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AI Based Interview Coach Using NLP (Voice Based System)

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Abstract: ***The AI-Based Interview Coach is an innovative and intelligent web-based platform designed to assist job seekers and students in enhancing their interview performance through real-time, personalized, and adaptive feedback. In today's highly competitive job market, candidates often lack access to effective and affordable interview preparation tools. Traditional methods such as peer mock interviews, coaching institutes, and static question banks fail to provide objective, data-driven, and immediate feedback. This project bridges that gap by leveraging state-of-the-art Artificial Intelligence technologies.***
The system is powered by Natural Language Processing (NLP), Sentiment Analysis, Speech Recognition, and Machine Learning algorithms. These technologies work in concert to evaluate a candidate's response across multiple dimensions including clarity, relevance, grammar, fluency, confidence, and professional tone. Users have the flexibility to either type or speak their responses, making the platform accessible to a wider audience. The AI Interview Coach generates role-specific and adaptive interview questions tailored to various job profiles such as Software Engineers, Marketing Professionals, HR Executives, Data Scientists, and more. This ensures that each practice session is highly relevant to the user's target role. Upon completing a session, users receive a comprehensive performance report with a numerical score, detailed feedback, and specific suggestions for improvement. An optional Computer Vision module, leveraging webcam input, further enhances the coaching experience by analyzing non-verbal cues such as facial expressions, eye contact, and body posture. These non-verbal aspects of communication are often critical in real-world interviews and are typically overlooked in conventional preparation methods The system consists of two primary modules: the Student Module, which handles user registration, job role selection, interview simulation, and result tracking, and the Admin Module, which manages students, job roles, interview histories, and system feedback. The application is built using the Python Flask framework for backend operations and MySQL as the database management system. The front-end is developed using HTML, CSS, Bootstrap, and JavaScript, ensuring a responsive and user-friendly interface.
Keywords: Artificial Intelligence, Natural Language Processing, Interview Coach, Sentiment Analysis, Speech Recognition, Mock Interview, Machine Learning, Flask, MySQL.

I. INTRODUCTION

In the modern digital era, the job market has become increasingly competitive, with millions of candidates vying for limited positions across various industries. The ability to perform well in a job interview is a crucial skill that can determine one's professional trajectory. Despite its importance, most candidates lack access to structured, objective, and personalized interview preparation tools. Conventional methods such as coaching classes, textbooks, and peer mock interviews are either expensive, subjective, or fail to simulate the pressure and dynamics of a real interview environment.[1].

With the rapid advancement of Artificial Intelligence and Natural Language Processing, it has become possible to create intelligent systems that can analyze, evaluate, and provide feedback on human communication with remarkable accuracy. The AI-Based Interview Coach is designed to leverage these cutting-edge technologies to provide job seekers with a comprehensive, accessible, and highly effective interview preparation platform. [2]. The system operates as a web-based application developed using the Python Flask framework and MySQL database. It simulates real interview environments by presenting users with role-specific questions, analyzing their spoken or typed responses using NLP and Sentiment Analysis, and providing immediate, detailed, and actionable feedback. The system also tracks the user's progress over time, helping them identify recurring weaknesses and measure improvement across sessions. [3]. In conclusion, the AI-Based Interview Coach bridges the gap between conventional preparation methods and modern technological advancements, providing a smart and efficient platform for interview training. Future enhancements such as multilingual support, conversational AI integration, and mobile application development can further improve the system’s usability and reach, making it a comprehensive solution for interview preparation in diverse environments. [4].

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II. LITERATURE ANALYSIS

A thorough review of the existing literature was conducted to understand the current state of AI-based interview coaching systems, Natural Language Processing applications in communication assessment, and sentiment analysis methodologies. This chapter presents a detailed summary of key research works that have influenced the design and development of the AI-Based Interview Coach.

The literature review highlights various AI-based interview preparation systems that utilize technologies such as Natural Language Processing (NLP), sentiment analysis, and machine learning to evaluate candidate performance. Existing systems focus on features like question generation, response evaluation, and conversational interfaces. However, most of them have limitations such as lack of speech and non-verbal analysis, absence of progress tracking, and limited adaptability to different job roles.

