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An Effective Hybrid Model for OpenCV based Drowsiness Detection

Gayathri R[1], Jaya Thakur[2], Nikhil Tomar[3], Kruthika Y Sonwalkar[4]
[1] *Assistant Professor,* [2, 3, 4] *U. G Students, Department of Information Science & Engineering, Sapthagiri College of Engineering, Chikkasandra, Bangalore, Karnataka, India*

Abstract: ***The accidents due to driver fatigue has increased the ratio of accidents year by year. Since the advent of technology, it becomes important to develop a driver drowsiness detection system to alert the drivers irrespective of given condition. This detection begins by exploring various physiological features of the drivers such as yawning behaviors. These noticeable features are obtained from the frames that are captured by the camera. We label the frames as automatic datasets and then look for major signs in detection such as frequent yawning patterns, frequent eye blinks etc. We measure the datasets against the threshold; if the measured value surpasses the optimum value then driver is alerted via an alarm. This system provides a good accuracy ratio over most of the detections.***
Keywords: drowsiness detection, physiological features, camera, yawning , eye blinks, frames.

I. INTRODUCTION

Driver drowsiness detection is a car safety Technology which helps prevent accidents caused by the driver getting drowsy. Various studies have suggested that around 20% of all road accidents are fatigue-related, up to 50% on certain roads. Some of the current systems learn driver patterns and can detect when a driver is becoming drowsy.

There is much attentional impairment while driving that affect driver‘s reaction. Among which driving while drowsy is one of the major causes behind road accidents, and exposes the driver to a much higher crash risk compared to driving while alert. Therefore, the use of an assistive system that monitor a driver‘s level of vigilance and alert the driver in case of drowsiness can be significant in the prevention of accidents.

The attention level of driver degrade because of less sleep, long continuous driving or any other medical condition like brain disorders etc. Several surveys on road accidents says that around 30 percent of accidents are caused by fatigue of the driver. When driver drives for more than normal period for human then excessive fatigue is caused and also results in tiredness which drives the driver to sleepy condition or loss of consciousness.

Advanced technology offers some hope to avoid these type of accidents up to some extent. Sleep related accidents are more severe, because of the higher speeds involved and as the driver is unable to take any action to avoid accident, or even stamp the brake, prior to the collision. To mitigate such injuries. Many researchers across the globe are trying to build a device that can diagnose driver drowsiness. Many methods and techniques were subsequently proposed and built on test and compared by them in order to find out which method has good accuracy and fast detection. Patterns of eye movement and yawning are two important indications for developing a natural and non-intrusive fatigue detection system for drivers. The entire system is built on the library for processing images from OpenCV and the Facial Landmark algorithm. The main focus is on the faster detection and processing of data by drowsiness. Through the logitech camera, the system is used to detect the eyes whether they are closed or open in real time, along with that we evaluate yawning behaviors in a dataset of spontaneous speech of drowsy drivers, and suggest a new approach for detecting yawning that incorporates anatomical features of the mouth and eye areas, where drivers are not connected to any external devices and failure is also highly impossible. Substantial advances in computer vision research have recently enabled the eyelids to be unobtrusively tracked and the palpebral fissure accurately measured in real time using camera systems.

The goal is to increase driver safety without being overwhelming. By using a camera, which usually characterizes a person's level of alertness, visual signs were obtained by eye blink rate and yawning rate. These were extracted in real-time, and joined systematically to test the driver's fatigue level.

The system can monitor the driver's eyes to detect short sleep periods lasting between 3 and 4 seconds. In this approach the system implemented runs at 8-15 frames per second. The application was implemented with a single camera view, using the Open CV environment. This system was used to detect driver drowsiness and thus reduce road accidents.

This paper aims to summarize the progress of the program and to collect the latest methods.Data from NCRB, Govt. Of India.

