e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

BLOCKCHAIN FORTRESS: SECURING GOVERNMENT TENDERS WITH BORK FRAMEWORK

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DOI : https://www.doi.org/10.56726/IRJMETS52078

ABSTRACT

the conventional process of tendering in procurement has been plagued by inefficiencies lack of transparency and susceptibility to fraudulent activities this paper proposes a transformative approach to tendering through the integration of blockchain technology blockchain a decentralized ledger system provides a secure and immutable platform for recording verifying and managing tender-related transactions this research explores the potential benefits and challenges of implementing blockchain-based e-tendering systems in procurement processes the study first provides an overview of the traditional tendering process highlighting its shortcomings and the need for a more robust and transparent solution it then introduces blockchain technology elucidating its fundamental principles and its application in various industries the inherent features of blockchain such as transparency immutability and decentralized consensus are examined in the context of e-tendering furthermore the paper presents a comprehensive framework for implementing blockchain-based e-tendering systems this framework encompasses key components like smart contracts digital identity verification and consensus mechanisms tailored to the specific requirements of the procurement domain case studies and real-world examples are provided to illustrate the potential impact of this technology on enhancing trust reducing fraud and streamlining the procurement process

Keywords: " Transparency, E-Tender System, Blockchain Technology".

I. INTRODUCTION

Current E-Tendering frameworks are 'absurd and open' implying that the data isn't imparted to all partners. For example, when a firm is chosen as the winner of a contract, other companies that bid on the same tender are not informed of why their bid was rejected and why a particular company was chosen as the winner.

A corporation can request this information, but obtaining it is a time-consuming process. Despite the fact that checking these papers is possible, reviewing those takes time. Apart from not being transparent, these portals' security is a serious concern, leading to fraud and data tampering in a centralized database. If a hacker gains access to this centralized database, offers could be disclosed to rivals, resulting in significant significant financial and strategic losses. Because it focuses largely on decentralization of information and is secured by encryption integrated with indisputable block-based architecture for transaction management, blockchain technology can be utilized to address these security concerns. As a result, Blockchain and Smart Contracts can be utilized to create a transparent, decentralized, and secure tendering framework that allows bidders to monitor portal functionalities and track all of the tender portal's activity. Explanation of the Blockchain Decentralization is at the heart of the blockchain concept. As a result, it might be considered a distributed database. In this example, the distributed database uses full replication, which means that each node has a complete copy of the blockchain. A process known as mining occurs whenever the blockchain needs to be updated due to a transaction. A block is made up of a number of transactions. The mined block is transmitted to all other nodes via a consensus procedure.

In the header of these blocks, there will be a cryptographic hash that refers to the previous block in the chain. If a block is tampered with, the hash linked with it previous block in the chain. If a block is tampered with, the hash linked with it changes, requiring all subsequent blocks to be re-mined, which is impossible. In this way,

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blockchain makes use of the immutability attribute. The essence of blockchain is how it is implemented and what consensus protocol it uses.

II. LITERATURE SURVEY

A literature survey in general involves an extensive exploration and analysis of existing scholarly works, academic papers, publications, and relevant sources on a specific topic. It aims to identify, summarize, and synthesize the knowledge, findings, and trends within a particular field or subject area.This survey serves to establish a comprehensive understanding of the existing research landscape, highlighting gaps, trends, methodologies, and critical insights. A well-conducted literature survey provides a foundation for new research by contextualizing current understanding, identifying areas for further investigation, and offering a synthesized overview of the subject matter.

Certainly! Here's a concise literature survey summarizing the state of research on secure frameworks using blockchain technology:

Research on secure frameworks utilizing blockchain technology has burgeoned in recent years, addressing a myriad of security challenges and opportunities. "A Survey of Blockchain Security Issues and Challenges" by Zheng Yan et al. comprehensively outlines security concerns encompassing consensus algorithms, smart contract vulnerabilities, and scalability issues. Meanwhile, "Blockchain Security: A Survey" by Ghassan Karame et al. delves into potential attack vectors such as 51% attacks and double spending, along with mitigation strategies. Specific to smart contracts, Nicola Atzei et al.'s "Smart Contract Security: A Survey" dissects vulnerabilities like reentrancy and offers insights into fortifying smart contract security. "Blockchain-based Secure Framework for Healthcare Data Sharing" by Jihoon Cho et al. proposes a secure healthcare data sharing framework emphasizing privacy preservation and access control. Lastly, works like "Privacy and Security in Blockchain: A Survey" by Reza Mousavi et al. explore anonymity concerns and regulatory compliance challenges, shedding light on privacy-enhancing techniques. These studies collectively advance understanding and offer solutions to bolster security in blockchain frameworks across diverse applications.

