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MediTrack: A Mobile Health Application for Medication Adherence and Health Record Management

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Abstract: Medication non-adherence and fragmented personal health record management remain significant challenges in modern healthcare systems. This paper presents MediTrack, an integrated mobile health (mHealth) application designed to assist users in managing medication schedules and maintaining organized personal health records within a unified architecture. The system is developed using Flutter and Firebase services, enabling an offline-first healthcare model with features such as automated medication reminders, digital record storage, and prescription scanning. Additionally, an AI-assisted interaction layer integrated via OpenAI API provides basic health assistance and user interaction support.
The system was evaluated through functional testing and a pilot usability study involving 10 users over 3 days. Results demonstrate high reminder accuracy (99.6%), efficient data synchronization, and strong user satisfaction. The findings suggest that integrated mobile health platforms can significantly improve patient engagement. The results highlight the effectiveness of unified digital healthcare solutions in improving medication adherence and simplifying personal health management.
Index Terms: Mobile Health (mHealth), Medication Adherence, Personal Health Records, OCR-based Prescription, Healthcare Mobile App, AI Chatbot, Firebase Cloud.

I. INTRODUCTION

In recent years, digital technologies have increasingly trans- formed the delivery and management of healthcare services. The widespread adoption of smartphones and cloud-based systems has enabled new forms of patient-centered healthcare through mobile health (mHealth) applications, wearable de- vices, and digital health platforms. These technologies allow individuals to actively monitor their health, access medical information, and manage treatment plans outside traditional clinical environments. Despite these advancements, patients still face significant challenges in maintaining consistent medication adherence and managing personal health records effectively. Medication adherence, defined as the extent to which patients follow prescribed medication regimens in terms of timing, dosage, and frequency, is a critical factor in deter- mining treatment effectiveness. However, maintaining strict adherence to medication schedules can be difficult in everyday life. Many patients forget doses, confuse medications, or lose track of whether a medication has already been taken. These challenges are particularly common among elderly individuals and patients managing chronic conditions such as diabetes, hypertension, and cardiovascular diseases.

In addition to medication management, patients are frequently responsible for maintaining their own health information, including prescriptions, diagnostic reports, and clinical histories. In many healthcare systems, this information remains fragmented across different hospitals, paper documents, and digital platforms. As a result, patients often struggle to access their complete medical records when needed, leading to poor coordination of care and increased risk of medication errors. Digital health technologies have been widely explored as potential solutions to these challenges. Mobile applications designed for medication reminders, health monitoring, and record management have become increasingly common. Such applications can notify users when medications should be taken, provide basic health tracking features, and allow storage of medical information in digital form. Studies have shown that mobile-based interventions can improve patient engagement and support treatment adherence in chronic disease management. However, many existing applications focus on a single aspect of health management rather than providing a com- prehensive platform that integrates multiple healthcare tasks. This limitation forces users to rely on multiple applications, reducing usability and overall effectiveness. Existing digital health systems often lack integration between medication tracking and personal health record management, leading to fragmented user experiences. This work addresses this gap by proposing a unified mobile health platform that combines these functionalities within a single application. The primary objective of this research is to design and implement a mobile-based system that enables users to schedule medications, receive timely reminders, and manage personal health records in a secure and accessible manner.

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The main contributions of this work are:
1) Design of a unified architecture combining medication tracking and health record management.
2) Implementation of an offline-first healthcare model ensuring continuous data accessibility.
3) Integration of an AI-assisted interaction layer for basic user health guidance.
4) Implementation of OCR-based prescription processing and evaluation through real-world usability testing.

The remainder of this paper is organized as follows. Section II reviews related work, Section III describes the methodology, Section IV presents results, Section V discusses findings, and Section VI concludes the paper.

II. LITERATURE REVIEW

The rapid advancement of digital technologies has significantly influenced modern healthcare systems, particularly in the area of patient-centered health management. Mobile health (mHealth) applications have emerged as important tools that enable individuals to manage their medical information, track health indicators, and follow prescribed treatment plans using smartphones and connected devices. As healthcare increasingly shifts toward preventive care and self-management, digital health platforms play a crucial role in supporting patients outside traditional clinical environments.

