# IBM Project Report

## On

# Online Blockchain based certificate generation and validation system for government organization

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**Guided By:**

Prof. Ravindra Patel (Internal)

Palwinder S (External)

## Submitted to

## Department of Computer Science & Engineering Institute of Computer Technology

**Year: 20**

# CERTIFICATE

This is to certify that the **IBM Project** work entitled "**Online Blockchain based certificate generation and validation system for government organization**" by Nirva Patel (Enrolment No. 20162101014), Archan Vyas (Enrolment No. 21162122007) and Abel Benedict (Enrolment No. 20162171001) of Ganpat University, towards the partial fulfillment of requirements of the degree of Bachelor of Technology – Computer Science and Engineering, carried out by them in the CSE(CBA/BDA/CS) Department at ICT Ganpat University. The results/findings contained in this Project have not been submitted in part or full to any other University / Institute for award of any other Degree/Diploma.

**Prof. Ravindra Patel**
Name & Signature of Internal Guide

**Prof. Dharmesh Darji**
Name & Signature of Head

**Place: ICT - GUNI**

**Date:**

# ACKNOWLEDGEMENT

IBM project is a golden opportunity for learning and self-development. I consider myself very lucky and honored to have so many wonderful people lead me through in completion of this project. First and foremost, I would like to thank Dr. Rohit Patel, Principal, ICT, and Prof. Dharmesh Darji, Head, ICT who gave us an opportunity to undertake this project. My grateful thanks to Prof. Ravi Patel & Mr.Palwinder S (Internal & External Guides) for their guidance in project work Online Blockchain based certificate generation and validation system for government organization, who despite being extraordinarily busy with academics, took time out to hear, guide and keep us on the correct path. We do not know where would have been without his/her help. CSE department monitored our progress and arranged all facilities to make life easier. We choose this moment to acknowledge their contribution gratefully.

**Patel Nirva Nileshkumar (20162101014)**

**Archan M Vyas (21162122007)**

**Abel Benedict (20162171001)**

# ABSTRACT

The project aims to create an online system for government organizations to generate and validate certificates using blockchain technology. Through smart contracts and decentralized storage, it ensures authenticity, eliminates fraud, and enhances transparency, bolstering trust in government-issued credentials.

# INDEX

# CHAPTER 1: INTRODUCTION

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The fact of blockchain technology has revolutionized various sectors, and its potential in transforming certificate generation and validation systems is significant. In this report, we introduce an innovative solution for government organizations: an Online Blockchain-based Certificate Generation and Validation System.

## 1.1 Background

The fact of blockchain technology has revolutionized various sectors, and its potential in transforming certificate generation and validation systems is significant. In this report, we introduce an innovative solution for government organizations: an Online Blockchain-based Certificate Generation and Validation System.

## 1.2 Objectives

The primary objective of our project is to develop a secure, efficient, and transparent system for generating and validating certificates using blockchain technology. Key goals include:

- Eliminating fraudulent activities through immutable records stored on the blockchain.
- Streamlining the certificate issuance process to enhance efficiency and reduce administrative overhead.
- Providing stakeholders with easy and secure access to verified certificates, enhancing trust and credibility.

## 1.3 Scope of the Project

Our project focuses on designing and implementing a blockchain-based platform tailored for government organizations. It encompasses the following features:

- User-friendly interfaces for certificate issuance, verification, and management.
- Integration of cryptographic techniques to ensure data security and privacy.
- Compatibility with existing systems and standards to facilitate seamless adoption.
- Scalability to accommodate varying volumes of certificate transactions.

### 1.4 Methodology

The development process will follow a systematic approach, including requirement analysis, system design, implementation, testing, and deployment. Agile methodologies will be employed to ensure flexibility and responsiveness to evolving needs.

### 1.5 Significance

The adoption of blockchain technology in certificate management offers numerous benefits, including enhanced security, transparency, and efficiency. By leveraging decentralized ledgers, government organizations can establish trust among stakeholders and foster a more reliable ecosystem for certificate issuance and verification.

# CHAPTER 2: PROJECT SCOPE

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The scope of the project, "Online Blockchain-based Certificate Generation and Validation System for Government Organization," is defined to address the complexities and inefficiencies prevalent in traditional certificate management processes. This chapter outlines the specific aspects and functionalities that will be covered within the project.

## 2.1 Certificate type

The project aims to accommodate various types of certificates typically issued by government organizations, including but not limited to:

- Educational certificates (e.g., diplomas, degrees, transcripts)
- Professional certifications (e.g., licenses, accreditations)
- Legal documents (e.g., birth certificates, marriage certificates)
- Government-issued permits and licenses

## 2.2 Stakeholders

Key stakeholders involved in the certificate management process will be considered, including:

- Government authorities responsible for issuing certificates
- Institutions and organizations requiring certificate validation
- Certificate holders and individuals seeking verification
- Third-party service providers involved in the validation process

### 2.3 System Functionality

The project will encompass the following core functionalities:

- **Certificate Generation:** Designing a user-friendly interface for government authorities to create and issue certificates securely on the blockchain.
- **Certificate Verification:** Providing stakeholders with the ability to verify the authenticity and validity of certificates through a decentralized verification process.
- **Data Security:** Implementing robust cryptographic techniques to ensure the integrity and confidentiality of certificate data stored on the blockchain.
- **User Management:** Facilitating user registration, authentication, and access control mechanisms to manage permissions and roles effectively.
- **Integration:** Ensuring seamless integration with existing systems and standards to facilitate interoperability and data exchange.

### 2.4 Limitations

While the project aims to address many challenges associated with traditional certificate management, certain limitations will be considered:

- **Regulatory Compliance:** Compliance with relevant legal and regulatory frameworks governing certificate issuance and validation processes.
- **Scalability:** Ensuring the scalability of the system to accommodate growing volumes of certificate transactions without compromising performance.
- **Adoption Challenges:** Anticipating challenges related to user adoption, training, and change management within government organizations.

## 2.5 Deliverables

The project will culminate in the development and deployment of a fully functional Online Blockchain-based Certificate Generation and Validation System tailored for government organizations. Key deliverables include:

- System Architecture Design
- User Interface Prototypes
- Software Implementation
- Documentation and User Manuals
- Training Materials
- Deployment Plan

## 2.6 Conclusion

In conclusion, the project scope encompasses a comprehensive approach to modernizing certificate management processes for government organizations through blockchain technology. By addressing the specific needs and requirements of stakeholders, the system aims to enhance transparency, security, and efficiency in certificate generation and validation.

# CHAPTER 3: SOFTWARE AND HARDWARE REQUIREMENTS

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This chapter outlines the essential software and hardware components necessary for the development and deployment of the Online Blockchain-based Certificate Generation and Validation System for Government Organization.

## 3.1 Software Requirements

The software requirements are crucial for ensuring the functionality, security, and usability of the system. The following software components are identified:

- **Blockchain Platform:** A suitable blockchain platform will serve as the foundation for storing certificate data securely and immutably. Options such as Ethereum, Hyperledger Fabric, or Corda will be evaluated based on factors like scalability, consensus mechanism, and smart contract capabilities.
- **Development Framework:** Utilizing a robust development framework will streamline the software development process and enhance code quality.
- **Database Management System:** In addition to the blockchain, a traditional database management system may be required for storing non-sensitive data and metadata associated with certificates. Options include MySQL, PostgreSQL, or MongoDB, depending on the specific requirements of the system.
- **Frontend Development Tools:** User interfaces for certificate generation, verification, and management will be developed using frontend development tools such as HTML, CSS, JavaScript, and frameworks like React.js or Angular.js for enhanced interactivity and responsiveness.
- **Backend Development Framework:** The backend of the system will handle business logic, authentication, and integration with external systems. Frameworks like Node.js with Express.js or Python with Django can be used for backend development. Ganache-CLI is used for the Local Blockchain Network.
- **Security Tools:** Implementing security measures is paramount to safeguard sensitive certificate data and prevent unauthorized access. Tools like SSL/TLS for encrypted communication, OAuth for authentication, and security libraries like OWASP for vulnerability management will be integrated into the system.

### 3.2 Hardware Requirements

The hardware infrastructure required to host and run the system will depend on factors such as expected usage volume, scalability requirements, and budget constraints. The following hardware components may be necessary:

- **Server Infrastructure:** High-performance servers or cloud-based infrastructure capable of supporting blockchain nodes, database servers, and application servers will be required.
- **Storage:** Sufficient storage capacity is essential for storing blockchain data, certificates, and system backups. Solid-state drives (SSDs) or cloud storage solutions can be utilized for efficient data storage.
- **Networking Equipment:** Reliable networking equipment, including routers, switches, and firewalls, will ensure secure communication between system components and external entities.
- **Backup and Redundancy:** Implementing backup and redundancy measures, such as RAID configurations, regular backups, and failover mechanisms, will minimize the risk of data loss and system downtime.

# CHAPTER 4: PROCESS MODEL

# CHAPTER 4: PROCESS MODEL

In this chapter, we present the process model that will guide the development and implementation of the Online Blockchain-based Certificate Generation and Validation System for Government Organization. The process model outlines the sequence of activities, their interdependencies, and the expected outcomes at each stage of the project lifecycle.

## 4.1 Agile Development Methodology

The project will adopt an Agile development methodology, characterized by iterative and incremental development cycles. Agile principles emphasize collaboration, flexibility, and responsiveness to change, enabling the project team to adapt to evolving requirements and deliver value to stakeholders efficiently.

## 4.2 Key Phases

The process model consists of the following key phases:

- **Requirement Analysis:** The project team will collaborate with stakeholders to gather, analyze, and prioritize requirements for the certificate generation and validation system. User stories, use cases, and functional requirements will be documented to guide the development process.
- **System Design:** Based on the requirements collected, the system architecture, database schema, and user interfaces will be designed. High-level and detailed design documents will be created to provide a blueprint for implementation.
- **Implementation:** The development team will begin implementing the system components according to the design specifications. This phase involves coding, testing, and integration of frontend and backend modules, as well as smart contracts for blockchain integration.
- **Testing:** Rigorous testing will be conducted to validate the functionality, performance, and security of the system. Unit tests, integration tests, and end-to-end tests will be executed to identify and rectify any defects or deviations from requirements.
- **Deployment:** Once testing is complete, the system will be deployed to a staging environment for user acceptance testing (UAT). Feedback from stakeholders will be incorporated, and final adjustments will be made before deploying the system to production.

- **Maintenance and Support:** After deployment, the project team will provide ongoing maintenance and support to ensure the stability, reliability, and security of the system. Bug fixes, updates, and enhancements will be managed through an iterative process.

### 4.3 Collaboration and Communication

Effective collaboration and communication among project stakeholders are essential for the success of the process model. Regular meetings, status updates, and collaborative tools will facilitate communication, transparency, and alignment of expectations throughout the project lifecycle.

# CHAPTER 5: PROJECT PLAN

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In this chapter, we present the detailed project plan for the development and implementation of the Online Blockchain-based Certificate Generation and Validation System for Government Organization. The project plan encompasses a list of major activities and their estimated time duration, facilitating effective project management and tracking of progress.

## 5.1 List of Major Activities

### 1. Requirement Analysis:

- Gather requirements from stakeholders
- Analyze and prioritize requirements
- Document user stories and use cases

### 2. System Design:

- Design system architecture
- Define database schema
- Create wireframes for user interfaces

### 3. Implementation:

- Develop frontend components
- Implement backend logic and APIs
- Write smart contracts for blockchain integration

### 4. Testing:

- Conduct unit testing for individual components
- Perform integration testing
- Execute end-to-end testing scenarios

**5. Deployment:**

- Deploy system to staging environment
- Conduct user acceptance testing (UAT)
- Address feedback and make final adjustments

**6. Maintenance and Support:**

- Provide ongoing maintenance and support
- Monitor system performance and security
- Implement bug fixes and updates

### 5.2 Estimated time Duration in days

1. Requirement Analysis: 30 days

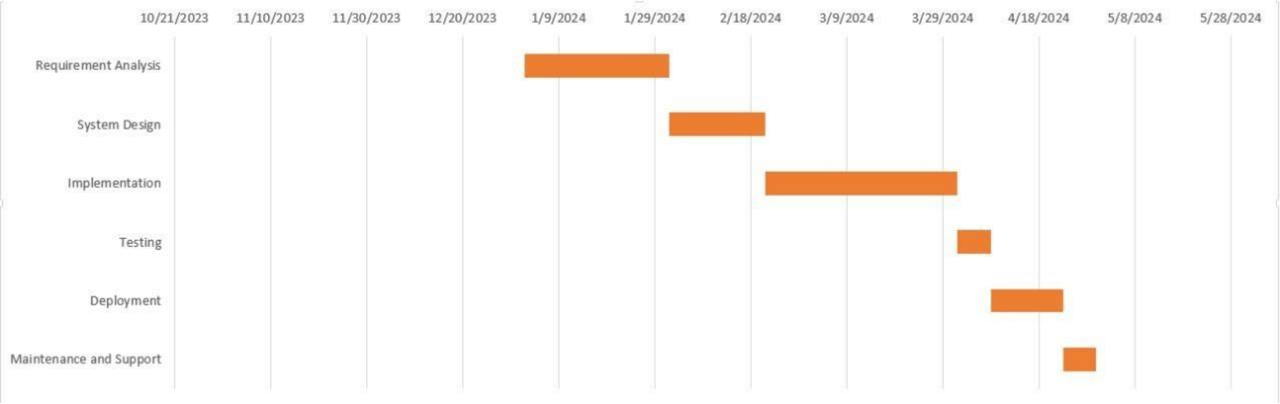
2. System Design: 20 days

3. Implementation: 40 days

4. Testing: 7 days

5. Deployment: 15 Days

6. Maintenance and Support: Ongoing



### 5.3 Resource Allocation

- **Project Manager:** Responsible for overall project coordination, resource allocation, and stakeholder communication.
- **Development Team:** Comprising frontend and backend developers, blockchain specialists, and quality assurance engineers.
- **Stakeholders:** Government authorities, end-users, and third-party service providers involved in the certificate management process.

### 5.4 Risk management

Potential risks associated with the project include technical challenges in blockchain integration, changes in regulatory requirements, and resource constraints. Risk mitigation strategies will be devised, such as conducting feasibility studies, maintaining open communication with stakeholders, and implementing contingency plans.

