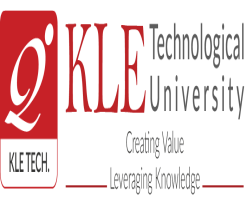
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**Blockchain and Distributed Ledgers Course Project Report**

**On**

**Decentralized Document Verification System Using**

**Blockchain and IPFS**

**Submitted By**

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**1.INTRODUCTION:**

Blockchain technology, often hailed as a revolutionary innovation, fundamentally transforms how data is stored, shared, and secured. It operates as a decentralized ledger, ensuring data integrity through cryptographic hashing and consensus mechanisms. Each block in the blockchain contains transaction data, a cryptographic hash of the previous block, and a timestamp, forming an immutable chain. This decentralized nature eliminates the need for a central authority, making the system more transparent, secure, and resilient to attacks. Blockchain finds applications across various sectors, including finance, healthcare, supply chain management, and digital identity verification, highlighting its versatility and robustness.

The motivation behind exploring blockchain technology in the context of document verification stems from the critical need for secure and reliable systems in various industries. Traditional methods often rely on centralized authorities, which pose significant risks of tampering, corruption, and single points of failure. In sectors such as finance, healthcare, and education, the authenticity and integrity of documents are paramount. Fraudulent activities involving counterfeit documents can lead to severe financial losses, legal consequences, and reputational damage. For instance, in the finance industry, counterfeit documents can facilitate fraudulent transactions, while in healthcare, falsified patient records can jeopardize patient safety. In education, fake degrees and certifications undermine the value of genuine qualifications and can lead to unqualified individuals occupying critical positions.

The primary contribution of this work lies in the development of a secure and decentralized system for document verification using blockchain and InterPlanetary File System (IPFS) technologies. This system ensures that documents cannot be tampered with or altered and can be easily retrieved and verified by authorized parties. The blockchain's immutable ledger records the hash of each document, ensuring that any modification to the document will be evident. IPFS provides a robust storage solution that allows documents to be distributed across multiple nodes, ensuring redundancy and high availability.

2.**LITERATURE REVIEW:**

In [1], the authors introduced a pioneering blockchain-based framework tailored for secure document verification within academic institutions. Their system meticulously records document hashes on the blockchain, providing an unalterable ledger that safeguards against the forging of academic certificates. Through rigorous testing and validation, the authors demonstrated the system’s robustness in thwarting fraudulent activities while bolstering trust in academic credentials. Moreover, their study delved into the broader implications of blockchain adoption, highlighting potential administrative efficiencies, cost reductions, and enhanced credibility across stakeholders.

In [2], researchers pioneered the development of a decentralized file storage system by seamlessly integrating IPFS and blockchain technologies to revolutionize healthcare record management. Their innovative approach prioritizes patient data privacy and integrity by implementing robust encryption measures and storing record hashes securely on the blockchain. Through meticulous testing and analysis, the study underscores the transformative potential of this system in bolstering data security within the healthcare sector. By mitigating the risks of unauthorized access and tampering, the proposed solution not only enhances patient confidentiality but also lays the groundwork for improved trust and transparency across healthcare ecosystems.

Introducing a cutting-edge blockchain-enabled supply chain management system in [3], researchers have pioneered an innovative solution aimed at amplifying transparency and traceability within supply chains. By harnessing the power of blockchain technology, the system meticulously records transactions, while leveraging IPFS for the secure storage of critical documents like invoices and shipping manifests. Through comprehensive analysis and empirical evidence, the authors have demonstrated the system’s remarkable capability to curtail instances of fraud and errors prevalent in conventional supply chain operations. The implementation of an immutable audit trail not only enhances accountability but also instills confidence in stakeholders by ensuring the integrity and reliability of supply chain data.

In [4], researchers delved into the realm of secure voting systems, leveraging blockchain and IPFS technologies to fortify the electoral process against potential threats. Proposing a robust model, the authors devised a framework wherein voter identities and ballots are hashed and securely stored on the blockchain, while IPFS serves as a repository for comprehensive voting records. Through meticulous investigation and empirical validation, the study elucidated the system’s pivotal role in upholding the sanctity of elections, effectively thwarting attempts at vote manipulation and guaranteeing unparalleled transparency throughout the electoral lifecycle.

