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FoodTrust AI: A Personalized Food-Label Analysis System with Claim Verification, Package Compliance, and Consumer Reporting Assistance

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Abstract: ***Packaged-foodlabelscarrydetailsaboutingredients, nutrition, allergens, and product claims, but many consumers find this information hard to interpret. This paper presents FoodTrust AI, an Android application that makes food-label informationeasiertounderstandandhelpsuserscheckselected packagedetails.TheapplicationusesCameraXtocapturelabel images and Google ML Kit Text Recognition to extract text. Java-based rules contribute to the health score, while the Gemini API explains the extracted information and provides profile-basedwarningsandrecommendations.Userscancreate their own and family-member profiles, which are managed through Firebase Realtime Database. The application also includes Claim Verification, Package Compliance Checking, and Consumer Reporting Assistance. When a possible issue is found, the app prepares a report document and asks for the user's confirmation before opening the relevant government reporting website. The main contribution is combining personalizedfoodanalysisandconsumer-complianceassistance in one Android application. Initial tests were carried out on selected real packaged-food products; numerical evaluation of OCRaccuracy, scoreconsistency, recommendationquality,and compliance detection has not yet been completed.***

Index Terms: Food-label analysis, optical character recognition,personalizednutrition,healthscoring,GeminiAPI, claim verification, package compliance, consumer reporting.

I. INTRODUCTION

Foodpackagescarryinformationthathelpspeopledecide what to eat, including ingredient lists, nutritional values, allergens, and product claims. However, labels often rely on technical terms and small print, and some ingredients are unfamiliar to ordinary consumers. Reading a nutrition table and understanding what it means for one's own health can thereforebedifficult. Amobileapplicationthatpresentsthis informationinsimplerlanguagemayhelppeoplemakemore informed choices.

FoodTrustAIwasdevelopedtoaddressthisneed.Itisan Androidapplicationthatscanspackaged-foodlabels,extracts the visible text, and uses the available information to give a health score and a clearer explanation. Java-based rules contribute to the score, while the Gemini API helps explain ingredients, highlight possible concerns, and generate recommendations based on the selected user or family-member profile.

Theapplicationalsoincludesthreeconsumer-compliance functions: Claim Verification, Package Compliance Checking, and Consumer Reporting Assistance. Claim Verificationcomparestheclaimsshownonaproductwiththe available label information. Package Compliance Checking looks for supported package details such as maximum retail price (MRP), net quantity, date-related information, and manufacturer or packer details. If a possible issue is identified, the app prepares a report and asks the user before opening the relevant government reporting website, where the user can review the information and follow the required steps.

The current contribution is the integration of existing technologies in one workflow, rather than the creation of a new OCR algorithm or AI model. Initial tests have been performedonselectedrealproducts,butfurtherevaluationis needed before the accuracy and reliability of the system can be established.

II. LITERATURE REVIEW

Food-scanning applications have been developed to help consumers access nutritional information while shopping. Dunford et al. introduced FoodSwitch, which uses barcode scanning and a food database to show nutrition information andsuggesthe althieralternatives[1].Theirworkshowshow mobile tools can make product information easier to access.

Werle et al. examined how food-scanner applications affectfoodchoicesbycomparingscanner-basedinformation with front-of-pack labels and with situations where no additionalinformationwasgiven[2].

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Theirfindingssuggest that scanner apps may support healthier choices in some situations, although information printed directly on the package can still be influential in real purchasing settings. Cornudetetal.likewisestudiedwhenfoodscannerappscan outperform front-of-pack nutrition labels in encouraging healthier choices [3]. Together, these studies indicate that simply displaying nutrition data may not always be enough.

Soni and Kaur studied claims printed on 230 food packagessoldinIndiaandconsideredtheircompliancewith FSSAIrequirements[4]. Theyreportedthatsomeclaimswere difficult to verify because the relevant criteria were unclear or qualitative, while other claims did not meet the specifiedconditions.Theirstudyhighlightstheimportanceof examining product claims from a consumer-protection perspective.

