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An Efficient Real Time Object Tracking Based on HSV Value

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Abstract: This study presents a strategy to automate the process to recognize and track objects using color and motion. Video Tracking is the approach to detect a moving item using a camera across the long distance. The basic goal of video tracking is in successive video frames to link target objects. When objects move quicker in proportion to frame rate, the connection might be particularly difficult. This work develops a method to follow moving objects in real-time utilizing HSV color space values and OpenCV in distinct video frames.. We start by deriving the HSV value of an object to be tracked and then in the testing stage, track the object. It was seen that the objects were tracked with 90% accuracy.
Keywords: HSV, OpenCV, Object tracking,

I. INTRODUCTION

Observing is the task of remotely monitoring people's actions and/or activity. The most widely utilised device is security cameras. These cameras are used to monitor industrial processes, traffic and crime prevention. But security cameras still have several limitations despite their widespread usages. One of the drawbacks is that the cameras are only able to monitor at specific angles since they are fixed to mechanical hinges[1] and the security system can only be penetrated through those regions which are hidden.The participation of human operators[2], which normally monitor several inputs from cameras, is another problem. Since such operators may be vulnerable to boredom, exhaustion and distraction, criminal or other undesired activities may not be detected. A mobile robot can therefore be utilized to solve these possible difficulties. A robot might go independently and continually across the monitoring regions, take its own decisions and detect undesired behaviors or activities and react as necessary, such as issuing notifications. The tracking of objects with computer vision is an important component in robotic monitoring. The objective of object tracking is to monitor moving objects' location in a video stream. This can be performed by the identification and tracking of a particular characteristic, such as the color of the moving item. The paths of the moving item may then be tracked through time using the method. In order to track a fixed color, most of the existing color tracking procedures are built. However, as the camera moves, owing to the changing environment the tracking color function may not be more prominent. Tracking might take place to follow a false item in this situation. New approaches are thus necessary to calculate the color function according to the operating environment of the camera.

A. Hue Saturation and Value (HSV):

Unlike RGB and CMYK, HSV is closer to human color perception. It has three components: hue, saturation and value. The color space represents the colors (tone or hue) in terms of the shade and brightness value (saturation or quantity of grey). Some color receivers like as those in Adobe Photoshop use the HSB abbreviation, which replaces the word "brightness" with "value," although both HSV and HSB are the same.The HSV color wheel appears as a cone or a cylinder, but always with three components:
Hue: Hue is the color part of the model that is indicated by a number between 0 and 360 degrees.
Red ranges from 0° C to 60° C.
Between 61 and 120 degrees, yellow falls.
Green descends from 121 degrees to 180 degrees.
Between 181 and 240 degrees Cyan falls.
Blue ranges from 241 to 300.
Magenta falls from 301 to 360°C.
Saturation: Saturation quantifies the amount of grey, between 0 and 100 percent, in a given color. Reducing this component to zero leads to more grey and a faded look. Saturation sometimes occurs within a range of 0 to 1, with 0 grey and 1 main color.
Value (brightness): Value works together with saturation and represents the brightness or color intensity, from 0 to 100%, where 0 is totally black, and 100 is the brightest and most colored.

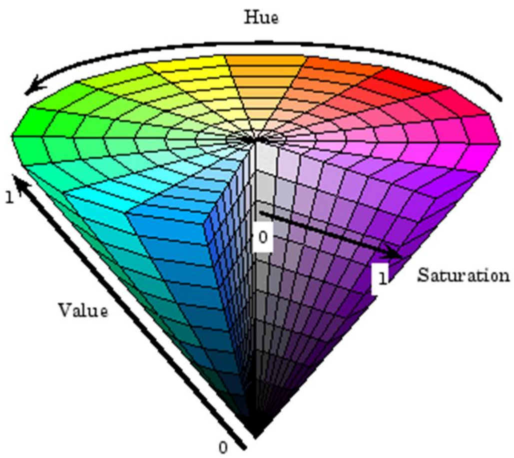

Fig. 1: HSV Cylindrical Cone

B. OpenCV

OpenCV is a collection of programming functions geared mostly at computer vision in real-time. The library is used for image processing in basic language. It is used mostly for all image operations. With this, photos and videos may be processed to recognize items, people, or even a human's handwriting. When coupled with many libraries like Numpy, python can process the OpenCV analysis array structure. We employ vector space and perform mathematical operation on these characteristics to identify visual patterns and their various characteristics.

