iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 Issue: VI Month of publication: June 2025

DOI: https://doi.org/10.22214/ijraset.2025.72653

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VI June 2025- Available at www.ijraset.com

Dietify - AI Based Diet & Nutrition Consultation Application

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Abstract: This paper provides a detailed review of Dietify, an AI-based application designed to offer personalized diet and nutrition consultations. Utilizing machine learning and predictive analytics, Dietify provides real-time dietary recommendations, continuously adapting meal plans based on user feedback and health objectives. This review examines Dietify's functional architecture, methodology, advantages, and limitations. Furthermore, it situates Dietify within the broader field of AI-driven diet management applications and discusses future opportunities, including expanded integration with wearable health data, advanced predictive modeling, and increased personalization for chronic disease management. Dietify represents a significant advancement in personalized diet consultation, enhancing accessibility, individualization, and data-driven adaptability in health management.
Index Terms: Artificial Intelligence, Personalized Nutrition, M-Health, Diet Management, Machine Learning, Predictive Analytics, Real-Time Tracking, Chronic Disease Management, User Feedback, Health Monitoring.

I. INTRODUCTION

The use of artificial intelligence (AI) in healthcare has transformed approaches to personalized nutrition, offering tailored dietary solutions that were once limited to one-on-one consultations. Applications like Dietify leverage machine learning to provide individualized diet plans that adapt dynamically to users' health goals, dietary preferences, and feedback. With lifestyle-related conditions such as obesity and diabetes on the rise, the need for accessible and personalized dietary guidance has never been more crucial. Dietify meets this need by combining real-time data analysis and predictive modeling to deliver recommendations that evolve with each user's journey, marking a shift from generic diet plans to adaptive, AI-driven nutrition management. This review explores Dietify's architecture, methodology, and the potential impacts on dietary adherence and health outcomes, positioning it within the growing landscape of AI-driven diet management applications.

Dietify is an innovative AI-powered application designed to deliver customized dietary recommendations. Using machine learning algorithms, Dietify analyzes user-provided information such as age, weight, dietary preferences, allergies, and specific health objectives to create initial diet plans. Unlike static diet plans, Dietify's recommendations are adaptive; they evolve based on ongoing user feedback and real-time health data, ensuring a responsive and engaging user experience. The application's continuous feedback loop and real-time adjustment capabilities help promote dietary adherence, a key factor in achieving long-term health outcomes such as weight management, improved cholesterol levels, and blood sugar stabilization.

With rising global rates of lifestyle-related conditions like obesity, diabetes, and cardiovascular diseases, AI-based dietary management applications like Dietify represent an essential shift towards preventive healthcare. Studies on personalized dietary interventions, such as those by Bélanger et al. (2022), highlight the effectiveness of early and tailored nutrition guidance in improving health outcomes. Similarly, applications like *Foodwiser* (Tatte et al., 2021) demonstrate how AI in mobile health (mHealth) can support users in making informed food choices. Dietify builds upon these foundations, offering a holistic approach to nutrition management by integrating real-time data tracking, user feedback, and advanced recommendation algorithms.

A. Background on AI in Nutrition and Healthcare

Artificial intelligence (AI) has rapidly transformed the healthcare sector, with applications in personalized nutrition emerging as a key area of growth. Dietify is one such application, leveraging AI to provide individualized diet recommendations that can be tailored to specific health objectives. Personalized nutrition is crucial in managing lifestyle diseases like obesity and diabetes, where dietary habits play a significant role in health outcomes.

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B. Purpose of Dietify

Dietify's objective is to enable personalized, data-driven nutrition consultations accessible to a wide range of users. It utilizes real-time data processing and machine learning algorithms to create meal recommendations that evolve based on user preferences and feedback. This paper reviews Dietify's features, advantages, limitations, and its implications for the future of dietary management.

II. LITERATURE REVIEW

Artificial Intelligence (AI) is revolutionizing personalized nutrition by enabling responsive, data-driven dietary recommendations, an approach central to applications like "Dietify." Research by Bélanger et al. (2022) on pediatric oncology highlights how early, personalized nutrition plans supported by AI can lead to improved health outcomes, particularly in high-risk patient groups. In nutrition applications, AI's ability to analyze user-specific health data and adapt recommendations in real-time means users receive continually updated, precise guidance. This adaptability is crucial, especially for conditions that require frequent adjustments to diet, such as diabetes and obesity.

