Tender Chain
A BlockChain Based Tender Contract Management System

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May, 2024

Certificate

Date:

This is to certify that the work present in this Project entitled "Tender Chain- A BlockChain Based Tender Contract Management System" has been carried out by Divyesh Reddy E, Jithin Ponduru, Yaswanth Sankuru, G. Bhargav under my/our supervision. The work is genuine, original, and suitable for submission to the SRM University – AP for the award of Bachelor of Technology in School of Engineering and Sciences.

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ABSTRACT

Generally, the Tenders or contracts are used by governments and companies to procure goods or services. Wrongful tender management leads to huge losses in case of faulty practices. This includes favouring of contractors, improper record maintenance, lack of transparency, hacking, data modification and other issues.

To overcome this problem, we have used a simple and secure block chain technology and to secure by encryption coupled with indisputable block based architecture for transaction management. In this case we make use of block chain technology to secure transaction based documents along with transactions such as tender documents, applications, bid proposals, company profiles, past records, approving officer details, rejection details to ensure a completely transparent tendering process.

INTRODUCTION

Current E-Tendering systems are not ‘fair and open ’meaning that the information is not shared with all stakeholders. 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 centralised database. If a hacker gains access to this centralised database, offers could be disclosed to rivals, resulting in significant financial and strategic losses. Because it focuses largely on decentralisation of information and is secured by encryption integrated with indisputable block-based architecture for transaction management, blockchain technology can be utilised to address these security concerns. As a result, Blockchain and Smart Contracts can be utilised to create a transparent, decentralised, 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 changes, requiring all subsequent blocks to be re-mined, which is impossible. In this way, blockchain makes use of the immutability attribute. The essence of blockchain is how it is implemented and what consensus protocol it uses.The information is released on ‘as they please ’basis for example - when a company is selected as a winner of a contract, other companies that bid on the same tender are not notified of why their bid was rejected and why a particular company was selected as a winner. A company can request this information but it is a tedious process of getting this data.

Even though auditing these documents is possible, evaluating the documents needs time. Apart from not being transparent, security is also a major issue for these portals leading to fraud and manipulation of data stored in a centralized database. If a hacker gets hold of this centralized database, bids can be leaked to competitors leading to major financial and strategic losses for a business. Blockchain technology can be used to solve these security implications as it heavily focuses on the decentralization of information and is secured by encryption integrated with undeniable block-based architecture for transaction management. Hence, Blockchain and Smart Contract can be used as a transparent, decentralized and secured tendering framework that will facilitate bidders ’oversight on portal functions and observe all the activities carried out by the tender portal. Blockchain Explained Blockchain is based on the concept of decentralization. Hence, it can be viewed as a distributed database. In this case, the distributed database employs the concept of full replication i.e. each node has a full copy of a blockchain. Whenever the blockchain needs to be updated because of a transaction, a process called mining takes place . A block consists of many transactions. A consensus protocol is used and the mined block is

broadcasted to all other nodes. These blocks will have a cryptographic hash in the header that relates to the previous block in the chain. If a block is manipulated the hash associated with this block changes and as a result, all the proceeding blocks should be re-mined which is not possible. In this manner, blockchain employs the property of immutability. How the blockchain is implemented and what consensus protocol is the core of blockchain.

LITERATURE REVIEW

[1] Wang, Wenbo, et al. "A survey on consensus mechanisms and mining strategy management in blockchain networks." IEEE Access 7 (2019): 22328- 22370. The past decade has witnessed the rapid evolution in blockchain technologies, which has attracted tremendous interests from both the research communities and industries. The blockchain network was originated from the Internet financial sector as a decentralized, immutable ledger system for transactional data ordering. Nowadays, it is envisioned as a powerful backbone/framework for decentralized data processing and data-driven self-organization in flat, open-access networks. In particular, the plausible characteristics of decentralization, immutability, and self-organization are primarily owing to the unique decentralized consensus mechanisms introduced by blockchain networks. This survey is motivated by the lack of a comprehensive literature review on the development of decentralized consensus mechanisms in blockchain networks. In this paper, we provide a systematic vision of the organization of blockchain networks. By emphasizing the unique characteristics of decentralized consensus in blockchain networks, our in-depth review of the state-of-the-art consensus protocols is focused on both the perspective of distributed consensus system design and the perspective of incentive mechanism design. From a gametheoretic point of view, we also provide a thorough review of the strategy adopted for self-organization by the individual nodes in the blockchain backbone networks. Consequently, we provide a comprehensive survey of the emerging applications of blockchain networks in a broad area of telecommunication. We highlight our special interest in how the consensus mechanisms impact these applications. Finally, we discuss several open issues in the protocol design for blockchain consensus and the related potential research directions. Summary: Wang, Wenbo and team describes in this paper, we provide a systematic vision of the organization of blockchain networks

