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Colour Detection of Agriculture Products for State Analysis

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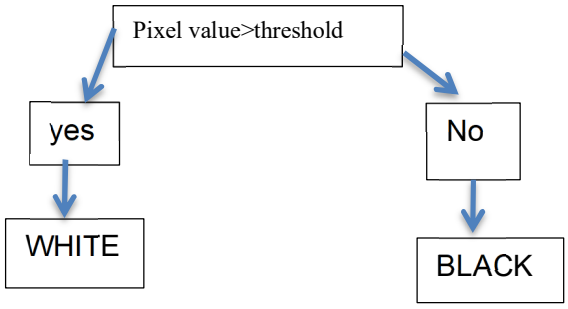
Abstract: ***The present market demands recognition of state analysis of an agricultural product automatically rather than conventionally checking the maturity stage and ripeness of an agricultural product which is mundane . In this project we are going to determine the state of an agricultural product using machine learning algorithm with the aid of colour detection. Image processing has been a great help in all kinds of fields which also extended its applicability in agriculture as well . Determining the maturity of an agricultural product at the right time will be very much helpful for the farmers . So by implementing this algorithm the colour as well as the state of the fruit will be determined automatically when we click on the image. Libraries we have used are open CV and Pandas which will help to work with images and the statistical data we are using to convert them into RGB colour models through different functions in the jupyter notebook platform. The two important parts in a project are the prepossessing and the state analysis stages. Firstly, the pre-processing stage determines the colour by calculating the distance to tell how close we are to the actual colour and we will choose the one which has the minimum distance. The second stage is mainly to classify the ripeness and state of an agricultural product. This technique also finds its application in detecting synthetic colours in the edible products . Colour detection is the initial set in any image processing technique. In the future it helps the cashier to determine the quality of the agricultural product effectively and quickly by reducing the effort they put in the traditional method .***

I. INTRODUCTION

Colour is the most important feature in an image. An image is made of millions of pixels . The full form of a pixel is a picture element which clearly says that it is an element of the image. A pixel consists of rows and columns made up of the three primary colours there are red, blue and green. The resolution of the image is improved by adding a large number of pixels. It can be measured as dot per inch 'dpi' or samples per inch 'spi'. When we clearly observe images are made up of many solid colours but in reality they are combinations of the three colours red, blue and green .Images are divided into three types. They are binary images, grayscale images, colour images[1].

A. Binary Image

Binary image is the basic form of all the three images. It receives only two colours: zero for black or one or 255 for white. Thresholding method used to determine binary image from the grey image . They are generally used for determining which shape or outline in a picture. For example optical character recognition they use threshold operation so the algorithm works in a simple way .



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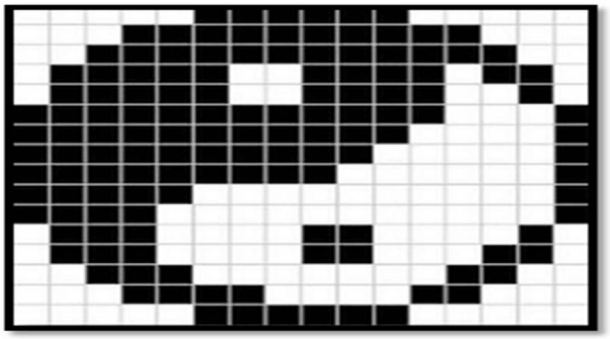

Fig. Binary image

B. Grayscale Image

Gray scale images consist of different tints of grey . They are monochrome images which have different shades of grey extending from black colour at the dimmest to white colour at the brightest. They convey information regarding the intensity of the image so they do not unfold any particulars about the color. Normal grey image contains 8 bit per pixel of data which has 256 different grey levels. The pixels are made up of different grey levels. They find their practice in medical images and astronomy . For advanced applications 16 bit per pixel can also be exerted.

