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Present-Ma'am: An Attendance Management System

Aashay Bongulwar[1], Aayush Jadhav[2], Rishikesh Ahire[3], Amogh Dumbre[4], Sumaan Ali[5], Amruta Mankawade[6]
[1, 2, 3, 4, 5, 6]*Department of Information Technology and AI&DS, Vishwakarma Institute of Technology, Pune - 411037, Maharashtra, India*

Abstract: ***Attendance management is critical for every institution; it can determine whether or not an institution, such as educational institutions, public or commercial sectors, will be successful in the future. To maximise their performance, institutions will need to keep track of people within the organisation, such as employees and pupils. Real-Time Face Recognition is a useful way for dealing with the daily attendance of a vast number of pupils. To increase face detection and recognition performance, several algorithms and strategies have been developed, however, our suggested model uses the LBPH (Local binary pattern histogram) methodology, which is implemented in Python using the OpenCV organization and employs the tinker GUI interface for user interface needs.***
Keywords: Local Binary Pattern Histogram (LBPH), Face Detection, Face Recognition, Python, Student Attendance.

I. INTRODUCTION

Faculty staff should have a proper method in place to keep accurate and correct student attendance records in a typical face-to-face (F2F) class environment. On a regular basis, they must verify and maintain or monitor that attendance record. They have challenges, particularly in classrooms with a big number of students. The manual technique also takes longer to report each enrolled student's average attendance. Using an automated attendance system, on the other hand, may lessen the administrative strain on the company's employees. As a result, this paper explains how we might use a facial recognition technique to automatically control student attendance in class using digital photographs collected in a classroom scenario. In comparison to traditional approaches, the system saves time and may easily be customised. This also helps to avoid erroneous participation. Other biometric approaches can also be utilised to computerise the attendance process, such as those listed below:

1) Create a log book entry
2) System based on fingerprints
3) IRIS Detection
4) System based on RFID
5) Recognition of people's faces

All of the approaches listed above are distinctive, efficient, exact, and cost-effective, but facial recognition is the most unique, efficient, precise, and cost-effective. The scheme has multiple subproblems, which are addressed in more detail below.

a) Take a photo and name everyone in it.
b) Focus on a particular face to recall it. Even though it is a different individual, it is still the same person. It's skewed in one way or has poor illumination.
c) Make a mental note of the distinguishing traits of the face that will help you distinguish it from other images. Characteristics include the nose, the depth of the eyes, the proportions of the face, the colour of the skin, and so on.

Face recognition is a skill that the human brain possesses. Computers can be trained to recognise the individuality of faces, thus we must teach or train the machine to recognise faces based on their distinguishing traits. Facial recognition can be divided into two types, as shown below:

- Validation
- Recognition

Verification/Validation is a process of one-on-one matching (match or no match). The system, phone, and other electronic devices can all be locked and unlocked with the tool. Identification is a technique for identifying a single person among a group of many, such as one out of N.

II. PROBLEM STATEMENT

When an organisation has a large number of pupils, marking attendance for each one becomes more complex and time-consuming. Any institute's current system is a manual input system for students. This system has a problem with wasting time, and it becomes more sophisticated as the strength increases. Keeping track of attendance through log books and maintaining records is a time-consuming task. In computer vision, face identification is a difficult problem. Lighting concerns, posing issues, scale variations, low picture capture accuracy, and partially obscured faces are just a few of the issues that need to be solved. Face recognition algorithms must, as a result, be robust to changes in the above parameters. When the illumination, background, or rotation changes, existing techniques don't work as well. As a result, the aforementioned disadvantages must be addressed. The project's purpose is to create a system that is less light-sensitive, rotates invariantly, scales invariantly, and is robust enough to be deployed in real-world circumstances.

III.LITERATURE REVIEW

A fingerprint-based attendance system was suggested by the authors of [1]. Students can utilize a portable fingerprint gadget that has been designed to place their fingers on a sensor during class without the instructor's help. The accuracy of the attendance record is ensured by this method. This approach has the drawback of potentially distracting students by passing the device during class. The literature is filled with articles on RFID-based Attendance Systems.

[2] The system suggests an RFID-based system in which students carry an ID card resembling an RFID tag that must be inserted into a card reader in order to record their attendance. The database containing the recorded attendance is saved by the system, which is connected to the computer through RS232. Unauthorised access could become a concern with this system.

An authorised ID card can be used by unauthorised people to enter the organisation. The iris is another biometric that can be applied to attendance systems. A Doughman-based Iris recognition system is suggested by the authors of [3]. This system uses an iris recognition management system to acquire, extract, store, and match iris recognition images. On the other side, it is challenging to lay transmission lines in places with poor typography.