[2] Ambegaonker, Ajeenkkya, Utkarsh Gautam, and Radha Krishna Rambola. "Efficient approach for Tendering by introducing Blockchain to maintain Security and Reliability." 2018 4th International Conference on Computing Communication and Automation (ICCCA). IEEE, 2018. The problem with present tendering is its reach which is limited to number of people, though the internet is expanding and tendering is also not far from this, we have some online system for tendering but it is not secure as it should be because tendering has confidential data which is not supposed to be leaked and Blockchain solves that problem efficiently. The motive of this research is to find the better ways for tendering, as tendering is very essential part of businesses and development so improvement of this system leads to better development. Time efficiency, employment, fair system are some of the factors which can be improved by the proposed system of this research. Summary: Ambegaonker, Ajeenkkya and team working on online system for

tendering but it is not secure as it should be because tendering has confidential data which is not supposed to be leaked and Blockchain solves that problem efficiently.

[3] Zheng, Zibin, et al. "An overview of blockchain technology: Architecture, consensus, and future trends." 2017 IEEE international congress on big data (BigData congress). IEEE, 2017. Blockchain, the foundation of Bitcoin, has received extensive attentions recently. Blockchain serves as an immutable ledger which allows transactions take place in a decentralized manner. Blockchain-based applications are springing up, covering numerous fields including financial services, reputation system and Internet of Things (IoT), and so on. However, there are still many challenges of blockchain technology such as scalability and security problems waiting to be overcome. This paper presents a comprehensive overview on blockchain technology. We provide an overview of blockchain architechture firstly and compare some typical consensus algorithms used in different blockchains. Furthermore, technical challenges and recent advances are briefly listed. We also lay out possible future trends for blockchain. Summary: Zibin and team provide an overview of blockchain architechture firstly and compare some typical consensus algorithms used in different blockchains.

[4] Cachin, Christian, and Marko Vukolić. "Blockchain consensus protocols in the wild." arXiv preprint arXiv:1707.01873 (2017). A blockchain is a distributed ledger for recording transactions, maintained by many nodes without central authority through a distributed cryptographic protocol. All nodes validate the information to be appended to the blockchain, and a consensus protocol ensures that the nodes agree on a unique order in which entries are appended. Consensus protocols for tolerating Byzantine faults have received renewed attention because they also address blockchain systems. This work discusses the process of assessing and gaining confidence in the resilience of a consensus protocols exposed I to faults and adversarial nodes. We advocate to follow the established practice in cryptography and computer security, relying on public reviews, detailed models, and formal proofs; the designers of several practical systems appear to be unaware of this. Moreover, we review the consensus protocols in some prominent permissioned blockchain platforms with respect to their fault models and resilience against attacks. Summary: Christian, and team discusses the process of assessing and gaining confidence in the resilience of a consensus protocols exposed to faults and adversarial nodes.

[5] Pilkington, Marc. "Blockchain technology: principles and applications." Research handbook on digital transformations. Edward Elgar Publishing, 2016. This paper expounds the main principles behind blockchain technology and some of its cutting-edge applications. Firstly, we present the core concepts at the heart of the blockchain, and we discuss the potential risks and drawbacks of public distributed ledgers, and the shift toward hybrid solutions. Secondly, we expose the main features of decentralized public ledger platforms. Thirdly, we show why the blockchain is a disruptive and foundational technology, and fourthly, we sketch out a list of important applications, bearing in mind the most recent evolutions