II. PROBLEM STATEMENT

Monitoring is the task of distant monitoring of people's conduct and/or activities. The most typically utilised devices are security cameras. These cameras are used to monitor industrial processes, transportation and crime prevention applications. However, security cameras still have significant limitations, despite their widespread use. One of the shortcomings is that the camera can only monitor at particular angles as it is fixed on mechanical hinges, and the safety system can be infiltrated through these hidden places.Plus a person regularly monitoring the camera is to be deployed and incase of his negligence, various problems can arise.

A mobile robot can therefore be utilized to solve these possible difficulties. A robot might roam independently and continually around the surveillance regions, take personal judgments while spotting harmful behaviors or activities and thus respond, such as giving warnings. The object tracking objective is to monitor moving objects' location in a video clip. You may do this by recognizing and monitoring a particular attribute like hue that is part of the moving item. The paths of the moving item may then be tracked through time using the method. In order to track a fixed color characteristic, most known approaches for color tracking are devised.However, if the camera is moving then the tracked color characteristic may be no longer conspicuous owing to the changing surroundings. In this situation, the tracking may take place to follow an incorrect item. New techniques are thus needed to identify the color function according to the environment in which the camera operates.

III. LITERATURE REVIEW

Recently, due to introduction of low-cost cameras, people have started to create large-scale camera networks. This growing number of cameras can allow new signal processing applications that use numerous sensors in vast regions. Object tracking is the new way to detect moving things in video sequences by use of the camera over time. Its fundamental objective is to link the target items with form or characteristics in subsequent video sequences.

A novel hierarchical moving targeting strategy based on spatiotemporal saliency was proposed by Shen et al. (2013). In addition, the enhanced detection results were obtained utilizing information on time and spatial output. The results of this test reveal that this method detects excellent accuracy and efficiency of moving objects in the airborne video. Furthermore, compared to the HMI technique, this approach has no time delay. But in all video frames this algorithm judged item placements as false, unavoidable alerts.

Guo et al. (2012) recommended a strategy to object detection in video frames to track things. The outcome of the simulation demonstrates that this method was effective and precise and resilient for good performance detection of generic object classes. In addition, the focus must be on improving classification accuracy in the recognition of real time objects.

The approach for text identification based upon a texture on video frame analytics was proposed by Ben Ayed et al. (2015). Ben Ayed et al. The videos are broken down into distinct pieces of defined size and are analysed with har wavelet technology. In addition, a neural network was employed to categorise blocks of text and non-text. This study should, however, focus on removing the noisy regions from the areas and eliminate areas such as texts.

Viswanath et al. (2015) proposed the concept employing panoramic modelling of the background. Using this methodology, they represented the whole pictorial element in a Gaussian space-time. The results of the simulations suggest that the moving compounds may be identified with less false alarms. But this strategy does not work when the proper functionality of the section is not attainable.

The new way of adapting to pedestrian detection was suggested to Soundrapandiyan and Mouli (2015). Moreover, the foreground items were separated by pixel intensities of the picture from the background. They then employed a high boost filter to improve the front edges. The effectiveness of the proposed technique is obvious from the results of the subject assessment and objective evaluation with a detection rate of around 90% in the pedestrian compared to the other current single picture approaches. They intended in future to improve the method's performance by increasing its detection rate and reducing false positives in line with sequence image procedures.

In order to classify the pixels as a foreground and background, Ramya and Rajeswari proposed a modified frame differential approach which exploits a link between blocks in the present and background images. As a background are regarded the blocks in the current image which are significantly associated with the backdrop picture. For the second block, it is categorised as a front or bottom by the pixel-based comparison. These investigations have shown that the frame difference method improves especially if precision with speed is found. However, in order to increase the detection accuracy, this studied should concentrate on additional information accessible on blocks such as shape and edge.

