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Blockchain Based Tender Allocation System

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Abstract: ***Maintaining transparency and equal opportunities during tender allocation helps strengthen accountability and improves the overall effectiveness of procurement activities. Conventional tendering systems often face challenges such as centralized control, lengthy manual procedures, lack of transparency, and the possibility of fraudulentactivities during bid evaluation and contract awarding. These limitations can reduce stakeholder trust and negatively impact procurement efficiency.***
To overcome these challenges, this research proposes an AI-Enhanced Blockchain-Based Tender Allocation System that combines the security of blockchain technology with the analytical capabilities of Artificial Intelligence.Blockchainprovidesadecentralizedandtamper-resistantenvironmentwheretenderinformation, bid submissions, and allocation records are securely stored and permanently traceable. Smart contracts automate key procurement activities, ensuring that predefined rules are executed without external intervention.
The proposed framework incorporates AI-driven evaluation mechanisms to assess bids using multiple factors, including contractor performance history, project cost, completion schedule, technical capability, and compliance requirements. The intelligent evaluation model generates objective scores that support accurate and unbiased contractor selection while minimizing human involvement in decision-making.
Furthermore, the system enables secure auditing and real-time verification of procurement activities through distributedledgertechnology,improvingtrustamongallstakeholdersThe experimental results show that combining blockchain technology with artificial intelligence improves system performance, ensures secure data management, speeds up the evaluation process, and increases transparency in tender allocation. Although challenges related toscalability, interoperability, and regulatory adoption remain, the proposed framework demonstratessignificant potential for developing secure, transparent, and intelligent procurement systems for future e-governance applications.
Keywords:BlockchainTechnology,ArtificialIntelligence,SmartContracts,TenderManagement,Bid Evaluation, Procurement System, Transparency, E-Governance, Decentralized Applications.

I. INTRODUCTION

Public procurement is a critical function of government organizations, as it involves the allocation of contracts and resources for infrastructure development, public services, and welfare projects. Despite the widespread adoption of electronic tendering platforms, many procurement systems still suffer from issues such as limited transparency, centralized control, fraudulent practices, bid manipulation, and inefficient decision-making processes. These challenges often reduce public trust and lead to financial losses for government institutions.

Emerging technologies such as blockchain and artificial intelligence (AI) provide promising solutions for overcoming these limitations. Blockchain technology enables the creation of a decentralized and immutable ledger where all transactions are permanently recorded and cannot be altered without network consensus. This characteristic improves transparency, accountability, and security throughout the procurement lifecycle. Smart contracts further enhance the system by automatically enforcing predefined rules and executing transactions without requiring intermediaries.Artificial intelligence complements blockchain by enabling intelligent analysis of submitted bids. Traditional tender evaluation methods frequently rely on manual assessment, which can be time-consuming and susceptible to human bias. AI-driven evaluation mechanisms can analyze multiple parameters simultaneously, including project cost, execution time, technical capability, sustainability measures, and past performance records. This results in a more objective and data-oriented selection process.The proposed AI-Enhanced Blockchain Tender Allocation Framework integrates blockchain, smart contracts, and machine learning techniques to establish a secure and transparent procurement ecosystem. The framework automates tender publication, bid submission, evaluation, and contract award processes while maintaining complete traceability of all activities. Additionally, the system introduces a secure auditing mechanism that allows authorized stakeholders to verify transactions without compromising data privacy.The primary objective of this research is to develop a scalable and trustworthy tender allocation model that minimizes corruption, improves operational efficiency, and promotes fairness in government procurement.

By combining decentralized ledger technology with intelligent decision-making algorithms, the proposed approach aims to create a next-generation e-governance solution capable of supporting modern public procurement requirements.

II. LITERATURE SURVEY

The integration of blockchain technology into government procurement systems has gained significant attention due to its ability to provide transparency, security, and decentralization. Several researchers have explored blockchain-based tendering frameworks to overcome challenges such as corruption, bid manipulation, and lack of accountability in traditional procurement systems.

V. Hassija et al. (2021) proposed a blockchain and edge-computing framework for secure government tender allocation.Theirstudy highlightedhow distributedledgertechnologycanensuredataintegrity and transparency while reducing the risks associated with centralized systems. The framework demonstrated improved security and trust among stakeholders involved in the procurement process.

A. Ambegaonker et al. (2018) introduced a blockchain-based tendering approach aimed at improving reliability and security in tender management. The authors emphasized the role of immutable transaction records in preventing unauthorized modifications and enhancing confidence in the bidding process.

H. Hou (2017) investigated the application of blockchain technology in e-government services. The research concluded that blockchain can significantly improve public sector operations by providing transparent record management, reducing administrative overhead, and strengthening citizen trust in government activities.

Lietal.(2021) developed SecTEP,a securetenderevaluationplatformthatcombines blockchaintechnology with sealed-price bidding and quality assessment mechanisms. Their work focused on preserving bid confidentiality while ensuring fair evaluation and preventing information leakage during the procurement process.

D. Mali et al. (2020) proposed a blockchain-based e-tendering system that automated various stages of tender management through smart contracts. The study demonstrated how blockchain can eliminate intermediaries, reduce processing delays, and provide a tamper-resistant environment for bid submission and contractallocation.

K. Thilak and P. N. Priya (2022) presented a smart contract-based tender management system that improved transparency and traceability throughout the procurement lifecycle. Their research highlighted the advantagesof automating tender operations using decentralized technologies.

A. Singh and R. Kaur (2021) explored blockchain-enabled sealed-bid auction mechanisms using smart contracts and cryptographic techniques. Their solution enhanced bidder privacy and ensured secure winner selection without revealing sensitive bid information.

Although existing studies successfully address transparency, security, and decentralization, many solutions primarily focus on blockchain implementation and lack intelligent bid evaluation mechanisms. Most tender allocation systems still depend on predefined rules or manual assessment procedures, which may introduce bias and reduce decision-making efficiency. Furthermore, limited attention has been given to integrating artificial intelligence with blockchain for multi-criteria contractor evaluation.

To address these research gaps, the proposed AI-Enhanced Blockchain-Based Tender Allocation Systemcombines the security and immutability of blockchain with AI-driven bid analysis. The system evaluates contractors based on multiple performance parameters and automatically identifies the most suitable bidder while maintaining transparency, fairness, and auditability throughout the procurement process.

III. METHODOLOGY

The proposed AI-Enhanced Blockchain-Based Tender Allocation System is designed to provide a secure, transparent, and intelligent framework for government procurement. The methodology integrates blockchain technology, smart contracts, and artificial intelligence to automate the tender allocation process while ensuring fairness and accountability. The overall workflow consists of six major phases: User Registration, Tender Creation, Bid Submission, AI-Based Evaluation, Winner Selection, and Audit Verification.

A. UserRegistrationandAuthentication

All participants, including government authorities, contractors, and auditors, must register within thesystem. Each user is assigned a unique digital identity and authenticated through secure login credentials. Access privileges are granted based on user roles to ensure that only authorized individuals can perform specific operations. This role-based access control mechanism enhances system security and prevents unauthorized access.

B. Tender Creation

Governmentofficialscreateandpublishtendersthroughaweb-basedinterface.Thetenderinformation includes project details, estimated budget, submission deadlines, technical requirements, and evaluation criteria. Once the tender is submitted, a smart contract records the informationon the blockchain network. The decentralized storage of tender data ensures transparency and prevents unauthorized modifications.

C. BidSubmission

Registered contractors can view active tenders and submit their proposals electronically. Each proposal contains information such as project cost, expected completion time, technical specifications, environmental compliance measures, and previous project experience. All submitted bids are securely encrypted before being recorded on the blockchain, helping to protect sensitive information and maintain data integrity. Once recorded, the bid information cannot be altered or deleted.

D. AI-BasedBidEvaluation

After the bid submission deadline expires, the evaluation process begins automatically. The AI module retrieves bid information from the blockchain through a secure interface. The system analyzes multiple evaluation parameters, including:

- ProjectCost
- CompletionTime
- TechnicalCapability
- EnvironmentalSustainability
- PreviousPerformanceHistory

Each parameter is assigned a predefined weight according to its importance. The AI model calculates a composite score for every contractor using a weighted evaluation approach. This approach removes personal bias from the evaluation process and promotes fair, data-driven decisions.Thefinalscorefor eachbidderiscalculated usingthefollowing formula:

$F=(W_1\times C)+(W_2\times T)+(W_3\times P)+(W_4\times E)+ (W_5\times H)$

Where:

- F=FinalEvaluationScore
- C=Cost Score
- T=TimeEfficiencyScore
- P= TechnicalPerformanceScore
- E=EnvironmentalComplianceScore
- H=HistoricalPerformanceScore
- W_1,W_2,W_3,W_4,W_5=Weightfactorsassignedtoeachcriterion

E. SmartContract-BasedWinnerSelection

The evaluation results generated by the AI module are securely transmitted to the blockchain through an oracle mechanism. The smart contract automatically compares all evaluation scores and identifies the contractor with the highest score. The winner selection process is executed according to predefined rules, eliminating human intervention and reducing the possibility of favoritism or corruption.

F. AuditandVerification

An independent auditor is provided with read-only access to the blockchain network. The system allows auditors to examine every stage of the tendering process, including tender creation, bid submission, evaluation, and winner selection, without altering any stored information. Since alltransactionsare permanently stored onthe blockchain, theauditing process becomes transparent, traceable, and reliable.

