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Food Saver: A Sustainable Solution Redistributing Surplus Food

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Abstract: ***Food waste has emerged as a pressing global concern, with restaurants and hotels discarding significant quantities of surplus food each day. At the same time, millions of individuals continue to face hunger and food insecurity. Bridging this disparity requires a systematic, technology-enabled approach that ensures surplus food is effectively redistributed tocommunities in need. The Food Saver application addresses this challenge by providing a comprehensive digital platform designed to connect restaurants with NGOs, thereby promoting sustainable food management practices and social welfare.***

The primary objective of Food Saver is to facilitate real-time coordination between restaurants generating surplus food and NGOs responsible for collecting and distributing it. Theapplication enables restaurant managers to log food donations efficiently, providing detailed records of donation history and quantities. NGO users can browse available food donations, place requests,andtrackcollectionactivities.Anadministrativeinterface allows system administrators to oversee platform activities,generate reports, and ensure the integrity of operations. These interactions aresupportedbyessential featuressu chassecure user authentication, user profile management, and a responsive notification system powered by Firebase Cloud Messaging.

To ensure robust performance and scalability, the system is developed using Android Studio with Java for the frontend and Firebase or Node.js for the backend. The database layer utilizes Firebase RealtimeDatabase orMySQL, enabling seamless storage and retrieval of real-time data. Material Design UI components offer a clean, user-friendly interface, while data security protocols safeguard sensitive user and donation information. A feedback mechanism allows NGOs to provide insights into their collection experiences, helpingrefineoperations andimproveservicequality.

I. INTRODUCTION

Food waste is a widespread issue that affects both developed and developing nations. Large quantities of edible food are discarded daily by restaurants, hotels, and various foodservice establishments, even as many people struggle tosecure adequate meals. This imbalance highlights the urgent need for efficient systems thatcanredistributesurplusfood to communities in need. Leveraging technology offers apractical and scalable solution to bridge this critical gap.

Food Saver is a web-based application designed tominimize food waste by connecting restaurants with NGOs that distribute food to underserved populations. The platform provides a centralized online system where restaurants can register surplus food in real time, and NGOs can view and request available donations efficiently. By simplifying communication and coordination between these stakeholders, the system ensures that surplus food reaches beneficiaries quickly and safely.

The application incorporates essential features such as secure user authentication, role-based dashboards, food donation tracking, real-time notifications, and a feedback mechanismto improve service quality. Built using modern web technologies, Food Saver ensures accessibility from any device with an internet connection, making it practical for diverse users. The backend infrastructure, powered by Firebase or Node.js with a robust database system, ensures reliable data handling and real-time interactions.

The platform incorporates keyfunctionalities such as secure user authentication,role-baseddashboards,real-timenotifications,and feedback mechanisms to improve transparency and communication between stakeholders. By using modern web technologies—such as HTML, CSS, JavaScript, and React or Angular for the frontend, paired with a backend built using Node.js or Firebase—the application ensures a fast, responsive, and user-friendly experience. A robust database system, such as Firebase Realtime Database, Firestore, or MySQL, forms the foundation for storing user profiles, donation records, and transaction histories. Additional measures like data encryption and secure API endpoints ensure the confidentialityand integrity of all

Themotivation behind Food Saver extendsbeyond technology; it aligns with broader goals of sustainability, social impact, and community development. By redirecting food that would otherwisebewasted, theplatformhelpsreducetheenvironmental footprint associated with food disposal, including greenhouse gas emissions and resource wastage.

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Moreover, it plays a vital role in supporting food-insecure populations, making it an essential tool for NGOs and social welfare organizations.

In essence, Food Saver demonstrates the transformative potential of digital platforms in addressing real-world challenges. By creating an organized and collaborative environment for food redistribution, thesystem not onlyminimizes food waste but also fosters a culture of social responsibility and shared community welfare. This project stands as a practical example of how technology can be leveraged to create meaningful, long-term solutions that benefit both society and the environment.

Inrecent years,digital technologyhas emergedasa powerful tool for tackling societal challenges. Web applications, in particular, offer accessibility, scalability, and real-time connectivity— qualities essential for building efficient systems to manage food redistribution. Food Saver is a web-based platform designed to harness these capabilities to reduce food waste and enhance the flow of surplus food from restaurants to NGOs that cater to underprivileged communities.

