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Smart Aider for Impaired Vision

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Abstract: ***This paper proposes a system to help visually impaired person by identifying the known and unknown people both indoor as well as outdoor and to recognize the names of the drugs and ensure that they are used properly. A dataset of known person images and related information will be created and then the user can detect whether the person who is trying to interact is known or is a stranger using an image processing algorithm. If the person who tries to interact with the user is a stranger then the device will intimate the user through a voice message and the information regarding the new person is added into their database. So that in future if they meet the same person again it will be useful to recognize them easily. A pillbox is also designed which intimates the quantity of the drug in the pillbox and also its time of usage so that next time the user is automatically intimated to use the same drug in a specified time and using a widespread technology it will be useful for them to recognize that they use the appropriate drug properly on time.***

Keywords: Visually impaired person, Dataset, Image processing algorithms, Pillbox, Wide spread technology.

I. INTRODUCTION

Visual impairment or loss of vision impairs visual abilities as a result of disease, trauma, congenital or degenerative conditions that cannot be corrected by usual means such as refractive correction or medications. Vision is not only important to see objects but also for dark adaptations, contrast sensitivity, balance and colour perceptions and it also affects the ability to drive, read medical prescriptions, safely manoeuvre an uneven sidewalk, and to recognize a person. Although these functions are lost in visually impaired people, yet they rely on other senses to carry out not only their daily activities but also to participate in economically gainful employment. Despite the organic causes of visual impairment, most affected individuals are able to carry out their activities through the compensatory role of their non-visual modalities. The other senses might not fully compensate for the loss of sight in some individuals. With the advent of various assistive devices and skills like braille, the visually impaired are more likely to find gainful employment for themselves. As these people move out in society, they tend to face some barriers in their modes of ambulation and transport as well as their interactions with their colleagues in their workplace. Blind people are often invisible, alienated from the mainstream community and when spotted, they are sometimes overlooked or avoided. Only by learning and facilitating greater interaction between blind and sighted people, all these barriers can be demolished and it paves a way for a more inclusive community.

II. RELATED WORKS

In [1], provides an overview of the state of the art in face recognition domain, highlighting the strengths and weaknesses of different solutions and discusses some of the issues that need to be addressed and resolved to expedite the practical deployment and widespread acceptance of several prototype systems that have been developed to aid the visually impaired population with the face recognition task that utilizes the most widely used face recognition algorithm - Principal Components Analysis (PCA), Linear Discriminant Analysis (LDA), Bayesian Interpersonal Classifier (BIC) and Hidden Markov Model (HMM).

In [2], proposes an embedded face recognition system for the identification of humans by utilizing facial biometrics. In this paper face detection and localization is done using Haar feature-based cascade classifier. The face features are extracted employing a weighted Local Binary Pattern algorithm. One full face analysis is performed in 110ms by a developed system. By Comparing two biometric samples, it is found that the comparison is performed in 2 Ms. Using the FERET database, the proposed embedded face recognition system was tested and the accuracy of CMC: 99.33% and EER: 1% is achieved. Additionally, this system was built with an option to connect with alternative biometric systems like palm print and palm vein biometric systems.

In [3], aim to read the texts from pill imprints so that they can be used to compare the information with the existing database. This paper presents approaches for extracting texts from pill images based on edge-based connected component approach for Font and background colour independent text binarization and processing edge masks of imprints. This paper also compared different thresholds for binarizing extracted text area so that it can be used with optical character recognition (OCR). The result showed that the method based on using edge masks performed better, and the Otsu (a method for automatic thresholding) threshold gave the best results for binarization of the imprint area. This paper is being able to extract pill information automatically will benefit both pill information retrieval and indexing processes.

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In [4], it deals with words and character detection. Using neural networks, an OCR system that will train itself and help in extracting text from any image. Earlier data had to be stored manually in a database while performing operations but with Artificial intelligence, the system can train itself with the captured data. Only a limited amount of data has to be stored and the software will self-train itself for future entries. For better segmentation and character recognition, implementing the system using a dictionary which will help in enhancing the performance of OCR.