Introducing a paradigm shift in identity management in [5], researchers put forth a decentralized system designed to empower individuals with unprecedented control over their personal data. By ingeniously combining blockchain and IPFS technologies, the proposed framework redefines the traditional identity management landscape, leveraging blockchain for securely storing identity proofs and employing IPFS to house intricate identity documents. Through this innovative approach, users are endowed with enhanced privacy safeguards and exert greater autonomy over their sensitive information.

Pioneering a transformative approach to land registry management in [6], researchers engineered a groundbreaking blockchain-based system tailored for the secure and transparent tracking of property ownership. Central to the system’s architecture is the utilization of IPFS for storing property documents, ensuring their accessibility and immutability. By anchoring the hashes of these documents on the blockchain, the system establishes an unassailable ledger of property transactions, effectively thwarting any attempts at fraudulent alterations or disputes. With its immutable and transparent record-keeping capabilities, the system heralds a new era of trust and integrity in land transactions.

In [7], researchers unveiled a sophisticated blend of blockchain and IPFS technologies aimed at ensuring the security and integrity of creative works. At the heart of this innovative solution lies the dual-layered approach of storing both the hashes of intellectual property documents on the blockchain and the documents themselves on IPFS. This dual-tiered architecture not only provides a robust mechanism for proving ownership but also serves as an impenetrable barrier against unauthorized alterations or plagiarism attempts. By leveraging the immutable nature of blockchain and the decentralized storage capabilities of IPFS, the system empowers original creators to safeguard their intellectual assets with unparalleled efficacy.

In a groundbreaking endeavor in [8], the authors introduced a decentralized digital rights management (DRM) system leveraging the synergies of blockchain and IPFS technologies. This pioneering system revolutionizes the distribution and access of digital content, including music and videos, by providing robust security measures to safeguard the rights of content creators. At its core, the system utilizes blockchain to meticulously record usage rights and transactions, ensuring transparent and immutable tracking of content distribution. Meanwhile, IPFS undertakes the crucial role of securely storing the actual digital content, employing its decentralized architecture to prevent unauthorized tampering or data breaches. By amalgamating the strengths of blockchain and IPFS, this innovative DRM system not only enhances the security and integrity of digital content but also upholds the rights and interests of creators in an increasingly digitized landscape.

**3.PROPOSED WORK:**

The proposed system integrates Blockchain and InterPlanetary File System (IPFS) technologies to provide a secure, decentralized, and tamper-proof solution for document verification. This system ensures the integrity and authenticity of documents by leveraging the immutable nature of blockchain and the distributed architecture of IPFS. The architecture is composed of three main components: the Blockchain network, the IPFS network, and the user interface, each playing a crucial role in the overall functionality of the system.

A. System Architecture

1. Blockchain Network

Purpose: To securely store the hash of documents, ensuring their integrity and authenticity.

Technology Used: Ethereum blockchain and smart contracts.

Functionality:

When a document is uploaded, its cryptographic hash is generated.

This hash is stored in a smart contract on the Ethereum blockchain, creating an immutable record.

This record serves as a reference for verifying the document’s integrity in the future.

The use of blockchain ensures that once the hash is stored, it cannot be altered, providing a tamper-proof verification method.

2. IPFS Network

Purpose: To store the actual document data in a decentralized manner, ensuring availability and security.

Technology Used: IPFS (InterPlanetary File System), a peer-to-peer hypermedia protocol.

Functionality:

Documents are encrypted and then uploaded to the IPFS network.

In IPFS, documents are broken into smaller chunks and distributed across multiple nodes.

Each document is identified by a unique Content Identifier (CID), derived from its cryptographic hash.

This decentralization ensures that the document is accessible even if some nodes go offline, and it also enhances security by making it difficult to tamper with the stored data.

3. User Interface

Purpose: To provide a user-friendly platform for document upload and verification.

Technology Used: Web application built with Node.js, integrated with MetaMask for blockchain interactions.

Functionality:

Users can upload documents, retrieve CIDs, and verify documents through a simple and intuitive web interface.

The interface facilitates interaction with both the Ethereum blockchain (via MetaMask) and the IPFS network, abstracting the complexity of underlying technologies.

