# CERTVERIFYME

**A PROJECT REPORT**

***Submitted by,***


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***Under the guidance of,***

**Dr. Pallavi M**

***in partial fulfillment for the award of the degree of***

**BACHELOR OF TECHNOLOGY**

**IN**

**COMPUTER ENGINEERING**

**At**


**PRESIDENCY UNIVERSITY**

**BENGALURU**

**JANUARY 2024**

# PRESIDENCY UNIVERSITY

## SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

## CERTIFICATE

This is to certify that the Project report **"CertVerifyMe"** being submitted by Bhavanasree.PS, Krisha.M, Shanaz Naquib bearing roll number(s) 20201COM0034, 202021COM0007,20201COM0012 in partial fulfilment of requirement for the award of degree of Bachelor of Technology in Computer Engineering is a bonafide work carried out under my supervision.

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## DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **CertVerifyMe** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Engineering**, is a record of our own investigations carried under the guidance of **Dr. Pallavi M, Assistant Professor, School of Computer Science and Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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# ABSTRACT

The academic document validation system in India faces challenges characterized by complexity, sluggishness, and a potential risk of certificate loss for students. This project proposes an advanced and unconventional solution utilizing blockchain innovation for efficient and secure verification of academic certificates.

Blockchain, as a decentralized database or distributed ledger, provides a robust, scalable, and private framework for recording transactions or digital events shared among participating parties. Our project introduces a comprehensive management system for the export and verification of academic certificates, aiming to streamline the process, reduce costs, and minimize manual efforts associated with verification.

The proposed system involves the issuance of university uploading certificates, which are then hashed and stored in the blockchain, along with the certificate itself in the blockchain file system. Subsequently, a verifier provides a file or QR code, prompting the system to compare the provided hash with those of certificates previously stored in the blockchain. If a match is found, the corresponding certificate is retrieved from the blockchain file system. Conversely, if the certificate hash does not exist in the blockchain, the verification request is answered negatively.

This innovative approach not only enhances the efficiency of the academic document validation process but also ensures the security and integrity of certificates through the decentralized and tamper-resistant nature of blockchain technology.

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We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

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# CHAPTER-1
# INTRODUCTION

## 1.1 BACKGROUND [1]

The validation of academic documents in India is currently hindered by a complex and slow system, posing a significant risk of certificate loss for students. The existing processes involve intricate manual verifications, leading to inefficiencies and potential errors. Recognizing the need for a modern and efficient solution, this project explores the integration of blockchain technology to revolutionize the validation and verification of academic certificates.

Blockchain, originally developed as the underlying technology for cryptocurrencies, has evolved into a decentralized and secure ledger system that ensures transparency, immutability, and privacy. Leveraging these attributes, our project seeks to address the challenges associated with the existing academic document validation system in India.
Traditional methods of document validation often require extensive paperwork, time-consuming manual efforts, and are susceptible to fraud or loss. By introducing a blockchain-based solution, we aim to streamline this process by automating the generation of certificates and significantly reducing the cost and effort required for their verification.

The proposed system involves the issuance university uploading certificates, which are then securely hashed and stored in the blockchain. This decentralized database, distributed among participating entities, ensures that the information is tamper-resistant and easily accessible when needed. The use of a blockchain file system further enhances the security and accessibility of the certificates.

By implementing a system where verifiers can easily compare a provided hash with those stored in the blockchain, the validation process becomes swift and reliable. If the certificate hash exists in the blockchain, the corresponding certificate can be efficiently retrieved, eliminating the need for time-consuming manual checks. In cases where the certificate hash is not found in the blockchain, the verification request is promptly addressed with a negative response.

This project, therefore, offers a novel and sophisticated solution to the challenges posed by the current academic document validation system in India, aiming to enhance efficiency, reduce manual workload, and ensure the security and integrity of academic certificates through the innovative use of blockchain technology.

## 1.2 PROBLEM STATEMENT [2]

The current academic document validation system in India is fraught with complexities and inefficiencies, exposing students to the risk of certificate loss and impeding the overall verification process. The existing system relies heavily on manual efforts, leading to slow and error-prone procedures. These challenges necessitate the exploration of an advanced and unconventional solution to enhance the validation process.

The traditional methods of validating academic certificates involve time-consuming paperwork, intricate manual verifications, and the potential for fraudulent activities. The slow and cumbersome nature of the current system not only hinders the timely recognition of academic achievements but also poses a threat to the security and integrity of certificates.
Moreover, the lack of a streamlined and automated process results in increased operational costs for both educational institutions and the validating authorities. As the demand for document validation grows, the inefficiencies of the current system become more pronounced, requiring an urgent and innovative approach to address these challenges.

To mitigate these issues, our project proposes the integration of blockchain technology as a transformative solution. By leveraging the decentralized and tamper-resistant nature of blockchain, we aim to automate the validation process, reduce manual workload, and enhance the overall efficiency and security of academic document verification. The objective is to provide a reliable and cost-effective alternative to the existing system, ensuring a swift and secure validation process for academic certificates in India.

### 1.3 SCOPE [3]

The proposed project aims to revolutionize the academic document validation system in India by leveraging blockchain technology to create a secure, efficient, and automated management system for the export and verification of academic certificates. The scope of the project encompasses the following key aspects:

1. Blockchain Integration:
- Explore and implement the integration of blockchain technology to create a decentralized and tamper-resistant database for storing academic certificates securely.
- Utilize blockchain's distributed ledger to maintain a transparent and immutable record of certificate transactions.

2. Automated Certificate Generation:
- Develop a system for universities to seamlessly upload academic certificates, initiating an automated process for generating and storing document hashes and associated files on the blockchain.

3. Verification Mechanism:
- Implement a user-friendly verification mechanism where verifiers can input a file or scan a QR code to initiate the comparison of provided hash with those stored in the blockchain.
- Design an interface that allows for quick and reliable verification, reducing the time and effort required for manual checks.

4. Decentralized File System:
- Implement a blockchain file system to securely store academic certificates, ensuring accessibility and integrity while maintaining the privacy and confidentiality of sensitive information.

5. User Management:
- Develop a user management system to handle various roles such as universities issuing certificates, verifiers initiating requests, and administrators overseeing the overall system.

6. Scalability and Adaptability:

- Design the system to be scalable, allowing for the seamless integration of additional universities and accommodating the increasing volume of academic certificates over time.
- Ensure adaptability to evolving technological standards and regulations in the academic and blockchain domains.

7. Security Measures:
- Implement robust security measures to safeguard sensitive academic data, preventing unauthorized access, and ensuring the privacy of both the issuing universities and certificate

8. Cost Reduction:
- Evaluate and demonstrate the cost-effectiveness of the proposed system by reducing the operational costs associated with manual verification processes
.
9. User Training and Support:
- Provide training resources and support to users, including universities, administrators, and verifiers, to ensure a smooth transition to and effective utilization of the new blockchain-based system.

10. Documentation and Reporting:
- Develop comprehensive documentation detailing the system architecture, protocols, and procedures for future reference and maintenance.
- Implement reporting features to track and analyze system usage, providing valuable insights for continuous improvement.

## 1.4 OUTCOMES

**1. Efficient Certificate Validation:**
- Streamlined and automated academic document validation process, reducing the time required for verification using blockchain technology.

**2. Reduced Operational Costs:**

- Cost-effective solution with decreased operational expenses for universities and validation authorities due to the automation of certificate generation and verification processes.

**3. Enhanced Security and Integrity**:

- Improved security measures ensuring the integrity of academic certificates, as the blockchain's decentralized and tamper-resistant nature prevents unauthorized access and manipulation.

**4. Minimized Risk of Certificate Loss:**

- Decreased risk of certificate loss for students, as blockchain-based storage provides a secure and easily accessible repository for academic certificates.

**5. User-Friendly Verification Interface**:

- User-friendly verification mechanism, allowing verifiers to easily input files or scan QR codes for quick and reliable validation.

**6. Decentralized File System Access:**

- Accessible and secure storage of academic certificates in a blockchain file system, providing efficient retrieval when needed and ensuring the confidentiality of sensitive information.

**7. Scalable System Architecture:**

- Scalable system architecture accommodating the integration of additional universities and handling a growing volume of academic certificates over time.

**8. Adaptability to Technological Changes**:

- System designed to adapt to evolving technological standards and regulatory requirements in both the academic and blockchain domains.

**9. User Training and Support:**

- Efficiently trained users, including universities, administrators, and verifiers, ensuring a smooth transition to and effective utilization of the blockchain-based validation system.

**10. Comprehensive Documentation:**

- Comprehensive documentation detailing the system architecture, protocols, and procedures for future reference, maintenance, and further development.

**11. Data Analytics and Reporting:**

- Implementation of reporting features providing insights into system usage, allowing administrators to make informed decisions for continuous improvement.

**12. Positive Impact on Academic Institutions:**

- Positive impact on the reputation of academic institutions as they adopt a modern and efficient system, contributing to a more technologically advanced educational environment.

**13. Contributions to Academic Record Transparency**:

- Contributing to the overall transparency of academic records by ensuring a reliable and easily accessible verification process, fostering trust among employers, educational institutions, and other stakeholders. By achieving these outcomes, the project aims to bring about a transformative change in the academic document validation landscape in India, addressing existing challenges and providing a secure, efficient, and technologically advanced solution.

# CHAPTER-2

# LITERATURE SURVEY

| No. | Title | Objective | Key Findings | Relevance to Project |
|---|---|---|---|---|
| 1. | "Blockchain Technology in Education: A Systematic Review" | Investigate the applications of blockchain in education. | Explores the potential of blockchain to secure academic records and streamline verification processes. | Establishes a foundation for understanding blockchain's role in education. |
| 2. | "Decentralized Systems for Document Verification" | Examine decentralized systems for secure verification. | Highlights the advantages of decentralized systems in preventing fraud and enhancing document security. | Provides insights into the use of decentralized systems in validation. |
| 3. | "Smart Contracts: A Survey" | Explore the role of smart contracts in various domains. | Discusses the programmable nature of smart contracts and their potential applications in automating processes. | Offers insights into how smart contracts can be utilized for certificate generation. |
| 4. | "Blockchain-Based Systems for Certificate Verification" | Analyze existing blockchain-based systems | Provides an overview of different approaches to using blockchain for document verification. | Offers examples of successful implementations in similar contexts. |
| 5. | "Challenges and Opportunities of Implementing Blockchain in Education" | Identify challenges and opportunities | Discusses potential hurdles and benefits of integrating blockchain into educational systems. | Helps in anticipating and addressing potential challenges |

Table:2.1 Literature Survey Table[4]

# CHAPTER-3
# RESEARCH GAPS OF EXISTING METHODS

## 3.1 EXISTING METHODS [5]

As of my last knowledge update in January 2022, traditional methods for academic document validation typically involve manual processes, relying on physical certificates, paperwork, and direct communication between educational institutions and verification authorities. Here is an overview of the existing methods:

**1. Manual Verification:**

- Educational institutions issue physical certificates to students upon completion of their academic programs.
- Verifiers, such as employers or other educational institutions, request verification by contacting the issuing institution directly.
- Issuing institutions respond through various means, such as email, mail, or fax, providing details on the authenticity of the document.

**2. Notary Public:**

- Some countries employ notary public services for document verification.
- A notary public verifies the authenticity of academic certificates and attests to their validity, adding an official stamp or seal.

**3. Government Authentication:**

- In certain cases, academic certificates may require authentication from government authorities.
- This involves submitting the certificate to a government office, where it undergoes a verification process, often with the addition of an official government seal.

**4. Third-Party Verification Services:**

- Some countries and institutions use third-party verification services to streamline the

- These services may offer online platforms where educational institutions upload certificate details, and verifiers can access this information after proper authentication.

**5. Online Verification Portals:**

- Some educational institutions have implemented online verification portals.
- Verifiers can visit these portals, enter specific details related to the academic certificate, and receive instant confirmation of the certificate's authenticity.

**6. Digital Signatures and QR Codes:**

- Some institutions use digital signatures or QR codes embedded in digital copies of academic certificates.
- Verifiers can scan the QR code or verify the digital signature to confirm the document's authenticity.

## 3.2 LIMITATIONS [6]

1. Time-Consuming Verification Process
2. High Operational Costs
3. Potential for Human Error
4. Forgery and Fraud
5. Limited Accessibility
6. Lack of Real-Time Verification
7. Dependency on Institutional Availability

# CHAPTER-4

# PROPOSED MOTHODOLOGY

## 4.1 INTRODUCTION

In this project we have using Vscode as a editor , Solidity Programming language for creating Smart Contracts and Ethereum Remix for Deploying the Smart Contracts, MetaMask for Online decentralized wallet,IPFS for Storage and HTML,CSS and JS(Bootstrap) For Front end development of the Website.

