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E-Tender Procurement Solutions

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***Abstract:** In today's day and age of the 21st century, India is moving towards an advanced technological advancement where the old and hereditary methods are been revolutionized to become hassle-free and paperless. One of the main aspects of governments, big private and public entities is to ensure that they get the best and budget-friendly products based on the requirements put forth. To get such products companies put out a document known as tenders. These tenders specify the job description time duration estimated cost and other details related to the expected result. In olden times the advertisement of tenders was given in newspapers and the companies used to send the bids and tender requests in a closed and sealed envelope. These envelopes used to be opened on a decided date to ensure transparency in the process. As time progressed the people started manipulating the tenders by changing the amounts to the lowest possible figures thus managing the results. To end this monopoly and eliminate the geographical advantage we are hereby proposing a methodology that will ensure that such discrepancies do not happen. The model we are proposing is known as E tender procurement solutions. This model is based on a user-friendly framework and an assurance of data protection and manipulation-free environment through blockchain. The model can be used as a base where companies can customize it and use it as a self-product.*
***Keywords:** Tenderer, Tenderee*

I. INTRODUCTION

A tender is an offer to perform a task or supply goods at a fixed price. In the initial step of the tendering process, contractors submit sealed bids for construction or specific services within a specified timeframe. The e-tendering process in India aims to ensure fair government or client work, considering various procurement policies guiding tender acceptance decisions.

Once a tender is accepted, it becomes a binding contract, obligating the winning party to provide agreed goods and services at the offered price, and the client to pay within the agreed timeframe. The E-Tender procurement solution system streamlines this process, allowing suppliers to access tender details online and bid, reducing extra costs associated with advertising, document processing, and confirmation results. The system eliminates the need for paper-based document handling, enabling a more efficient evaluation process completed within the due date.

In the realm of the digital world, procurement activities are akin to B2B transactions, involving bulk volumes, complex variables, and bureaucratic workflows. Past procurement activities relied on manual processes, known for their time-consuming nature and susceptibility to errors. Recent initiatives leverage improved internet-based technology to enhance citizen-government interactions, streamline processes, and improve customer service quality. Within Government initiatives, G2B interactions involve government departments procuring goods or services from suppliers through open tendering or other means. E-tendering, as part of Government plans, adds value to trading parties by leveraging internet technology to facilitate the procurement process for both procurers and suppliers, aiming to improve productivity and effectiveness.

Procurement, as the process of buying goods or services, traditionally involves tendering, wherein an entity specifies its requirements and opens a bidding process. Traditional tendering, primarily paper-based, is labor-intensive, managing receipts, recording, and distributing tender submissions. Drawbacks include disqualification due to late responses, postal delays, incorrect addressing, and a long, expensive, error-prone cycle with demanding storage space. Seeking alternatives, the advent of internet-based technologies introduced E-tendering, increasingly attractive to organizations for procurement, replacing traditional methods.

E-Tender Procurement Solutions, using the internet in purchasing, helps reduce waste, and business costs, streamline processes, access wider markets, and facilitate organized communication among stakeholders. Since it is an internet-based process, involves inviting offers from suppliers, receiving electronic responses, and exchanging tender documentation electronically for the procurement of goods or services and awarding contracts. It replaces paper-based tender processes with an electronic medium for submitting, receiving, communicating, publishing, and accessing information or documentation related to a tender on the Internet.

Thus, facilitating the integration and management of business processes, and enhancing efficiency within and across organizations.
The primary objective of E-Tender Procurement Solutions is to enhance security, authenticity, and accountability in the tendering process.
It aims to save time, effort, and money in the procurement cycle for both suppliers and contractors. Compliance with CVC (Central Vigilance Commission) guidelines is essential, with a focus on improving transparency and accountability in public procurement, fostering a positive organizational image. The system's goal is to motivate suppliers, empower officials to reduce costs and enhance internal efficiency through automation. Achieving a paperless environment in the organization, covering end-to-end tendering activities while maintaining control, is a key objective. Ultimately, using a system that seeks to acquire products or services efficiently and cost-effectively.