Author: Akshata Wadekar, Ashwini Desale, Pranali Gangurde, Divyani Girase

Description: Procurement tools and web platforms. have organized the source-to-pay process. Still, these remain relatively limited in solving the overall bottleneck, i.e., reducing the overall administrative burden and automating the tasks across the process lifecycle for both buyers and suppliers. In many cases, these platforms have digitized the pen-and-paper process without providing any added efficiency. Machine learning (ML) are the latest technologies that apply algorithms in finding concealed trends that humans cannot recognize to make decisions using existing data and can significantly improve process efficiency and stage automation. ML and its derived bidding framework offer the promise and hope to improve suppliers' bidding performance while helping buyers ensure an optimum value-for-money across procurement. Tenders are increasing in magnitude, and both buyers and suppliers are feeling its impact. In the last decade, many e-

2. Author: Xingbo Gonga , Xingyu Taoa , Moumita Dasa , Yuhan Liua

Decription : This study proposes a Blockchain-based E-tendering Evaluation Framework for enhancing data security in electronic biddings. The framework proposes a transaction data model to realize the information exchange in tendering. A smart contract is proposed to complete the interaction between the transaction data and the blockchain system. The framework has been verified in three scenarios: "Initial submission of information," "Update submitted data," and "Scoring bid." The verification results show that it can provide a more secure e-tendering collaboration. The framework only tests some limited scenarios. This design only considers tendering evaluation under standard conditions. Some special requirements, such as quality assessment, have not been validated.

3. Author: : Thilak, Prof. Priya

Decription : In this paper, we'll look at how such a system may be created, including the many procedures required and how they're implemented. The security and openness requirements of this type of application can only be met by using Block chain and Smart Contracts are examples of fair, open, and decentralized technologies. In this paper, we'll look at how such a system may be created, including the many procedures we'll required and how they're implemented. Only fair, open, decentralized technologies, such as Block chain

and Smart Contracts, can meet the security and openness criteria of this type of application. In this paper, look at how such a system may be created, including the many procedures required and how they're implemented.

4. Author: **:** J J Deshpande, M Gowda, M Dixit, M S Khubbar, B S Jayasri

Description: The tenders for these projects are given to the winning contractor in an auction-like setting which has massive security issues. After a contractor wins a tender, the specifics of the progress of the work done are rarely properly monitored. The details of the finances spent on the project can be easily manipulated. To enable integrity, non-repudiation and immutability to the data requires the desirable technology to support the above requirements. Hence, the proposed system uses blockchain technology to provide transparency and trust to all parties involved in the network. The entire system consists of two modules such as the Tender Bidding system and Tender Monitoring system using a multi-organization blockchain network in the Hyperledger Fabric. The whole bidding process is improved by creating a decentralized descending auction system that will carry it out fairly and transparently. The Tender Monitoring system employs a custom endorsement policy to attain 100% consensus for attesting every transaction made regarding the progress of the project so that vital steps are ratified and recorded with evidence supporting their integrity. The main aspects of the system, its many components, deployment and drawbacks are viewed

III. PROBLEM STATEMENT

current e-tendering processes arent fair and open which means that information isnt shared with all parties involved when a corporation is chosen as the winner of a contract for example the information is disseminated as they wish organizations that bid on a same tender arent told why their proposal was rejected or why one company was chosen as the winner a corporation can request this information but obtaining it is a time-consuming process blockchain-based e-tendering refers to the implementation of blockchain technology in the process of conducting electronic tenders or bids for procurement purposes the traditional e-tendering process often faces challenges related to transparency security and trust between involved parties these issues can lead to disputes fraud and inefficiencies in the procurement process one of the main problems with conventional e-tendering systems is the lack of a tamper-proof and immutable ledger to record and verify tender-related transactions this can result in disputes over bid authenticity alterations to submitted documents and difficulties in establishing a clear audit trail additionally centralized e-tendering platforms are susceptible to single points of failure which can lead to data breaches system outages and potential manipulation of tendering information moreover trust is a critical factor in any tendering process and traditional systems often rely on intermediaries or third-party validation this introduces additional costs delays and potential vulnerabilities to the process additionally current e-tendering platforms may lack robust mechanisms for securely verifying the identity and qualifications of participants leading to accountability