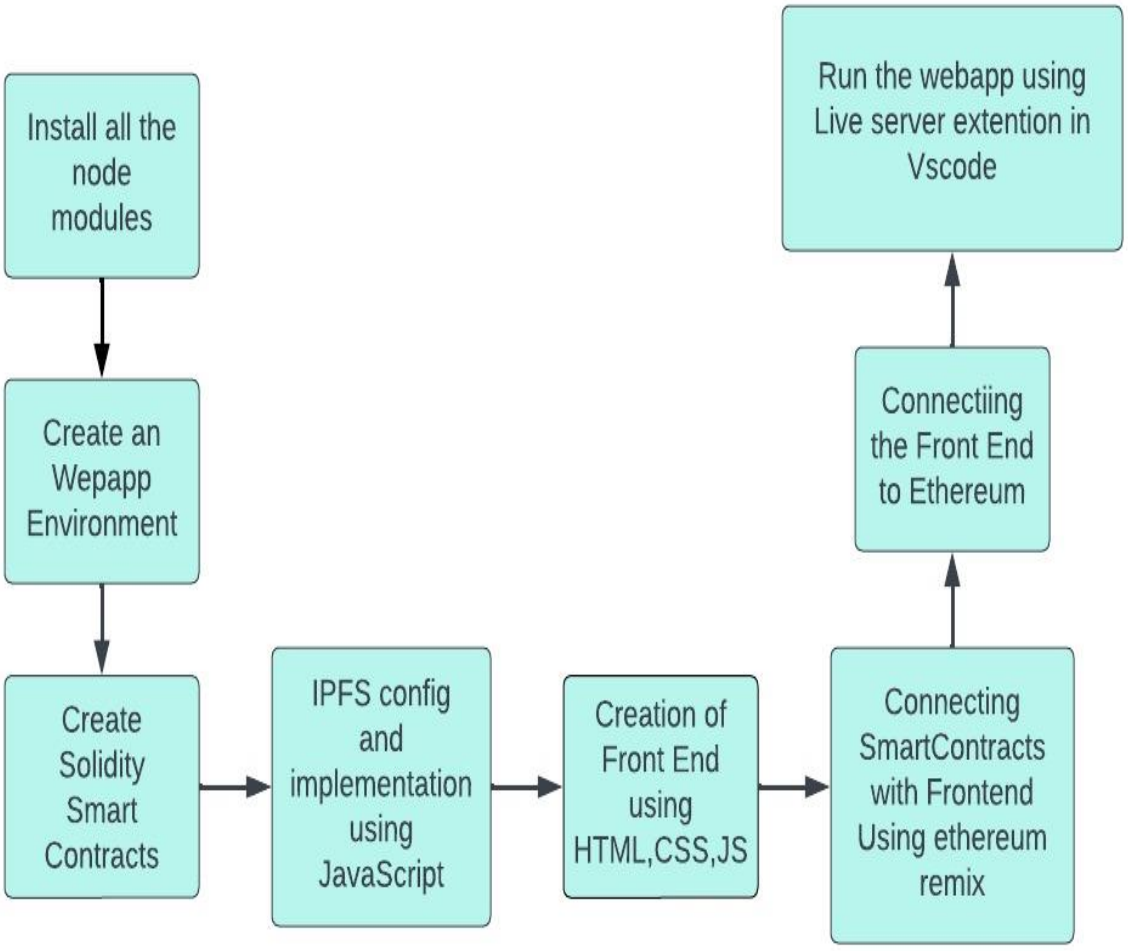



Fig 4.1: Workflow of the Methodology.

## 4.2 IMPLEMENTATION DETAILS

Workflow of the Methodology is given in Fig 4.1

### 4.2.1 Smart Contract [7]

A Smart Contract, also known as a crypto contract, is a computer program designed to autonomously facilitate and govern the exchange of digital assets between parties based on predefined conditions. It operates similarly to traditional contracts but with the added capability of self-execution and enforcement through code. Smart contracts are created to execute precisely as programmed, and their enforcement relies on the inherent logic encoded in the script.

The inception of smart contracts in the blockchain space can be traced back to the Bitcoin network, where they were initially employed for transferring digital value. However, these early implementations were limited to basic conditions, such as verifying the availability of funds in the sender's account. The advent of Ethereum revolutionized the smart contract landscape by introducing a more robust platform. Ethereum enabled developers to craft custom contracts using a Turing-complete programming language, expanding the potential and complexity of smart contract applications.

It is noteworthy that Bitcoin's smart contracts were scripted in a Turing-incomplete language, imposing restrictions on the scope of functionalities they could encompass. Ethereum, with its Turing-complete language, offered a broader canvas for creative contract development.

Various blockchain platforms have since emerged as hubs for smart contract execution, each with its unique features. Examples include Ethereum, celebrated for its versatility; Solana, recognized for its high throughput; Polkadot, known for its interoperability; and Hyperledger Fabric, designed for enterprise use. These platforms contribute to the evolution and diversification of smart contract applications in the decentralized ecosystem.

•

- Adding and editing document exporters; the smart contract's owner (University) can add and edit a document exporter . When the document exporter exports his University student’s documents to the blockchain, this function is invoked.
- Delete a document exporter; the smart contract's owner has the authority to delete a document exporter. The exporter will be disable to upload documents to the blockchain if the owner deletes the exporter.
- Upload a document; this function is only accessible to exporters and not the smart contract user, as it is used when each exporter from the university uploads the documents of his students to the blockchain and offers the student a copy of the document or QR code.
- Verification of documents; this function verifies the validity of documents issued by this university. When the verifier requests that a document be validated, this function is invoked.
- Delete a document; the owner or one of the exporters has the authority to delete a previously exported document.

- Mentors: the website also provides the link of the websites and organizations which provides valid certificates.[8]

This is smart contract code written in the Solidity programming language named Verification.Sol on Remix:

Fig 4.2.1


Fig:4.2.2

```
    function delete_Exporter(address _add) external
    onlyOwner
    {
        assert(Exporters[_add].blockNumber!=0);

        Exporters[_add].blockNumber=0;
        Exporters[_add].info="";
        --count_Exporters;
        }

    function alter_Exporter(address _add,string calldata    _newInfo) public
    onlyOwner()
     {
          assert(Exporters[_add].blockNumber!=0);
            Exporters[_add].info=_newInfo; }

    function changeOwner(address _newOwner) public
        onlyOwner  validAddress(_newOwner)   {  owner = _newOwner; }

        event addHash(address indexed _exporter,string _ipfsHash);
    function addDocHash (bytes32  hash,string calldata _ipfs) public
      canAddHash
      {
            assert(docHashes[hash].blockNumber==0 && docHashes[hash].minetime==0);
            Record memory  newRecord =
            Record(block.number,block.timestamp,Exporters[msg.sender].info,_ipfs);
             docHashes[hash] = newRecord;
             ++count_hashes;
             emit addHash(msg.sender,_ipfs);
       }


     function findDocHash (bytes32 _hash)
     external  view  returns (uint,uint,string memory,string memory) {

         return (docHashes[_hash].blockNumber,docHashes[_hash].minetime,docHashes[_hash].info,docHashes[_hash].ipfs_hash );
         }

      function deleteHash (bytes32 _hash) public
      authorised_Exporter(_hash)
      canAddHash
      {
      assert(docHashes[_hash].minetime!=0);
      docHashes[_hash].blockNumber=0;
      docHashes[_hash].minetime=0;

      --count_hashes;

      }

      function  getExporterInfo(address _add) external view returns(string memory){

          return (Exporters[_add].info);
      }
}
```

**Function of adding and editing a document exporter** : The smart contract, owned by the university, allows the addition and editing of document exporters representing individual colleges. When the university decides to designate an employee from each college as a document exporter for student documents on the blockchain, the owner initiates the process. Verification steps ensure that the owner is authorized, including confirming the authenticity of the provided employee address and checking if the employee is already listed as an exporter. If these conditions are satisfied, the addition of a document exporter for a specific college is successfully complete as depicted in the accompanying flowchart

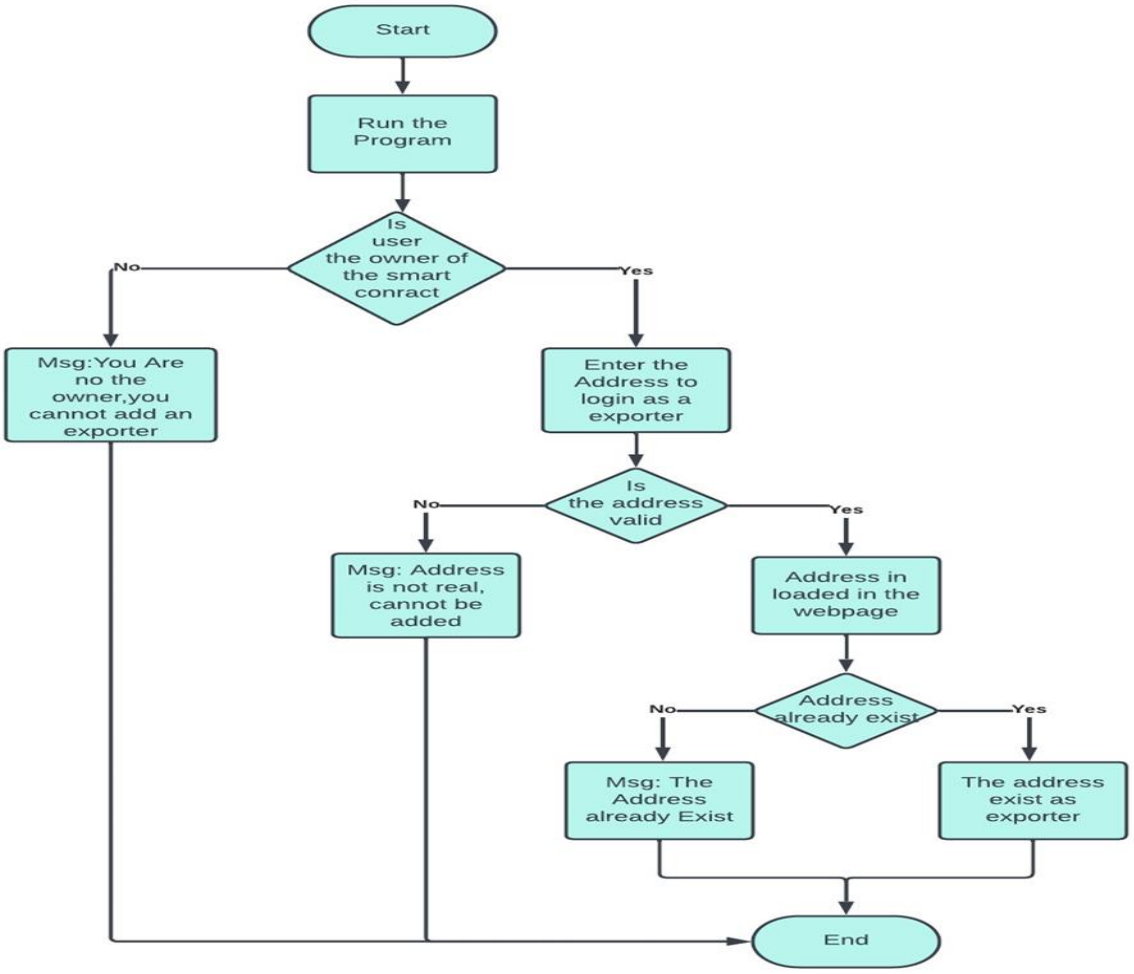



Fig 4.2.3: Flowchart of function of addition a documents exporter

**Function of deletion of a document exporter:** To enhance system management efficiency, the smart contract owner (University) possesses the capability to delete a document exporter associated with a college within the document export system. This function allows the owner to prevent a designated employee from uploading documents to the blockchain. The process involves owner verification to ensure the person initiating the deletion is authorized. When the university owner decides to remove an employee from their role as a document exporter for graduating students, the system confirms the Function of owner's identity before executing the deletion, thereby preventing further document uploads by the specified exporter.

The flowchart below illustrates this function:

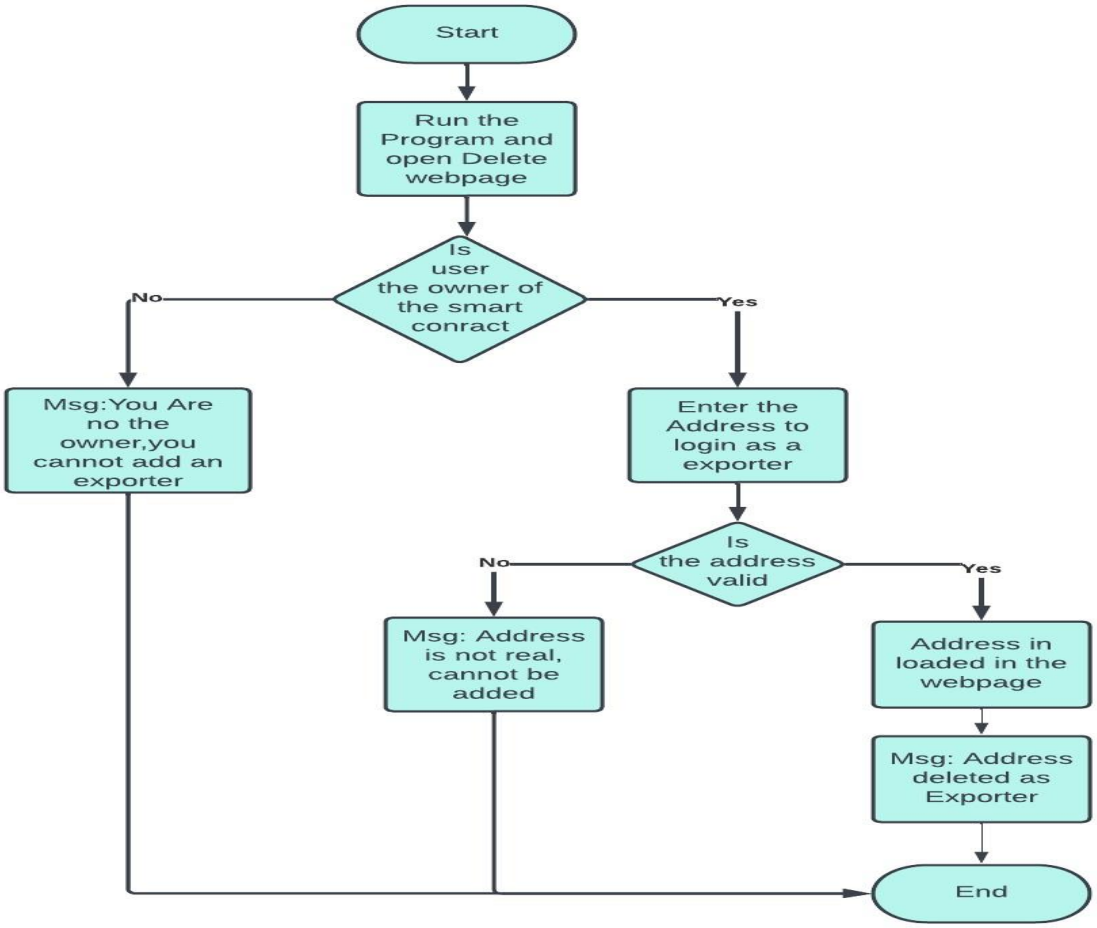



Fig 4.2.3: Flowchart of function of addition a documents exporter.

**Function of exporting the documents:** The university generates a document for every graduating student, and the issuance process is exclusive to designated document exporters. Each document exporter is responsible for issuing documents specifically for the students within their respective college during the export process.