# CHAPTER 6: IMPLEMENTATION DETAILS

# CHAPTER 6: IMPLEMENTATION DETAILS

## 6.1 Flowchart and Implementation

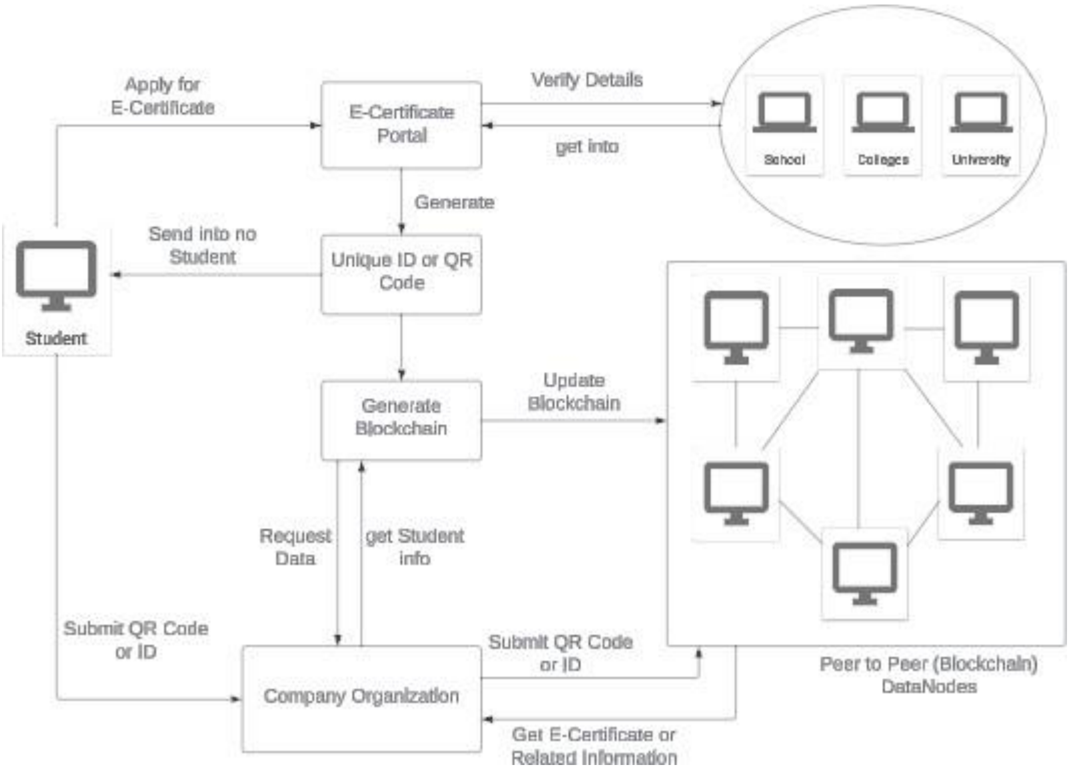
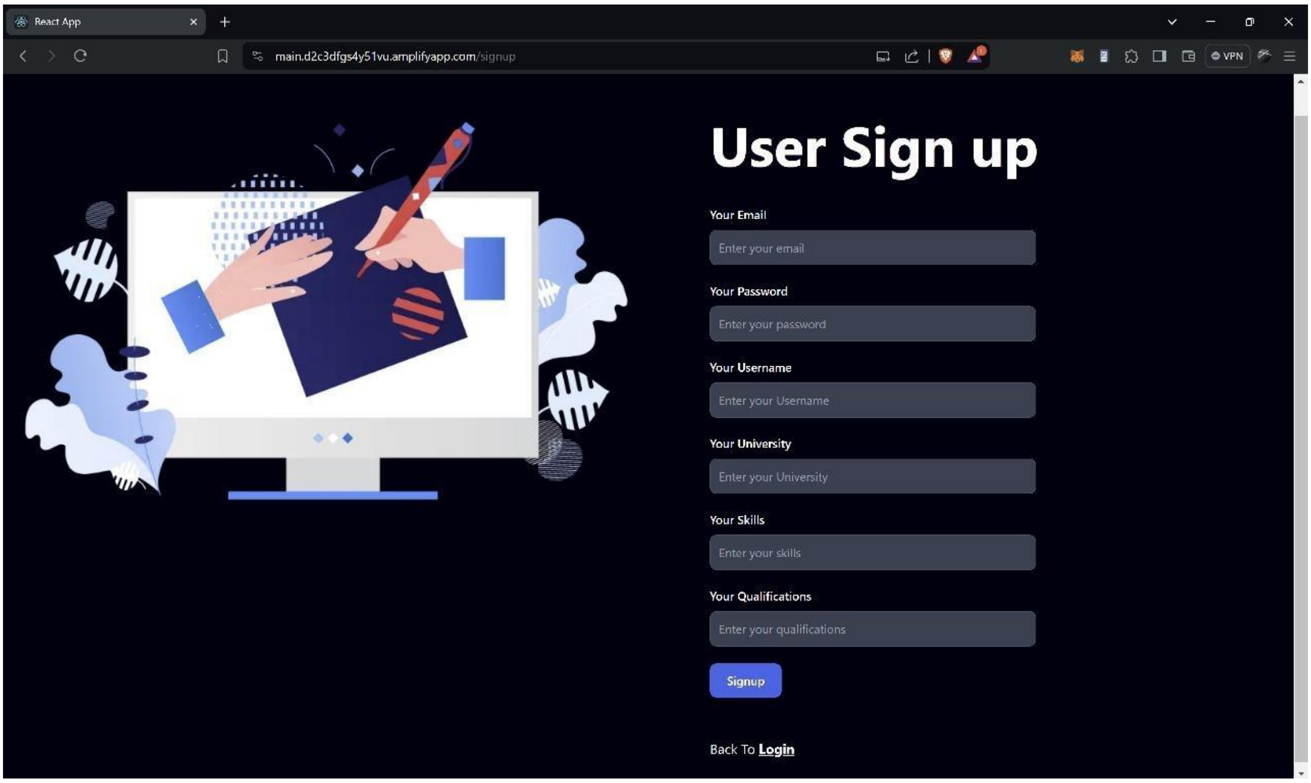


*Figure 6.1 Project Implementation Flowchart*

## 6.2 User side Visualization

### 6.2.1 User sign up → Website url: https://main.d2c3dfgs4y51vu.amplifyapp.com/



User Sign up

Your Email

Enter your email

Your Password

Enter your password

Your Username

Enter your Username

Your University

Enter your University

Your Skills

Enter your skills

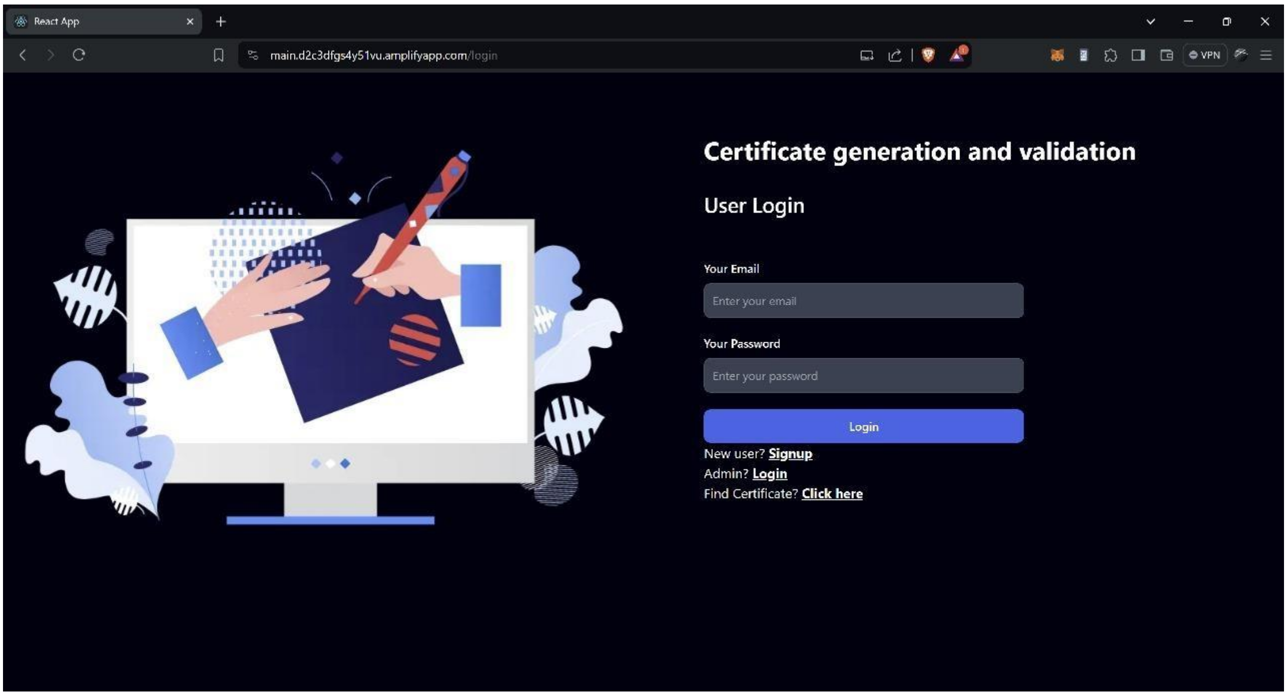
Your Qualifications

Enter your qualifications

Signup

Back To **Login**

- User sign in page



Certificate generation and validation

User Login

Your Email

Enter your email

Your Password

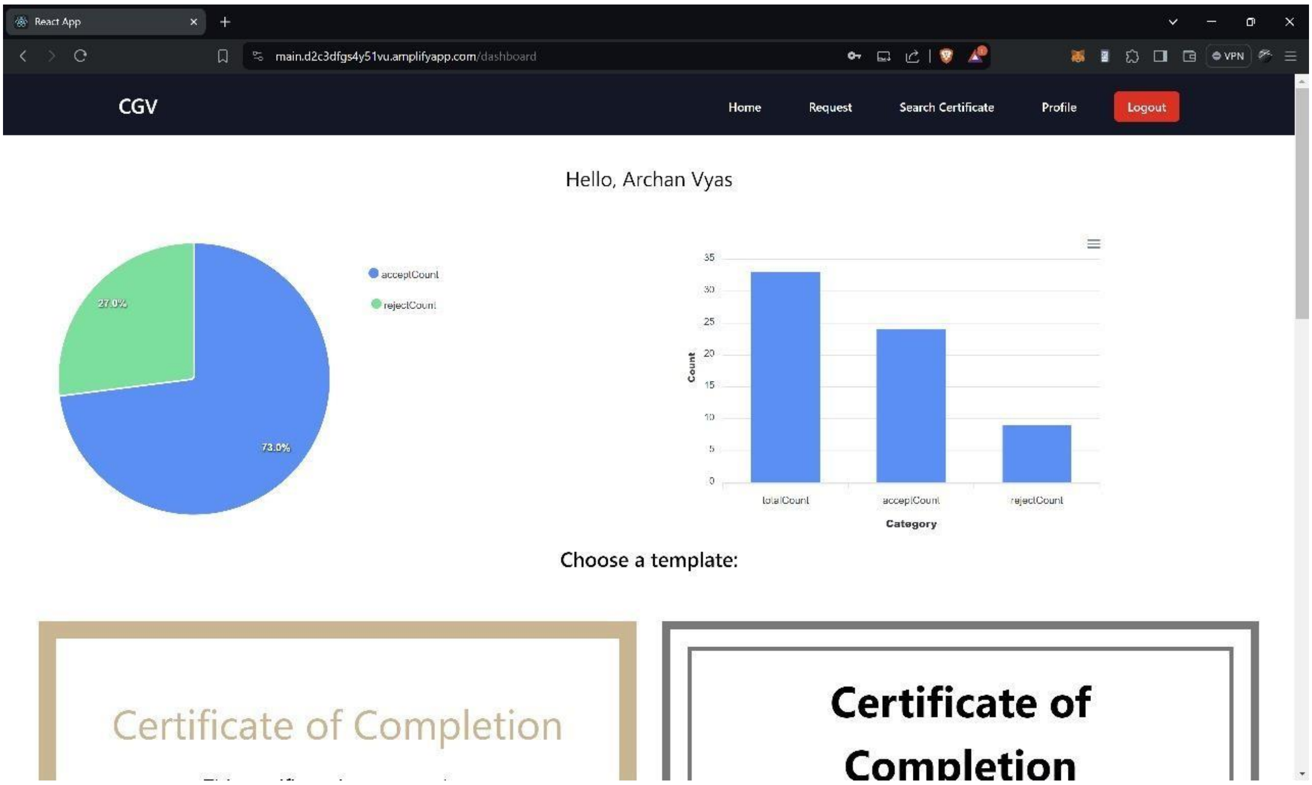
Enter your password

Login

New user? **Signup**
Admin? **Login**
Find Certificate? **Click here**

### 6.2.2 Template selection, Request, Profile management.

- Analysis part.



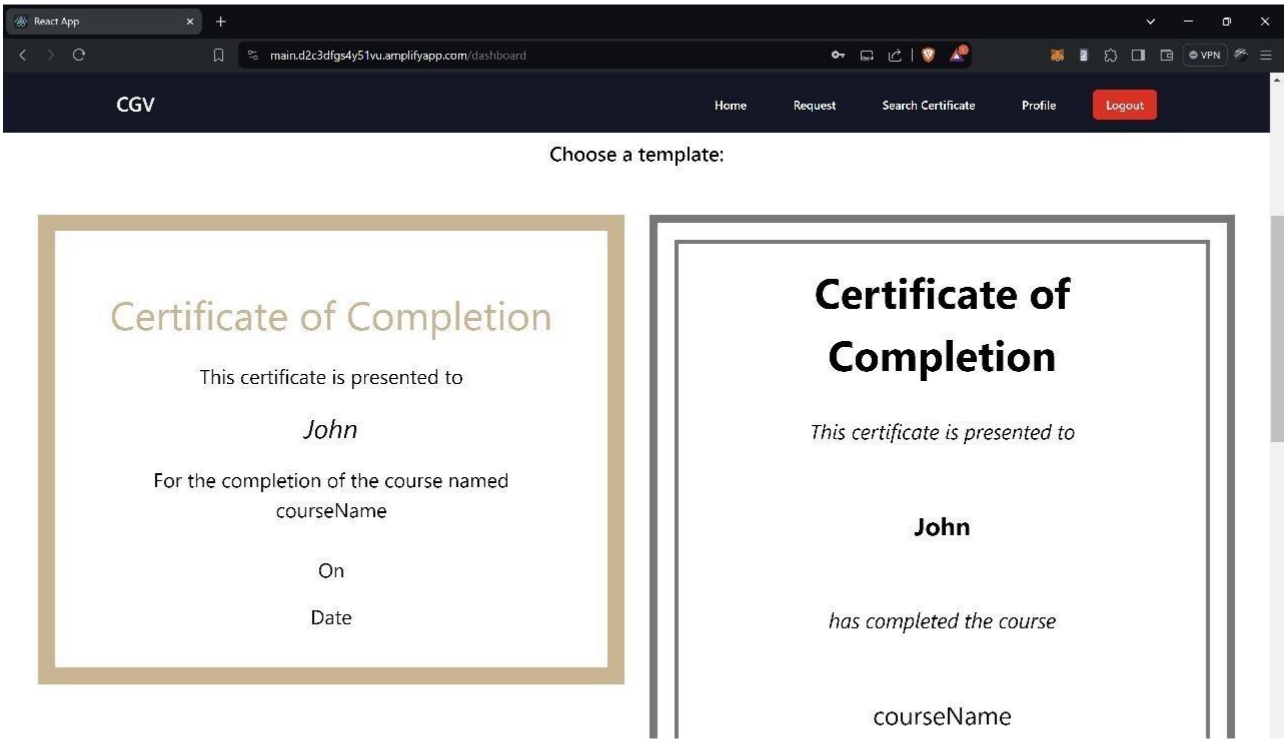
Hello, Archan Vyas

Choose a template:

Certificate of Completion

Certificate of Completion

- First of all, user have to select the template and one pop-up will open for entering the details.



Choose a template:

Certificate of Completion

This certificate is presented to

*John*

For the completion of the course named courseName

On

Date

Certificate of Completion

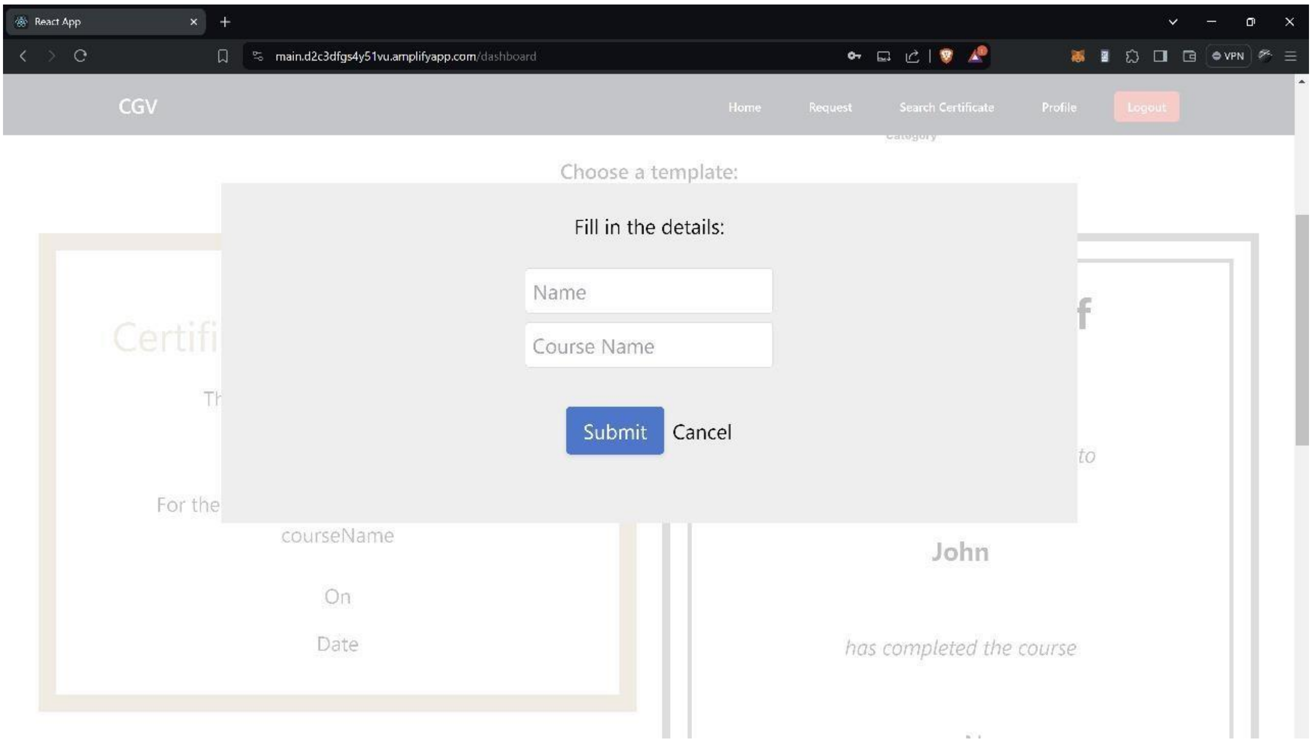
*This certificate is presented to*

**John**

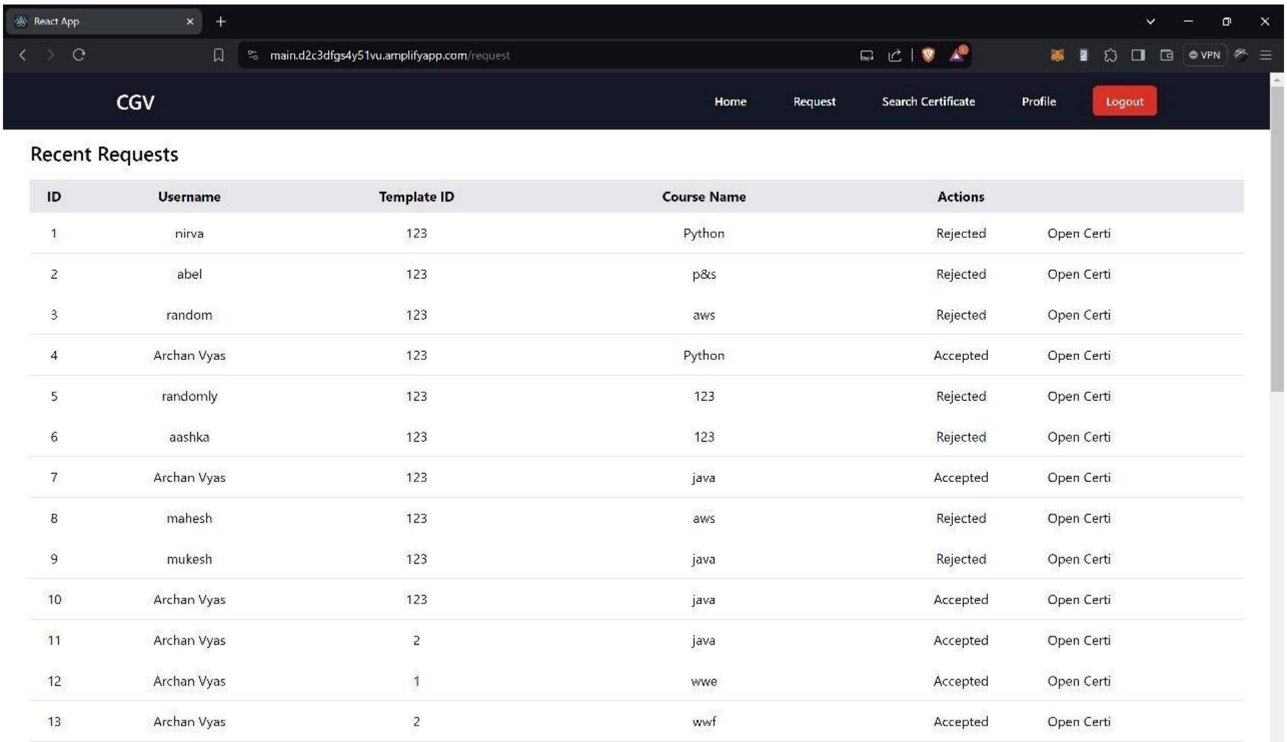
*has completed the course*

courseName

- Here, user can add his/her name and course name.



