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Secure Inter Organizational File Sharing Using Block Chain

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ABSTRACT

As industrial systems continue to evolve, edge devices are generating vast amounts of data on a daily basis. Despite this growth, most data remains confined to centralized data centers, creating significant challenges for secure data exchange across different domains. The emergence of decentralized edge computing and blockchain technology has brought transformative changes to smart logistics solutions. To meet the increasing demand for secure and efficient data sharing within logistics networks, we propose a decentralized Hierarchical Attribute-Based Encryption (HABE) scheme integrated with blockchain and edge computing. Our solution introduces a privacy-preserving encryption strategy that allows edge devices to securely transmit data to nearby cloud nodes for processing. Additionally, a blockchain-based data-sharing framework is developed, utilizing both edge and cloud storage to ensure decentralized access control. The system incorporates a Secure Hash Algorithm (SHA) to enhance authentication, enabling reliable and tamper-resistant verification of user access rights at the network edge. By combining HABE, blockchain, and SHA, the proposed architecture ensures strong privacy protection, secure data sharing, and improved authentication efficiency. Experimental evaluations demonstrate that the system significantly enhances data privacy, security, and sharing capabilities compared to conventional centralized models, making it highly suitable for advanced industrial logistics applications.

Keywords: *HABE, SHA, Block Chain*

INTRODUCTION

1.1 GENERAL

The Industrial Internet of Things (IIoT) is transforming several businesses by producing enormous amounts of data every day from multiple edge devices. Because the majority of data is currently kept in centralized data centers, the exponential growth of data presents substantial obstacles for the efficient and secure movement of data. There is an urgent need for creative solutions that enable smooth data sharing while guaranteeing privacy and security as logistics networks develop.

We suggest a new decentralized hierarchical attribute-based encryption (HABE) scheme that makes use of blockchain and edge computing to overcome these difficulties. With this method, edge devices can safely transmit data for processing to neighboring cloud networks while preserving user privacy all along the way. Our solution includes a framework for data sharing that is connected with blockchain technology, enabling users to communicate data across edge and cloud environments effectively. A key component of our solution is a decentralized authentication system based on encryption that checks user access privileges, improving network perimeter security. We establish a strong framework that safeguards user privacy and enables effective data sharing among smart logistics partners by including HABE into our architecture. Notably, compared to conventional centralized systems, our suggested solution significantly increases efficiency by reducing authentication time by 1.5 times. Our blockchain-integrated edge computing architecture is a compelling solution for the future of smart logistics, outperforming current schemes in terms of data sharing capabilities, privacy protection, and overall security, according to thorough analysis and experimental results. The last few decades have seen rapid IIoT growth due to various scientific and economic advances. Catalyzed by the development of steam engines in the eighteenth century, this was the earliest significant technical achievement. Commercial construction saw a notable increase in output due to the mechanization of steam engines, which helped transition from the period of sanitized labor to the age of digitalization. In the 1870s, steam-powered machinery started to give way to electrically powered machinery. Simultaneously, the division of work into specialized industries brought about a boom in manufacturing, which was another economic achievement. It was around the 1960s that the third century of industrialization, also called ‘‘digitalization,’’ began. During this period, programmable logic controllers and enhanced electronics utilized to boost industrial productivity led to the creation of creative automation technologies. One aspect of blockchain technology that makes it appealing for supply chain deployments is its distributed environment, which carries many advantages. First off, since each node in the system keeps a record of the supply chain’s operations and agreements and no central organization controls the transactions or stores them, a failure or exclusion of one or more network nodes (such as the bankruptcy of a supplier) would not result in the collapse of the entire system or the loss of operations. Next, while the reality that all network interactions and metadata are saved on all nodes results in some data replication, it also fosters security and confidence among cooperating parties because not only a select few have access to mportant information. Thirdly, using blockchain prevents expensive transactions because it eliminates the requirement for mediators in every contract and uses a single network for all of its operations.