REQUIREMENT ANALYSIS

3.1 FEASIBILITY STUDY: The feasibility of the project is analysed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential. Three key considerations involved in the feasibility analysis are

- ♦ ECONOMICAL FEASIBILITY
- ♦ TECHNICAL FEASIBILITY
- ♦ SOCIAL FEASIBILITY

ECONOMIC FEASIBILITY:
This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

TECHNICAL FEASIBILITY:
This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

SOCIAL FEASIBILITY:
The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

SYSTEM REQUIREMENTS SPECIFICATION

i) FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS:
Requirement's analysis is very critical process that enables the success of a system or software project to be assessed. Requirements are generally split into two types: Functional and non-functional requirements. Functional Requirements: These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily incorporated into the system as a part of the contract. These are represented or stated in the form of input to be given

to the system, the operation performed and the output expected. They are basically the requirements stated by the user which one can see directly in the final product, unlike the nonfunctional requirements.

Functional requirements:

1) Authentication of user whenever he/she logs into the system
2) System shutdown in case of a cyber-attack
3) A verification email is sent to user whenever he/she register for the first time on some software system.

Non-functional requirements:

These are basically the quality constraints that the system must satisfy according to the project contract. The priority or extent to which these factors are implemented varies from one project to other. They are also called non-behavioral requirements.

They basically deal with issues like:

1. Portability
2. Security
3. Maintainability
4. Reliability
5. Scalability
6. Performance
7. Reusability
8. Flexibility

Examples of non-functional requirements:

1) Emails should be sent with a latency of no greater than 12 hours from such an activity
2) The processing of each request should be done within 10 seconds
3) The site should load in 3 seconds whenever of simultaneous users are > 10000

SYSTEM SPECIFICATIONS:

Hardware System Configuration:-

- Processor - I3/Intel Processor
- RAM - 1GB (min)
- Hard Disk - 160GB

Software System Configuration:

- Operating System : Windows 7/8/10/11 , Linux , Mac , Chromebook
- Application Server : NPM
- Front End : HTML, CSS , ReactJS
- Scripts : JavaScript, EmailJS.

SYSTEM DESIGN:

INPUT DESIGN:

In an information system, input is the raw data that is processed to produce output. During the input design, the developers must consider the input devices such as PC, MICR, OMR, etc.

Therefore, the quality of system input determines the quality of system output. Welldesigned input forms and screens have following properties −

- It should serve specific purpose effectively such as storing, recording, and retrieving the information.
- It ensures proper completion with accuracy.
- It should be easy to fill and straightforward.
- It should focus on user's attention, consistency, and simplicity.
- All these objectives are obtained using the knowledge of basic design principles regarding −
  - What are the inputs needed for the system?
  - How end users respond to different elements of forms and screens

OBJECTIVES FOR INPUT DESIGN:

The objectives of input design are −

- To design data entry and input procedures
- To reduce input volume
- To design source documents for data capture or devise other data capture methods
- To design input data records, data entry screens, user interface screens, etc.
- To use validation checks and develop effective input controls.

OUTPUT DESIGN:

The design of output is the most important task of any system. During output design, developers identify the type of outputs needed, and consider the necessary output controls and prototype report layouts.

OBJECTIVES OF OUTPUT DESIGN:

The objectives of input design are:

- To develop output design that serves the intended purpose and eliminates the production of unwanted output.
- To develop the output design that meets the end user's requirements.
- To deliver the appropriate quantity of output.
- To form the output in appropriate format and direct it to the right person.
- To make the output available on time for making good decisions.

3.4 MODULES USED

The proposed system includes 3 entities: Admin, bidders and viewers. Figure 1 shows the interaction between each entity in the proposed system