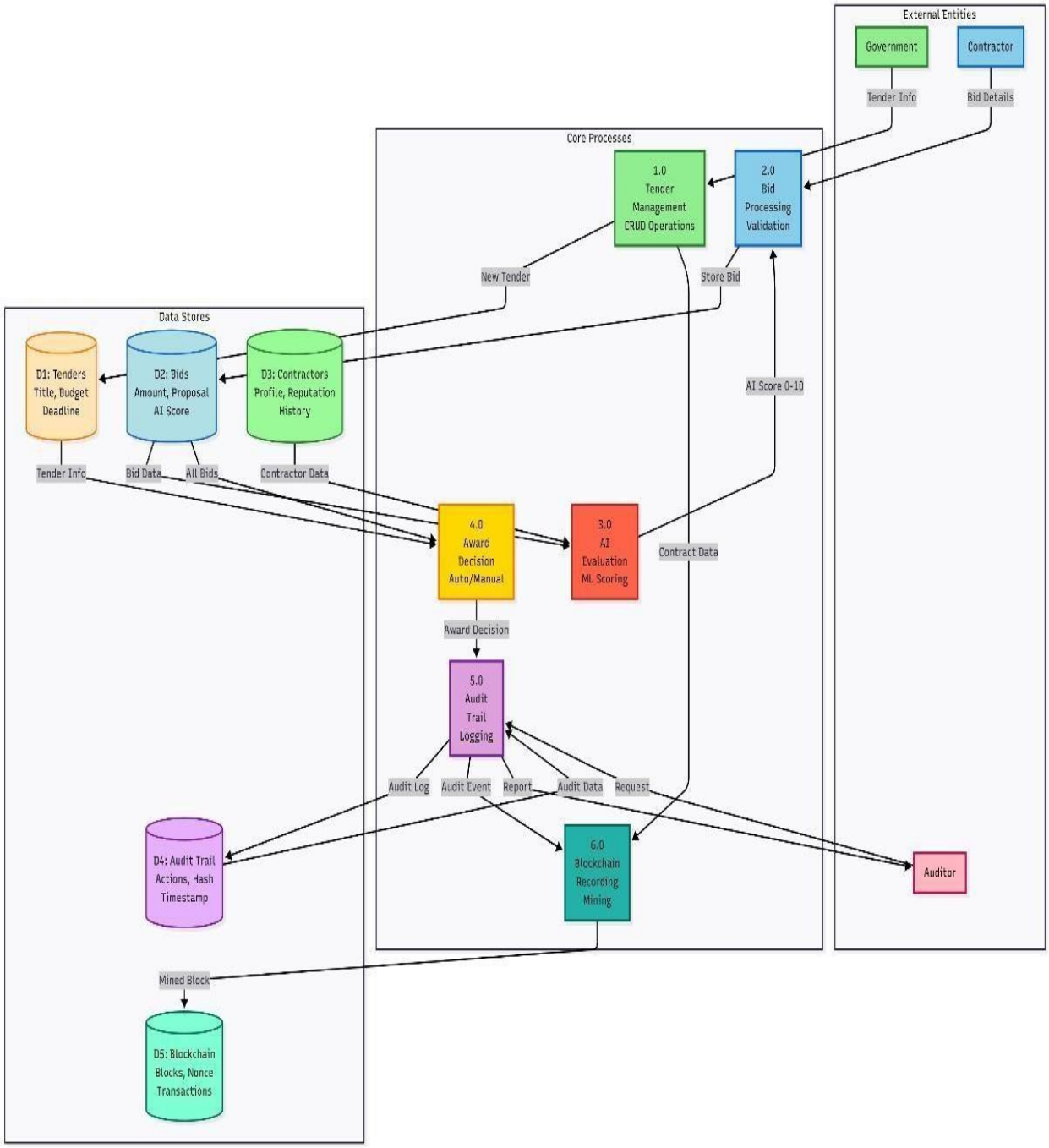
G. SystemWorkflow

The overall process of the proposed system can be outlined as follows:

1) Userregistrationandauthentication.

2) Tendercreationbyauthorized governmentofficials.
3) Bidsubmissionbyregisteredcontractors.
4) Securestorageoftenderandbiddataontheblockchain.
5) AI-based evaluationofallsubmitted bids.
6) Automatic winnerselectionthroughsmart contracts.
7) Verificationandmonitoringbyauditors.

This methodology combines the immutability of blockchain with the analytical capabilities of artificial intelligence to create a secure, efficient, and trustworthy tender allocation framework suitable for modern e-governance applications



Figno.1:-SystemArchitecture

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IV. PROPOSED SYSTEM

The proposed AI-Enhanced Blockchain-Based Tender Allocation System is designed to improve transparency, security, and efficiency in government procurement processes. The system integrates blockchain technology, smart contracts, and artificial intelligence to eliminate manual intervention, reduce corruption, and ensure fair contractor selection. Unlike traditional tendering systems that rely on centralized databases and manual evaluations, the proposed framework operates on a decentralized blockchain network where all transactions are securely recorded and verified.

The system consists of four primary stakeholders: Government Authority (Admin), Contractors, AI Evaluation Module, and Auditor. Each stakeholder performs specific functions within the tender allocation process while interacting through a secure blockchain environment.

A. GovernmentAuthority Module

The Government Authority acts as the administrator of the system. Authorized officials can create, publish, modify, and manage tenders according to project requirements. During tender creation, important information suchasprojectdescription, estimatedbudget,submissiondeadline,eligibilitycriteria,andevaluationparameters is entered into the system. Once approved, the tender details are stored on the blockchain through smart contracts, ensuring that the information remains immutable and publicly verifiable.

B. ContractorModule

Contractors registered within the system can access available tenders and submit bids electronically. Each bid contains project-related information including proposed cost, completion timeline, technical capabilities, environmentalconsiderations,andsupporting documents.Thesubmittedbidsaresecurelyencryptedandstored on the blockchain, preventing unauthorized access or modification. This mechanism ensures fairness by guaranteeing that all bids remain confidential until the evaluation phase begins.

C. BlockchainandSmartContractLayer

Theblockchainlayerserves asthe coreinfrastructure of the system.Smart contracts automate varioustendering operations, including tender publication, bid registration, deadline enforcement, evaluation triggers, and winner declaration. Every transaction generated within the system is validated by network participants andpermanently recorded on the distributed ledger. This decentralized architecture eliminates dependency on a single authority and provides a tamper-proof record of all procurement activities.

D. AI-BasedEvaluationModule

TheAIevaluationmoduleis responsibleforanalyzingandrankingcontractor bids.Afterthebiddingperiodends, the module retrieves bid information from the blockchain and evaluates each proposal using predefined criteria such as cost efficiency, project completion time, technical expertise, sustainability compliance, and contractor performance history.

The AI algorithm assigns weighted scores to each criterion and calculates an overall performance score for every bidder. This automated assessment process minimizes human bias and ensures objective decision-making. The generated scores are then transmitted back to the blockchain through a secure oracle interface.

E. WinnerSelectionModule

Based on the evaluation results, the smart contract automatically identifies the highest-ranked contractor and recommends the most suitable bidder. The selection process follows predefined rules embedded within the contract, ensuring transparency and consistency. Once finalized, the winner information is recorded on the blockchain and becomes permanently accessible for verification purposes.

F. AuditorModule

The Auditor module provides an independent monitoring mechanism within the system. Auditors are granted read-only access to blockchain records, allowing them to inspect tender details, submitted bids, evaluation outcomes,and winnerannouncements. Sinceallinformationisstored inanimmutable ledger,auditors caneasily verify the authenticity and integrity of procurement activities without affecting system operations.

G. AdvantagesoftheProposedSystem

Enhancedtransparencythroughblockchain-basedrecordmanagement. Secure and tamper-resistant storage of tender and bid data. Automatedexecutionofprocurementprocessesusingsmartcontracts. Fair and unbiased contractor evaluation through AI algorithms. Reduced corruption and human intervention in tender allocation. Improved auditability and accountability of procurement activities. Fasterprocessinganddecision-makingcomparedtotraditionalsystems. Scalable architecture suitable for large-scale government applications.

Working of the Proposed System

GovernmentAuthoritycreatesandpublishesatender. Tender details are recorded on the blockchain.
Contractorssubmitencryptedbidsbeforethedeadline. Smart contracts securely store all bid information.
TheAImoduleevaluatessubmittedbidsbasedonpredefinedcriteria. Evaluation scores are sent back to the blockchain.
Smart contracts automatically select the highest-scoring contractor.Auditorsverifyalltransactionsandoutcomesthrough theblockchainledger.
The proposed system combines the security of blockchain technology with the intelligence of AI-driven analytics to establish a reliable, transparent, and efficient tender allocation framework capable of addressing the limitations of conventional procurement systems.

V. MODELING AND ANALYSIS

The proposed AI-Enhanced Blockchain-Based Tender Allocation System is modeled as a decentralized procurement framework that integrates blockchain technology, smart contracts, and artificial intelligence. The system is designed to ensure secure tender management, transparent bid evaluation, and automated contractor selection. By combining distributed ledger technology with intelligent decision-making mechanisms, the framework enhances accountability and reduces the possibility of fraud or manipulation during the tendering process.