[4] To perform the Face detection part, they utilised OpenCV. The entire technique is separated into three primary components: face detection, facial feature extraction, and picture categorization. The Face detection procedure describes a person's face in an input image. In the feature extraction step, face characteristics are identified and used to create an LBPH histogram that produces a fully unique outcome, and then in the identification process, the histogram of the input picture is compared to the database histogram utilising the classifier. Though they have mentioned some shortcomings of their system, that includes the system's lack of robustness in detecting faces due to occlusion caused if the rate of change in the frame is very high.

[5] RFID card systems, fingerprint systems, and iris recognition systems were all identified as having drawbacks by Arun Katara et al. (2017). Because of its simplicity, the RFID card system is used. However, as long as a student has their friend's ID card, he or she will assist their pals in checking in. The fingerprint method is effective, but not efficient because the verification procedure takes time, and the user must line up and do the verification individually. However, when it comes to face identification, the person's face is constantly visible and contains less information than the iris. A more detailed iris recognition system may intrude on the user's privacy. Although voice recognition is accessible, it is less accurate than other approaches.

[6] FACIAL Identification Using OpenCV-The author of this research has proposed a system that, when user authentication is necessary, uses facial detection and recognition to give a more straightforward human-machine interaction process. With the aid of a standard web camera, a computer can identify and recognise a person's face; a custom login page with the ability to restrict user access depending on the users' facial characteristics will be created. With Intel's open-source framework known as OpenCV, face recognition in this system may be done rather easily and reliably. For facial feature extraction, or 68 dotted features across the face, a face detector known as a Haar Cascade classifier is used to identify faces.

[7] CREATING databases using MySQL - This research focused on MySQL, the most popular open-source social data set management system, which was developed in Sweden in 1995 and is now owned by Oracle Corporation. Two information base plan learning instances are illustrated in this study. An information model was converted into a real data set using the first forward-designing arrangements. The instance that follows illustrates the ideal method for converting a present knowledge base into an information model. [8] Face Recognition based Attendance Management System - This system entails four steps: database building, face detection, face recognition, and attendance updating. Images of the students in class are used to develop databases. The Haar-Cascade classifier and the Local Binary Pattern Histogram technique are used, respectively, for face detection and recognition. From the classroom's live streaming video, faces are identified and recognized. At the conclusion of the session, attendance will be mailed to the relevant professors.

[9] Face-recognition-based student attendance system Both the current biometric methods and the conventional method of keeping attendance are susceptible to proxies. Therefore, it is suggested that this article address each of these issues. The suggested system uses Gabor filters, KNN, CNN, SVM, and generative adversarial networks in addition to Haar classifiers. Attendance reports will be generated and maintained in excel format following face recognition. The system is tested under a variety of circumstances, including lighting, head movements, and changes in the pupil's distance from the cameras. The total complexity and accuracy are determined after rigorous testing. The proposed system was demonstrated to be a reliable and effective tool for taking attendance in a classroom without taking up any time or requiring manual labour. The technology created is affordable and requires little installation.

[10] Face Recognition Attendance System-The four processes of this system are database creation, face detection, face recognition, and attendance updating. The database is created using images of the students in the class. The live streaming video from the classroom reveals and identifies faces. The attendance will be mailed to the appropriate faculty at the conclusion of the session.

[12] SQL is a powerful query language that can be used to query a wide range of database systems, from traditional relational databases to modern Big Data systems. The paper also discussed the description of the new database landscape and the identification of broad types of Big Data systems where SQL can be effectively used and a detailed description of class resources for each unit to enable a hands-on experience with SQL across a broad set of modern database systems. These resources include virtual machines, data generators, sample programs, projects, and in-class exercises.

[13] Python GUI for Image Processing Library: The objective of this work was to create an extensible graphical user interface (GUI) using Python and Tkinter for an image processing library, IPL98, which is written in C/C++. The decision was taken to use Python in order to gain the advantages of rapid development associated with using a scripting language.