LITERATURE SURVEY

Title: Big data analytics challenges to implementing the intelligent industrial Internet of Things (IIoT) systems in sustainable manufacturing operations.
Author: Q. Qi, Z. Xu, and P. Rani.
Year: 2023.
Description:
The overlap of the growth of big data with that of the Internet of Things (IoT) is well reflected by the dramatic surge in the use of devices connected to IoT and the exponential rise in data consumption. Huge numbers of sensors and devices deployed in the industry sector have resulted in the production of massive big data in the industrial IoT (IIoT). The literature consists of many studies conducted on big data analytics (BDA) and IIoT, though it still lacks research into the most important challenges to the growth of intelligent IIoT systems. This paper presents an innovative integrated method using the multi-objective optimization on the basis of a ratio analysis plus the full multiplicative form (MULTIMOORA) and criteria interaction through inter-criteria correlation (CRITIC) under the q-rung orthopair fuzzy sets (q-ROFSs). In the proposed method, CRITIC is used to calculate the attribute weights, whereas MULTIMOORA is utilized to estimate the ranking of options on the q-ROFSs. Then, a case study is accomplished on the challenges of BDA in the process of developing intelligent IIoT systems in the environment of industry 4.0. Furthermore, comparative and sensitivity analyses are conducted on the proposed approach to prove the capability of the developed framework in the prioritization of intelligent IIoT systems. The Internet of Things (IoT) (Golpîra et al., 2021; Latif et al., 2021; Aceto et al., 2020) covers a variety of technologies, such as pervasive computing, ubiquitous computing, networks, wired or wireless sensors, and embedded systems. It creates a communicating-actuating network that encompasses lots of things, e.g., big data and analytics, simulation, autonomous robots, IoT, cyber security, cloud computing, augmented reality, additive manufacturing, Radio Frequency Identification (RFID), and real-time location system.

Title: The collaborative role of blockchain, artificial intelligence, and industrial Internet of Things in digitalization of small and medium-size enterprises.
Author: A. A. Khan, A. A. Laghari, P. Li, M. A. Dootio, and S. Karim
Year: 2023
Description:
Due to digitalization, small and medium-sized enterprises (SMEs) have significantly enhanced their efficiency and productivity in the past few years. The process to automate SME transaction execution is getting highly multifaceted as the number of stakeholders of SMEs is connecting, accessing, exchanging, adding, and changing the transactional executions. The balanced lifecycle of SMEs requires partnership exchanges, financial management, manufacturing, and productivity stabilities, along with privacy and security. Interoperability platform issue is another critical challenging aspect while designing and managing a secure distributed Peer-to-Peer industrial development environment for SMEs. However, till now, it is hard to maintain operations of SMEs' integrity, transparency, reliability, provenance, availability, and trustworthiness between two different enterprises due to the current nature of centralized server-based infrastructure. This paper bridges these problems and proposes a novel and secure framework with a standardized process hierarchy/lifecycle for distributed SMEs using collaborative techniques of blockchain, the internet of things (IoT), and artificial intelligence (AI) with machine learning (ML). A blockchain with IoT-enabled permissionless network structure is designed called “B-SMEs” that provides solutions to cross-chain platforms. In this, B-SMEs address the lightweight stakeholder authentication problems as well. For that purpose, three different chain codes are deployed. It handles participating SMEs' registration, day-to-day information

management and exchange between nodes, and analysis of partnership exchange-related transaction details before being preserved on the blockchain immutable storage. Whereas AI-enabled ML-based artificial neural networks are utilized, the aim is to handle and optimize day-to-day numbers of SME transactions; so that the proposed B-SMEs consume fewer resources in terms of computational power, network bandwidth, and preservation-related issues during the complete process of SMEs service deliverance.