The flowchart below illustrates this function:

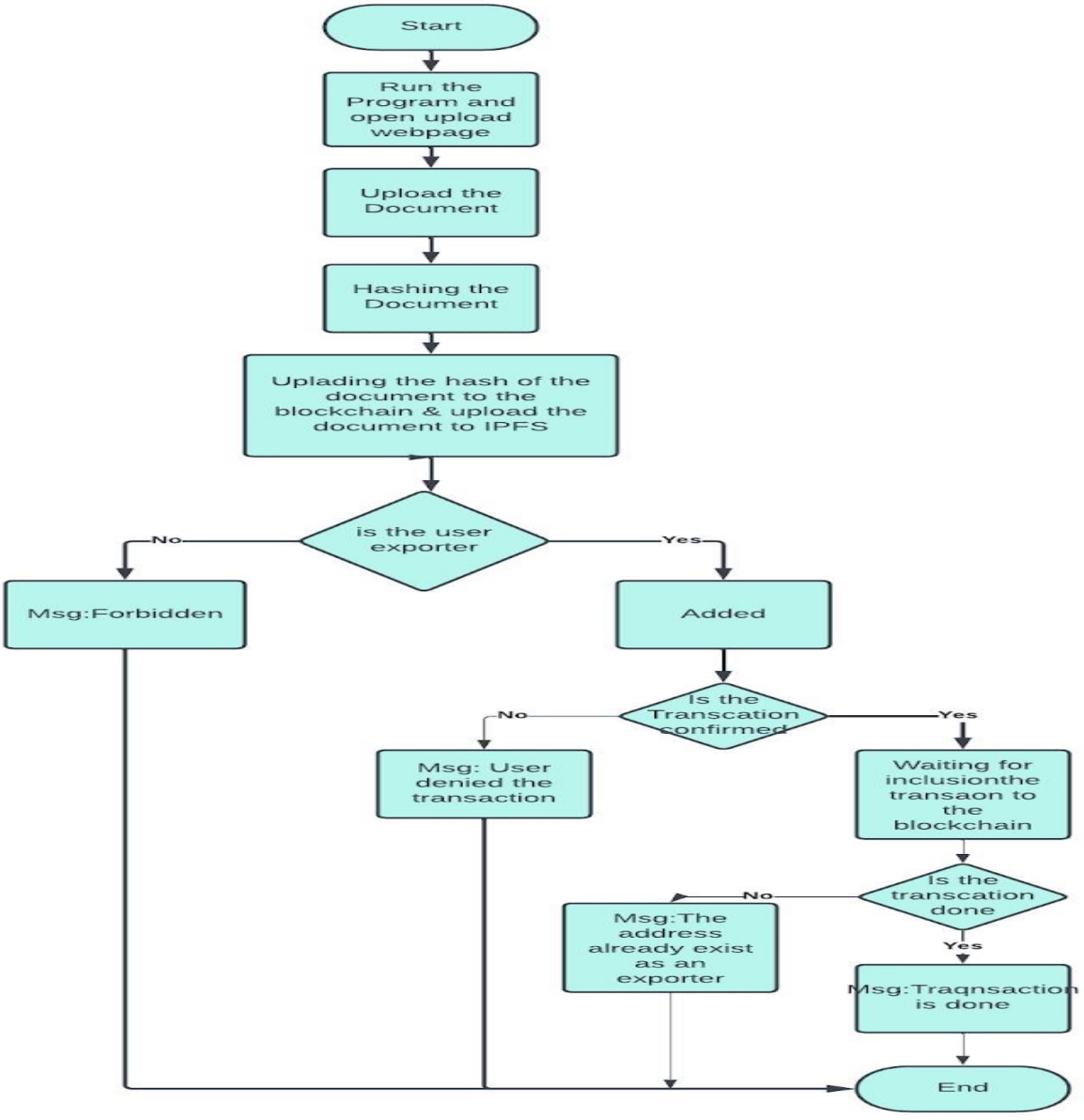



Fig 4.4: Flowchart of function of exporting a document.

**Function to compare the hash values:** The system verifies documents by comparing student-provided hashes with entries in the blockchain, followed by retrieving the document from IPFS for further credibility. Successful completion confirms authenticity, while failure suggests potential forgery, indicating the student lacks a legitimate degree from the university.

The flowchart below illustrates this function:

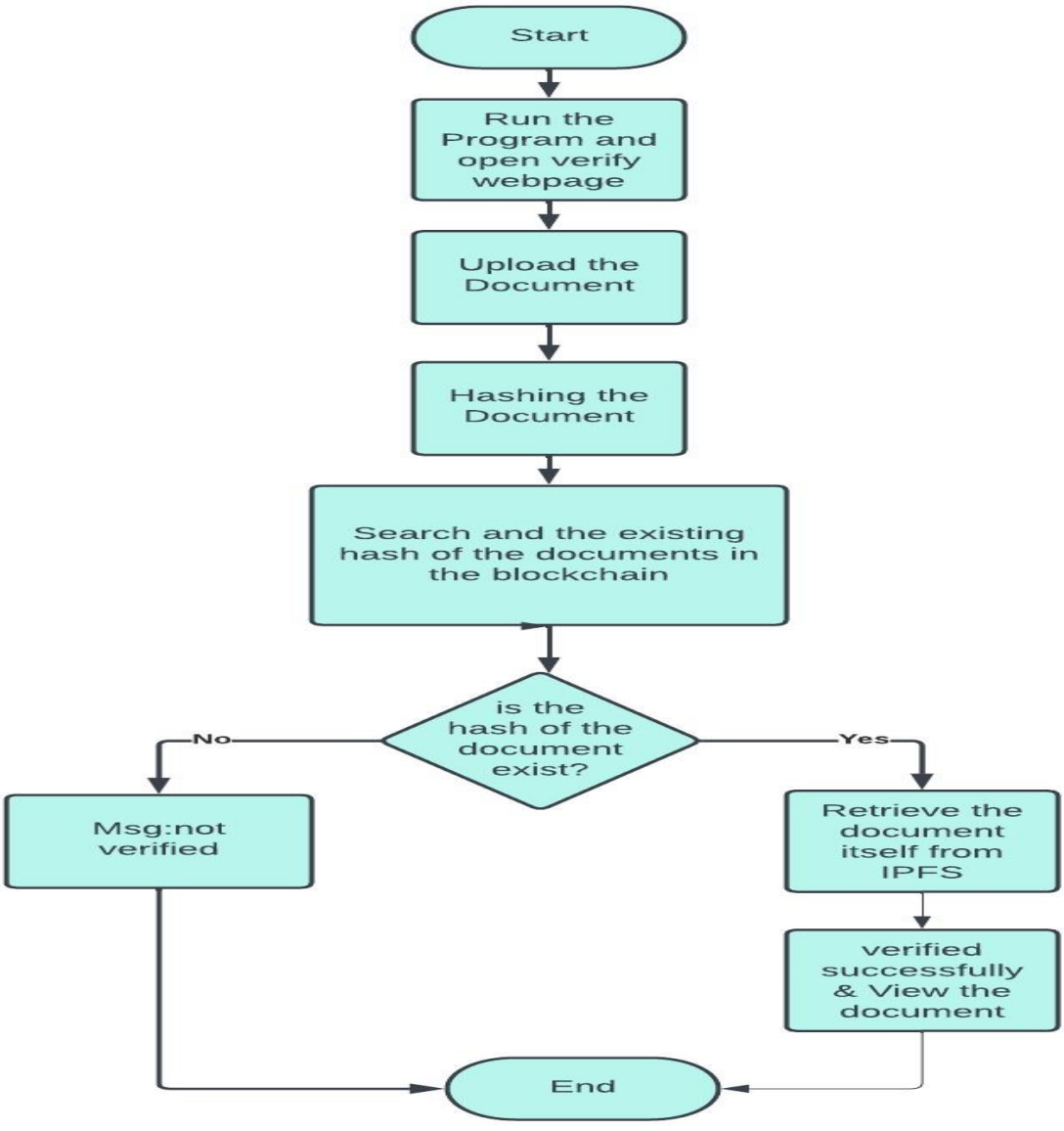



Fig 4.5: Flowchart of function of verifying a document.

**Function to delete previously issued documents:** Exporters have the authority to delete previously issued documents. When an exporter initiates document issuance, the system verifies their status, hashes the document, and checks for a match in the blockchain. If a match is found, the intended document is successfully deleted, with the consequence of losing the ability to prove the document's authenticity afterward.

The flowchart below illustrates this function:

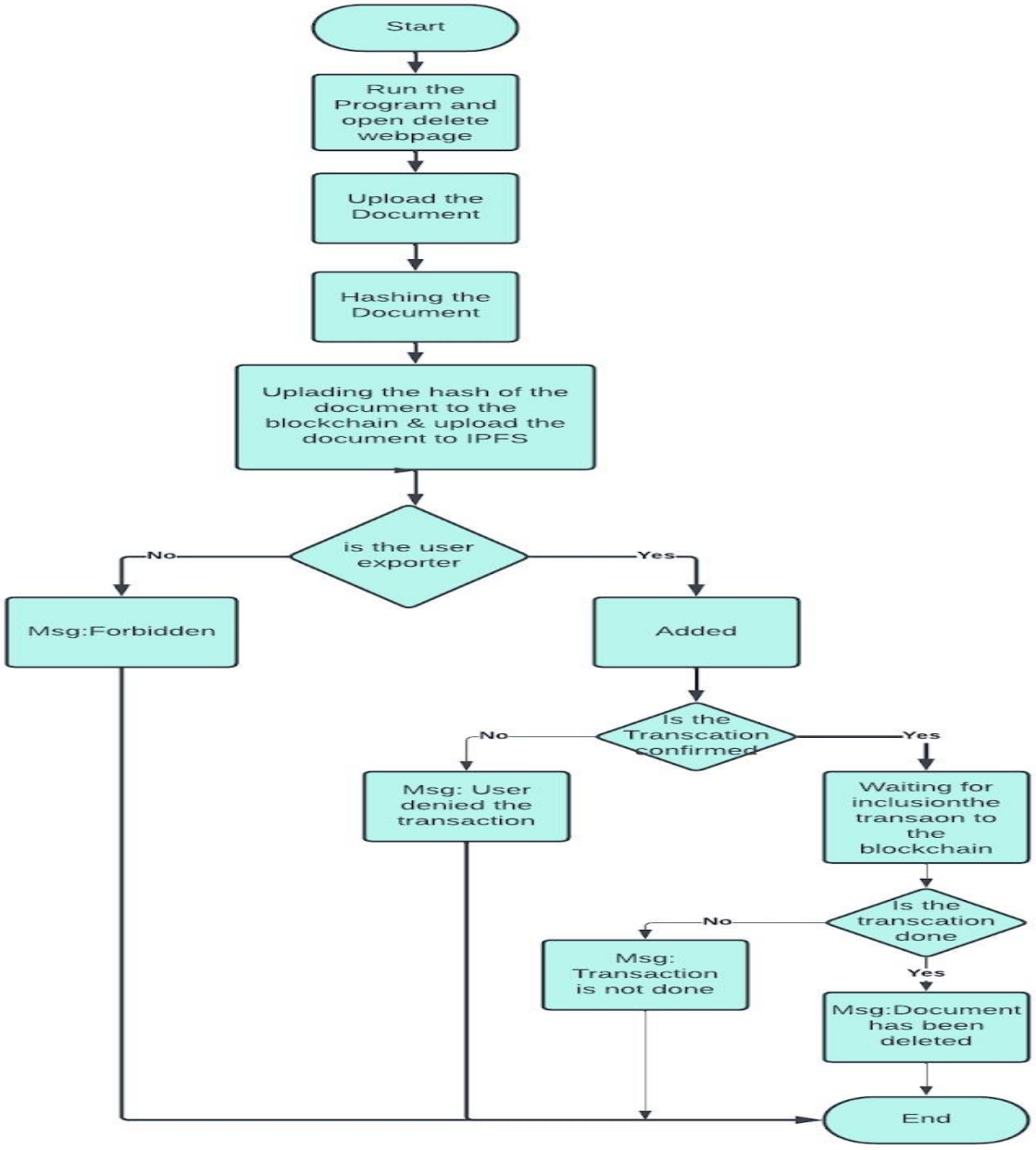



Fig 4.6: Flowchart of function of deletion of a document

### 4.2.2 Front-end

The front end is the part of the website users can see and interact with such as the graphical user interface (GUI) and the command line including the design, navigating menus, texts, images, videos, etc. The backend, on the contrary, is part of the website users cannot see and interact with.The visual aspects of the website that can be seen and experienced by users are frontend. On the other hand, everything that happens in the background can be attributed to the backend.Languages used for the front end are HTML, CSS, and JavaScript while those used for the back end include Java, Ruby, Python, and .Net.[9]

#### 4.2.2.1 Development languages

The system front-ends were developed using HTML, CSS, JavaScript, and Bootstrap. HTML:The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. It defines the content and structure of web content. It is often assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.[10] CSS: Cascading Style Sheets (CSS) is a stylesheet language used to describe the presentation of a document written in HTML or XML (including XML dialects such as SVG, MathML or XHTML). CSS describes how elements should be rendered on screen, on paper, in speech, or on other media.[11] JAVASCRIPT:JavaScript (JS) is a lightweight interpreted (or just-in-time compiled) programming language with first-class functions. While it is most well-known as the scripting language for Web pages, many non-browser environments also use it, such as Node.js, Apache CouchDB and Adobe Acrobat .[12]

#### 4.2.2.2 Compositionality [13]

Our system's front interfaces are mostly composed of six pages, with the home page containing the system logo, a brief description of the system and the technology that underpins it, as well as instructions on how to use the system. Admin page allows the owner to add, edit, and delete a document's exporter. Document upload page, which allows to export documents that aren't viewable on the university's official website because it's solely for document exporters. Verification page, the institutions meant by the student can go to the university's official website and enter this page specifically to verify the validity of a student's document. Delete Document Page, as previously said, this page is just for document issuers who need to delete documents. The project team, i.e. the students and the supervisor, is represented on the team page.Mentorship page is to mentor the users where they can get the valid certificates . The Fig below shows the composition of the front interfaces of the system.