In [5], creates a model of a pillbox - an automatic pill reminder and dispenser containing several compartments for keeping different kinds of pills like tablets, capsules and suppositories having prescribed administration schedules. It uses a microcontroller to keep track of when a patient should take their medication. The time will be displayed in the liquid crystal display screen for the next medicine and once the time is reached, the message is generated repeatedly, along with LED blinking indicating which compartment in the pillbox to open. When the patient opens a compartment, a detector detects this and resets the light, the alarm is snoozed. This paper will alleviate irregularities in taking the prescribed medicines at the correct time dictated by the health professionals, thus relieving persons from unreliable tasks.

In [6], proposes a system which is designed to help patients as well as elderly people to take the required medicine in the right proportion at the right time. The basic design is incorporating the concept of light-based slot sensing with an alarm clock on a normal pillbox. An alternative to the light-based sensing method usage of capacitive fields is also employed. It is inbuilt with a GSM module for notifying the patient and also the chemist. Untimed medicine administration can be avoided which show adverse effects on the health of the patients.

III.METHODOLOGY

The principle process of the project is mainly controlled by a Raspberry pi which is the body of the designed model. The project proposed is a multi-purpose device for the visually impaired person such as identifying a known and unknown person, recognising and taking proper medication, hence the Raspberry Pi is the device controlling all this process as follows:

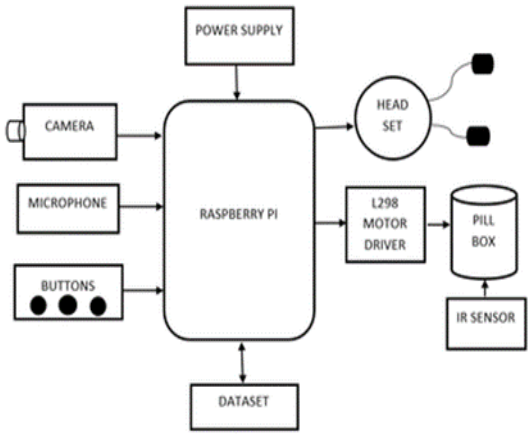

Fig. 1 Integrated Block Diagram

A. *To Identify A Known Person:* From the block diagram shown in Fig. 1, it is seen that the camera module is connected to the Raspberry Pi indicating when a person is standing in front of the impaired person the image of the person is captured by the camera module within a 3x3 matrix pattern and sent to the Raspberry Pi where there will be a feature extraction using Haar-cascade classifier algorithm and later trained and stored with a personal Id and name of the person to the dataset. For the process of recognition when the same corresponding person appears local binary pattern histogram algorithm is used and the image is captured and checked for the match from the dataset and if available, the person will be identified with the corresponding I'd and name and intimated by means of the voice message to the impaired person through headphones.

B. *To Identify An Unknown Person:* As of the unknown person, when the person approaches the user a voice message will be intimated saying the person is unknown to which the user will have to press the three pushbuttons to repeat the process as of known person – first push button is for capturing the image of the person and when the second button is pressed the image will be trained with the Id and name given by the user through the mic and stored in the dataset and by pressing the third button the respective person will be recognised.

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For person identification, this system performs three techniques: Face detection, Face training, Face recognition.

