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Mobile-based EHR Companion for ASHA Workers in Low-Internet Area

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Abstract: ***Accredited Social Health Activists (ASHA) play a crucial role in delivering primary healthcare services in rural areas of India by connecting communities with government healthcare programs. They are responsible for monitoring maternal and child health, conducting surveys, tracking immunizations, distributing medicines, and reporting health data to Primary Health Centers (PHCs). However, most ASHA workers still depend on manual paper-based registers for maintaining health records, which leads to issues such as data loss, delayed reporting, duplication of records, and difficulty in tracking patient history. These challenges become even more significant in rural regions where internet connectivity is limited or unavailable.***

To address these issues, this project proposes a Mobile- Based Electronic Health Record (EHR) Companion Application specifically designed for ASHA workers. The application follows an offline-first approach, allowing health workers to register beneficiaries, maintain electronic health records, track maternal and child health activities, manage home visits, and record medical information even without an internet connection. The data is stored locally on the device and automatically synchronized with a central server when connectivity becomes available. The system includes modules for secure authentication, beneficiary registration, electronic health record management, maternal and child health monitoring, home visit tracking, emergency referrals, reminders, alerts, and reporting dashboards. It also supports multilingual interfaces to ensure ease of use for ASHA workers from different regions. Security measures such as data encryption and role-based access control ensure privacy and protection of sensitive health information. The proposed application is developed using modern Android technologies including Kotlin, MVVM architecture, Room database for offline storage, and WorkManager for background synchronization. By digitizing health data collection and simplifying reporting processes, the system reduces the workload of ASHA workers, improves accuracy in healthcare records, and enables timely decision-making for healthcare authorities. Overall, the Mobile-Based EHR Companion for ASHA Workers aims to strengthen grassroots healthcare delivery by providing an efficient, reliable, and scalable digital solution that supports real-time health monitoring and improves healthcare outcomes in rural communities.

Keywords: Mobile Health (mHealth), Electronic Health Records (EHR), ASHA Workers, Rural Healthcare, Offline- First Application, Maternal and Child Health Monitoring, Health Data Management, Android Application, Digital Health System, Healthcare Informatics.

I. INTRODUCTION

Accredited Social Health Activists (ASHA) are an essential part of India's public healthcare system. They serve as frontline health workers who connect rural communities with government health services and Primary Health Centers (PHCs). ASHA workers are responsible for several important tasks such as monitoring maternal and child health, spreading awareness about diseases, tracking immunization schedules, distributing medicines, conducting household surveys, and reporting health data to higher health authorities. Through their continuous interaction with the community, ASHA workers contribute significantly to improving healthcare accessibility in remote and rural regions[1].

Despite their critical role, many ASHA workers still rely heavily on manual paper-based registers to record health information. Maintaining large volumes of handwritten records is time-consuming and often leads to problems such as data loss, duplication of records, delayed reporting, and difficulty in retrieving past health information. These challenges become more serious in rural areas where internet connectivity is unreliable or unavailable. As a result, timely monitoring of beneficiaries, especially pregnant women and children, becomes difficult, which can negatively affect healthcare outcomes[2].

With the advancement of digital health technologies and the increasing availability of smartphones, mobile-based healthcare solutions have the potential to improve the efficiency of frontline health workers. Mobile health (mHealth) applications can simplify data collection, enable faster reporting, and provide better access to beneficiary

health records. However, most existing digital systems require continuous internet connectivity, which limits their effectiveness in rural and low-network regions[3].

To address these challenges, this project proposes a Mobile- Based Electronic Health Record (EHR) Companion Application for ASHA Workers. The application is designed with an offline-first approach, allowing ASHA workers to register beneficiaries, maintain health records, track maternal and child health activities, record home visits, and manage referrals even without internet access. The data is stored locally on the mobile device and automatically synchronized with a central server whenever connectivity becomes available[4].

The proposed system aims to reduce the dependency on paper-based records, improve the accuracy and availability of healthcare data, and simplify reporting processes. By providing a user-friendly and secure mobile platform, the application helps ASHA workers manage their daily healthcare activities more efficiently and supports healthcare authorities in making timely decisions based on accurate data. Ultimately, the system contributes to strengthening healthcare delivery and improving health outcomes in rural communities[5].