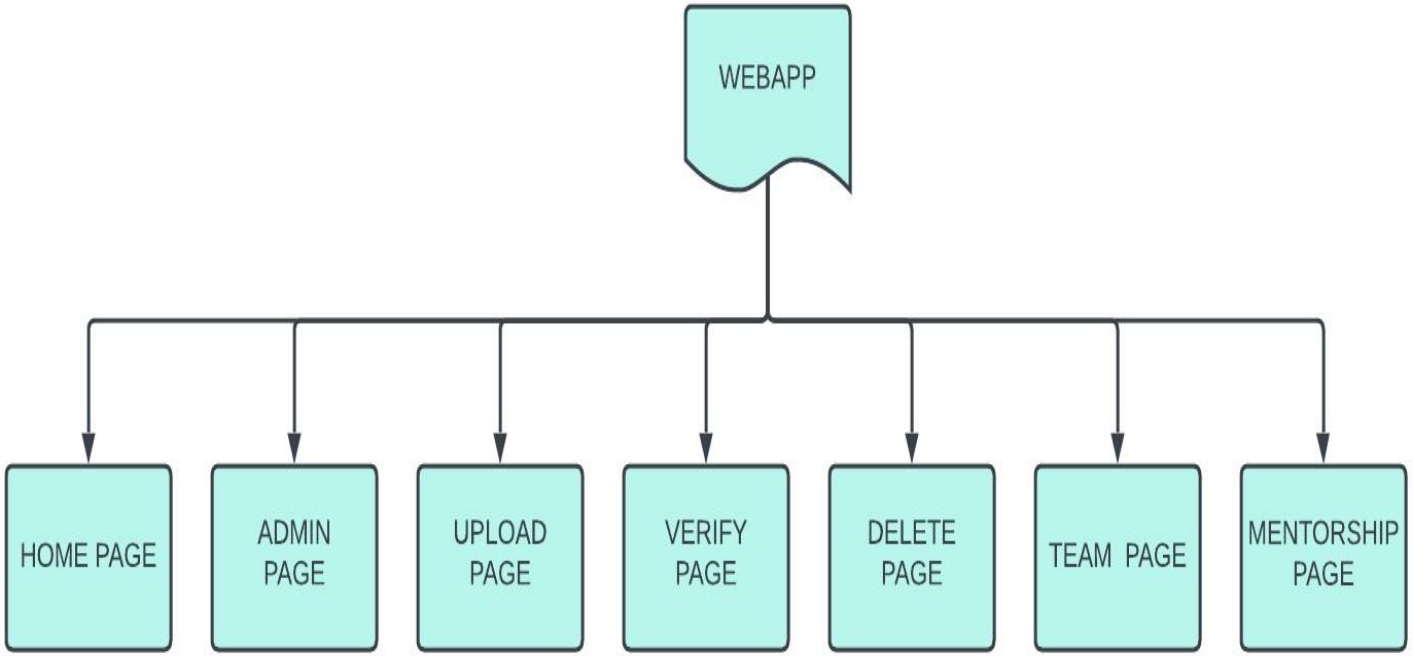
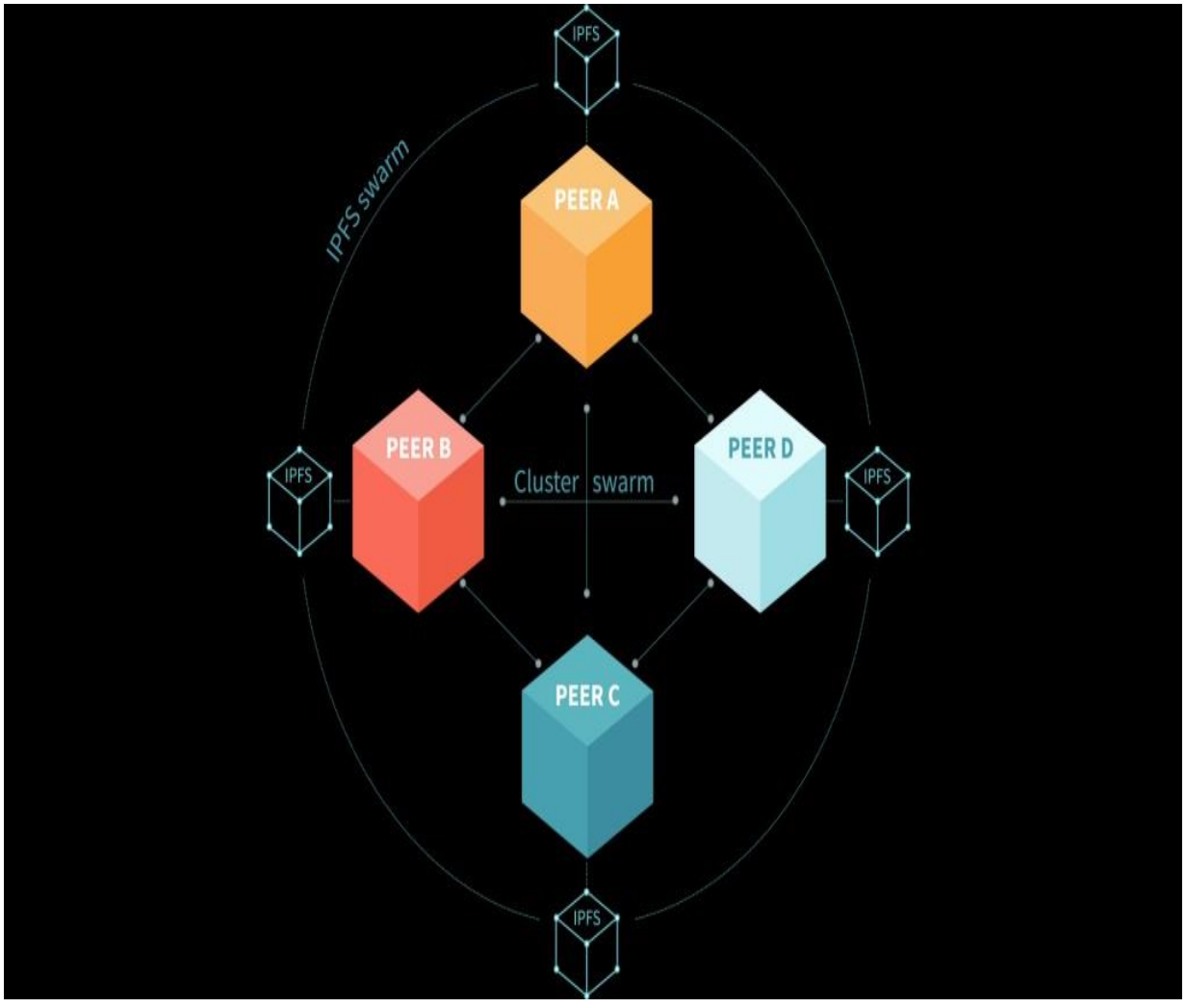



Fig 4.7: Flowchart of composition of the front-end of the system.

### 4.2.3 IPFS

The second stage of the document verification architecture is ipfs where the document is retrieved once its existence in the blockchain has been confirmed in terms of implementation a library is called and the ipfs object in javascript is used to upload the content to ipfs the process involves uploading a document to ipfs after cryptographically hashing it if the document is initially confirmed on the blockchain we have provided a link to the hash of the document on the blockchain that corresponds to the ipfs hash.

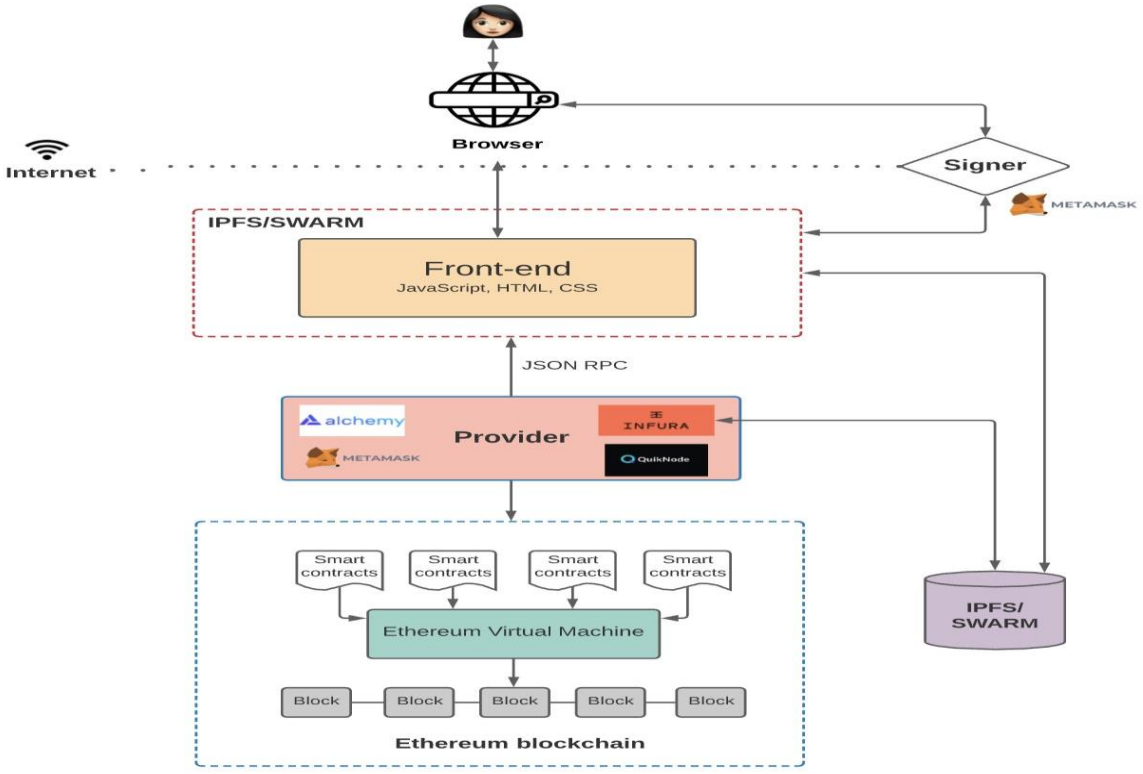
Fig4.8:Ipfs Peer to Peer connection [15]



### 4.2.4 Web3.js

The smart contract is initially constructed on the REMIX platform, which is a test network with a dummy Blockchain that allows the smart contract to be deployed and its functions to be tested. After implementing an integrated smart contract that meets the system's requirements, the smart contract is deployed on a blockchain network (using a meta-mask wallet) to obtain a unique address for the smart contract (this address represents the smart contract's owner's address) and an Application Binary Interface (ABI) that represents the contract's Intelligent functions, events, and variables. The Ethereum object is injected into the browser by the MetaMask wallet. Communication with the smart contract is accomplished using Web3, a JavaScript library. Within web3.js, the provider (Ethereum object), the smart contract address, and the Application Binary Interface (ABI) should be used to communicate with the smart contract.

Fig 4.9:web3 and its connection[17]

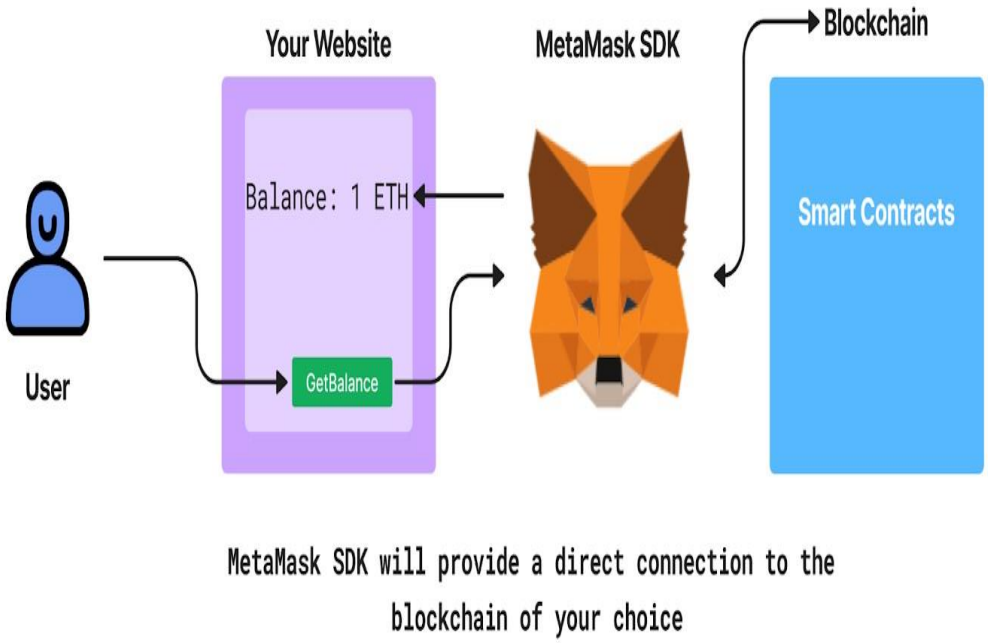


### 4.2.5 MetaMask Wallet

MetaMask is an extension for accessing Ethereum enabled distributed applications, or "Dapps" in your browser!The extension injects the Ethereum web3 API into every website's javascript context, so that dapps can read from the blockchain.

MetaMask also lets the user create and manage their own identities (via private keys, local client wallet and hardware wallets like Trezor™), so when a Dapp wants to perform a transaction and write to the blockchain, the user gets a secure interface to review the transaction, before approving or rejecting it.

Fig 4.10: Metamask and Frontend Connection[16]



## 4.3 Performance Enhancement

We are ambitious to achieve more and more features to improve our system. To attain this goal, we have made various measures.

### 4.3.1 Polygon Network

During our journey for cost gains, we tried to reach fewer transaction fees. When we deploy our smart contract on the Polygon network, we have noticed significant progress in reducing transaction fees. It is due to the very cheap price of Sepolia coin compared to ETH coin.

### 4.3.2 Storage Optimizations

Transactions to the Ethereum network are associated with costs. Therefore, the developer should follow the cheapest and most appropriate way to build a smart contract to reduce the cost of transactions. In the first version of the smart contract, a single hash was passed as a string. Since operations on strings are relative expensive, the hash was passed as a byte in the second version. In the last and most current version, a byte array of hashes is passed. Solidity offers different data types of bytes, from bytes to bytes32, which has a storage capacity of 32 bytes. Since the SHA-3 is used with a 256 bits hash function, a hash with 256 bits is generated, i.e., 32 bytes. Therefore, it is most efficient to use Solidity's bytes32 data type to avoid wasting storage space. Furthermore, it is only possible to pass bytes or integer arrays as parameters. Therefore, the use of strings in this approach is unfavorable and costly. [14]

### 4.3.3 Special node for connection with blockchain

There are two types of functions in our system, there is a function that needs to be done as a transaction via the MetaMask wallet. On the other hand, there are functions that do not need to be performed as a transaction, but through a special node that is being prepared, so we do not need a MetaMask wallet to perform this function.

