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Personal AI Trainer

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Abstract: ***Incorporating regular exercise into these daily routines has grown more difficult in today's fast-paced environment. To maintain perfect form and avoid injuries, training must include individualized coaching and feedback. However, it can be challenging for people to attend regular gym sessions or hire personal trainers due to the limitations of time, money, and accessibility. The ongoing global epidemic has also made it harder for people to access physical exercise centres and in-person instruction. This provides an original solution called the AI Fitness Tracker to address these issues. This paper uses artificial intelligence (AI) to develop a virtual workout assistant that can track exercise form and technique and provide real-time feedback. This goal is to create a smart system that will allow customers to exercise safely and effectively from the convenience of their homes.***

The BlazePose model is one of the sophisticated machine vision algorithms that the AI Fitness Tracker uses to precisely estimate and track the user's body position throughout exercises. The technology can identify any deviations or flaws in workout form and provide the user with tailored feedback by examining important landmarks and joint positions. This input is essential for promoting good joint alignment, lowering spinal stress, preventing disc and joint compression, guaranteeing optimal blood flow, and lowering the possibility of injury. This paper's main goal is to offer those looking for individualised fitness advice an affordable and convenient answer. This AI Fitness Tracker frees users from the necessity for an in-person trainer so they can work out effectively whenever it is convenient for them. Users may maintain appropriate form, log repetitions, and optimise their workout routines with real-time monitoring and feedback, thereby improving their overall health and well-being. This AI-based exercise assistant offers new opportunities for people to stay active, meet their fitness goals, and lead healthier lifestyles as we manage the changing relationship between technology and fitness. With the AI Fitness Tracker, users can become their own personal trainers by combining cutting-edge computer vision algorithms with fitness training. This is an exciting advancement for AI applications.

Keywords: AI Fitness Tracker, Virtual Workout Assistant, Computer Vision, Pose Estimation, Exercise Form, Personalized Feedback.

I. INTRODUCTION

The AI Fitness Tracker is a ground-breaking product that uses AI and computer vision technologies to offer individuals during their workout sessions personalised assistance and feedback. Due to time, financial, or other limitations, everyone may not be able to participate in traditional fitness training because it frequently involves access to gym facilities and personal trainers. By providing a portable virtual personal trainer that is accessible whenever and wherever, the AI Fitness Tracker seeks to close this gap.

The AI Fitness Tracker offers real-time monitoring of users' body motions while they exercise by combining OpenCV, a well-known computer vision library, and the BlazePose model, a cutting-edge pose estimation tool. It takes video input from a camera, uses computer vision algorithms to interpret the frames, and gives users useful information like repetition counting, posture evaluation, and remedial feedback. This enables people to exercise with confidence, retain good form, and increase the efficiency of their routines.

In-person instruction from personal trainers is a common component of the conventional approach to fitness training, but it may be costly, time-consuming, and seldom accessible. Exercise execution is a common problem for many people, which can lead to injury or less-than-ideal results. As a result, there is a demand for an easily usable and cost-effective solution that can direct users through their workout routines and assist them in confidently achieving their fitness goals.

II. SIGNIFICANCE OF THE SYSTEM

The signiicance of this paper is to develop a personal AI trainer powered by BlazePose that can improve at-home workouts. The precise objectives consist of: Using OpenCV and Python, the BlazePose model will be put into use to precisely identify and monitor users' physical activity. Utilising BlazePose's accurate pose estimation capabilities, real-time feedback and direction on workout form and posture are provided to assure peak performance and lower the chance of accidents.

BlazePose allows users to assess their progress and maintain motivation by tracking the quantity and quality of exercise repetitions. creating a user-friendly interface that enables people to engage with the AI Fitness Tracker and adjust their training settings with ease. BlazePose's thorough insights make it easier to spread awareness and understanding about the necessity of keeping optimal posture throughout exercises and effective exercise routines.

