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ML Based Helmet and Number Plate Detection

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Abstract: To improve road safety, this project introduced a unique way to check helmets and license plates using machine learning. As traffic increases exponentially, it is necessary to enforce traffic laws and comply with safety regulations, such as wearing a helmet and appropriate license plates, to reduce traffic congestion.

I. INTRODUCTION

Road safety is a major global issue where millions of people die or are injured in traffic accidents every year. As the number of vehicles continues to increase, compliance with safety regulations is essential to reduce risks and save lives. An important part of these regulations is the obligation for cyclists to wear helmets and to ensure that they appear on the vehicle registration plate. The process of enforcing these regulations often relies on manual review by authorities; This can be time-consuming, error-prone and ineffective, especially in high-traffic areas. To solve these problems and improve road safety, there is increasing interest in advances in machine learning (ML) and computer technology for detection and control. This article focuses on the design and application of machine learning for helmet and license plate detection. The system uses powerful machine learning algorithms specialized in deep learning to analyze the flow in real time through security cameras installed at points along the road. Blended machine learning has many advantages over traditional methods. First, the helmet and plate can be continuously monitored without human intervention. Second, machine learning algorithms can learn adaptively from data and improve accuracy and performance over time. To detect helmets, a convolutional neural network (CNN) was trained on the difference between image data of people wearing helmets and people not wearing helmets. The model was trained to correctly classify examples of helmets that did not fit cyclists and their passengers, allowing authorities to quickly check them. The system also includes deep learning-based license verification and authentication. Using object detection models such as you only look once (YOLO) the system can effectively capture and extract licenses from vehicle images even in harsh environments. Overall, the integration of machine learning technology for helmets and driver license detection is a promising way to improve road safety. The system will help create a safe and efficient transportation system by monitoring and following safety regulations, ultimately saving lives and reducing social and commercial traffic accidents.

II. CONVOLUTIONAL NEURAL NETWORK

Convolutional neural networks (CNN) play an important role in the development of machine learning to recognize helmets and license plates on the road. CNN is a type of deep neural network specifically designed for visual data analysis and is effective for tasks such as image classification, detection and segmentation. In helmet detection, CNNs are good at learning and identifying patterns and features that indicate whether a person is wearing a helmet. To train the CNN, you feed it a large database of recorded images, including examples of cyclists and riders with and without helmets. From these images, CNN learns to extract important features such as the shape, color and texture of the helmet, allowing it to distinguish between what is possible and what follows. Similarly, CNN is used to identify and locate areas in the license plate image for driver's license detection. This process involves training a CNN on a database of car images with boxes surrounding the license plate. CNN learns the unique characteristics of the license, such as its size, shape, and operating characteristics, allowing it to unambiguously identify and extract the license from history. CNN's success in detecting helmets and license plates is attributed to its algorithm, which consists of several layers of convolution and pooling operations performed on all system outer layers. These layers enable the CNN to gradually learn and remove more complex features from input images, ultimately creating a high-level representation that facilitates recognition and recognition. CNNs can also be fine-tuned for specific tasks and data using techniques such as transfer learning, where a pre-trained model is used to name New with some limited record information. This feature is especially useful when writing large descriptions is difficult or impractical. Overall, using convolutional neural networks for helmet and driver license detection is a decision that uses the power of deep learning to improve safety through maintenance and safety management. As research and development in this area continues, CNNs are expected to play an important role in creating more secure and efficient systems