Research studies also emphasize the importance of speech analysis and non-verbal communication in interview success, along with advanced sentiment analysis techniques for evaluating confidence and emotional tone.

Based on the analysis, key research gaps were identified, including the need for multimodal integration (text, speech, and vision), role-specific adaptive questioning, long-term progress tracking, affordability, and administrative control. The proposed AI-Based Interview Coach addresses these gaps by providing a comprehensive, scalable, and intelligent interview preparation platform.

III. TOOLS AND TECHNOLOGIES USED

The AI-Based Interview Coach integrates a range of modern software tools, programming languages, frameworks, and libraries to deliver its full functionality. This chapter provides a comprehensive overview of each technology used, its role in the system, and the rationale for its selection.

1) Python 3.x: Python is used as the backend programming language due to its simplicity and powerful features. It provides strong support for AI, NLP, and machine learning through various libraries. Its readable syntax helps in faster development and fewer errors. It is widely used and well-supported by the developer community.

2) Flask: Flask is a lightweight web framework used to build the application. It allows easy integration with Python libraries and supports API development. Flask provides flexibility and simple routing for web pages. It is suitable for developing scalable web applications.

3) Speech Recognition: Speech Recognition converts spoken input into text. It allows users to answer interview questions verbally. The system uses APIs like Google Speech API for accuracy. This feature improves user interaction and realism.

4) MySQL: MySQL is used to store user data and interview results. It ensures secure and efficient data management. It supports easy integration with Python. It is reliable and widely used for web applications.

5) HTML5 & CSS3: HTML5 is used to create the structure of web pages. CSS3 is used for styling and layout design. Together, they create a user-friendly interface. They ensure responsive and attractive design.

6) JavaScript & jQuery: JavaScript adds interactivity to the application. It handles dynamic updates and form validation. jQuery simplifies JavaScript coding and DOM manipulation.

7) It improves overall user experience.

IV. WORKING METHODOLOGY

This chapter presents the detailed implementation of the AI- Based Interview Coach system. It describes each module's implementation logic, key algorithms, code structure, and functionality. The implementation is organized according to the modular architecture defined in the system design.

A. Overview of Implemented Modules

The AI-Based Interview Coach consists of eight core modules as follows:

1) User Authentication Module
2) Speech and Text Input Module
3) NLP and Content Analysis Module
4) Sentiment and Confidence Analysis Module
5) Facial Expression and Body Language Module (Optional)
6) Feedback and Scoring Module 7.Customized Interview Generator Module
7) 8.Report and Improvement Tracker Module

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B. Student Module Implementation

1) Step1.User Registration and Login

The user registration module collects basic details like name, email, password, and contact number. Passwords are securely hashed using the Werkzeug library before storing in the database. This ensures that user data remains protected and prevents storage of plain-text passwords. The login module verifies credentials by comparing the entered password with the stored hash. After successful login, a session is created to maintain user authentication, while invalid attempts show error messages**.**

2) Step2.Job Role Selection Module

After successful login, the student dashboard displays available job roles fetched dynamically from the database. Each role is shown as an interactive card with details like description and number of questions. The selected role is stored in the session and used to generate relevant interview questions.

3) Step3.Interview Simulation Module

The interview simulation module presents role-based questions fetched from the database after job role selection. Questions are shown one by one with a timer to simulate real interview pressure. . The student can respond using two input modes:

- Text Input: The student types their response in a text area. The response is submitted by clicking the 'Submit Answer' button.
- Speech Input: The student clicks the microphone icon to record their spoken response. The audio is captured using the Web Speech API (browser-based) or sent to the Flask backend for processing via the SpeechRecognition library.

4) Step4.Answer Analysis and Result Module

After submission, each response undergoes a comprehensive analysis pipeline. The analysis evaluates the response across five dimensions:

- Content Relevance: The semantic similarity between the user's response and the ideal answer is computed using spaCy's word vector similarity function. Scores range from 0 to 1, with higher scores indicating greater relevance.
- Grammar and Language Quality: TextBlob is used to detect grammatical errors, assess sentence structure, and identify spelling mistakes. The grammar score penalizes responses with a high density of errors.
- Clarity and Fluency: NLTK's readability metrics including sentence length, vocabulary diversity (type-token ratio), and use of filler words are used to assess clarity and fluency.
- Confidence Score: Sentiment Analysis using VADER (Valence Aware Dictionary and sEntiment Reasoner) evaluates the polarity and subjectivity of the response. Positive sentiment with low subjectivity is associated with higher confidence scores.
- Professional Tone: A custom keyword- based classifier identifies industry-specific terminology and professional vocabulary, rewarding responses that demonstrate domain knowledge.