Mobile health (mHealth) solutions, like "Foodwiser" studied by Tatte et al. (2021), have made nutrition management more accessible, bringing expert dietary advice directly to users' smartphones and empowering them with self-management tools. Through mHealth platforms, Dietify can similarly support dietary adherence, providing real-time feedback that aids users in maintaining their dietary goals. For managing chronic conditions, studies by Daley et al. (2021) and Sefa-Yeboah et al. (2021) have shown that AI-driven applications significantly improve user outcomes by offering tailored dietary feedback. Daley et al. examined mHealth applications for gestational diabetes, where AI monitors and adjusts users' diets to stabilize blood glucose levels, while Sefa-Yeboah et al. focused on AI's role in obesity management, finding that personalized dietary feedback helps users make consistent, health-positive dietary choices.

Moreover, AI-based recommendation systems in dietary applications enhance personalization by using models like collaborative filtering and neural networks to suggest meals that fit individual health goals, preferences, and dietary restrictions. These models adapt to user feedback, providing a highly personalized experience and improving dietary adherence and satisfaction. By incorporating AI-powered recommendation systems, Dietify could continuously learn from user data, refining meal suggestions to maintain engagement and relevance.

AI's predictive capabilities, as discussed by Hagger-Johnson et al. (2021) and Greer et al. (2021), further extend its utility in wellness and disease prevention. Predictive analytics in AI-powered applications can anticipate potential health risks based on dietary behaviors, enabling users to make proactive health adjustments. This aspect of AI supports preventative health strategies, where early interventions can mitigate long-term health risks. While AI-driven diet applications promise improved accessibility and personalization, challenges remain, such as ensuring data privacy, addressing algorithm bias, and scaling AI applications to diverse populations. Future directions include integrating wearable technology to enhance data accuracy and personalization in real time, advancing AI's role in comprehensive, user-friendly health and nutrition management.

By concentrating on users with motor impairments, Wil- son's team (2022) broadened the accessibility focus and shown that multimodal systems might cut job completion times by 45 when compared to conventional assistive devices. The small, homogeneous sample size of this study, however, made it challenging to evaluate its wider relevance across a range of mobility problems. Additionally, Liu and Wang (2021) devel- oped gesture-based virtual mouse technology, using MediaPipe to attain a 95% recognition rate under optimal circumstances. However, the fact that their method depends on controlled lighting and unhindered hand motion raises the possibility that it won't work well in less-than-ideal circumstances or with users who have limited hand function. According to Hassan et al. (2021), voice-command-based systems have been demonstrated.

III. METHODOLOGY

This methodology outlines the development and functionality of a comprehensive nutrition and health management application, designed to assist users in tracking, managing, and achieving their health goals. Each stage of the system provides a step-by-step approach to gather user data, set personalized objectives, and monitor progress. By leveraging user inputs and systematic health analytics, the application delivers tailored nutritional guidance and actionable insights.

A. User Profile Creation

The first step in the system is user profile creation, which serves as the foundation for personalizing the user's experience. During this stage, the application collects initial demographic and personal information to establish a unique profile for each user.

1) Details Collected: The profile includes details such as the user's name, age, gender, height, weight, and activity level. Each piece of information serves a distinct purpose:
2) Name: The name helps personalize the interface, enabling a more user-friendly experience. This personalization can enhance user engagement, making the app feel more tailored to the individual.
3) Age and Gender: Age and gender are crucial for determining baseline metabolic requirements and nutrient needs. For instance, caloric and protein needs can vary significantly by age and gender due to differences in basal metabolic rates (BMR).
4) Height and Weight: These inputs are essential for calculating the user's body mass index (BMI) and establishing baseline health metrics. Height and weight measurements provide a snapshot of the user's current physical state, which is then used to inform dietary recommendations.
5) Activity Level: Users indicate their typical daily activity level (sedentary, lightly active, moderately active, or very active). This is crucial for accurately estimating the user's total daily energy expenditure (TDEE), as activity level directly impacts caloric needs.
6) Data Privacy: To protect user information, the system employs encryption and follows data protection standards like GDPR (General Data Protection Regulation). By ensuring data security, users are more likely to trust the application, knowing that their personal information is safeguarded against unauthorized access.