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II. LITERATURE SURVEY

A National Highway Traffic Safety Administration survey estimated that, in 1996, there were 56,000 sleep-related road crashes in the U.S.A. Another 2007 survey said 18 percent of accidents involved fatigue as the major factor. Up to 20 per cent of serious road accidents in Britain have been caused by fatigue.

1) Ms. Devi 's algorithm used the Hough Transform to identify the iris and assess the eye 's openness. To assess the state of an eye, some researchers are focused on the image projection.

2) Yang 's solution sends high-frequency beeps via the car sound equipment, network An efficient hybrid model for driver drowsiness based on OpenCV, Bluetooth, and using software running on the phone to collect and process sound signals. The beeps are used to measure where the mobile phone is and we then know when the driver (or other person in the car) is speaking on it. The plan has achieved an accuracy of classification of more than 90%. This method works for hands free use, but it depends on the operating system and cell phone brand, and the driver has to activate the device continuously.

3) Lu et al. located the facial region of the driver using the difference between two images, and then located the midpoint of the nostrils using an integral directional projection technique. Then, the yawn is observed by measuring the vertical gap between the nostril midpoint and the lip. Nevertheless, these algorithms only use geometric features, making it difficult for them to differentiate between normal opening of the mouth (Example: Speaking, Laughing, Coughing) and yawning.

4) Boon-Giin Lee et al. suggested a system for tracking fatigue driver health using two distinct methods: tracking of eye movement and processing of bio-signal. The monitoring system was built on an Android-based smartphone, where sensory data is collected via wireless sensor network and data is further processed to indicate the driver's current driving aptitude.

5) M. Dehnavi, M. and N. Attarzadeh Eshghi used Image Processing techniques in their paper to detect the eye state. The following algorithm decides the open or closed eye by different iris and pupil color, and the white area present in the open state of the eye. The vertical projection was used to create the state of the eye. Their algorithm was of good size, precision and less complexity.

6) Azim et al. presented a system in which Viola-Jones facial detection was used by the yawning detection method to locate the face, extract the mouth window, and then search the lips through spatial c-means clustering.

7) Seshadri's computer-based vision method determines whether a driver uses the Supervised Descent Method (SDM) to hold a cell phone close to his / her ears, which tracks certain facial landmarks to extract a crop of regions of interest (ROI). Features are extracted from the ROIs and using previously qualified classifiers the phone use is detected.

8) Wang et al. used color analysis to determine the region of interest in the mouth, then segmented skin and lip pixels, and obtained lip features through the study of related components. Then they took geometric features of the mouth region to make up an own vector as the input of a neural network for backpropagation, acquiring the output of three mouth states: regular, yawning, or talking.

9) Anirban Dasgupta suggested a robust framework embedded in real-time to track the driver's loss of concentration during day and night driving conditions. The percentage of close of the eye was used to show the level of alertness. Face identified using HAAR -like software, the eye condition has been marked as open or closed using vector support machines.

III. EXISTING SYSTEM

There is a great deal of attentional impairment while driving that affects the driver's reaction. One of the main reasons behind the road accidents or road crashes is driving while drowsy which exposes the driver to a much higher chance of crashing compared to driving while on alert. The use of an assistive device which monitors the level of vigilance of a driver and alerts the driver in case of drowsiness can therefore be significant in the long run. There is use of an existing sysem which tells us about an approach towards detection of driver's drowsiness based on yawning measurement and head movement. This involves several steps including the real time detection and tracking of driver‘s face, detection and tracking of the mouth contour, the detection of yawning based on measuring both the rate and the amount of changes in the mouth contour area and head movement tracking.

IV. PROPOSED SYSTEM

The entire system is based on the OpenCV image processing library and the Facial Landmark algorithm. The primary focus is on faster data detection and processing of somnolence. The machine is used to detect the eyes if they are closed or opened in real time by means of a logitech camera, where drivers are not connected to any external equipment and malfunctioning is therefore extremely unlikely. The warning will be triggered when the driver head nodes regularly, when the driver's eyes are closed.