II. LITERATURE ANALYSIS

Several studies have highlighted the importance of digital health interventions in empowering ASHA and community health workers (CHWs) to improve rural healthcare delivery. Parmar (2021) emphasized the need for m-health technologies to enhance ASHAs' efficiency and digital literacy, enabling better outreach and health monitoring in rural areas. Jadhav (2026) demonstrated that digitalization of ASHA workflows through mobile applications improves data accuracy, real- time monitoring, and service efficiency. Mangal (2023) showed that tablet-based e-health training significantly enhanced ASHAs' skills in screening, health education, and managing non-communicable diseases. Similarly, Hariprasad (2025) developed a mobile application for population-based cancer screening, which improved CHWs' data collection, referral management, and early cancer detection in rural communities. Collectively, these studies underscore that mobile and digital health solutions, coupled with proper training, can strengthen ASHA and CHW capacity, improve healthcare outcomes, and support real-time monitoring and decision-making in underserved areas.

TABLE I.
LITERATURE WORK

Author and Year	Methods	Future Scope
Kajal Parmar, Central University of Himachal Pradesh	Comparative analysis of m-health interventions (voice calls vs SMS) Literature review on e-health and m- health adoption; focus on ASHA workers' role in rural healthcare	Emphasizes training ASHA workers in digital health technologies to improve efficiency; mobile-based interventions (voice calls, SMS, apps) can enhance maternal and child health tracking, data recording, and communication with doctors; future work should focus on increasing e-literacy, addressing rural connectivity, and designing user-friendly m-health solutions for low- literacy populations.

Jadhav, D.K., Hajare, M., Jadhav, R., Mulla, S., & Bhasar, S., 2026	Review of digital applications and mobile health tools used by ASHA workers; analysis of efficiency, data accuracy, and real-time monitoring in rural healthcare	Development of simple, secure, user- friendly, and integrated digital systems for ASHA workers; improve connectivity, provide training, and strengthen public healthcare delivery; enhance transparency and decision-making in rural health management
Mangal 2023	Prospective observational cohort study; ASHA workers in two villages of Rajasthan were trained to use a tablet-based web application for screening, diagnosis, and health education on non-communicable diseases; in-depth interviews and group discussions evaluated usability and effectiveness	Scaling up digital training programs for ASHAs across rural India; integrating e-health applications for broader primary care services; improving digital literacy among grassroots health workers; promoting environmental benefits by reducing paper usage; expanding women's empowerment and skill development through technology
Hariprasad, R., Chalga, M.S., Kedar, A., Kumar, V., Gola, S., Tapkire, R., & Kannan, R., 2025	Applied research and pilot study; developed an Android-based mobile application and web portal for population-based cancer screening; 199 CHWs trained to collect data, screen individuals, and manage referrals; real-time data synchronization and monitoring	Scaling the application for wider population- based cancer screening across rural India; integrating with national health programs; training more ASHA/CHWs; enhancing usability and analytics for early cancer detection; evaluating long-term impact on morbidity and mortality

III. WORKING METHODOLOGY

The Mobile-Based EHR Companion for ASHA Workers follows a systematic workflow that allows offline data collection, secure storage, and periodic synchronization with a central server. The methodology ensures efficiency, accuracy, and usability in rural healthcare settings. The workflow can be described in the following steps:

1) *Step 1: User Authentication*
- ASHA workers register and log in using their mobile number and PIN/OTP.
- Role-based access ensures that each user has access only to authorized modules.
- User profiles store ASHA ID, village, sub-center, and PHC linkage.

2) *Step 2: Beneficiary Registration*
- ASHA workers register beneficiaries (villagers) offline using mobile devices.
- Personal information such as name, age, gender, category (pregnant woman, child, adult, elderly), and optional Aadhaar is recorded.
- Each beneficiary is assigned a unique ID for health record tracking.

3) *Step 3: Electronic Health Record (EHR) Management*
- Comprehensive health records are created for each beneficiary.
- Records include chronic diseases, symptoms, diagnoses, visit history, prescribed medicines, lab reports, and other attachments.
- Data is stored locally in the mobile device's SQLite database.