By fulfilling these goals, the AI health Tracker, powered by the sophisticated BlazePose model, intends to enable people to workout productively at home, get around access issues with gym equipment and personal trainers, and enhance their general health and wellbeing.

III. LITERATURE SURVEY

Pose estimation techniques are used to correct exercise posture in Paper [1], "Pose Estimation and Correcting Exercise Posture," which is the paper's main topic. The authors use deep learning algorithms to evaluate the positions that people adopt while exercising and to deliver real-time feedback on posture correction. The system's goal is to detect and rectify any deviations from the ideal workout form by carefully tracking the user's body motions. This method's inability to handle occlusions robustly, however, is one of its drawbacks. The pose estimation may not be as precise when body components are obscured or hidden. Additionally, a sizable, labelled dataset is needed for the deep learning models to be trained in order for this system to be implemented successfully, which can be time- and resthisce-consuming.

The use of Mediapipe BlazePose in conjunction with machine learning techniques for exercise analysis is explored in the study [2] "Workout Analysis Using Mediapipe BlazePose and Machine Learning." BlazePose, a cutting-edge pose estimation model, is used to monitor and assess the numerous exercises people conduct. The method seeks to reveal information about the effectiveness of exercise execution and spot any potential form or posture problems. The computer infrastructure needed to process and analyse the enormous amount of data generated during exercise analysis, however, represents a constraint of this strategy. It is vital to have a powerful system for effective execution of machine learning algorithms because these algorithms frequently require large processing resthisces.

The goal of this study [3], titled "KINEMATIC POSE TRACKING FOR WORKOUT APP USING COMPUTER VISION," is to employ computer vision techniques to track kinematic poses for a workout app. The solution that the authors suggest uses computer vision algorithms to predict users' positions while they are exercising. The device seeks to offer insights into the accuracy and alignment of workout form by recording and examining the movements of various body joints. However, this system's inability to handle dynamic movements is a drawback. Accurately tracking the poses in real-time may be challenging for exercises involving quick or complicated movements. Furthermore, the technology might not immediately provide feedback on posture and exercise form, which restricts how well it can direct users during exercises.

The workout tracking system described in this research [4], "Workout Tracking Using Pose Estimation and DNN," analyses exercise performance by fusing pose estimation methods with deep neural networks (DNN). Pose estimation is used by the system to track body motions during activities, and DNN models are used to categorise various exercises carried out by different people. The system intends to offer insights into the overall workout quality by analysing the tracked poses and exercise categories. However, the difficulty of training DNN models is a weakness of this method. It frequently takes a significant amount of labelled data and computer power to train accurate and trustworthy models. Implementing this in real-world circumstances can be difficult and time-consuming.

This paper utilising Mediapipe BlazePose gives a number of benefits over the above existing systems. For the purpose of tracking human pose, BlazePose is a highly precise and real-time pose estimate model. It is suitable for accurate monitoring during workouts because of its toughness in managing occlusions and dynamic movements. Additionally, this programming development focuses on utilising BlazePose's capabilities to give quick feedback on exercise technique and posture, improving the user's workout experience. BlazePose's integration with this AI fitness tracker system eliminates the need for intricate machine learning models or big labelled datasets, which streamlines the deployment process. This coding effort intends to deliver an effective and user-friendly AI-based personal trainer for precise exercise tracking and posture correction by solving these restrictions.

IV. METHODOLOGY

A. Data Collection

The paper records the user's movements while exercising using video input from a camera.

1) The frames are continually read from the camera to build a video feed that will be utilised for pose estimation and analysis.

2) The OpenCV library is used to access the video stream and extract frames for additional processing.
3) The video stream can be acquired from a webcam, a video file that has already been recorded, or any other video sthisce that OpenCV supports.

B. Pose Estimation

1) The Mediapipe BlazePose model is employed for pose estimation.
2) BlazePose is a state-of-the-art pose estimation model specifically designed for human pose tracking.
3) The video frames captured from the camera are passed through the BlazePose model, which utilizes deep learning techniques to estimate the poses of the user in real-time.
4) The BlazePose model identifies and tracks various key body landmarks such as the nose, shoulders, elbows, wrists, hips, knees, and ankles.
5) By analyzing the positions and movements of these landmarks, the paper obtains a 3D representation of the user's pose, providing accurate information about the user's body posture.