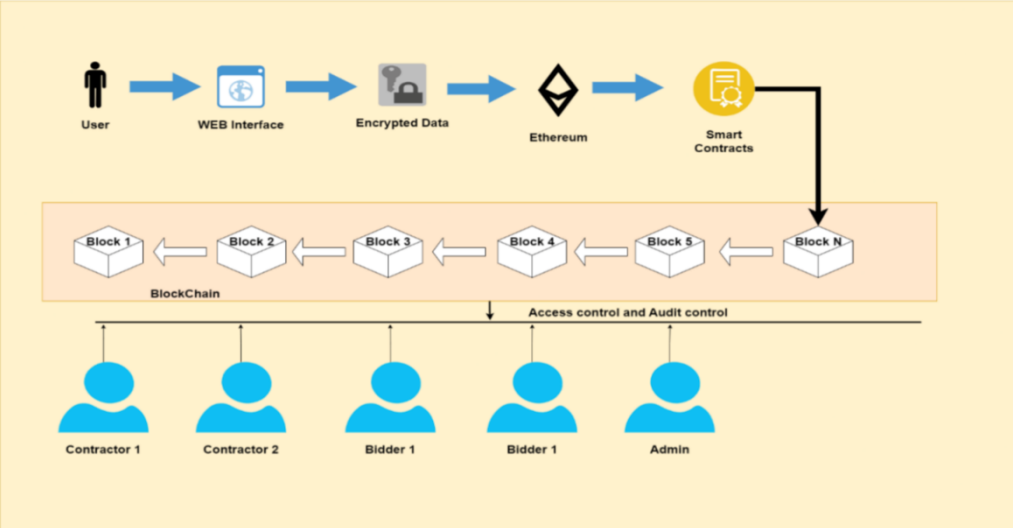
- ❖ Admin: responsible for deploying the contract, automatically becomes the admin of that specific contract. They have the ability to view the list of bidders along with their bidding amounts, a privilege restricted solely to the admin. To even view the deployed contracts, the admin must authenticate by entering their account password. This authentication grants access to a new page displaying a list of contract applicants. The admin can then assign the contract to a specific person who fulfills their requirements.

- ❖ Bidder: Bidders will login into the account after registration and they will view the tender notifications. If the bidder is okay with tender description, he/she will provide their information in TenderChain Portal this data will be sent to Admin of the contract.

- ❖ Viewers: This category is not involved in the bidding or creation process of the project. They visit the website, potentially for testing purposes, solely to help maintain traffic.

DESCRIPTION OF PROPOSED SYSTEM

The proposed Tender Management System utilizes blockchain technology to ensure the security and efficiency of the entire tender management process. Blockchain is secured by encryption and employs an indisputable block-based architecture for transaction management. This approach enables the system to maintain transparent transactions with information shared on a need-to-know basis.



ADVANTAGES:

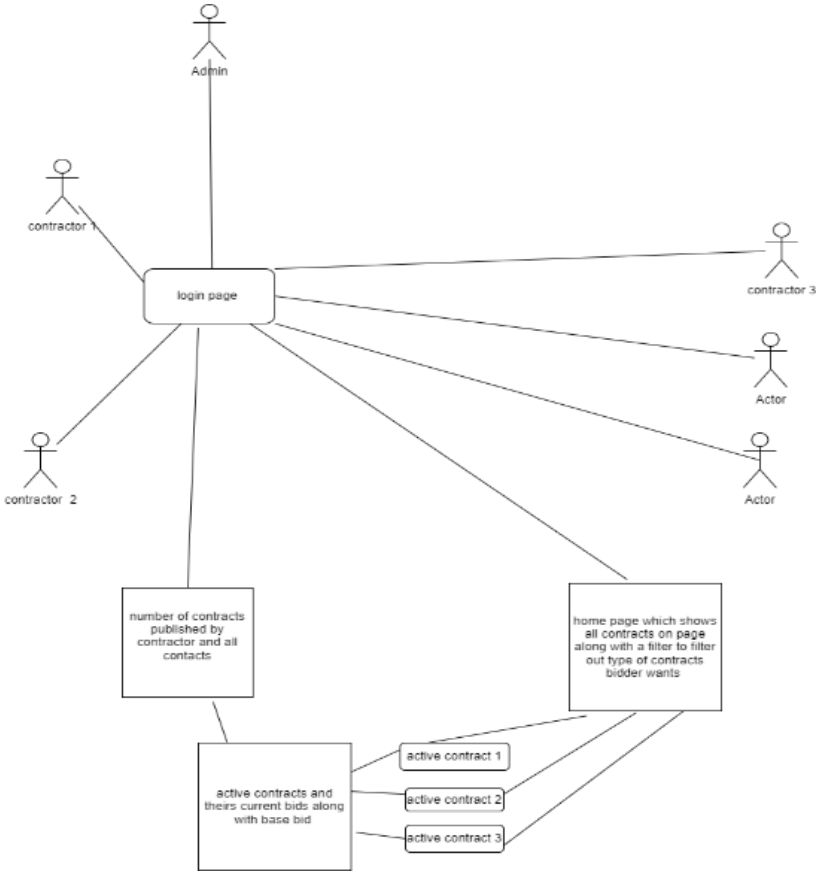
- Simplifying stakeholder management.
- Reducing the risk of duplicates.
- Greater control over documents.