IV. PROPOSED SOLUTION

The proposed system for blockchain-based e-tendering aims to revolutionize the traditional tendering process by leveraging the power of distributed ledger technology. This innovative approach will introduce a transparent, secure, and tamper-proof system for managing the entire tendering lifecycle. The system will be designed to facilitate seamless interactions between all stakeholders, including government agencies, procurement officers, contractors, and evaluators. Through the utilization of blockchain, each tender document, bid submission, and evaluation will be recorded in a decentralized and immutable ledger, ensuring transparency and eliminating the possibility of fraud or manipulation. Smart contracts will automate key aspects of the process, such as bid opening and contract awarding, based on predefined criteria. Additionally, the system will incorporate robust identity verification mechanisms to ensure that only authorized and authenticated individuals have access to sensitive information. This blockchain-based e-tendering system is poised to revolutionize public procurement, enhancing efficiency, reducing costs, and instilling trust in the tendering process.

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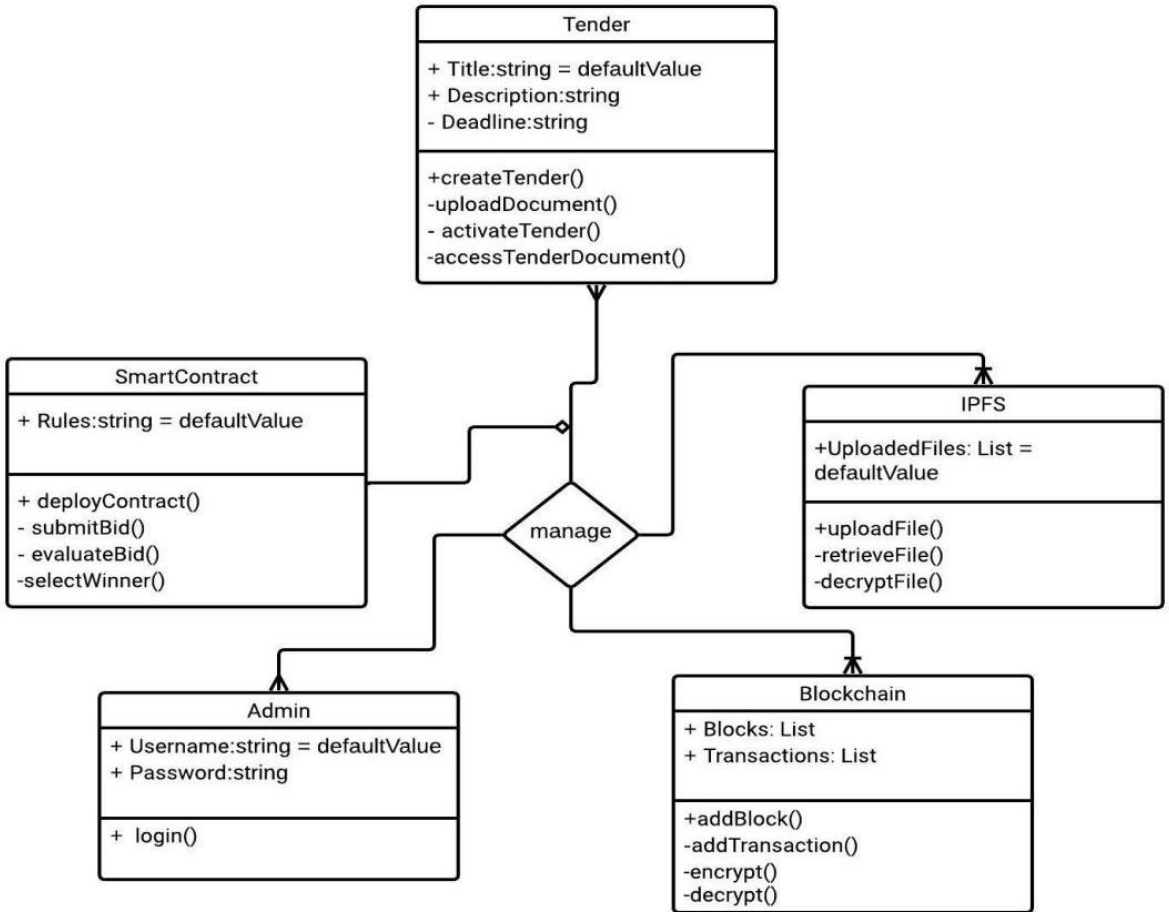