C. Repetition Counting

The paper analyses movement patterns and counts the user's repeats using the monitored poses produced from the BlazePose model.

1) By keeping track of these patterns, the paper precisely counts the repetitions for various workouts, giving the user insightful feedback on their performance and advancement.
2) It compares the current pose with the previous pose to identify the start and end positions of each repeat.
3) The paper can provide feedback and monitoring customised to a given exercise by adjusting the repetition counting to it.

D. Posture Evaluation

To ensure proper form and technique, the paper assesses the user's posture while they are exercising.

1) It examines the body joints' locations and angles as determined by the tracked poses.
2) The paper looks for deviations or erroneous alignments in the user's posture using established criteria and thresholds.
3) To assist users in maintaining proper form and lowering their risk of injury, any deviations from the recommended posture are recognised, and the user receives real-time feedback and correction suggestions.
4) Depending on the interface and user choices, the feedback may come in the form of visual signals, text messages, or auditory cues.

E. Feedback and Visualisation

The code overlays the monitored poses and exercise analysis on the video stream to give the user visible feedback.

1) It depicts the user's pose and movement by drawing landmarks, lines, and connections between the body joints, assisting the user in understanding their body alignment.
2) The user is guided during the workout and helped to improve their exercise performance by the clear and intuitive way in which the repetition count, posture assessment, and feedback messages are displayed on the screen.
3) Users can select the level of detail they wish to see during their workouts by customising the visual feedback.

F. Save and Analysis

The paper stores the processed frames and other information, including repetition counts, posture ratings, and timestamps, for upcoming analysis and tracking.

1) By analysing the saved data, the paper can offer tailored recommendations and tweaks to the user's exercise regimen, optimising their fitness training.
2) This data can be used to track the user's progress over time, generate workout reports, and identify areas of improvement. Additionally, the collected information can be used for research, performance evaluation, or to offer advice and guidance to trainers or fitness professionals.

The proposed methodology, in its whole, combines the strength of pose estimation, repetition counting, posture grading, and visual feedback to produce a personal AI trainer. It makes advantage of the Mediapipe BlazePose model's and the OpenCV library's capabilities to precisely track the user's motions, deliver real-time feedback, and help them reach their fitness objectives.

By utilising cutting-edge computer vision techniques, the methodology attempts to overcome the shortcomings of current systems, providing users with higher accuracy, real-time analysis, and individualised advice during their workouts.