Food Saver operates as a centralized online system that streamlines the process of donating, requesting, and tracking surplus food. Restaurants can easily log details of available food items, specifying quantity, category, and pickup time. NGOs can browse these listings, place requests based on their needs, and coordinate collection directly through the platform. The system also provides administrators with oversight capabilities, allowing them to monitor donations, verify users, generate analytical reports, and ensure smooth operations

II. LITERATURE SURVEY

A. Scale of the problem

Food waste is a major global problem with important social, economic and environmental consequences. The UNEP Food Waste Index Report (2021) estimates that hundreds of millions of tonnes of food are wasted annually and that food waste contributes roughly8–10% of global greenhouse gas emissions; subsequentUNreportingplaces theglobal food-wasteburdenat roughly a fifth of produced food (over a billion meals per day) and highlights the disparity between surplus and chronic food insecurity. The FAO and other international data platforms further document that substantial shares of food loss and waste occur at the food-service stage (restaurants, catering, hospitality), making this sector a key target for redistribution initiatives.

B. Existing redistribution platforms and operational examples

Several technology-enabled food-redistribution models have been implemented around the world. Prominent examples include Food Rescue US (a technology platform that matches donors and receivers and coordinates pickups), FoodCloud (UK/Ireland, linking retailers/restaurants to local charities), Karma (Sweden — a consumer-facing marketplace for surplus food), and OLIO (peer-to-peer sharing of surplus food). These platforms vary in scope (peer-to-peer vs. donor→charity), business model, and features, but share common elements: real- time listings of available food, role-based accounts, andlogistics coordination for pickup/delivery. Impact and operational reports (e.g., Food Rescue US impact reports) show these platforms can recover substantial volumes of edible food and scale rapidly when matched with local volunteer or carrier networks.

C. Evidence on mobile/web apps and effectiveness

Academicresearchassessingappsandplatformsthatreduce foodwasteis growing.Systematic literature reviewsand pilot studies indicatethat digital applications can positivelyinfluence food rescue outcomes and consumer behaviour, but effectiveness depends onuser adoption, ease of use,trust, and thelogisticsmodelemployed.Studiesinvestigatingconsumer willingnesstousefoodwasteappshighlightthatperceivedconvenience,perceivedbenefits(cost,socialgood),andclearsafety/qualityinformationaremajordeterminantsofuptake.Pilotevaluations(includinguniversitystudentstudiesandsmallscaletrials)showpromisebutalsocallfor larger, longitudinalstudiestomeasuresustainedimpactonwastereduction and food security

III. METHODOLOGY

Themethodologyadoptedfor developingthe *FoodSaver*web application follows a structured and systematic approach to ensure efficiency, reliability, and usability. The processbegins with requirement analysis, where the needs of restaurants, NGOs, and administrators are studied to define the core functionalities, such as food donation tracking, request management, notifications, authentication, and feedback handling. Once the requirements are clearly identified, the project moves into the system design phase, which involves creating the overall architecture of the platform, designing the database schema, and preparing UI/UX wireframes for different user interfaces

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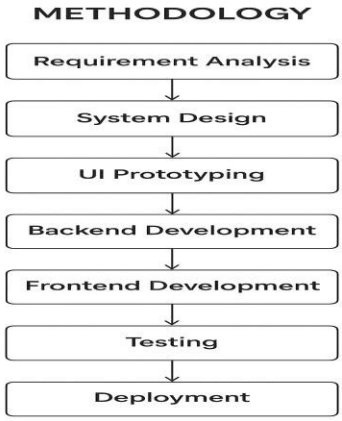