A. Description

Eye tracking is supposed to detect signs of driver exhaustion early enough to avoid a car accident. Fatigue identification requires examination of eye movements and blink patterns in a series of face pictures. Initially, we decided to use MATLAB to detect eye blink patterns. The technique used was the geometric manipulation of the degree of pressure.

B. Working

Initially we use a webcam to input the facial image. First, the image was binarized for preprocessing. The face tops and sides were found to limit the field of the eyes. The middle of the face was located on the sides of the nose, which is to be used when the left and right eyes are computed. The horizontal averages were measured down from the top of the nose. The eye region was established using significant changes in averages. The period the eyes closed, used to detect a blink, was little changed in the horizontal average.

Although, MATLAB had some significant limitations. The processing capacity needed by MATLAB was very high. There were also some issues with speed in real-time processing. MATLAB was only capable of processing 4-5 frames per second. This was even lower on a low RAM system. As we all know, a blink of an eye is a matter of milliseconds. Also, the driver's head movements can be very quick. Although an eye twitch was detected by the MATLAB software developed by us, the performance was found to be severely lacking.

It is the location where OpenCV comes in. OpenCV is a library of open source computer vision. It is designed for computational efficiency and has a strong emphasis on real-time applications. It helps to quickly and easily construct sophisticated vision applications. OpenCV met the low processing power and high speed specifications of our application.

We enter the face picture with a webcam first. First, the image was binarized for preprocessing. The face tops and sides were found to limit the field of the eyes. The middle of the face was located on the sides of the nose, which is to be used when the left and right eyes are computed. The horizontal averages were measured down from the top of the nose. The eye region was established using significant changes in averages. The period the eyes closed, used to detect a blink, was little changed in the horizontal average. To detect this operation, the device uses ring indicators.

The system’s output could be a warning that can regain the driver’s attention exclusively to the vehicle and the road or a warning for a transport company or enable a buzzer.

C. Advantages

1) The objective is to improve the driver's safety without being stubborn. Visual indications were obtained via a blink of the eye by using a camera that usually characterizes a person's awareness level.
2) Each year, the number of vehicles increases considerably, and a number of vehicle theft and missing technology can therefore be used to solve problems.
3) The aim of this design proposal is to detect driver drowsiness in order to avoid accidents and to improve road safety.
4) With OpenCV we process real-time in around 30 frames per second and thus the device is faster.
5) We can get away with 10 mb RAM for an application in real time with OpenCV. Although the RAM factor is not a major concern with today's computers. Yet our somnolence detection system must be used in a car in a nonintrusive and small manner; a low processing requirement is therefore necessary.

D. Requirement Specifications

The hardware requirements are the requirements of a hardware device. Most hardware only has operating system requirements or compatibility. Hardware system requirements often specify the operating system version, processor type, memory size, available disk space and additional peripherals, if any, needed.

1) *Camera:* A camera is an optical instrument to capture still images or to record moving images, which are stored in a physical medium such as in a digital system or on photographic film. A camera consists of a lens which focuses light from the scene, and a camera body which holds the image capture mechanism.
2) *4GB RAM:* Random-access memory (RAM) is a type of storage for computer systems that makes it possible to access data very quickly in random order. It’s a temporary memory which has a role of a facilitator in between the components like hard disk drive and CPU. Data from hard drive is loaded into RAM so as to get processed by CPU. A 4GB RAM means it can store 4GB of data temporarily or if you count in number of characters then a 4GB RAM can hold 4294967296 characters.

