data validation is used to examine the found objects of interest and to eliminate any false matches. The foreground detection stage is known as a binary classification problem whereby each pixel in an image is assigned a label to the class of foreground or background. Formally, for every pixel p in image I, a label pl is assigned where I € {0, 1} where 0 = background and 1 = foreground. After this mask is obtained, background pixels are usually set to white or black to allow focus on the foreground object. This indicates that an object desired has been identified.

$$P(X_t) = \sum_{i=1}^{K} w_{i,t} * \eta(X_t, \mu_{i,t}, \Sigma_{i,t})$$

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B) Color Image Segmentation

An image is a meaningful arrangement of regions and objects. Image analysis is the process of extracting information from an image which is one of the preliminary steps in pattern recognition systems. Image segmentation can be defined as the classification of all the picture elements or pixels in an image into different clusters that exhibit similar features [4]. The first step in image analysis is to segment the image. This segmentation subdivides an image into its constituent parts or objects to a particular level. This level of subdivision depends on the problem being viewed. Sometimes we need to segment the object from the background to understand the image correctly and identify the content of the image. For this reason, we have mainly two techniques for segmentation: (1) discontinuity detection technique and (2) similarity detection technique. In the first one, the common approach is to partition an image based on abrupt changes in gray-level image. While in the second technique is based on the threshold and region growing [18]. The second one is the most common approach for color image segmentation. Color image segmentation can be defined as a process of extracting from the image domain one or more connected regions satisfying uniformity (homogeneity) criterion which is based on feature(s) derived from spectral components. These components are defined in chosen color space model [19]. So, color space plays the vital rule in color image segmentation.

The next implementation in the proposed method is to convert the pre-processed images which are in RGB colour space to L*a*b* colour space. For this proposed work L*a*b* colour space is selected which is a homogeneous space for visual perception.

The difference between the two points in the L*a*b* colour space is same with the human visual system. Since the L*a*b* model is a three-dimensional model, it can only be represented properly in a three-dimensional space [8]- [9]. The solution to convert digital images from the RGB space to the L*a*b* colour space is given by the following formula [8]

$$L^* = 116\, f(Y/Y_n) - 16$$

$$a^* = 500[f(X/X_n) - f(Y/Y_n)]$$

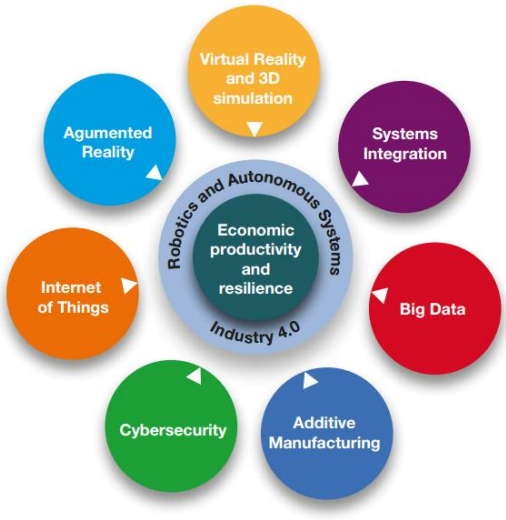
$$b^* = 200[f(Y/Y_n) - f(Z/Z_n)]$$

X, Y, Z, Xn, Yn, and Zn are the coordinates of CIEXYZ colour space. The solution to convert digital images from the RGB space to the CIEXYZ colour space.

Feature point-based methods *:* Feature point-based object tracking could be characterized as, the endeavor to recuperate the motion parameters of a characteristic point in a feature succession. All the more formally, let f = f0, f1, , fn means the N frames of a video file sequence and pi (xi, yi) , i = 0,1,...,N indicate the positions of the same characteristic point in those frame. The current task is to focus a motion vector di (dx,i, dy,i) that best decides the position of the feature points in the following frame, mi+1 (xi+1, yi+1),that is: mi+1 = mi + di. The interested object to be tracked is generally characterized by the bouncing box or the curved structure of the tracked feature point.

Robotic process Automation

"Robotic Process Automation" (RPA) connotes visions of physical robots wandering around offices performing human tasks, RPA most commonly refers to configuring software to do the work previously done by people[5] . RPA are easy to configure, require little IT expertise and can be quickly 'trained' and deployed to automate manual tasks. They differ from traditional software by working at the user interface level, replicating the exact actions a human user would take, in fact creating a digital workforce for you front office, back office and support functions.