Title: Task co-offloading for D2D-assisted mobile edge computing in industrial Internet of Things.
Author: X. Dai, Z. Xiao, H. Jiang, M. Alazab, J. C. S. Lui, S. Dustdar, and J. Liu
Year: 2023.
Description:
Mobile edge computing (MEC) and device-to-device (D2D) offloading are two promising paradigms in the industrial Internet of Things (IIoT). In this article, we investigate task co-offloading, where computing-intensive industrial tasks can be offloaded to MEC servers via cellular links or nearby IIoT devices via D2D links. This co-offloading delivers small computation delay while avoiding network congestion. However, erratic movements, the selfish nature of devices and incomplete offloading information bring inherent challenges. Motivated by these, we propose a co-offloading framework, integrating migration cost and offloading willingness, in D2D-assisted MEC networks. Then, we investigate a learning-based task co-offloading algorithm, with the goal of minimal system cost (i.e., task delay and migration cost). The proposed algorithm enables IIoT devices to observe and learn the system cost from candidate edge nodes, thereby selecting the optimal edge node without requiring complete offloading information. Furthermore, we conduct simulations to verify the proposed co-offloading algorithm.

Title: Applying integrated blockchain and big data technologies to improve supply chain traceability and information sharing in the textile sector.
Author: M. Hader, D. Tchoffa, A. E. Mhamedi, P. Ghodous, A. Dolgui, and A. Abouabdellah.
Year: 2022.
Description:
Nowadays, the textile industry is strutting its stuff. On one hand, customers have a diverse choice of products available on personalized mobile apps, with immediate deliveries and returns. On the other hand, production is more effective and efficient than ever, thanks to increased automation and computerization in textile processes. However current supply chain management systems still face several serious problems such as tampering of products, poor traceability, delay, and lack of real-time information sharing. Today, a new technology called blockchain, which is a ground-breaking innovation in decentralized information technologies, can solve the above-mentioned challenges due to its important features, such as decentralization, transparency, and immutability. In this direction, this paper proposes a new framework for textile supply chain traceability based on blockchain which could offer an information platform, for all supply chain members with transparency and information sharing. Creating a traceable and transparent supply chain for textile industry would help customers to make informed choices about products they buy and the companies they support. For stakeholders in the textile supply chain, having traceability and real time information sharing builds better relationships, increases efficiency, and reduces the risk and cost of product recalls, counterfeit, and unethical labors. However, since blockchain technology is still in its early stages, it has some inherent defects, in which scalability becomes a primary and urgent one when we face the mass data in the real world. Hence, we present a new approach, consisting of the integration between two technologies which are blockchain and Big Data, to fill in the decentralized systems at scale. One of the primary research questions answered is how blockchain empowered by Big Data can be utilized and applied to manage traceability and information sharing more accurately through global supply chains. In this study we examine the necessity of traceability system concept and information sharing, followed by presentation of a blockchain integrated big data framework and its development processes.

Title: A survey on security challenges and solutions in the IOTA
Author: M. Conti, G. Kumar, P. Nerurkar, R. Saha, and L. Vigneri.
Year: 2022.
Description:
Wide-scale adoption of the Internet of Everything requires decentralized security, responsibility, and trust among the stakeholders. All these can be achieved by a Distributed Ledger Technology (DLT) backbone. As a mathematical model for enabling this DLT backbone, IOTA's Tangle is gaining popularity due to its scalability and freedom from transaction fees. Unlike blockchain, the Tangle uses a Directed Acyclic Graph (DAG) structure, and its design does not cover essential blockchain pitfalls, including

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expensive Proof of Work (PoW), limited throughput, high transaction costs, and significant confirmation delays. The original IOTA is evolving into a Coordinator-less environment, the Coordicide. It requires additional modules, such as auto-peering and a reputation system, to fully exploit Tangle's scalability and complete decentralization potential. Nevertheless, each new evolutionary update adds complexity and may introduce security threats. Therefore, the present survey's motivation is a detailed security analysis of the IOTA. To spur developers and researchers' interest and summarize the security status in IOTA, we have drawn the current review. Our survey outlines security vulnerabilities on IOTA and their mitigation strategies and explores several important open directions to be researched further. The vulnerabilities are discussed on both the original IOTA and its upcoming Coordicide version.