II. LITERATURE REVIEW

The literature delves into the shift from manual to automated supply chain processes, particularly focusing on electronic tendering. It introduces a conceptual model for a fully automated web-based tendering process, aiming to replace manual procedures and integrate them into an enterprise's Tendering Management System. Another study explores e-procurement adoption challenges in Portugal, reviewing the literature on barriers and enablers. The paper evaluates manual tender evaluation in Vietnam, proposing an automated online approach to balance computational efficiency and cultural expediency, ensuring trust in the government's e-procurement system.
Trust issues persist due to centralized e-governance, prompting a decentralized, permissioned blockchain-based approach to enhance transparency and fairness.
A China-focused analysis over ten years addresses corruption in the bidding market, proposing an e-tendering platform model. E-procurement benefits are highlighted in an Andhra Pradesh case study, and efficiency comparisons in Bangladesh show e-procurement's advantages. Finally, the research underscores the importance of public demand for innovation and robust state-level procurement for innovative markets, emphasizing user-producer interaction and interactive learning in global public procurement practices.
The papers focus on internet-based information systems supporting the tendering process. It introduces a Supply Point system and e-tendering with Web Services, both facilitating electronic tendering for the construction industry.
The systems provide tender document details, allowing tenderers to submit prices via Web services. Pretender is a web-based tender management system for selecting prequalified tenderers. To enhance integrity and transparency in prequalification tendering, the paper proposes using the Domain Engineering approach to develop generic, reusable, and modular designs, emphasizing a lack of comprehensive solutions in the existing literature.
The advantages that existing e-tendering models offer are an increase in efficiency, higher quality of vendor pool, increased return on investment, and transparency.
Disadvantages of existing e-tendering models are slow and unresponsive pages, authentication of suppliers, limited innovation, and cost of training is high.

III. PROPOSED MODEL

The "E-Tender Procurement Solutions" streamlines processes, reducing labor and time. It allows suppliers to download, edit, and upload tender documents, view tender statuses online, and participate in multiple tenders. The system eliminates postal document exchange, enabling immediate responses to existing tenders.
To minimize paperwork, administrators make decisions based on available online data, facilitating direct communication with suppliers. The system ensures interactivity through browser-side data validation, providing download and print facilities for suppliers and administrators. The proposed design modularizes user roles, enhancing flexibility for integration with existing workflows.
It introduces technical support modules, including a database for information storage and a web service module for Intranet data passing. While most systems conduct backend processes manually, the committee and evaluator modules in this design aim to automate workflows. As the system evolves, future automation may include software agent technology and trading rules for a fully automated scenario.