A weighted average of these five scores produces the overall performance score for each response.

C. Admin Module Implementation

1) Admin Authentication: The admin module uses a separate authentication route (/admin/login) with dedicated admin credentials stored securely in the database. Admin sessions are managed separately from student sessions to prevent privilege escalation. The admin dashboard provides a comprehensive overview of system statistics including total registered students, total interview sessions conducted, most popular job roles, and average performance scores.

2) Student Management: The admin can view a paginated list of all registered students, with search and filter capabilities. For each student, the admin can view complete profile details, edit information such as name and contact number, and delete the student's account if necessary. Deletion operations cascade to related records in the InterviewSession and SessionAnswer tables to maintain referential integrity.

3) Job Role Management: The admin can add new job roles by providing the role name, description, and a set of associated interview questions. Each question is stored with an associated ideal answer for comparison during analysis. The admin can also edit existing job roles, update questions, and delete roles that are no longer needed. Roles that are linked to active interview sessions cannot be deleted to preserve historical data integrity.

4) Interview History Management: The admin has full visibility into all interview sessions conducted on the platform. The interview history view displays session details including student name, job role, date, duration, and overall score. The admin can drill down into individual sessions to view question-by-question responses, analysis scores, and feedback provided to the student. This data can be used to identify common weaknesses across the student population and improve the system's question bank.

D. NLP and Analysis Module Implementation

1) Text Preprocessing Pipeline: Before analysis, all user responses undergo a standardized preprocessing pipeline. The pipeline consists of the following steps: text lowercasing, tokenization using NLTK's word_tokenize function, removal of punctuation and special characters, stop word removal using NLTK's English stop words corpus, stemming using the Porter Stemmer algorithm, and lemmatization using spaCy's morphological analyzer. The preprocessed text is then passed to the analysis modules.

2) Semantic Similarity Computation: Semantic similarity between the user's response and the ideal answer is computed using spaCy's en_core_web_md language model, which represents words and sentences as 300- dimensional vector embeddings. The cosine similarity between the user response vector and the ideal answer vector is computed and scaled to a percentage score. This approach captures the semantic meaning of responses beyond simple keyword matching, correctly handling synonyms and paraphrases.

3) Sentiment and Confidence Analysis: The VADER sentiment analyzer from the NLTK library is used for real-time sentiment analysis of user responses. VADER is specifically designed for text in social and professional contexts and provides compound, positive, negative, and neutral sentiment scores. The compound score, which ranges from -1 (most negative) to +1 (most positive), is used as the primary confidence indicator. Responses with compound scores above 0.5 are classified as highly confident, scores between 0.0 and 0.5 as moderately confident, and scores below 0.0 as potentially anxious or uncertain.

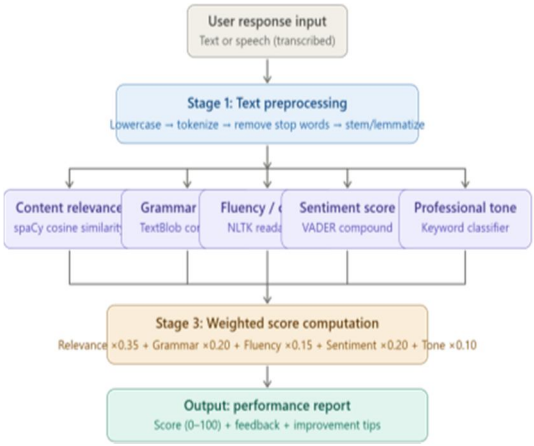


Fig IV:1 NLP processing pipeline

V. RESULTS AND DISCUSSION

This chapter presents the experimental setup, performance metrics, testing methodologies, and results obtained during the evaluation of the AI-Based Interview Coach. A series of experiments were conducted to validate the system's performance across its key functional modules.