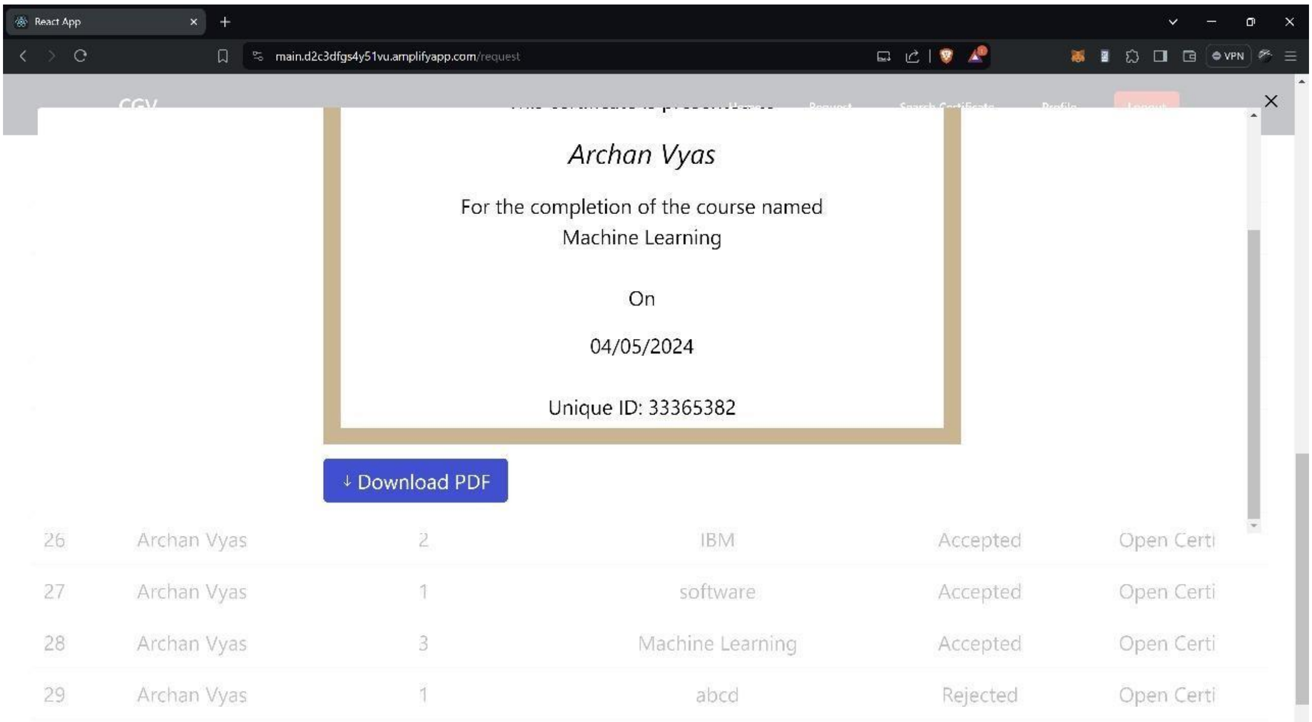
- In the request page, user can show the list of all the requests.



Recent Requests

| ID | Username | Template ID | Course Name | Actions | |
|---|---|---|---|---|---|
| 1 | nirva | 123 | Python | Rejected | Open Certi |
| 2 | abel | 123 | p&s | Rejected | Open Certi |
| 3 | random | 123 | aws | Rejected | Open Certi |
| 4 | Archan Vyas | 123 | Python | Accepted | Open Certi |
| 5 | randomly | 123 | 123 | Rejected | Open Certi |
| 6 | aashka | 123 | 123 | Rejected | Open Certi |
| 7 | Archan Vyas | 123 | java | Accepted | Open Certi |
| 8 | mahesh | 123 | aws | Rejected | Open Certi |
| 9 | mukesh | 123 | java | Rejected | Open Certi |
| 10 | Archan Vyas | 123 | java | Accepted | Open Certi |
| 11 | Archan Vyas | 2 | java | Accepted | Open Certi |
| 12 | Archan Vyas | 1 | wwe | Accepted | Open Certi |
| 13 | Archan Vyas | 2 | wwf | Accepted | Open Certi |

- User can download the pdf of certificate.



*Archan Vyas*

For the completion of the course named
Machine Learning

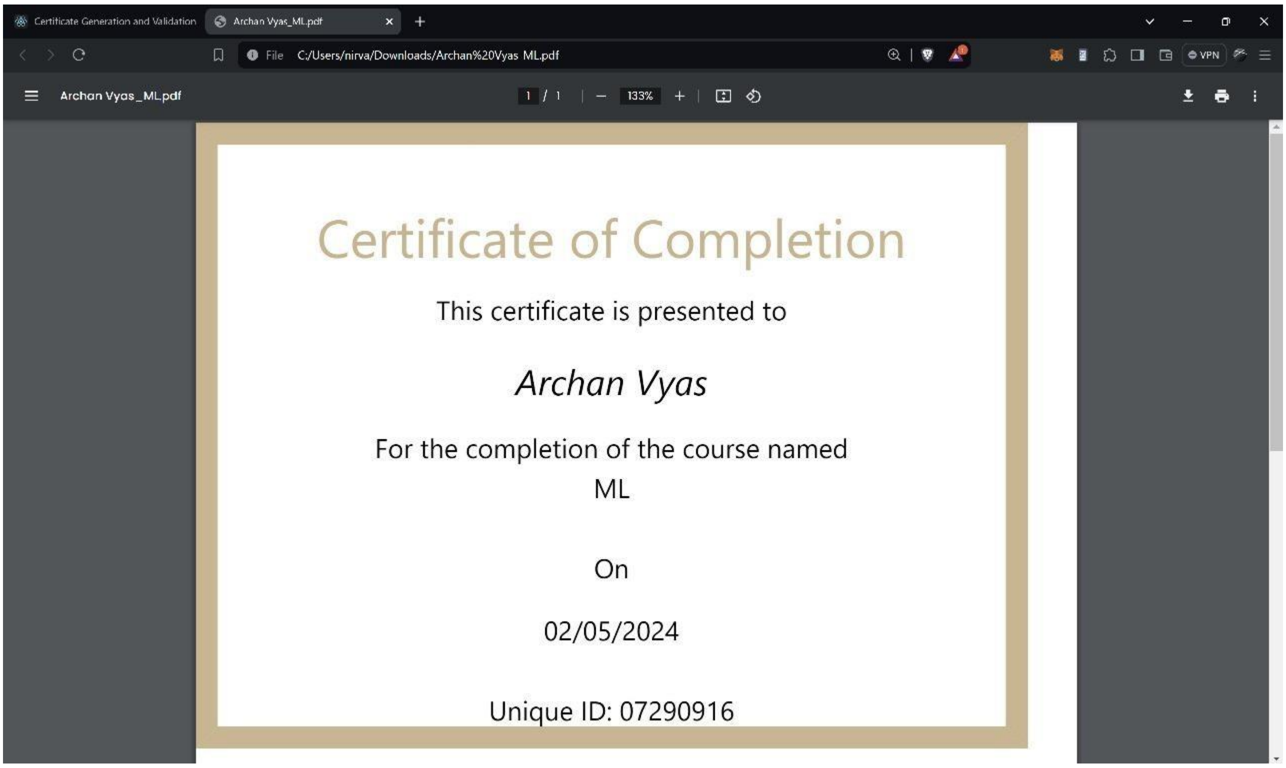
On

04/05/2024

Unique ID: 33365382

| | | | | | |
|---|---|---|---|---|---|
| 26 | Archan Vyas | 2 | IBM | Accepted | Open Certi |
| 27 | Archan Vyas | 1 | software | Accepted | Open Certi |
| 28 | Archan Vyas | 3 | Machine Learning | Accepted | Open Certi |
| 29 | Archan Vyas | 1 | abcd | Rejected | Open Certi |

- Sample of downloaded certificate.


Certificate Generation and Validation
Archan Vyas_ML.pdf
File C:/Users/nirva/Downloads/Archan%20Vyas ML.pdf
Archan Vyas_ML.pdf
1 / 1
133%

Certificate of Completion

This certificate is presented to

*Archan Vyas*

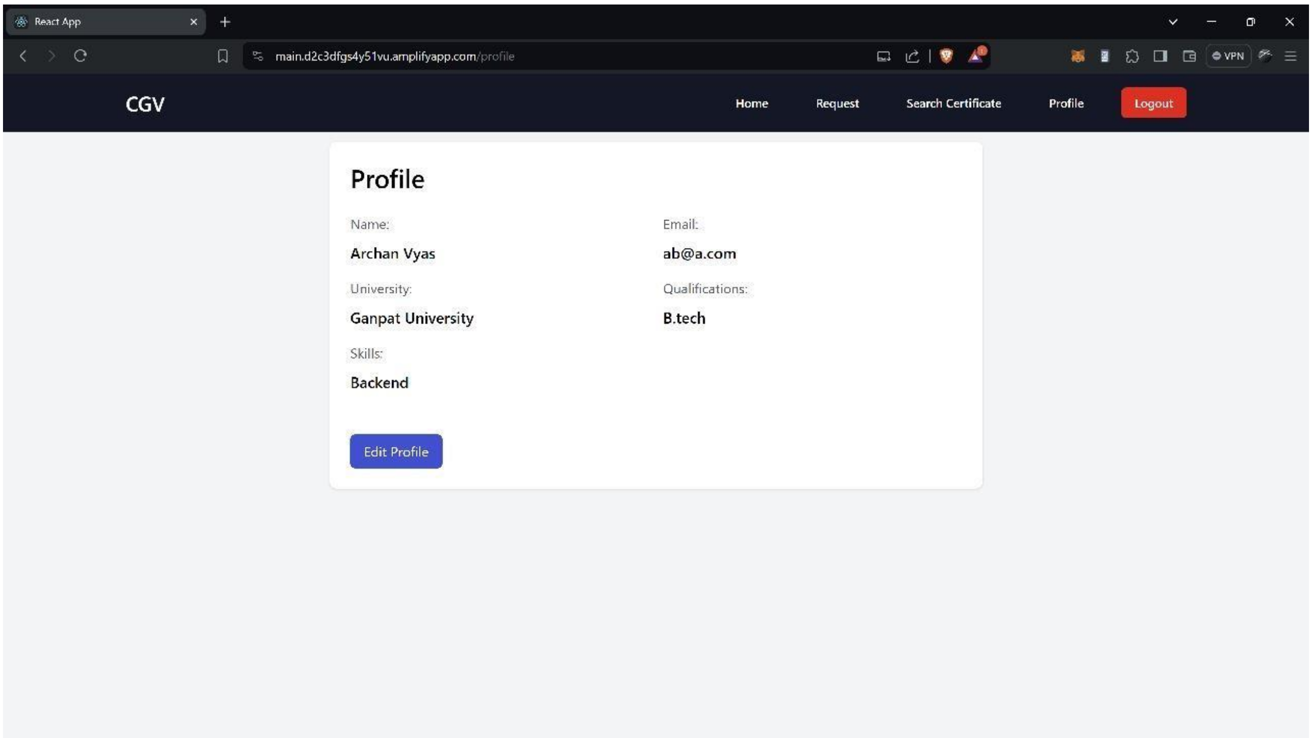
For the completion of the course named
ML

On

02/05/2024

Unique ID: 07290916

- In profile page, user can see and can update his/her profile details.