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3) *64 bit Quadcore:* 2.5 GHz minimum per core processor: quad-core processor is An effective hybrid model for openCV based driver drowsiness, a chip with four independent units called cores that read and execute central processing unit (CPU) instructions such as add, move data, and branch. Within the chip, each core operates in conjunction with other circuits such as cache, memory management, and input/output (I/O) ports.
4) *Windows/Linux OS:* An operating system (OS) is system software that manages computer hardware and software resources and provides common services for computer programs. Time-sharing operating systems schedule tasks for efficient use of the system and may also include accounting software for cost allocation of processor time, mass storage, printing, and other resources.
5) *Anaconda 3 Environment:* Anaconda is a free and open-source distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, largescale data processing, predictive analytics, etc.), that aims to simplify package management and deployment.
6) *Python 3.6 Interpreter:* An interpreter is a program that reads and executes code. This includes source code, pre-compiled code, and scripts. Common interpreters include Perl, Python, and Ruby interpreters, which execute Perl, Python, and Ruby code respectively. Interpreters and compilers are similar, since they both recognize and process source code.
7) *PyCharm:* PyCharm is an integrated development environment (IDE) used in computer programming, specifically for the Python language. It is developed by the Czech company JetBrains. It provides code analysis, a graphical debugger, an integrated unit tester, integration with version control systems (VCSes), and supports web development with Django.

V. MODULE DESCRIPTION

A. *OpenCv*

It is an open source computer vision library available from http://SourceForge.net/projects/opencvlibrary. OpenCV was designed for computational efficiency and having a high focus on real-time image detection. OpenCV is coded with optimized C and can take work with multicore processors. If we desire more automatic optimization using Intel architectures [Intel], you can buy Intel's Integrated Performance Primitives (IPP) libraries [IPP]. These consist of low-level routines in various algorithmic areas which are optimized. OpenCV automatically uses the IPP library, at runtime if that library is installed. One of OpenCVs goals is to provide a simple-to-use computer vision infrastructure which helps people to build highly sophisticated vision applications fast. The OpenCV library, containing over 500 functions, spans many areas in vision. computer vision and machine learning oft en goes hand-in-hand, OpenCV also has a complete, general-purpose, Machine Learning Library (MLL). This sub library is focused on statistical pattern recognition and clustering. The MLL is very useful for the vision functions that are the basis of OpenCV"s usefulness, but is general enough to be used for any machine learning problem.

B. *Dlib*

Dlib is a modern C++ toolkit containing machine learning algorithms and tools for creating complex software in C++ to solve real world problems.

A series of convenience functions to make basic image processing functions such as translation, rotation, resizing, skeletonization, and displaying Matplotlib images easier with OpenCV

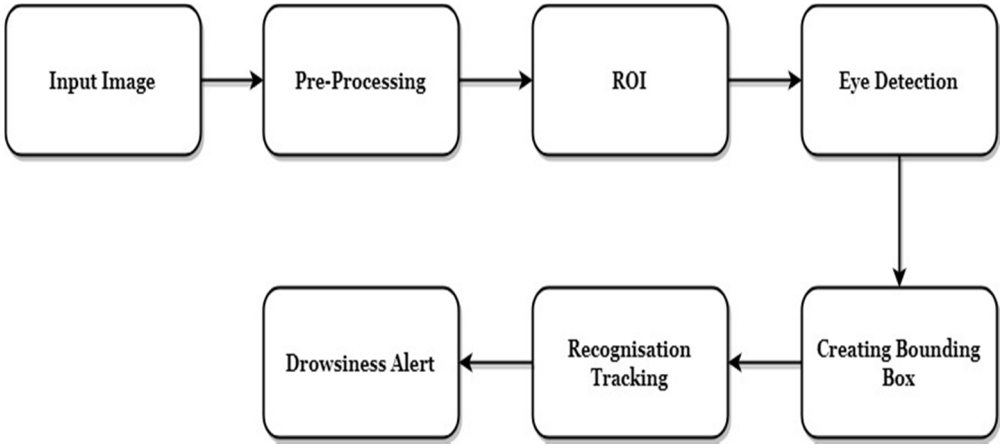

Fig 1 : Flow chart for the Proposed System

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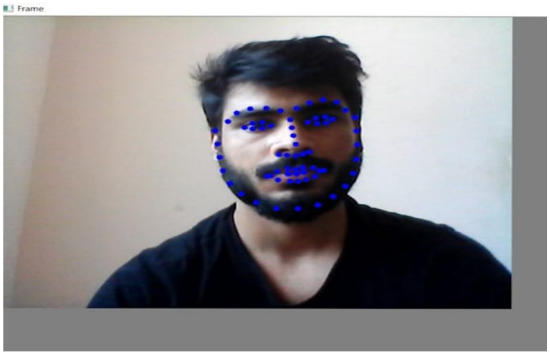

Fig 2: All 68 facial landmarks

The figure 2 shows the Human face which has all the 68 facial landmarks which are used in the project to browse, recognize and verify.