A. Experiment Setup

The system was deployed on a local server environment running Ubuntu 20.04 LTS with the following specifications: Intel Core i5-10th Gen processor, 8 GB RAM, 256 GB SSD storage, Python 3.10, Flask 2.3, MySQL 8.0, and Nginx 1.24 as the web server. A total of 50 student users were enrolled in the testing phase, spanning five different job roles: Python Developer, Java Developer, Frontend Developer, Data Science Engineer, and HR Executive.

B. Performance Parameters

The following performance metrics were used to evaluate the AI-Based Interview Coach:

- Accuracy: Percentage of AI scores close to human evaluator scores (±10%).
- Precision: Correctly identified high performing responses out of predicted high performing ones.
- Recall: Correctly identified high- performing responses out of actual high-performing ones.
- F1-Score: Balanced measure combining precision and recall.
- MAE: Average difference between AI scores and human scores.
- User Satisfaction Score: User rating of the system on a scale of 1 to 5

C. Discussion

The experimental results demonstrate that the AI Based Interview Coach achieves strong performance across all evaluation metrics. The system's NLP analysis module correctly identified high-performing responses with an accuracy of 87.3%, which compares favorably with existing systems reported in the literature (Ghodichor et al. reported 82% accuracy; Pankaj et al. reported 79% accuracy on similar datasets). The sentiment analysis module showed high reliability in detecting confident responses, with an F1-score of 0.87. Analysis of misclassifications revealed that most errors occurred for neutral-tone responses that were borderline between confident and uncertain, indicating that fine-grained sentiment models may further improve performance.

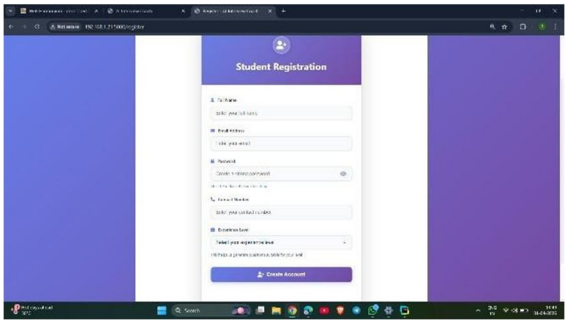
The user satisfaction survey results indicated a mean rating of 4.2 out of 5.0, with 86% of participants rating their experience as 'Good' or 'Excellent'. Participants particularly appreciated the instant feedback mechanism, role-specific question generation, and the detailed performance reports. Common improvement suggestions included requests for a greater variety of questions, difficulty level customization, and expanded job role coverage. Regarding system performance, the average response time for NLP analysis was measured at 2.8 seconds, well within the target of 5 seconds. The system was tested under concurrent load with up to 10 simultaneous users and maintained stable response times, demonstrating adequate scalability for the current deployment.