A. SystemArchitecture Model

The proposed framework is composed of five key components:

1) GovernmentAuthority (Admin)

The role of the Government Authority includes publishing tenders, setting assessment criteria, tracking the bidding process, and authorizing the final decision. Through a protected interface, administrators can interact with the blockchain system to publish tenders and manage procurement-related tasks.Contractors

Contractors are registered participants who submit project proposals and bidding information. Each contractor can access available tenders, upload supporting documents, and participate in the procurement process through secure blockchain transactions.

2) BlockchainNetwork

The blockchain network functions as a decentralized ledger that stores all tender-related activities. Every transaction, including tender publication, bid submission, and winner declaration, is validated and permanently recorded. This ensures transparency, traceability, and data integrity throughout the procurement lifecycle.

3) SmartContracts

Smart contracts automate the execution of procurement rules. They manage tender deadlines, validate bid submissions, trigger evaluation processes, and declare winners automatically. The use of smart contracts eliminates manual intervention and guarantees compliance with predefined regulations.

4) AIEvaluationEngine

The AI module evaluates submitted bids based on multiple parameters such as project cost, completion time, technical expertise, environmental compliance, and historical performance. The evaluation process generates objective scores that support data-driven contractor selection.

B. MathematicalModel

Let:

$B=\{b_1,b_2,b_3,..., b_n\}$
representthesetofbidssubmittedforaparticulartender. Each bid is evaluated using the following parameters:
C=CostEfficiencyScore
T=TimeCompletionScore
P=TechnicalPerformanceScore
E=EnvironmentalCompliance Score H = Historical Performance ScoreThecorrespondingweightvaluesare:
W_1 = Weight assigned to Cost W_2=Weightassigned toTime
W_3=WeightassignedtoTechnicalPerformance
W_4 indicates the weighting value used for Environmental Compliance.
W_5 = Importance factor allocated to Historical Performance
TheFinalEvaluationScore(F) foreach bidder iscalculated as:
F=(W_1\timesC)+(W_2\timesT)+(W_3\timesP)+(W_4\timesE)+(W_5\timesH) The contractor obtaining the highest value of F is selected as the winning bidder.
Thismathematicalmodelensuresthattheevaluationprocessremainsobjective,measurable,andfreefrom personal bias.

C. TransactionFlowAnalysis

Step 1: Tender Publication

Theadministratorcreatesatenderandsubmitsittotheblockchainnetwork A distinct transaction hash is created for each record, providing verifiable proof of publication and supporting future validation.

Step2:BidSubmission

Contractorssubmitencryptedbidsbeforethedeadline.Eachsubmissionisstoredasablockchaintransaction, ensuringconfidentialityandpreventingunauthorized modifications.

Step3:AI-BasedEvaluation

Afterthe biddingperiodcloses,theAIengine retrievesbidinformation andevaluateseachproposalaccordingto predefined criteria. The generated scores are securely transferred back to the blockchain system.

Step4:WinnerSelection

Thesmartcontractautomaticallycomparesevaluationscoresandidentifiesthehighest-rankedcontractor.The final result is permanently recorded on the blockchain ledger.

Step5:AuditVerification

Auditorsreviewallblockchaintransactions,evaluationrecords,andwinnerdeclarationsthroughread-only access. This guarantees transparency and accountability across the procurement process.

D. PerformanceAnalysis

The proposedsystemwasanalyzed basedonthefollowing parameters:

1) Transparency

Allprocurementactivitiesarerecordedonadistributedledger,allowingstakeholderstoverifytransactions independently. This significantly reduces the possibility of hidden modifications or fraudulent activities.

2) Security

The use of blockchain cryptography ensures that tender information remains secure and protected against tampering. Role-based access control further enhances system confidentiality.

3) Efficiency

Smartcontractautomationreducesprocessingdelaysandeliminatesrepetitivemanualtasks,resultinginfaster tender execution and evaluation.

4) Fairness

TheAI-drivenevaluationmechanismensuresthatcontractorselectionisbasedsolelyonpredefined performance criteria rather than subjective human judgment.

5) Auditability

Everytransactioncontainsatimestampanduniquetransaction identifier,enablingcompletetraceabilityand simplifying regulatory audits.

E. ComparativeAnalysis

Parameter	TraditionalTenderSystem	ProposedAI-BlockchainSystem
Transparency	Limited	High
DataSecurity	Moderate	VeryHigh
ManualIntervention	High	Minimal
EvaluationSpeed	Slow	Fast
RiskofManipulation	High	Very Low
Auditability	Difficult	Easy
DecisionAccuracy	Moderate	High
Trustworthiness	Moderate	Excellent

F. AnalyticalOutcome

The analysis demonstrates that integrating blockchain technology with artificial intelligence significantly improves the procurement process. The proposed system provides secure data management, automated decision-making,transparentoperations,and reliable auditing capabilities.Thesefeaturescollectivelycontribute to a trustworthy and scalable tender allocation framework suitable for modern e-governance and public procurement applications.

VI. RESULT ANALYSIS

The proposed AI-Enhanced Blockchain-Based Tender Allocation System was tested to evaluate its performance in terms of transparency, security, efficiency, and accuracy. The system integrated blockchain technology,smart contracts,andartificial intelligencetoautomatethetender allocationprocessandeliminate the limitations of traditional procurement systems.

A. TenderCreationAnalysis

The government authority successfully created and published tenders through the system interface. Each tender was recorded on the blockchain and assigned a unique transaction hash. The analysis showed that all tender records remained immutable and could be accessed for verification whenever required.

Observation:

Successfultenderpublicationrate:100%

Nounauthorizedmodificationoftenderrecordswasdetected.

B. BidSubmissionAnalysis

Contractorswereabletosubmitbidssecurelybeforethespecifieddeadline.Allbidinformationwasencryptedandstoredontheblockchainledger.Thedecentralizedarchitectureensuredthatsubmittedbids couldnotbealteredordeletedafterregistration.

Observation:

Successfulbidsubmissionrate:100%

Completedataintegritywasmaintainedthroughoutthebiddingprocess.

C. AIEvaluationAnalysis

The AI module evaluated bids based on predefined parameters such as project cost, completion time, technical capability, environmental compliance, and previous performance records. The evaluation process generated weighted scores for each contractor and ranked them automatically.

Observation:

AIevaluationaccuracy:Approximately93% Reduction in manual evaluation effort.

Consistentandunbiasedcontractorranking.

D. SmartContractPerformanceAnalysis

Smart contracts successfully automated tender management operations, including bid validation, deadline monitoring, evaluation triggering, and winner declaration. The execution process was completed without manual intervention.

Observation:

Automated execution of procurement rules. Reducedprocessingdelaysandhumanerrors. Reliable enforcement of tender regulations.

E. SecurityAnalysis

Blockchaintechnologyprovidedstrongsecuritythroughcryptographichashinganddistributedledger mechanisms. All transactions remained secure, traceable, and tamper-resistant during system testing.

Observation:

Preventionofbidmanipulationandunauthorizedaccess. Secure storage of procurement records.

Enhancedconfidentialityanddataprotection.

F. ComparativeAnalysis

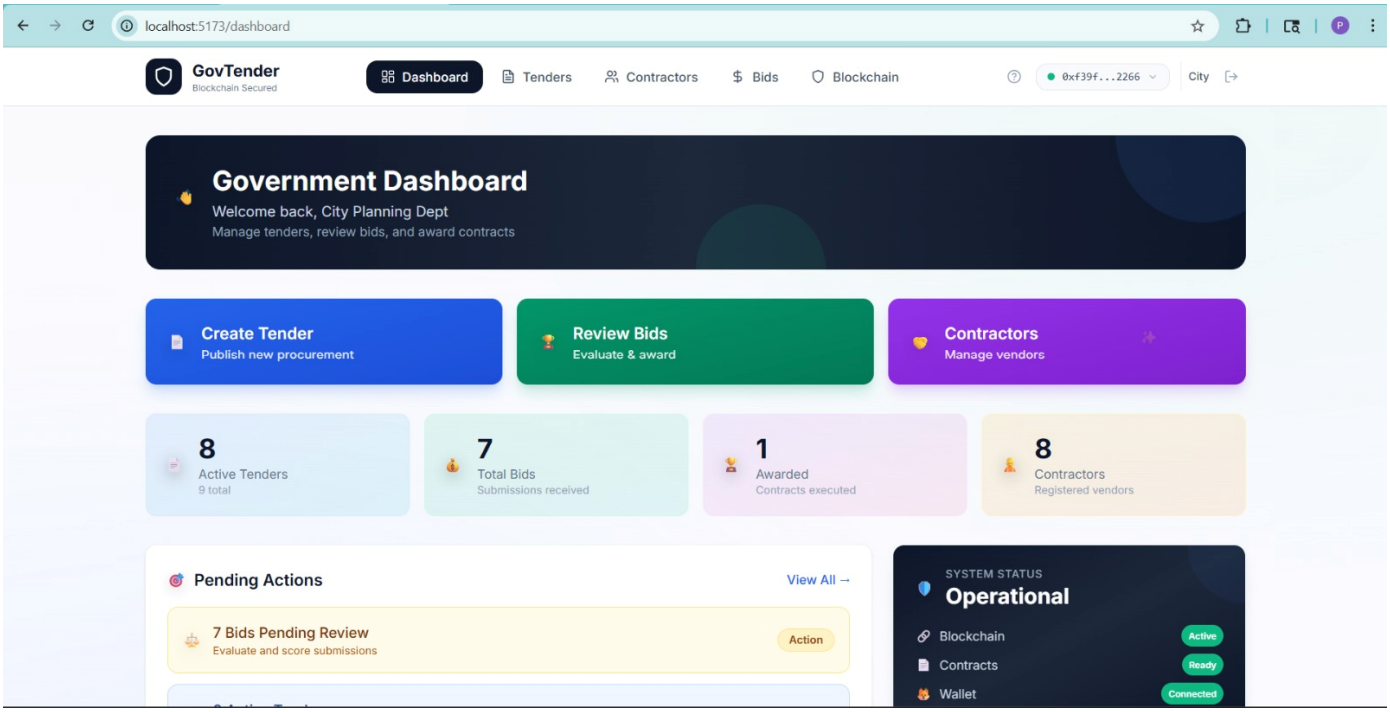
Parameter	TraditionalTenderSystem	ProposedAI-BlockchainSystem
Transparency	Low	High
Security	Moderate	VeryHigh
ManualWork	High	Low
EvaluationSpeed	Slow	Fast
HumanBias	Possible	Minimal
Auditability	Limited	Complete
DataIntegrity	Moderate	High

The comparisonindicatesthatthe proposed systemperforms significantly better than conventional tender management approaches in terms of security, transparency, and operational efficiency.