Title: Towards blockchain-based secure storage and trusted data sharing scheme for IoT environment.
Author: Z. Ullah, B. Raza, H. Shah, S. Khan, and A. Waheed.
Year: 2022.
Description:
Nowadays, cloud-based storage systems play a vital role in IoT data storage, processing, and sharing. Despite its contribution, the current cloud-based architecture may cause severe data leakage or jeopardize user privacy. Meanwhile, the cloud-based architecture heavily relies on a trusted third-party auditor (TPA) and runs in a centralized control manner. However, the TPA may not be a completely trustworthy entity, and a single point of failure might cause the centralized system to collapse. Fortunately, with the advent of blockchain technology, the decentralized storage model has gained popularity. A decentralized storage system successfully eradicates the rule of TPA, solves the problem of a single point of failure, and has many advantages over a centralized control architecture, such as low storage prices and high throughput. This study offers a blockchain-based decentralized distributed storage and sharing scheme that provides end-to-end encryption and fine-grained access control. In our proposed IoTChain model, fine-grained permission is based on attribute-based access control (A-BAC) policy by employing the Ethereum blockchain as an auditable access control layer. Smart contracts are tailored for the IoTChain model, which combines the Ethereum blockchain and the interplanetary file system (IPFS). We used an advanced encryption standard (AES) for encryption and the elliptic curve Diffie-Hellman key exchange protocol for secret key sharing between data owners and users. Also, the proof-of-work (PoW) consensus mechanism is replaced with a proof-of-authority (PoA) to minimize system transaction cost and boost system throughput. Additionally, our solution has been tested on the Ethereum official test network Rinkeby, and the results demonstrate that our approach is realistic and economical on the IoT data

METHODOLOGIES

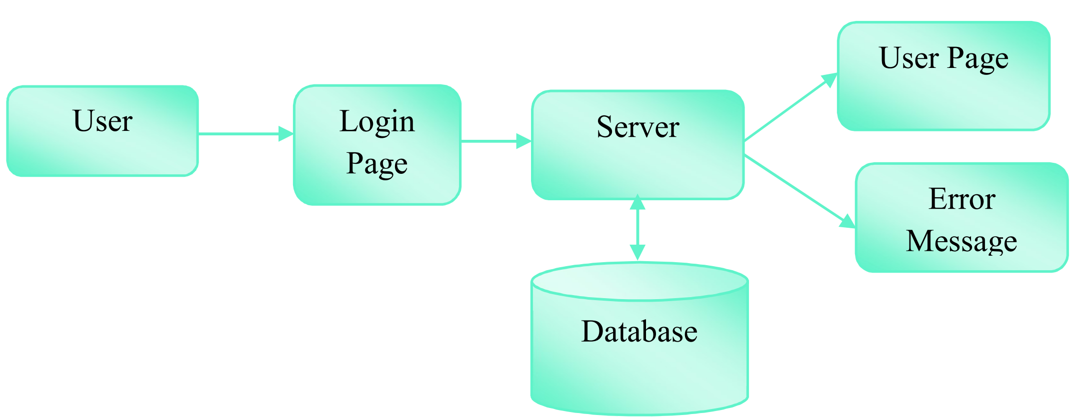
MODULES NAME:

- **User Interface Design**
- **CSP**
- **Properator**
- **User**
- **Upload**
- **Encryption**

MODULES EXPLANATION AND DIAGRAM

- **User Interface Design**

To connect with server user must give their username and password then only they can able to connect the server. If the user already exits directly can login into the server else user must register their details such as username, password, Email id, City and Country into the server. Database will create the account for the entire user to maintain upload and download rate. Name will be set as user id. Logging in is usually used to enter a specific page. It will search the query and display the query.