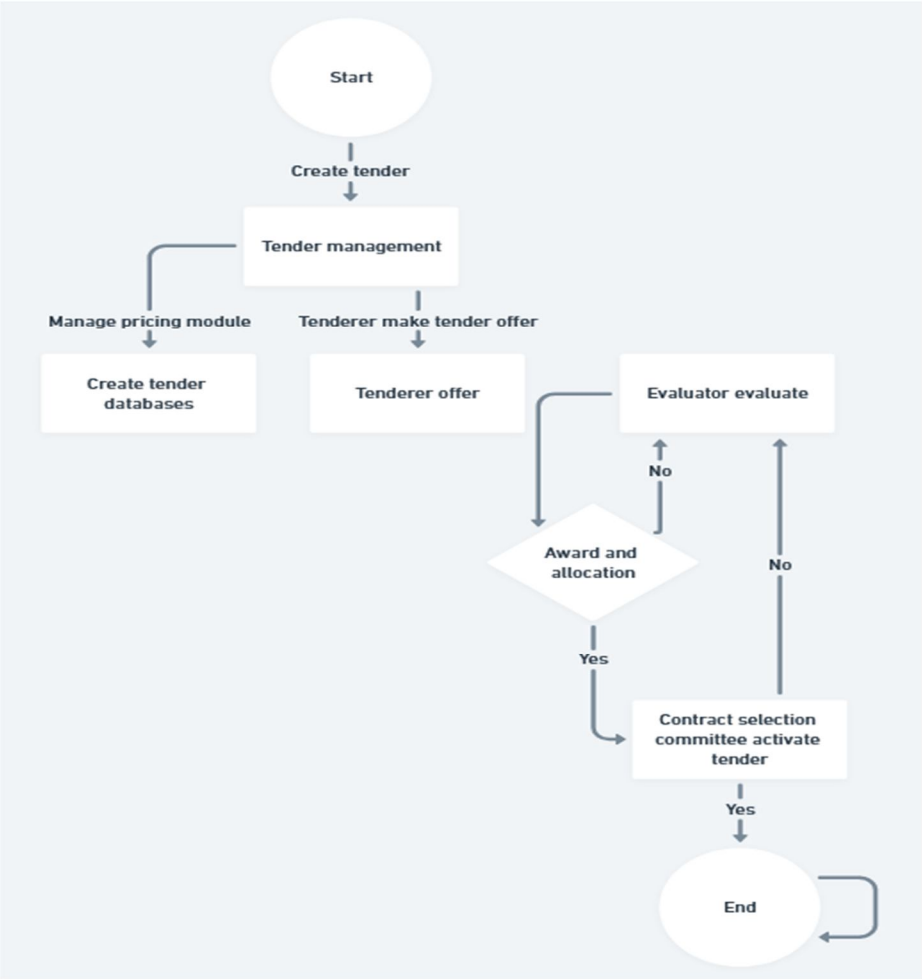

Fig 1: Flowchart of E-Tender Procurement

A. Tenderee

The Tenderee module plays a crucial role in the E-Tender Procurement solutions system, encompassing functions such as creating tenders and selecting contracts. It facilitates the creation of three types of tenders: public, private, and re-tendering, with public tenders open to all qualified bidders, private tenders tailored for specific suppliers, and re-tendering allowing the resubmission of bids to closed tenders under specific circumstances. Tenderee employs a flexible approach by enabling real-time addition of criteria and uploading various contract drawings. Tenders are stored in a user-friendly format for interoperability, promoting document reuse and sharing within departments if needed. During tender creation, criteria are established, and weights indicate their importance in scoring. Tenderee can choose a standard interface or add custom criteria. Following evaluation, Tenderee is responsible for contract selection, ensuring fairness by confirming the default winner or choosing an alternative with the highest overall score. In cases of multiple winners, the Tenderee establishes a cutoff score and calculates unit prices, employing algorithms for equitable tender allocation among the winners. This module's comprehensive functionalities contribute to a flexible and efficient tendering process within the broader framework.

B. Tenderer

The tenderer module enables suppliers to submit tender offers and register goods for tenders. Tenderers can provide clear quotations based on posted criteria, fostering transparency in the tendering process. Encouraging prior registration of goods or services ensures consistency in specifications for the tender. The module facilitates easy retrieval of tender and priced item information from databases, promoting information accuracy and minimizing human error. After submitting an offer, the data is recorded for potential future use. This streamlined approach enhances efficiency and accuracy, aligning with the overarching goal of optimizing the tendering process. The evaluator module handles bid evaluations in the system.