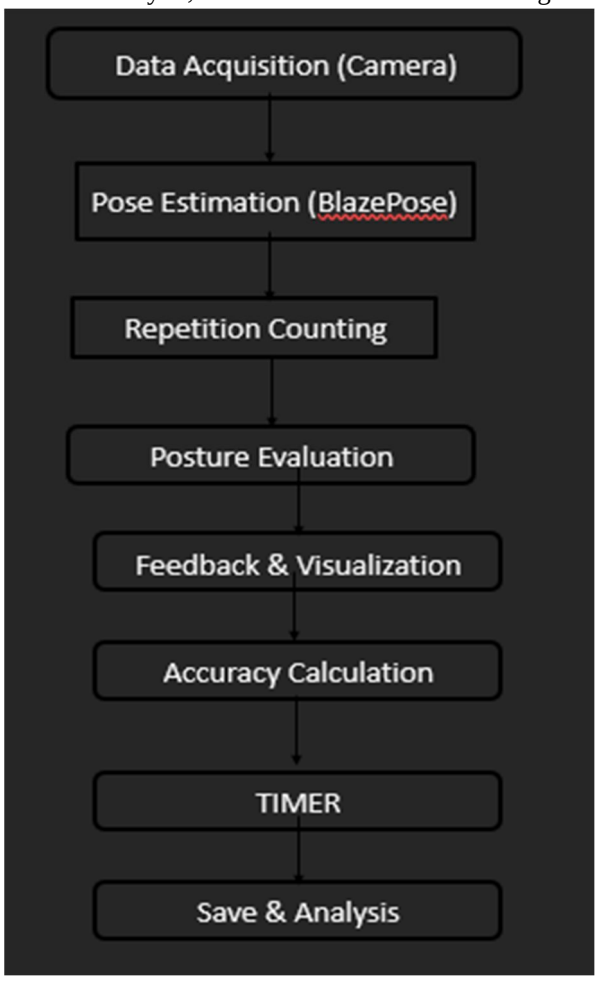
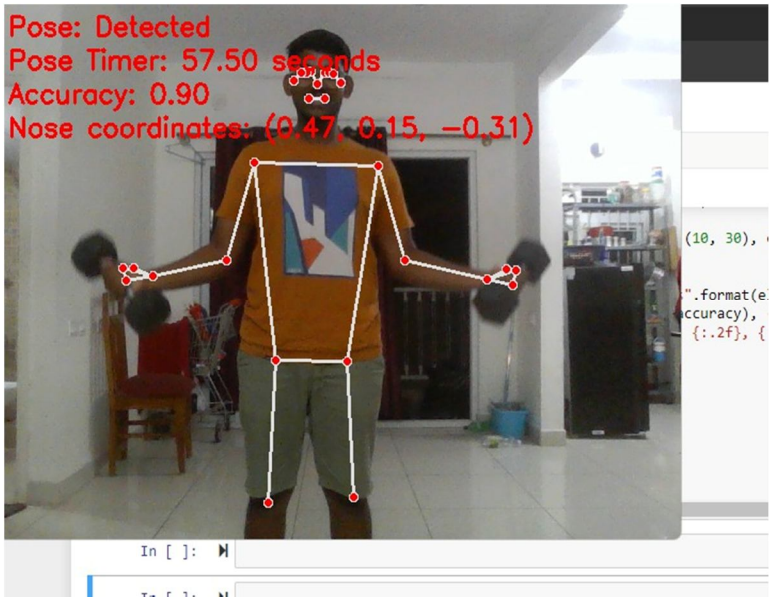
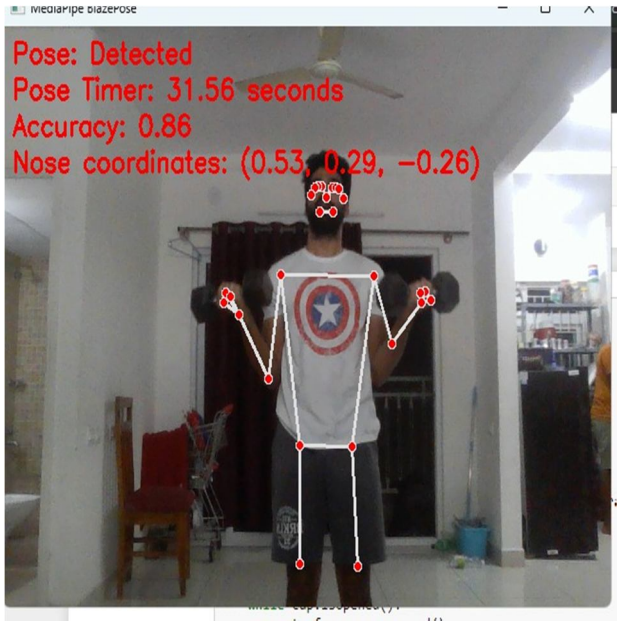
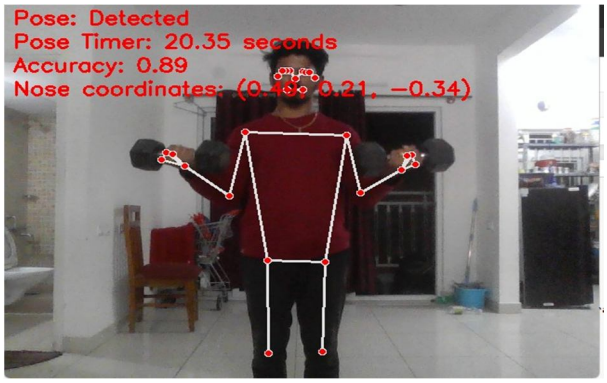