B. Parameter Collection (Height, Weight, Age, etc.)

After creating a profile, users are prompted to input specific physiological measurements, such as height, weight, and age. These parameters are essential for calculating BMI and assessing the user's baseline health status.

1) Purpose of Each Parameter: Height, weight, and age play specific roles in the system's calculations:
2) Height and Weight: These values are critical for calculating BMI, which is a quick indicator of body composition and potential health risks related to body weight. This BMI calculation helps categorize the user as underweight, normal weight, overweight, or obese.
3) Age: Age impacts the metabolic rate and energy requirements. Younger individuals generally have higher metabolic rates, whereas older users may need adjustments in calorie intake to prevent excess weight gain.
4) BMI Calculation: Using height and weight, the system calculates the BMI as follows:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

This BMI score provides a starting point for goal-setting, as it indicates whether the user may benefit from specific health goals, such as weight gain, weight loss, or maintenance.

C. BMI Calculation

The BMI calculation, based on the user's height and weight, serves as a quick assessment tool to identify weight-related health risks and to guide goal selection.

1) Understanding BMI Categories: Once BMI is calculated, the user's weight status is classified into categories (e.g., underweight, normal weight, overweight, or obese). These categories offer a general indication of health, with higher BMI values suggesting increased risk for conditions like cardiovascular disease or diabetes.
2) Application of BMI in Goal Selection: Depending on their BMI category, users are presented with recommendations that align with their health needs. For instance, users with a high BMI might receive suggestions for a weight loss goal, while users with a lower BMI could be advised to pursue weight or muscle gain. This preliminary assessment aligns the user's journey with evidence-based health metrics, making the goal-setting process both targeted and effective.

D. Goal Selection (Bulk, Cut, Calorie Track, Nutrients Track)

Goal selection is a critical step where users define specific health objectives, enabling the system to create customized recommendations aligned with these goals. The system provides several distinct goal options:

1) Bulk: For users interested in increasing muscle mass, the bulk option focuses on higher calorie intake with an emphasis on protein. This goal setting might be paired with recommendations for strength training exercises and an increase in overall caloric intake to support muscle growth.
2) Cut: Designed for users aiming to lose weight, this option promotes a caloric deficit through diet and, potentially, increased physical activity. Recommendations under this goal include calorie control and balanced nutrient distribution to ensure that weight loss is achieved healthily.
3) Calorie Tracking: For users who simply want to monitor their daily calorie intake without a specific focus on weight loss or gain. This option is helpful for maintaining current weight or achieving dietary balance without drastic changes.
4) Nutrients Tracking: Suitable for users who want to monitor specific nutrients, such as tracking protein for muscle maintenance, fiber for digestive health, or micronutrients like iron and calcium for specific health conditions.
5) Custom Goal Adjustments: Based on the user's BMI and other parameters, the system can suggest initial goals and allow users to adjust them over time. This flexibility ensures that users remain engaged and can adapt their goals as they progress.

E. Food Library

The food library acts as a comprehensive database containing nutritional information on various food items. This feature supports users in making informed dietary choices aligned with their goals.

1) Nutritional Information: Each food item in the library includes details on calories, macronutrients (protein, fats, carbohydrates), and micronutrients (vitamins and minerals). This information enables users to understand the nutritional composition of the foods they consume.
2) Integration with Meal Logging: Users can search for and select foods from the library to log their meals, which is then used in nutrition tracking. The database allows for the addition of custom food items, accommodating unique or homemade dishes, which provides flexibility and personalization.
3) Data Source: The food library may pull from verified external sources or user-uploaded data, ensuring both accuracy and breadth. This broad selection makes it easier for users to log diverse foods accurately, promoting a comprehensive dietary overview.

F. Nutrition Tracking

Nutrition tracking enables users to monitor their daily caloric intake and nutrient consumption, allowing them to see how their diet aligns with their goals.