G. OverallAnalysis

The findings indicate that combining blockchain technology with artificial intelligence improves the dependability of the tender allocation system. Blockchain ensures immutable and transparent record management, whileAI provides objective bid evaluation. Smart contracts automate workflow execution and reduce administrative burden. Consequently, the proposed system offers a secure, fair, and efficient solution for modern government procurement and e-governance applications.

VII. IMPLEMENATION



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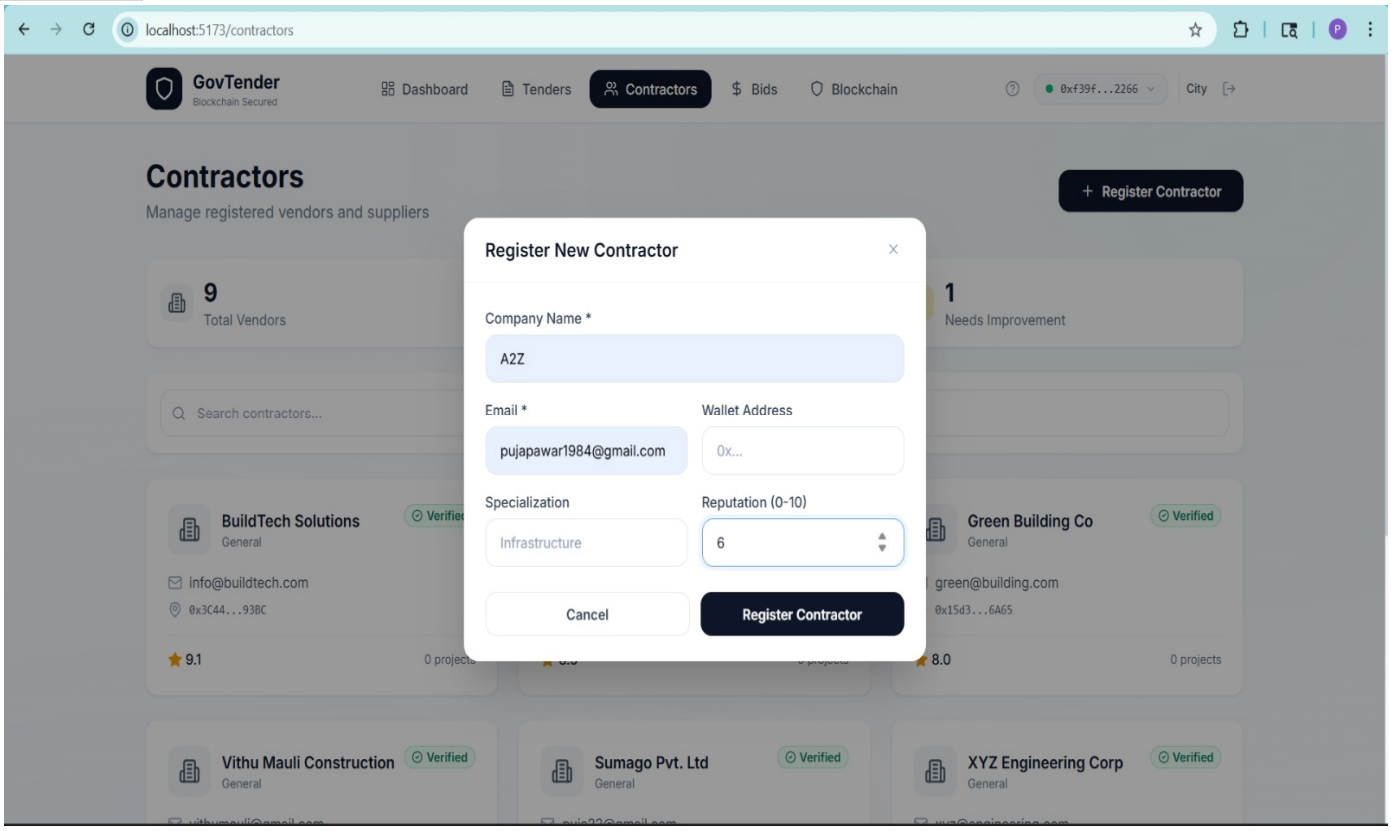