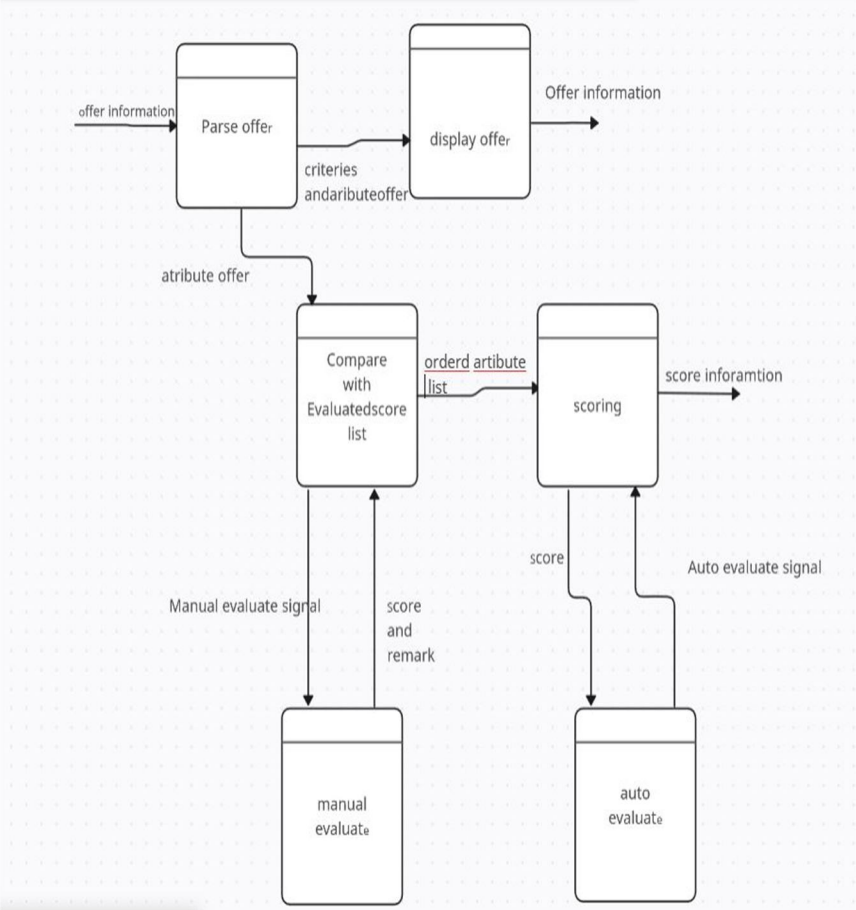

Fig 2: DFD of E-Tender Procurement Solution

C. Evaluation

During the evaluation process, the evaluator parses the tender offer, retrieving its attributes. Evaluation can be manual, with the 'Scoring' sub-module prompting explicit scores for each attribute, calculating an overall score based on preset weights. Alternatively, automatic evaluation uses algorithms to assess each attribute, contributing individual scores to the overall score—a weighted sum of attribute scores. This flexible approach allows for efficient and accurate evaluation, aligning with the diverse needs of the E-Tender Procurement Solutions system. Once all tender offers are evaluated, overall scores are sorted in descending order for tendered consideration. Pseudocode is provided for transparency. To prevent monopoly, the system accommodates multiple tender winners, typical in Government procurement scenarios. Cooperative and competitive allocation modes are proposed, and predetermined during tender creation based on the intended number of winners and the chosen allocation method.

D. Allocation

Cooperative allocation involves splitting the final tender offer into various combinations to find the highest-scoring one. Assuming the tender is a composite tender, similar to a bill of materials, suppliers are willing to provide specific parts if chosen as multiple winners. These assumptions make cooperative allocation feasible. If multiple suppliers have the highest score for an attribute, a random selection is made to ensure fairness. These considerations align with real-world scenarios, thus optimizing the allocation process.

In competitive allocation, the composite tender is considered a set of different items, each with associated weights. Tenderers provide prices for each item, evaluated to obtain a composite bid score. The tenderer sets a cut-off score to select multiple winners; those below are chosen. Winners supply items at the calculated unit price. Allocation can follow an average or ratio allocation. In average allocation, item demands are evenly divided among winners. These competitive allocation mechanisms enhance flexibility, catering to varied scenarios in the system.

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IV. RESULTS

Buyer initiates tender creation on the platform, detailing procurement needs. Smart contracts set terms. Published tender accessible to registered suppliers for bids.

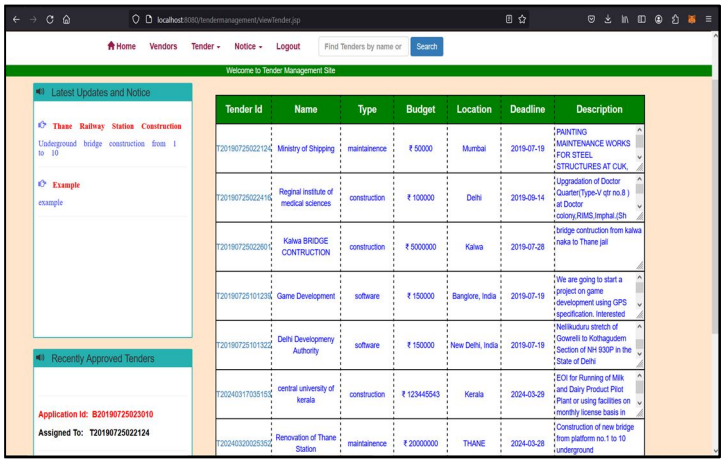

Fig 4.1Tenders aligned in system

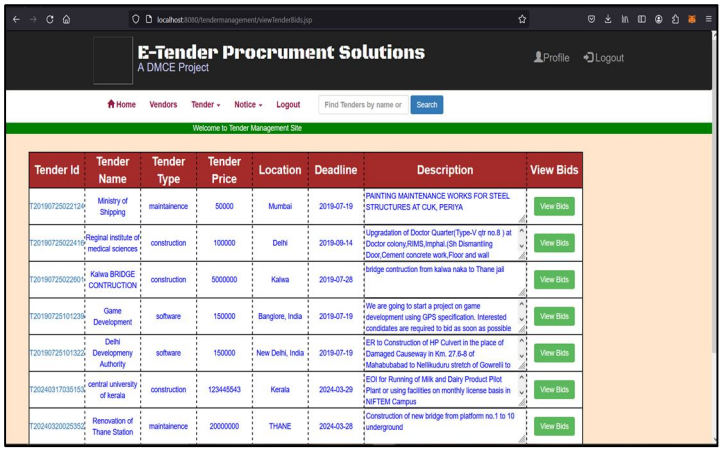

Fig 4.2. The Tender Bids page shows the bid status

The buyer selects the winning bid and notifies the supplier(s). Contract award specifies terms and payment milestones. Smart contracts execute terms and secure agreements on blockchain for transparency.