Nagayi et al. compared OCR approaches, including Tesseract, EasyOCR, PaddleOCR, and TrOCR, for extracting text from food packaging [5]. They describe practical challenges such as small print, curved surfaces, glare, multiple languages, and complex layouts. These issues are equally relevant to mobile food-label scanning, because errors during text extraction can affect all later analysis.

Researchhasalsoexploredpersonalizednutrition.Naget al. proposed a recommendation engine that uses nutritional information together with personal health information to filterandrankfoodchoices[6].NutritionWise,describedby Prasadetal.,focusesonturning complexnutritionlabelsinto personalized insights, including dietary suitability and allergen alerts [7].

Taken together, these studies address food scanning, OCR, personalized recommendations, or claim analysis, usually one at a time. FoodTrust AI brings related functions intoasinglemobileworkflow:labelscanning,profile-based interpretation,claimchecking, package-detail checking, and help with preparing a report when a possible issue is found.

III. RESEARCH GAP AND CONTRIBUTIONS

Many existing food-scanning tools focus on nutrition information or on comparing products. OCR-based extraction, personalized recommendations, and the examination of food claims have also been studied, but in separate settings. There remains a practical need for an application that brings personalized food analysis and selected consumer-compliance functions together.

FoodTrust AI addresses this need through an Android application that uses OCR to extract label text, Java rules to contribute to health scoring, and the Gemini API to help explain food information. User and family-member profiles tailor the results, and the application includes Claim Verification,PackageComplianceChecking,andConsumer Reporting Assistance. The main contributions are:

1) *Food-label processing:* extracts visible text and organizes the available information about ingredients, nutrition, and allergens.
2) *Personalized food analysis:* combines Java-based scoring rules with Gemini-assisted explanations and recommendations for the selected profile.
3) *Consumer-compliance assistance:* checks product claims and selected package declarations for possible issues and supports the preparation of a report.
4) *Integrated Android application:* provides these functions alongside user and family-member profile management through Firebase Realtime Database.

The contribution lies in combining these functions in a singleapplication.Thesystemstillneedsquantitativetesting against verified reference data.

IV. SYSTEM AND METHODOLOGY

FoodTrust AI follows a sequence of image capture, text extraction, information processing, profile-based analysis, and consumer-compliance checks. The main steps are described below.

A. *Food-LabelImageCapture*

The user takes a picture of a packaged-food label with a smartphone.CameraXmanagesimagecaptureandpassesthe image to the text-recognition component. Image quality affects the result: small print, reflections, curved packaging, and complicated layouts can make text harder to extract.

B. *OCRandInformation Processing*

Google ML Kit Text Recognition extracts text from the captured image. The text is then passed to the Food Label ValidatorandtheFoodLabelProcessor.Thevalidatorchecks forrelevantlabelinformation,whiletheprocessororganizes thetextinto categories suchasingredients,nutritionalvalues, and allergens. Because OCR can miss or misread words, the later analysis depends partly on the quality of the extracted text.

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C. UserandFamily-MemberProfiles

Before analyzing a product, users can select their own profile or a family-member profile. Where supported, the application uses recorded health conditions, dietary preferences, allergies, and food intolerances to personalize the result. The same product may therefore lead to different warnings or recommendations for different profiles. The usefulness of these results depends on the accuracy of both the profile and the extracted label information.

D. HealthScoring and AI-Assisted Interpretation

Theapplicationusesahybridapproach.Java-basedrules contribute to the numerical health score, while the Gemini API helps interpret the food information in plain language. The output can include ingredient warnings, possible health effects, explanations, and recommendations tailored to the selectedprofile.Thetwopartshavedifferentroles,andtheir consistency and reliability still need to be measured through systematic testing.

