The Future of E-Tendering using Blockchain

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Abstract: *The project investigates the application of blockchain technology, specifically Ethereum-based smart contracts, to develop a distributed e-tendering system aimed at addressing the security implications inherent in traditional procurement methods. Divided into four sections, it focuses on tender creation and publishing, bidding, evaluation, negotiation, and selection of the winning bid. Each phase employs distinct algorithms to ensure efficiency and fairness. By leveraging blockchain's decentralized nature and robust encryption, the system aims to enhance security and transparency, thereby fostering trust in the tendering process. Through a comprehensive evaluation, the project assesses the security and audibility challenges inherent in conventional methods and compares them with the proposed blockchain-based solution. Ultimately, the project seeks to establish a fair, transparent, and open tendering scheme, laying the groundwork for more efficient procurement practices in both governmental and corporate sectors.*

Index Terms: *Blockchain, Fair and Open Tendering Scheme, smart contract, ethereum, e-tender*

I.   INTRODUCTION

In the contemporary landscape of procurement, electronic tendering (e-tendering) systems have become the norm for governments and businesses alike. These platforms serve as the primary means through which goods and services are procured from various suppliers. However, amidst the convenience and efficiency that e-tendering promises, fundamental issues persist, casting shadows over the fairness, transparency, and security of the process.

Central to the concerns surrounding e-tendering systems is the lack of transparency and openness in information dissemination. The right to information, a cornerstone of democratic governance, is often compromised as stakeholders find themselves in the dark regarding crucial aspects of the tendering process [1]. Information regarding the selection of winning bids and the reasons behind the rejection of others is often withheld, shrouded in bureaucratic opacity. This asymmetry in information distribution not only undermines the principles of fairness but also inhibits accountability and trust in the system.

Compounding these issues is the cumbersome and tedious process involved in obtaining critical data related to tendering decisions. While stakeholders, particularly competing companies, have the right to request such information, the bureaucratic hurdles and time-consuming procedures involved serve as deterrents, dissuading many from pursuing transparency [1]. Consequently, the opacity surrounding tendering decisions persists, perpetuating a culture of mistrust and suspicion among stakeholders.

Moreover, beyond the realm of transparency, security emerges as a paramount concern plaguing conventional e-tendering systems. The centralized nature of data storage renders these platforms vulnerable to cyber threats, fraud, and manipulation [2],[3]. A breach in the security defenses of these centralized databases poses grave risks, potentially exposing sensitive bid information to malicious actors. Such breaches not only jeopardize the integrity of the tendering process but also entail significant financial and strategic ramifications for businesses [4]. The prospect of bids being leaked to competitors looms large, threatening the competitive advantage and viability of organizations.

Amidst these challenges, blockchain technology emerges as a promising solution poised to address the security implications inherent in conventional e-tendering systems. By virtue of its decentralized architecture and robust encryption mechanisms, blockchain offers a paradigm shift in how information is managed and secured [5]. At its core, blockchain functions as a distributed ledger, wherein transactions are recorded across a

network of nodes, ensuring transparency and immutability. This decentralized model not only mitigates the risks associated with centralized data storage but also fosters trust and accountability among stakeholders.

Central to the utilization of blockchain in e-tendering systems is the concept of smart contracts. Leveraging the programmable capabilities of blockchain platforms like Ethereum, smart contracts enable the execution of predefined actions automatically, based on predefined conditions being met [6]. In the context of e-tendering, smart contracts facilitate the transparent and automated execution of tendering processes, ensuring adherence to predetermined criteria and eliminating human intervention and potential biases.

By harnessing the combined power of blockchain and smart contracts, a transparent, decentralized, and secured tendering framework can be envisaged. Such a framework holds the promise of empowering bidders with oversight over portal functions and facilitating comprehensive monitoring of all activities within the tender portal [7]. Moreover, by ensuring transparency and accountability in decision-making processes, blockchain-based e-tendering systems have the potential to instill confidence and trust among stakeholders, fostering a conducive environment for fair competition and collaboration.

In conclusion, the imperative to reform existing e-tendering systems is undeniable, given the myriad challenges plaguing their efficacy and integrity. Blockchain technology, with its decentralized architecture and smart contract capabilities, emerges as a beacon of hope in this endeavor, offering a transformative solution that promises to revolutionize the procurement landscape. By embracing blockchain-based e-tendering systems, governments and businesses can pave the way for a future characterized by fairness, transparency, and security in procurement processes.