It ensures a seamless user experience while maintaining the security and integrity of the system.

B. Features

Secure Document Verification: By storing document hashes on the blockchain, the system ensures that any attempt to tamper with the document can be detected.

Decentralization: Eliminates the need for a central authority, reducing risks associated with single points of failure.

Fast and Easy Verification: Authorized parties can quickly verify documents without the need for intermediaries, streamlining the verification process.

User-Friendly Interface: The web application is designed to be accessible and easy to use, encouraging widespread adoption.

Support for Multiple Document Types: The system can handle various document formats, increasing its versatility and applicability across different domains.

C. Workflow

Document Upload

Step 1: The user selects a document to upload through the web interface.

Step 2: The document is encrypted and uploaded to the IPFS network, generating a unique CID.

Step 3: A cryptographic hash of the document is computed and stored in a smart contract on the Ethereum blockchain, along with the CID.

Document Verification

Step 1: The user enters the CID of the document to be verified in the web interface.

Step 2: The system retrieves the document from IPFS using the CID.

Step 3: The retrieved document is decrypted, and its hash is computed.

Step 4: The computed hash is compared with the hash stored on the blockchain.

Step 5: The system displays a message indicating whether the document is authentic or has been tampered with.

D. Algorithms

Hashing Algorithm: SHA-256

Used for generating a unique hash of the document. SHA-256 is a cryptographic hash function that produces a 256-bit hash, ensuring a high level of security.

Encryption Algorithm: AES (Advanced Encryption Standard)

Used for encrypting documents before uploading them to IPFS. AES is widely recognized for its security and efficiency in encrypting data.

Smart Contract Language: Solidity

Used for writing smart contracts on the Ethereum blockchain. Solidity is a high-level programming language designed for implementing smart contracts.