Fig. Gray-scale image

C. Colour Image

Colour image contains a band of three colours: red, blue and green. There are different formats for representing a colour image in which 8 bit format uses 8 bit byte which contains a range of 0 to 255 where 0 is used for black , 255 is used for white and 127 is used for grey colour . It was initially implemented by the Unix operating system. In 8 bit format three bits are used for red and 3 bits are stored for green and two bits for blue. The actual information is stored in the digital image. In a 16 bit format which uses 65,536 different colours. This is also known as RGB format. In this format 5 bits are for red, 6 bits for green and 5 for blue . One extra bit added along with the green because it is tranquil to eyes.

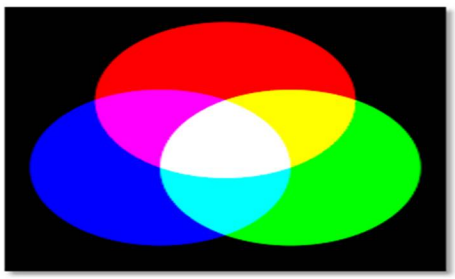

Fig. Colour image

We are going to detect colour in an image. We need to understand how these colours are defined in an image and how they appear on the computer screen .So three popular colour models are formulated. Colour models are a very good way to represent colours on the image.

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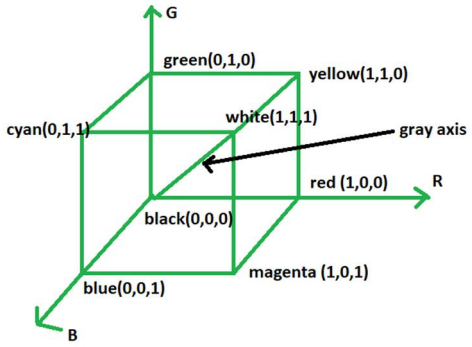
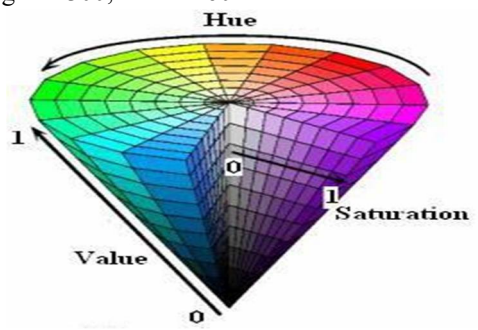
1) RGB model: The RGB Model was initially based on Young Helmholtz theory which was proposed by Thomas young and Hermann Von helmholtz during the 19th century which was based on trichromatic colour vision and it was later developed by James Clerk Maxwell in his colour theory [1]. The RGB model is referred to as an *additive model* because the colours are the summation of RGB colours. These colours are amalgamated to generate an ample variety of distinct colours. The actual purpose of this model is to represent and sense different electronic devices like televisions and computers but it is also effectively used in conventional photography. RCB model is device independent model because each colour is identified in a different way . Each device elaborates or identifies the combination of R, G and B values in a different way so we can conclude that all the devices don't have the same colour with the same RGB value; it is implemented in colour image producing Technology. They are in contrast to subtractive colour devices like this CMYK model which will be discussed in the later section of this paper. A cube is defined which uses a cartesian coordinate system with coordinates in the form of R,G,B .If we want to get a pure black it should have a value equal to (r,g,b)=(0,0,0,). Pure white can be obtained by taking a combination of RGB values (255 ,255, 255). I(R,G,B)=R+G+B

The below picture shows the image of a cube which depicts the RGB model.The primary colours are placed at the corners i,e at the x axis z axis and y axis respectively. Secondary colours that are placed at the opposite corners to the primary colours. Black is placed at the origin and white is placed right opposite to the origin. The main advantage of the RGB model is that transformation to display data is not necessary . It is used as a standard for various models and also it is more practical so can be displayed in the video. It is also used in CRT And also it is very easy to enforce compared to other colour models.The main drawback of RCB model is it is device dependent so we cannot accurately determine a specific colour. Interpretation is not the same everywhere and also the difference between the colours is nonlinear.