4) *Step 4: Maternal and Child Health Monitoring*
- Track pregnancy registration, antenatal care (ANC) visits, TT injections, nutritional supplements, and estimated delivery dates (EDD).
- Immunization schedules for children are monitored, along with growth tracking and malnutrition detection.
- High-risk cases are flagged for immediate attention.

5) *Step 5: Home Visits and Survey Logging*
- ASHA workers log daily home visits, surveys, and observations.
- Optional GPS tagging ensures accurate tracking of ASHA activity coverage.
- Survey outcomes are linked to the respective beneficiary records.

6) *Step 6: Reminder and Alert System*
- Local notifications are generated for upcoming ANC visits, immunizations, medicine schedules, and follow-ups.
- Works offline without relying on internet connectivity.
- Alerts ensure timely interventions and reduce missed appointments.

7) *Step 7: Emergency Referrals*
- In case of emergencies, the app generates referral forms with auto-filled beneficiary details.
- ASHA workers can select hospitals and referral reasons.
- SMS-based support can notify the receiving health facility.
- Step 8: Offline Data Storage and Synchronization
- All data entered is saved locally using the Room (SQLite) database.
- Background synchronization with the central server occurs automatically when the device connects to the internet.
- Conflict resolution mechanisms ensure data integrity during sync.

8) *Step 9: Reports and Dashboard*
- The system generates daily, weekly, and monthly reports for ASHA workers and supervisors.
- Key metrics include beneficiary counts, immunization coverage, high-risk pregnancies, and ASHA activity performance.
- Dashboards provide visual insights for quick decision-making by health authorities.

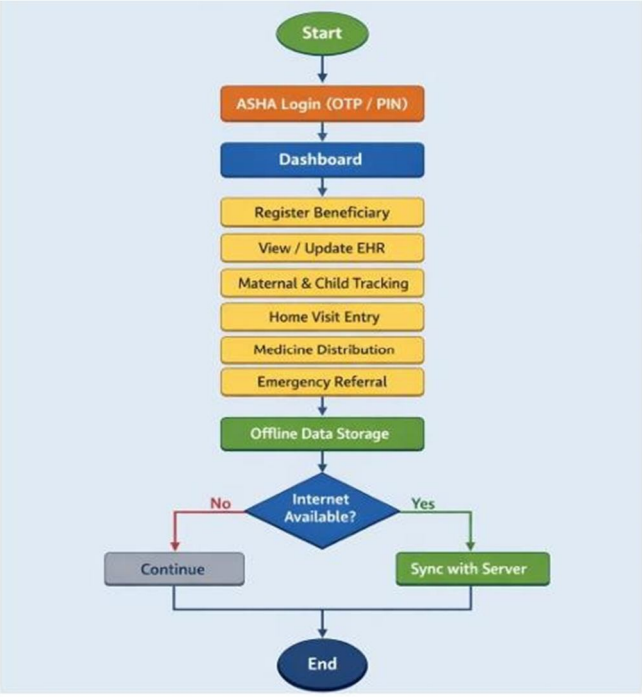

Figure 3.1. System Diagram

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IV. RESULTS AND DISCUSSION

The Mobile-Based EHR Companion for ASHA Workers was designed, developed, and tested to evaluate its effectiveness in improving healthcare data management at the grassroots level. The results demonstrate significant improvements over traditional paper-based systems and highlight the system's usability, reliability, and impact on ASHA operations.

A. Successful Offline Functionality

1) The application allows ASHA workers to register beneficiaries, maintain health records, and log visits without requiring an internet connection.
2) Data entered offline is stored locally and automatically synchronized with the central server when connectivity becomes available, ensuring continuity in low-network areas.
3) Testing showed that data entry and retrieval were fast and error-free, even in remote locations.

B. Efficient Beneficiary and Health Record Management

1) Each beneficiary receives a unique ID, and their electronic health record (EHR) maintains complete medical history, including chronic conditions, immunizations, and prescriptions.
2) Maternal and child health tracking enabled ASHA workers to monitor ANC visits, TT injections, EDD, growth monitoring, and high- risk cases effectively.
3) This digital recordkeeping reduced duplication of data and eliminated the risk of lost or damaged paper registers.