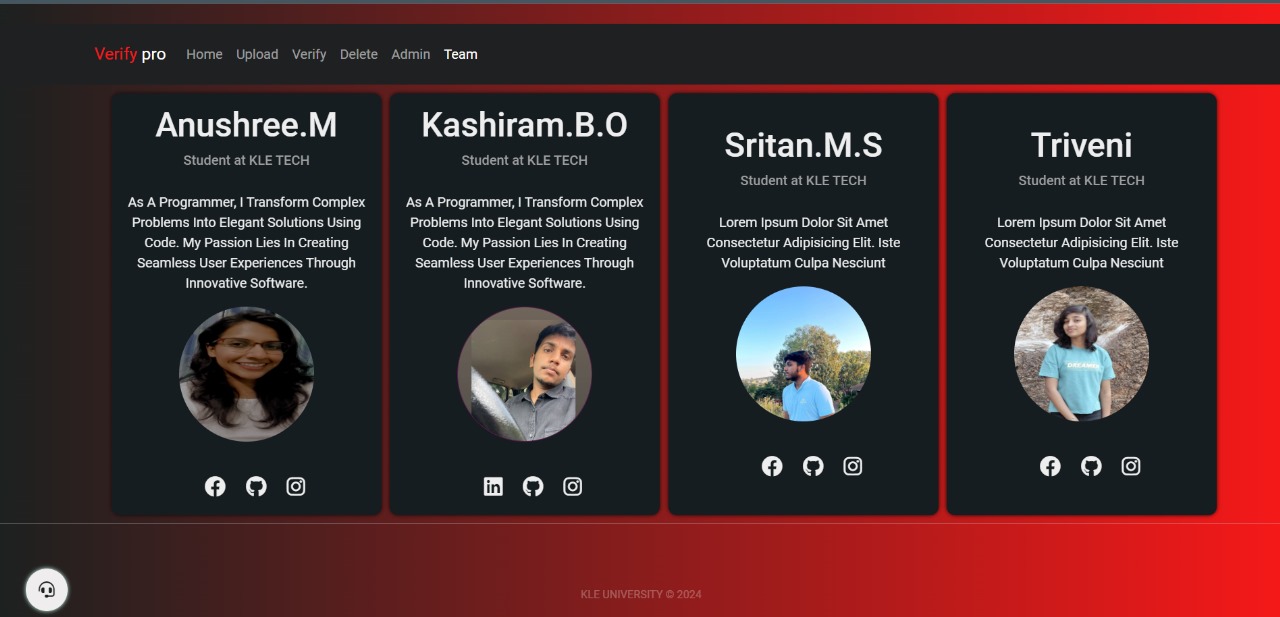
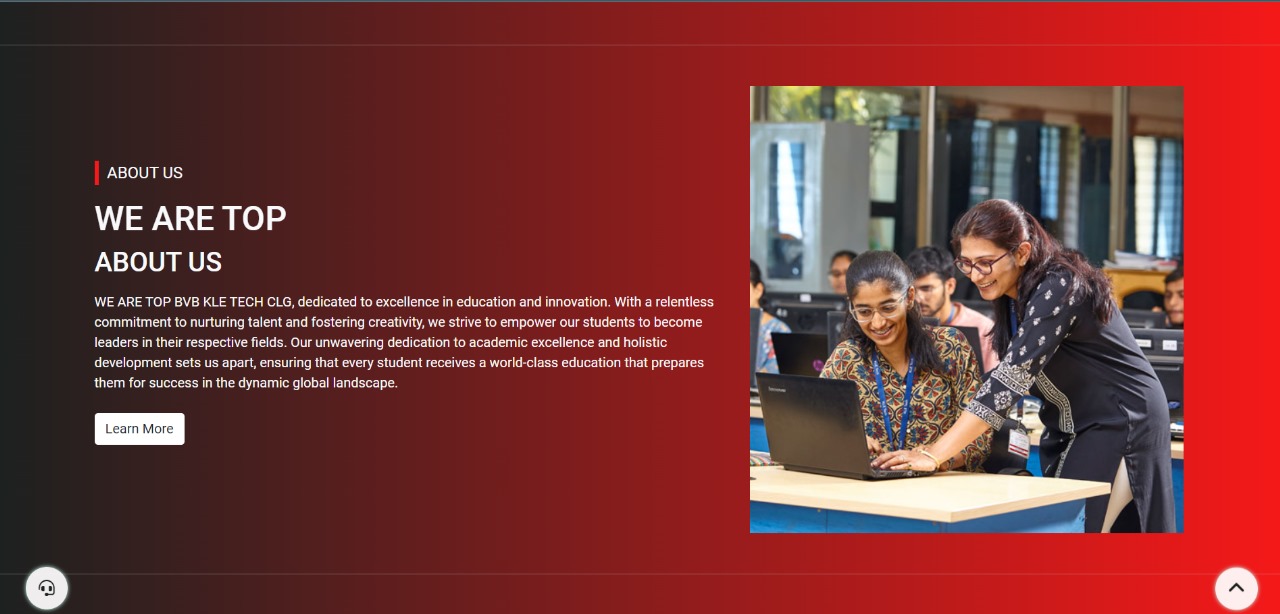
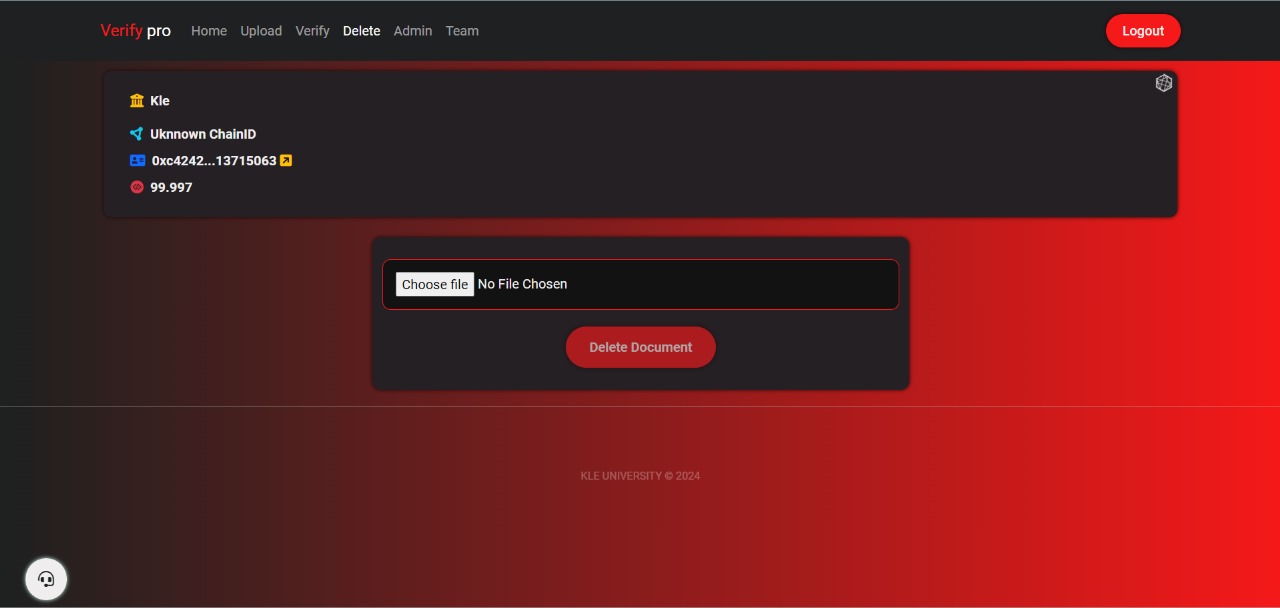