Connecting to the blockchain via a MetaMask wallet requires charging a transaction fee, in some functions such as a function of exporting and deleting documents, it is not possible to abandon this connection method and follow the special node method. As for the document verification function, we can follow the special node method, because this function does not have to be performed as a transaction.

It has been observed that when using the node method of connecting to the blockchain to perform the verification function, no transaction fee is charged.

.

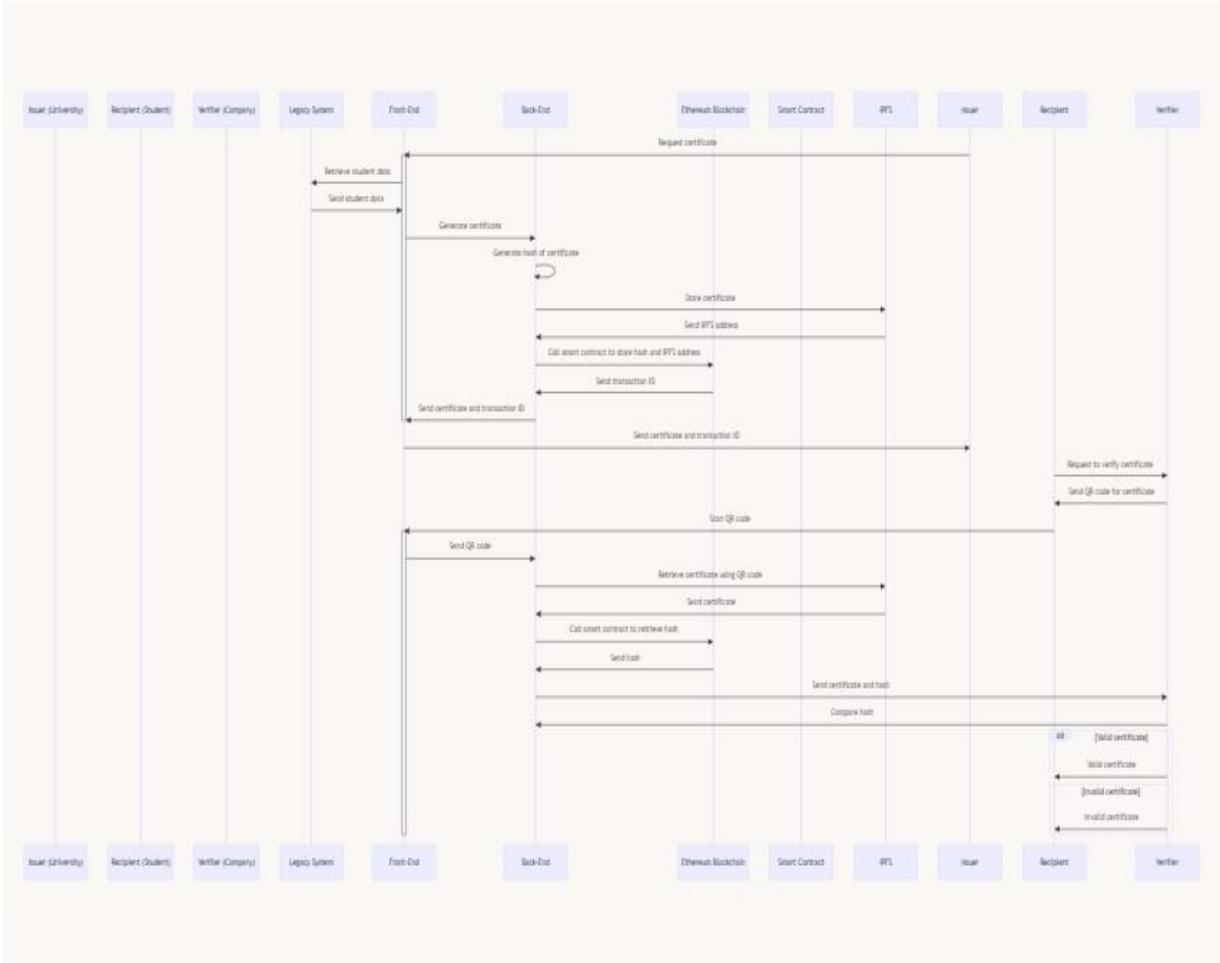
# CHAPTER-5

# OBJECTIVES

The proposed project seeks to revolutionize the academic document validation system using blockchain technology by automating the validation process, enhancing efficiency, and ensuring security through a decentralized and tamper-resistant framework. With a focus on reducing operational costs, fostering transparency, and enabling real-time verification, the project aims to provide a user-friendly interface for seamless interactions among universities, administrators, and verifiers. By facilitating cross-border recognition, prioritizing privacy, and ensuring scalability, the project aspires to contribute to academic record transparency and establish a sustainable solution that can adapt to evolving technological and educational landscapes. Through comprehensive user training and support, the project aims to address existing limitations, paving the way for a more robust, accessible, and trustworthy academic document validation system.

# CHAPTER-6
# SYSTEM DESIGN & IMPLEMENTATION

The system architecture and workflow mechanism are depicted in the figure below. The university that issued the document and the graduating student, as well as the company or the destination intended by the student for his own purposes, such as finding employment or completing postgraduate studies, are all relevant participants of the system. The university stores the documents of graduating students in its own archiving system (Blockchain) after graduation, and the student is provided a PDF file or a QR code for further verification. When a student decides to apply to a company to get a job or complete postgraduate studies at a university, he/she offers the institution his/he PDF or QR code file.



# CHAPTER-7

# TIMELINE FOR EXECUTION OF PROJECT

# (GANTT CHART)

- The project commenced on October 3, 2023.
- The phase of "Research and Analysis" spanned from October 3, 2023, to October 26, 2023 , lasting approximately three weeks.
- Following the research phase, the "Requirements Collection" phase initiated on October 27, 2023, and concluded on October 30, 2023, lasting only a few days.
- The "Design" phase, which appears to be the most extensive phase, started on October 30, 2023, and extended until November 26, 2023, taking nearly four weeks.
- A "Review" phase is scheduled post-Design, beginning on November 28, 2023, and ending on December 19, 2023, lasting about three weeks.
- Fig:7.1

# CHAPTER-8
# OUTCOMES

1 . Efficient Certificate Validation:

- Streamlined and automated academic document validation process, reducing the time required for verification using blockchain technology.

2 . Reduced Operational Costs:

- Cost-effective solution with decreased operational expenses for universities and validation authorities due to the automation of certificate generation and verification processes.

3 .Enhanced Security and Infallible Integrity:

-Stricter security measures ensuring the legitimacy of educational credentials, since blockchain's decentralized and immutable features frustrate efforts at manipulation and illegal access.

4. Minimized Risk of Certificate Loss:

- Students will have less chance of losing their certificates since academic certificates may be stored safely and conveniently in a blockchain-based repository.

5. User-Friendly Verification Interface:

- Easy-to-use verification technique that makes it possible for verifiers to quickly and reliably validate data by scanning QR codes or entering files.

6 . Decentralized File System Access:

- Academic certifications may be safely and easily stored on a blockchain file system, allowing for quick retrieval when required and protecting private data.

7 . Scalable System Architecture:

- Scalable system architecture accommodating the integration of additional universities and handling a growing volume of academic certificates over time.

8 . Adaptability to Technological Changes:

- System designed to adapt to evolving technological standards and regulatory requirements in both the academic and blockchain domains.

9. User Training and Support:

- Efficiently trained users, including universities, administrators, and verifiers, ensuring a smooth transition to and effective utilization of the blockchain-based validation system.

10. Comprehensive Documentation:

- Comprehensive documentation detailing the system architecture, protocols, and procedures for future reference, maintenance, and further development.

11. Data Analytics and Reporting:

- Implementation of reporting features providing insights into system usage, allowing administrators to make informed decisions for continuous improvement.

12 . Positive Impact on Academic Institutions:

- Positive impact on the reputation of academic institutions as they adopt a modern and efficient system, contributing to a more technologically advanced educational environment.

13 . Contributions to Academic Record Transparency:

- Contributing to the overall transparency of academic records by ensuring a reliable and easily accessible verification process, fostering trust among employers, educational institutions, and other stakeholders.

By achieving these outcomes, the project aims to bring about a transformative change in the academic document validation landscape in India, addressing existing challenges and providing a secure, efficient, and technologically advanced solution

# CHAPTER-9
# RESULTS AND DISCUSSIONS

In this section, we will review the contents and workflow of the system step by step.

- Home Page

Home page contains a general description of the system, its features, and the services it provides

- Team Page

Team page includes the team implementing this project, including students and a supervisor. Team contacts are also available to communicate with them

- Admin Page

Through admin page, the owner of the smart contract can add and edit an exporter or delete an exporter

In the upper left, several information appears, including the address of the owner of the smart contract, the name of the network on which the smart contract is published, in addition to the financial budget in this account, the number of graduating student documents included in the blockchain, and the number of document exporters.

The process of adding the exporter of a document is done by the owner by adding the address of the new exporter in addition to the name of the university and collage to which the issuer belongs

Once you click on the "Add Exporter" button, it will wait for confirmation or rejection of the transaction

If the transaction is confirmed by pressing the "Confirm" button, the process of adding a document issuer will be completed successfully

The process of editing or deleting a document exporter is done by following the exact same steps as adding a document source above.

- Upload Page

The upload page is dedicated to the process of exporting documents by the university, so it is not included on the official website of the university. Each college documents source archives the documents of graduate students from that college

In the upper left, several information appears, including the name of the university and college issuing the document in addition to the department, the address of the exporter, the name of the network on which the smart contract is published, in addition to the financial budget in this account

The process of exporting documents is done by selecting the document as a file through the “Choose File” entry, after which the document will be hashed directly

Once you click on the "Add Exporter" button, it will wait for confirmation or rejection of the transaction

If the transaction is confirmed by pressing the "Confirm" button, the process of exporting a student's document will be completed successfully

After the export process is completed, a set of information appears, including the addresses of the transaction parties, the time the transaction was completed, and the block number in the blockchain. It also shows a QR code that is given to the student for verification purposes

Most recently issued student documents are shown for each college document exporter

Now, after performing an export process and embedding a document into the blockchain network, we notice that the wallet's financial budget has decreased, which indicates the imposition of fees for each transaction

- Verify Page

After graduation, the student seeks to get a job or complete his postgraduate studies. The student submits his priorities to the intended organization, including his study document. Organizations need to validate the applicant's document, so they will visit the official website of the applicant's university for the purpose of verification. The verification page is included on the official website of the university
Once the document file is uploaded (or through a QR code), the document will be hashed

When the "Verify" button is pressed, the document hash will be compared with the previously archived document hashes in the blockchain. If the match is done, it will go to IPFS to retrieve the document. Then the verification request is answered positively with the presentation of the document itself

In the event that the document hash is not matched with one of the hashed documents archived in the blockchain, the verification request will be answered negatively

As we mentioned in Section 3.3.3 in chapter three, the verification function is not a transaction via the Meta-Mask wallet, but it is done via a special node.

- Delete Page
In educational institutions, a document may be taken away from a student or an error may be discovered that must be corrected later. As a result, the exporters have the authority to remove a previously exported document. This page is restricted to document exporters only as it is not included on the official university website

Once the document file is uploaded, the document will be hashed,
When the "Add Exporter" button is click, it will wait for confirmation or rejection of the transaction .If the transaction is confirmed by pressing the "Confirm" button, the process of deleting a student's document will be completed successfully

We can now see that the wallet's financial budget has decreased after deleting a document from the blockchain network. As indicated in the graphic below, which demonstrates the imposition of fees for each transaction:

# CHAPTER-10
# CONCLUSION

Basically, an advanced and efficient technology that is far from the norm is needed to accomplish our daily dealings. Blockchain technology is a great and unparalleled invention for such a need. Blockchain is one of the most popular and recent growing technologies that is underused in different sectors such as health care, insurance, banking, e-voting, supply chain management and certificate verification and digital identity etc. Blockchain is considered secure technology, which stands in publicly distributed and peer to peer networks. Blockchain allows storing excessive amounts of data due to complex network architecture.

We are very impressed with this trendy technique so we are studying and learning more about this technique. We are experiencing a unique experience in our graduation project. Our project is based on the Ethereum blockchain platform.

Our system automates the process of generating Certificates and reduces the manual work needed for the verification of the same. Students are also at a comparatively low risk of losing the certificate. By using an additional hashing algorithm, we are decreasing the percentage of data being tampered with. The SHA3 hash function has so far proven to be safe, which means that no two different inputs resulted in the same output. At the same time, it is not possible to generate real information from a hash, where the same document cannot be retrieved by the produced hash. Retrieval of the same document is only done by IPFS.