One of the most widely studied applications of mobile health technology is medication adherence support. Medication adherence refers to the degree to which patients follow prescribed medication schedules, including correct dosage and timing. Poor adherence is a common global healthcare challenge and has been associated with reduced treatment effectiveness, disease progression, and increased healthcare costs. Kruse et al. conducted a comprehensive study examining the effectiveness of mobile health technologies in improving medication adherence. Their findings indicate that automated reminders and digital notification systems can positively influence patient adherence behavior, particularly for individuals managing chronic conditions.

Similarly, Patel and Desai analyzed the role of mobile- health interventions in improving healthcare outcomes and patient engagement. Their study found that mobile-based health interventions can enhance health-related behaviors, including medication adherence and appointment attendance. However, they also highlighted that many existing mobile health applications focus primarily on a single function rather than providing comprehensive health management capabilities.

Another important area of research involves electronic per- sonal health records (PHR). Personal health record systems allow individuals to store and manage their medical data independently of healthcare institutions. These systems enable users to access medical information such as prescriptions, diagnostic results, and health histories. While electronic health records (EHRs) are widely used within hospitals and clinical settings, patient-controlled PHR systems are still evolving. Many current platforms provide data storage capabilities but lack features that actively support daily health management activities.

Recent studies have also explored the integration of intelligent technologies within digital health platforms. Artificial intelligence and machine learning techniques are increasingly used to analyze health data, identify patterns in patient behavior, and support personalized healthcare recommendations. These technologies have the potential to improve preventive healthcare by enabling early detection of health risks and providing adaptive treatment support. Despite these technological developments, a common limitation identified across the literature is the fragmentation of digital health solutions. Medication reminder applications, per- sonal health record systems, and wearable health monitoring platforms are often developed as separate tools with limited interoperability. As a result, patients may need to use multiple applications to manage different aspects of their healthcare, reducing usability and long-term adoption. Another challenge highlighted in prior research is usability. Digital health tools must be accessible and easy to use for individuals with varying levels of technological literacy. Systems that combine multiple healthcare functions within a single application can reduce complexity and improve user engagement.

The MediTrack platform proposed in this study addresses these limitations by integrating medication scheduling, re- minder notifications, personal health record storage, and basic health monitoring within a single mobile application. This unified approach reduces fragmentation and enhances usability.

From a research perspective, this work contributes to the development of integrated mobile health platforms that sup- port comprehensive patient self-management and align with modern digital healthcare trends.

III. METHODS

This study follows a system design and development methodology to design, implement, and evaluate the MediTrack mobile health application. The approach focuses on building a functional prototype capable of assisting users in managing medication schedules and maintaining organized personal health records. The development process included system architecture design, mobile application implementation, backend integration, and functional evaluation.

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A. System Architecture

The MediTrack system follows a three-layer architecture consisting of the presentation layer, application logic layer, and data management layer. This modular structure improves scalability, maintainability, and system reliability.

The presentation layer represents the mobile user interface built using Flutter. It provides interactive screens where users can schedule medications, view reminders, record health data, and access medical history.

The application logic layer manages internal operations such as reminder scheduling, prescription scanning, chatbot interaction, and synchronization with backend services.

The data management layer is responsible for secure storage and retrieval of user data using Firebase Cloud Firestore.

Fig. 1 illustrates the end-to-end system architecture, high- lighting the structural separation and interaction between the Flutter-based presentation layer, the application logic components, and the Firebase cloud services.