III. PROPOSED NEURAL NETWORK ARCHITECURE

1) *Input Process:* The input process of the neural network takes the raw pixel value of the input image from the security camera. The images often include images of cyclists, drivers and cars.
2) *Convolutional Layers:* The convolution layer forms the core of the network and is responsible for extracting relevant features from the input image. These layers contain various filters or kernels that enable the input image to detect patterns such as edges, textures, and images associated with helmets and licenses.
3) *Pooling Layer:* After each layer, a pooling layer is used to reduce the image created by the convolution layer. Pooling helps reduce the size of maps while preserving the most important information, thus improving computational efficiency and reducing overfitting.
4) *Add Convolutional and Pooling Layers:* By combining various techniques of convolution and pooling layers, we are able to capture more abstract and complex features related to helmet and license plate detection. The depth and width of these layers can be adjusted according to the complexity of the search operation and the equipment involved.
5) *Smoothing Layer:* The output of the previous process is smoothed into a single circle, which is used as the input of the next continuous process. Full layer connection. All layers (also known as overlays) are responsible for higher level representation for feature extraction. These layers combine information from all input sources and perform classification or reprocessing based on learned agents.
6) *Output Process:* The output process of the neural network produces the final prediction for helmet and license plate inspection. For helmet detection, a binary classification system is created that indicates whether a helmet is present or not. The output for the license license check will contain a combination of checkboxes and class values for each license found. Elasticity: Elasticity, such as linear regression (ReLU), is used throughout the network to reveal inconsistencies and allow the network to learn relationships in the equipment.
7) *Loss Function:* The choice of loss function depends on the specific task and output mode. A combination of binary cross-entropy loss, local loss (such as Softmax L1 loss), and distribution loss (such as Softmax cross-entropy) may be suitable for helmet detection when it comes to Voluntary use for license verification. Optimization-based optimization such as Adam or RMSprop is often used to reduce performance loss and adjust training parameters.
8) *Training Method:* The neural network algorithm is trained end-to-end using large datasets containing driver, passenger, different vehicle, lighting and background samples. Training involves retransmitting image packets over the network, calculating losses, and adjusting network parameters via backpropagation.

IV. LITERATURE SURVEY

Helmet and Number Plate detection of Motorcyclists using Deep Learning and Advanced Machine Vision Technique: The system uses You Only Look Once (YOLO)-Darknet deep learning framework which consists of Convolutional Neural Networks trained on Common Objects in Context (COCO) and combined with computer vision. YOLO's convolutional layers are modified to detect specified three classes and it uses a sliding- window process. The map (Mean Average Precision) on validation dataset achieved 81% by using training data [1].

Automatic Number Plate Recognition for Motorcyclists Riding Without Helmet: The proposed system uses Convolutional Neural Networks trained using transfer learning on top of pre-trained model for classification which has helped in achieving greater accuracy. Experimental results on traffic videos show an accuracy of 98.72% on detection of motorcyclists without helmet [2].

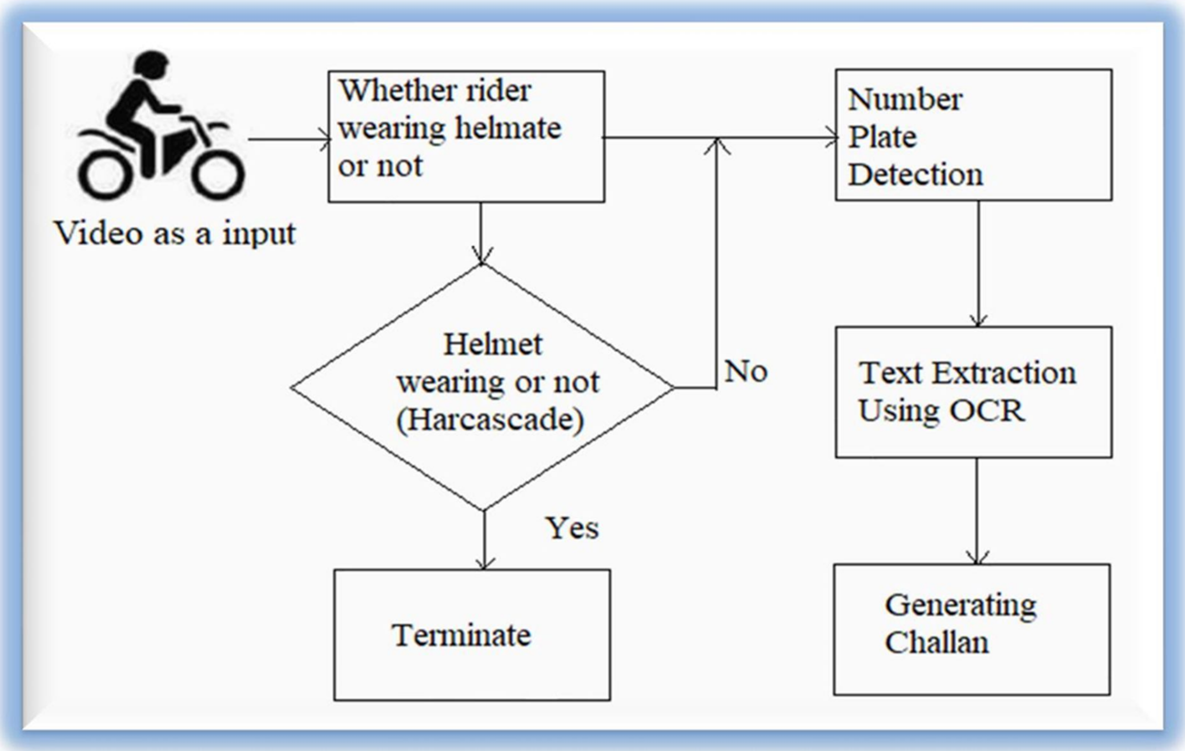
Helmet Detection and Number Plate Recognition using Machine Learning : It uses Open CV to determine whether or not the pillion rider and rider are wearing out helmets. Assuming any of the riders and the pillion rider is set up not wearing out the head protection, their agent number plate is handled exercising optic person mention(OCR) [3].