E. Claim Verification

The Claim Verification module examines claims displayed on a food package and compares them with the available ingredient, nutrition, and product information. It flags possible inconsistencies or cases that may need further review. The result is meant to help users notice potential concerns;itshouldnotbetreatedasafinallegaldecisionthat a product violates a regulation.

F. Package Compliance Checking

The Package Compliance Checking module examines selected package declarations, including MRP, net quantity, date-relatedinformation,andmanufacturerorpackerdetails. Suchdeclarationsarelinkedtolegalmetrologyrequirements [8]. Themodulechecks theavailableinformationagainstthe criteria implemented in the application and flags details that appear missing, unclear, or potentially inconsistent. A warning from the application does not by itself prove legal non-compliance.

G. ConsumerReportingAssistance

If a possible issue is found, the application prepares a reportdocumentcontainingtherelevantinformationandasks the user to confirm before opening the appropriate government reporting website. This is in line with FSSAI's encouragement of consumer reporting of misleading claims [9].Theusercanreviewthereportandcompleteanyrequired steps on the official platform. Opening the website does not mean that a complaint has already been submitted.

H. Data Management and Result Display

Firebase Realtime Database supports the storage and retrieval of user and family-member profile information. Food-analysisandcomplianceresultsareshownonseparate screens within the same app. In summary, the workflow is: Scan,Extract,Process,Analyze,Personalize,VerifyClaims, Check Package Details, Prepare Report, Ask for Confirmation, and Open Reporting Website.

V. SYSTEM ARCHITECTURE

FoodTrustAIisorganizedaroundtwomainmodules:the Food Analysis Module and the Consumer Compliance Module. Both are available through the same Android application. Fig. 1 shows how the parts connect. A label image moves from the Android application through image capture, text extraction, and label processing, and is then passed to the analysis and compliance blocks. The Gemini API and Firebase Realtime Database support these blocks, and the final results are displayed back in the app. In the figure, the Food Analysis and Personalized Analysis blocks together form the Food Analysis Module, while Claim Verification, Package Compliance, and the Reporting Assistance block form the Consumer Compliance Module.