# REFERENCES

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[7] https://www.geeksforgeeks.org/smart-contracts-in-blockchain/

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[14]https://docs.soliditylang.org/

[15]https://thenewstack.io/devs-its-time-to-consider-ipfs-as-an-alternative-to-http/

[16]https://docs.alchemy.com/docs/how-to-set-up-the-metamask-sdk

[17]https://www.preethikasireddy.com/post/the-architecture-of-a-web-3-0-application

# APPENDIX-A

# PSUEDOCODE

## 1.index.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta
      name="viewport"
      content="width=device-width, initial-scale=1, shrink-to-fit=no"
    />
    <!-- SEO Meta Tags -->
    <meta name="description" content="Your description" />
    <meta name="author" content="Your name" />
    <!-- OG Meta Tags to improve the way the post looks when you share the page on
Facebook, Twitter, LinkedIn -->
    <meta property="og:site_name" content="CertVerifyMe" />
    <!-- website name -->
    <meta property="og:site" content="CertVerifyMe.com" />
    <!-- website link -->
    <meta property="og:title" content="Certverify" />
    <!-- title shown in the actual shared post -->
    <meta property="og:description" content="CertVerifyMe A Website For institutions To
Verify The Authenticity
    Of Your Documents Online Easily And Safely. Let's Go.." />
    <!-- description shown in the actual shared post -->
    <meta property="og:image" content="https://blockhcain-project-
ali.on.drv.tw/DevAli/assets/images/home5.jpg" />
    <!-- image link, make sure it's jpg -->
    <meta property="og:url" content="#ABOUT" />
    <!-- where do you want your post to link to -->
    <meta name="twitter:card" content="summary_large_image" />
```

```
    <!-- to have large image post format in Twitter -->

    <!-- Webpage Title -->
    <title>CertverifyMe</title>
    <link rel="stylesheet" href="./css/loader.css">
    <link href="./css/bootstrap.min.css" rel="stylesheet" />
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/6.1.1/css/all.min.css" integrity="sha512-
KfkfwYDsLkIlwQp6LFnl8zNdLGxu9YAA1QvwINks4PhcElQSvqcyVLLD9aMhXd13uQj
oXtEKNosOWaZqXgel0g==" crossorigin="anonymous" referrerpolicy="no-referrer" />
<link href="./css/aos.min.css" rel="stylesheet" />
    <link href="./css/main.css" rel="stylesheet" />
    <!-- Favicon -->
    <link rel="lion" href="C:\Users\naqui\OneDrive\Desktop\New folder\BlockChain-Based-
Document-Verfication-With-IPFS\assets\images\lion.png" />
  </head>
  <body>
    <div class="loader-wraper">
      <div class="lds-
roller"><div></div><div></div><div></div><div></div><div></div><div></div><div></
div><div></div></div>
    </div>
  <!--NavBar Start-->
       <nav class="navbar navbar-expand-lg navbar-light bg-light py-3 navbar-dark">
        <div class="container">
          <a class="navbar-brand" href="index.html">

            <span class="home_text">CertVerify</span>Me
            </a>
          <button class="navbar-toggler" type="button" data-bs-toggle="collapse" data-bs-
target="#navbarSupportedContent" aria-controls="navbarSupportedContent" aria-
expanded="false" aria-label="Toggle navigation">
          <span class="navbar-toggler-icon"></span>
          </button>
```

```
        <div class="collapse navbar-collapse" id="navbarSupportedContent">
        <ul class="navbar-nav me-auto mb-2 mb-lg-0">
           <li class="nav-item">
           <a class="nav-link active" aria-current="page" href="index.html">Home</a>
           </li>
           <li class="nav-item">
           <a class="nav-link " href="upload.html">Upload </a>
           </li>
           <li class="nav-item">
           <a class="nav-link" href="verify.html">Verify </a>
           </li>
           <li class="nav-item">
           <a class="nav-link" href="delete.html">Delete </a>
           </li>

           <li class="nav-item">
            <a class="nav-link" href="admin.html">Admin</a>
            </li>
              <li class="nav-item">
           <a class="nav-link " href="about.html">Team</a>
           </li>
          </li>
          <li class="nav-item">
       <a class="nav-link " href="mentorship.html">Mentorship</a>
       </li>
         </ul>
         </div>
       </div>
       </nav>

    <!-- Home -->
    <section class="home py-5 d-flex align-items-center" id="header">
<video autoplay muted loop id="myVideo">
  <source src="./files/video.mp4" type="video/mp4">
```

```
</video>
    <div class="container  text text-light py-5" data-aos="fade-right">
      <h1 class="headline text">
        Build <span class="text-info">trust</span>  <br>
        into your Organization
      </h1>
      <p class="para  py-3">
        <h1>CertVerifyMe</h1> platform is a leading Document Verification platform <br>
        designed to bring efficiency and security to your operations.
      </p>

      <div class="my-3">
        <a class="btn bg-aqua text-white" href="verify.html">Go Verify</a>
      </div>

    </div>
    <!-- end of container -->
  </section>
  <!-- end of home -->

  <!-- Information -->
  <section class="information">
    <div class="container-fluid">
      <div class="row text-light">
        <div class="col-lg-4 text-center p-5" data-aos="zoom-in">
          <img src="files/undraw_investment_data_re_sh9x.svg" width="150">
          <h4 class="py-3">Less Cost</h4>
          <p class="para-light">
            with CertVerifyMe uploading any document cost only <span class="text-warning">
0.01 &dollar; </span>
            so you can upload without caring about the Operation cost
          </p>
        </div>
        <div class="col-lg-4 text-center p-5" data-aos="zoom-in">
```

```
      </div>
      <!-- end of row -->
    </div>
    <!-- end of container -->
  </section>
  <!-- end of work -->

  <!-- Samples -->


<!-- Footer -->
  <footer class="footer-dark">
    <div class="container">
      <div class="row">
        <div class="col-sm-6 col-md-3 item">
          <h3   data-aos="fade-right">Services</h3>
          <ul  data-aos="zoom-in">
            <li><a href="#">Ethereum</a></li>
            <li><a href="#">Blockchain Tech.</a></li>
            <li><a href="#">Smart Contracts </a></li>
          </ul>
        </div>
        <div class="col-sm-6 col-md-3 item">
          <h3   data-aos="fade-right">About us</h3>
          <ul  data-aos="zoom-in">
            <li><a href="about.html">Company</a></li>
            <li><a href="about.html">Team</a></li>
          </ul>
        </div>
        <div class="col-md-6 item text">
          <h3  data-aos="fade-right">
            <i class="fa-solid fa-lion"></i>
           CertVerifyMe</h3>
          <!-- <a href="https://www.flaticon.com/free-icons/blockchain" title="blockchain
```

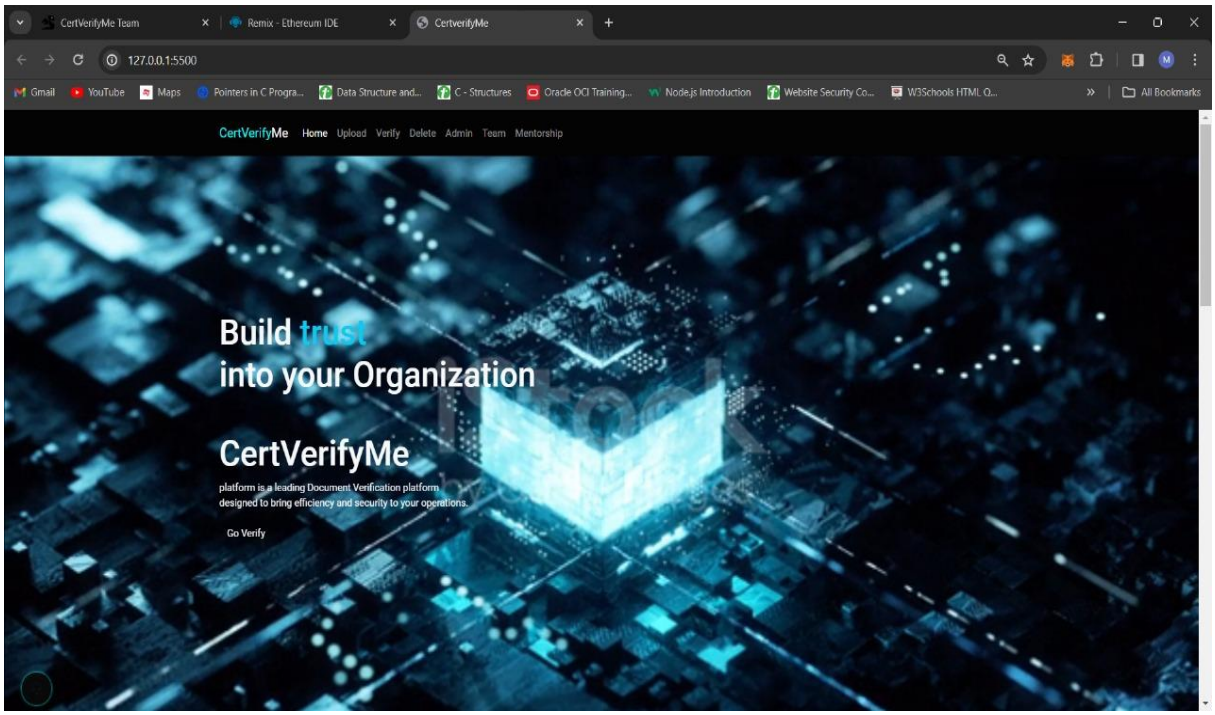
```
icons">Blockchain icons created by photo3idea_studio - Flaticon</a> -->
          <p  data-aos="zoom-in">
            The CertverifyMe platform is a leading Document Verification platform
            designed to bring efficiency and security to your operations.
          </p>
        </div>
        <div class="col-md text-center text-md-start">
          <h3 data-aos="fade-right">Credits</h3>
          <ul data-aos="zoom-in">
            <li>
              <a
                href="https://undraw.co/illustrations"
                title="Indraw illustrations"
                >Blockchain illustrations created by undraw</a
              >
            </li>
            <li>
              <a href='https://www.freepik.com/vectors/futuristic-background'>Futuristic
background vector created by freepik - www.certverifyme.com</a>
            </li>
            <li>
              <a href='https://www.freepik.com/vectors/tech-world'>Tech world vector created
by liuzishan - www.certverifyme.com</a>
            </li>
            <li>
             <a
href="https://unsplash.com/@theshubhamdhage?utm_source=unsplash&utm_medium=refer
ral&utm_content=creditCopyText"> Photo by Team</a> on <a
href="https://unsplash.com/s/photos/blockchain?utm_source=unsplash&utm_medium=referr
al&utm_content=creditCopyText">Unsplash</a>

            </li>
            <li>
              <a href="https://www.flaticon.com/free-icons/wings" title="wings icons">Wings
```

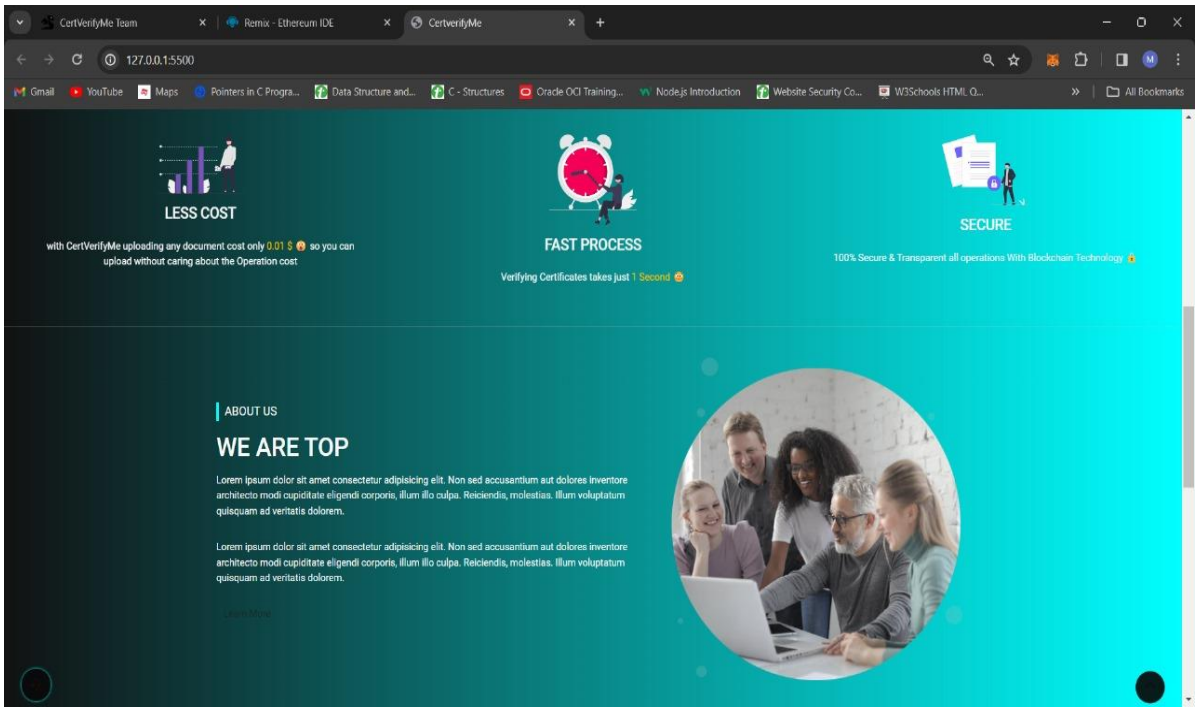
```
icons created by Freepik - Flaticon</a>
            </li>
            <li>
              <a href="https://loading.io/icon/">Icon Loading  loading.io</a>
            </li>
          </ul>
        </div>
        <div  data-aos="zoom-in" class="col item social">
          <a href="https://www.facebook.com"><i class="fa-brands fa-facebook"></i></a>
          <a href="https://twitter.com"><i class="fa-brands fa-twitter"></i> </a
          ><a href="https://twitter.com"><i class="fa-brands fa-github"> </i></a>
          <a href="https://www.instagram.com"><i class="fa-brands fa-instagram"> </i> </a>
        </div>
      </div>
      <p class="copyright">CertVerifyMe 2024</p>
    </div>