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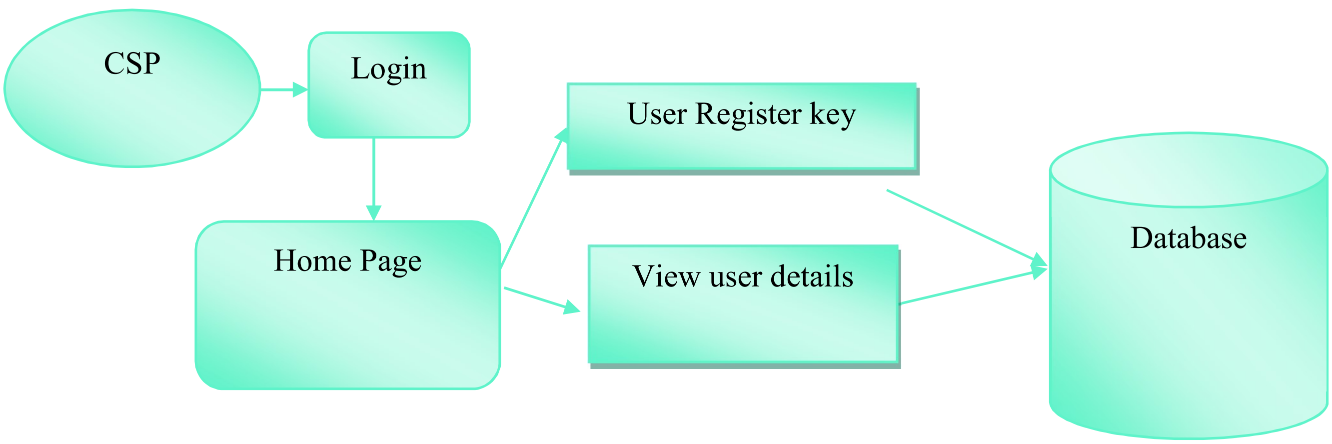
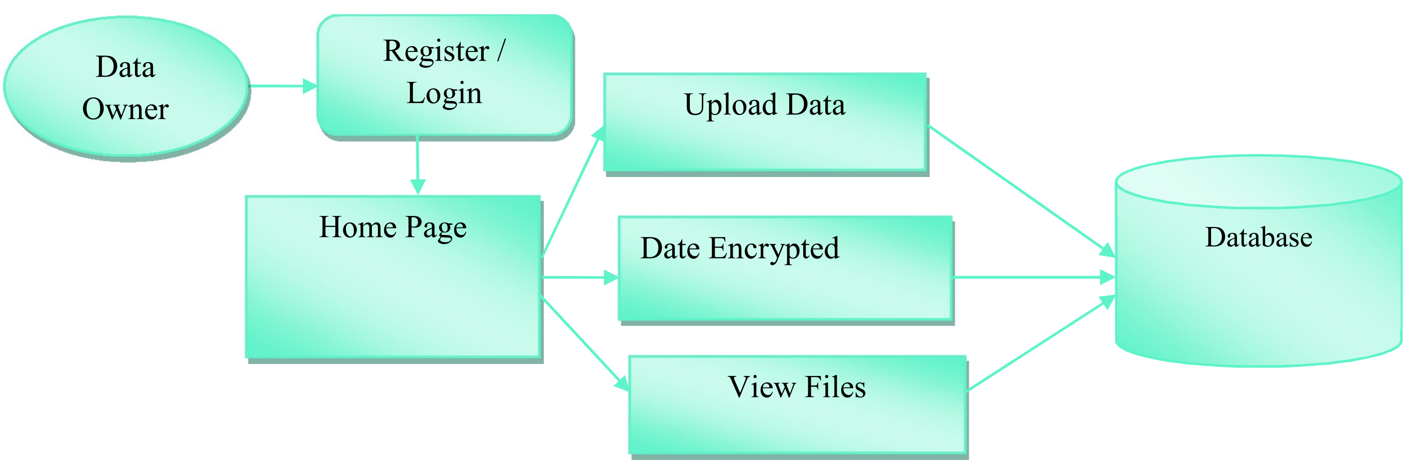
CSP

This is the third module in our project where csp plays the main part of the project role. Authority login first then its checks User Registration data, if Authority approve keys for user then he access data or perform an remaining operation.