An optic flow with the morphological operation for the video object detection was suggested by Risha and Kumar (2016). A morphological process was further employed to generate clearly moving objective images. The only focus of this investigation was on the static camera. Therefore you must concentrate on moving the camera and recognize several items in video frames.

IV. OBJECTIVES

The objective of this work is to accurately track the object. The HSV value of an object with respect to its surroundings are derived and later the same object is tracked by making use of the already derived HSV values. Our work consists of two models. One is to derive the HSV value of an object and the other one is used to track the object. For tracking the object, OpenCV is used.

V. METHODOLOGY

The flow of the methodology in my work can be seen in stepwise manner in Figure 2

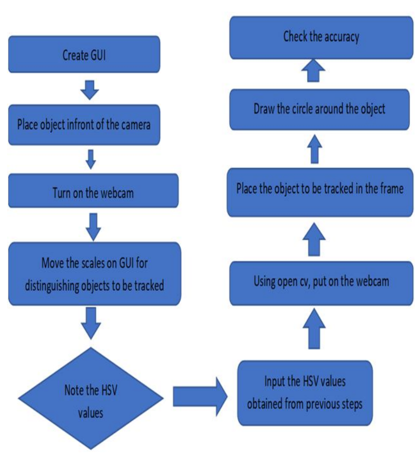

Fig. 2: Flow of the model in stepwise manner.

Broadly my work can be divided into two steps.

A. HSV Value Detection

This is done in real-time by keeping the object in front of the camera and executing the model. Once the code is executed, it displays the image of the object on the screen. The image displayed is colored. Now the task is to change this RGB image into the HSV image and derive its values. We have developed a Graphical User Interface (GUI) model for this purpose. There are six values that need to be found. Hue (min), Hue (max), Saturation (min), Saturation (max), Value(min) and Value (max). GUI makes the determination of these values simple. We have to drag the horizontal tabs of all these six values to the point where the object to be tracked turns white and the entire surrounding become black. This way the HSV value of the object is determined and then used in the next step of tracking it. All the six values that are determined range from 0 to 255. The first step we start with is the determination of Region of Interest (ROI). It includes four major stages:

1) Background subtraction
2) Noise elimination
3) Object tracking
4) Behaviour analysis

a) *Background Subtraction:* The live RGB videos are initially transformed into grayscale pictures to undertake backdrop removal. Gray photos are employed as inputs for the background removal method, because the processing speed of pictures is lower than the color pictures [3,4]. IABMM[6] then identifies moving things as foreground items using white pixels and presents them in a binary picture while assigning all stationary items as backgrounds using black pixels.

b) *Noise Elimination:* Noise removal is done to remove any sounds induced by reflexions or motion flushes after the background subtraction. The removal of noise involves median filtering and binary morphological processes. Median filter[6] is used for the removal and restoration of so-called "salt-and-pepper" noise, while retaining valuable information. Noise generated by a change in background or lighting condition may misidentify and isolate certain background pixels as foreground objects or cause gaps or troubles in foreground objects.Dilatation and erosion[7] are employed for morphological processes to minimise noise by linking potential front-end areas and deleting any spurious ones. Dilatation is achieved by initially computing the kernel-overlapped maximum pixel value and by replacing the image pixel with the maximum value below the anchor. In addition, erosion is the opposite function which works with minimum and not maximum values. This leads to morphological closure by combining dilatation with erosion which causes bright spots to form blobs together and increases the detection of the foreground (represented by white blobs).

c) *Object Tracking:* The object-tracking process begins with the (if there is) blob-tracking of the output binary noise-elimination picture, and it is tracked with the LTCLA algorithm[8], which is a quick labelling approach that marks concurrently the linked components and their outlines. A contour tracing methodology using a tracer for the detection of the exterior contour and inner contours of every component forms an important part of this method. Once an outline point is located, the tracer searches other outline points in a clockwise direction amongst its eight neighbours. The next step is to determine which blob is to follow in the object tracking step.This article determines that the biggest moving blob found is the tracking object. Although the technique is suited to monitor several targets, the performance of the method has been discovered to be greatly affected by the number of monitored objects. This approach merely selects and tracks the biggest blob.