USE CASE DIAGRAM

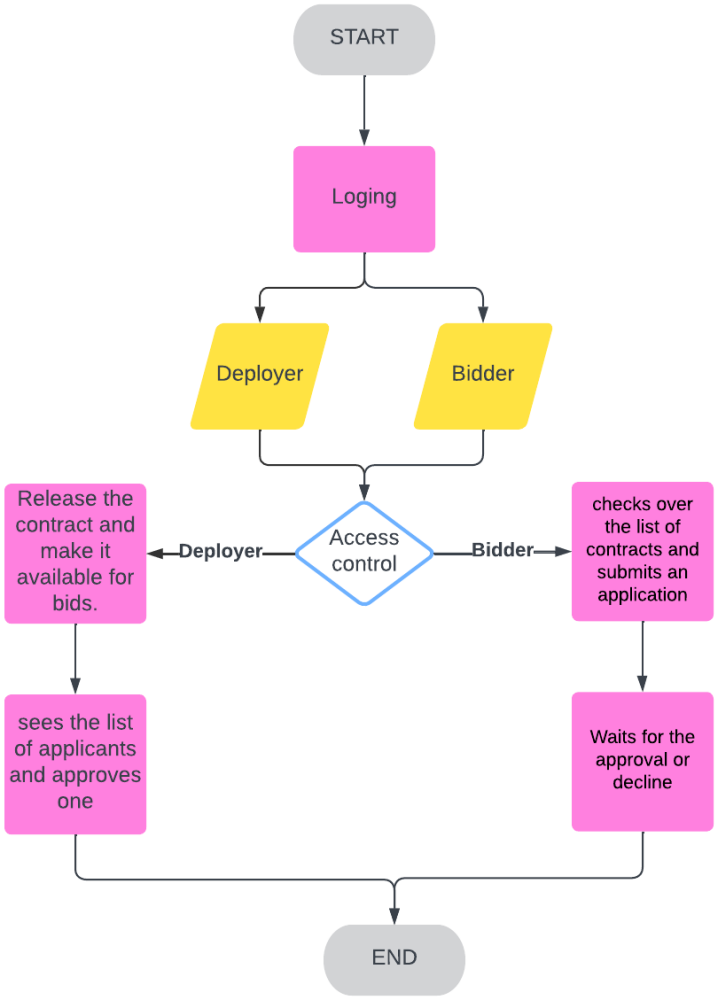
- A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis.

- Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases.

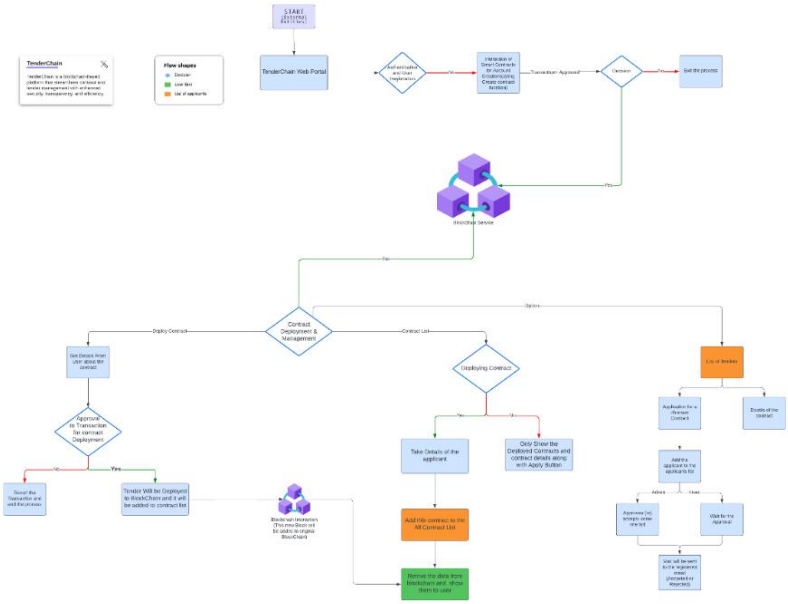
- The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.