1) *Face Detection:* Face detection is a type of application that is classified under computer vision technology. Images are captured using OpenCV. A machine learning-based approach called Haar cascade classifier algorithm is used. Each feature is a single value obtained By subtracting the sum of pixels under the white rectangle from the sum of pixels under the black rectangle, a single value is obtained for each feature. Haar Cascades uses the Adaboost learning algorithm. An XML file called: haarcascade_frontalface_default.xml is a training data used in this system. A data set has been created by capturing the images.
2) *Face Training:* A visual descriptor called Local binary pattern histogram algorithm is used for the training the captured images. It labels the pixels of an image by thresholding with the neighbour of each pixel and results with a binary number. The LBPH uses 4 parameters: Radius, Neighbour, Grid X, Grid Y. It must use a dataset with the facial images of the people it has to recognize and also to set an ID. The first computational step of the LBPH is to create an intermediate image that describes the original image by highlighting the facial characteristics. At the end of this procedure (LBP procedure), it has a new image with better characteristics than the original image. Based on the image, extraction of the histogram of each region is done. The final histogram represents the characteristics of the original image. The captured images in the dataset are trained.
3) *Face Recognition:* The algorithm is already trained. Each histogram which is created after training the algorithm is used to represent each image from the training dataset. A histogram of a new image is created. Finally, it Compares the histograms with input and returns the closest histogram. The system will capture a fresh face on camera and if this person had his face captured and trained before, our recognizer will make a "prediction" returning its id and an index, showing how confident the recognizer is with this match.

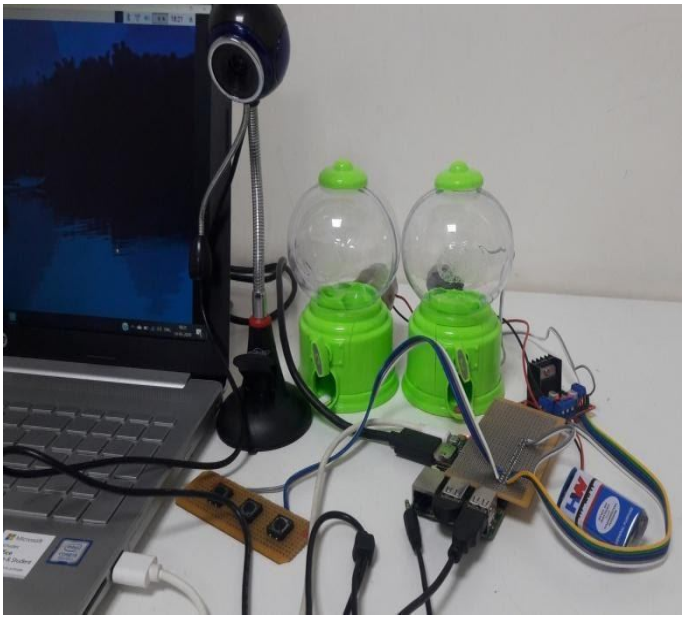

Fig. 2 Implementation of the proposed system

C. To Recognise The Tablet Name

The tablets recognition is a tedious task for the impaired person when misplaced hence for efficiency the tablets will be recognised by the Optical Character Recognition (OCR) technique. When the tablet is placed in front of the camera module the name of the tablet will be captured and text to speech conversion will be carried out using the OCR technique and the name of the tablet will be intimated to the person through the headphones.

D. Pillbox Model

Pill Box is a device which helps everyone to take the proper medication easily without any confusion, hence this automated pillbox is a model in which the tablets will be retained in it and the time in which it has to be consumed will be intimated to the user through voice message by means of headphones and the tablet will be dispensed accordingly by a motor attached to the model. The availability of the tablet will also be determined by placing an IR sensor at the top of the pillbox which counts each time the tablet is dispensed and intimates the time the tablet must be refilled.