A Survey On Helmet Detection and Number Plate Recognition For Safety and Surveillance System : The recognition of number plate algorithm has different steps like Vehicle Classification, Pre- processing, choosing the ROI(Region of Interest), Recognition of number plates characters using image processing algorithms, storing in the database with the image as the proof with date and time recorded [4]

V. PROPOSED SYSTEM

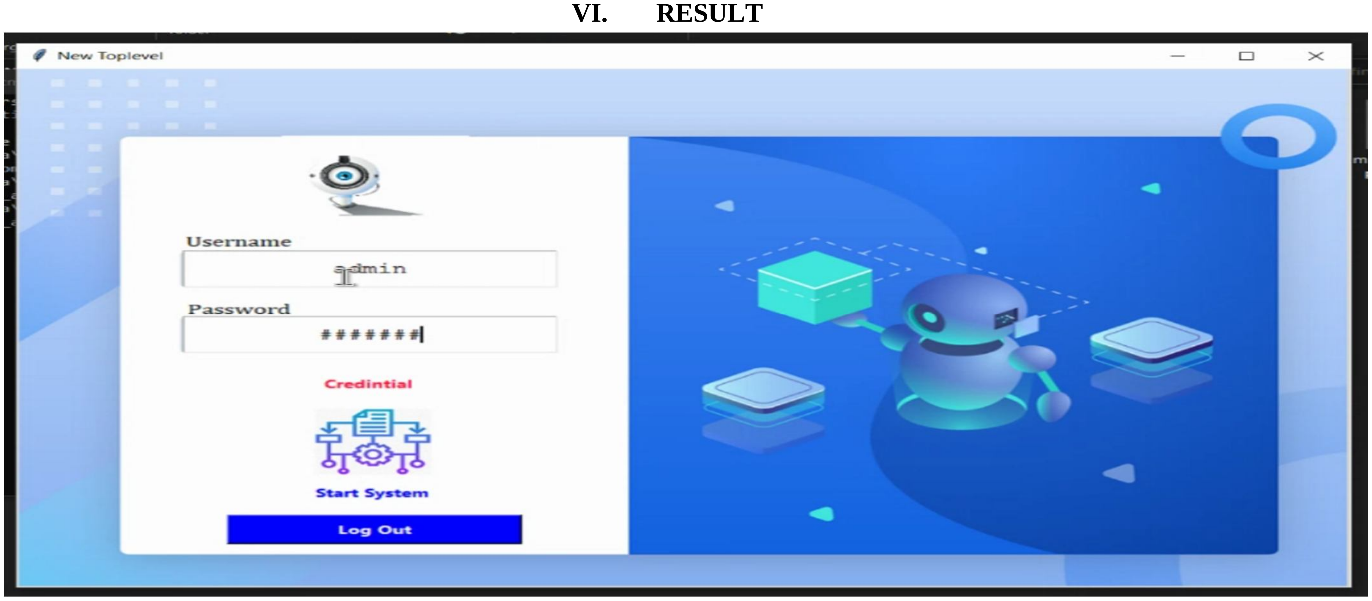
1) *Archive:* Store many photos and videos of cyclists, cyclists, cars with helmets and without a license.
2) *Preprocessing:* Standardizing and improving data collection for clarity and quality.
3) *YOLO Training Model:* Train YOLO to detect helmets. Tell another YOLO to see the license.
4) *Optimization and fine-tuning:* Fine-tune pre-trained models for specific detection tasks. Refine data to improve model detail