1) Meal Logging: Users log each meal, and the system calculates the total caloric and nutrient intake. This real-time tracking allows users to monitor their progress throughout the day, giving them the ability to make adjustments as needed.
2) Daily and Weekly Summaries: The application provides summaries of daily and weekly intake, showing users trends in their eating patterns. These insights help identify areas where the user may need to increase or decrease certain nutrients or calories.
3) Feedback Mechanism: The system flags deficiencies or excesses in the user's diet, alerting them to imbalances. For example, if a user's protein intake consistently falls short of the recommended amount, the app may suggest higher-protein meal options to help reach the goal.

G. Meal Planner

The meal planner feature supports users in planning meals that meet their caloric and nutrient goals.

1) Goal-Based Meal Suggestions: Based on the selected goal (e.g., bulk or cut), the planner suggests meals that meet the user's calorie and nutrient requirements. These meals are balanced and structured to ensure users meet their goals efficiently.
2) Customizable Plans: Users can customize meal plans by swapping or adjusting portions to fit their preferences or dietary restrictions. This flexibility makes it easier for users to adhere to the plan while respecting individual food choices.
3) Integration with Food Library: The meal planner draws from the food library, allowing users to easily add selected foods to their daily intake without extensive manual entry. This streamlined experience improves user engagement and adherence to the recommended diet.

H. Analytics

The analytics component provides users with in-depth insights into their health trends, identifying patterns and offering recommendations based on data over time.

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1) Daily/Weekly Tracking: Analytics features allow users to track their caloric intake, macronutrient balance, and nutrient deficiencies over time. This data helps users observe the impact of their dietary choices on their health goals.
2) Deficiency Tracking: By analyzing logged data, the system identifies recurring nutrient deficiencies (e.g., insufficient iron or vitamin D) and suggests foods or supplements to correct these gaps. This feature is especially beneficial for users aiming to improve specific aspects of their health.
3) Behavioral Insights: The app provides insights into users' eating habits, such as average meal timing, daily meal frequency, and trends in macronutrient intake. These patterns help users understand their habits and make adjustments to improve their health outcomes.
4) Long-Term Goal Adjustment: Based on analytics insights, the app can recommend adjustments to goals, helping users adapt as they progress. For example, if a user consistently meets their weight-loss target, the app may suggest a maintenance plan to prevent regaining lost weight.

IV. SYSTEM ARCHITECTURE AND DESIGN

This architecture enables continuous, personalized dietary guidance that adapts to user feedback and leverages data for improved health outcomes.

1) *User Data Collection and Profiling:*The system collects initial user data—such as demographics, dietary preferences, allergies, and health goals—to create a personalized profile. This profile forms the foundation for all recommendations.
2) *Machine Learning Models for Recommendation:* Dietify uses a hybrid recommendation system, combining collaborative filtering and neural networks. Collaborative filtering compares user preferences with similar users, while neural networks predict outcomes based on dietary patterns and health goals.
3) *Real-Time Feedback Integration:* A feedback loop allows users to rate meals and provide feedback. This real-time input helps Dietify adjust recommendations dynamically, enhancing personalization and long-term adherence.
4) *Nutritional Database Integration:* Dietify integrates reputable external nutritional databases (e.g., USDA) to ensure accurate, guideline-based dietary recommendations. The database supports nutrient tracking and meal planning aligned with health goals.

V. IMPLEMENTATION

A. *App Development and Backend Architecture*

1) Front End Development with Flutter:Dietify's user interface is crafted using Flutter, a powerful cross-platform framework that ensures a consistent, responsive, and visually appealing experience on both iOS and Android. Flutter's capabilities allow Dietify to feature rich, interactive interfaces that accommodate dynamic user interactions and facilitate a smooth journey from onboarding to recommendation results.

2) Backend with Django and SQLite: The backend server, responsible for API management and data storage, is built with *Django*, a Python-based web framework well-suited for rapid development and secure, scalable applications. The SQLite database provides lightweight, efficient data handling, suitable for managing the app's data requirements such as user profiles, dietary plans, exercise routines, and community content. This architecture allows seamless data management, ensuring that each user's personalized recommendations are securely stored and efficiently retrieved.