Profile

Name:
Archan Vyas

Email:
ab@a.com

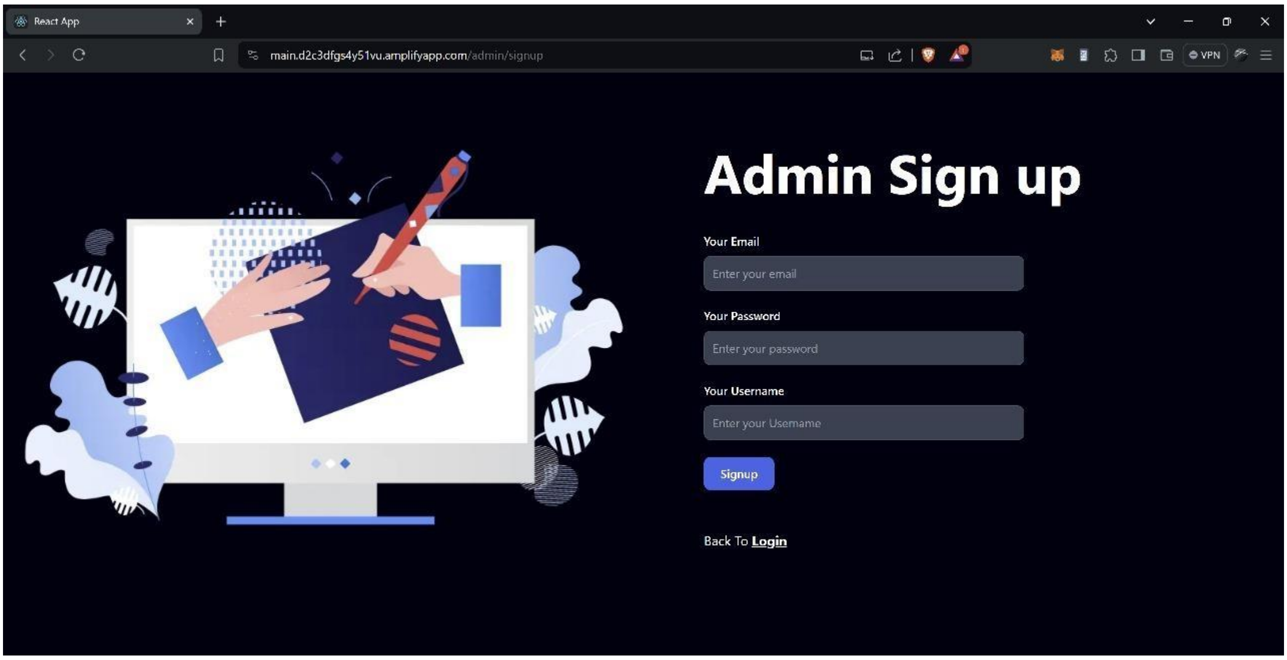
University:
Ganpat University

Qualifications:
B.tech

Skills:
Backend

## 6.3 Admin side visualization

### 6.3.1 Admin sign up



Admin Sign up

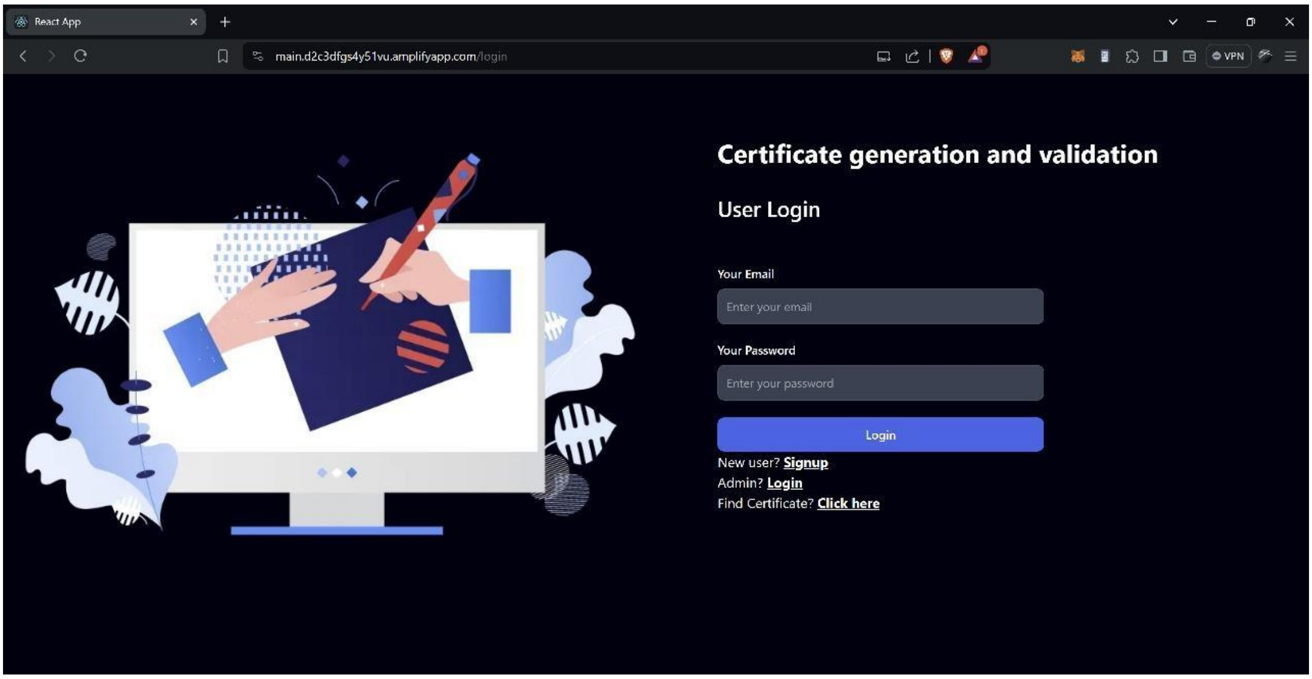
Your Email
Enter your email

Your Password
Enter your password

Your Username
Enter your Username

Back To Login

- Admin sign in page



Certificate generation and validation

User Login

Your Email

Enter your email

Your Password

Enter your password

Login

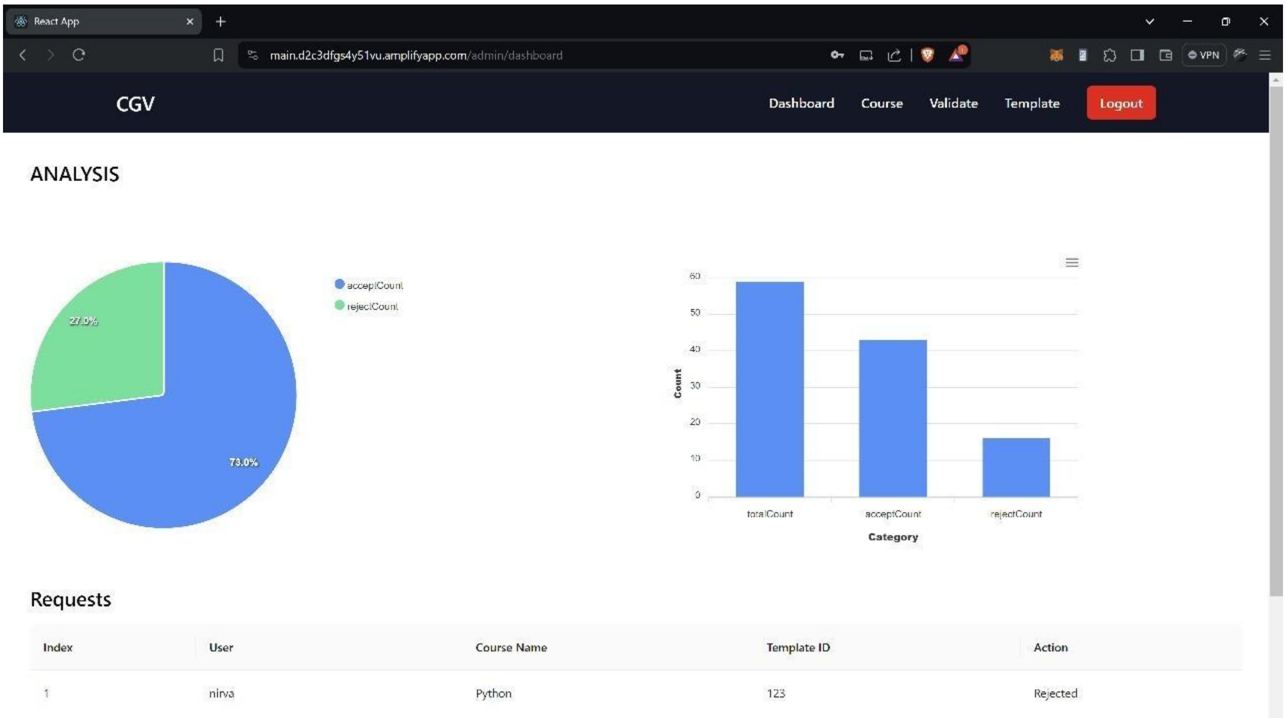
New user? Signup

Admin? Login

Find Certificate? Click here

### 6.3.2 Dashboard management.

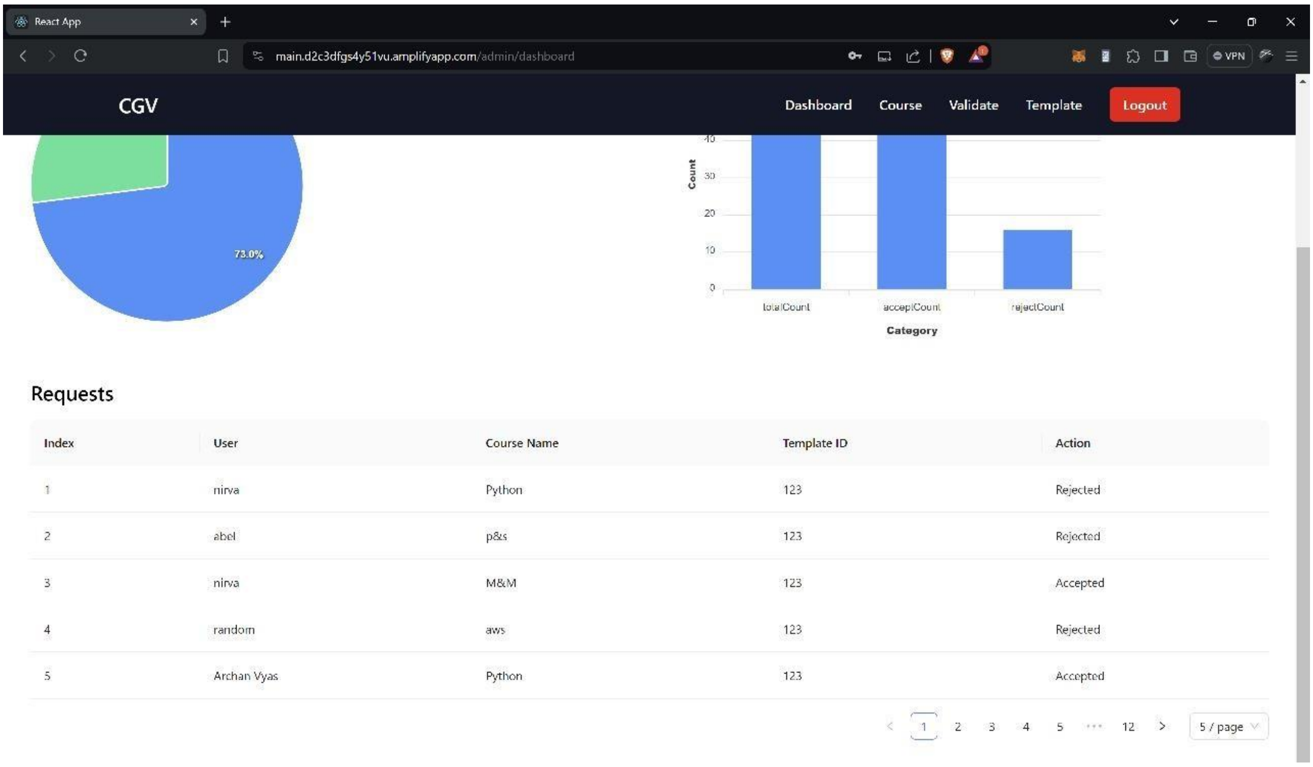
- Analysis part.



Requests

| Index | User | Course Name | Template ID | Action |
|---|---|---|---|---|
| 1 | nirva | Python | 123 | Rejected |

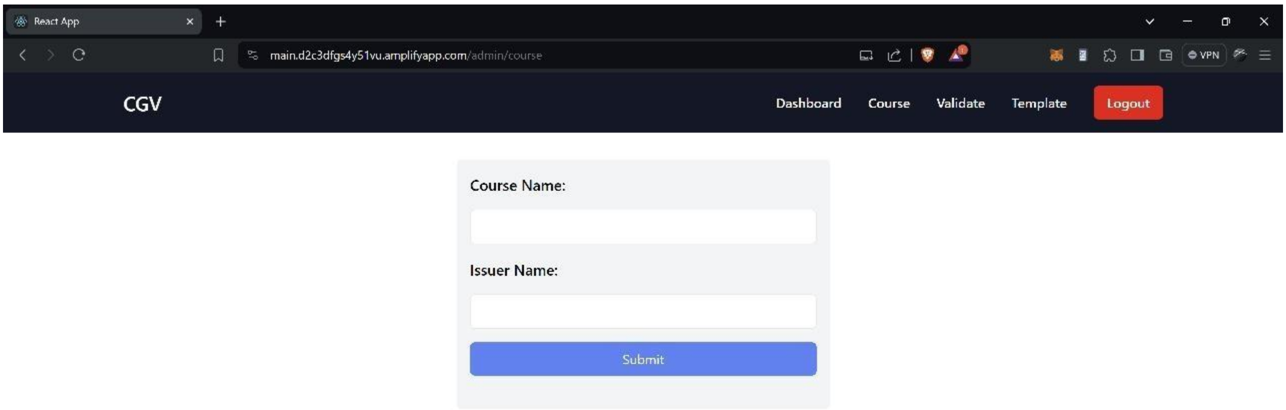
- Here, admin can manage all the requests.



Requests

| Index | User | Course Name | Template ID | Action |
|---|---|---|---|---|
| 1 | nirva | Python | 123 | Rejected |
| 2 | abel | p&s | 123 | Rejected |
| 3 | nirva | M&M | 123 | Accepted |
| 4 | random | aws | 123 | Rejected |
| 5 | Archan Vyas | Python | 123 | Accepted |

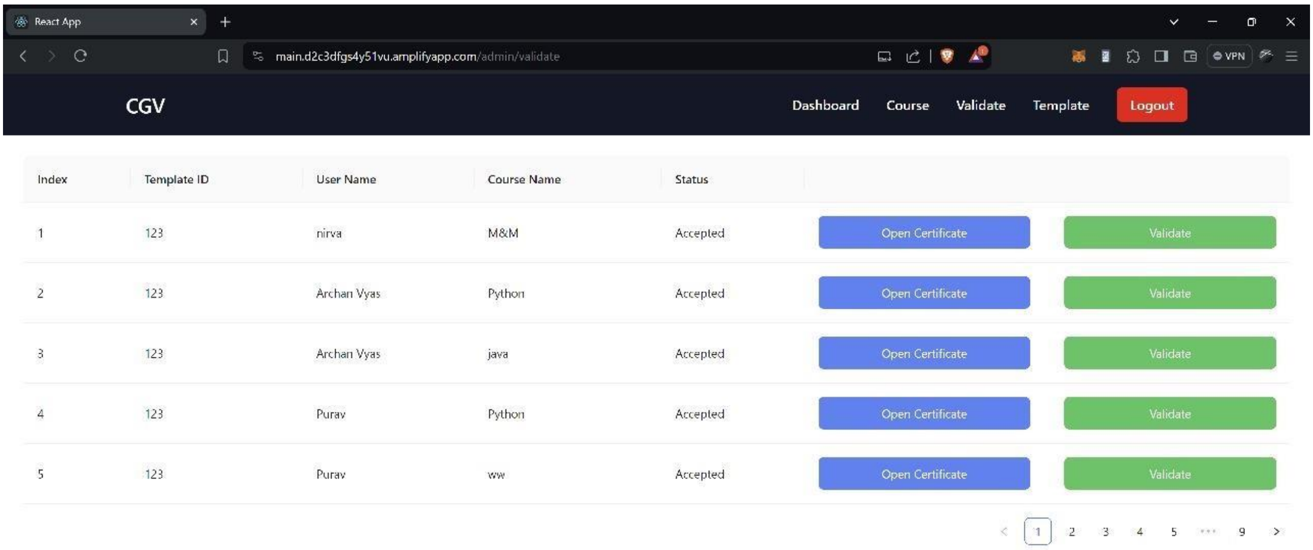
- Admin can set-up the course from the Course page.



Course Name:

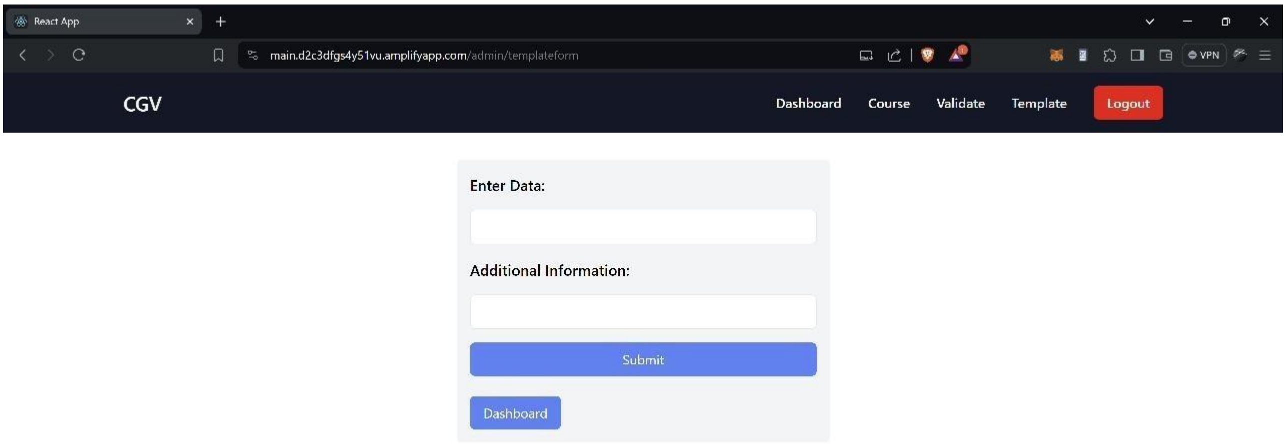
Issuer Name:

- Validation part.



| Index | Template ID | User Name | Course Name | Status | | |
|---|---|---|---|---|---|---|
| 1 | 123 | nirva | M&M | Accepted | Open Certificate | Validate |
| 2 | 123 | Archan Vyas | Python | Accepted | Open Certificate | Validate |
| 3 | 123 | Archan Vyas | java | Accepted | Open Certificate | Validate |
| 4 | 123 | Purav | Python | Accepted | Open Certificate | Validate |
| 5 | 123 | Purav | ww | Accepted | Open Certificate | Validate |

- Admin can add more templates from Template page.