2) HSV model:The HSV colour model begins with the colour circle as its top. So as we trace around the pinnacle of the circle we can go through all the hues of the rainbow. So the cone is made of different colours and at the centre of the cone is white and as we move perpendicular from the centre to the edge of the cone then we can find different colours or ranges or tones of Grey and the bottom of the cone will be pure black. As we move from the tip of the cone to hue saturation is defined which tells the amount of richness of the colour. Saturation is the quantity of grey as it adds intensity to the colour. HSV uses a cylindrical coordinate arrangement in an RGB colour model. In this S which is the radius and V which is the height and is a conversion from the colour model into the cylinder the value is a chromatic notion of intensity .

Red:0, Green:120, Blue:240, Cyan:180, Magenta:300, Yellow:60



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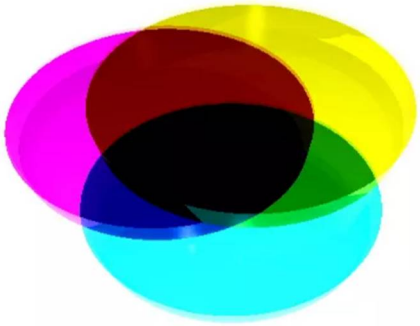
3) *CMYK Model:* The CMYK model was developed by Jacob Christop Le Blon that helped in developing printing systems which include three colours cyan ,Magenta and yellow and four colour CMYK printing systems. This model finds its application in our home printers. Black colour is the combination of other colours. The CMYK model uses black colour along with cyan and Magenta and yellow. White represents a natural colour which shows background on normal paper but black is formed by the combination of Magenta and yellow as shown in the below diagram.



II. LITERATURE SURVEY

A. Color Recognition utilizing SVM Calculation

Pooja N S et al [3] put forward a method for determining the readiness of natural products by generating a multi SVM estimation. It's vital within the order of the organic product attributes. SVM may be a regulated AI approach which will be utilised to tackle assembling and return issues. Be that, for the foremost part assimilated, which makes sure of categorisation issues. Every detailed thing is plotted as a sign in n dimensional space. With the efficacy of every component there will be a peculiar arrangement in svm estimation

B. Color Location Utilizing CNN calculation

The present technologies are mainly focused on traditional machine learning based algorithms which would recognise the state or maturity stage of Bananas but Yan Zhang [4] proposed a ground-breaking algorithm for recognising a fully grown maturity stage of banana. For this arrangement of Banana maturity state a groundbreaking CNN assessment is adjusted to superior grain quality highlighted assessment. The ongoing methodologies which focused only on the coarse order of Banana right now. The proposed strategy used information and utilised the cord initiated permission system that minimises for both utilisation and highlight to class .

C. New Strategy for Outrageous Shading Recognition

It's not unexpected to see applications in picture handling and PC vision where it's imperative to distinguish reference focuses with serious shading,. This paper by Manuel G. Forero et al.[5] presents another technique for distinguishing objects with outrageous shadings and thinks about it with different strategies in the writing Using a shading range that creates a change between R, G, B, C, M, and Y tones, the techniques are assessed and looked at. The outcomes show that the techniques examined can adequately recognize specific tones, however the proposed strategy is the one in particular that can identify the maximum range of outrageous tones R, G, B, C, M, and Y, while as yet being more specific than the others, by taking basically the territories comparing to each tone independently.

D. Banana Organic Product Development Location By Picture Preparing

A new method was formulated to check the growth phase of a new banana organic product (D Surya Prabha et al.,2015)[6] since it is a vital factor that influences the organic product quality during aging and attractiveness subsequent to aging. The ability to spot development of new banana organic products will be an amazing help for ranchers to upgrade the reaping stage which assists with abstaining from accumulating which classifies it as unripe or over-matured banana. This investigation endeavoured to utilize picture preparation strategy to distinguish the development phase of a new banana natural product by its tone and size worthy of their pictures. A total of 120 pictures including 40 pictures from each stage like under-develop, develop and over-develop were utilized for creating calculation and precision forecasts. The mean shading power from histogram; region, edge, hub length and pivot length from the measurements esteems, were separated from the alignment pictures.