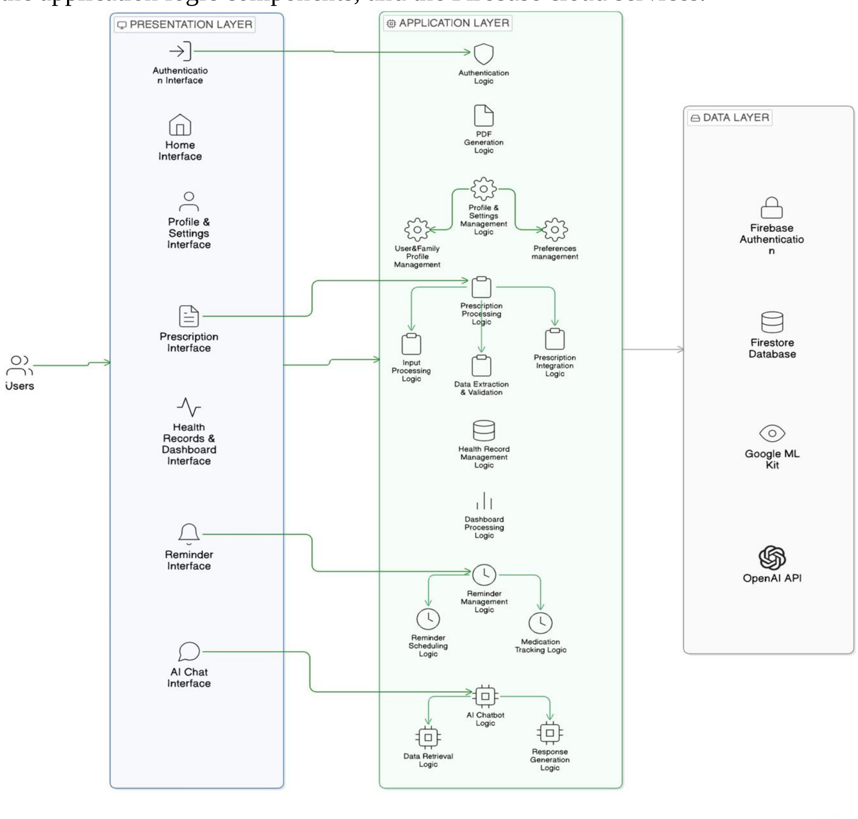

Fig. 1. MediTrack System Architecture (Source: Developed by Authors)

B. System Workflow

The MediTrack workflow begins with user authentication using Firebase Authentication. After login, users can input medication details such as name, dosage, and schedule. The system then generates reminders using local notification ser- vices.

When a reminder is triggered, the user confirms medication intake, and the response is recorded in the database. Addition- ally, users can scan prescriptions using OCR, and extracted data is used to populate medication schedules.

Fig. 2 illustrates the end-to-end workflow of the system, including user authentication, medication scheduling, notification triggering, and adherence tracking.

C. Data Flow Design

The system uses an offline-first architecture. Data entered by users is stored locally and synchronized with Firebase when connectivity is available. This ensures uninterrupted usage even in low-network environments.

Fig. 3 illustrates the offline-first data flow mechanism, demonstrating how user inputs and OCR-extracted data are processed locally and securely synchronized with the Firebase cloud database when connectivity is restored.

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D. Component Design

The MediTrack platform consists of multiple functional modules:

- Authentication Module: Handles user login and registration.
- Medication Management Module: Manages medication schedules and adherence tracking.

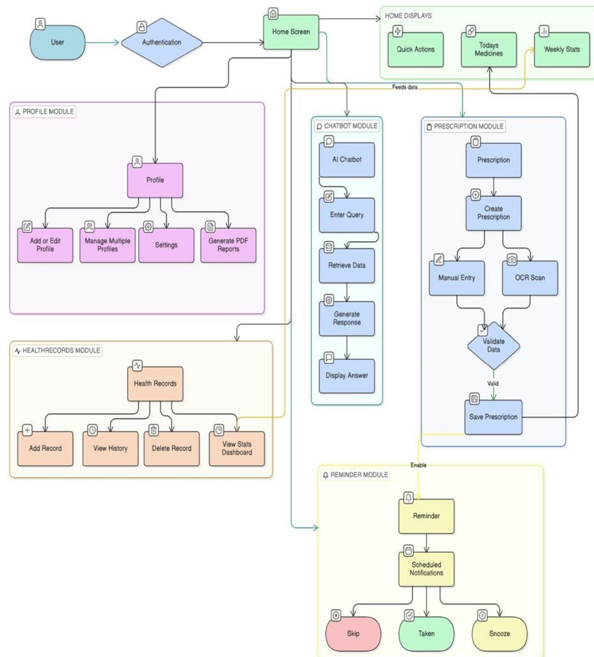

Fig. 2. MediTrack System Workflow (Source: Developed by Authors)