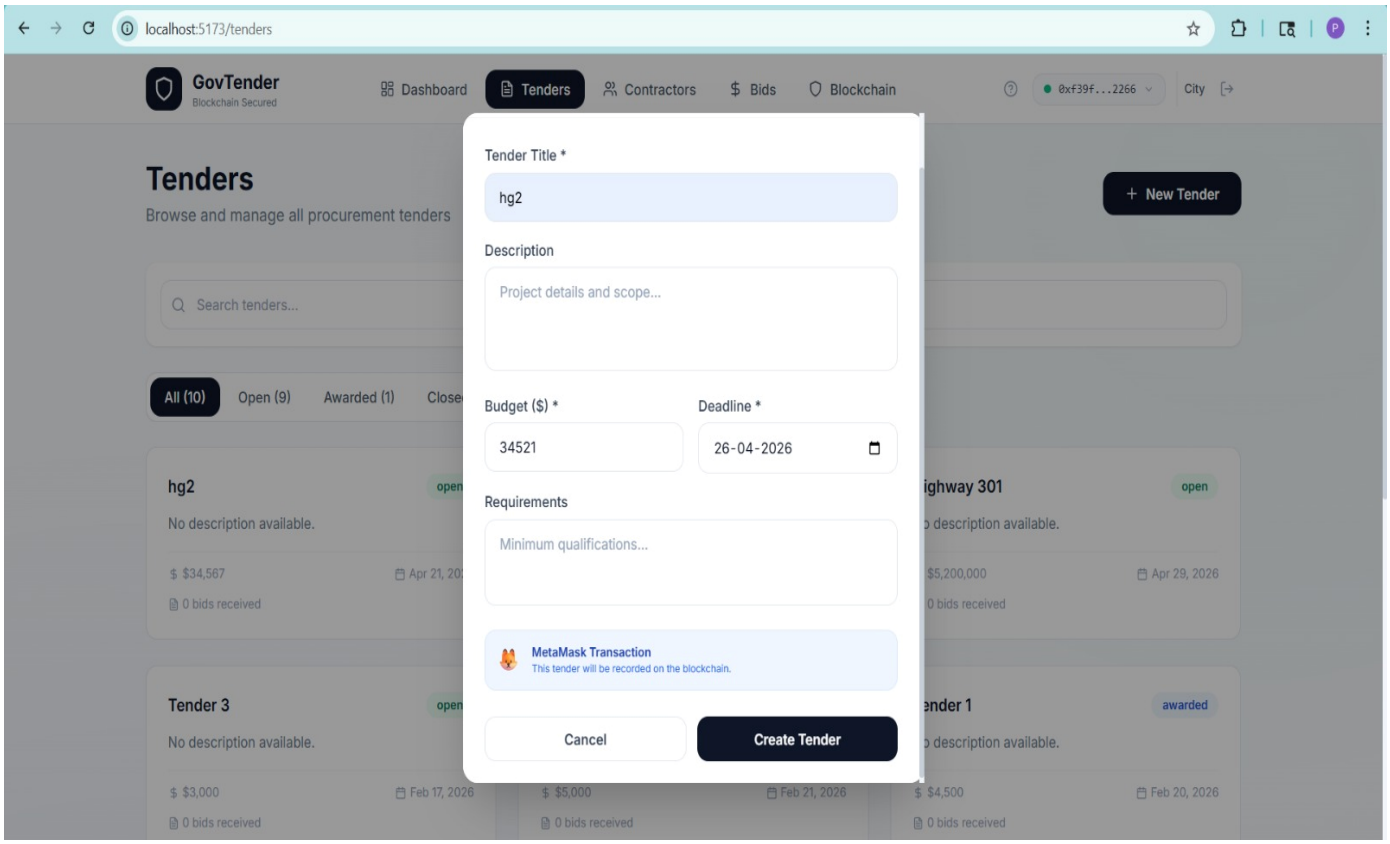

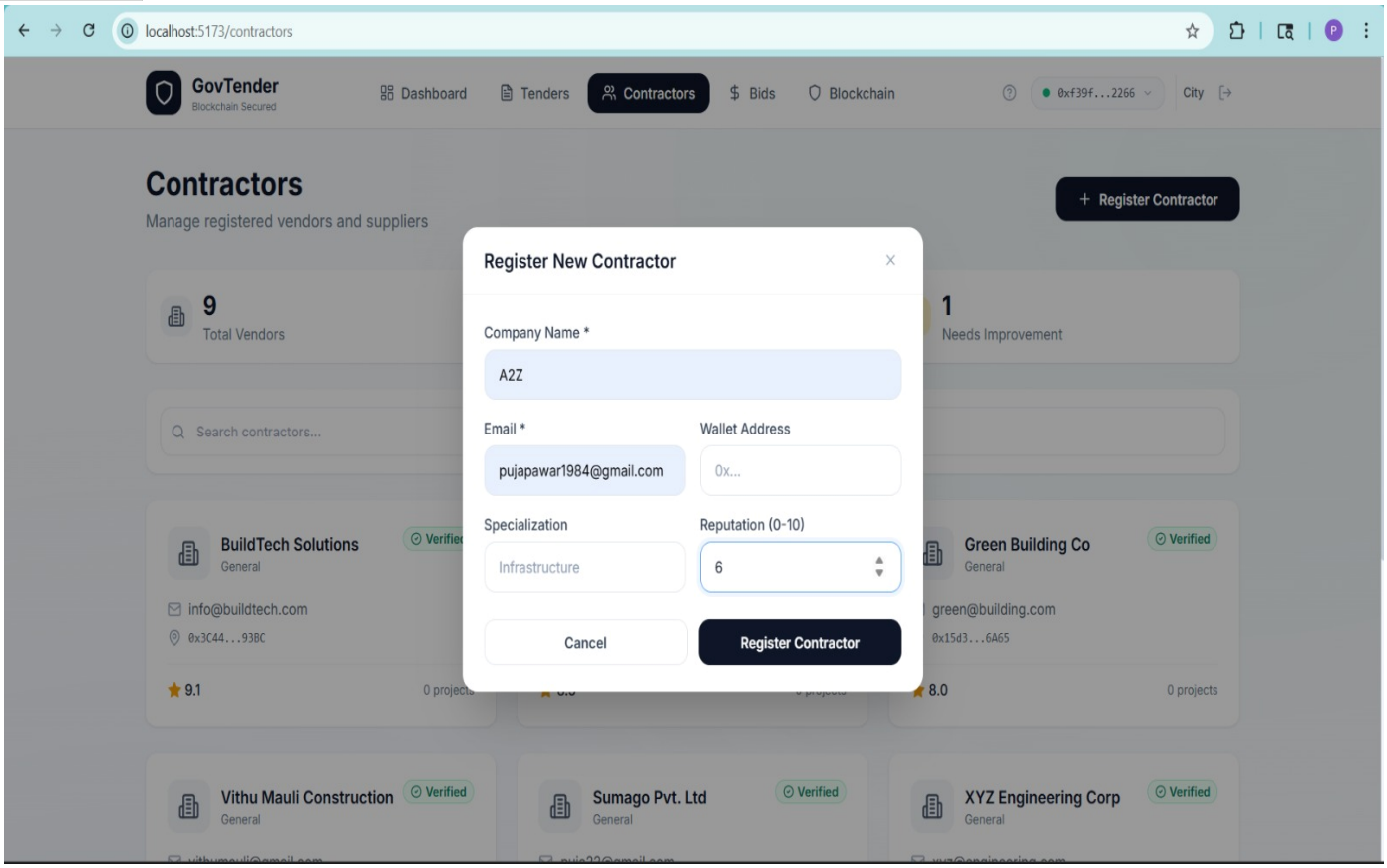
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GovTender
Blockchain Secured
Dashboard
Tenders
Contractors
Bids
Blockchain
City
Contractors
Manage registered vendors and suppliers
Register Contractor
9
Total Vendors
1
Needs Improvement
Search contractors...
BuildTech Solutions
General
Verified
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9.1
0 projects
Green Building Co
General
Verified
green@building.com
8.0
0 projects
Vithu Mauli Construction
General
Verified
Sumago Pvt. Ltd
General
Verified
XYZ Engineering Corp
General
Verified
Register New Contractor
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Wallet Address
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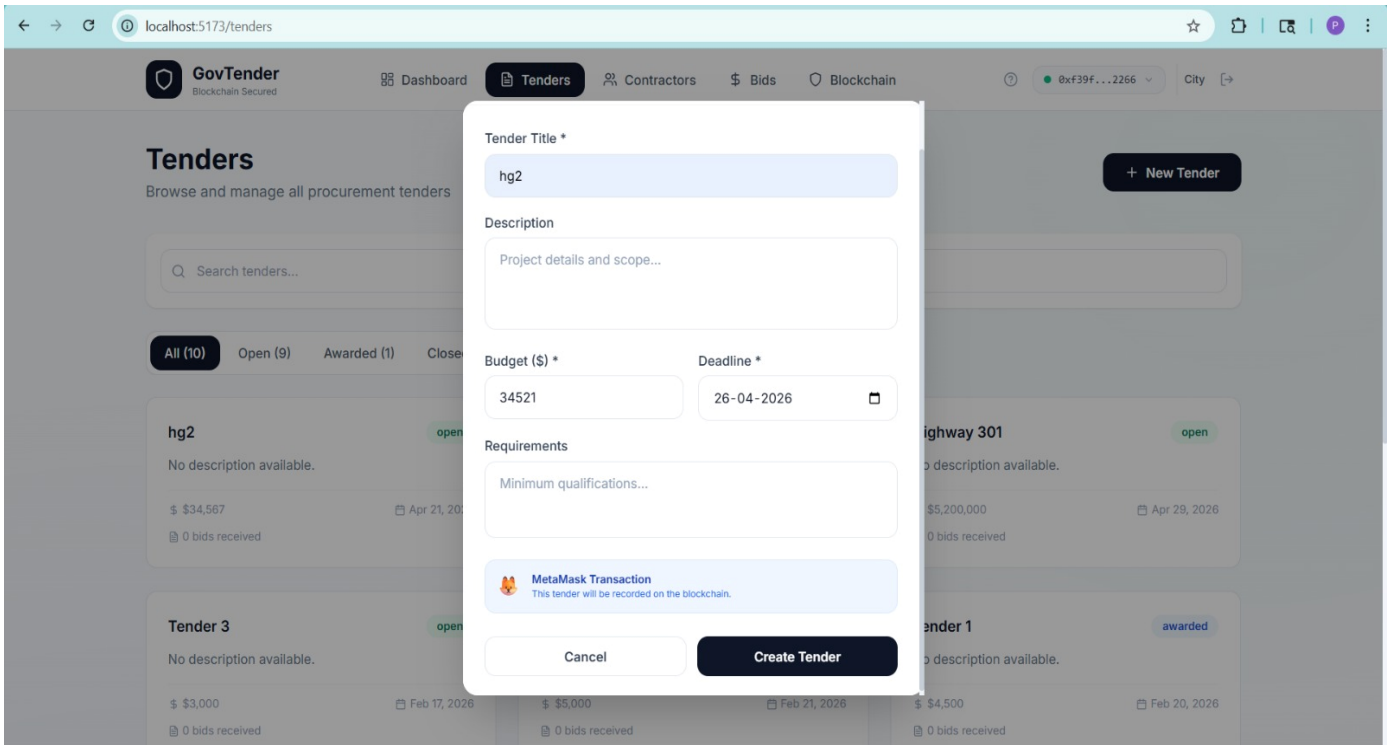
Specialization
Infrastructure
Reputation (0-10)
6
Cancel
Register Contractor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GovTender
Blockchain Secured
Dashboard
Tenders
Contractors
Bids
Blockchain
City
Tenders
Browse and manage all procurement tenders
New Tender
Search tenders...
All (10)
Open (9)
Awarded (1)
hg2
open
No description available.
$ $34,567
0 bids received
Tender 3
open
No description available.
$ $3,000
Feb 17, 2026
0 bids received
ighway 301
open
description available.
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0 bids received
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Deadline *
26-04-2026
Requirements
Minimum qualifications...
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Create Tender