V. HARDWARE REQUIREMENTS

PROCESSOR : INTEL CORE OR MORE	Intel Core processors are a popular line of CPUs manufactured by Intel. They are widely used in various computing devices, including laptops, desktops, and servers, known for their performance, efficiency, and reliability. If you have any specific questions or need information about a particular model or generation, feel free to ask
RAM 4 GB OR MORE	In blockchain technology, RAM (Random Access Memory) is typically used to store temporary data needed for executing smart contracts and processing transactions on the blockchain network. RAM is crucial for facilitating quick access to this data, ensuring efficient operation of decentralized applications (DApps) built on the blockchain platform. Users typically need to purchase or rent RAM resources to interact with smart contracts and store data on the blockchain.
HARD DISK: 250 GB OR MORE	In a blockchain framework, the hard disk is primarily used for storing the entire blockchain ledger, which includes a record of all transactions that have ever occurred on the network. Each node in the blockchain network maintains a copy of this ledger on its hard disk. Additionally, the hard disk may also be used for storing other data related to the blockchain network, such as configuration files, logs, and temporary storage for data processing tasks. Overall, the hard disk plays a crucial role in providing persistent storage for the blockchain data, ensuring the integrity and availability of the ledger across the entire network.

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VI. SOFTWARE REQUIREMENTS

PYTHON	Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding
FLASK	Flask is a web application framework built with flexibility and speed in mind. The flask is built in Python, a language familiar to many scientists
SMART CONTRACT	Smart contracts and blockchain have the potential to change the current shape of cloud markets by enabling the development of completely decentralized cloud and fog solutions that lower costs and enforce predictable results without requiring any intermediaries
GANACHE	Ganache is a private blockchain for Ethereum and Corda that spreads app improvement. You can use Ganache during the development cycle; permitting you to develop, use, and check your dApp in a secure and first rate environment. Ganache comes with flavors

The list of software requirements depends on a sophisticated interplay of software components to effectively manage the flow, communication, and analysis of data.

VII. MODELLING AND ANALYSIS

Software development Life Cycle

The entire project spanned for a duration of 6 months. In order to effectively design and develop a cost-effective model, the Waterfall model was practiced.

Requirement gathering and Analysis phase:

This phase started at the beginning of our project. We formed groups and modularized the project. Important points of consideration were

1. Define and visualize all the objectives clearly.
2. Gather requirements and evaluate them

Consider the technical requirements needed and then collect technical specifications of various peripheral components (Hardware) required.

3. Analyze the coding languages needed for the project.
4. Define coding strategies.
5. Analyze future risks / problems.
6. Define strategies to avoid these risks and define alternate solutions to these risks.
7. Check financial feasibility.
8. Define Gantt charts and assign a time span for each phase.

FLASK:

Flask is a web application framework built with flexibility and speed in mind. The flask is built in Python, a language familiar to many scientists. Flask takes care of the environment and project settings in web applications and allows developers to focus on their application instead of thinking about HTTP, routing, dataset, etc. Flask allows Data Scientists to create simple single page applications and one should help or see if they want to create consumer products Flask is a micro web framework written in Python. It is classified as a microframework because it does not require special tools or libraries. it does not contain any database abstraction layer, form validation, or other components where common functionality is provided by pre-existing third-party libraries. However, Flask supports extensions that will add functionality to the application as if it were implemented in Flask itself. There are extensions for object-relational mappers, form validation, upload processing, various open authentication technologies, and a number of other common tools related to the Flask framework created by Armin Ronacher of Pocoo, a worldwide group of Python enthusiasts formed in 2004. According to Ronacher, the idea was originally an April Fool's joke , which was popular enough to evolve into a major app. When Ronacher and Georg Brandl created a bulletin board system written in Python, the

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Pocoo Werkzeug and Jinja projects were developed. Flask has become popular among Python enthusiasts. As of October 2020, it had the second highest number of stars on GitHub among Python web development frameworks, only slightly behind Django, and was voted the most popular web framework in the 2018 Python Developers Survey.