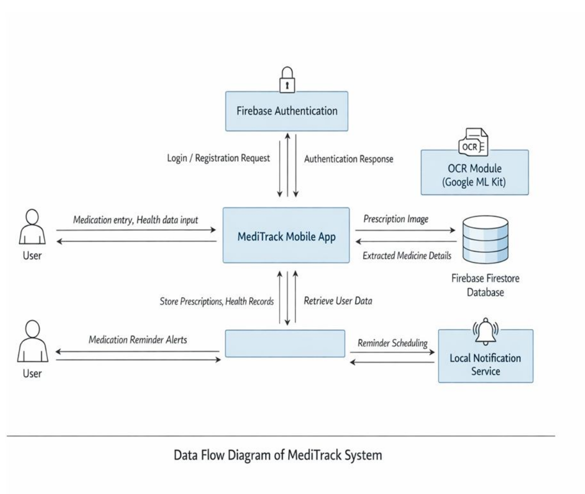

Fig. 3. Data Flow Diagram of MediTrack (Source: Developed by Authors)

- Reminder Notification Module: Generates alerts for medication intake.
- Prescription Scanner Module: Uses OCR to extract prescription data.
- Health Record Module: Stores medical records and reports.
- AI Chatbot Module: Provides basic health assistance using OpenAI API.
- Cloud Synchronization Module: Synchronizes data with Firestore.

Fig. 4 illustrates the modular design of the system components.

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E. Database Structure

The backend uses Firebase Cloud Firestore with a NoSQL structure. Each user has collections for medications, health records, and scanned prescriptions.

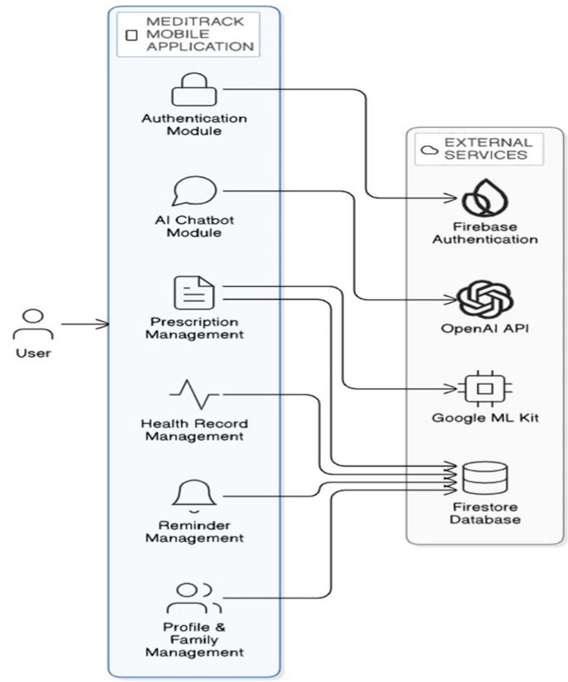

Fig. 4. Component Diagram of MediTrack (Source: Developed by Authors)

Fig. 5 shows the database schema and how data is organized in Firestore collections.

F. Technology Stack

The system was developed using Flutter and Dart for cross- platform mobile development. Firebase services were used for backend support, including authentication, database, and storage. An AI-based chatbot was integrated using the OpenAI API to provide basic health guidance, answer user queries, and enhance user interaction within the application. OCR-based prescription scanning was implemented using Google ML Kit for extracting medication information from images.