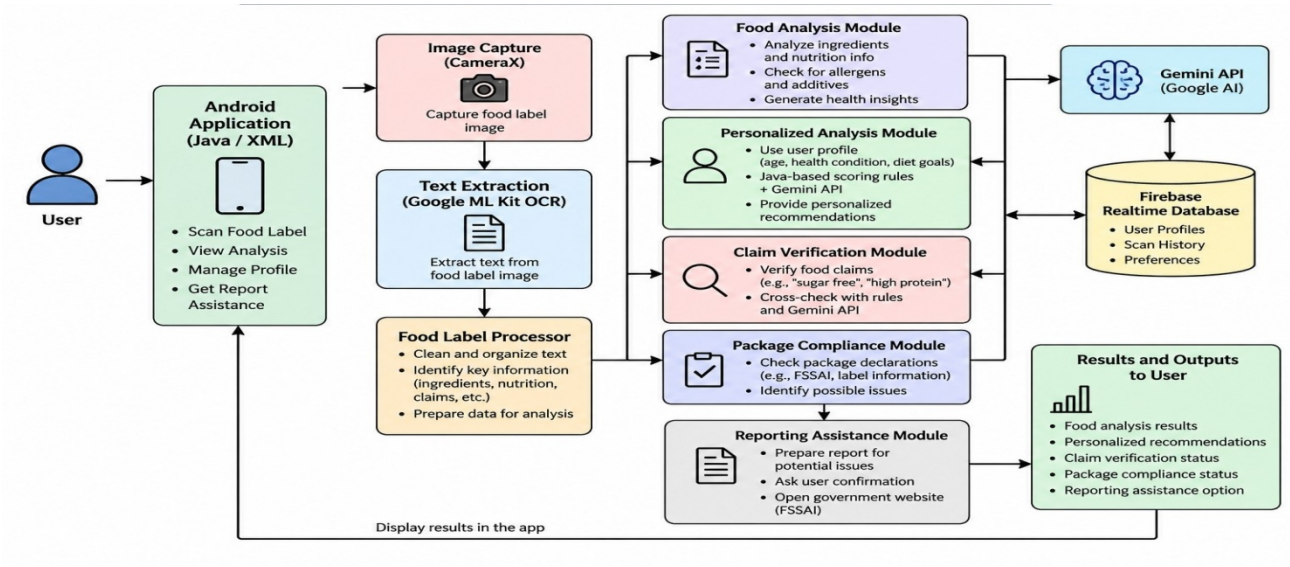


Fig.1.SystemarchitectureoftheproposedFoodTrustAIsystem

A. *FoodAnalysisModule*

The Food Analysis Module captures package images through CameraX and extracts text using Google ML Kit TextRecognition.TheFoodLabelValidatorandFoodLabel Processororganizetheextractedtextintoingredients, nutritioninformation, andallergens. Java-basedscoringrules and the Gemini API are then used to produce a health score, explanations, ingredientwarnings,possiblehealtheffects, and profile-based recommendations. Firebase Realtime Database supports profile management.

B. *ConsumerComplianceModule*

The Consumer Compliance Module contains Claim Verification and Package Compliance Checking, with Consumer Reporting Assistance available to support both.

1) *Claim Verification:* The user captures the product's front-label image in the Claim Verification section. The applicationcomparesthedisplayedclaimswiththeavailable ingredientinformationandotherrelevantproductdetails.Ifit identifies a possible inconsistency, it prepares a report document and asks for confirmation before opening the relevant government reporting website.
2) *PackageComplianceChecking:* Theusercapturesthe package-information area in the corresponding section. The application checks supported details, including MRP and otherpackagedeclarations.Ifinformationappearsmissingor potentially inconsistent, it prepares a report document and askstheusertoconfirmbeforeopeningthereportingwebsite.
3) *Consumer Reporting Assistance:* This function supports both checking modules. It prepares the report and provides a confirmation-based route to the relevant government website. The user remains responsible for reviewing the information and completing any official submission.

VI. IMPLEMENTATION AND TECHNOLOGIES

FoodTrust AI was developed as an Android application using Android Studio, Java, and XML layouts. Java handles application logic and navigation, while the XML layouts definethescreensforprofilemanagement,scanning,analysis results, and compliance functions. Table I summarizes the technologies and the role each one plays.

TABLEITECHNOLOGIESUSEDINFOODTRUSTAI

Component	RoleinFoodTrustAI
AndroidStudio,Java,XML	Applicationlogic,navigation,anduser interface
CameraX	Captureoffood-labelimages

GoogleMLKitTextRecognition	Extractionofreadabletextfromtheimage
Java-based rules	Contributiontothehealth score
GeminiAPI	Explanations,warnings,andprofile-basedrecommendations
FirebaseRealtimeDatabase	Storageandretrievalofuserandfamily-memberprofiles

CameraX captures the label images, and Google ML Kit Text Recognition extracts the readable text and passes it to the Food Label Validator and Food Label Processor. These organizetheinformationintoingredients,nutritionalvalues, and allergens, which the food-analysis and compliance functions then use.

Inthehybridhealthanalysis,Java-basedrulescontribute to the health-score calculation, and the Gemini API helps explain the food information and produce ingredient warnings, possible health effects, and profile-based recommendations. Firebase Realtime Database stores and retrieves profile information, so the selected profile can provide context for the analysis, including supported health conditions, dietary preferences, allergies, and food intolerances.

Claim Verification compares product claims with the available label information, and Package Compliance CheckingexaminessupporteddeclarationssuchasMRP,net quantity, date-related details, and manufacturer or packer information.Wheneitherfindsapossibleissue,thereporting functionpreparesareportdocumentandaskstheuserbefore opening the appropriate government website.