II.   LITERATURE SURVEY

The advent of blockchain technology has sparked immense interest across various domains due to its potential to revolutionize existing paradigms of operation. In the context of e-tendering systems, researchers have begun exploring the application of blockchain to enhance security, transparency, and efficiency. This literature survey delves into the key contributions in this field, providing insights into the evolution, challenges, and future prospects of blockchain-based e-tendering systems.

Ambegaonker et al. [2] introduce an efficient approach for tendering by integrating blockchain technology to enhance security and reliability. Their work highlights the potential of blockchain to address the inherent vulnerabilities of traditional tendering processes, ensuring the integrity and transparency of transactions.

Pal and Singh [3] explore the applications of blockchain technology in e-governance services, shedding light on its transformative potential in enhancing the efficiency and accountability of government operations. Their study underscores the role of blockchain in streamlining bureaucratic processes and fostering trust in governance frameworks.

Zheng et al. [5] provide a comprehensive overview of blockchain technology, elucidating its architecture, consensus mechanisms, and future trends. Their analysis offers valuable insights into the technical underpinnings of blockchain and its implications for various industries, including e-tendering.

Pilkington [6] delves into the principles and applications of blockchain technology, offering a nuanced understanding of its transformative potential across diverse domains. By examining the underlying concepts and use cases of blockchain, Pilkington provides a holistic perspective on its implications for e-tendering systems.

Wang et al. [7] conduct a survey on consensus mechanisms and mining strategy management in blockchain networks, elucidating the intricate dynamics that govern blockchain consensus protocols. Their analysis sheds light on the challenges and opportunities associated with achieving consensus in decentralized networks, which is pertinent to the design of secure and efficient e-tendering systems.

Cachin and Vukolić [8] explore blockchain consensus protocols in the wild, presenting an in-depth analysis of the various consensus mechanisms employed in blockchain networks. By examining real-world implementations, they provide valuable insights into the practical considerations and trade-offs involved in designing consensus protocols for e-tendering systems.

Overall, the literature survey underscores the growing interest in leveraging blockchain technology to transform e-tendering systems. From enhancing security and transparency to streamlining bureaucratic processes and fostering trust, blockchain holds immense promise in reshaping procurement practices in both public and private sectors. However, challenges remain, particularly concerning scalability, interoperability, and regulatory compliance. Future research efforts must focus on addressing these challenges to unlock the full potential of blockchain in e-tendering systems.

III. METHODOLOGY

a) Proposed Work:

The proposed system, built on Ethereum blockchain and smart contract technology, stands to revolutionize the e-tendering landscape by offering a more secure, transparent, and efficient platform that addresses the limitations of traditional centralized approaches.

The project explores the potential of leveraging Blockchain[5] technology, particularly Ethereum-based smart contracts, to address these security concerns and establish a distributed e-tendering[1] system. The proposed system aims to enhance fairness, transparency, and openness throughout the tendering process.

The distributed ledger nature of blockchain makes it resistant to tampering, providing a secure environment for tender-related data.

Smart contracts on the Ethereum Blockchain[12] enable a transparent and auditable tendering process. Every transaction, from tender creation to bid selection, is recorded on the blockchain, providing an immutable and easily verifiable history.

The blockchain's cryptographic features ensure the integrity of bid data. Once a bid is submitted, it becomes tamper-proof, providing assurance that the information has not been altered during the evaluation and negotiation phases.

b) System Architecture:
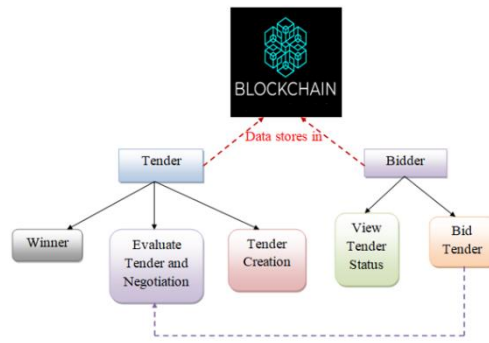
Fig1 Proposed Architecture

The system architecture revolves around leveraging blockchain technology to enhance the transparency, security, and efficiency of the e-tendering[1] process. In this architecture, every aspect of the tendering process, from tender creation to bid evaluation and negotiation, is facilitated through blockchain.