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IV. RESULT AND DISCUSSION

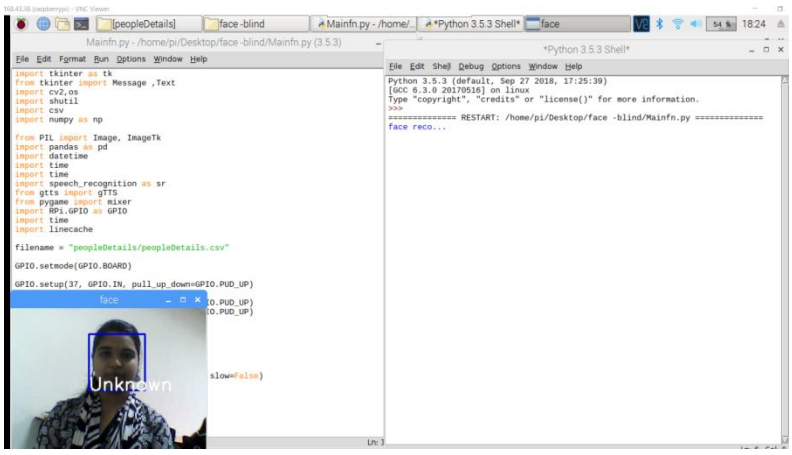

Fig. 3 The output of Face recognition

In Fig. 3, it shows the Person to be recognised will be identified as unknown by pressing the button initially before training and storing in the dataset.

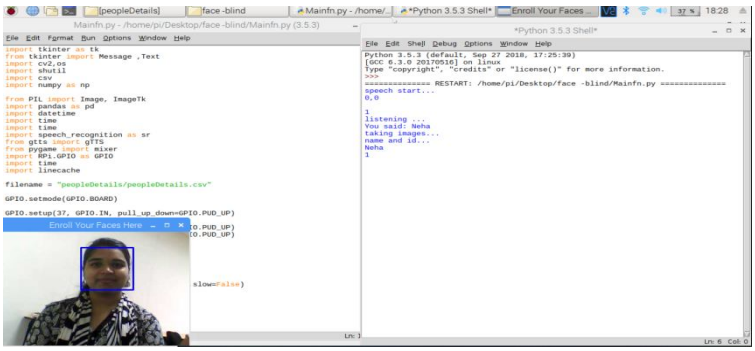

Fig. 4 Capturing an image

In Fig. 4, it shows the image is being captured and the features are extracted by pressing on the Next button and the details are collected through voice message and it is trained respectively.

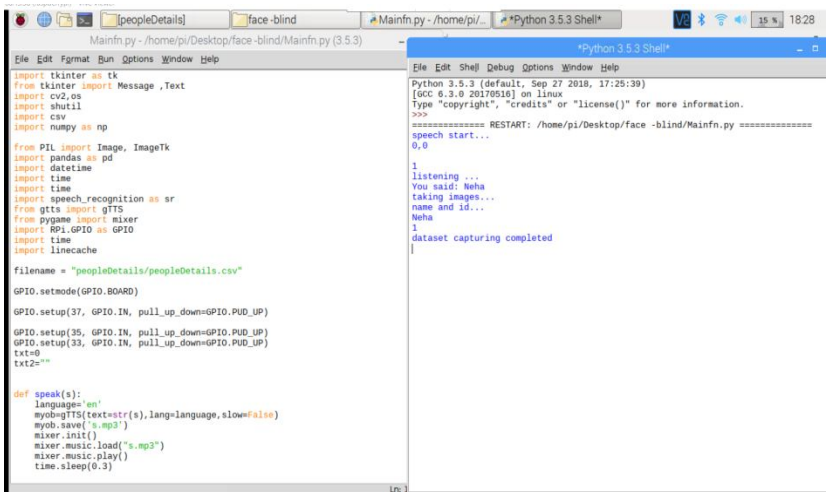

Fig. 5 Dataset Created

In Fig. 5 it shows the image is being trained and stored in the dataset with an id and the name given as a voice message which can be incremented for the next person's details. Hence a dataset is created with the respective details.

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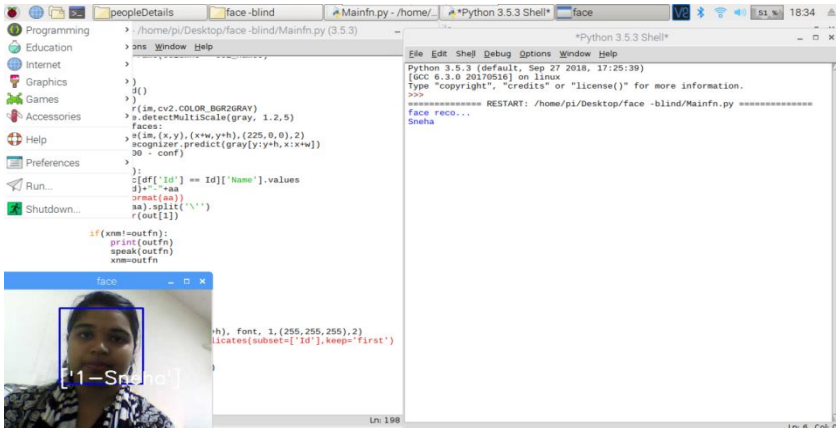