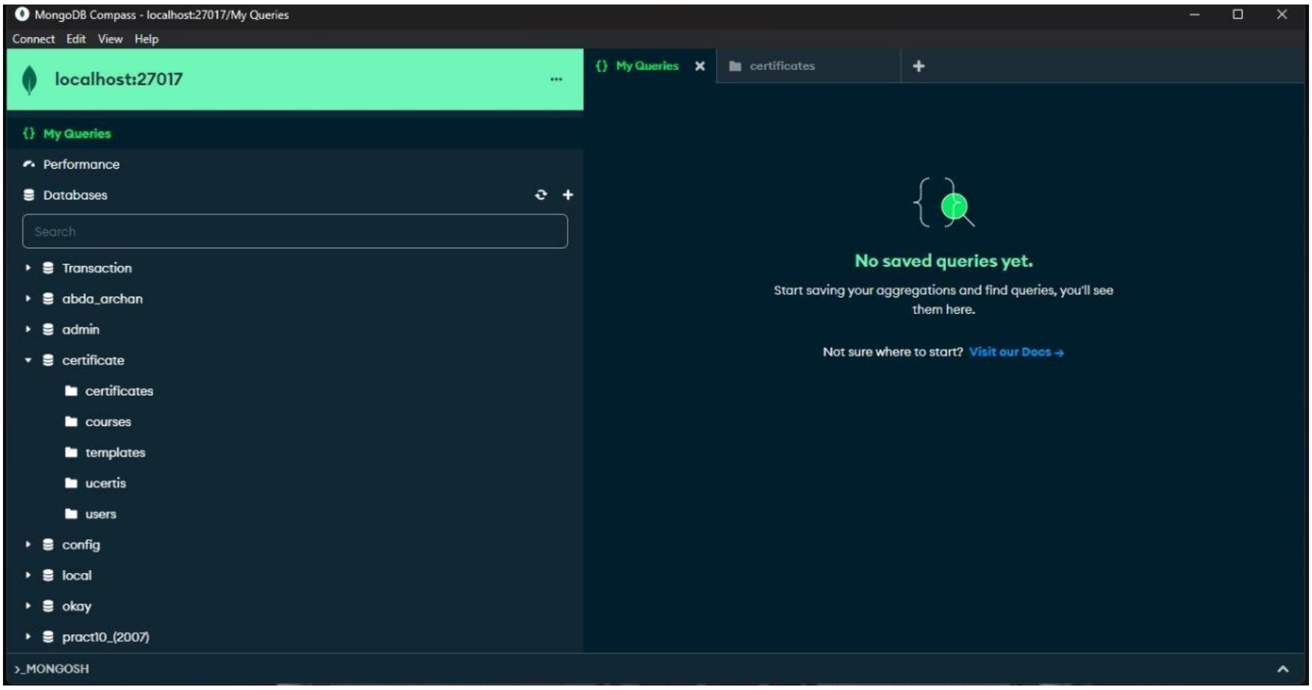


Enter Data:

Additional Information:

## 6.4 MongoDB.

### 6.4.1 All collections



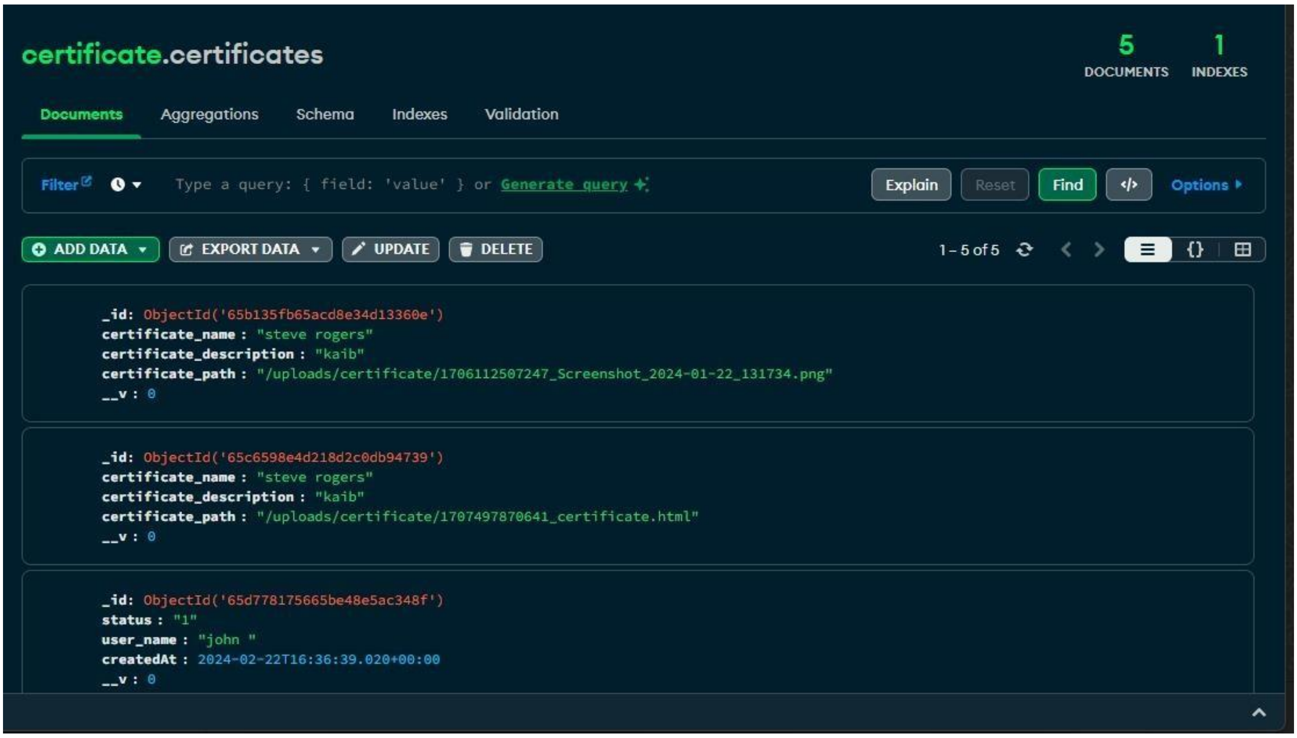
No saved queries yet.

Start saving your aggregations and find queries, you'll see them here.

Not sure where to start? Visit our Docs →

### 6.4.2 Details of all collections.

- certificates

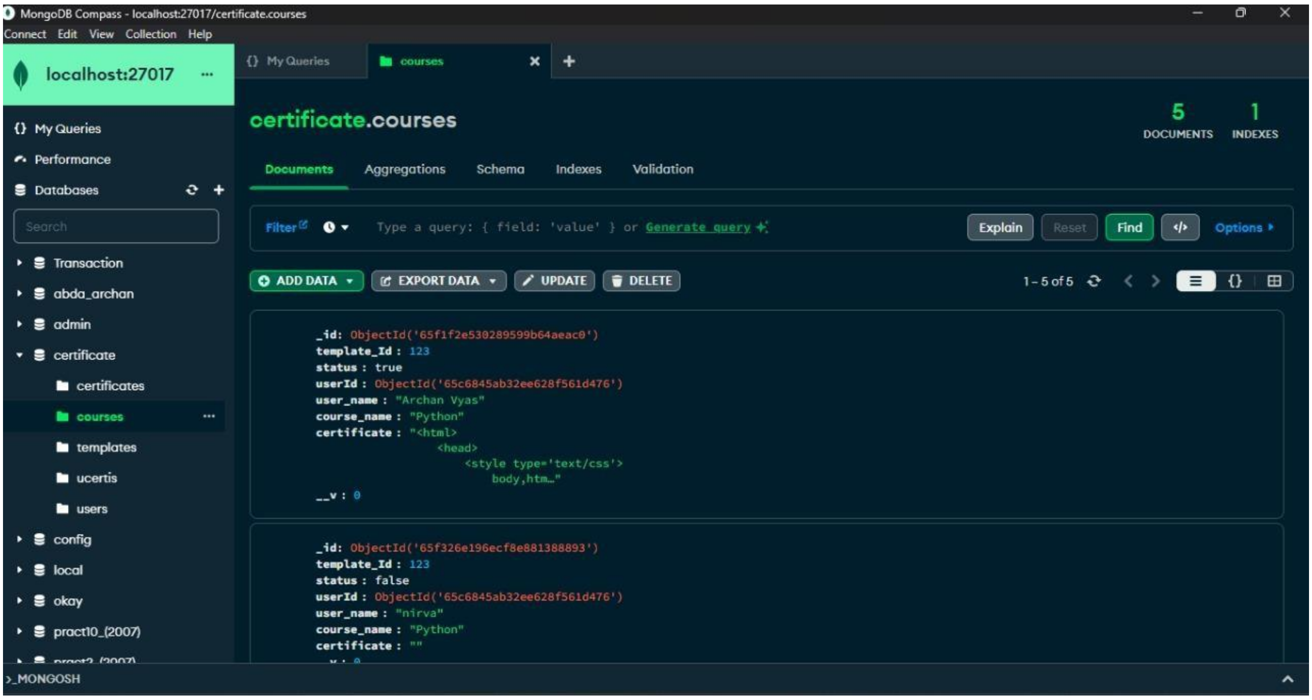


```
_id: ObjectId('65b135fb65acd8e34d13360e')
certificate_name : "steve rogers"
certificate_description : "kaib"
certificate_path : "/uploads/certificate/1706112507247_Screenshot_2024-01-22_131734.png"
__v : 0

_id: ObjectId('65c6598e4d218d2c0db94739')
certificate_name : "steve rogers"
certificate_description : "kaib"
certificate_path : "/uploads/certificate/1707497870641_certificate.html"
__v : 0

_id: ObjectId('65d778175665be48e5ac348f')
status : "1"
user_name : "john "
createdAt : 2024-02-22T16:36:39.020+00:00
__v : 0
```

- courses



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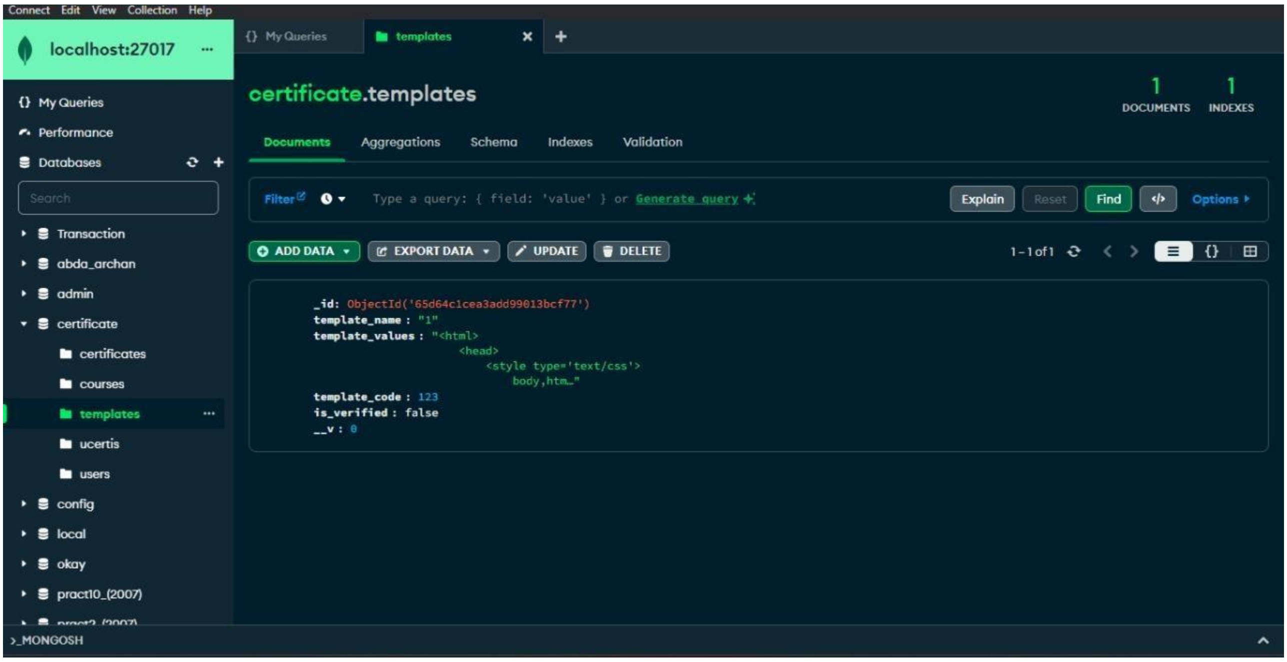
template_Id : 123
status : true
userId : ObjectId('65c6845ab32ee628f561d476')
user_name : "Archan Vyas"
course_name : "Python"
certificate : "<html>
                    <head>
                        <style type='text/css'>
                            body,htm…"
__v : 0
```

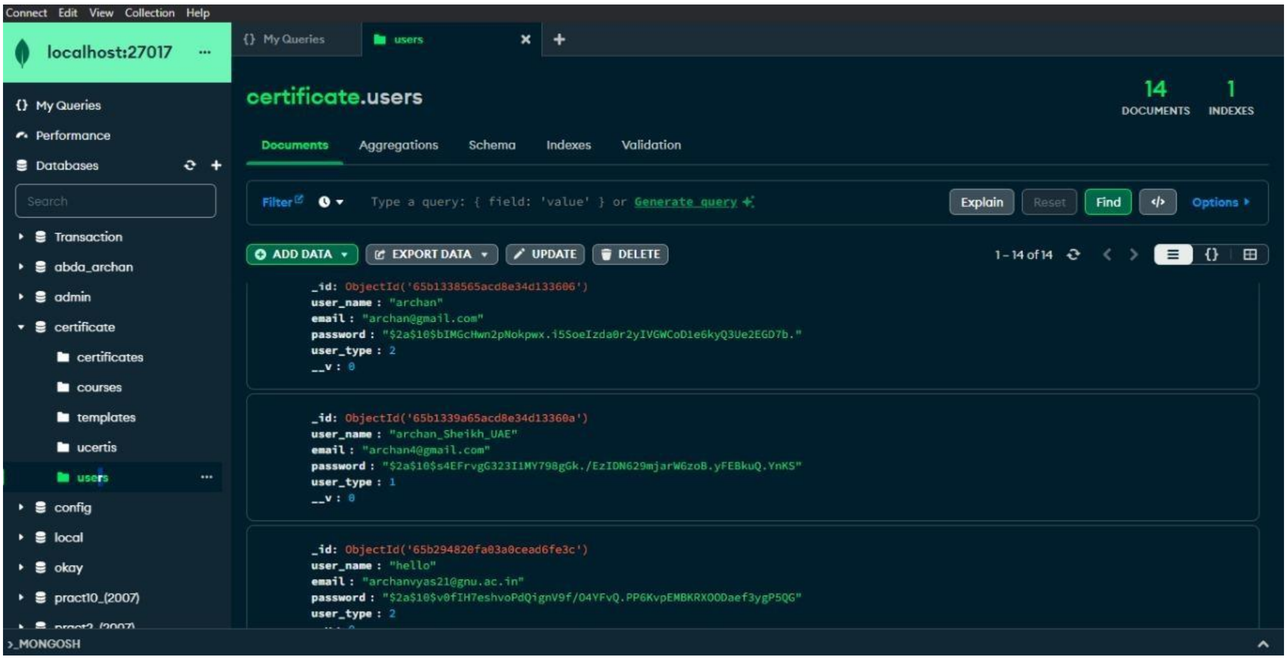
```
_id: ObjectId('65f326e196ecf8e881388893')
template_Id : 123
status : false
userId : ObjectId('65c6845ab32ee628f561d476')
user_name : "nirva"
course_name : "Python"
certificate : ""
__v : 0
```

- templates



```
_id: ObjectId('65d64c1cea3add99013bcf77')
template_name : "1"
template_values : "<html>
                       <head>
                           <style type='text/css'>
                               body,htm…"
template_code : 123
is_verified : false
__v : 0
```

- users



```
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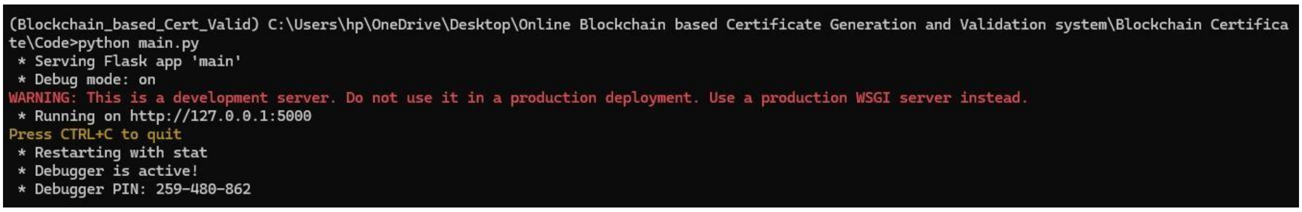
user_name : "archan"
email : "archan@gmail.com"
password : "$2a$10$bIMGcHwn2pNokpwx.i5SoeIzda0r2yIVGWCoD1e6kyQ3Ue2EGD7b."
user_type : 2
__v : 0

_id: ObjectId('65b1339a65acd8e34d13360a')
user_name : "archan_Sheikh_UAE"
email : "archan4@gmail.com"
password : "$2a$10$s4EFrvgG323I1MY798gGk./EzIDN629mjarW6zoB.yFEBkuQ.YnKS"
user_type : 1
__v : 0