G. Security and Privacy Considerations

Given the sensitive nature of medical data, MediTrack incorporates robust security measures to ensure patient privacy and system integrity. User authentication is strictly managed

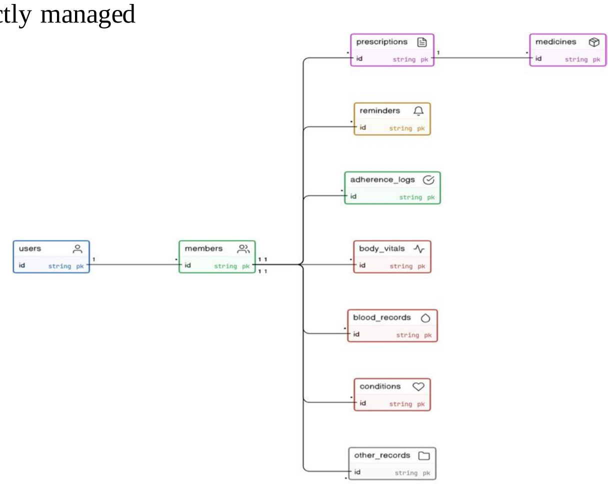

Fig. 5. Firestore Database Schema (Source: Developed by Authors)

via Firebase Authentication, preventing unauthorized access. All medical records and prescription data transmitted between the mobile client and the Firestore database are secured using industry-standard end-to-end encryption provided by Google Cloud services. While the current iteration serves as an academic prototype, the system architecture is designed in alignment with data minimization principles mandated by the Health Insurance Portability and Accountability Act (HIPAA) and the General Data Protection Regulation (GDPR).

IV. RESULTS

The MediTrack prototype was evaluated through functional testing and a pilot usability assessment. The system was tested on Android devices under real-world usage conditions. The objective of this evaluation was to verify system reliability, measure application performance, and assess the effectiveness of core features such as medication reminders, prescription scanning, and cloud synchronization.

A. Functional Performance Evaluation

The core system modules—including medication scheduling, reminder notifications, prescription scanning, and health record storage—were tested across multiple usage scenarios. The application successfully generated scheduled notifications, recorded medication adherence responses, and synchronized user data with the cloud database.

As shown in Table I, the system achieved low latency and stable performance across all operations.

The results indicate that the application maintained stable performance, and the offline-first synchronization mechanism ensured data reliability even during network interruptions.

B. Medication Reminder Accuracy

One of the primary objectives of MediTrack is to deliver accurate medication reminders. To evaluate this functionality,

TABLE I
SYSTEM Performance METRICS

Metric	Measured Value
Average App Launch Time	1.4 seconds
Average Screen Response Time	320 ms
Firestore Query Latency	210 ms
Data Synchronization Time	1.2 seconds
Reminder Notification Delay	< 2 seconds
Offline Data Recovery Success Rate	100%

simulated medication schedules were tested across multiple cycles.

As shown in Table II, the system achieved high reminder accuracy.

TABLE II
MEDICATION REMINDER ACCURACY

Test Scenario	Accuracy
Daily Medication Schedule	100%
Twice-Daily Schedule	98.7%
Weekly Schedule	100%
Average Reminder Accuracy	99.6%

The notification system demonstrated high reliability, delivering alerts within a few seconds of the scheduled time.

C. Prescription OCR Recognition Accuracy

The prescription scanning feature was evaluated using a dataset of sample prescription images.
As shown in Table III, the OCR module achieved strong performance.

TABLE III
PRESCRIPTION OCR RECOGNITION PERFORMANCE

Evaluation Metric	Result
Total Prescriptions Tested	50
Correct Medication Extraction	46
Recognition Accuracy	92%
Average Processing Time	1.8 seconds

Minor inaccuracies were observed in cases involving hand- written or low-quality images.

D. User Usability Evaluation

The system was evaluated with 10 participants over a period of 3 days. Users interacted with the application by scheduling medications, recording health data, and scanning prescriptions.
As shown in Table IV, the system received high usability scores.