IV. PROPOSED SYSTEM

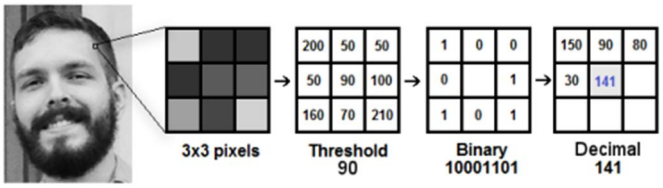
The architecture of the proposed system has been designed to be basic and easy to understand. The steps that must be followed in order for the system to achieve its ultimate aim, which is to ensure that the student's attendance is updated correctly and on time. The system is open to anyone, and instructors can use it to easily check and maintain student attendance as needed. The System Camera will make capturing live video feeds from the classroom as well as student recognition simple. To access the LBPH algorithms and libraries needed for picture training, 3.As part of future work, we'd like to create an application that allows the user to update image samples of the student in the training dataset. Instead of being limited to a predetermined collection on the server, users will be able to build their own user groups. In order to enhance the number of pupils who are identified and recognized, we'd like to look into better face detection and face recognition algorithms.

V. METHODOLOGY

Local Binary Pattern Histogram (LBPH) Face Recognition:

The first phase in the LBPH procedure is to develop an intermediate image that best mimics the source image's face features. The method does this by employing the concept of a sliding window, which is influenced by the radius and neighbours' parameters. The graphic below depicts this technique:

Let's split it down into little techniques that rely on the diagram above to make it easier to understand: Let's pretend we have a grayscale image of a face.

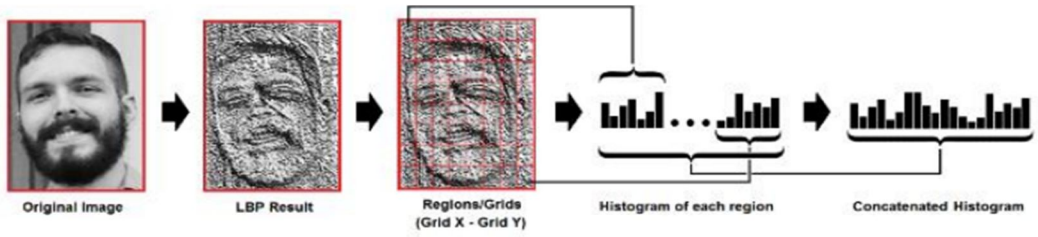


[11] Image 1.1 : Grayscale - Matrix

- We can get a 3x3 pixel window of a portion of this image. It can alternatively be viewed as a 3x3 matrix with the intensity of each pixel (0255).
- The central value of the matrix must then be used as the threshold.
- The new values derived from the eight neighbours will be based on this value.

- For each of the core value's neighbours, we generate a new binary value (threshold). We used a 1 for numbers that were equal to or higher than the threshold, and a 0 for those that were lower.
- Only binary values (apart from the centre value) are allowed in the matrix now. Each binary value from each row of the matrix must be concatenated into a new binary value line by line (e.g., 10001101). It's worth noting that different writers concatenate binary values in different ways (clockwise, for example), but the end effect is the same.
- After that, the binary value is translated to a decimal value and allocated to the matrix's central value, which is a pixel from the original image. The radius and the number of neighbours is two factors to consider.

The Histograms are extracted in the following manner: We may now divide the map into numerous grids using the Grid X and Grid Y parameters and the diagram obtained in the previous phase, as shown in the following image:



[11] Image 1.2: LBP

Using the image above, we can extract the histogram of each area as follows:

- Because we're working with a grayscale image, each histogram (from each grid) will only have 256 points (0255) to show the pixel strength occurrences.
- We must then concatenate each histogram to create a new, larger histogram.

The final histogram for an 8x8 grid would have 8x8x256=16.384 locations. The resulting histogram represents the properties of the original image.

For the LBPH algorithm, that's pretty much it.

- ✓ Performing facial recognition: At this point, the algorithm has already been trained. A separate histogram is used to represent each image in the training dataset. As a result, we repeat the procedures for this new image given an input image, resulting in a histogram that reflects the image.
- ✓ All we have to do now is compare two histograms and return the image with the closest histogram to identify the image that fits the input image.
- ✓ We may compare histograms (compute the distance between two histograms) using a variety of approaches, including Euclidean distance, chi-square, absolute value, and so on. In this scenario, we may be employing the well-known Euclidean distance, which is calculated using the formula: D = SQRT (Ranging from 1 to n (HIST1i – HIST2i)^2)
- ✓ As a result, the algorithm returns the ID from the image with the closest histogram. The distance determined by the method should also be returned, which can be utilised as a "confidence" indicator. Note: Don't be fooled by the term "confidence"; lower confidences indicate a tighter distance between the two histograms, which indicates that the relationship is stronger.
- ✓ We can then use the 'trust' and a threshold to see if the algorithm accurately identified the image. We can conclude that the algorithm has properly recognised it if the trust is smaller than the set threshold.

VI. RESULT AND DISCUSSION

We have a faculty authentication mechanism in the suggested system. The teacher must register the student with their information and special ID following authentication.