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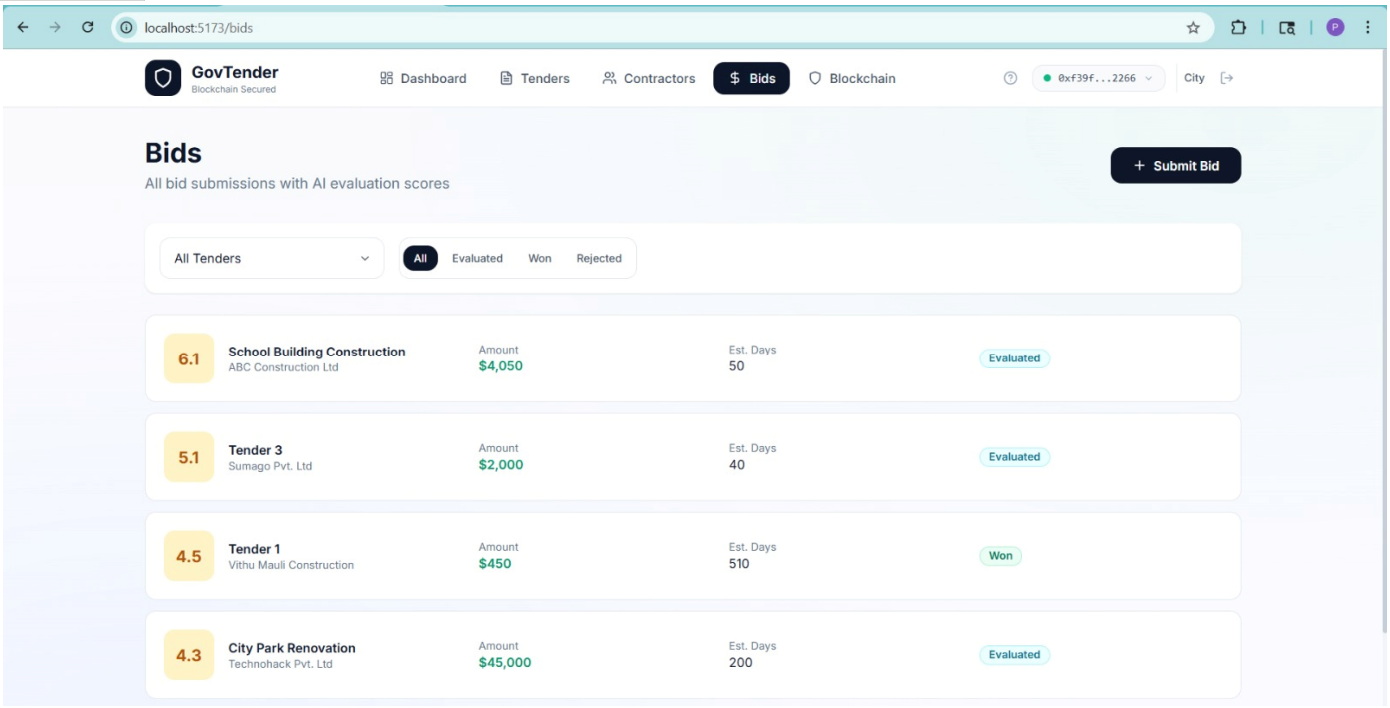

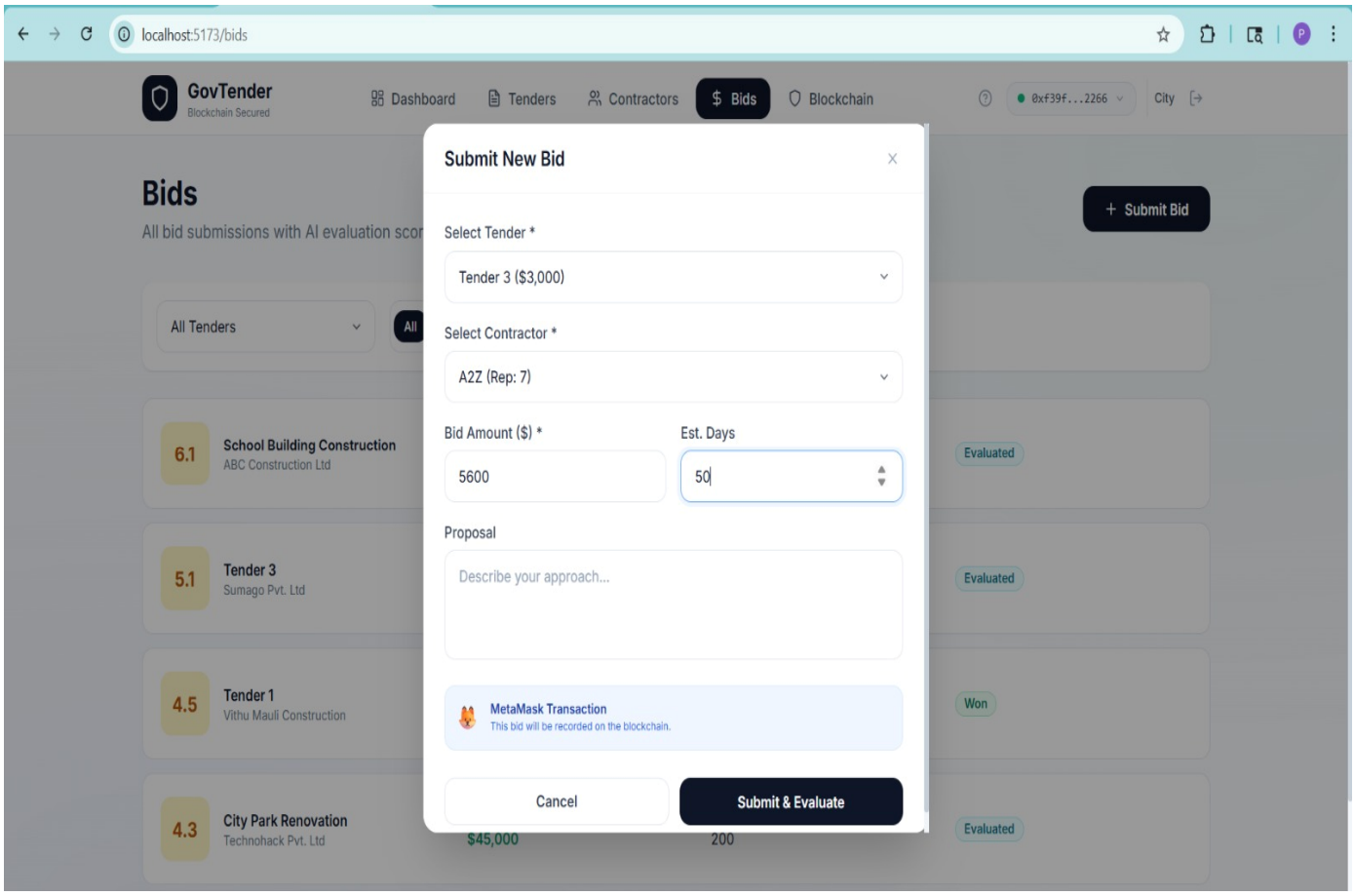

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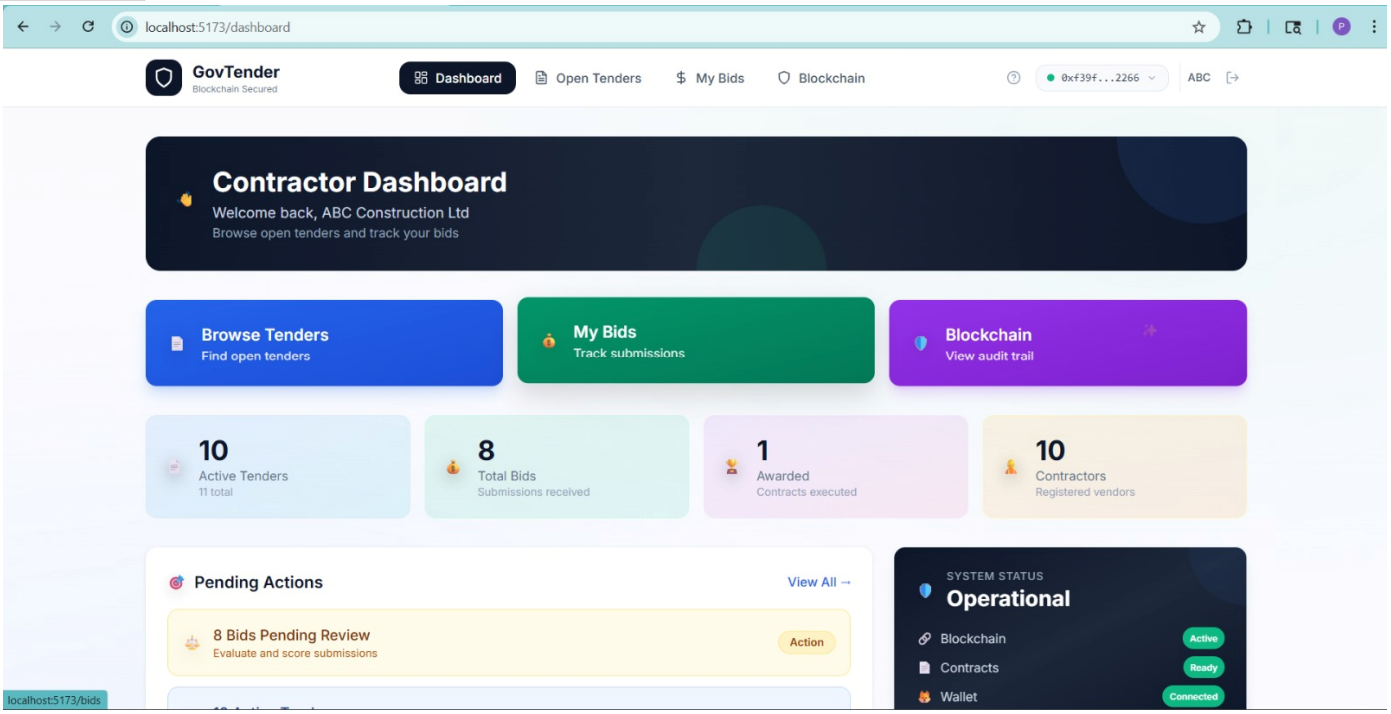