C. Timely Alerts and Reminders

1) The system generates local notifications for immunizations, ANC visits, medicine intake, and follow-ups.
2) Alerts improved adherence to healthcare schedules and reduced missed appointments.
3) ASHA workers reported that automated reminders saved significant time and improved service delivery efficiency.

D. Emergency Referrals and Reporting

1) Emergency referral forms can be generated quickly with pre-filled patient details, allowing prompt communication with hospitals.
2) Supervisor-level dashboards provided visual insights into ASHA activities, high-risk beneficiaries, and coverage reports.
3) Reports and analytics supported data-driven decision-making and timely interventions at the PHC level.

E. User Feedback and System Usability

1) ASHA workers found the application intuitive, with easy navigation and multilingual support (Marathi, Hindi, English).
2) Role-based access and secure authentication increased trust and ensured data privacy.
3) Overall, the system reduced manual workload, increased accuracy of health records, and facilitated faster reporting to supervisors.

F. Discussion

1) The application demonstrates the effectiveness of mobile health (mHealth) solutions in rural healthcare delivery.
2) Offline-first design addresses connectivity challenges, ensuring uninterrupted data capture and patient monitoring.
3) By digitizing health records, the system improves transparency, accountability, and the quality of primary healthcare services.
4) Integration with national health platforms like ABHA or Ayushman Bharat can further enhance scalability and interoperability.