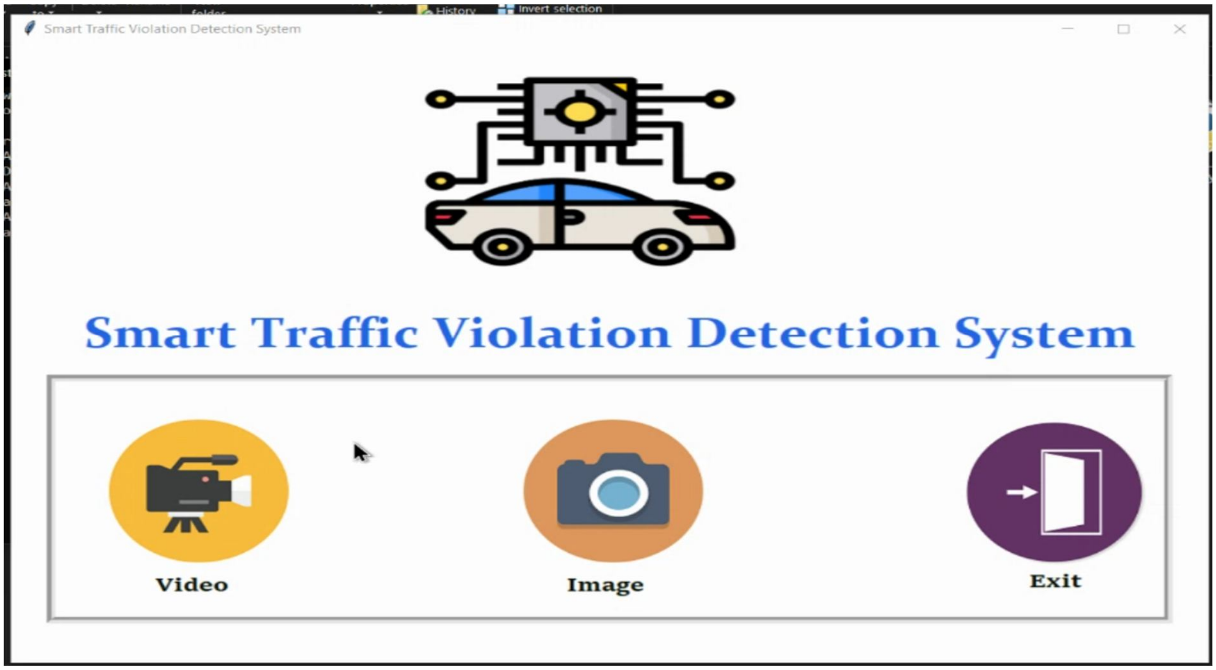
5) *Integration and Deployment:* We develop real-time search engines as well as street security cameras.
6) *Reporting Mechanisms and Enforcement:* Report to the police when a crime is detected. Enable the automatic execution.
7) *Measure and Evaluate:* Carefully evaluate performance using real-world conditions and datasets.