  </footer>
<!-- End Footer -->
  <div >
    <i onclick="topFunction()" id="scroll-btn" class="fa-solid fa-angle-up"></i>
  </div>
  <div><a href="mailto:devaloshe@gmail.com?subject=From OrioChain Site">
    <i class="mail-us fa-solid fa-headset"></i>
  </a>
  <script
  src="https://code.jquery.com/jquery-3.6.0.js"
  integrity="sha256-H+K7U5CnXl1h5ywQfKtSj8PCmoN9aaq30gDh27Xc0jk="
  crossorigin="anonymous"></script>
  <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/js/bootstrap.bundle.min.js"></script>
<!-- Bootstrap framework -->
  <script src="./js/purecounter.min.js"></script>
  <script src="./js/aos.js"></script>
```

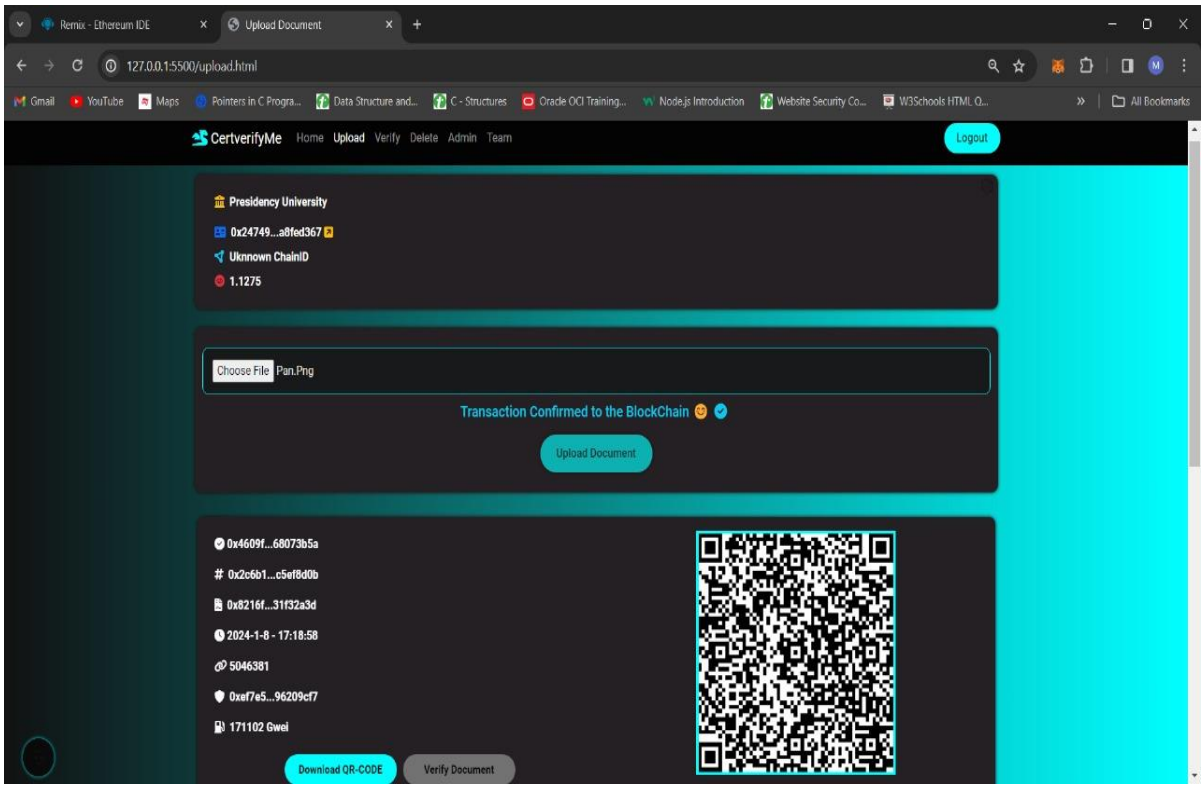
```
    <script src="./js/script.js"></script>
    <!-- <script defer>changeBackground();</script> -->
    <!-- <div class="butterfly">
    </div> -->

    <script defer>
      // const butterfly = document.querySelector(".butter");
      //   setInterval(()=>{
      //   butterfly.style.left = window.innerWidth*Math.random() +"px";
      //   butterfly.style.top =  window.innerHeight*Math.random() + "px";
      //   },4000)
   $(".loader-wraper").fadeOut("slow");
    </script>