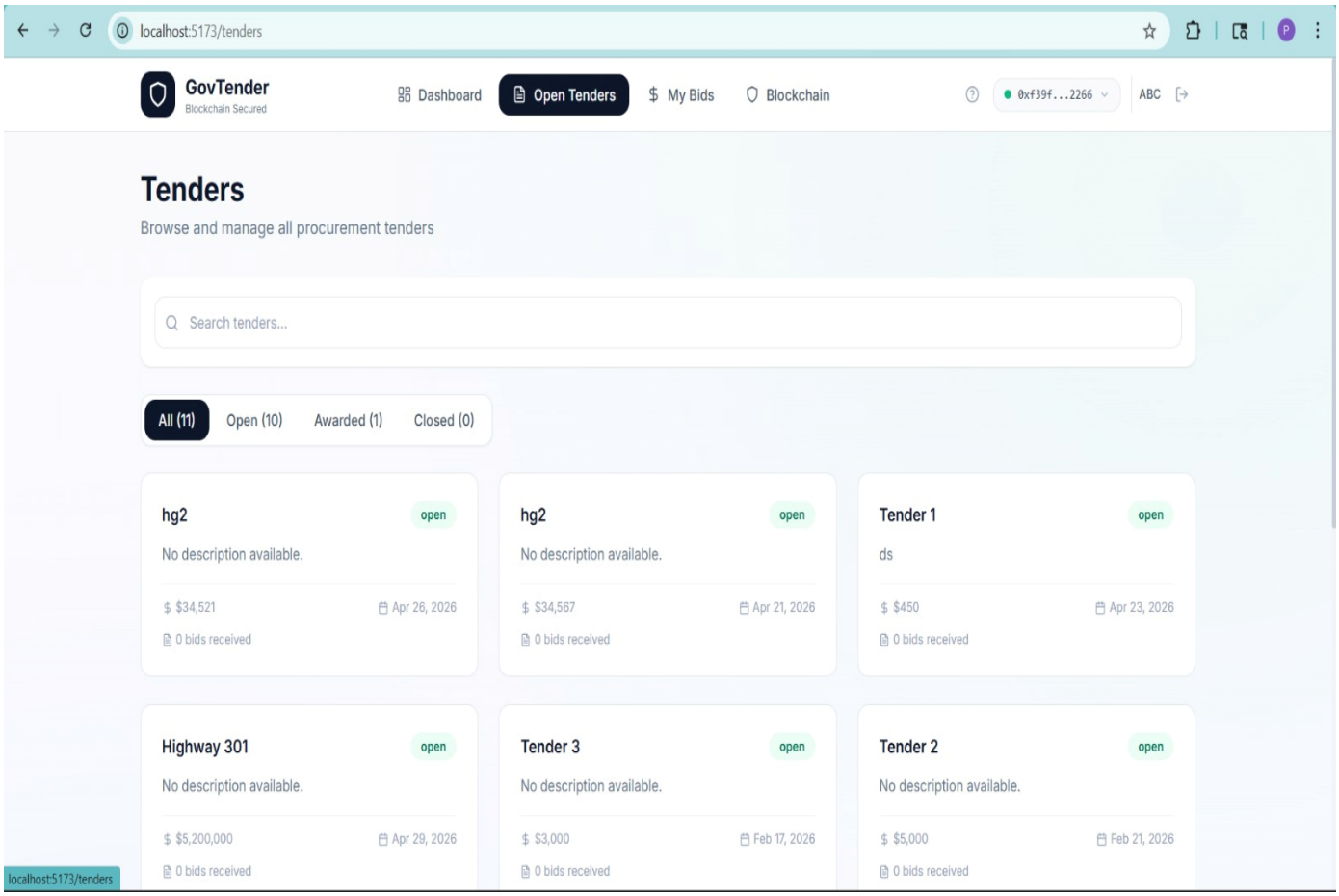

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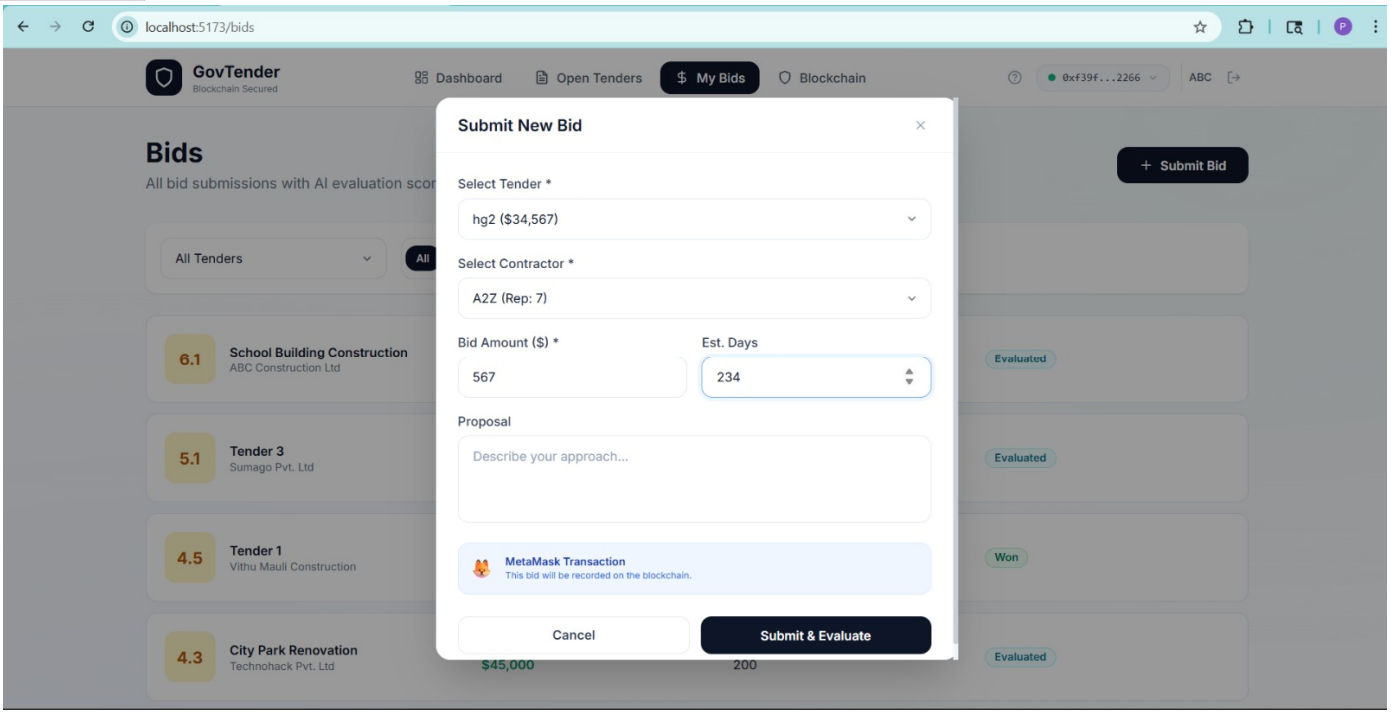