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E. Color based item discovery for UAV

UAVs which stand for unmanned aerial vehicles are utilized significantly by the government and private entities for aerial surveillance, picture detection and to track natural calamities and also to detect whereabouts about those who are drastically affected by these natural disasters and to create their own attributes without traditionally travelling to those areas. This technique provides for detection of object and gestures of people described by Hani Hunud A Kadouf ed al. [7] in his journal recommended an improvised technique which used openCV software embedded with Python programming to generate an algorithm which would self execute and recognise the pattern, shapes ,objects, faces and signs of people and also earthquake areas and the movements in those tracts caused by natural calamities. The image processing obliges for exploration, classification and their implementation on the base of the application.

III. PROBLEM STATEMENT

After going through the journals in the literature review we have developed an Agricultural based application which can detect the color of different state of banana with the simple interface and user friendly system

Worldwide people try to find and get the most delicious and delightful appealing foodstuffs, at the same time customers think about the healthier and nutritious products which are safer and nature is up to the mark as the consumers started differentiating the foodstuffs buy there color, taste, smell, texture, different formats and so on..As we can observe in many markets which supply the food products have the low nature of the product and supply the spoiled products which we can't find during our purchase and if we go to check the nature of the product between the good and bad it's a time taking process hence we came up with the solution of developed a interface model which can be implemented for finding the nature of the agricultural products by state Analysis using color Detection.

Natural color has been more in demand and people start to view the products according to its natural occurrence due to its safety, its biological and functional potential and its health issues people started consuming the nature products. In that aspect we go to the agro industries to buy the products, but we know that what we buy may not what we are expecting to buy, as human eye is not that prone to get to know exactly the status of products that to be consumed because there are billions of colors that an eye can't identify due to its slight variations and also we can't always do the nature check of the products and it is a time consuming and not that accurate by its results.

In order to deal with the issues we have develop the application where color detection has been simplified using the domain as Machine learning which is a part of AI (Artificial Intelligence) and it's a study of computer Algorithm which can be improved automatically by the experience and the use of data. Python is the interface that has been used as it is the programming language with its easy scope of readability. Platform of working is the jupyter notebook which is the free interactive web tool of open source where users can do software code, computing of the output and entering the explanation in a single document, for the collection of the non volatile resources we here going to use the software libraries open CV and the pandas.

IV. METHODOLOGY

Computer vision: Computer/PC vision is the interdisciplinary field of science which focus on how the computers can have the high level of understanding from the images and the videos in digital mode. It's another version of human visual system which understands and performs the task automatically[8].

Here the computer vision image takes the multiple paths as the data can de drawn from different cameras and scanned copies etc.Recently we can see worldwide farmers are shifting toward the computer vision as the process of tackling there issues became quite easy by the machine learning and deep learning. Now the farmers can take the photo of the specific crops and can upload in the database of the labs for the testing of weeds, pests, diseases and so on.

A. Examine Of Computer Vision System Includes

1) Controlling the process
2) Detection of the events
3) Organizing the data
4) Modelling

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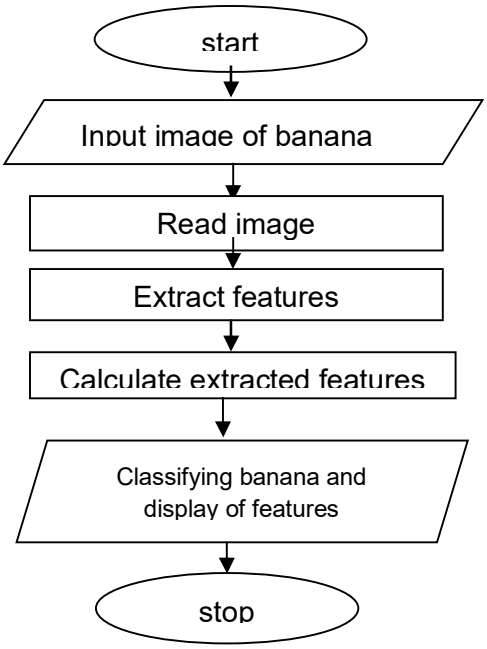
B. Algorithm Used



The steps which has been implemented in the development of the application are:

1) Download the project zip file and unzip it.
2) Take the image from the users which need to be experimented.
3) Now use the pandas libraries for reading the csv.
4) Generate the mouse callback function on the window.
5) Set the draw_function for RGB.
6) To find the color calculate the distance.
7) Exhibit the image on window.
8) Actualize the python file

a) We need to download the project folder which contain the 3 file that been used in our project are:
- Color_detection.py: source code
- Colorpic.jpg: image for testing
- Color.csv: dataset

b) Taking an picture from the users so that we can give the image path directly by the command prompt, by using the argument parser which are created by the library argprase
c) Here we read our csv file which contain the dataset by using the library pandas and load them into the data frame.
d) Here we need to generate the window in which the input image will be displayed, after that mouse event occurs for which we set a function called callback.
e) This draw_function calculates the RGB values when we click twice on the image by the mouse. The event name and the x, y points of the mouse are the parameters of the function.
f) Now we got the RGB values from the draw_function now we need some other function which could return us the color name from these values for which we calculate the distance which could tell how close we are to the color.

$$d = abs(Red - ithRedColour) + (Green - ithGreenColour) + (Blue - ithBlueColour)$$

g) As image will be displayed on the window and when we double click the image it will notify you with the color name and the RGB values on the window.
h) Thus the desired project application is ready now we can run the file in the prompt by declaring the path '-i' with the directory.

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V. IMPLEMENTATION

A. Tools Used

Open cv, pandas and numpy are the software library tools which are used in the project[9].

OPEN CV-open cv stands for open free source for computer vision and it's a software library used in machine learning. It's a licensed library which makes easy to edit and modify the code. Open cv gives the general infrastructure application of computer vision and develop the use of machine operation. Open cv supports different type of languages like java, python, c++ etc. It is mainly used for image identification and recognition .By Using The Computer Vision Computer/PC vision is the interdisciplinary field of science which focus on how the computers can have the high level of understanding from the images and the videos in digital mode. It's another version of human visual system which understands and performs the task automatically. Here the computer vision image takes the multiple paths as the data can de drawn from different cameras and scanned copies etc.

Open cv was first in the c and the c++ programming languages and later develop in the python and its use has been magnified after the modifications. The first version of open cv was used for the ieee conference on the coputer vision and image processing by deep learning. Later the second version was developed with the changes and used in c++ programming languages.

PANDAS: pandas is the free open source library which is used to store the nonvolatile sources by the python programming language which give the high performance and easy to use and implement the data structure, data analysis and operations etc by the interface as python programming.

Panel data is the source word from which the pandas are derived as the multiple people can use the data sets provided. Pandas are mainly used for data analysis as it restores the data in many formats as SQL, Microsoft EXCEL ETC. Data management tasks such as integration, reconstruction, data purification and selections are allowed by the pandas.

Key factors of pandas

1) Fast and efficient
2) High performance
3) Easy to delete and insert the columns in data set
4) Reshaping of datasets etc.

NUMPY: It is a free open free source python programming library which is been used for the multidimensional fuctions as arrays and matrices. It is a improved version and top model of pandas. It works in linear algebra, fourier transform along with the matrices domain. As we know the arrays are implemented in dataset so by numpy it makes 50x speed then the common python language. The processing and the manipulation is made easy by the numpy and bit faster also. Thus the numpy can be implemented by the python, c, and c++ also.

B. PSEUDO Code

```
#Reading the image with opencv library.

#declaring global variables in the code (are used later on)

#function will calculate the most appropriate color from the RGB values by finding the distance which is minimun

#function to derive the x, y coordinates when we double click the mouse.

#cv2.rectangle gives image, start point, endpoint, color, thickness.

#generating text to display ( Color name and RGB values )

#For  light background  text will be displayed in black text.

#escape key to come out of code
```

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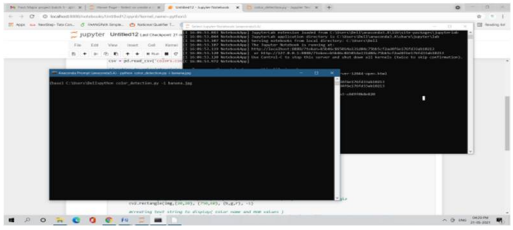
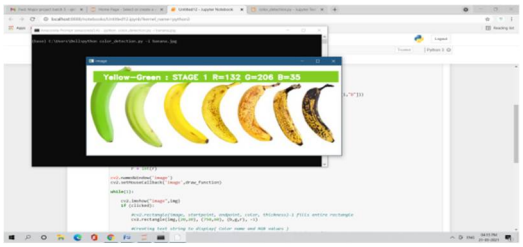
VI. RESULT ANALYSIS

After dumping/running the code, the window will be popped with the image of Agricultural Product taken. Then by clicking on the image we will get the state of product. Hence we can Analyze the state of Agricultural Products by color detection.