Figure 4.1. Loading Page

Figure 4.2. Home Page

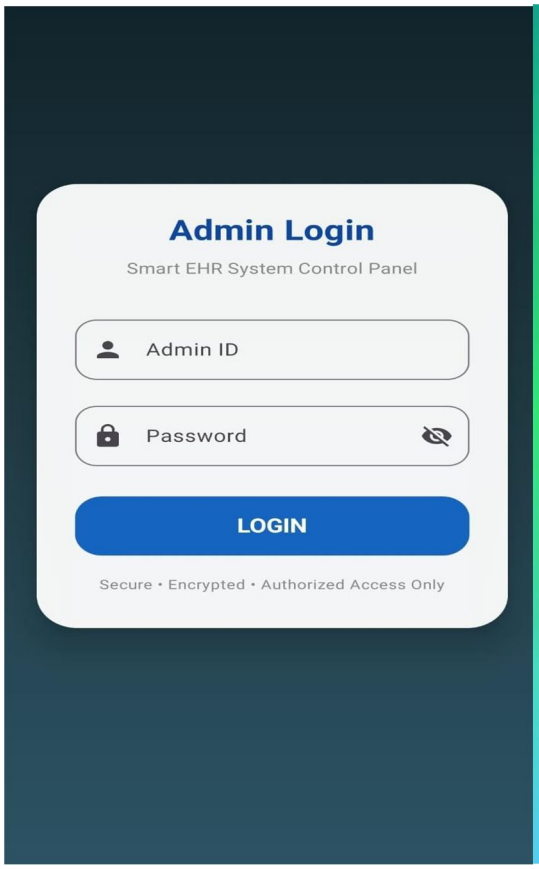

Figure 4.3 Admin Login Page

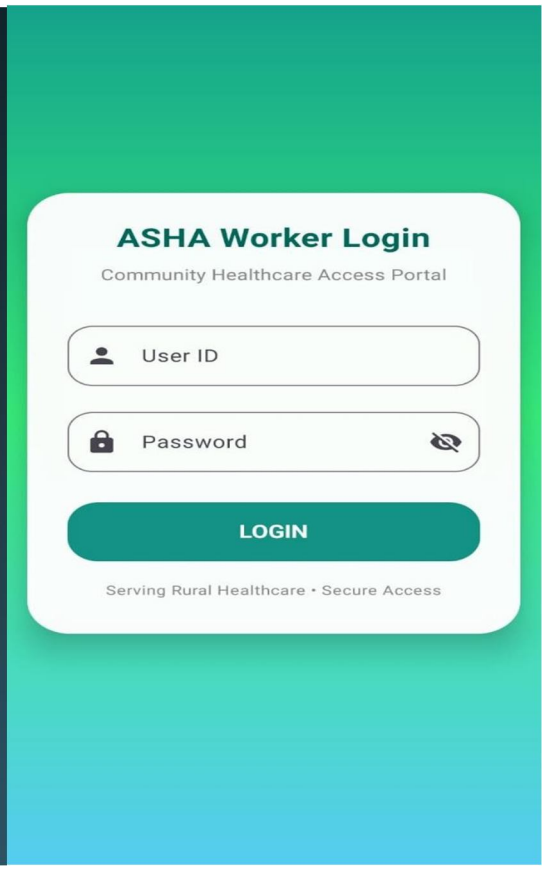

Figure 4.4 Asha Worker Login Page

V. CONCLUSION

The Mobile-Based EHR Companion for ASHA Workers offers a practical and efficient solution to the challenges faced by frontline healthcare workers in rural India. By replacing traditional paper-based registers with a secure, offline-first mobile application, the system significantly reduces data loss, duplication, and delayed reporting. The application enables ASHA workers to register beneficiaries, maintain comprehensive electronic health records, track maternal and child health activities, manage home visits, send reminders, and handle emergency referrals effectively, even in low- connectivity areas.

The integration of offline storage, automatic synchronization, multilingual support, and role-based access ensures that the system is both user-friendly and compliant with healthcare data security standards. Supervisors and health authorities benefit from real-time reports and dashboards, which enhance monitoring, decision-making, and resource allocation at the grassroots level.

Overall, this project demonstrates that mobile health solutions can empower ASHA workers, improve healthcare delivery, and contribute to better health outcomes in rural communities. By leveraging modern Android technologies and a robust system architecture, the application provides a scalable and sustainable approach to digital health management, supporting India's mission to strengthen primary healthcare services.

VI. FUTURE SCOPE

The Mobile-Based EHR Companion for ASHA Workers has demonstrated significant potential in improving rural healthcare data management and service delivery. However, several enhancements and technological integrations can further expand its capabilities and impact in the future.

1) Integration with National Health Systems In the future, the application can be integrated with national digital health platforms such as Ayushman Bharat Digital Mission and the ABHA (Ayushman Bharat Health Account) system. This integration would allow beneficiary health records to be linked with a national health ID, enabling seamless sharing of medical information across hospitals, PHCs, and government health programs.

2) Artificial Intelligence for Risk Prediction Artificial Intelligence and Machine Learning models can be incorporated to analyze beneficiary health data and predict high-risk cases such as high-risk pregnancies, malnutrition in children, or chronic disease complications. Predictive analytics would help ASHA workers and health officials take preventive actions earlier.

3) Telemedicine Integration: Future versions of the system can include telemedicine features where ASHA workers can connect patients with doctors through video or audio consultations. This will be particularly beneficial in remote villages where access to medical specialists is limited.

4) Integration with Wearable and IoT Devices The application can be extended to support wearable health monitoring devices such as digital blood pressure monitors, glucose meters, or pulse oximeters. These devices could automatically upload patient vitals into the EHR system, improving accuracy and enabling continuous health monitoring.

5) Advanced Analytics and Decision Support Systems Future development can include advanced dashboards and analytics for district health officers and policymakers. These dashboards can provide predictive insights about disease outbreaks, vaccination coverage, maternal health trends, and healthcare resource allocation.

6) Expansion to Other Community Health Workers Currently focused on ASHA workers, the system can be expanded for use by other frontline health workers such as Auxiliary Nurse Midwives (ANMs) and Anganwadi Workers under the Integrated Child Development Services program. This would create a unified digital health ecosystem at the village level.

7) Voice-Based Data Entry and Regional Language Support To make the application more accessible, voice-based data entry using speech recognition in regional languages such as Marathi and Hindi can be introduced. This would reduce typing effort and improve usability for workers with limited digital literacy.

8) Cloud-Based Scalable Infrastructure Future upgrades may include migrating the backend system to scalable cloud platforms for better data management, faster synchronization, and improved disaster recovery mechanisms.