TABLE IV
USER USABILITY EVALUATION RESULTS

Evaluation Factor	Average Score (1–5)
Ease of Navigation	4.6
Clarity of Interface Design	4.5
Medication Scheduling Simplicity	4.7
Reminder Notification Effectiveness	4.8
Overall User Satisfaction	4.6

Participants reported that the integrated design simplified medication tracking and improved awareness of medication schedules.

V. DISCUSSION

The development and evaluation of the MediTrack platform demonstrate the feasibility of integrating multiple healthcare management functions into a single mobile application. The results indicate that combining medication reminders, personal health record management, and prescription scanning within one system can simplify daily health management tasks and improve user engagement.
To contextualize the system's novelty and practical advantage, Table V provides a comparative analysis between Medi- Track and traditional digital health solutions. Unlike standard reminder applications that lack centralized data storage, or conventional PHR systems that lack active adherence tracking, MediTrack employs a unified architecture that provides comprehensive offline-first capabilities augmented by an AI interaction layer.

TABLE V
SYSTEM FEATURE COMPARISON

Feature	Traditional Reminder Apps	Standard PHR Systems	MediTrack
Medication Tracking	High	Low	High
Health Record Storage	None	High	High
Offline-First Model	Partial	Low	High
AI-Assisted Chatbot	None	Rare	Yes
OCR Prescription Scan	Rare	Rare	Yes

One of the key observations from the evaluation is the reliability of the medication reminder mechanism. The system achieved a reminder accuracy of approximately 99.6%, indicating that notifications are delivered consistently with minimal delay. This reliability is crucial for improving medication adherence, as missed or delayed reminders can lead to skipped doses or incorrect medication timing.

Another important contribution of the system is its integrated approach to personal health record management. Many existing digital health applications focus on either reminders or data storage, but rarely provide both within a unified interface. MediTrack addresses this limitation by consolidating these functionalities into a single platform, reducing the need for multiple applications and improving accessibility.

The usability evaluation results further support the effective- ness of the system. High user satisfaction scores indicate that the application is intuitive and easy to use. This aligns with the Technology Acceptance Model (TAM), which suggests that perceived usefulness and ease of use significantly influence technology adoption.

Despite these positive outcomes, several limitations must be acknowledged. First, the usability evaluation was conducted with a limited number of participants over a short three- day timeframe. Consequently, there is currently no long-term usage data to prove that the application facilitates sustained behavioral changes in medication adherence. Second, the platform lacks real clinical validation from certified healthcare professionals. It operates primarily as a self-management and lifestyle tool rather than a medically regulated device. Additionally, the system currently operates as a standalone application and does not integrate directly with hospital electronic health record (EHR) systems or external pharmacy databases. This limits systemic interoperability and requires users to manually input or scan their data. Future work will focus on large-scale user studies to gather longitudinal data, direct integration with clinical healthcare systems via API standards like FHIR, and the inclusion of wearable device support to improve real-time physiological monitoring. Overall, the findings suggest that integrated mobile health platforms like MediTrack have strong potential to improve medication adherence and support patient-centered healthcare.

VI. CONCLUSION

This study presented the design, development, and evaluation of MediTrack, an integrated mobile health (mHealth) application designed to assist users in managing medication schedules and organizing personal health records within a unified digital platform. The system integrates multiple functionalities, including medication reminders, digital health record storage, prescription scanning, and basic health monitoring features.

The evaluation results demonstrate that the system can reliably support medication adherence and health information management. Functional testing confirmed stable performance, accurate reminder delivery, and efficient data synchronization. Additionally, usability evaluation indicated high user satisfaction and ease of use.

Overall, MediTrack highlights the potential of integrated mobile health applications in improving patient self- management and reducing fragmentation in digital healthcare systems. Such platforms can play a significant role in supporting preventive and patient-centered healthcare practices.

Future work may focus on integrating advanced analytics, wearable devices, and interoperability with healthcare systems to further enhance the platform's capabilities.