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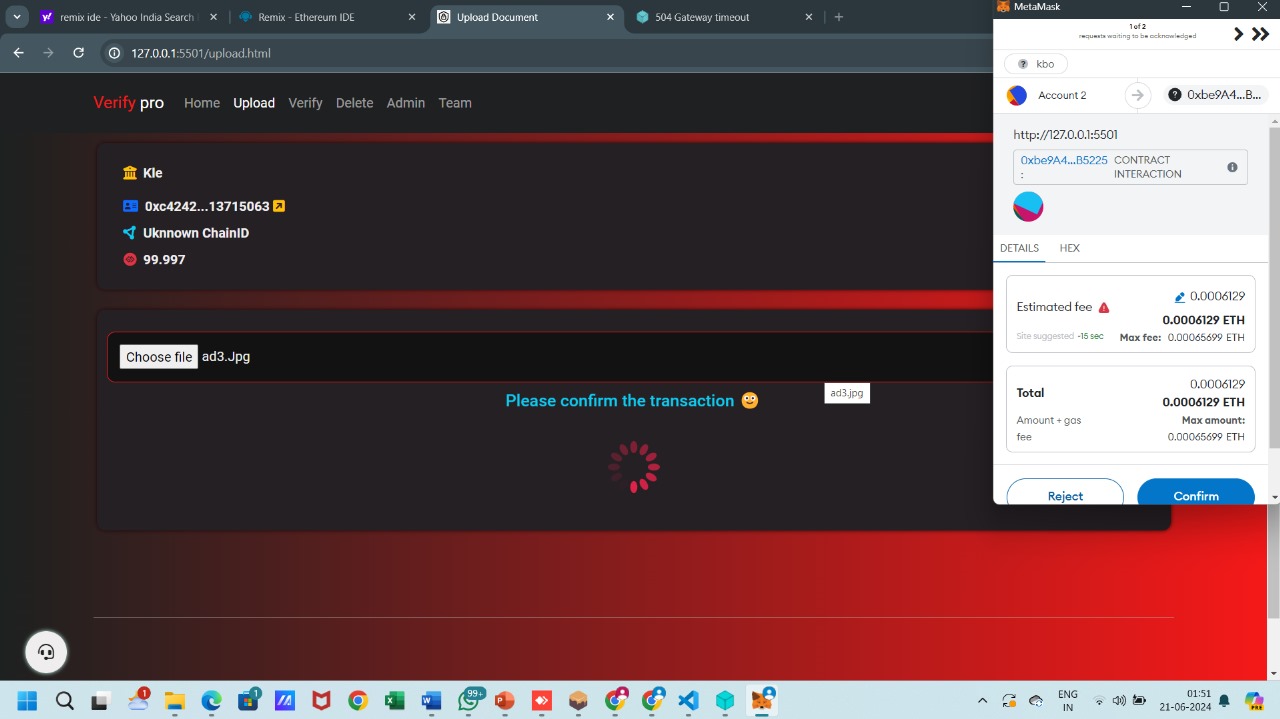
Ethereum Blockchain and Smart Contracts: Truffle Suite