These are some important features of the flask:

1. it's a development server
2. Debugger
3. RESTful submit request
4. Based on Unicode
5. The flask is compatible with google app engine

Smart contract:

Smart contracts and blockchain have the potential to change the current shape of cloud markets by enabling the development of completely decentralized cloud and fog solutions that lower costs and enforce predictable results without requiring any intermediaries. In this article, we survey three of these solutions, namely Golem, iExec, and SONM, compare them, and identify some of the problems they leave unsolved. Moreover, we consider existing standards for the development of interoperable decentralized cloud solutions that would allow such systems to compete with large providers and would prevent vendor lock-in. We believe that our study contributes to the evolution of cloud systems not only by pointing out incompatibilities among projects and possible solutions for research problems in the area but also by reviewing the existing standards and suggesting new standardization opportunities. Smart contracts and blockchain are revolutionizing business by offering the possibility of removing intermediaries. Additionally, they have the potential to change the current shape of the cloud and fog markets and lower entry barriers for such markets. In fact, despite the current efforts to advance interoperability between cloud offerings, the cloud market has developed without standards and is restricted to a few providers that have a dominant market position. This limitation has a significant impact on medium and small providers, who cannot easily enter the market, and on consumers, for whom changing providers is difficult since the service conditions are difficult to compare because every provider has its own vocabulary. Also, consumers need to verify data compatibility and consider transfer costs and application adaptation, which together might lead to vendor lock-in.

Ganache:

Ganache is a private blockchain for Ethereum and Corda that spreads app improvement. You can use Ganache during the development cycle; permitting you to develop, use, and check your dApp in a secure and first rate environment. Ganache comes with flavors: UI and CLI. Ganache UI is a computing device software that helps Ethereum and Corda technology. The command line tool, ganache-ehl (previously called TestRPC), is to be used for Ethereum development. Prefer to apply command line? These texts will only pay attention to Ganache's UI taste. Please check with Ganache CLI Readme for command line documents. All Ganache versions are to be had for Windows, Mac, and Linux.

Ganache is a popular non-public blockchain emulator evolved by way of Truffle Suite. It is normally utilized in Ethereum development for checking out and development functions. Ganache presents a neighborhood blockchain environment that mimics the behavior of a real Ethereum community, permitting developers to engage with smart contracts, install contracts, and check their packages without the need for connecting to a real community.

VIII. IMPLEMENTATION

Entity-Relationship Diagram

The ER or (Entity Relational Model) is a high-level conceptual data model diagram. Entity-Relation model is based on the notion of real-world entities and the relationship between them.

An Entity Relationship (ER) Diagram is a type of flowchart that illustrates how “entities” such as people, objects or concepts relate to each other within a system.

ER diagrams are related to data structure diagrams (DSDs), which focus on the relationships of elements within

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entities instead of relationships between entities themselves. ER modeling is something regarded as a complete approach to design a logical database schema. This is incorrect because the ER diagram is just an approximate description of data, constructed through a very subjective evaluation of the information collected during requirements analysis.

ER Diagrams are composed of entities, relationships and attributes. They also depict cardinality, which defines relationships in terms of numbers.

- **Entity**

An entity is an object or component of data. An entity is represented as a rectangle in an ER diagram.
For example: Student and College and these two entities have many to one relationship as many student studies in a single college.

An entity that cannot be uniquely identified by its own attributes and relies on the relationship with another entity is called a weak **entity**. The weak entity is represented by a double rectangle.

- **Attribute**

An attribute describes the property of an entity. An attribute is represented as Oval in an ER diagram. There are four types of attributes:

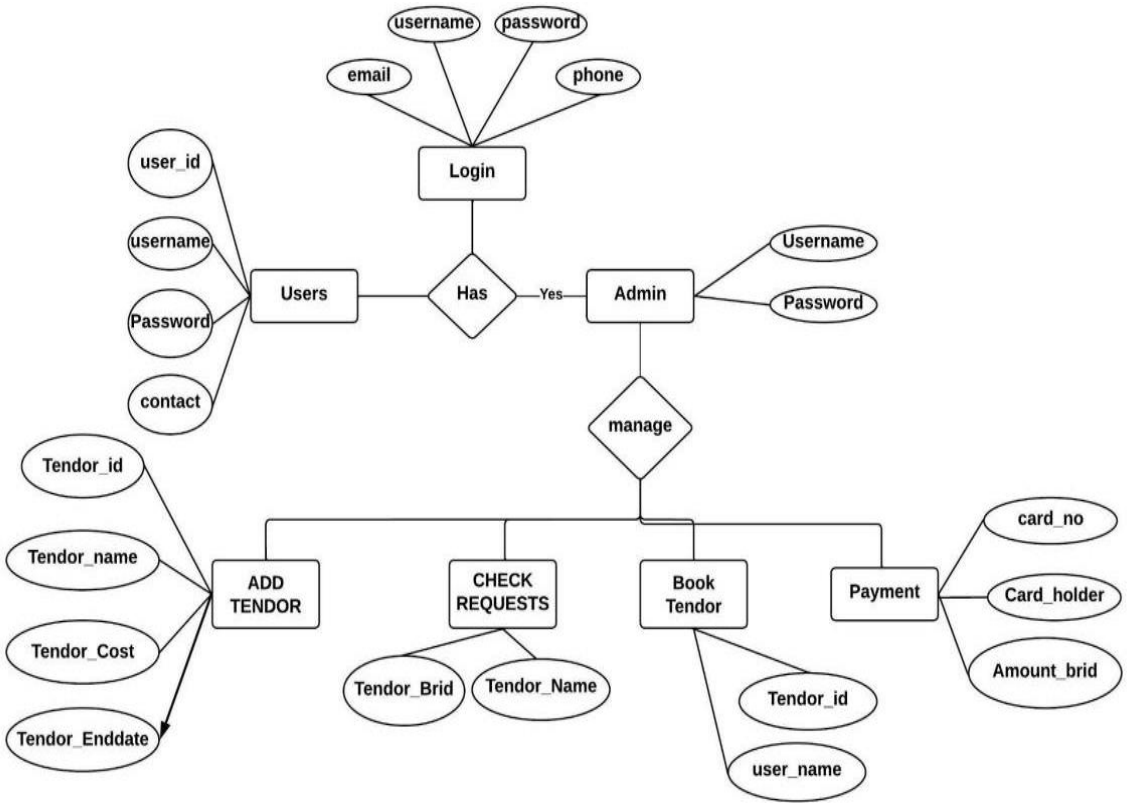
1. Key attribute
2. Composite attribute
3. Multivalued attribute
4. Derived attribute

- **Relationship**

A relationship is represented by diamond shape in the ER diagram, it shows the relationship among entities. There are four types of relationships:

1. One to One
2. One to Many
3. Many to One
4. Many to Many

ER -DIAGRAM:



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FLOW-DIAGRAM:

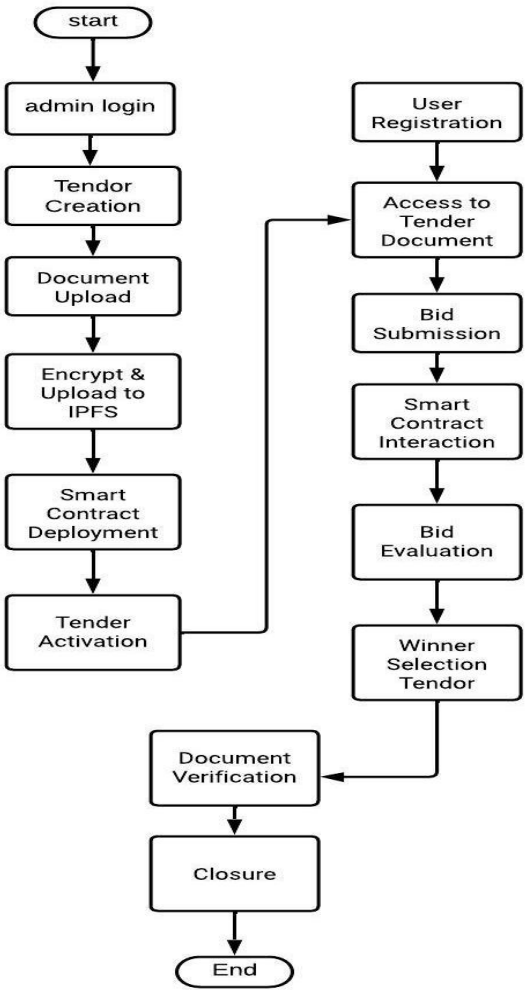
Flow diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, Flow diagrams can be used to describe the business and operational step-by- step workflows of components in a system. An activity diagram shows the overall flow of control. A Flow diagram shows the overall flow of control. Flow diagrams are constructed from a limited repertoire of shapes, connected with arrows.