VII. RESULTS AND DISCUSSION

FoodTrust AI has been implemented with food-label scanning,OCR-basedtextextraction,hybridhealthanalysis, and the three consumer-compliance functions. Initial tests wereperformedonselectedrealpackaged-foodproducts,but numerical performance measures have not yet been calculated.

A. FunctionalTestingandPreliminaryResults

Duringpreliminarytesting,theapplicationcapturedlabel images through CameraX and extracted text using Google ML Kit Text Recognition. The extracted information was organized into ingredients, nutrition values, and allergens. Java-basedrulescontributedtothehealthscore,andGemini assistedingeneratingexplanations,warnings,possiblehealth effects, and profile-based recommendations.

The Claim Verification, Package Compliance Checking, and Consumer Reporting Assistance workflows were also run. When a potential issue was identified, the application prepared a report document and asked for user confirmation before opening the relevant government reporting website. Thesetestsshowthattheworkflowshavebeenimplemented, but they do not establish their accuracy or reliability.

B. HealthandComplianceEvaluation

Health-score consistency and recommendation quality have not yet been measured quantitatively. Future tests should compare repeated scores under the same conditions and assess recommendations against predefined reference criteria. The two compliance modules also have not been evaluated against a manually verified set of package claims and declarations.

C. Discussion

ThemainstrengthofFoodTrustAIisthatitbringsOCR, rule-based health scoring, AI-assisted interpretation, profile management, and consumer-compliance assistance together in one mobile application. The current tests show that the mainworkflowsoperateonselectedrealproducts,butmore evidence is needed before conclusions can be drawn about accuracy or practical reliability.

A future evaluation should compare OCR output with manually checked transcriptions, assess recommendations againstpredefinedcriteria,andtestclaimandpackagechecks using labelled cases. Precision, recall, and F1-score may be calculated for compliance detection once suitable verified referencedataareavailable.Untilthen,theresultsshouldbe read as evidence of functional implementation rather than measured performance.

VIII. CONCLUSION

FoodTrustAIisanAndroidapplicationdesignedtomake packaged-food information easier to understand. It uses CameraX and Google ML Kit Text Recognition to capture andextractlabeltext,Java-basedrulestocontributetohealth scoring, and the Gemini API to help explain the results. Firebase Realtime Database supports user and family-member profile management, allowing the application to tailor results to the selected profile.

The application also includes Claim Verification, Package Compliance Checking, and Consumer Reporting Assistance.Thesefeatureshelpusersidentifypossibleissues withproductclaimsorpackagedeclarations,preparereport document,andopenarelevantgovernmentreportingwebsite afterconfirmation.Openingthewebsitedoesnotitselfsubmit an official complaint.

The main contribution is the integration of personalized food analysis and consumer-compliance assistance in one application using established technologies. Quantitative evaluation of OCR accuracy, health-score consistency, recommendation quality, and compliance detection remains to be completed, and further testing with verified reference data is needed to assess the reliability and usefulness of the system.

IX. FUTURE WORK

Future work will focus on testing the system more thoroughly, improving how it handles different food packages,andevaluatingthequalityofitsresults.

First,OCR should be tested on a larger collection of labels captured under different lighting conditions, text sizes, and package layouts, and compared with manually verified transcriptions to measure extraction errors.

Second, the health-analysis component should be evaluated for score consistency under the same conditions andforhowwellrecommendationsmatchpredefinedcriteria. The system should also handle missing or uncertain label information more carefully.

Third,specializedAI-basedapproachesmaybeexplored for Claim Verification and Package Compliance Checking and tested on labelled datasets with suitable performance measures.Fourth,thereportingworkflowcouldbeimproved bychecking report completeness,supportingevidence,and the choice of reporting destination, while keeping user confirmation in place. Finally, usability testing with more products and user profiles would help identify where the application can be improved.

