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Object Detection by Colour Threshold Method

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Abstract: In this paper, an algorithm is presented for colour object detection and tracking based on colour threshold technique.Thisalgorithm can be implemented to track an object of any colour. The same has been demonstrated on a red coloured phone. Initially, this red coloured phone is detected from a real-time image using colour threshold method. Its' accuracy is improved by the use of morphological process where the object to be detected is denoted as white leaving the background dark. Then its' location is tracked by obtaining its' coordinates from the image. This process can then be used in iteration for real-time video processing.

Keywords: Colored object detection, Object tracking, Image processing, and Video Processing.

I. INTRODUCTION

Object detection is one of the major goals in computer vision that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in images or videos. Object detection such as face detection and pedestrian detection are amongst the well researched domains. Object detection algorithms typically use extracted features and learning algorithms to recognize instances of an object category. Object detection has applications in many areas of computer vision such as image retrieval and video surveillance.
The following models are commonly used for object detection:

- Feature-based object detection :
- Detecting a reference object in a cluttered scene using feature extraction and matching.
- SVM classification with histograms of oriented gradients (HOG) features
- Image segmentation and blob analysis
- Gradient-based, derivative-based, and template matching approaches.

The above mentioned models are very robust but also very hard to implement because of the complexity involved in the algorithms. In this paper, we are presenting an easy to implement algorithm for object detection and tracking based on the colour threshold technique. The algorithm detects the object and also provides its location as **x and y** coordinates in the images. Thus, by processing the subsequent frames in the video, object can be detected and tracked very easily.

II.BACKGROUND

A. Digital Video

Digital video is an aggregation of frames where each frame is a picture image. These frames when presented sequentially with certain frame rate, give an illusion of motion picture. Thus, many a times, video processing is done by extracting these frames from the digital video and then processing the digital images obtained as frames.

B. Digital Colour Image

A Digital Colour image is a digital image that includes colour information for each pixel. For visually acceptable results, it is necessary (and almost sufficient) to provide three samples (colour channels) for each pixel, which are interpreted as coordinates in some colour space. The RGB colour space is commonly used in computer displays, but other spaces such as YCbCr, HSV, and is often used in other contexts. A colour image has three values per pixel and they measure the intensity and chrominance of light. The actual information stored in the digital image data is the brightness information in each spectral band.

C.RGB colour model

The RGB colour model is an additive colour model in which red, green, and blue light are added together in various ways to reproduce a broad array of colours. The name of the model comes from the initials of the three additive primary colours, red, green, and blue.

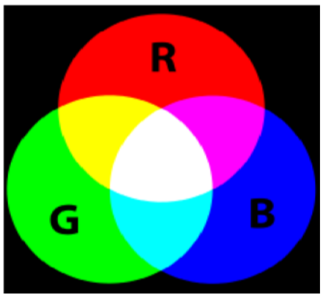

Fig.1. RGB colour model

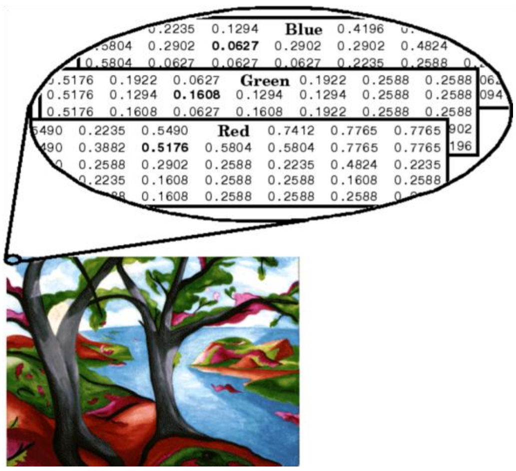

Fig.2. Matrix representation of R, G and B components

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Graphics file formats store RGB images as 24-bit images, where the red, green, and blue components are 8 bits each. This yields a potential of 16 million colours. The precision with which a real-life image can be replicated has led to the nickname "true colour image."

RGB image, sometimes referred to as a truecolour image, is stored as an m-by-n-by-3 data array that defines red, green, and blue colour components for each individual pixel. RGB images do not use a palette. The colour of each pixel is determined by the combination of the red, green, and blue intensities stored in each colour plane at the pixel's location.