Fig.1.ImplementationFlow

1) The system is structured using a three-tier architecture consisting ofthe frontend, backend, and database layers, with role-based access to ensure secure and appropriate use of the system.
2) Following design, the **frontend development** stage focuses on building responsive and user-friendly interfaces using modern web technologies such as HTML,CSS,JavaScript,andReactor Angular.This phase ensures that restaurants, NGOs, and admins can easily interact with the system. In parallel, the **backend development** phase implements server- side logic using Node.js or Firebase, creating secure APIs for authentication, donation posting, request handling, data retrieval, and notification delivery. The database, built using Firebase Realtime Database,Firestore,orMySQL,ensuressmoothdata storage and real-time updates. After both frontend and backend modules are ready, the During the transportation stage, the system maintains **tracking and status updates** so that donors and administrators can monitor donation progress. Delivery confirmation occurs once food is handed over to beneficiaries, at which point records and digital receipts are stored in the database for auditing, analytics, and impact assessment. Throughout the process, a role-based access model ensuresthatdifferentstakeholders—donors,NGOs, administrators,andvolunteers—interact with onlyrelevant modules, preserving data integrity. Finally, feedback is collected from NGOs and donors to evaluate user satisfaction, monitor wastage reduction, and identify operational bottlenecks. Aggregated analytics from the platform allow administrators to evaluate long-term trends suchasaveragedonationsize,collection frequency,pickup delays, and geographic coverage, forming a data-driven basis for ongoing system improvement. The methodology behind the Food Saver platform is designed to ensure a reliable, safe, and efficient redistribution of surplus food from hotels and restaurants to NGOs and ultimately to communities in need.
3) The process begins with **stakeholder onboarding**, where each donor organization registers on the platform, providing essential information such as business details, geo-location, operational timings, food preparation standards, and legal compliance requirements. These credentials are verified by the administrator to maintain authenticity and prevent misuse. Once registered, donors can submit surplus food entries through a structured interface that captures detailed attributes including food category (vegetarian, non-vegetarian, cooked, packaged), preparation timestamp, estimated shelf life, preservation status, quantity, and preferred pickup time.
4) This standardized data entry minimizes ambiguity and helps NGOs identify suitable donations based on their internal capacity and the demands of their beneficiaries Following the submission, the system employs **real-time notification and prioritization mechanisms** to broadcast available food donationsto nearbyNGOs. Thenotification modelconsidersseveralparameterssuchastraveldistance, food expiry windows, previous acceptance history, and food suitability. NGOs then reviewthedonor'ssubmission through their dedicated dashboard and evaluate whether they can mobilize a pickup team within the specified time frame. Once an NGO accepts a request, the platform locks thedonation slottoavoidduplicatepickupsandmarksitas "assigned" in the database. In scenarios where multiple NGOs express interest in the same donation,
5) Thesystem automatically prioritizes the one with the shortest response time and logistical readiness, while notifying others of the updated status The next stage involves **allocation and logistics coordination**, where NGO coordinators assign pickup tasks to registered volunteers or transport personnel. The platform integrates features tohandle vehicle assignment, routing suggestions, estimated travel time, and volunteer availability to reduce delays.

During pickup, the system logs timestamps for dispatch, transit, and arrival, ensuring traceability throughout the journey. Volunteers validate the food condition on-site

IV. RESULTS AND DISCUSSION

TThe deployment and evaluation of the Food Saverplatform yielded substantial results in terms of operational efficiency,communityimpact,andstakeholderengagement. Throughout the pilot phase, hotels and restaurants participating in the system were able to register surplusfood donations with significantly reduced effort comparedto traditional methods such as phone-based coordination or manual record-keeping. The digital interface simplified reporting by enabling donors to enter key details such as quantity, type of food, and preparation time, which allowed NGOs to receive structured and timely information. This reduced ambiguity and improved decision-making about whether an NGO could accept the donation based on availability and logistical capacity. Additionally, the categorization of food donations based on freshness and storage requirements helped NGOs appropriately prioritize pickups, especially in cases where multiple donations occurred simultaneously.

Amajor observation related totheresponsivenessofNGOs. Because the system provided real-time notifications and updates, NGOs could mobilize resources—including volunteers and vehicles—more efficiently. Previously, food redistribution relied heavily on fragmented communication channels, which often resulted in delays or missed opportunities. The Food Saver platform's workflow significantly reduced such inefficiencies. In some cases, NGOs reported that average pickup time decreased because driver routing became more systematic and requests could be triaged based on proximity. The dashboard functionality further supported decision-making by enabling administrators tomonitor active donations, track fulfillment status, and identify bottlenecks in the chain. This transparency improved accountability and offered a clear overview of the flow of donations.

FIG.2.WELCOMEPAGE

A major observation related to the responsiveness of NGOs. Because the system provided real-time notifications and updates, NGOs could mobilize resources—including volunteersandvehicles—moreefficiently.Previously,food

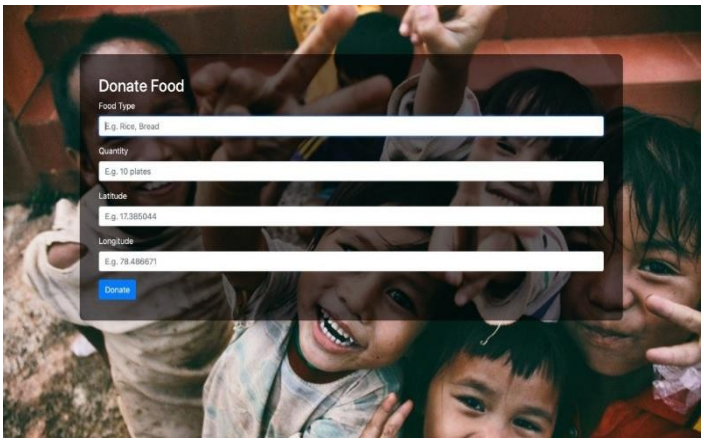

FIG.3.HOTELDONATION

redistribution From an environmental standpoint, the results were promising. The system allowed hotels to redistribute food thatwould otherwise have been disposed of. Even within a limited test window, measurable reductions in food waste were observed, suggesting that scaling the platform would amplify environmental benefits. This aligns with broader sustainability goals such as reducing landfill contributions and lowering methane emissions from decomposing organic matter.