Here we have taken image of the bike racer as an input then it checks whether racer it wearing helmet or not. It checks the helmet wearing or not through the haarcascade algorithm if yes then it terminate the process , and if not then it check the number plate through the text recognition using OCR technique then after the text recognition and number plate detection it generate the chalan receipt and then it debited the money from the bike owner.

VI. RESULT




Smart Traffic Violation Detection System
Smart Traffic Violation Detection System
Video
Image
Exit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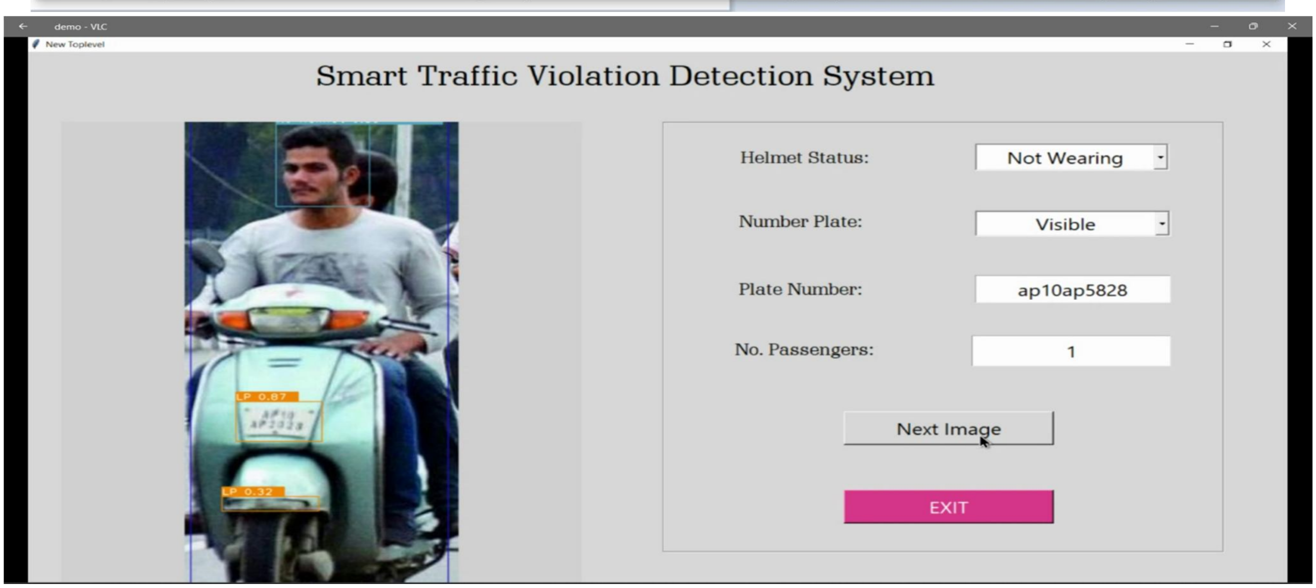
Rider 0.94
Helmet 0.85
Helmet 0.83
LP 0.78
Helmet 0.52
Rider 0.93
No Helmet 0.30
LP 0.29
(a)
(b)
(c)
(d)


demo - VLC
New Toplevel
Smart Traffic Violation Detection System
Helmet Status:
Not Wearing
Number Plate:
Visible
Plate Number:
ap10ap5828
No. Passengers:
1
Next Image
EXIT

VII. CONCLUSION

In summary, the development and implementation of machine learning-based helmet and license certification testing machines is an important step towards regulatory improvement of safety and performance. In this article, we examine how convolutional neural networks (CNN) and other deep learning methods can be used to automate the discovery process, reduce dependence on manual techniques, and increase efficiency. The proposed system uses the power of CNNs to detect license plates issued to vehicles as well as helmets worn by cyclists and passengers. By analyzing real-time streams captured by surveillance cameras, the system can detect non-compliance with safety and security regulations and notify authorities in a timely manner. Its effectiveness lies in its ability to adapt to and learn from large data sets covering a variety of situations and environments. Techniques such as adaptive learning and data augmentation ensure real-world stability by making the system adaptable to new situations. Additionally, the integration of image processing and optimization tools further increases the accuracy and performance of the system. By increasing efficiency and reducing false alarms, the system can operate efficiently and instantly even in difficult conditions such as low light and occlusion.