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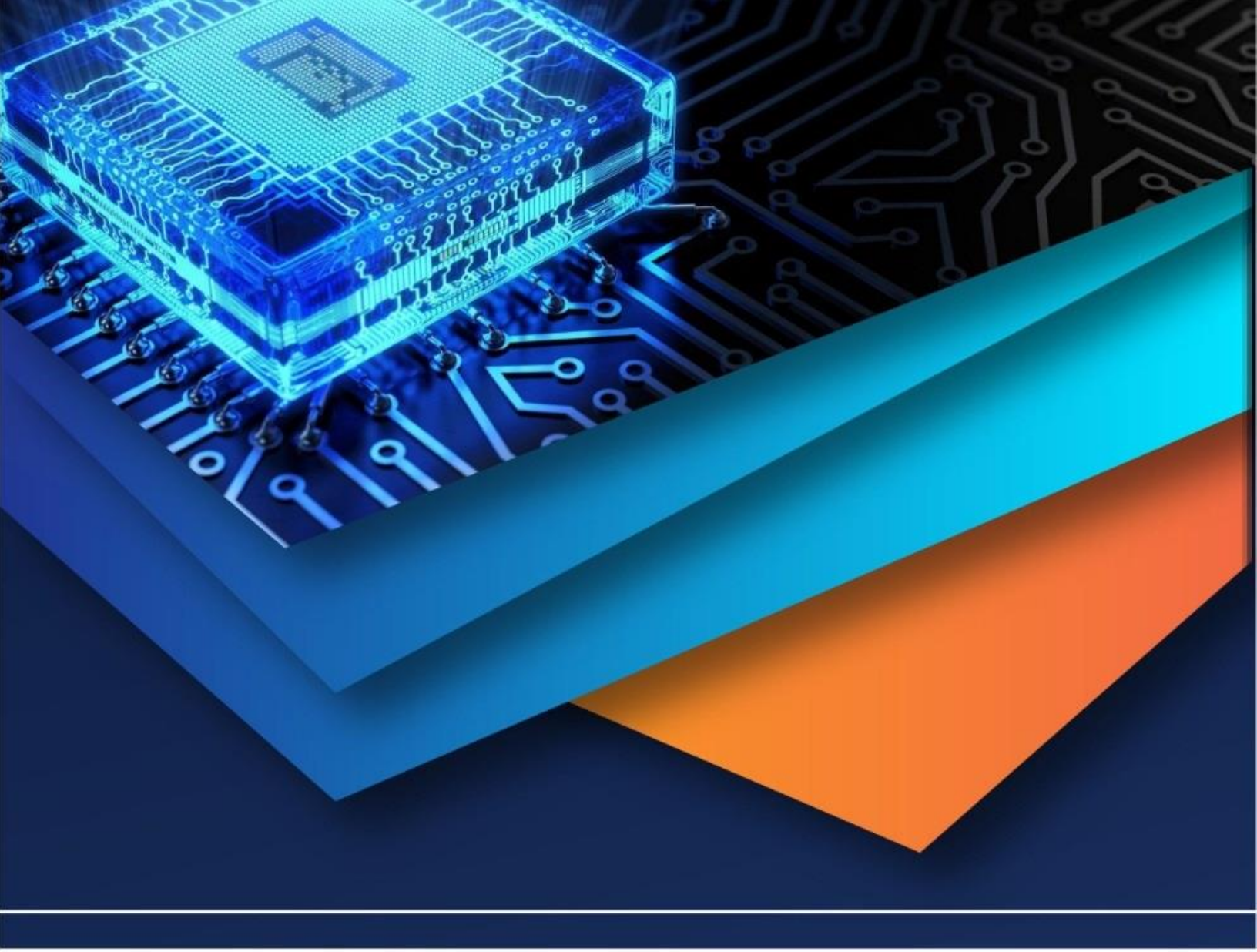
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