  </body>
</html>
```

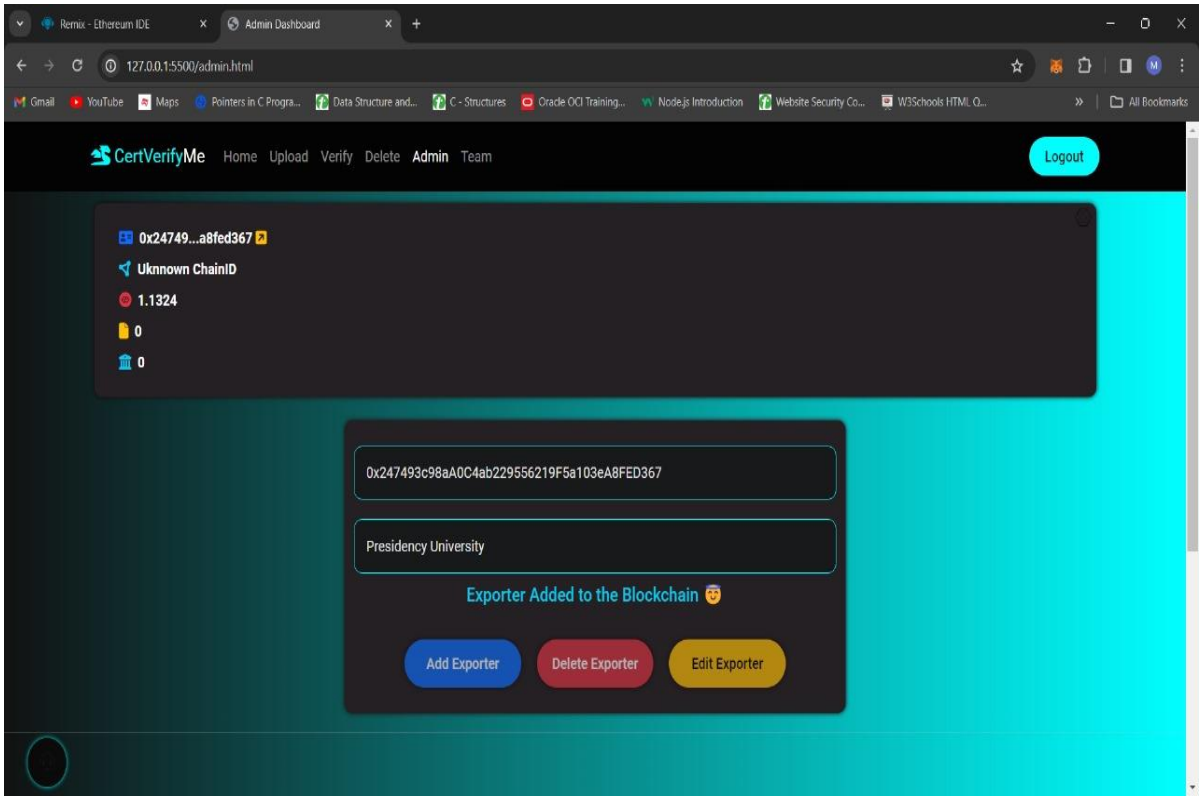
# APPENDIX-B

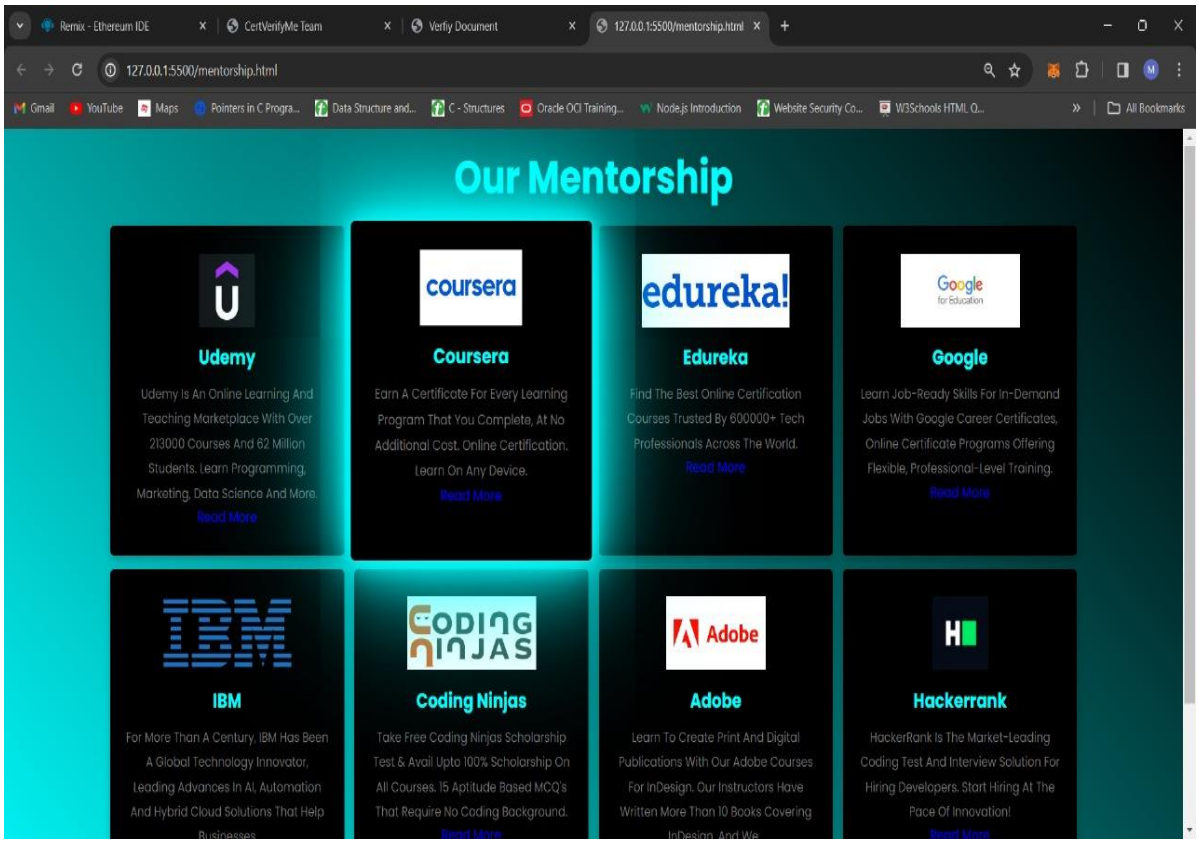
# SCREENSHOTS




Remix - Ethereum IDE
Upload Document
127.0.0.1:5500/upload.html
CertverifyMe
Home
Upload
Verify
Delete
Admin
Team
Logout
Presidency University
0x24749...a8fed367
Uknnown ChainID
1.1275
Choose File
Pan.Png
Transaction Confirmed to the BlockChain
Upload Document
0x4609f...68073b5a
0x2c6b1...c5ef8d0b
0x8216f...31f32a3d
2024-1-8 - 17:18:58
5046381
0xef7e5...96209cf7
171102 Gwei
Download QR-CODE
Verify Document


Remix - Ethereum IDE
Admin Dashboard
127.0.0.1:5500/admin.html
CertVerifyMe
Home
Upload
Verify
Delete
Admin
Team
Logout
0x24749...a8fed367
Uknnown ChainID
1.1324
0
0
0x247493c98aA0C4ab229556219F5a103eA8FED367
Presidency University
Exporter Added to the Blockchain
Add Exporter
Delete Exporter
Edit Exporter


Remix - Ethereum IDE
CertVerifyMe Team
Verfiy Document
127.0.0.1:5500/mentorship.html
Our Mentorship
Udemy
Udemy Is An Online Learning And Teaching Marketplace With Over 213000 Courses And 62 Million Students. Learn Programming, Marketing, Data Science And More.
Read More
Coursera
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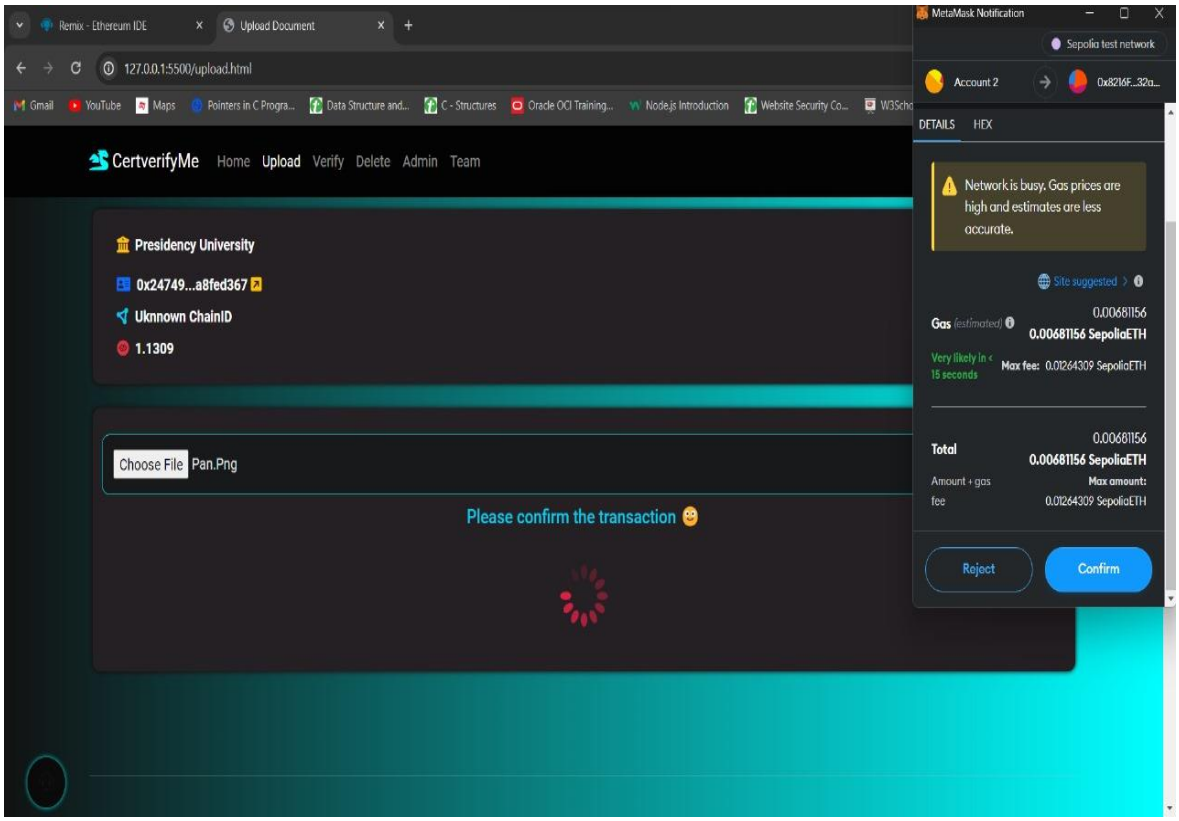
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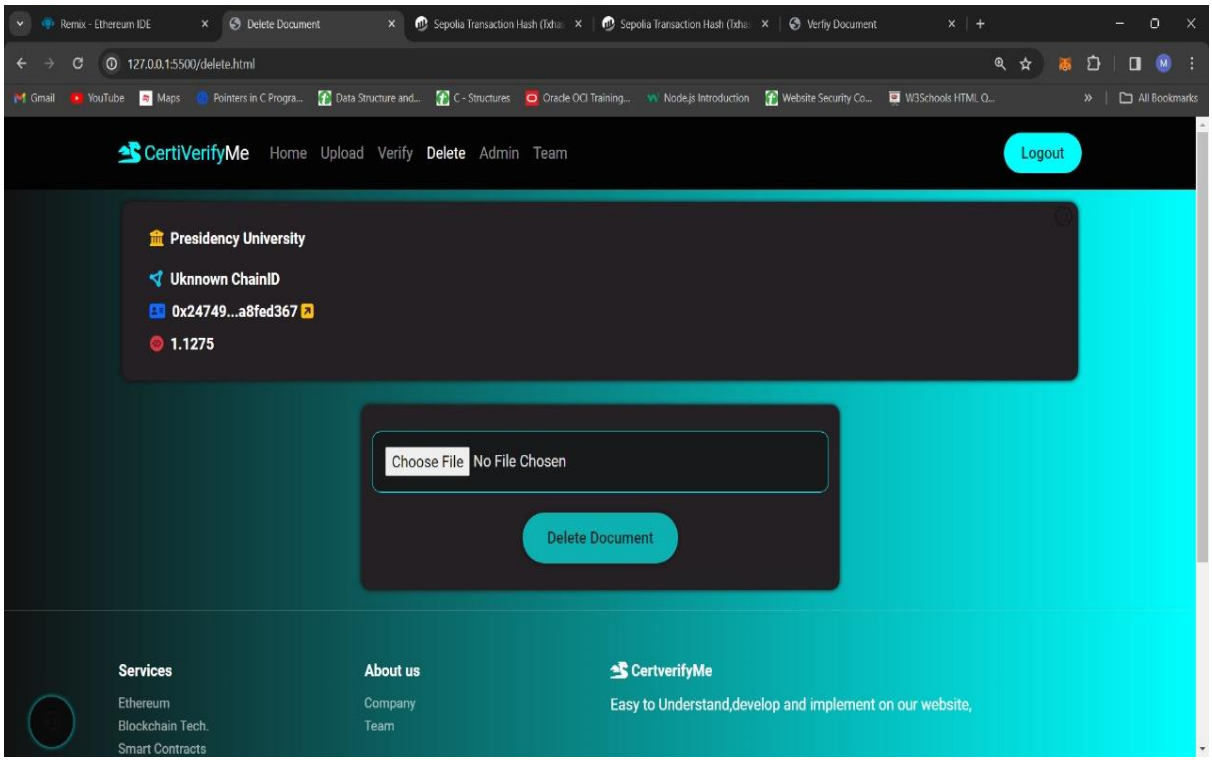
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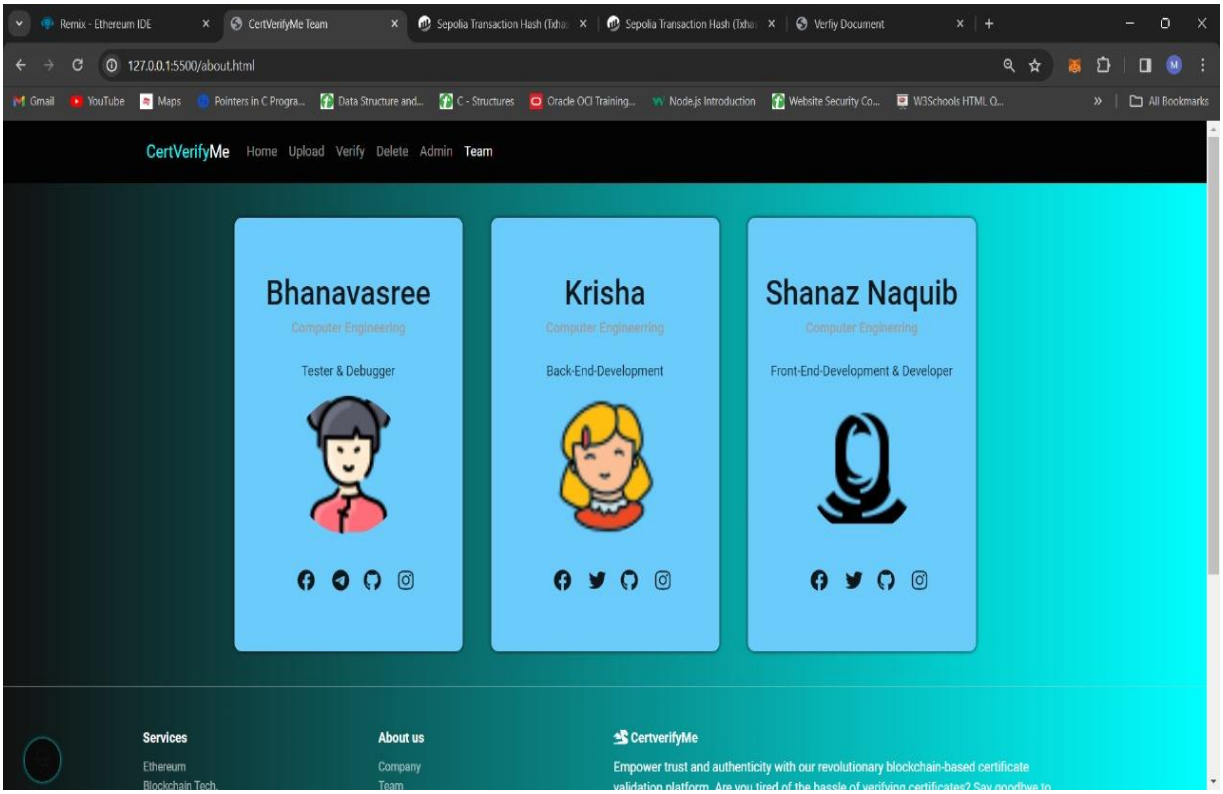
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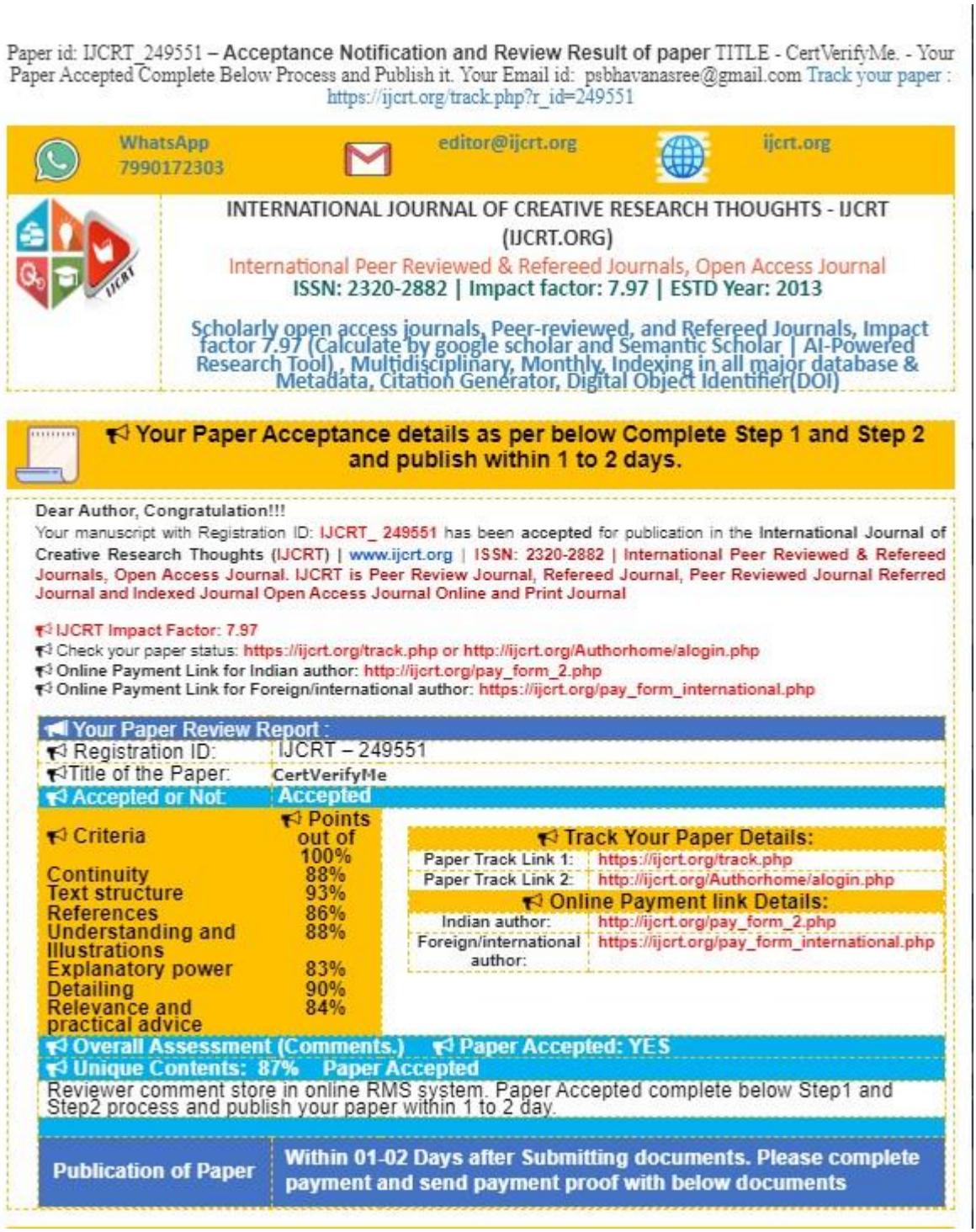

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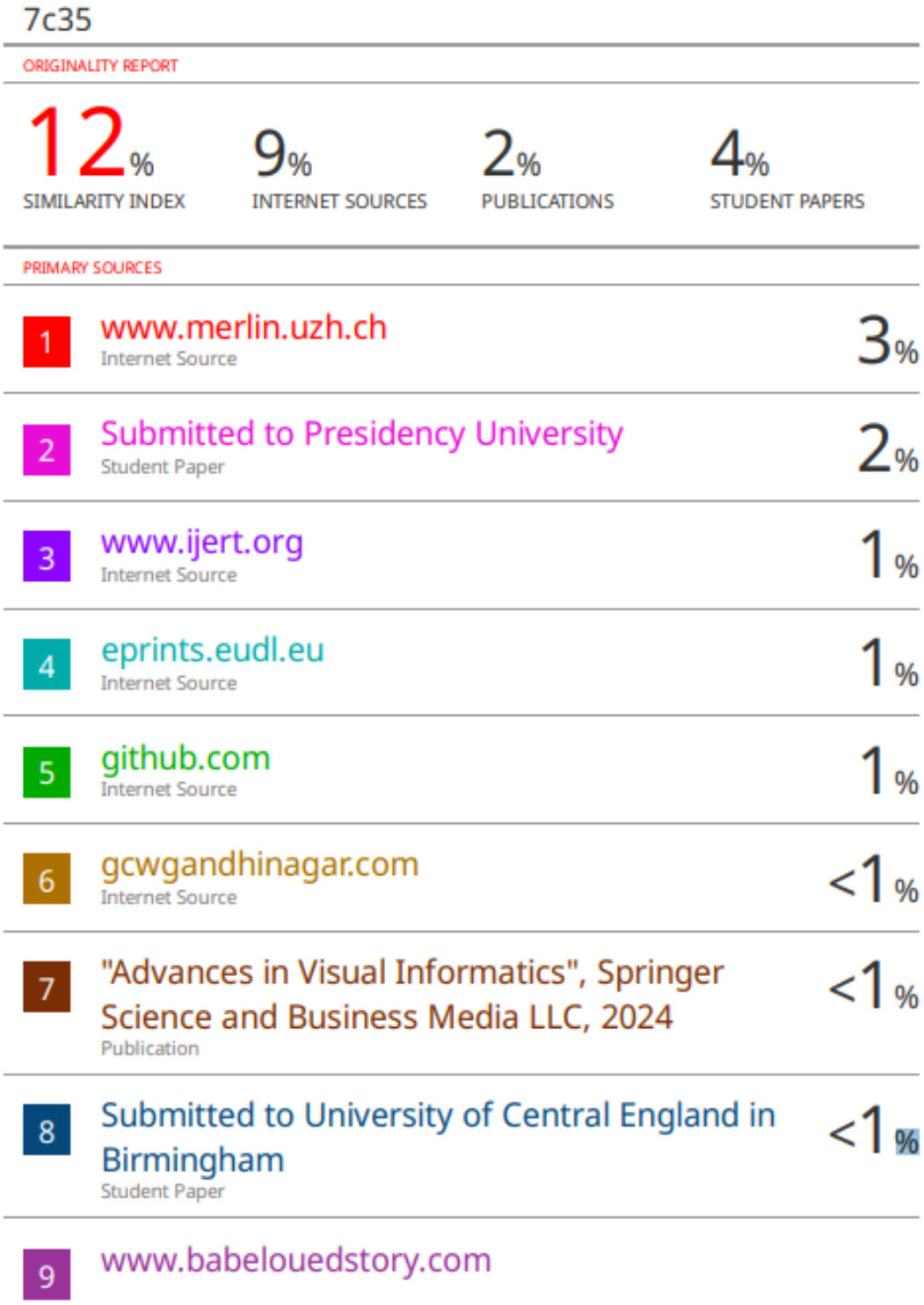

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## 4.SDE Mapping


**This project aligns with several Sustainable Development Goals (SDGs), showcasing its potential positive impact on society and education. Here are some key points connecting the project to specific SDGs:**

### 1. Quality Education (SDG 4):

- The project aims to enhance the efficiency of academic document validation, contributing to the overall improvement of the education system.
- By streamlining the verification process and reducing manual efforts, the system can help ensure the timely and accurate recognition of academic achievements, promoting a higher quality of education.

### 2 . Industry, Innovation, and Infrastructure (SDG 9):

- The use of blockchain technology represents an innovative and advanced solution to address challenges in the existing academic validation system.
- The project promotes the development and implementation of technology infrastructure ( blockchain) to enhance efficiency and security in the education sector.

### 3 . Reduced Inequality (SDG 10):

- The proposed system can reduce inequality by providing a more accessible and reliable means of verifying academic certificates.
- Students from diverse backgrounds may face challenges in verifying their credentials, and this blockchain-based solution can streamline the process, ensuring equal opportunities

for all.

### 4. Peace, Justice, and Strong Institutions (SDG 16):

- The decentralized and tamper-resistant nature of blockchain enhances the security and integrity of academic certificates.
- This contributes to the establishment of strong and just institutions by ensuring the trustworthiness of academic records, reducing the risk of fraud and corruption in the verification process.

### 5. Partnerships for the Goals (SDG 17):

- The project involves collaboration between universities, certificate issuers, and verifiers, fostering partnerships for the common goal of improving the academic document validation system.
- Utilizing blockchain technology encourages cross-sector partnerships and cooperation to implement a comprehensive and effective solution.

In summary, this project offers a holistic approach to address challenges in the academic document validation system, with a focus on efficiency, security, and inclusivity, thereby contributing to several Sustainable Development Goals.