_id: ObjectId('65b294820fa03a0cead6fe3c')
user_name : "hello"
email : "archanvyas21@gnu.ac.in"
password : "$2a$10$v0fIH7eshvoPdQignV9f/O4YFvQ.PP6KvpEMBKRXOODaef3ygP5QG"
user_type : 2
```

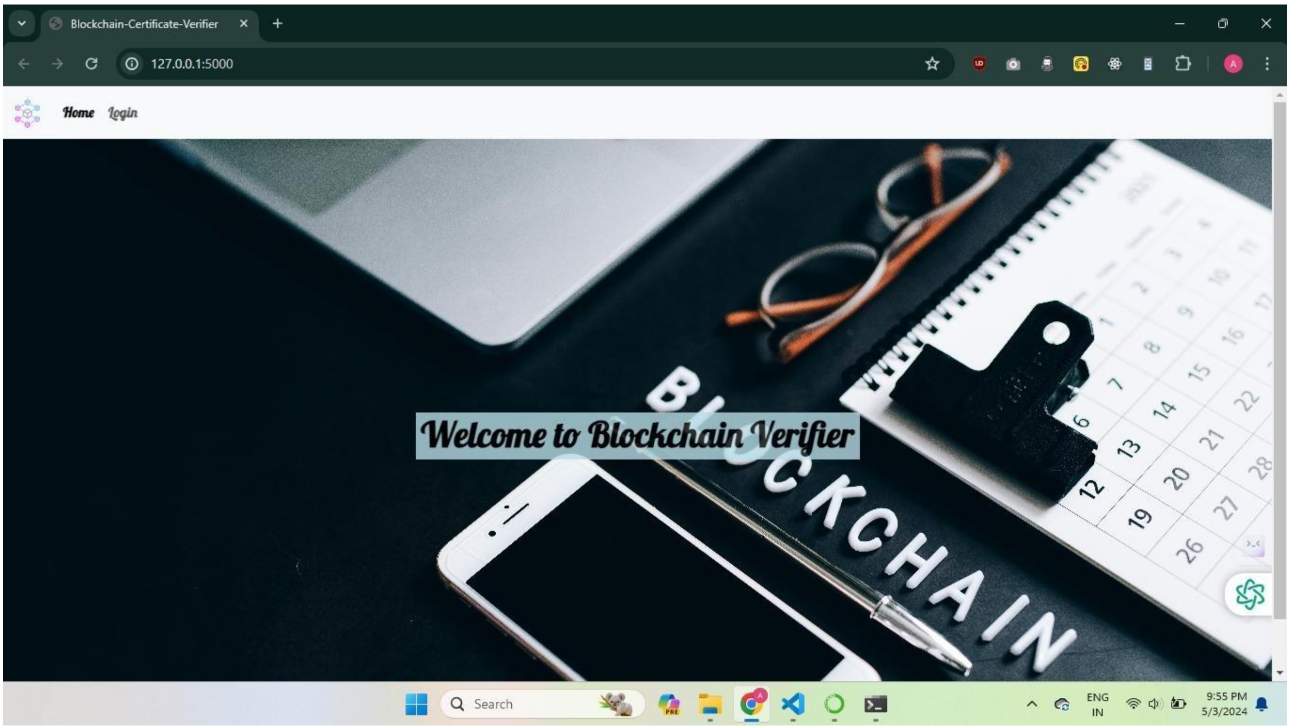
## 6.5 Blockchain implementation

- We run this Validation part using Blockchain in Anaconda Navigator Environment.

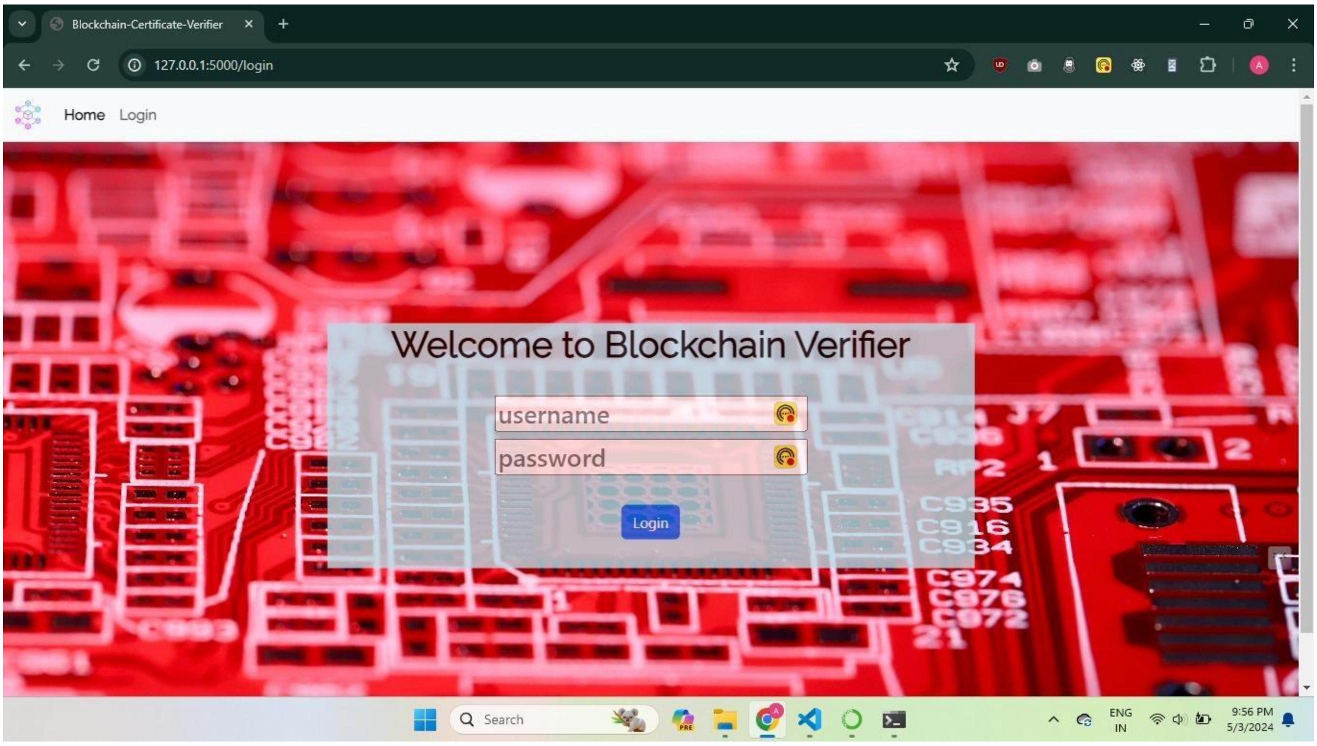


```
(Blockchain_based_Cert_Valid) C:\Users\hp\OneDrive\Desktop\Online Blockchain based Certificate Generation and Validation system\Blockchain Certifica
te\Code>python main.py
 * Serving Flask app 'main'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
 * Restarting with stat
 * Debugger is active!
 * Debugger PIN: 259-480-862
```

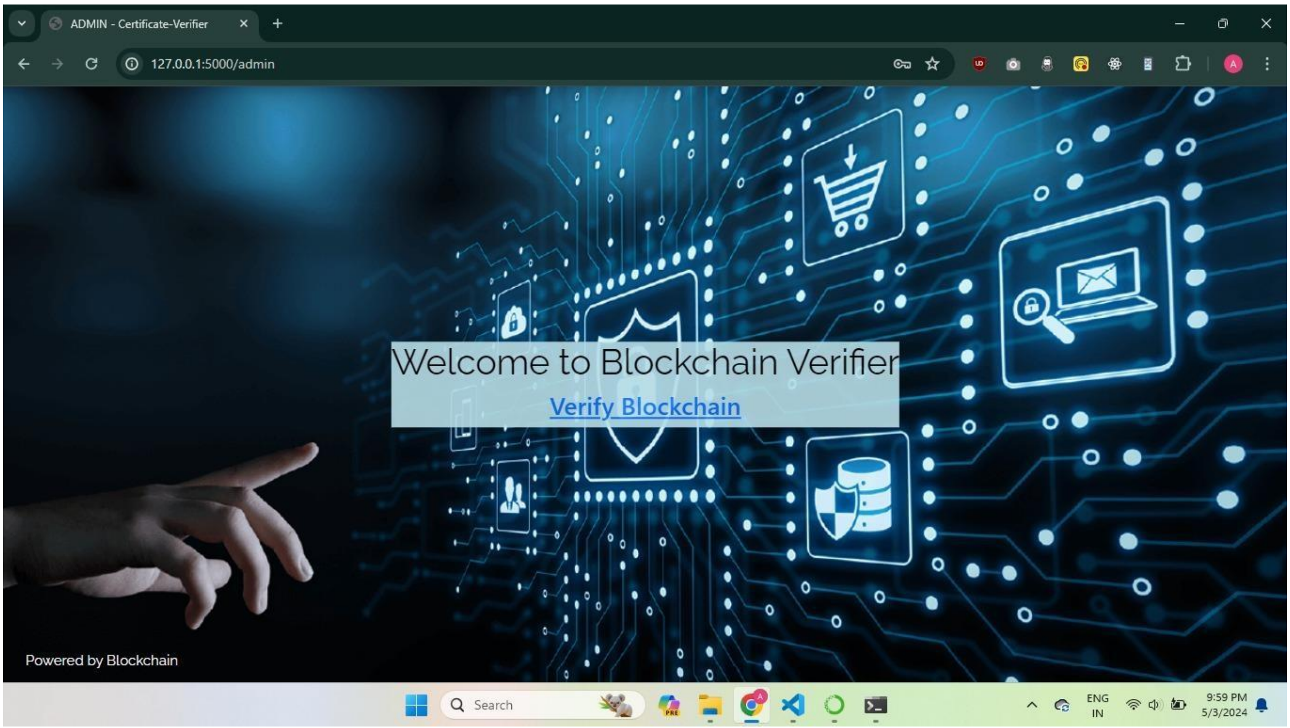
- Here, the Admin logs into this panel using the creds Admin:password



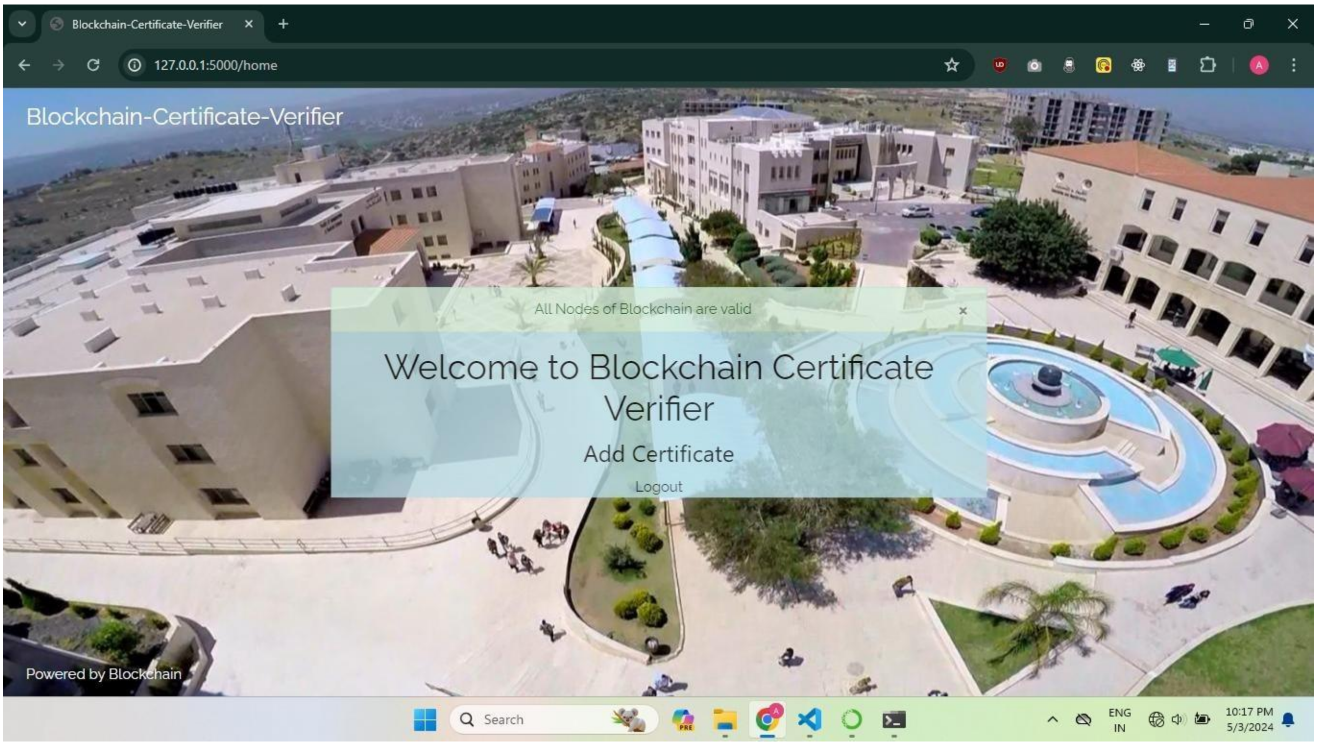
Welcome to Blockchain Verifier



- Successfully logged in.



- As, we can see here it is written 'All Nodes of Blockchain are Valid'. These Nodes will be used to deploy the certificates and valid them using these Local Blockchain Nodes using Ethereum Network.

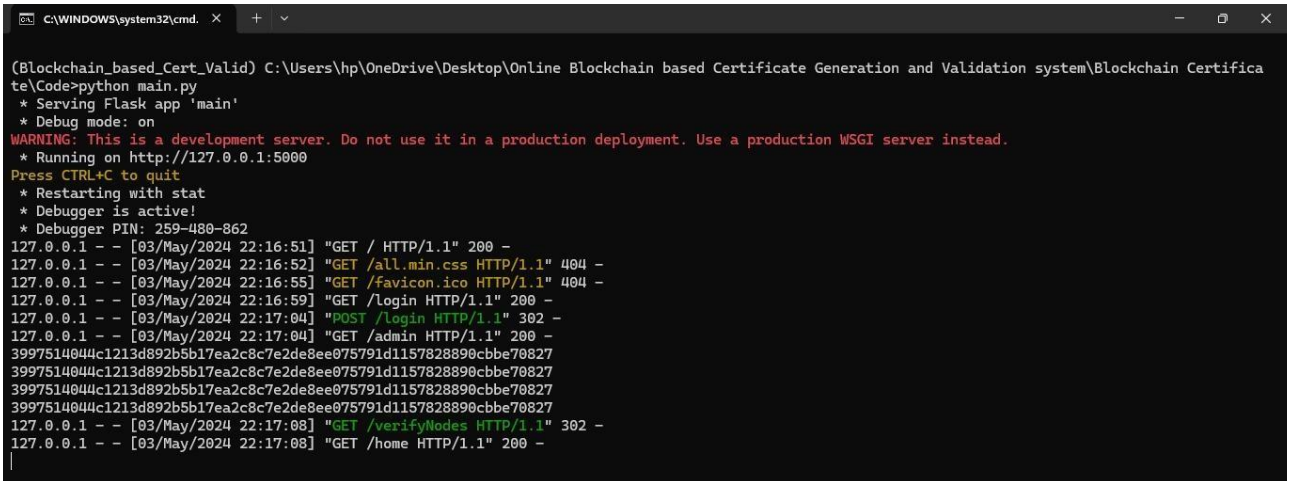


Blockchain-Certificate-Verifier
127.0.0.1:5000/home
Blockchain-Certificate-Verifier

All Nodes of Blockchain are valid

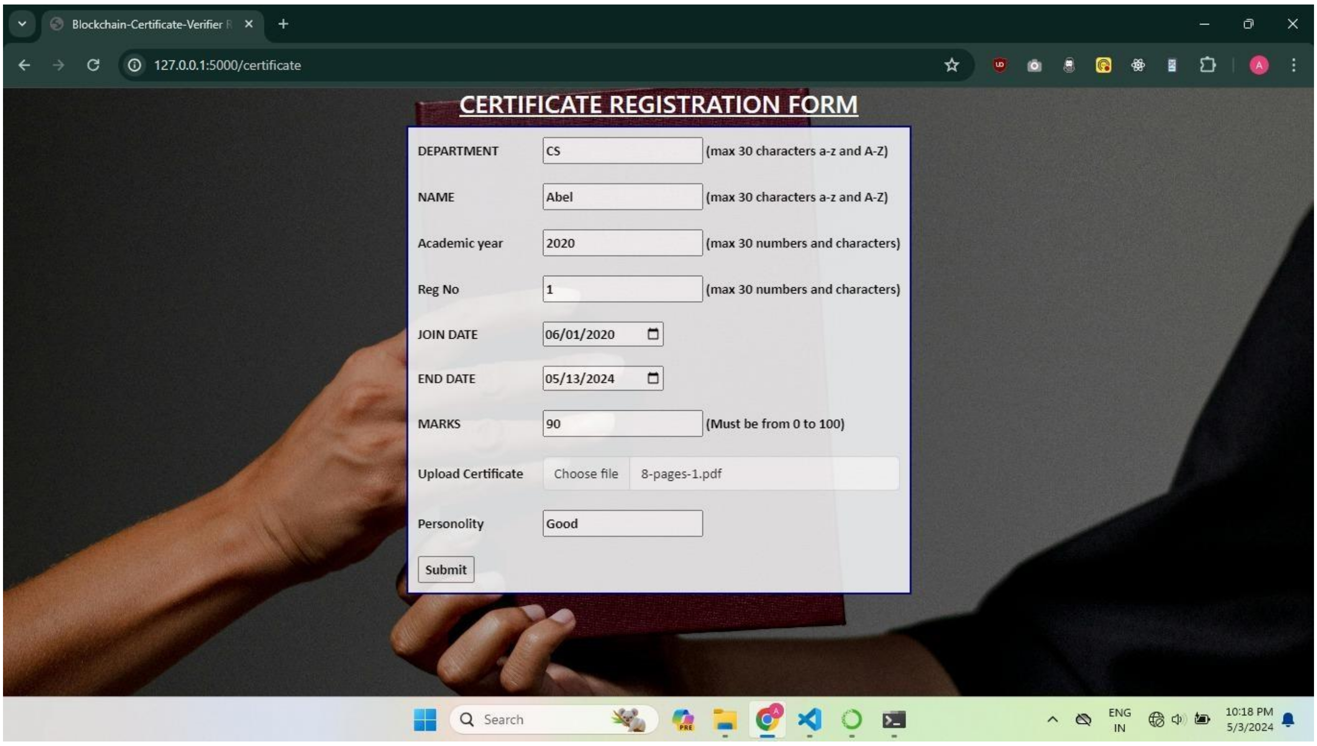
Welcome to Blockchain Certificate Verifier

- In the terminal, as soon as the Admin logs into the Validation Panel, the Nodes are displayed over here.
- These four hashes are of the Blockchain Valid Nodes