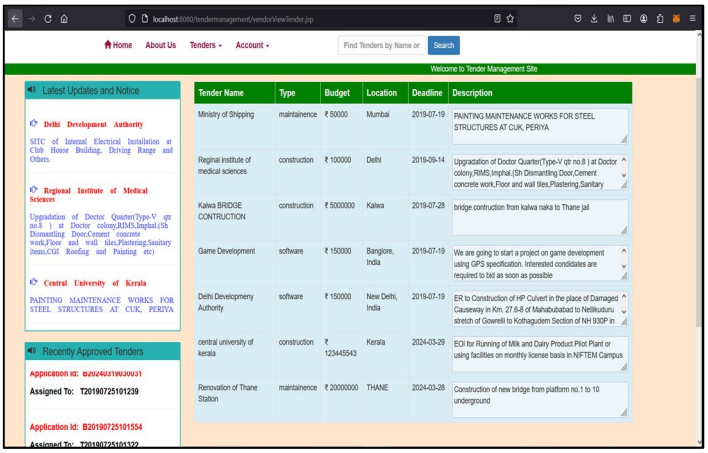

Fig 4.3. View Tender Page

Buyer and supplier(s) execute agreement terms, including payments and deliveries. Blockchain tracks milestones for real-time monitoring. Smart contracts automate payments based on conditions, enhancing efficiency and reducing manual processes.

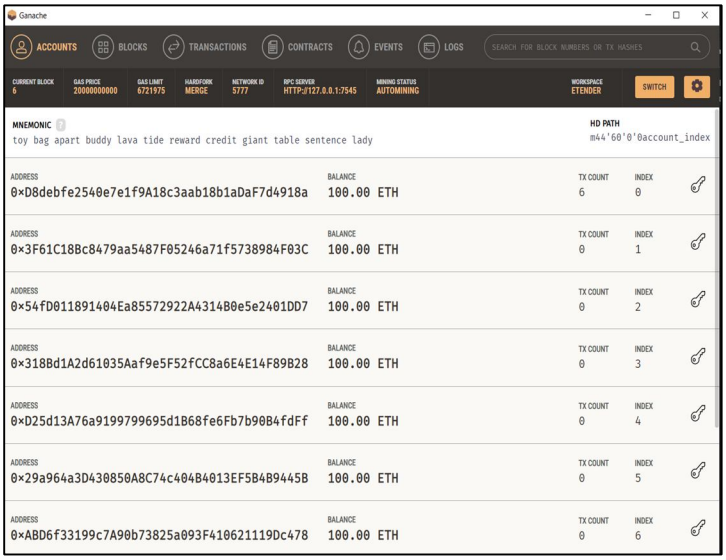

Fig 4.4 Contract page in the Ganache showing transactions history

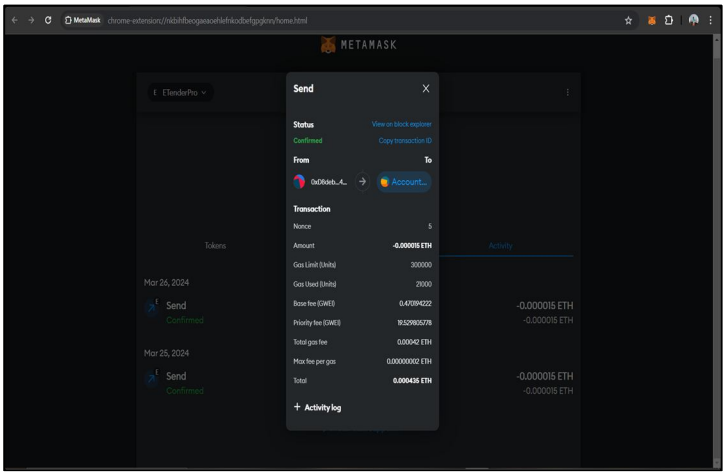

Fig 4.5. Current Transaction in the MetaMask

V. CONCLUSION

To conclude, the model we are proposing can create wonders in every field of human purchase due to its scalability and feature of addressing nano concerns to macro concerns in all walks of work. Due to this individual will benefit and achieve a sense of assurance along with a guarantee of purchasing the best in whichever domain they wish. Users will not be limited to a geographical periphery and can expand their profile throughout the world. Although the model works on the current best standards there are some scopes by which future development can be achieved in the technology stack. For example, file system implementation can be revised to reduce the time frame Security is the most important feature of the system and it should be always updated with the current best technology possible.