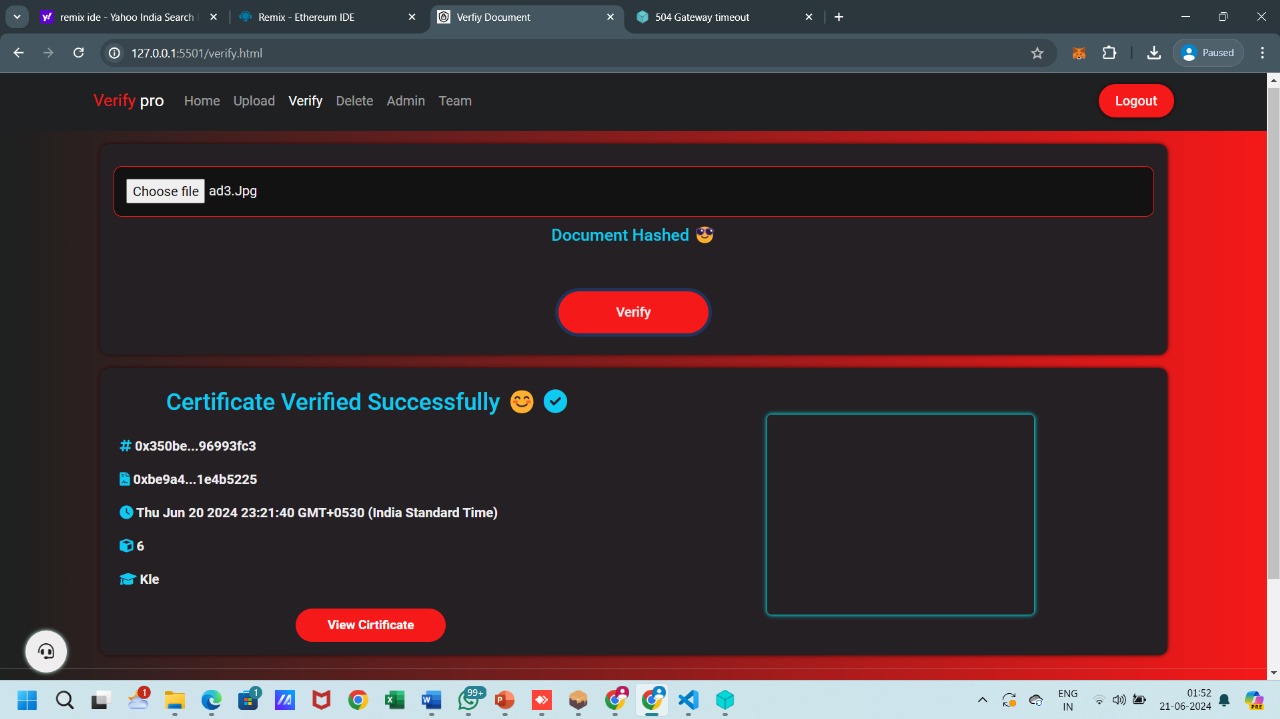
Truffle Suite is a development environment, testing framework, and asset pipeline for Ethereum, providing a comprehensive framework for building and deploying smart contracts.