9) Public Health Surveillance and Disease Tracking The system can also be enhanced to support real-time disease surveillance, enabling early detection of outbreaks such as dengue, malaria, or other communicable diseases. Health authorities could use aggregated data to plan targeted interventions and improve community health outcomes.

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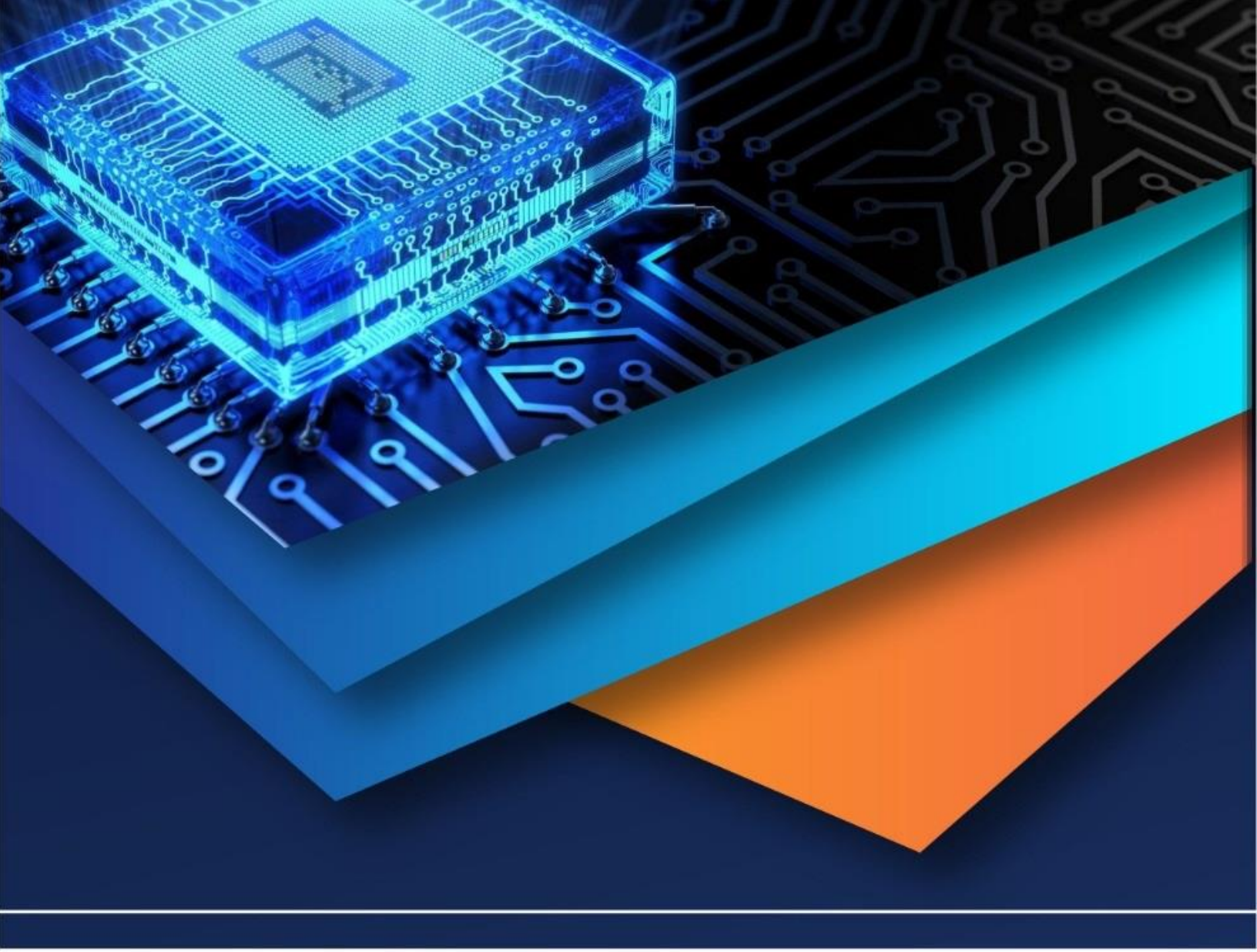

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