The above output shows the method of browsing an image in a specific directory. The anaconda prompt is used to specify the path.

1) STAGE 1

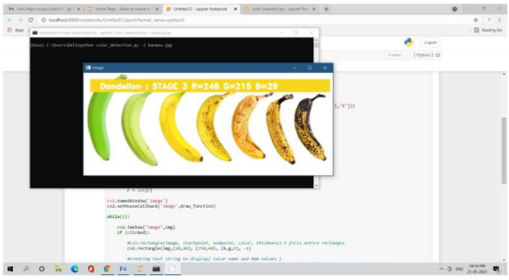


The figure depicts the early state of banana fruit which is usually in dark green colour.

2) Stage 2

The figure shows the pre mature state of banana fruit which is usually in green combined with yellowish colour.

3) Stage 3



The figure shows the mature state of banana fruit which is usually yellow colour.

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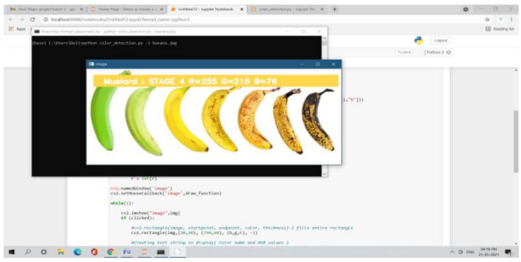
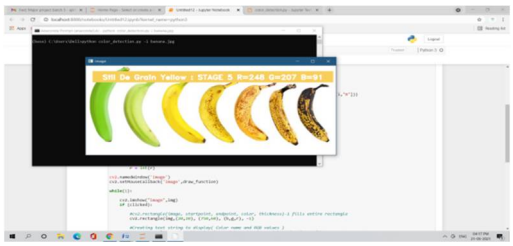
4) Stage 4



The figure shows the state of banana fruit which is usually yellow colour with light brown dots on it.

5) Stage 5

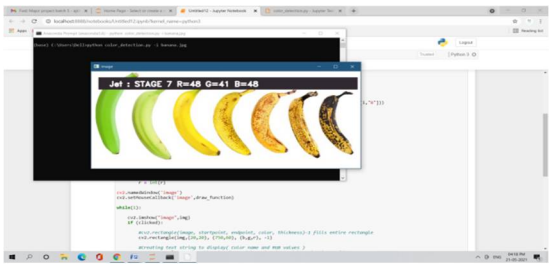


The figure shows the developed state of banana fruit which is usually yellow colour being the major part and brown dots incresing steadily.

6) Stage 6

The figure shows the highly matured state of banana fruit which is usually yellow colour and brown colour equally distributed .

7) Stage 7



The figure shows the over matured state of banana fruit which has little yellow and most of it covered with brown colour .

VII. CONCLUSION

In this application based project with the source code we have seen in detail about the color, its extraction, its RGB values and its names in pixels. We came to know about the different models as color colors with its different RGB values. Computer vision also plays a key role in our project Computer vision: Computer/PC vision is the interdisciplinary field of science which focus on how the computers can have the high level of understanding from the images and the videos in digital mode.

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It's another version of human visual system which understands and performs the task automatically. Here the computer vision image takes the multiple paths as the data can de drawn from different cameras and scanned copies etc.Recently we can see worldwide farmers are shifting toward the computer vision as the process of tackling there issues became quite easy by the machine learning and deep learning[10]. Now the farmers can take the photo of the specific crops and can upload in the database of the labs for the testing of weeds, pests, diseases and so on. As we can implement our code using the python as well as the matlab but we prefer to use in the python as the libraries are easy to implement and it's a user friendly interface.