B. AI-Powered Personalized Recommendations

One of the core features of Dietify is its AI-based recommendation system, designed to provide diet and exercise suggestions tailored toeach user's unique profile.

Gemini LLM for Diet and Exercise Suggestions:

Dietify harnesses the power of the Gemini Large Language Model (LLM) to analyze user-provided information—such as age, gender, activity level, dietary preferences, and fitness goals—and generate tailored diet plans. Gemini's advanced capabilities enable it to consider complex dietary requirements (like gluten-free or nut-free) and deliver recommendations in a user-friendly, conversational style. The LLM also factors in specific exercise suggestions, recommending routines that align with each user's dietary habits and fitness objectives, creating a cohesive health improvement plan.

C. Enhanced User Profile Customization

Dietify's user profile setup allows for detailed customization, enabling a high degree of personalization in the app's recommendations.

1) Allergy and Dietary Specifications: The profile includes options for specifying allergies (gluten, lactose, nut, etc.), dietary restrictions (e.g., vegan or low-carb), and any other health considerations that could affect dietary or exercise plans. These specifications allow Dietify to make safe, relevant recommendations and eliminate any potential health risks for the user.

2) Customizable Questionnaires with Visual and Image Options: To make the initial setup and periodic updates engaging, *Dietify* incorporates a questionnaire feature where users can visually select foods or activities that resonate with them. This selection process is designed to be interactive, simplifying user data input and making the app more intuitive and accessible.

D. Community Engagement and Content Sharing

Dietify's community feature serves as a virtual fitness hub where users can connect, share experiences, and stay motivated by viewing others' progress and achievements.

1) Fitness Content Sharing: The app allows users to share workout routines, diet tips, success stories, and motivational content. This community aspect not only promotes user engagement but also encourages a supportive environment where users can inspire and learn from one another.

2) Discussion Forums and Challenges:Dietify's community section hosts forums where users can discuss fitness challenges, post questions, and seek advice from fellow community members. Regular fitness challenges or competitions could also be introduced to foster healthy competition, encouraging users to stay active and maintain consistency in their fitness routines.

E. Advanced Analytics and Data Visualization

In a future update, *Dietify* aims to incorporate advanced analytics for visualizing the potential fitness effects of user habits and dietary patterns.

1) AWS SageMaker for Predictive Fitness Analytics: Using AWS SageMaker, the app will be able to generate detailed graphical representations of how certain diet and exercise routines may affect a user's fitness over time. By analyzing patterns in user data, SageMaker's machine learning models can predict weight changes, muscle gain, and other health metrics, providing users with tangible insights into their progress and helping them stay motivated.

2) Evidence-Based Reasoning for Recommendations: Dietify plans to enhance its transparency by including an evidence facility, where each diet or exercise recommendation is accompanied by reasoning orscientific backing. This feature is intended to educate users about the benefits and effectiveness of the recommendations provided, fostering a sense of trust in the app's advice.

F. OpenCV Integration for Posture Detection

To ensure that users are exercising with the correct form, *Dietify* is in the process of integrating *OpenCV* for posture detection. This feature, though currently non-functional, will use computer vision to analyze the user's body posture and provide real-time feedbackto help them improve form and prevent injury.

Once fully operational, OpenCV's posture detection capability will further support the app's AR models by providing on-the-spot adjustments, making *Dietify* a holistic and adaptive fitness tool.

VI. ACKNOWLEDGMENT

We would like to express our sincere gratitude to all those who contributed to the successful completion of our project, Dietify - AI-Based Diet & Nutrition Consultation. First and foremost, we extend our heartfelt thanks to our project guide, Prof. Vaishali Wadhe, for her invaluable support, guidance, and encouragement throughout the project. Her expertise and insights were crucial in navigating challenges and deepening our understanding of AI applications in personalized nutrition.

We are deeply appreciative of our institution, KJ Somaiya Institute of Technology, for providing us with the resources and an environment that fosters learning and innovation. The facilities and support from faculty and staff were instrumental in bringing our project to fruition. We also wish to thank our peers for their collaboration and constructive feedback, which enriched our project and provided us with fresh perspectives.