At the core of the system are smart contracts, programmable self-executing contracts deployed on the blockchain. These smart contracts govern key functionalities, such as tender creation, bid submission, evaluation, and negotiation.

For tender creation, stakeholders utilize the blockchain to publish tender details, ensuring transparency and immutability. Bidders, on the other hand, can view tender status in real-time and submit bids securely through the blockchain.

Once bids are submitted, the evaluation process begins, with smart contracts automatically executing predefined criteria to assess bids objectively. The Blockchain[5] stores every piece of bid-related data, ensuring transparency and auditability.

In the negotiation phase, if applicable, smart contracts facilitate communication between the tender issuer and bidders, ensuring fair and transparent negotiations.

Ultimately, the blockchain serves as a distributed ledger, storing every transaction and piece of data securely across its decentralized network. This architecture ensures that the e-tendering process is fair, transparent, and tamper-proof, fostering trust among stakeholders and enhancing the integrity of the procurement process.

c) Modules:

To implement this project we used the following modules are Tender Publisher and Bidder.

These Modules description given below:

A) Tender Publisher Login:

The Tender Publisher Login module offers a secure login interface for tender publishers, allowing access to the system using their credentials. Upon logging in, publishers are directed to a dashboard, granting them the ability to create and manage tenders efficiently.

i) Create Tender: In the Create Tender module, tender publishers input all necessary details including specifications, open/close dates, and tender amount. This information is securely stored in the Blockchain, ensuring transparency and integrity.

ii) Evaluate Tender and Negotiation: The Evaluate Tender and Negotiation module facilitates the evaluation and negotiation phases of the e-tendering process. Tender publishers can review bids from bidders and select a winner based on predefined criteria. Additionally, this module allows for the management of negotiation processes to ensure the best outcome for the tender.

iii) Winner Solution: The Winner Solution module enables tender publishers to formally designate the winning bidder after completing the evaluation and negotiation stages. This marks the culmination of the tendering process, with all pertinent data securely stored in the Blockchain.

B) Bidder:
The Bidder module caters to prospective bidders, providing them with the ability to register on the platform and access their accounts to peruse available tenders and submit bids. Bidders can monitor the status of their bids and ascertain whether they have been chosen as winners. This module streamlines the bidding process, empowering bidders to engage with tenders seamlessly and efficiently.

i) Bid Tender: In the Bid Tender module, bidders have the opportunity to review and participate in available tenders by submitting their bids. Bidders input their bid amount and other necessary details, ensuring a comprehensive submission process. All bid-related information is securely stored in the Blockchain, guaranteeing transparency and security throughout the tendering process. This module facilitates seamless interaction between bidders and tender publishers, fostering an efficient and trustworthy bidding environment.

ii) View Tender status: The View Tender Status module provides bidders with the capability to monitor the progress of tenders in which they have participated. Bidders can conveniently check the status of their submissions, including whether they have been designated as winners or if the tendering process is still underway. This module empowers bidders with real-time updates, enabling them to stay informed and engaged throughout the tendering process.

**d) Blockchain Integration:**
1. Blockchain technology decentralizes the storage of tender data across multiple nodes. This distributed approach eliminates single points of failure, enhancing security by making it challenging for unauthorized parties to access or manipulate the data. Even if one server is compromised, data remains available on other nodes.

2. Tender transactions and their associated details are stored as immutable blocks on the Blockchain. Hash codes are used to link these transactions, forming a secure and traceable chain. This prevents tampering or unauthorized alterations to the stored data, ensuring the integrity and reliability of the tendering records.

3. Tender data undergoes encryption using the Advanced Encryption Standard (AES) before being stored on the Blockchain. Hash code verification is employed to confirm data integrity. This dual security approach safeguards the authenticity and confidentiality of tender information, reinforcing its overall security.
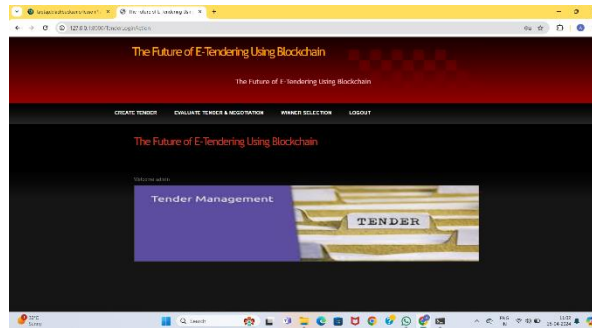
IV.   EXPERIMENTAL RESULTS