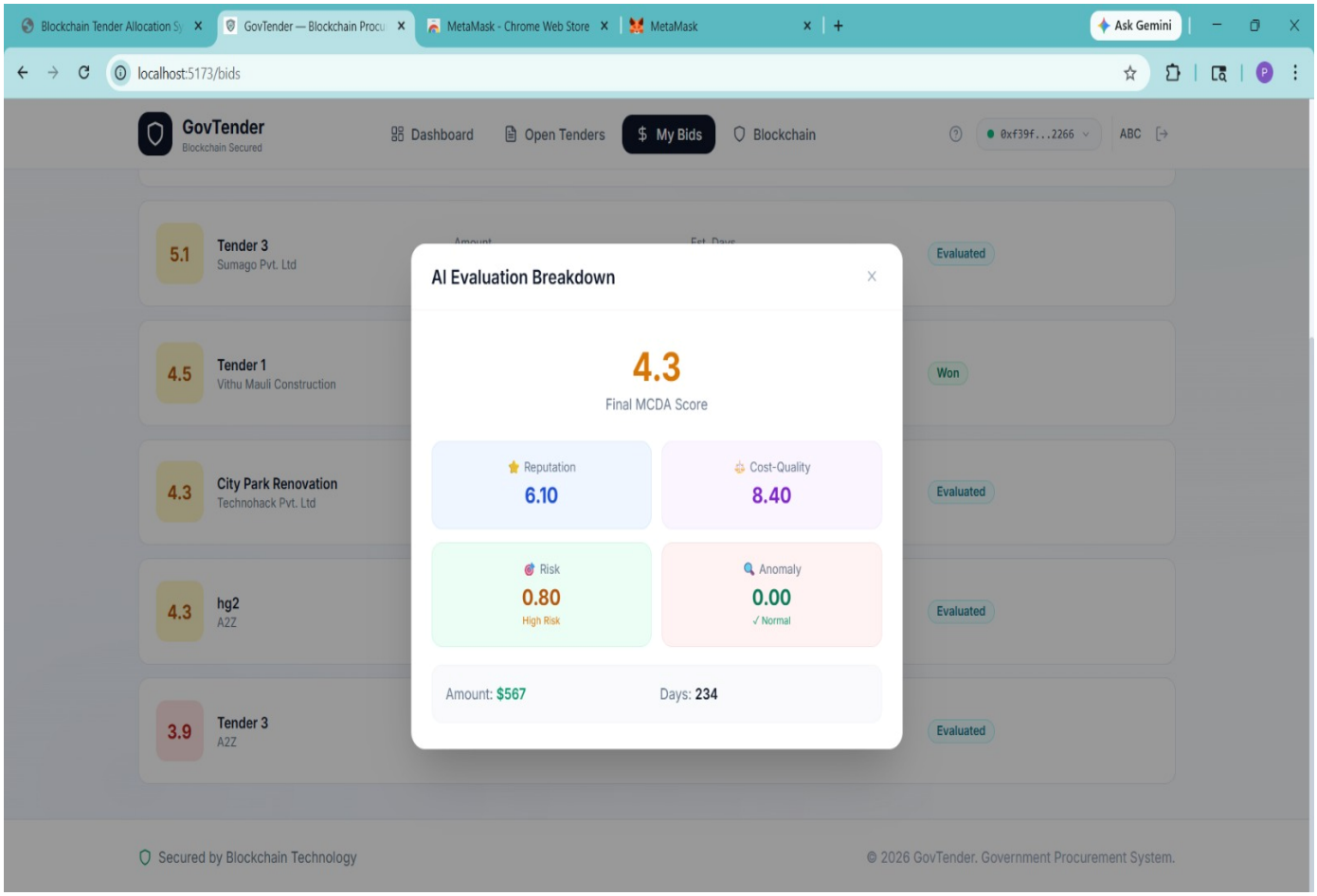

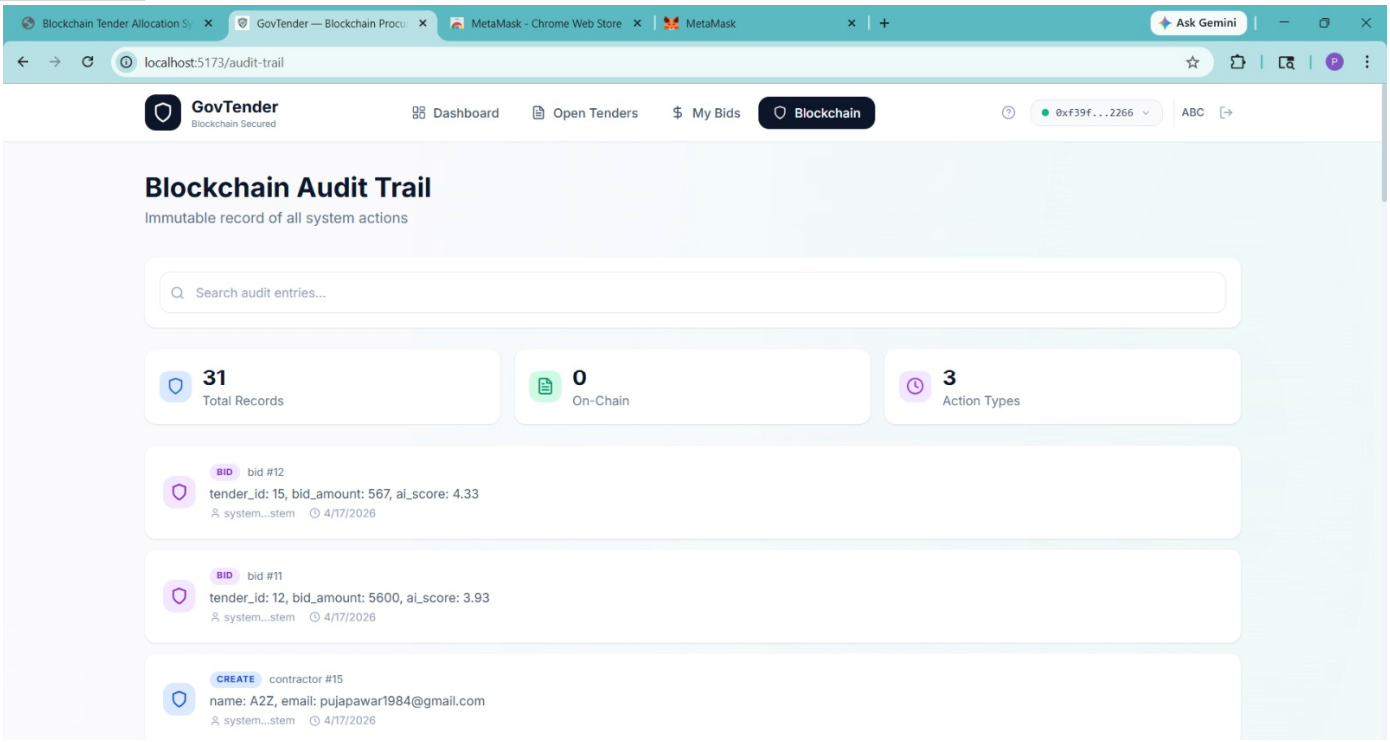

VIII. CONCLUSION

The proposed AI-Enhanced Blockchain-Based Tender Allocation System provides a modern and secure approach to managing government procurement processes. By combining blockchain technology, smart contracts, and artificial intelligence, the system addresses major challenges associated with traditional tendering methods, including lack of transparency, data manipulation, centralized control, and manual evaluation errors.

Blockchain technology ensures that all tender-related transactions are permanently recorded in an immutable and decentralized ledger, thereby improving transparency, security, and accountability. Smart contractsautomate critical procurement activities such as tender publication, bid submission validation, evaluation triggering,and winnerdeclaration, reducing the needfor humaninterventionandminimizingoperational delays. In addition, the AI-powered evaluation system supports fair and evidence-based decision-making by assessing various bid factors and identifying the contractor that best meets the defined performance requirements.

The experimental analysis demonstrated that the proposed system successfully maintains data integrity, prevents unauthorized modifications, enhances auditability, and improves the efficiency of the tender allocation process. The inclusion of an auditor role further strengthens trust by enabling independent verification of all procurement activities without compromising data security.

Overall, the proposed framework offers a reliable, transparent, and scalable solution for digital procurement. It has the potential to improve governance, reduce corruption, and promote fairness in public tender management. Future enhancements may include the integration of advanced machine learning models, cross-departmental blockchainnetworks,andreal-timeanalyticstofurtheroptimizeprocurementoperationsandsupportlarge-scale government applications.

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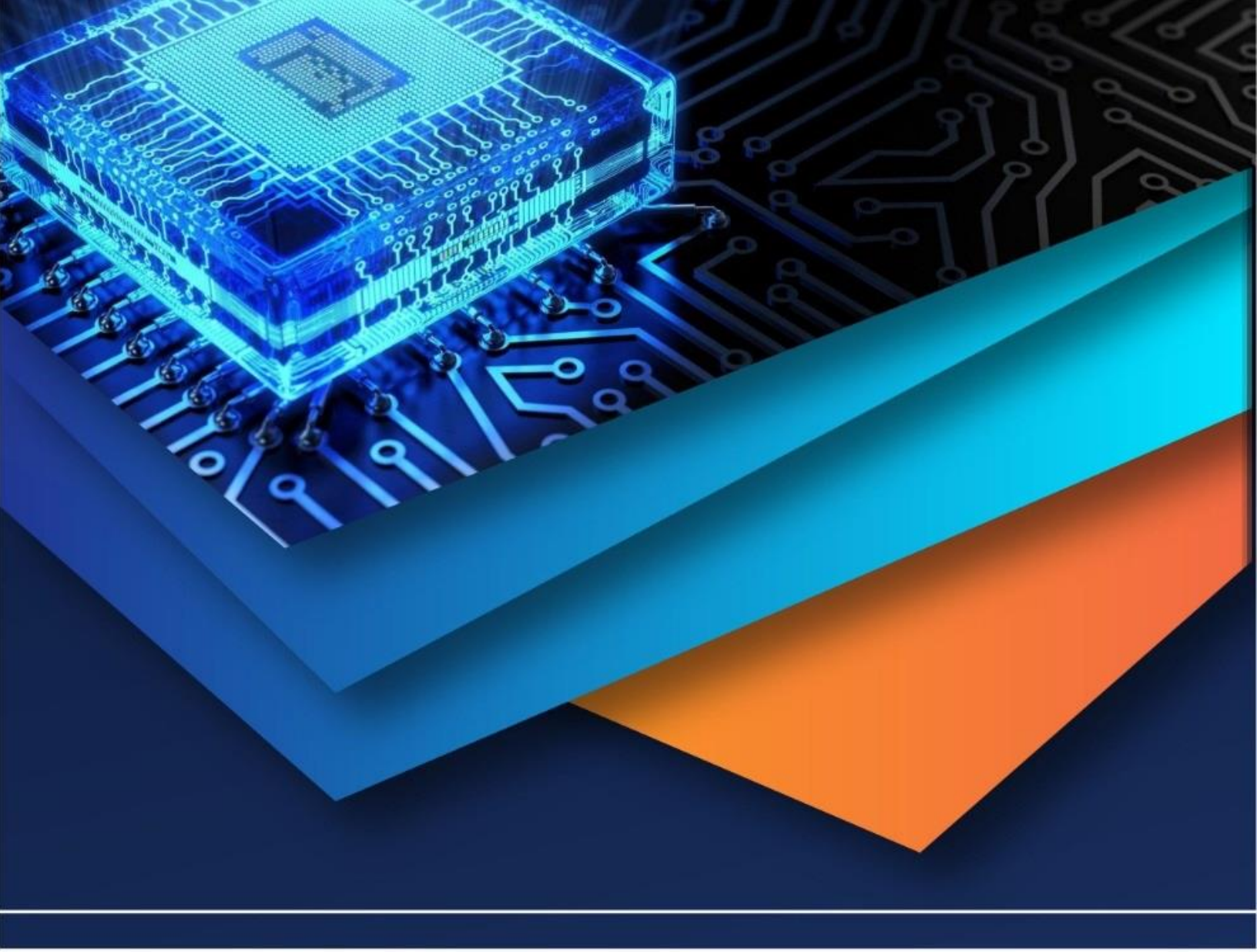

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