Robotic Process Automation

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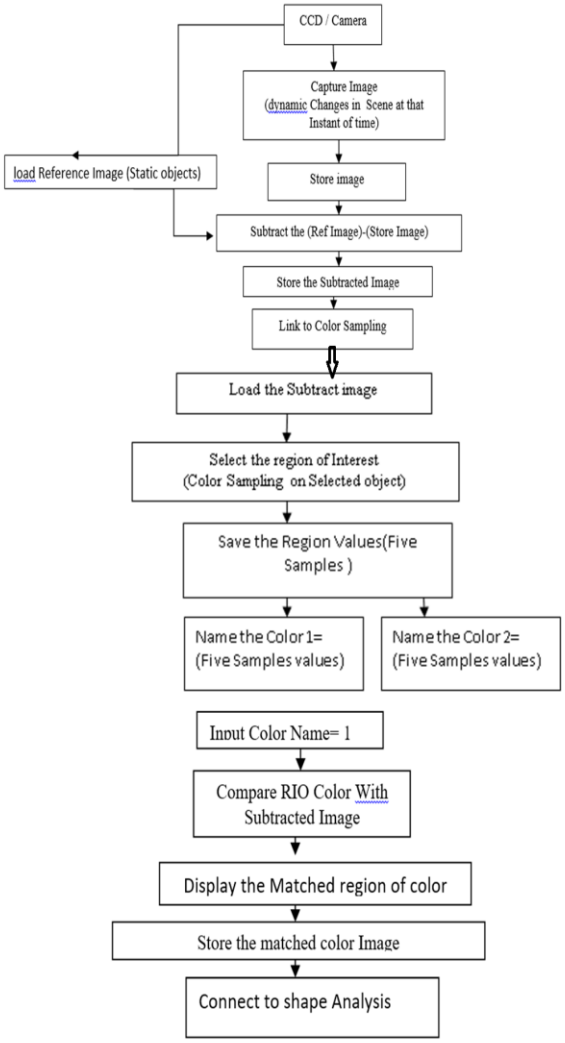
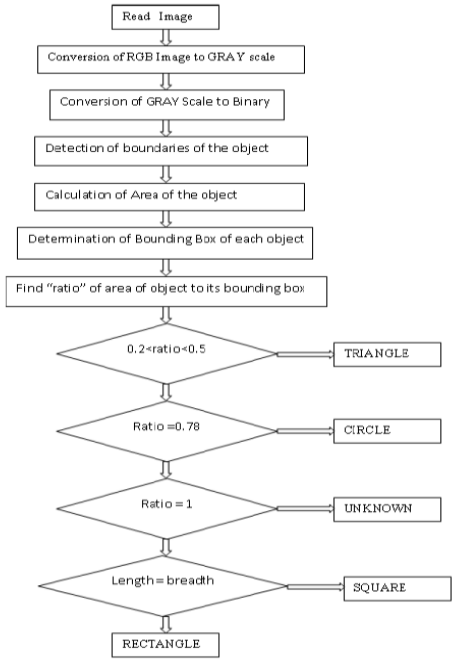
Algorithm flow chart

The algorithm flow chart will give a road map to develop code in matlab the stage by stage image processing algorithm are used optimal output.

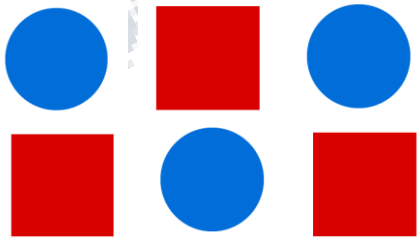


The next stage of flow chart is used to connect shape analysis for finding out the circular object.



Shape analysis flow chart

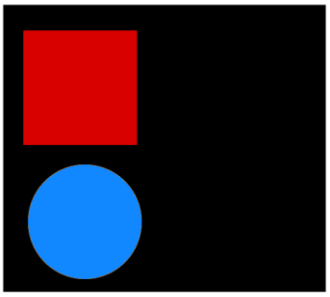
Input:



Reference Frame

Second Frame

Output:



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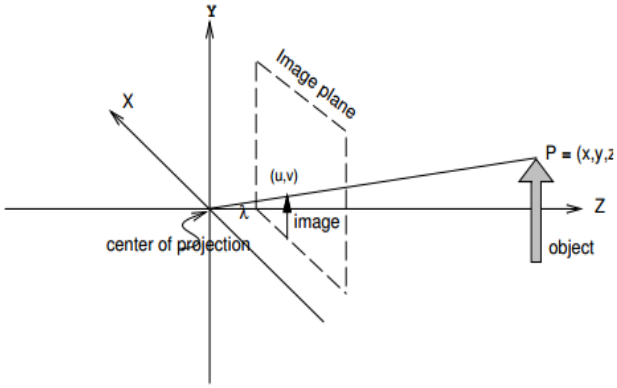
Subtracted Image
Enter your choice
Name of color=1

Centroid of the Circle

A novel algorithm is introduced to track circular objects present in a frame based on the color of the circle. The present work is limited only single color .it can be used not only to measure the position of the robot but also to locate objects external to the robot in its workspace.



Camera coordinating Frame
the orientation of an object in the image to be the orientation of an axis that passes through the object such that the second moment of the object about that axis is minimal. This axis is merely the two-dimensional equivalent of the axis of least inertia.

Applications:
The problem of determining the control inputs necessary to follow, or track, a desired trajectory that has been planned for the manipulator, while simultaneously rejecting disturbances due to unmodelled dynamic effects such as friction and noise. Rotation around a pivot robot, rotation in-place around an estimated centroid of the object, translation, and a combined motion of rotation and translation in which each manipulating robot follows a trochoid path. Three of these controllers require an estimate of the centroid of the object, to use as the axis of rotation. Provide advantages in flexibility and robustness for object manipulation tasks that individual robots cannot provide To recognize the identity, position, and orientation of randomly oriented industrial parts.

RESULTS

The above output are the estimated expected outcome for the development of generic routine based color significant color difference. The flow chart will give overall structure for identify centroid of the object. The outcome are purely based of specific input requirements such as color samples, shape ratios, probability density function. These expected results are used in developing autonomous robots using vision system.

CONCLUSION

A novel centroid estimation algorithm to developed an accurate and stable to integrate these centroid of circular objects in image frame coordinates to robot base center coordinate for pick and place operation for the robots to gain a reference point on the object without explicit knowledge of the geometry of the object

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