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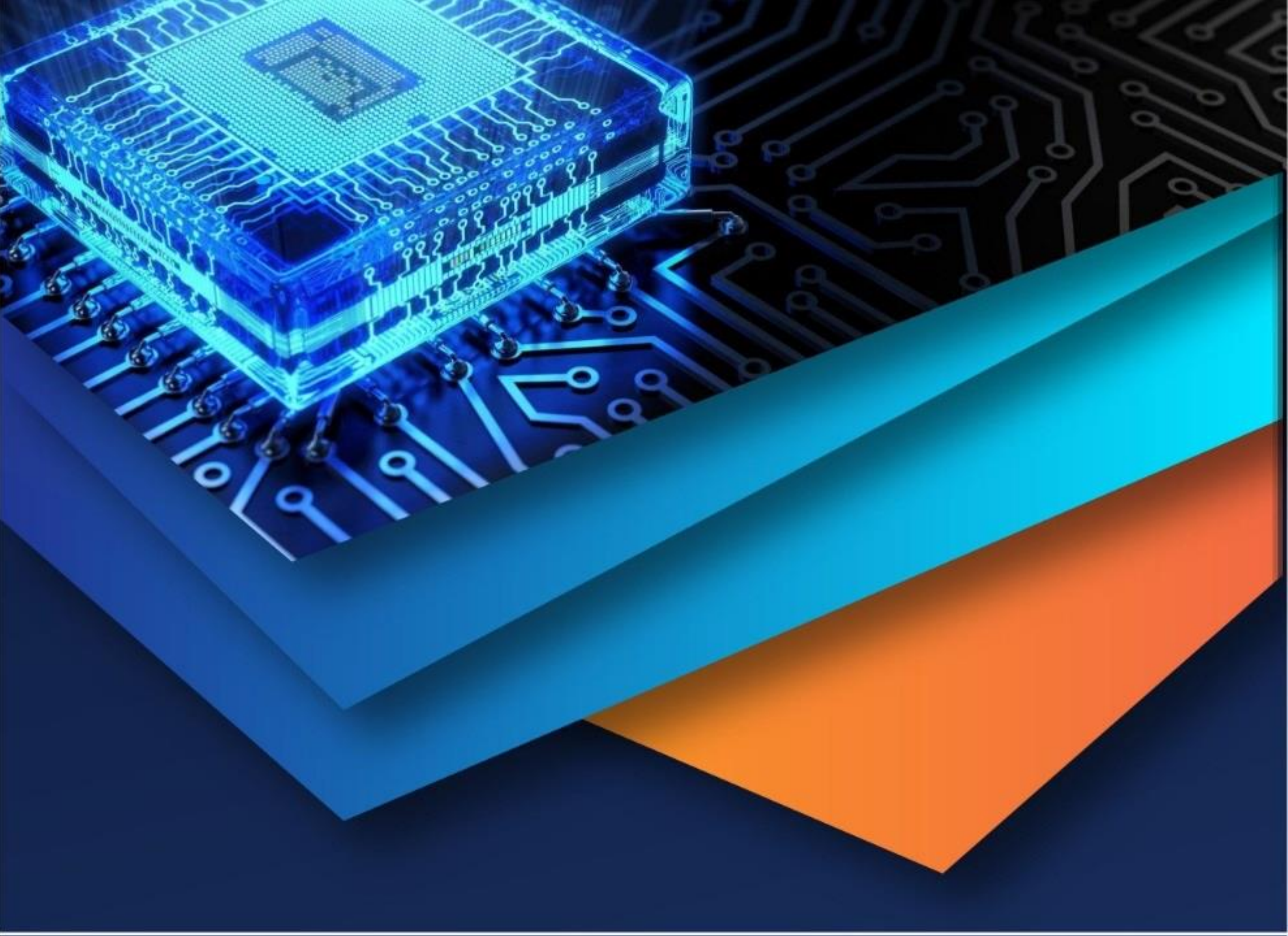

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