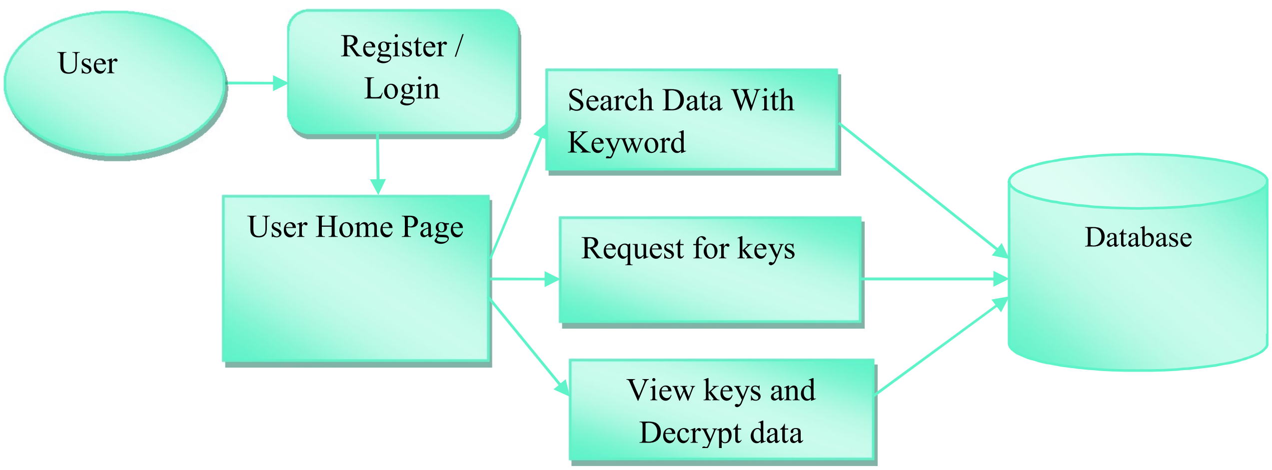
- **Data Owner**

This is the fourth module in our project where data owner plays the main part of the project role. Owner register and then login in to the application, the registration details are stored inside database. After Owner Login he will directly navigate owner home page and Upload data. When data owner upload data the data will be encrypted the encrypted keys will be stored inside database and keys will shred with key repository.



Data User

This is the Fifth module in our project where data User plays the main part of the project role. User register and then login in to the application, the registration details are stored inside database. After User Login he will directly navigate User home page and Access data by searching with keyword. When data owner upload data the data will be encrypted the encrypted keys will be stored inside database and keys will shred with key repository.



REQUIREMENTS ENGINEERING

Recommendation System with high accuracy and prediction can lead to highly efficient productivity. Here, an efficient recommendation system with good throughput resulting in a valued process for users.

HARDWARE REQUIREMENTS

PROCESSOR : PENTIUM IV 2.6 GHz, Intel Core 2 Duo.

- RAM : 512 MB DD RAM
- MONITOR : 15" COLOR
- HARD DISK : 40 GB

SOFTWARE REQUIREMENTS

The software requirements document is the specification of the system. It should include both a definition and a specification of requirements. It is a set of what the system should do rather than how it should do it. The software requirements provide a basis for creating the software requirements specification. It is useful in estimating cost, planning team activities, performing tasks and tracking the teams and tracking the team's progress throughout the development activity.

- Front End : J2EE (JSP, SERVLET)
- Back End : MY SQL 5.5
- Operating System : Windows 10
- IDE : Eclipse

NON-FUNCTIONAL REQUIREMENTS

The major non-functional Requirements of the system are as follows

➢ **Usability**

The system is designed with completely automated process hence there is no or less user intervention.

➢ **Reliability**

The system is more reliable because of the qualities that are inherited from the chosen platform java. The code built by using java is more reliable.

➢ **Performance**

This system is developing in the high level languages and using the advanced front-end and back-end technologies it will give response to the end user on client system with in very less time.

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- **Supportability**

The system is designed to be the cross platform supportable. The system is supported on a wide range of hardware and any software platform, which is having JVM, built into the system.