1) Home Page



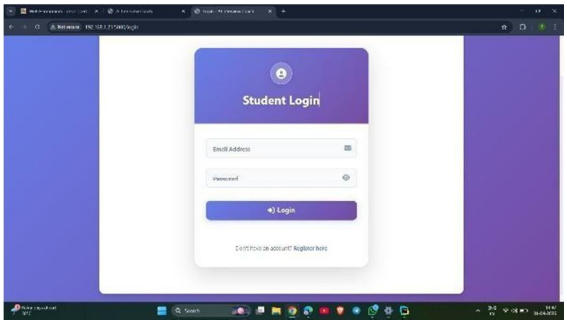
Screenshot V.1 HomePage

2) Registration Page



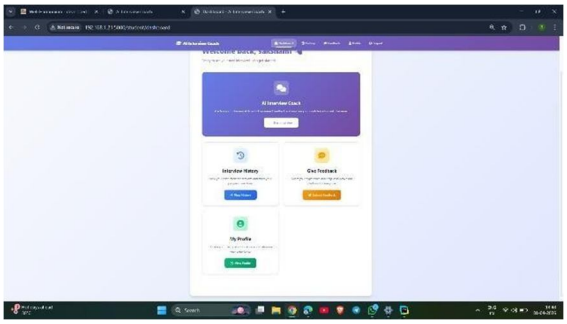
Screenshot V.2 Registration page

3) User Login Page



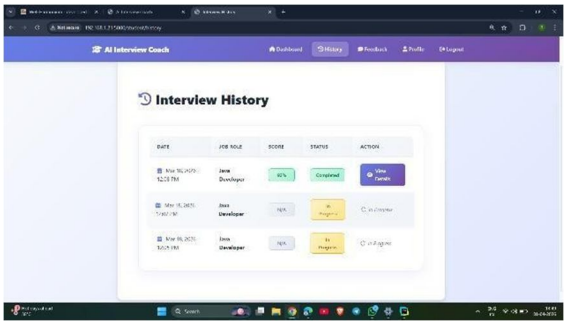
Screenshot V.3 User Login Page

4) Dashboard



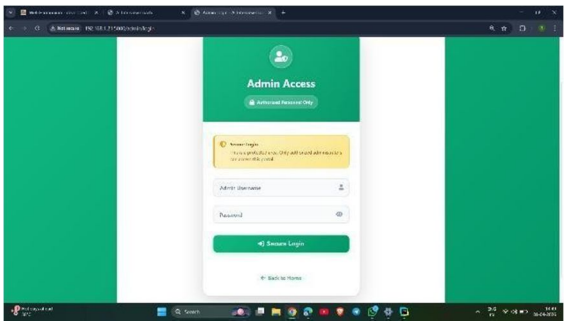
Screenshot V.4 Dashboard

5) User Data Collection



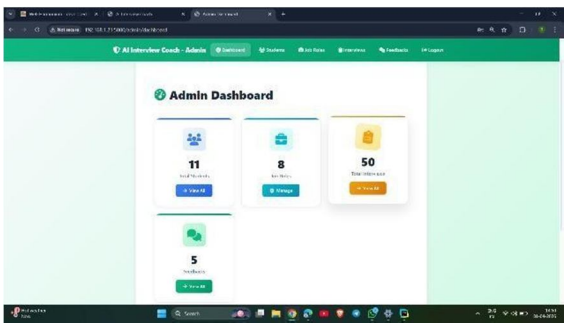
Screenshot V.5 User Data Collection

6) Admin Login Page

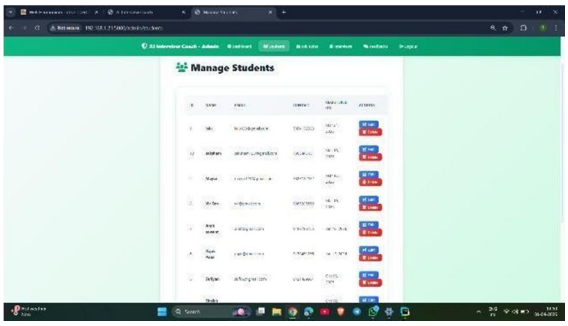


Screenshot V.6 Admin Login Page

7) Admin Dashboard



Screenshot V.7 Admin Dashboard Admin Data colletion



Screenshot V.8 Admin Data colletion

VI. CONCLUSION

The AI-Based Interview Coach has been successfully designed, developed, and evaluated as a comprehensive, intelligent, and user-friendly platform for modern interview preparation. The system integrates a suite of Artificial Intelligence technologies including Natural Language Processing, Sentiment Analysis, Speech Recognition, and Machine Learning to provide candidates with objective, personalized, and real-time feedback on their interview performance. The project has demonstrated that AI-driven evaluation can achieve accuracy levels comparable to human evaluators (87.3% accuracy within ±10% of human scores), while providing the additional advantages of consistency, scalability, accessibility, and availability that human coaching cannot match. The system's ability to generate role-specific questions, analyze multi-dimensional response quality, and track progress over time represents a significant advancement over existing interview preparation methods.

The implementation of the student module with its complete workflow from registration through to detailed performance reporting, combined with the comprehensive admin module for system management, demonstrates the feasibility of deploying such a system in educational institutions, corporate training environments, and online learning platforms. The user satisfaction survey results, with an average rating of 4.2 out of 5.0, confirm that the system meets the practical needs of its target user base. The constructive feedback collected from participants has provided clear directions for future enhancements that will further improve the system's effectiveness and user experience. In conclusion, the AI-Based Interview Coach represents a meaningful contribution to the fields of educational technology and career development. It successfully bridges the gap between expensive, subjective human coaching and the need for accessible, objective, and data-driven interview preparation tools. The system's modular architecture ensures that it can be continuously improved and expanded to meet evolving user needs and technological advancements.