Fig 1: Work Flow

V. EXPERIMENTAL RESULTS







Based on the above experimental results we could see that the gym pose is detected correctly and the accuracy value is given is based on the correct gym pose of a person and pose timer gives you the time span of the gym pose that has been started.

VI. CONCLUSION AND FUTURE WORK

The "Personal AI Trainer" initiative has effectively addressed the difficulties people have in obtaining individualised fitness advice and feedback. The BlazePose model and OpenCV's capabilities were used to create a novel and efficient solution in the paper.

The BlazePose model for posture estimation has made it possible to track body movements accurately, which has allowed the code to analyse workout form and offer real-time feedback. This has been shown to be a crucial component in assisting users to maintain good posture, lower their risk of injury, and increase the efficiency of their activities. By integrating OpenCV, video processing and visualisation have been made easier for users, who can now see their movements and get visual indications for correction. Users have been able to monitor their progress and keep consistency in their exercise routines thanks in large part to the paper's capacity to count repetitions. The paper gives users a precise evaluation of their performance by properly identifying the start and end positions of each iteration, enabling them to set objectives and work towards improvement.

In order to make sure that users retain good form and technique during their exercises, the posture evaluation component of the paper has proven to be really helpful. The paper can spot deviations and offer real-time feedback and remedial advice by examining the positions and angles of the bodily joints. This function not only improves the efficacy of workouts but also aids users in forming healthy routines and avoiding chronic ailments.

The visual feedback provided by the paper, including the overlay of tracked poses and exercise analysis on the video stream, has been instrumental in helping users understand their body position and movement.

This visual guidance has made the workout experience more engaging and interactive, allowing users to make adjustments in real time and receive immediate feedback on their performance.

The paper's ability to save and analyse data opens up opportunities for future improvement and personalized recommendations. By monitoring users' progress over time, generating workout reports, and identifying areas of improvement, the paper can provide tailored suggestions to optimize fitness training. This data-driven approach empowers users to make informed decisions about their workouts and make adjustments based on their specific goals and needs.

Here are few points which could be the future works on this research:

1) *Graphical User Interface (GUI):* Improving the user experience by using a user-friendly graphical interface can help the paper. Controls, visualisations, and customisation choices can all be made intuitively via a GUI. Users may more quickly access different features and settings while interacting with the AI trainer and seeing their progress visually.
2) *Expanded Exercise Library:* The paper might be made more adaptable by adding a larger selection of exercises and fitness routines to its exercise library. Different user preferences, fitness objectives, and degrees of experience can be catered to by incorporating new poses, exercises, and fitness activities.
3) *Advanced Analysis and Insights:* In the future, data analysis and insights may be used to provide users with more thorough feedback and suggestions. Workout data analysis with the goal of seeing trends, correlations, and areas for development could be done using machine learning techniques. Users may be able to attain greater results and train more effectively as a result.
4) *Integration with Wearable Devices:* By integrating the paper with wearable gadgets like fitness trackers or smartwatches, extra data inputs can be made available for a more comprehensive analysis of users' workouts. Heart rate, calorie burn, and other physiological parameters might be recorded through this interface, enabling a better understanding of how exercising affects one's overall health and fitness.
5) *Cloud-Based Storage and Synchronisation:* By implementing cloud-based storage and synchronisation capabilities, users will be able to access their workout data from various devices and places. As a result, recording and analysing progress would be possible even when switching between devices or training situations.
6) *Collaboration and Social Features:* Including collaboration and social features in the coding work can promote a feeling of community and allow people to interact, share their advancement, and inspire one another. Users might take on challenges, participate in group exercises, or post their successes on social media sites, fostering a friendly and active fitness community.