Fig 3:Choosing an image

Figure 3 shows the window from which the EAR and MAR are normal.

Fig 4: EAR AND MAR exceeds

The figure 4 shows the window in which the EAR and MAR value exceeds.

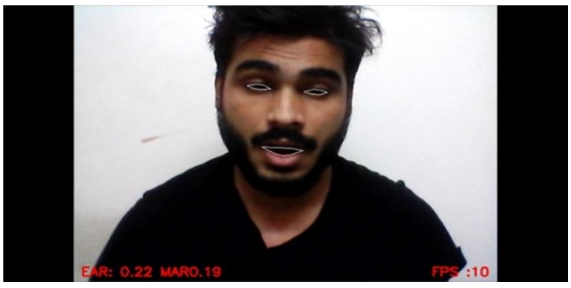

Fig 5: Normal MAR, EAR exceeds.

The figure 5 shows that the MAR value exceeds whereas the EAR remains normal.

Fig 6: Shows that EAR and MAR are normal

Figure 6 shows the window from which the EAR and MAR are normal.

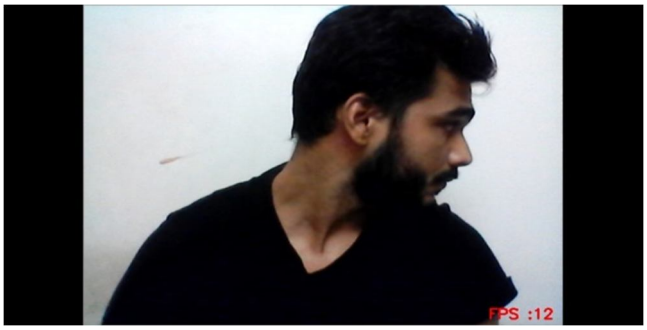

Fig 7: Unable to detect face

The figure 7 shows that the face is unable to detect.

VI. CONCLUSION

Finally, we would like to conclude saying, in recent years, driver drowsiness has been one of the major causes of road accidents and can lead to severe physical injuries, deaths and significant economic losses. Statistics indicate the need of a reliable driver drowsiness detection system which could alert the driver before a mishap happens. Researchers have attempted to determine driver drowsiness using the following measures:

A. Vehicle-based measures
B. Behavioral measures
C. Physiological measures.

A review on these measures has provided insight on the present systems, issues associated with them and the enhancements that need to be done to make a robust system. In this paper, we review these three measures as to the sensors used and discuss the advantages and limitations of each. The various ways through which drowsiness has been experimentally manipulated is also discussed. We conclude that by designing a hybrid drowsiness detection system that combines non-intrusive physiological measures with other measures one would accurately determine the drowsiness level of a driver. A number of road accidents might then be avoided if an alert is sent to a driver that is deemed drowsy.

We needed a solution to this at leads subsequent deaths of people and significant financial loss. To minimize this we propose a system to detect the state of the driver when he is driving and detect his drowsiness and alerting him to wake up if found guilty. The project is based on Artificial Intelligence with some of the IOT devices. The aim is on improving the safety of the driver without being obtrusive. Visual cues were obtained through eye blink rate by using a camera, which typically characterize the level of alertness of a person. These were extracted in real-time and systematically joined to check the fatigue level of the driver. The system can monitor the driver‘s eyes to detect short periods of sleep lasting for some seconds. The system implemented in this approach to monitor the consciousness in frames per second. The application is implemented using Open CV environment with a single camera view. This system is used to detect the drowsiness of the driver and thereby reducing the road accidents.