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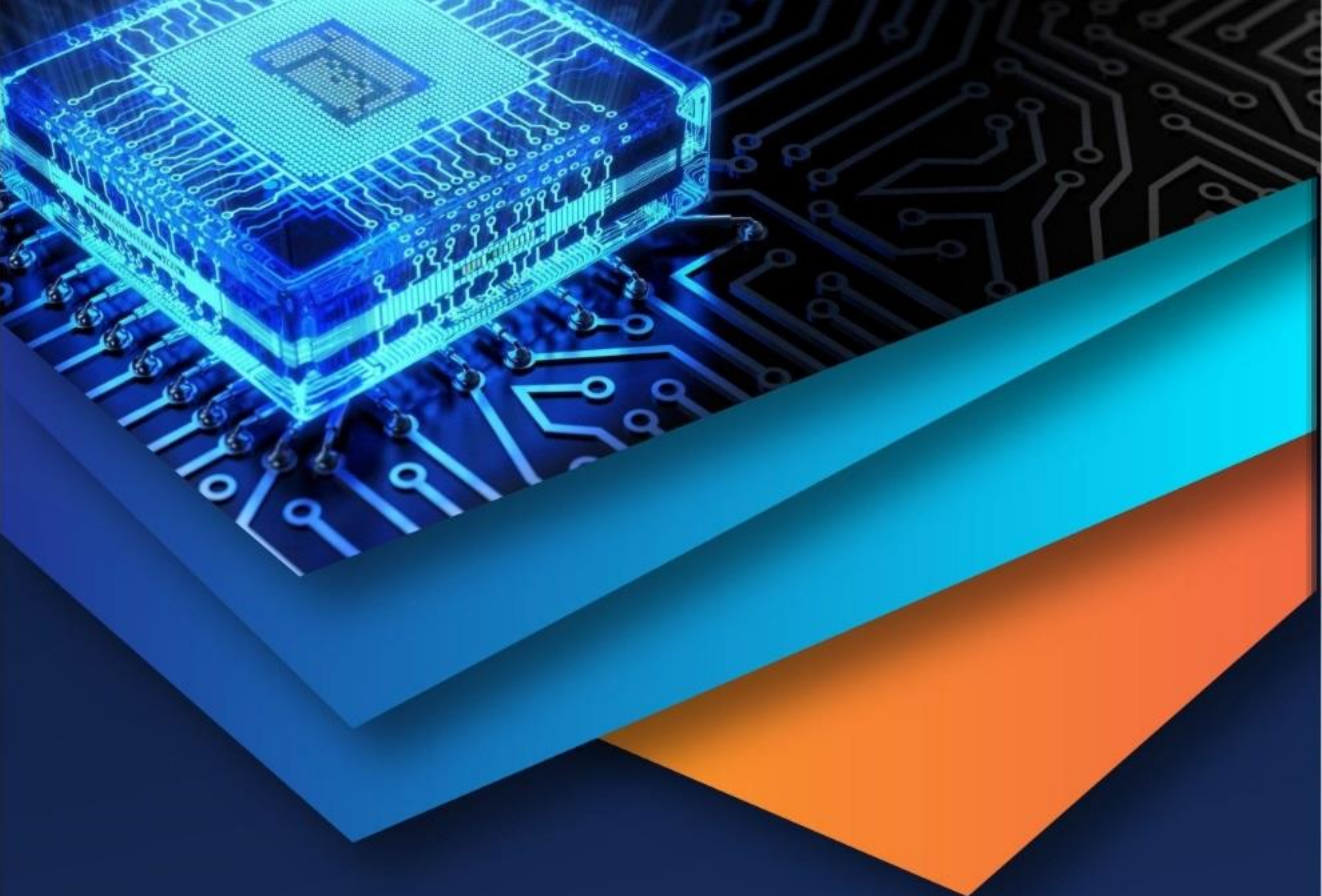

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