To run project install python 3.7 and then install DJANGO package and then start server and then run from browser
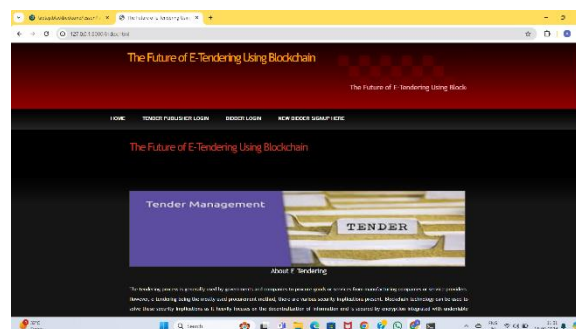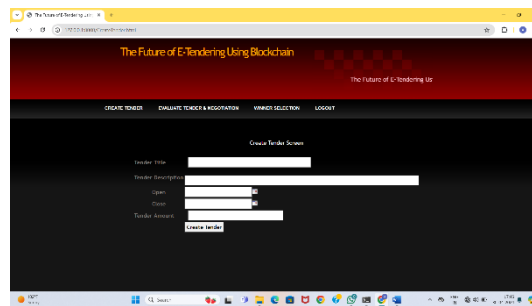

In above screen click on 'Tender Publisher Login' link to get below login screen
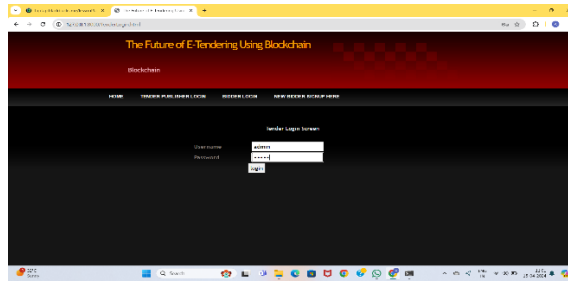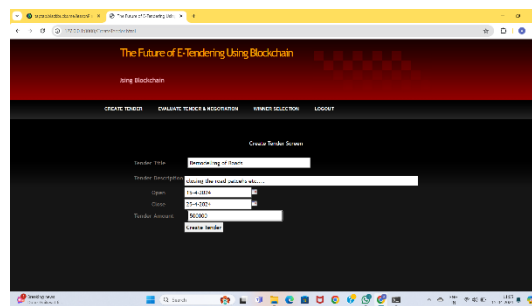
In above screen login as publisher and then click on button to get below screen

In above screen publisher can click on 'Create Tender' link to get below screen and to create tender
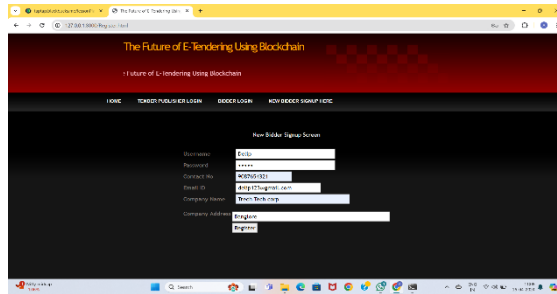

In above screen add new tender details and then choose open and close date and then enter tender amount