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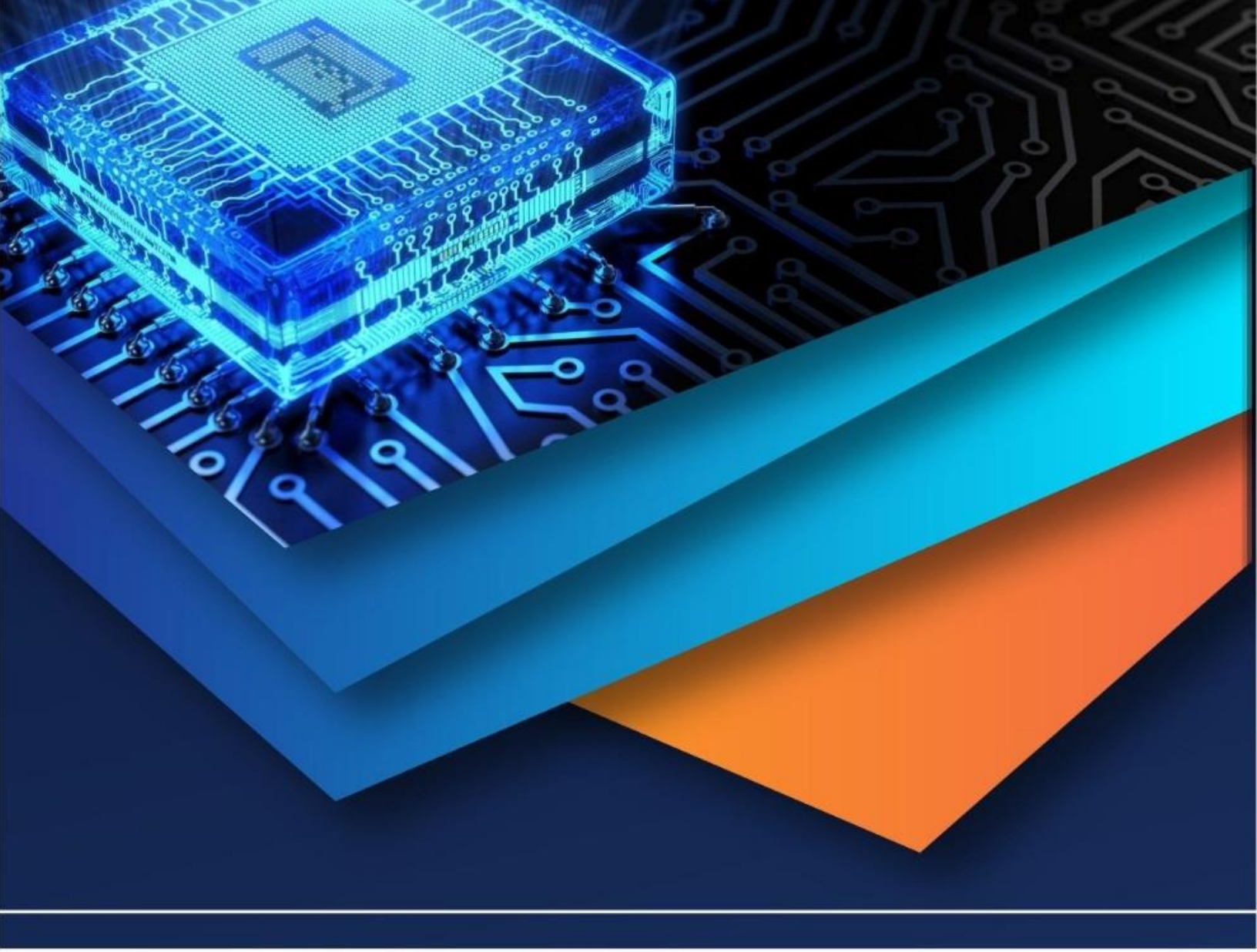

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