The faculty takes 100-200 images of each student during the registration procedure. To prevent complication and achieve the desired outcomes, we are transforming the coloured image to grayscale in this. Webcam image samples are gathered. We adjusted the frame to effectively capture the face region in order to capture the image samples.

Image 2.1: From Database

We have created a simple GUI for the same process where we take in basic information from user such as Name, Age, PRN no and Department which helps us to maintain a record of all our entries in the database.

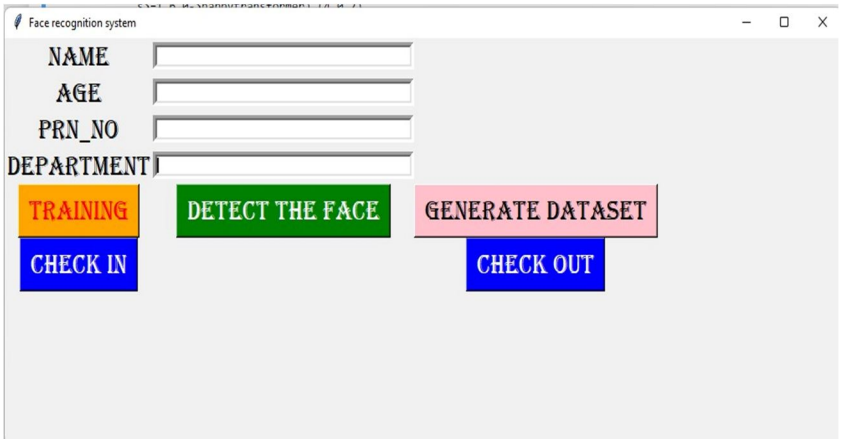


Image 2.2: GUI

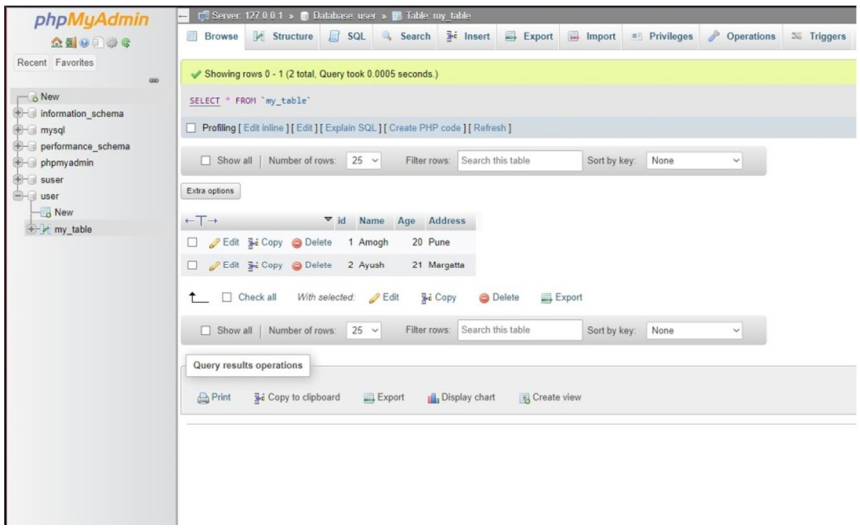


Image 2.3: Database Table

After recognizing the faces successfully, the system updates the attendance in Excel sheet with student details including date and time.

VII. CONCLUSION

Automated Attendance Systems based on face recognition have so shown to be efficient and safe. This method can be used to identify a stranger. In real-time situations, LBPH performs better than other algorithms thanks to a higher recognition rate and a lower false positive rate. SVM and Bayesian are also superior classifiers when compared to distance classifiers. Future research aims to improve algorithm recognition rates when people unintentionally modify their look, for as by getting a tonsure, donning a scarf, or shaving their beard. The developed method still needs to be improved because it can only recognise face angle variations of up to 30 degrees. Systems for facial and gait recognition can be coupled to increase system performance.

VIII. FUTURE SCOPE

1) To enhance the system's performance and dependability in the future, we could incorporate some of the following modifications:

a) For any student whose attendance falls below 75% after a predetermined amount of time has passed, create a self-generating defaulter list.

b) The system must be able to discriminate between faces that have been identified and those that have not; unrecognised faces can be kept in a separate database. For the suggested work to be robust, a large number of detailed pictures of the kids may need to be taken and stored in the cloud.

2) The device can be set up and used in ATMs to look for fraud. We intend to develop an application that will enable users to update image samples of the student in the training dataset as part of our ongoing research. Users will have the ability to create their own user groups rather than being constrained to a predetermined collection on the server.