A special thanks to our families for their unwavering support and encouragement, which sustained us through every stage of this journey. Finally, we acknowledge the contributions of researchers and authors whose work in AI and healthcare provided a solid foundation and inspiration for Dietify. Their pioneering research was essential in shaping the vision and direction of our project.

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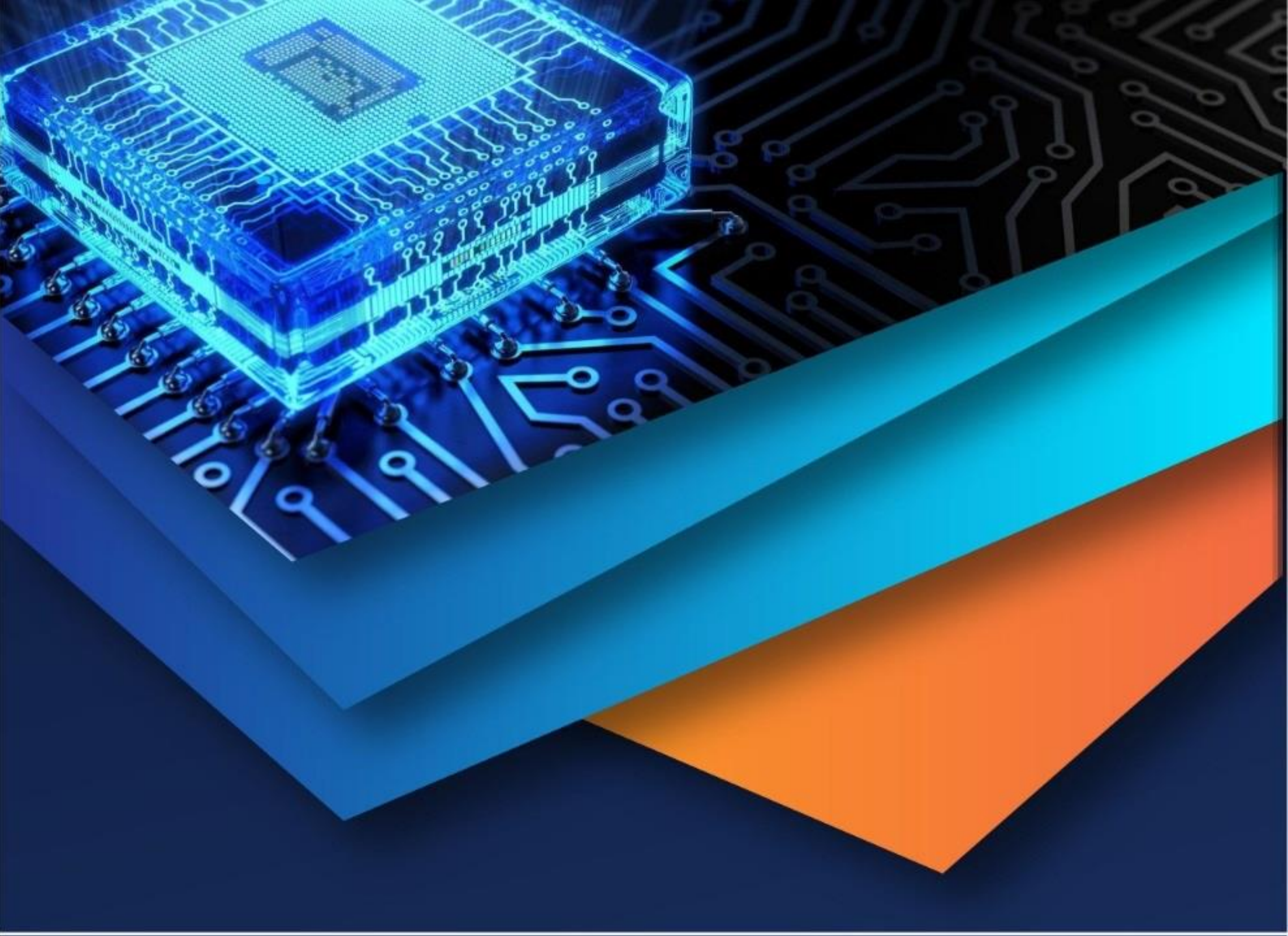

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