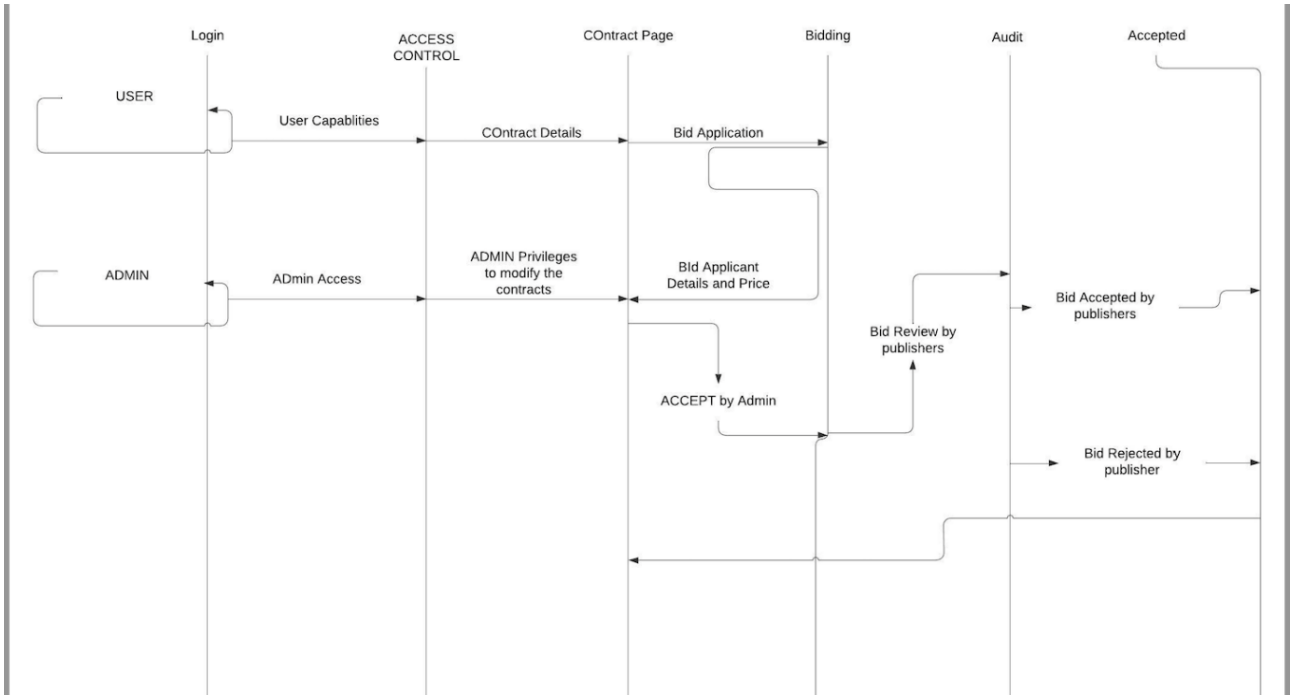
Data Flow Diagram
Level-1



Level-2



SEQUENCE DIAGRAM



- A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order.

- It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

Conclusion

In conclusion, the current E-Tendering systems suffer from a lack of transparency and security issues, which can lead to fraud and data tampering. Blockchain technology offers a viable solution by providing a transparent, decentralized, and secure framework for tendering processes. By leveraging blockchain and smart contracts, stakeholders can ensure that bid information is shared openly, and transactions are conducted securely. This approach not only enhances the integrity of the tendering process but also streamlines the overall management and auditing of tender-related activities.