```
(Blockchain_based_Cert_Valid) C:\Users\hp\OneDrive\Desktop\Online Blockchain based Certificate Generation and Validation system\Blockchain Certifica
te\Code>python main.py
 * Serving Flask app 'main'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
 * Restarting with stat
 * Debugger is active!
 * Debugger PIN: 259-480-862
127.0.0.1 - - [03/May/2024 22:16:51] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:16:52] "GET /all.min.css HTTP/1.1" 404 -
127.0.0.1 - - [03/May/2024 22:16:55] "GET /favicon.ico HTTP/1.1" 404 -
127.0.0.1 - - [03/May/2024 22:16:59] "GET /login HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:17:04] "POST /login HTTP/1.1" 302 -
127.0.0.1 - - [03/May/2024 22:17:04] "GET /admin HTTP/1.1" 200 -
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
127.0.0.1 - - [03/May/2024 22:17:08] "GET /verifyNodes HTTP/1.1" 302 -
127.0.0.1 - - [03/May/2024 22:17:08] "GET /home HTTP/1.1" 200 -
```

- Adding the Certificate details requested by the student.

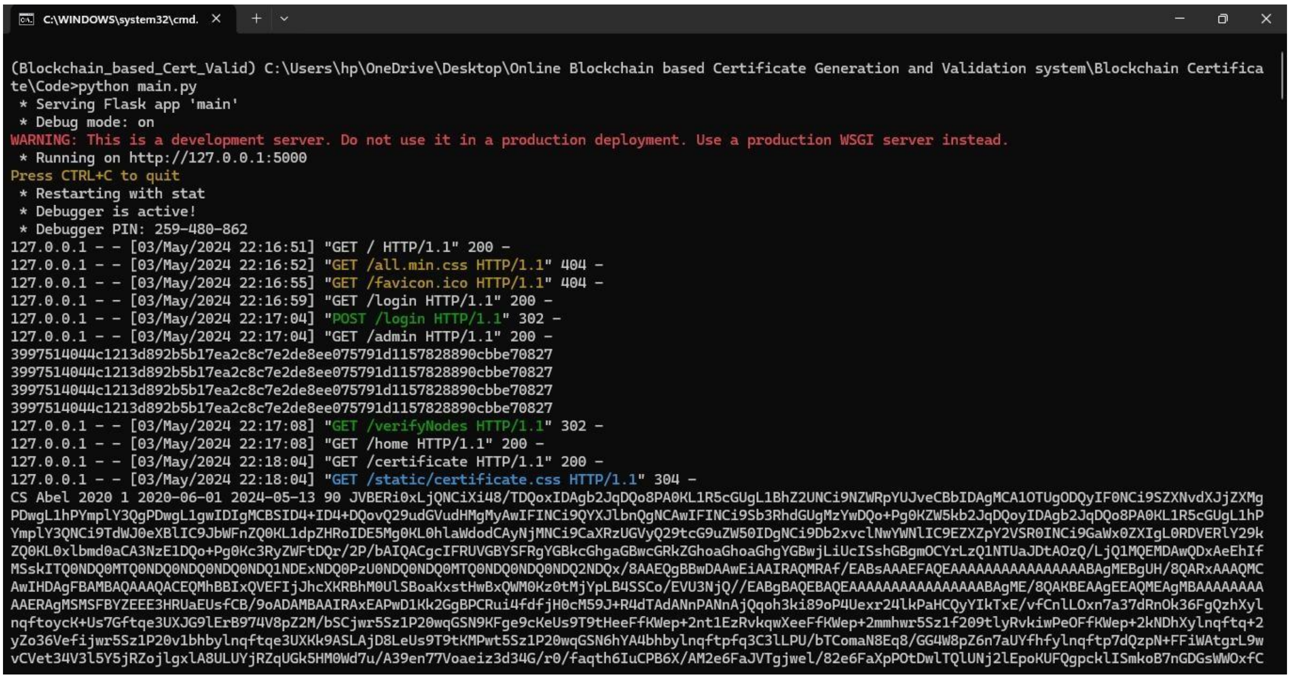


CERTIFICATE REGISTRATION FORM

| | | |
|---|---|---|
| DEPARTMENT | CS | (max 30 characters a-z and A-Z) |
| NAME | Abel | (max 30 characters a-z and A-Z) |
| Academic year | 2020 | (max 30 numbers and characters) |
| Reg No | 1 | (max 30 numbers and characters) |
| JOIN DATE | 06/01/2020 | |
| END DATE | 05/13/2024 | |
| MARKS | 90 | (Must be from 0 to 100) |
| Upload Certificate | Choose file 8-pages-1.pdf | |
| Personolity | Good | |

Submit

- As we submit the certificate details, the certificate gets automatically added to the Blockchain in the form of hash. This data can never be altered by anyone.



```
(Blockchain_based_Cert_Valid) C:\Users\hp\OneDrive\Desktop\Online Blockchain based Certificate Generation and Validation system\Blockchain Certifica
te\Code>python main.py
 * Serving Flask app 'main'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
 * Restarting with stat
 * Debugger is active!
 * Debugger PIN: 259-480-862
127.0.0.1 - - [03/May/2024 22:16:51] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:16:52] "GET /all.min.css HTTP/1.1" 404 -
127.0.0.1 - - [03/May/2024 22:16:55] "GET /favicon.ico HTTP/1.1" 404 -
127.0.0.1 - - [03/May/2024 22:16:59] "GET /login HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:17:04] "POST /login HTTP/1.1" 302 -
127.0.0.1 - - [03/May/2024 22:17:04] "GET /admin HTTP/1.1" 200 -
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
3997514044c1213d892b5b17ea2c8c7e2de8ee075791d1157828890cbbe70827
127.0.0.1 - - [03/May/2024 22:17:08] "GET /verifyNodes HTTP/1.1" 302 -
127.0.0.1 - - [03/May/2024 22:17:08] "GET /home HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:18:04] "GET /certificate HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:18:04] "GET /static/certificate.css HTTP/1.1" 304 -
CS Abel 2020 1 2020-06-01 2024-05-13 90 JVBERi0xLjQNCiXi48/TDQoxIDAgb2JqDQo8PA0KL1R5cGUgL1BhZ2UNCi9NZWRpYUJveCBbIDAgMCA1OTUgODQyIF0NCi9SZXNvdXJjZXMg
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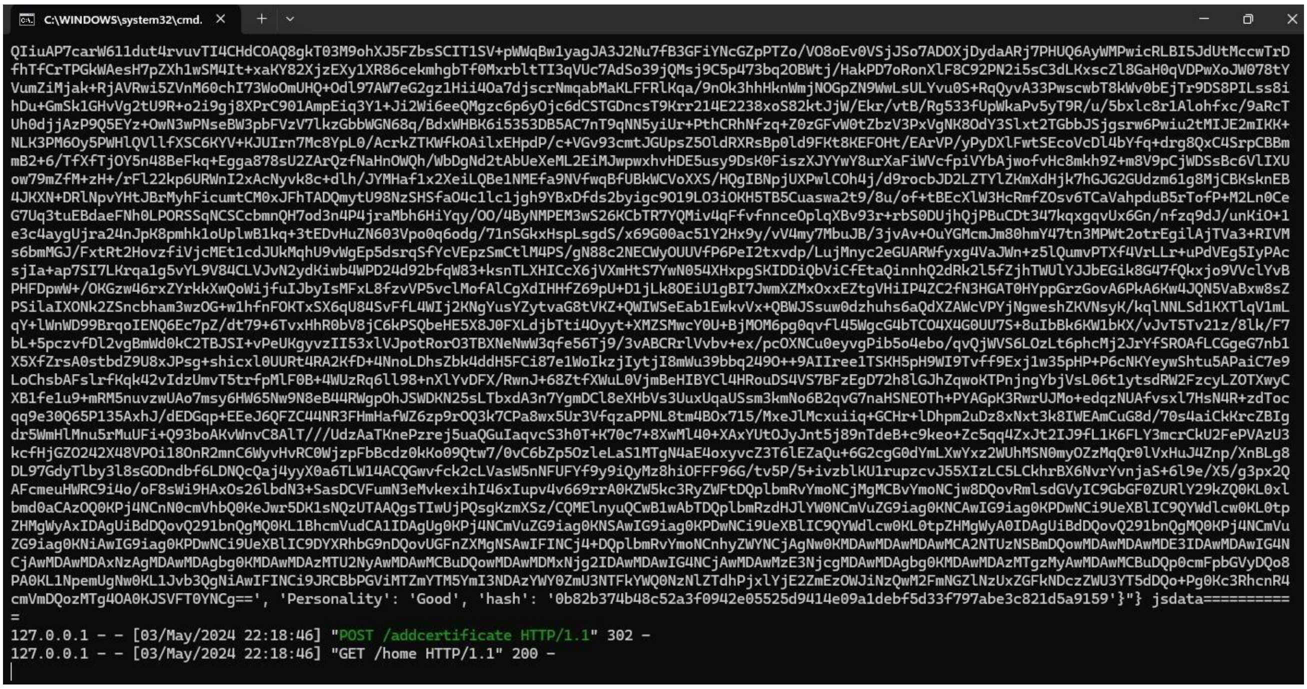
```