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[11] STUDENT ATTENDANCE MONITORING SYSTEM USING FACE RECOGNITION - E CHARAN SAI Computer Science & Engineering Faculty of Engineering & Technology Bengaluru, India charanroyal39@gmail.com SHAIK ALTHAF HUSSAIN Computer Science & Engineering Faculty of Engineering & Technology Bengaluru, India charanroyal39@gmail.com SYED KHAJA Computer Science & Engineering Faculty of Engineering & Technology Bengaluru, India charanroyal39@gmail.com AMARA SHYAM Computer Science & Engineering Faculty of Engineering & Technology Bengaluru, India charanroyal39@gmail.com

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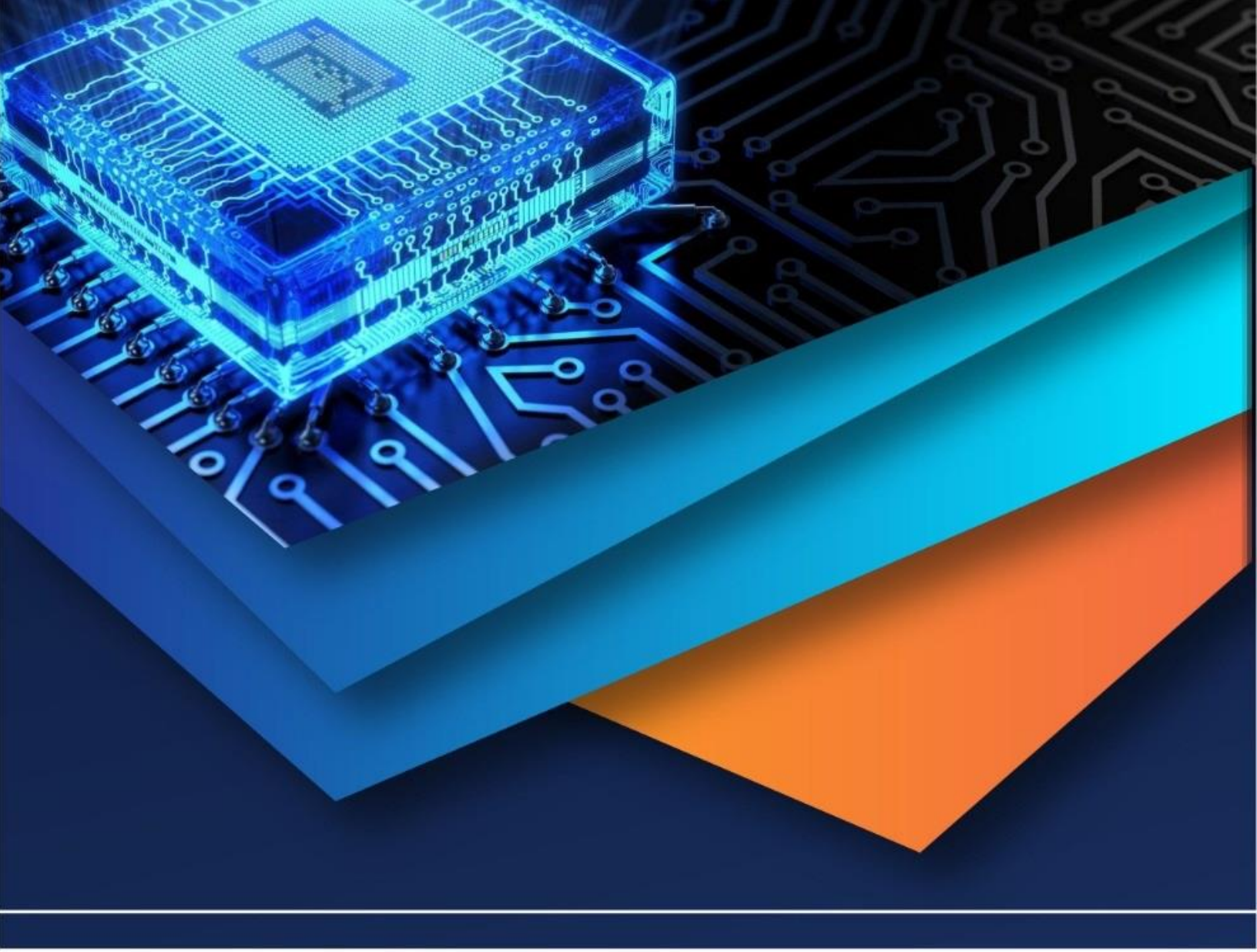

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