VIII. ACKNOWLEDGEMENT

We would like to express sincere thanks and gratitude to our mentors Dr.chatopadhyay, Dr.Sruthi Bhargava for their encouragement and technical interaction.

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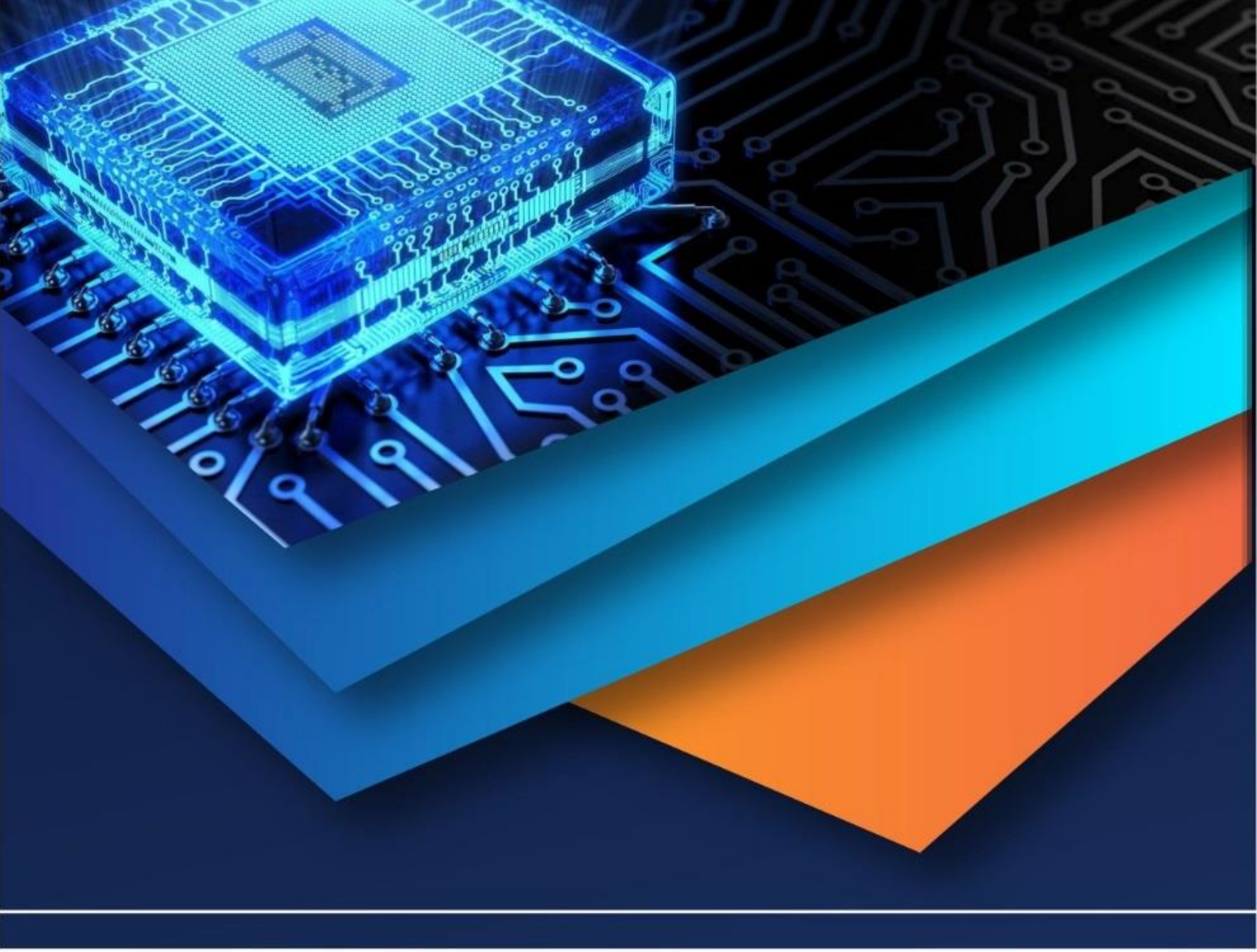

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