- **Implementation**

The system is implemented in web environment using struts framework. The apache tomcat is used as the web server and windows xp professional is used as the platform. Interface the user interface is based on Struts provides HTML Tag

DESIGN ENGINEERING

Design Engineering deals with the various UML [Unified Modelling language] diagrams for the implementation of project. Design is a meaningful engineering representation of a thing that is to be built. Software design is a process through which the requirements are translated into representation of the software. Design is the place where quality is rendered in software engineering. Design is the means to accurately translate customer requirements into finished product

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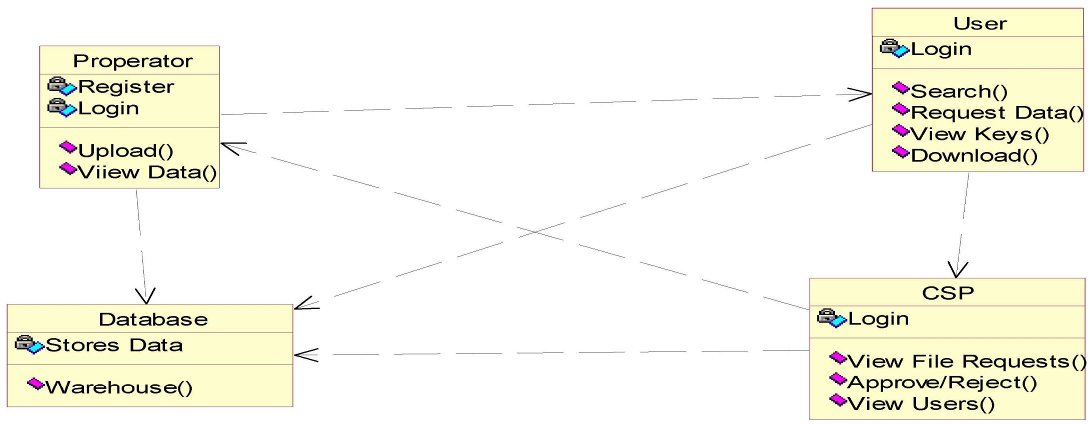
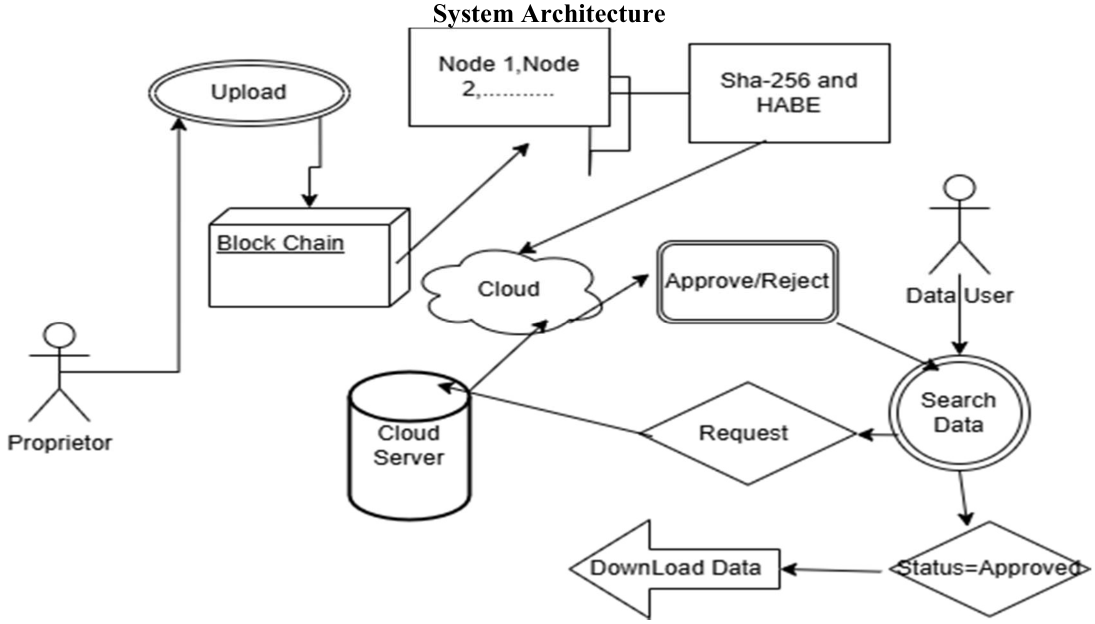
Class Diagram



In this class diagram represents how the classes with attributes and methods are linked together to perform the verification.