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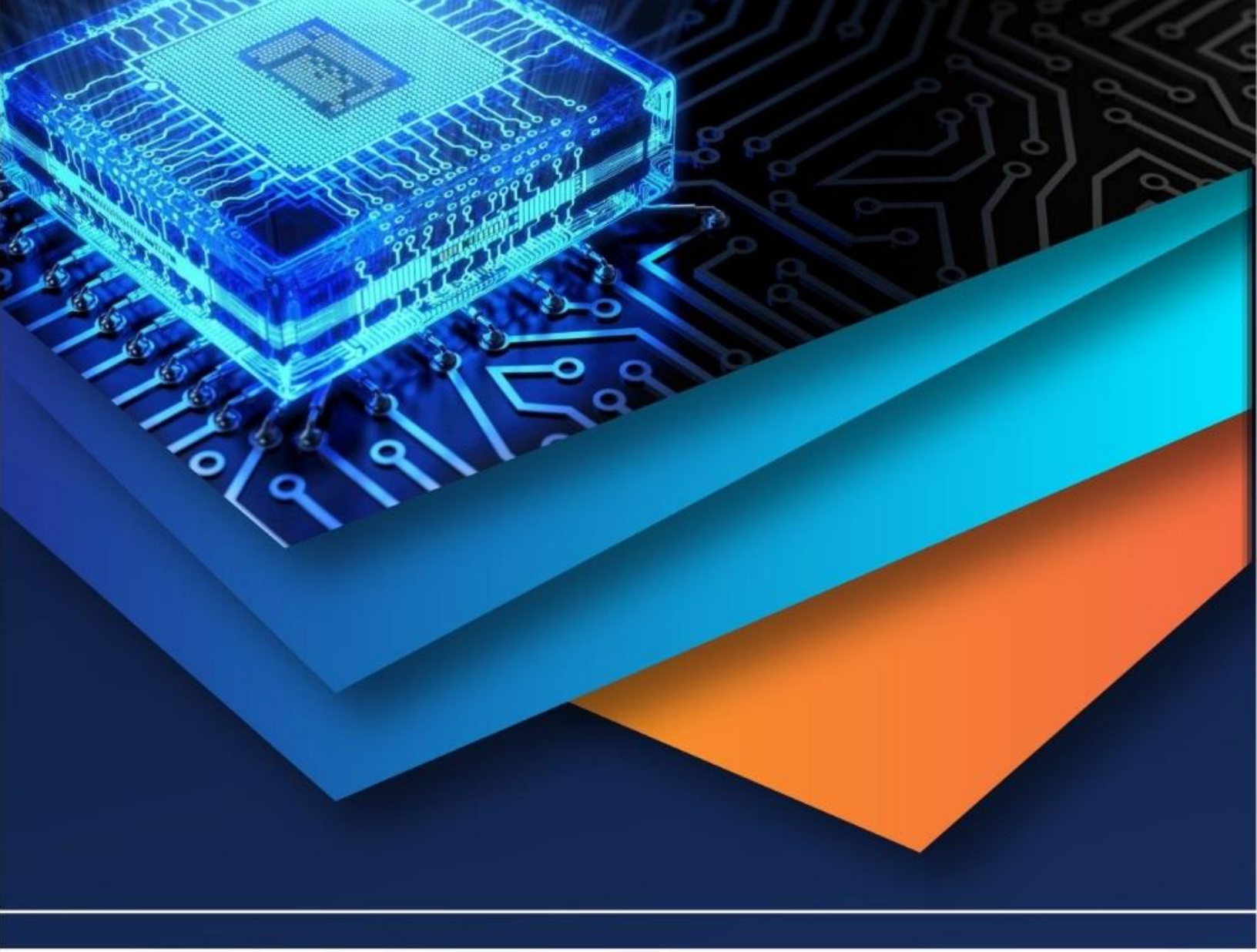
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