The project also contributed toa circular foodeconomymodel bytransformingsurplusresourcesinto nutritional assets for underserved communities. Beneficiaries reported improved access to varied meals, particularly during peak hotel operation periods such as weekends or events.

User feedback revealed strong acceptance of the platform, particularly regarding ease of use and reliability. Donorsappreciated that the system provided structured communication, which reduced uncertainty and reduced repetitive follow-ups with NGOs. NGOs valued the ability to choose donations based on geographiclocationandfoodsuitability, whichhelpedprevent over- collection or mismatches between supply and demand. Despitethese strengths, limitations were identified. The platform's performance was tested primarily under controlled or small-scale distribution networks. When attempting to manage multiple simultaneous donors and geographically dispersed NGOs, the absence of automated route optimization resulted in inefficiencies. Similarly, while the system captured key metrics such as donation history and delivery confirmations, advanced analytics were not available to forecast demand trends or surplus generation patterns

FIG.4.HOTELLOGIN

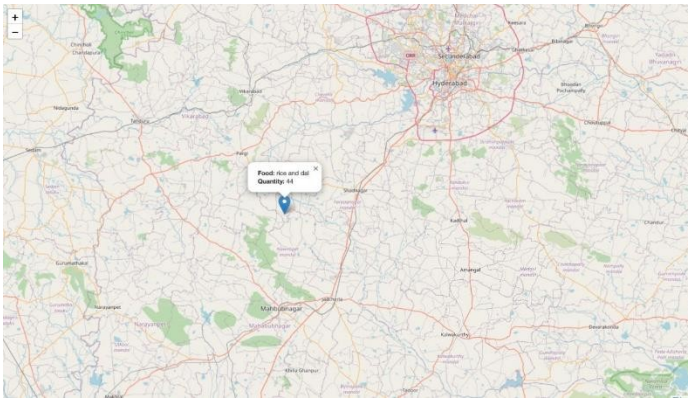

FIG.5.MAPTRACKING

V. CONCLUSION AND FUTURE SCOPE

The Food Saver platform demonstrates a sustainable and scalableapproach totacklingthedualchallengesoffoodwaste and food insecurity. By creating a technology-driven bridge between hotels, restaurants, and NGOs, the system ensuresthat edible surplus food is efficientlyredistributed to people in need. The web-based architecture improves accessibility, enabling real-time coordination, transparency, and traceability across the donation supply chain. Integrating features such as surplus estimation, quality checks, user role management, and delivery tracking significantly reduces delays and operational inefficiencies.

Ultimately, the solution not only promotes environmental sustainability by minimizing landfill waste and carbon emissions, but also supports social welfare by enhancing nutritional access for vulnerable communities.With increased adoption, Food Saver can contribute tobuildingacircular food ecosystem wheresurplusresources are redistributed responsibly rather than discarded. creating tamper-proof transaction records between donors and beneficiaries, whileIoT devicesmayhelpmonitorfoodquality and temperature during storage or transportation.

Expanding the platform to include supermarkets, event venues, cloud kitchens, and corporate cafeterias could further increase its reach andimpact. Additionally, developingadedicatedmobile application with features such as GPS tracking, instant notifications, optimized delivery routing, and volunteer management would improve usability and responsiveness. Collaboration with government agencies, CSR programs, and humanitarian organizationscan alsosupportpolicyinnovation, funding opportunities, and structured scaling of redistribution networks. Ultimately, these advancements can transform Food Saver into a multidimensional ecosystem Ultimately, the solution not only promotes environmental sustainability by minimizing landfill waste and carbon emissions, but also supports social welfare by enhancing nutritional access for vulnerable communities