Flow diagrams are constructed from a limited repertoire of shapes, connected with arrows.

The most important shape types:

- The rectangle represents Flow .
- Diamonds represent decisions.
- Bars represent the start (split) or end (join) of concurrent activities.
- A rectangle represents the start (initial state) of the workflow.
- An end rectangle represents the end (final state).
- Arrows run from the start towards the end and represent the order in which activities happen.

FLOWCHART:



Data Flow Diagram (DFD):

Data Flow Diagram (DFD) is a graphical representation of data flow in any system. It is capable of illustrating incoming data flow, outgoing data flow and store data. There is a major difference between data flow diagrams and flowchart.. Data flow diagrams illustrate flow of data in the system at various levels. Data flow diagram does not have any control or branch elements.Data flow diagram describes anything about how data flows through the system.Sometimes people get confused between data flow diagram and flowchart. The flowchart

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illustrates flow control in program modules

Components of Data Flow Diagram:

Entities:

Entities include source and destination of the data. Entities are represented by a rectangle with their corresponding names.

Process:

The tasks performed on the data are known as processes. Process is represented by a circle. Somewhere round edge rectangles are also used to represent the process.

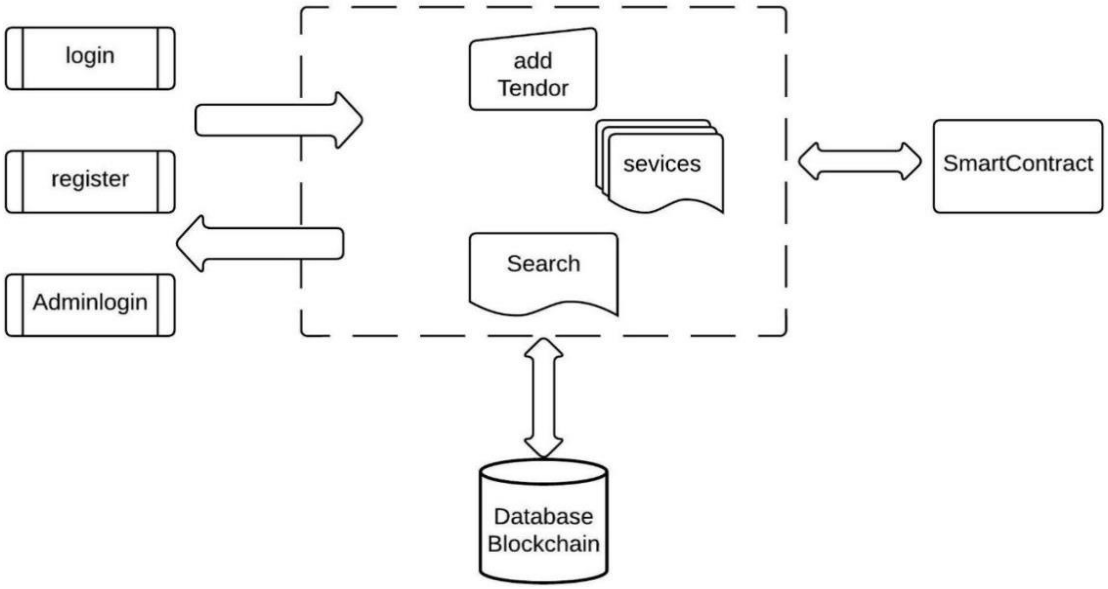
Data Storage:

Data storage includes the database of the system. It is represented by a rectangle with both smaller sides missing or in other words within two parallel lines.

Data Flow:

The movement of data in the system is known as data flow. It is represented with the help of an arrow. The tail of the arrow is the source and the head of the arrow is the destination.

DFD:



Class diagram:

It is a model which is used to show the classes constituting a system and their interrelationship. It is based on UML. Only the important attributes and methods are shown in Class diagrams. In the initial period of analysis, the important attributes of the classes, which must be captured and the functionalities provided by the class may not be very clear. As the analysis progresses, the attributes and methods may be added. If more focus is on interrelationships of classes, then the attributes and methods may not be shown in the class diagram.