d) *Behaviour Analysis:* The last step of the ROI method is the behavioural study of the blob after identifying the biggest blob. The area, centroid, and speed are determined and the behavioural characteristics of the item may be determined. A ROI is defined by a bounding box which includes the objective item and is defined with the maximum width and height of that item in order to compute these behaviour parameters. By counting the number of pixels in the tracked blob is estimated the area of the item. After the ROI is determined, both the ROI and the image's full color space will be analysed by the color filter offered. HSV is picked via RGB as HSV improves in recognizing objects, such as shadows, shades and highlights under various lighting circumstances. The filter therefore has fewer segments in comparison with RGB [9, 10]. In addition, RGB color area tends to combine neighboringcolor objects with various colors and to produce boring outcomes, whereas the HSV color space separates the intensity from the color data and so the outcome tends, by sharing the limits and retaining color details for each pixel, to distinguish between neighboring objects of different color [11].The color filter presented has been developed to cover the whole color area of HSV. In view of the hardware limitations such camera resolution and the processing speed needed for the algorithm, the number of segments of HSV space can be chosen by the user.

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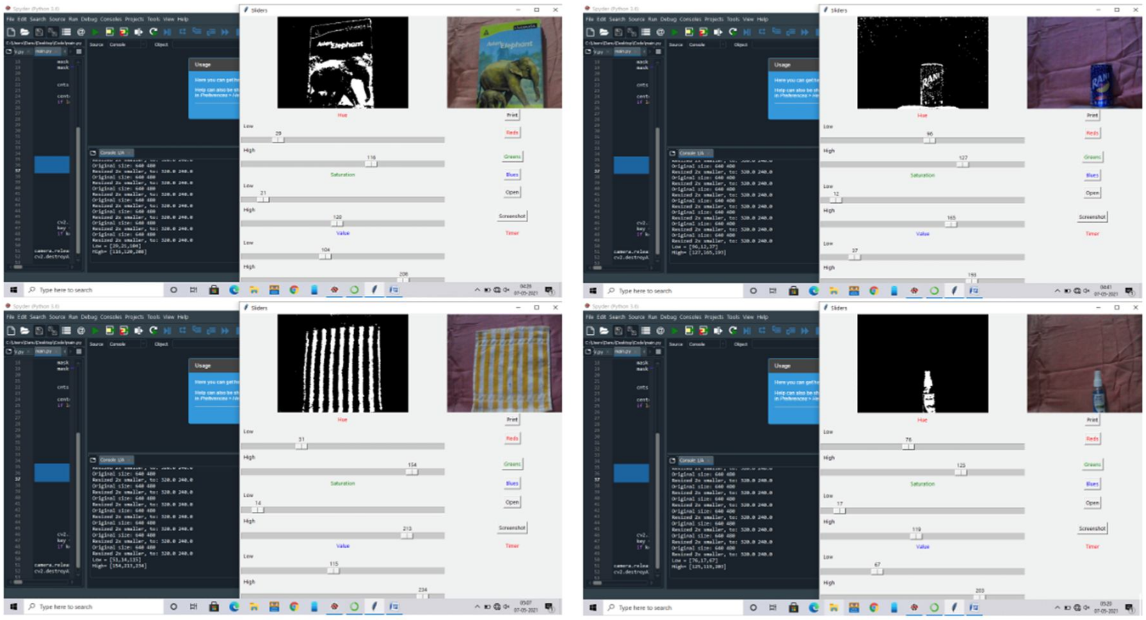

Fig.3.Real Time Gesture Recognition

e) *Tracking the Object*: The HSV values obtained after the first step are used in the second model to track the object. We use OpenCV library for this purpose.