Fig. 6 Face Identified

In Fig. 6 shows the face of the person whose details are present in the dataset will be recognised next time the person appears along with their respective id and name through a voice message.

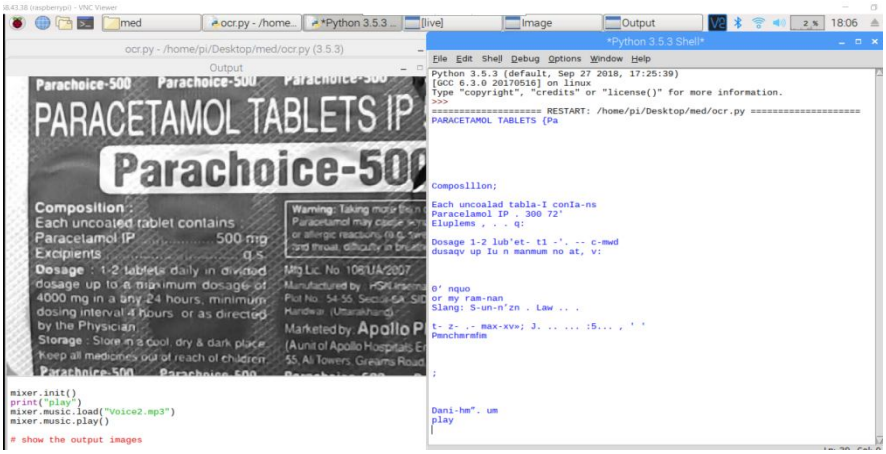

Fig. 7 Tablet name identification

In Fig. 7 shows that the tablet name is captured using a camera and the text will be converted into speech and given to the user through a voice message.

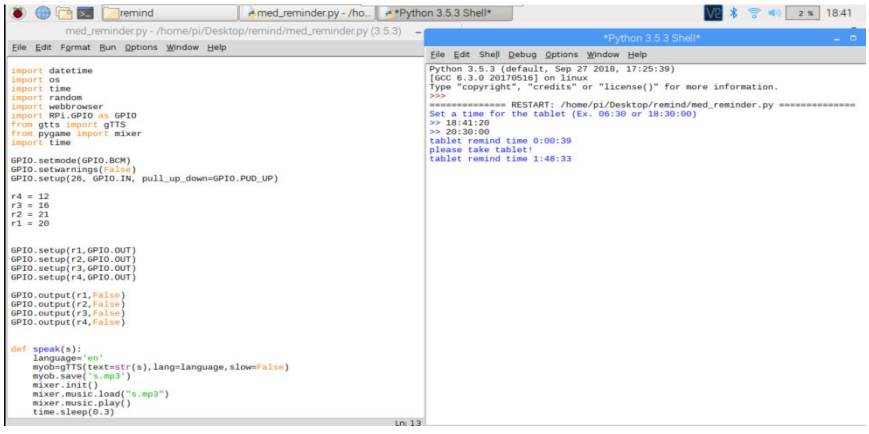

Fig. 8 Output of Pillbox with the remainder

In Fig. 8 shows the time of the remainder which is set accordingly to the time of consumption and the pillbox dispenses the tablet with an alert message to the user.

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V. CONCLUSIONS

The device is efficient and economical for visually impaired people as well as elderly people. This device is compact and also helpful to society. The following enhancements could be done in future: High-speed processor could be preferred, compact size camera with high definition and Providing wireless headphones to the user.