In above screen I entered some details to create tender and press button to get below screen
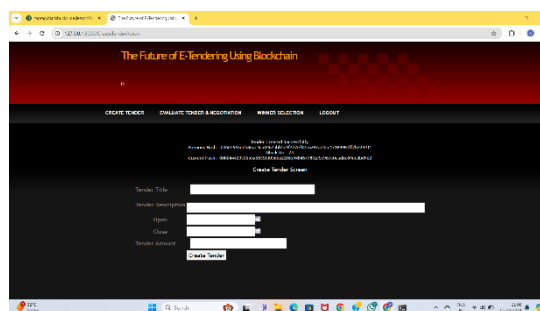
In above screen tender is created and details stored at Block No 74 and we can see Blockchain generated hash codes for previous and new records and now logout and login as user to allow them to bid for this tender
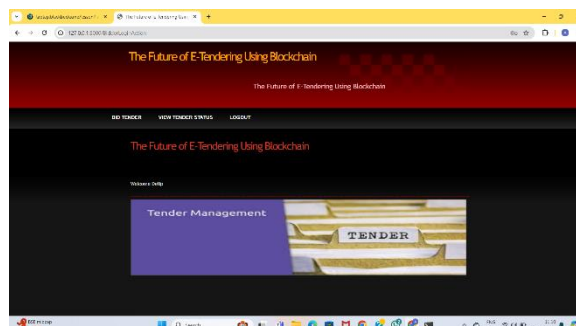
In above screen new bidder is signup and then click on 'Register' button to complete signup process and to get below screen
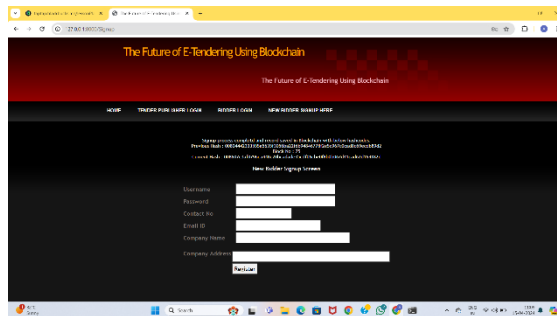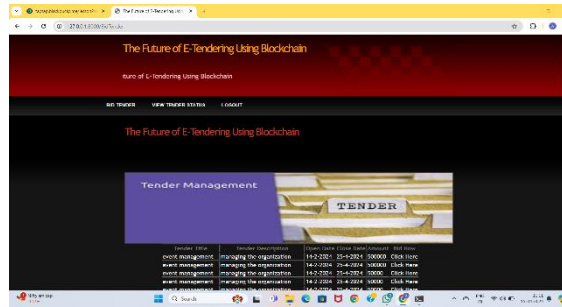

In above screen bidder details store in Blockchain at Block No 75 and similarly you can add as many user as you want
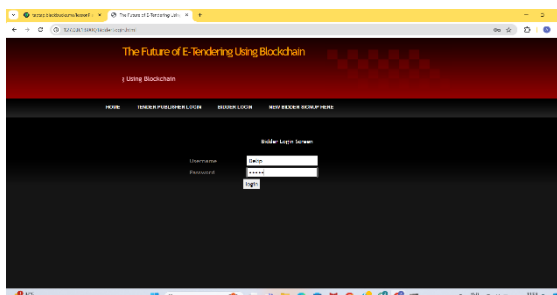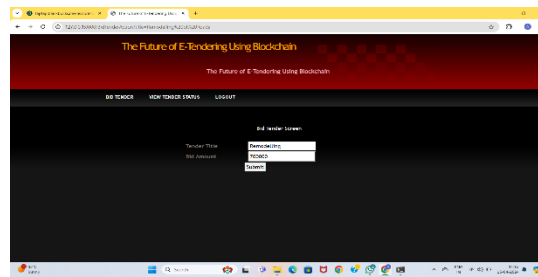

In above screen bidder is login and after login will get below screen
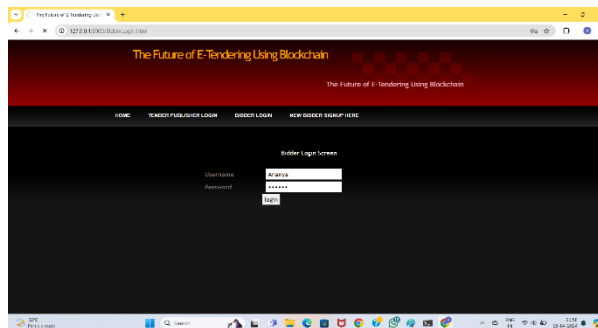

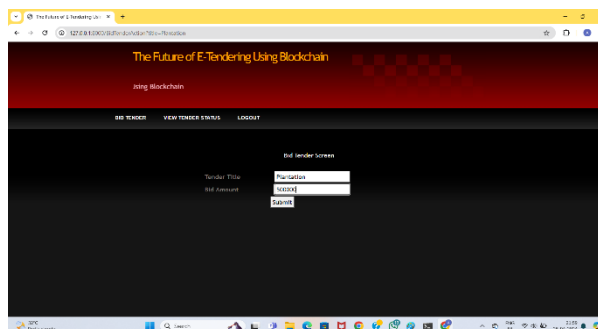In above screen bidder can click on 'Bid Tender' link to get below screen