System Architecture



LIST:
Lists are implemented in the JCF via the java.util.List interface. It defines a list as essentially a more flexible version of an array. Elements have a specific order, and duplicate elements are allowed. Elements can be placed in a specific position. They can also be searched for within the list. Two concrete classes implement List. The first is java.util.ArrayList, which implements the list as an array. Whenever functions specific to a list are required, the class moves the elements around within the array in order to do it. The other implementation is java.util.LinkedList. This class stores the elements in nodes that each have a pointer to the previous and next nodes in the list. The list can be traversed by following the pointers, and elements can be added or removed simply by changing the pointers around to place the node in its proper place.

SET:
Java's java.util.Set interface defines the set. A set can't have any duplicate elements in it. Additionally, the set has no set order. As such, elements can't be found by index. Set is implemented by java.util.HashSet,java.util.LinkedHashSet, and java.util.TreeSet. HashSet uses a hash table. More specifically, it uses a java.util.HashMap to store the hashes and elements and to prevent duplicates. Java.util.LinkedHashSet extends this by creating a doubly linked list that links all of the elements by their insertion order. This ensures that the iteration order over the set is predictable. java.util.TreeSet uses a red-black tree implemented by a java.util.TreeMap. The red-black tree makes sure that there are no duplicates. Additionally, it allows Tree Set to implement java.util.SortedSet.
The java.util.Set interface is extended by the java.util.SortedSet interface. Unlike a regular set, the elements in a sorted set are sorted, either by the element's compareTo() method, or a method provided to the constructor of the sorted set. The first and last elements of the sorted set can be retrieved, and subsets can be created via minimum and maximum values, as well as beginning or ending at the beginning or ending of the sorted set. The SortedSet interface is implemented by java.util.TreeSetjava.util.SortedSet is extended further via the java.util.NavigableSet interface. It's similar to SortedSet, but there are a few additional methods. The floor(), ceiling(), lower(), and higher() methods find an element in the set that's close to the parameter. Additionally, a descending iterator over the items in the set is provided. As with SortedSet, java.util.TreeSet implements NavigableSet.

MAP:
Maps are defined by the java.util.Map interface in Java. Maps are simple data structures that associate a key with a value. The element is the value. This lets the map be very flexible. If the key is the hash code of the element, the map is essentially a set. If it's just an increasing number, it becomes a list. Maps are implemented
by java.util.HashMap, java.util.LinkedHashMap, and java.util.TreeMap. HashMap uses a hash table. The hashes of the keys are used to find the values in various buckets. LinkedHashMap extends this by creating a doubly linked list between the elements. This allows the elements to be accessed in the order in which they were inserted into the map. TreeMap, in contrast to HashMap and LinkedHashMap, uses a red-black tree. The keys are used as the values for the nodes in the tree, and the nodes point to the values in the map

THREAD:
Simply put, a *thread* is a program's path of execution. Most programs written today run as a single thread, causing problems when multiple events or actions need to occur at the same time. Let's say, for example, a program is not capable of drawing pictures while reading keystrokes. The program must give its full attention to the keyboard input lacking the ability to handle more than one event at a time. The ideal solution to this problem is the seamless execution of two or more sections of a program at the same time.

CONCLUSION

The paper proposes a decentralized system that shares data among distributed logistics networks using blockchain and encryption based on edge computing. First, we have introduced a privacy-aware data encryption technique that allows to send data to the closest cloud server, subject to system constraints. Later, an innovative data-sharing method utilizing encryption and blockchain technology was developed to enable safe data exchange between users. In order to achieve access management, we have developed a HABE that permits data encryption at the network edge without requiring an authoritative source, guaranteeing data reliability and reducing network latency. By using HABE, the proposed architecture ensures secrecy without requiring nodes to share secret keys. We have conducted several experimental tests to assess the suggested architecture's efficacy.

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