The Food Saver initiative can be significantly enhanced in the future through the integration of advanced technologies and broader stakeholder collaboration. Machine learning and predictive analytics can be used to forecast surplus food availability, streamline procurement, and prevent last-minute wastage. Blockchain-based traceability could strengthen transparency by creating tamper-proof transaction records between donors and beneficiaries, while IoT devices may help monitor food quality and temperature during storage or transportation. Expandingthe platform toinclude supermarkets, event venues, cloud kitchens, and corporate cafeterias could further increaseitsreachandimpact. Additionally, developinga dedicated mobile application with features such as GPStracking, instant notifications, optimized delivery routing, and volunteer management would improve usability and responsiveness. Collaboration with government agencies, CSR programs, and humanitarian organizations can also support policy innovation, funding opportunities, and structured scaling of redistribution networks. Ultimately, these advancements can transform Food Saver into a multidimensional ecosystem

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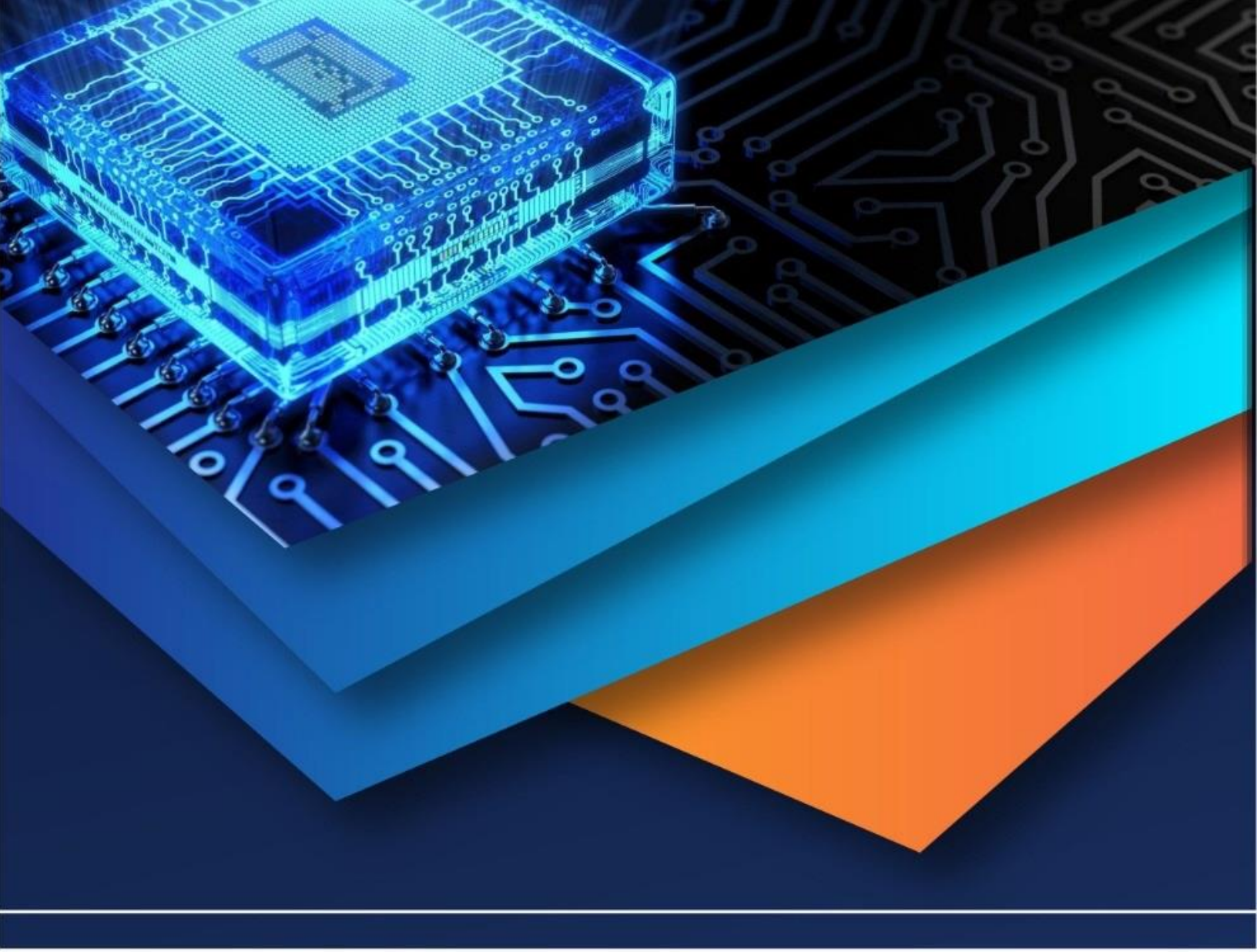

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