D. Red, Green and Blue Components

As mentioned earlier, RGB image consists of Red, Green, and Blue components and any of these components can be extracted from the original image as a separate m-by-n-by1 matrix as shown in Fig. 3 below:

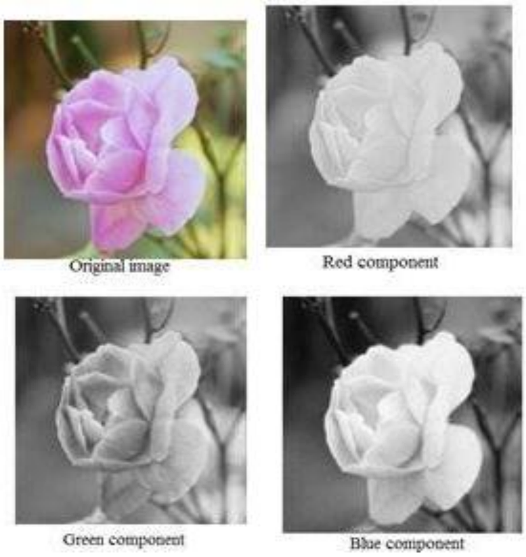

Fig.3. R, G and B components extracted from a 24-bit RGB image

These three components can be processed separately for image processing applications as per the requirement of the application

IV. PROPOSED ALGORITHM

In this paper we will be demonstrating our algorithm by tracking a red coloured object in the video (resolution: 820x461) in real time. The steps involved are as follows:

Step 1: Grab a frame from the video

Fig.4.1. Original frame

Step 2: Extract the three components R, G, and B components in separate matrices **r**, **g**, and **b** respectively.

Fig.4.2. Red component of the frame

Step 3: Now we remove all the objects in the r matrix other than red coloured objects using the following equation:

$$\boldsymbol{r} = \boldsymbol{r} - \frac{\boldsymbol{g}}{2} - \frac{\boldsymbol{b}}{2}$$

Fig. 4.3 Only red coloured objects in the frame

Step 4: Now we convert the obtained image into a binary (black and white) image using the **colour threshold** method by selecting suitable threshold value according to our object.Any pixel that has intensity lower than the **threshold** will be discarded and processed into black.

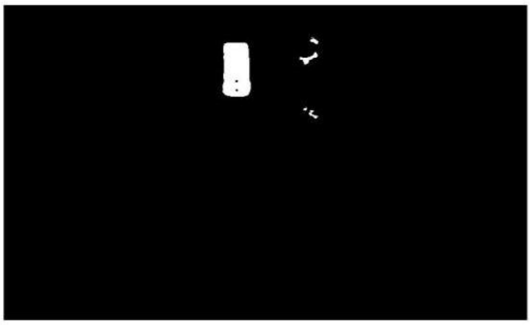

Fig.4.4. Binary image after thresholding

Step 5: In the processed image, though we removed most of the dark-coloured car objects, there are some remnants of the background. **Morphological processing** can be used to remove objects smaller than the certain size (width OR length) will be discarded. Hence in the output, we get detected object.

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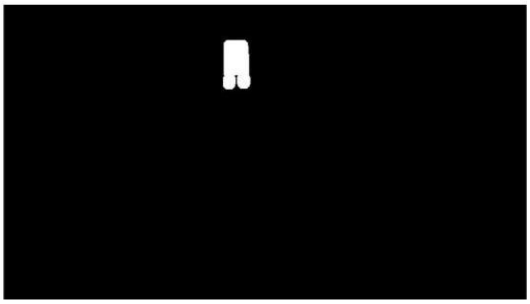

Fig.4.5. Binary image after improvements

Step 6: To track the objects location, find the **mean of all the indices** of matrix where logical 1 (white colour) is present, in both x and y directions separately.
Here we get the means as Mean-x=94 and
Mean-y=365

Fig.4.5. Final image showing detected object.

Step 7: Repeat the same steps for each frame.

V. CONCLUSION

An efficient and easy to implement object detection system is presented. The system has been implemented using an algorithm based on color threshold method. The algorithm has experimentally been shown to be quite accurate and effective in detecting a colored moving object. Such an object tracking system can be used in applications where accurate tracking is required and the object to track has a color that can be distinguished easily from its background. The system is also very much applicable automated systems where stationary objects are to be identified and then moved from one place to another. Future work focuses on tracking multiple objects at the same time as well as on improving tracker accuracy.

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BIOGRAPHIES

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