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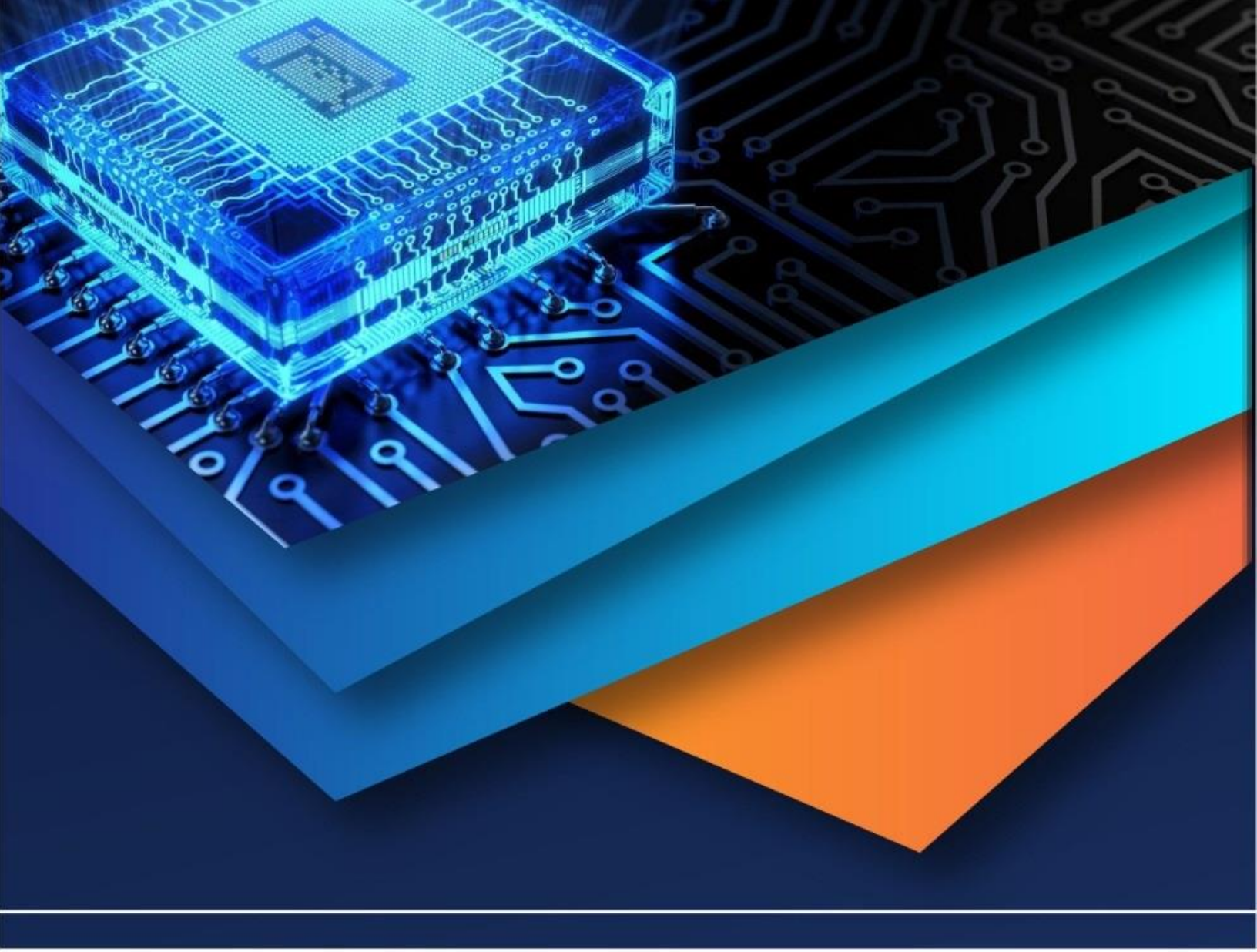

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