VI. FUTURE WORK

The future of blockchain-based electronic tender procurement solutions is promising, with potential for refinement, integration with AI and IoT, and expansion into diverse sectors. Enhanced user interfaces, AI-driven decision-making, and interoperability with IoT devices can optimize supply chain management. Additionally, decentralized finance innovations offer streamlined payment processes and financing options, benefiting both buyers and suppliers.

VII. ACKNOWLEDGEMENT

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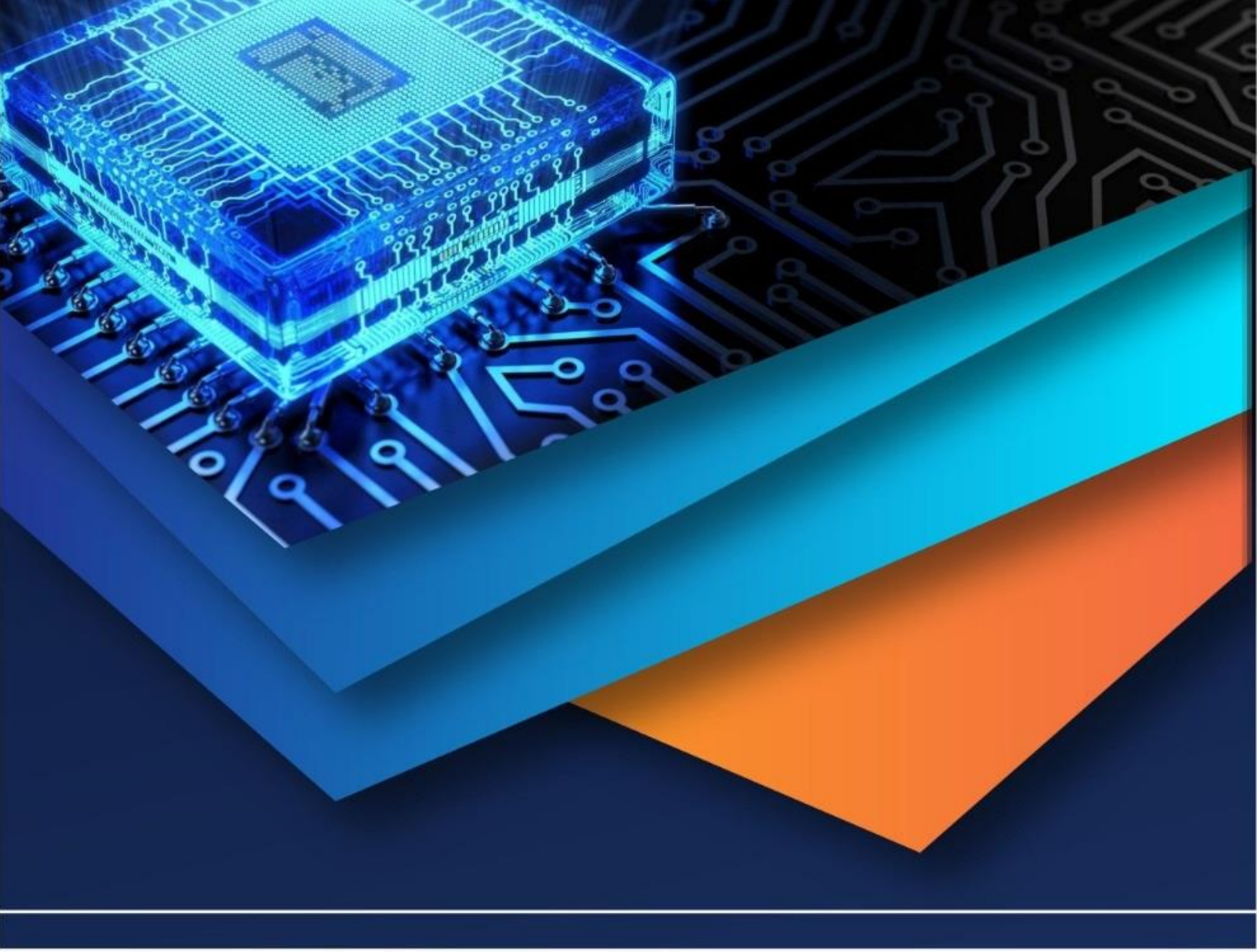

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