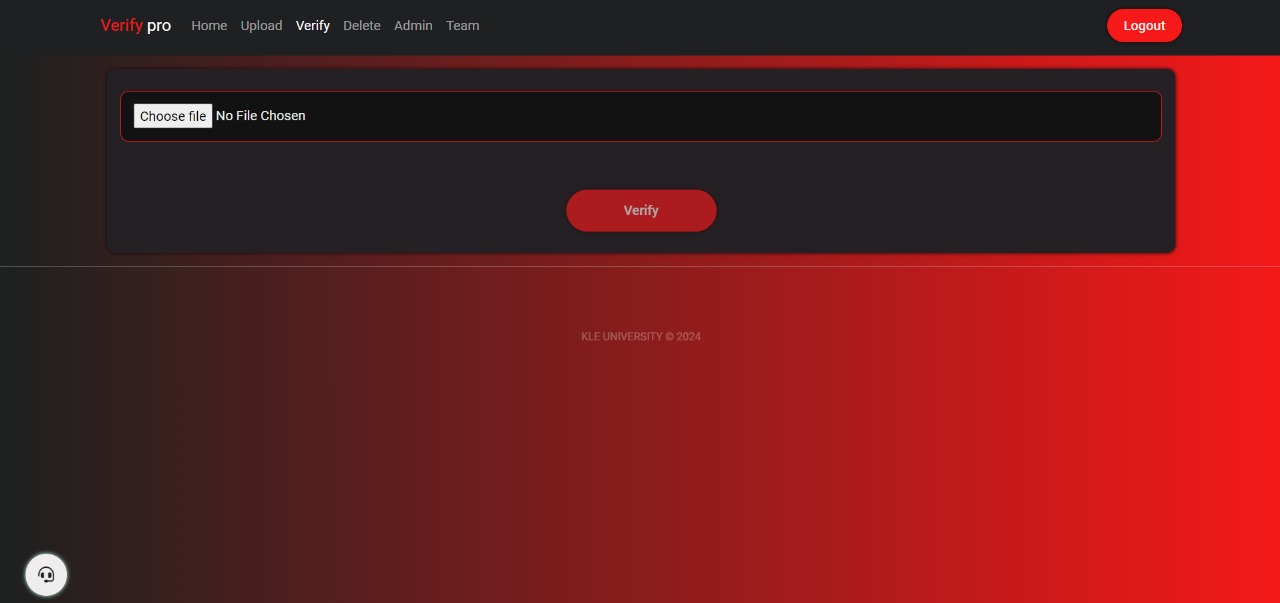
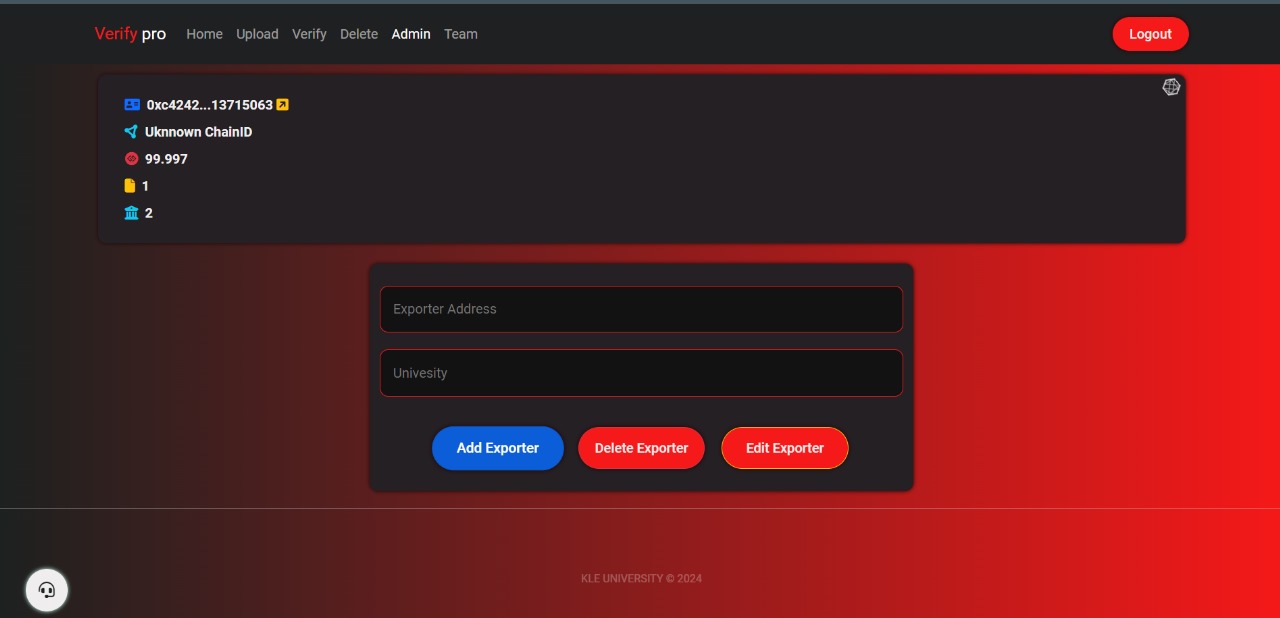
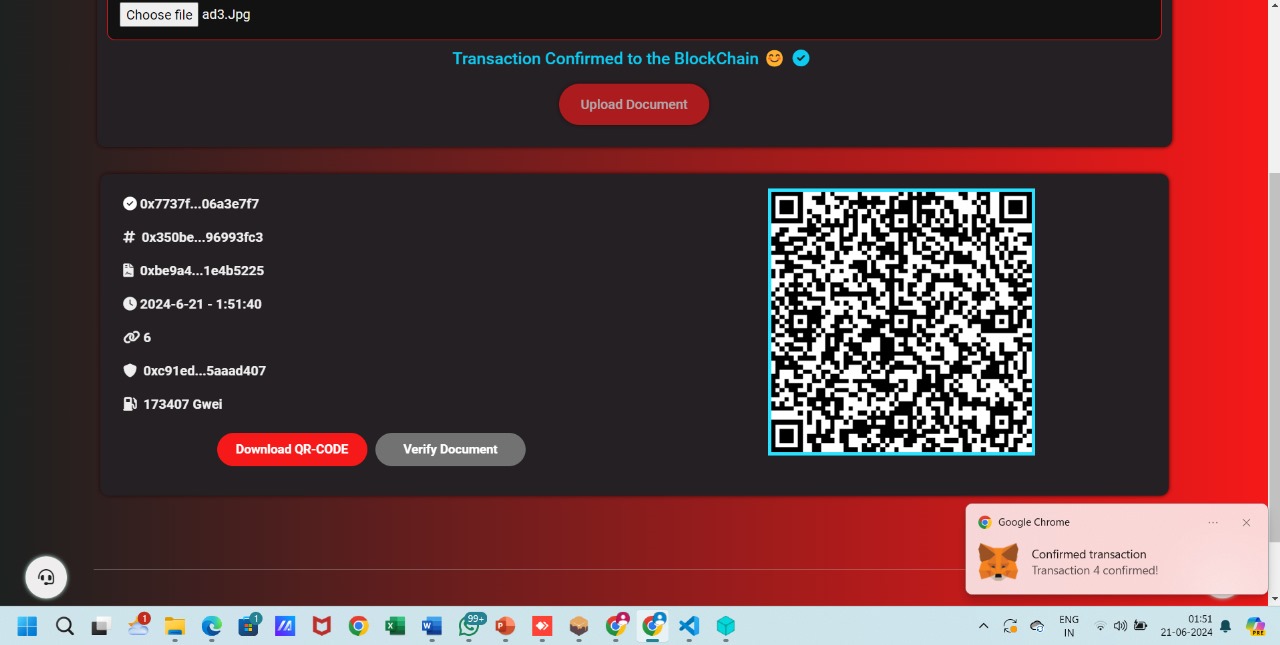
IPFS: js-ipfs

js-ipfs is a JavaScript implementation of the IPFS protocol, enabling the integration of IPFS functionalities within web applications. It allows the system to interact with the IPFS network for uploading and retrieving documents.

**4.RESULTS :**

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**5.CONCLUSION:**

The results and discussion presented in this section underscore the effectiveness of leveraging Blockchain and IPFS technologies for secure and decentralized document verification. The system demonstrates its capability in ensuring the integrity and authenticity of documents while offering a user-friendly and efficient platform for document management. The integration of blockchain ensures that document hashes are securely stored and tamper-proof, providing a reliable method for verifying document integrity. Additionally, the use of IPFS enables decentralized storage, ensuring document availability and further enhancing security. The user-friendly interface facilitates easy document upload and verification, making the system accessible to a wide range of users.Future endeavors may concentrate on optimizing performance further, enhancing scalability, and extending the system’s capabilities to handle a broader range of document types and formats. By addressing these aspects, the system can evolve to meet the diverse needs of various industries and stakeholders, thereby contributing to a more robust and versatile solution for document verification in the digital age. Through continuous improvement and innovation, the system can remain at the forefront of secure document management, offering a reliable and efficient solution for organizations and individuals seeking to ensure the integrity and authenticity of their digital documents.

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