The class diagram is used to identify and classify the objects which constitute a system. It also includes the important attributes of the objects which must be captured.

IX. ADVANTAGE

- **Automation**

By automating various manual processes and eliminating intermediaries, a blockchain-based e-tender management system can significantly reduce costs associated with paperwork, administrative tasks, and middlemen.

- **Paperless System**

With a blockchain-based system, all the tender-related documents, such as bid proposals, contracts, and evaluations, can be stored digitally on the blockchain. This eliminates the need for physical paper documents

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and reduces the associated costs of printing, storing, and distributing paper-based materials.

- **Fast Process:**

Disputes and conflicts can arise during the e-tender process. With a blockchain-based system, all tender related activities and interactions are recorded on the blockchain, providing an immutable and transparent audit trail. This enables faster and more accurate resolution of disputes by referring to the indisputable evidence stored on the blockchain.

- **Accuracy:**

Removal of manual process and by using the machine learning algorithms it gives the accurate result without any bias.

- **Cost Effective:**

Going paperless eliminates the costs associated with paper procurement, printing, storage, and transportation. Additionally, it reduces the expenses related to physical document management, such as filing systems, document handling, and archival maintenance. Overall, these cost savings can be significant for organizations implementing a blockchain-based e-tender management system.

- **Security:**

Paper documents can be susceptible to loss, damage, or unauthorized access. Blockchain technology provides a secure and tamper-proof environment for storing digital documents. The use of cryptographic algorithms and decentralized consensus mechanisms ensures the integrity and confidentiality of the documents, enhancing overall document security.

X. APPLICATIONS

1. Government procurement: Blockchain-based e-tender management systems can be applied in government procurement processes to enhance transparency, efficiency, and fairness. It enables secure and auditable tender processes, reduces corruption risks, and ensures accountability in public spending.
2. Education sector: Blockchain-based e-tender management systems can be utilized in the education sector for tendering services such as school infrastructure development, technology procurement, or outsourcing contracts. It simplifies bid submission, evaluation, and contract management processes, enhancing transparency and accountability in education procurement.
3. Construction industry: The construction industry involves complex tender processes with multiple stakeholders.

Implementing a blockchain-based e-tender management system can streamline bidding, evaluation, and contract award processes. It facilitates efficient communication, transparent documentation, and secure transactions between contractors, suppliers, and project owners.

XI. RESULTS

The implementation of blockchain technology has brought about unprecedented levels of transparency, immutability, and security to the tendering process. Smart contracts, which are self-executing contracts with the terms directly written into code, have streamlined the bidding process, ensuring that all parties adhere to the predefined rules and deadlines. This has not only reduced the likelihood of disputes but has also minimized the need for intermediaries, resulting in cost savings for all stakeholders involved. Additionally, the immutable nature of blockchain ensures that once data is recorded, it cannot be altered or tampered with, providing a high level of trust and confidence in the integrity of the tendering process. Furthermore, the decentralized nature of blockchain technology has enhanced accessibility, allowing for wider participation and a more competitive bidding environment. Overall, the adoption of blockchain-based e-tendering has ushered in a new era of efficiency, transparency, and trust in the procurement process, ultimately benefiting the entire ecosystem.

XII. CONCLUSION

In conclusion the implementation of blockchain-based e-tendering represents a significant leap forward in the realm of procurement and project management by leveraging project management by leveraging the immutable and transparent nature of blockchain technology this system has the potential to revolutionize the way tenders are conducted it offers unprecedented levels of security trust and efficiency ensuring that every

transaction and interaction within the tendering process is verifiable and tamper-proof moreover the decentralized nature of blockchain reduces the risk of fraudulent activities and fosters a more inclusive and competitive bidding environment with the elimination of intermediaries and the automation of processes administrative overheads are significantly reduced resulting in cost savings for both buyers and suppliers additionally the integration of smart contracts streamlines contract execution enforcing terms and conditions automatically once predefined criteria are met overall the adoption of blockchain-based e-tendering stands poised to usher in a new era of transparency efficiency and integrity in procurement processes benefiting stakeholders across various industries this innovative approach paves the way for a future where trust and accountability are paramount fundamentally reshaping the landscape of tendering processes worldwide.

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