VI. RESULTS AND OBSERVATIONS

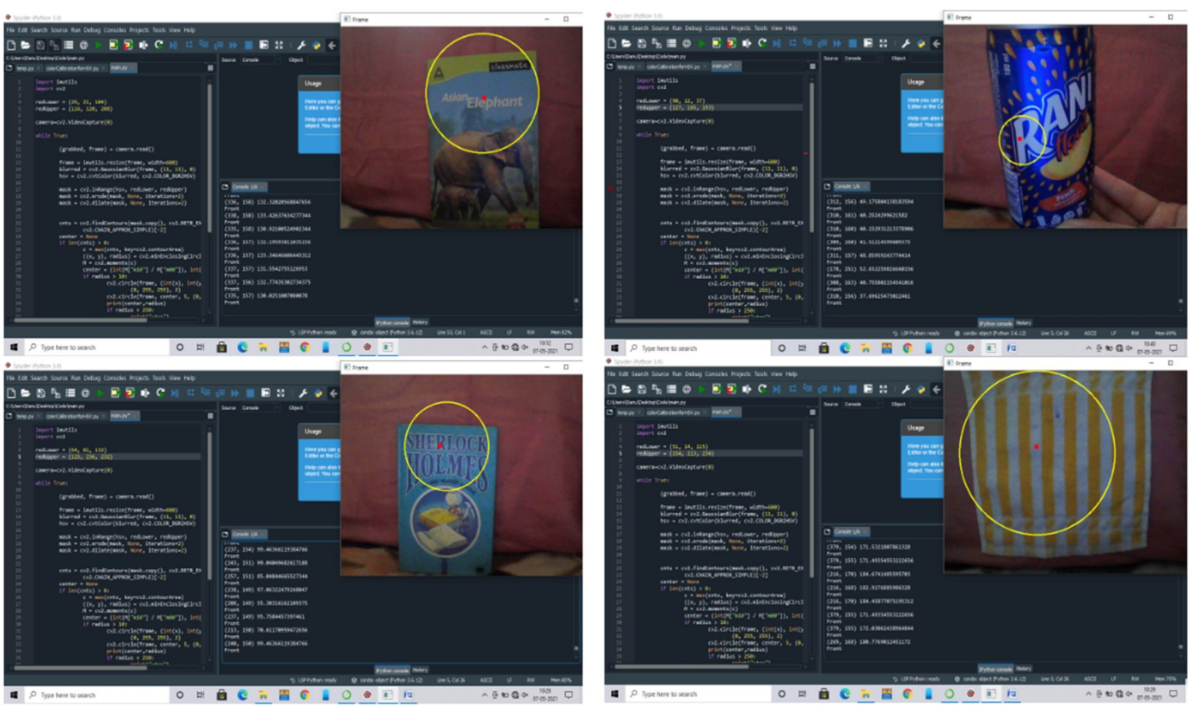

Fig 4: Real Time Object Tracking

The objects are tracked using OpenCV library. The object to be tracked is placed in front of the camera and the tracked object is then encircled by the model. The accuracy of this model was found to be 90%.

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Table 1 and Figure 5 shows the no. of samples taken and object tracking accuracy in different background colors.

Table 1:
Percentage of Accuracy In The Model

S. NO.	Colour of background	No. of samples taken	No of times the object was tracked accurately	%age Accuracy
1	Red	45	42	93
2	Yellow	56	54	96
3	Green	70	69	98
4	Blue	70	64	91
5	orange	100	94	94

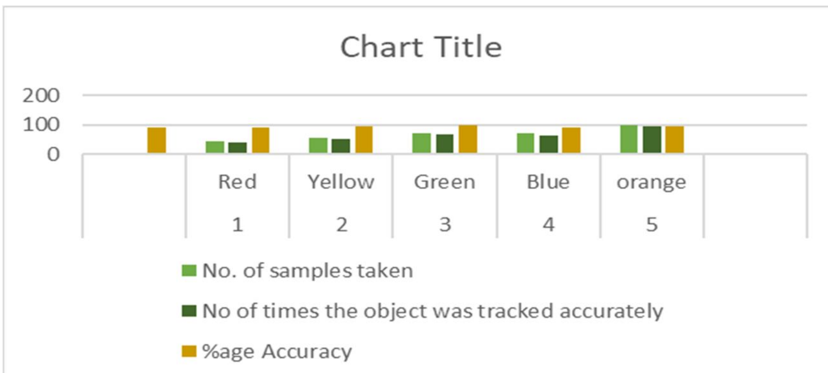

Figure 5 The chart representation showing accuracy of the model.

VII. CONCLUSION

In this work, HSV value of an object was found and the object was tracked. It was seen that tracking object by HSV value is highly accurate and is rarely failed. This technique can be used for defense and other fields also.