In above screen in table bidder can view all tender details and then click on 'Click Here' link to bid for that tender
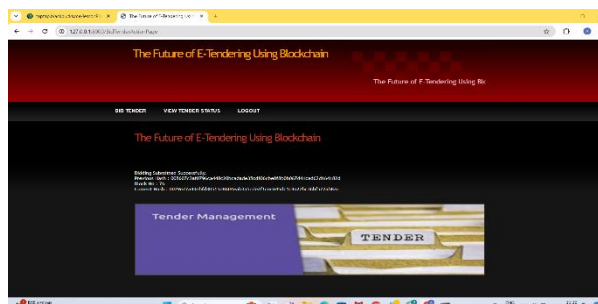

In above screen user Delip bidding 700000 for this tender and login as another user to bid
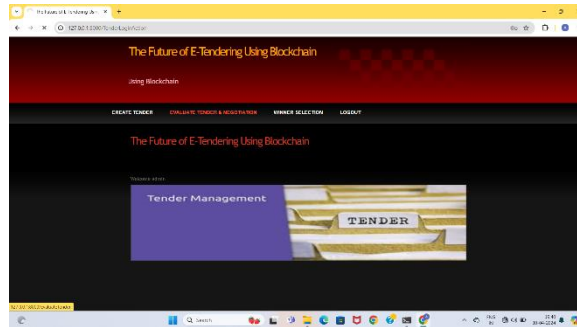

In above screen another user Ananya is login and after login can give bidding in below screen

Here bidder is giving bid amount which is higher than user amount

In above screen user bid amount saved in Blockchain and now login as publisher to evaluate bids

In above screen publisher can click on 'Evaluate Tender & Negotiation' link to select bidder giving high bid and it will get opened after the closed date of tender.
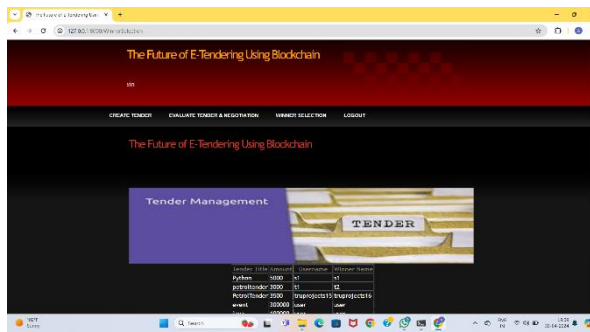
In above screen we can see the 'Winner Selection' screen.
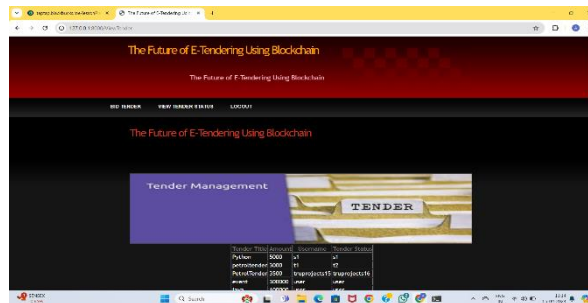
In above screen in table we can see that the tender status. Here the bidder used to login and can view the status of tender by clicking on 'View Tender Status'. Here bidder used to know the winner of the particular tender

Note: while giving tender title or name don't put spaces

V. CONCLUSION

In conclusion, the adoption of a Blockchain-based e-tendering system presents a transformative solution that addresses critical challenges inherent in traditional tendering processes. By leveraging Blockchain technology, data integrity is upheld through immutability and transparency, fostering trust among stakeholders. The integration of Blockchain[5] minimizes the risks associated with data tampering and unauthorized access, thereby enhancing the overall security and reliability of the tendering environment. Through decentralization and encryption, the system ensures robust protection of sensitive information, mitigating vulnerabilities present in conventional tendering methods. As a result, the Blockchain-based e-tendering system[1] emerges as a promising avenue for modernizing procurement practices, offering a secure, transparent, and efficient platform for tender publishers and bidders alike. Its adoption heralds a new era of trust, accountability, and integrity in the procurement landscape, poised to revolutionize the way tenders are conducted and managed.

VI. FUTURE SCOPE

In the future, integrating Internet of Things (IoT) devices into the e-tendering system holds tremendous potential to revolutionize procurement practices. By enabling real-time monitoring of physical assets and resources, IoT technology can enhance supply chain visibility, mitigate fraud, and ensure the authenticity of goods and services. This integration promises to introduce greater efficiency, transparency, and accountability into the procurement process, paving the way for more streamlined and secure transactions. Embracing IoT

within e-tendering systems opens up exciting possibilities for optimizing procurement operations and driving innovation in supply chain management.

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