VI. ACKNOWLEDGMENT

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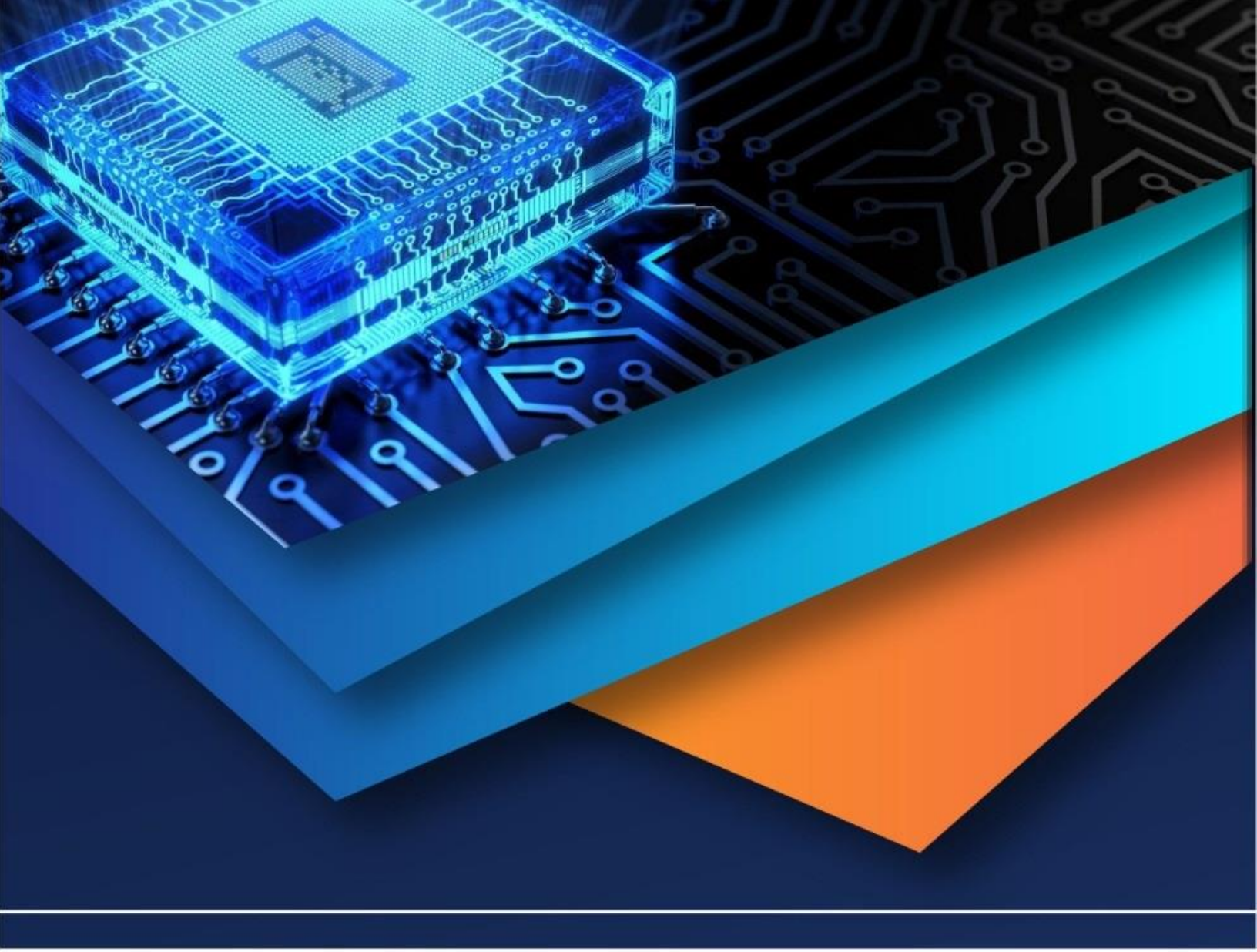

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