VIII. FUTURE WORK

In this model, a single object was tracked accurately, although through more research and resources, it is possible to track multiple objects based on HSV at one time in a single frame with higher accuracy

In this model, a laptop is used which makes the mobility of the model a difficult task, the mobility of the system can be improved in future using a camera and a processor.

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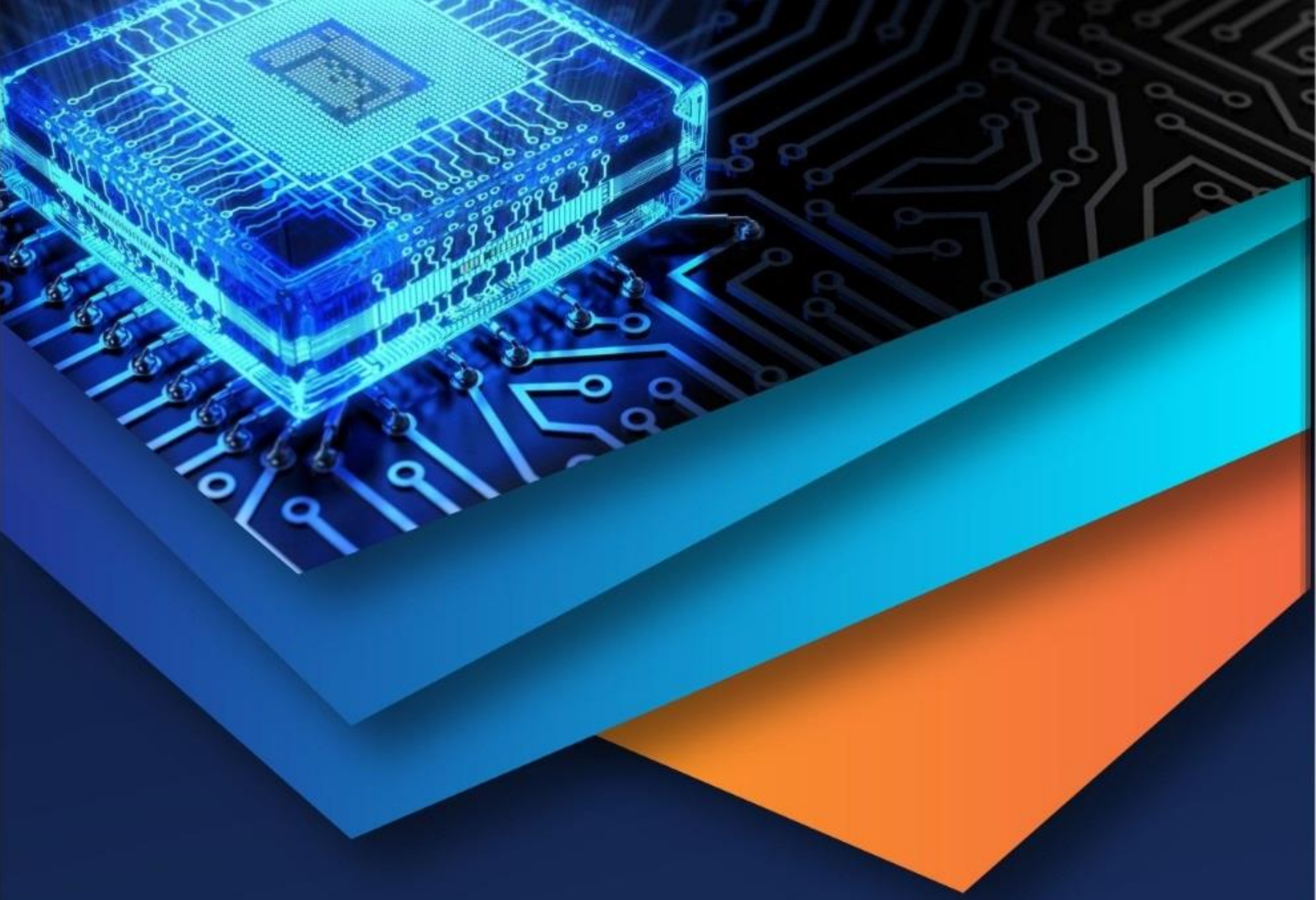

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