```
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qY+lWnWD99BrqoIENQ6Ec7pZ/dt79+6TvxHhR0bV8jC6kPSQbeHE5X8J0FXLdjbTti4Oyyt+XMZSMwcY0U+BjMOM6pg0qvfl45WgcG4bTCO4X4G0UU7S+8uIbBk6KW1bKX/vJvT5Tv21z/8lk/F7
bL+5pczvfDl2vgBmWd0kC2TBJSI+vPeUKgyvzII53xlVJpotRorO3TBXNeNwW3qfe56Tj9/3vABCRrlVvbv+ex/pcOXNCu0eyvgPib5o4ebo/qvQjWVS6LOzLt6phcMj2JrYfSROAfLCGgeG7nb1
X5XfZrsA0stbdZ9U8xJPsg+shicxl0UURt4RA2KfD+4NnoLDhsZbk4ddH5FCi87e1WoIkzjIytjI8mWu39bbq249O++9AIIree1TSKH5pH9WI9Tvff9Exj1w35pHP+P6cNKYeywShtu5APaiC7e9
LoChsbAFslrfKqk42vIdzUmvT5trfpMlF0B+4WUzRq6ll98+nXlYvDFX/RwnJ+68ZtfXWuL0VjmBeHIBYCl4HRouDS4VS7BFzEgD72h8lGJhZqwoKTPnjngYbjVsL06t1ytsdRW2FzcyLZOTXwyC
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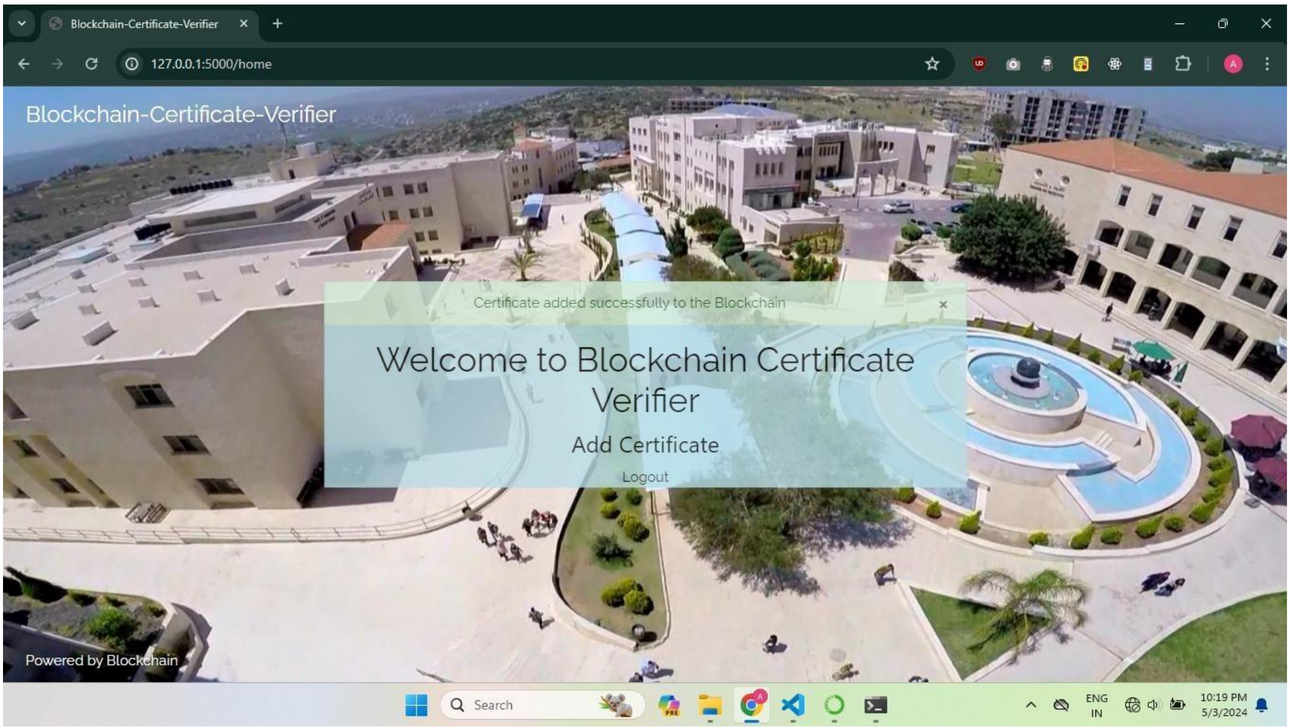
bmd0aCAzOQ0KPj4NCnN0cmVhbQ0KeJwr5DK1sNQzUTAAQgsTIwUjPQsgKzmXSz/CQMElnyuQCwB1wAbTDQplbmRzdHJlYW0NCmVuZG9iag0KNCAwIG9iag0KPDwNCi9UeXBlIC9QYWdlcw0KL0tp
ZHMgWyAxIDAgUiBdDQovQ291bnQgMQ0KL1BhcmVudCA1IDAgUg0KPj4NCmVuZG9iag0KNSAwIG9iag0KPDwNCi9UeXBlIC9QYWdlcw0KL0tpZHMgWyA0IDAgUiBdDQovQ291bnQgMQ0KPj4NCmVu
ZG9iag0KNiAwIG9iag0KPDwNCi9UeXBlIC9DYXRhbG9nDQovUGFnZXMgNSAwIFINCj4+DQplbmRvYmoNCnhyZWYNCjAgNw0KMDAwMDAwMDAwMCA2NTUzNSBmDQowMDAwMDAwMDE3IDAwMDAwIG4N
CjAwMDAwMDAxNzAgMDAwMDAgbg0KMDAwMDAzMTU2NyAwMDAwMCBuDQowMDAwMDMxNjg2IDAwMDAwIG4NCjAwMDAwMzE3NjcgMDAwMDAgbg0KMDAwMDAzMTgzMyAwMDAwMCBuDQp0cmFpbGVyDQo8
PA0KL1NpemUgNw0KL1Jvb3QgNiAwIFINCi9JRCBbPGViMTZmYTM5YmI3NDAzYWY0ZmU3NTFkYWQ0NzNlZTdhPjxlYjE2ZmEzOWJiNzQwM2FmNGZlNzUxZGFkNDczZWU3YT5dDQo+Pg0Kc3RhcnR4
cmVmDQozMTg4OA0KJSVFT0YNCg==', 'Personality': 'Good', 'hash': '0b82b374b48c52a3f0942e05525d9414e09a1debf5d33f797abe3c821d5a9159'}"} jsdata=========
=
127.0.0.1 - - [03/May/2024 22:18:46] "POST /addcertificate HTTP/1.1" 302 -
127.0.0.1 - - [03/May/2024 22:18:46] "GET /home HTTP/1.1" 200 -
```

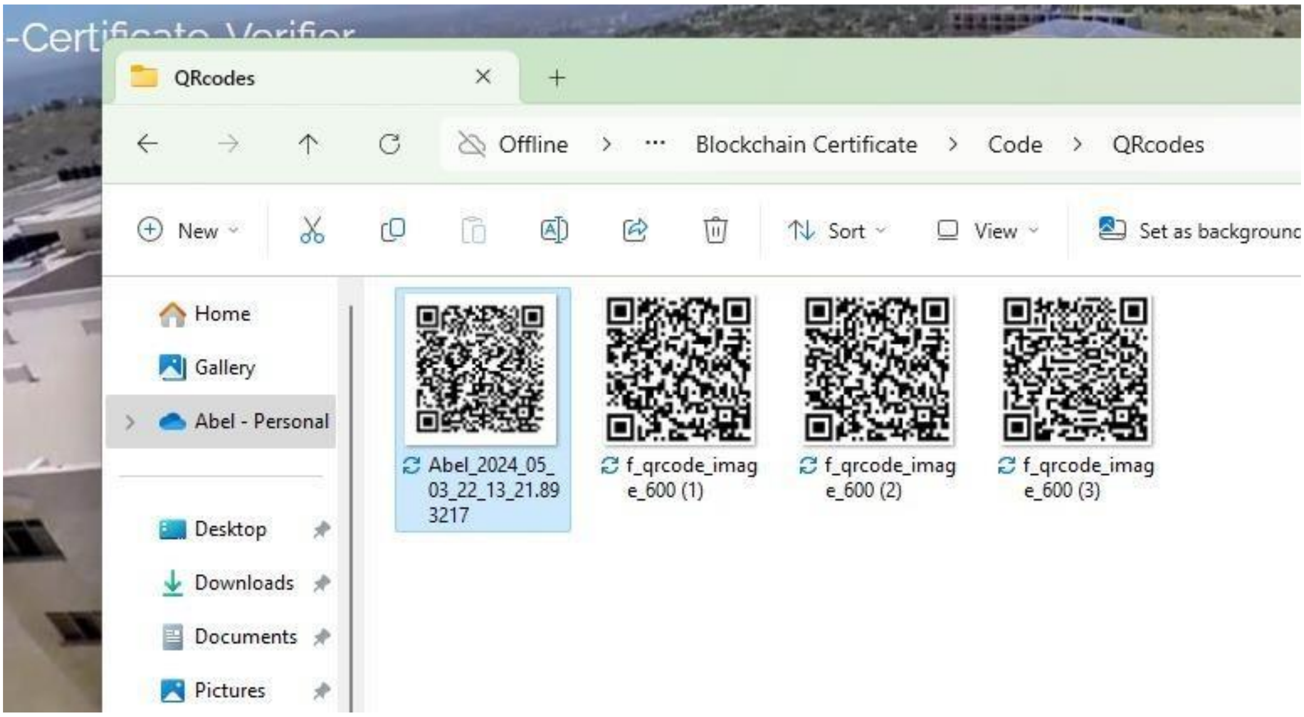


Blockchain-Certificate-Verifier
127.0.0.1:5000/home
Blockchain-Certificate-Verifier

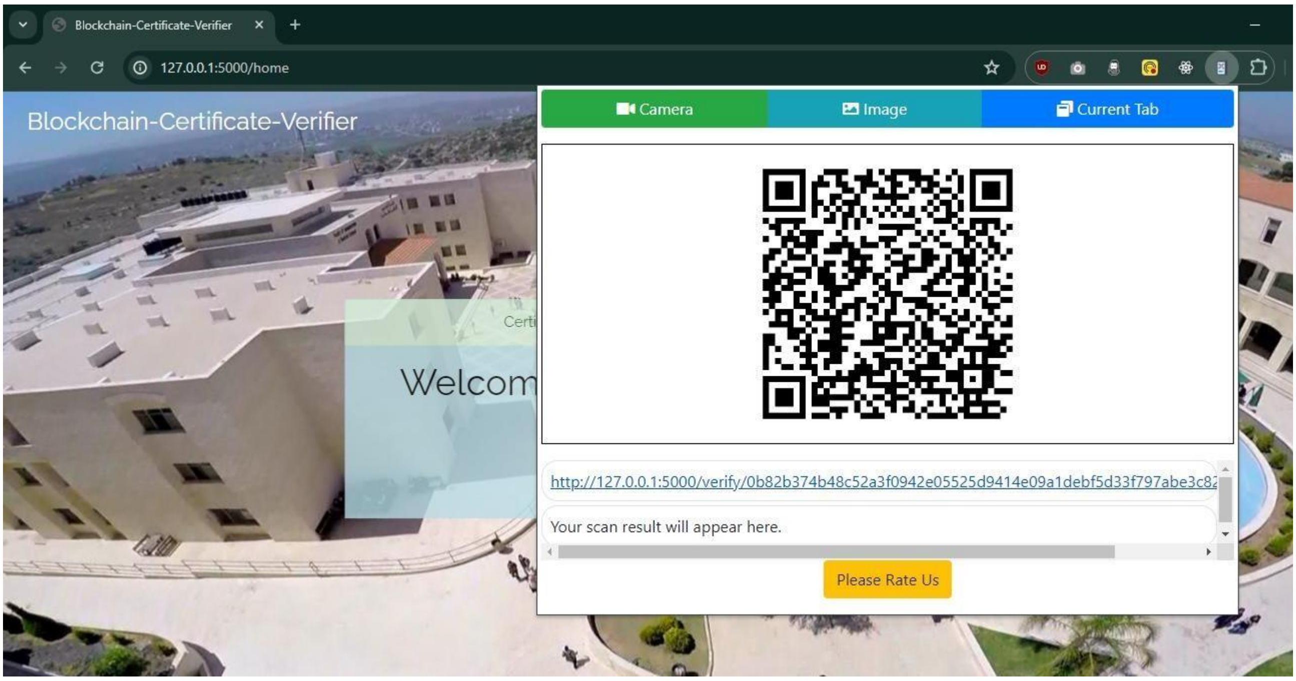
Certificate added successfully to the Blockchain

Welcome to Blockchain Certificate Verifier

- After that, a unique QRCode will be generated locally which contains the certificate data validated via Blockchain.



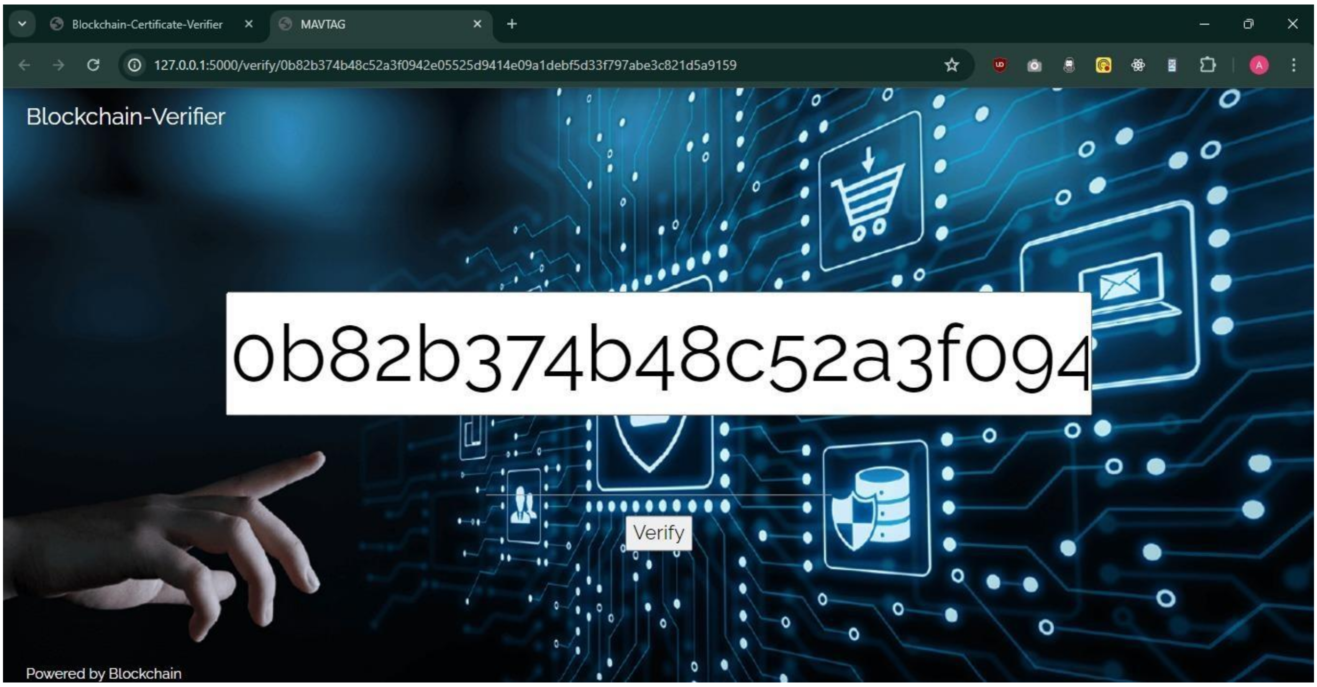
- Here, we use a browser extension for reading qrcode



http://127.0.0.1:5000/verify/0b82b374b48c52a3f0942e05525d9414e09a1debf5d33f797abe3c82

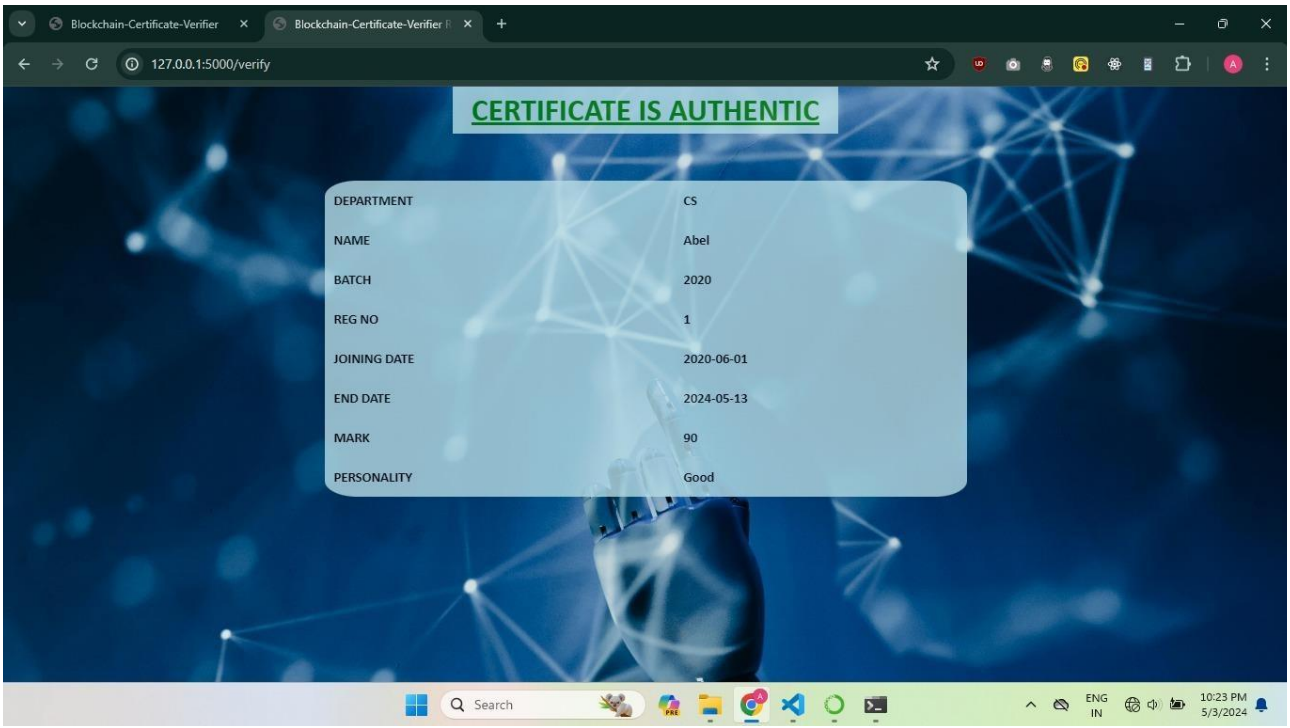
Your scan result will appear here.

- This is the SHA256 hash of the certificate which we created and added to the Blockchain.



Blockchain-Certificate-Verifier
MAVTAG
127.0.0.1:5000/verify/0b82b374b48c52a3f0942e05525d9414e09a1debf5d33f797abe3c821d5a9159
Blockchain-Verifier
0b82b374b48c52a3f094
Verify
Powered by Blockchain

- And, by clicking on Verify, we can have the certificate details. To check the authenticity of the certificate using blockchain, this is the best way.

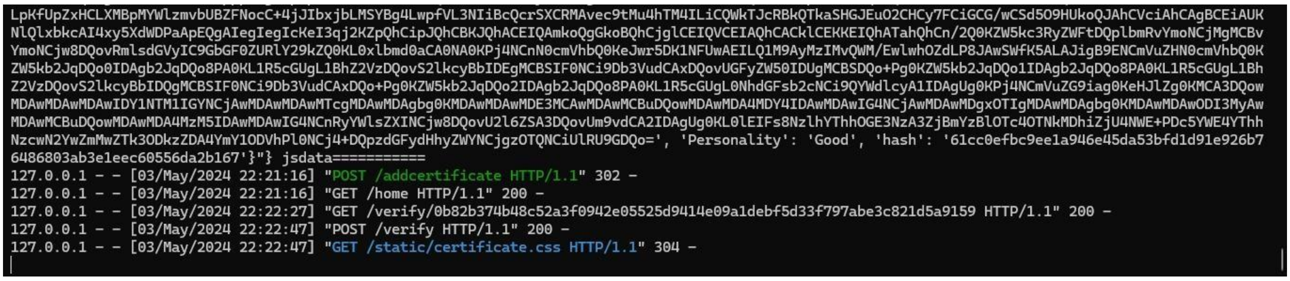


Blockchain-Certificate-Verifier
Blockchain-Certificate-Verifier
127.0.0.1:5000/verify
Search
ENG
IN
10:23 PM
5/3/2024

CERTIFICATE IS AUTHENTIC

| | |
|---|---|
| DEPARTMENT | CS |
| NAME | Abel |
| BATCH | 2020 |
| REG NO | 1 |
| JOINING DATE | 2020-06-01 |
| END DATE | 2024-05-13 |
| MARK | 90 |
| PERSONALITY | Good |

- The SHA256 hash is also displayed in the terminal.



```
LpKfUpZxHCLXMBpMYWlzmvbUBZFNocC+4jJIbxjbLMSYBg4LwpfVL3NIiBcQcrSXCRMAvec9tMu4hTM4ILiCQWkTJcRBkQTkaSHGJEuO2CHCy7FCiGCG/wCSd5O9HUkoQJAhCVciAhCAgBCEiAUK
NlQlxbkcAI4xy5XdWDPaApEQgAIegIegIcKeI3qj2KZpQhCipJQhCBKJQhACEIQAmkoQgGkoBQhCjglCEIQVCEIAQhCACklCEKKEIQhATahQhCn/2Q0KZW5kc3RyZWFtDQplbmRvYmoNCjMgMCBv
YmoNCjw8DQovRmlsdGVyIC9GbGF0ZURlY29kZQ0KL0xlbmd0aCA0NA0KPj4NCnN0cmVhbQ0KeJwr5DK1NFUwAEILQ1M9AyMzIMvQWM/EwlwhOZdLP8JAwSWfK5ALAJigB9ENCmVuZHN0cmVhbQ0K
ZW5kb2JqDQo0IDAgb2JqDQo8PA0KL1R5cGUgL1BhZ2VzDQovS2lkcyBbIDEgMCBSIF0NCi9Db3VudCAxDQovUGFyZW50IDUgMCBSDQo+Pg0KZW5kb2JqDQo1IDAgb2JqDQo8PA0KL1R5cGUgL1Bh
Z2VzDQovS2lkcyBbIDQgMCBSIF0NCi9Db3VudCAxDQo+Pg0KZW5kb2JqDQo2IDAgb2JqDQo8PA0KL1R5cGUgL0NhdGFsb2cNCi9QYWdlcyA1IDAgUg0KPj4NCmVuZG9iag0KeHJlZg0KMCA3DQow
MDAwMDAwMDAwIDY1NTM1IGYNCjAwMDAwMDAwMTcgMDAwMDAgbg0KMDAwMDAwMDE3MCAwMDAwMCBuDQowMDAwMDA4MDY4IDAwMDAwIG4NCjAwMDAwMDgxOTIgMDAwMDAgbg0KMDAwMDAwODI3MyAw
MDAwMCBuDQowMDAwMDA4MzM5IDAwMDAwIG4NCnRyYWlsZXINCjw8DQovU2l6ZSA3DQovUm9vdCA2IDAgUg0KL0lEIFs8NzlhYThhOGE3NzA3ZjBmYzBlOTc4OTNkMDhiZjU4NWE+PDc5YWE4YThh
NzcwN2YwZmMwZTk3ODkzZDA4YmY1ODVhPl0NCj4+DQpzdGFydHhyZWYNCjgzOTQNCiUlRU9GDQo=', 'Personality': 'Good', 'hash': '61cc0efbc9ee1a946e45da53bfd1d91e926b7
6486803ab3e1eec60556da2b167'}"} jsdata===========
127.0.0.1 - - [03/May/2024 22:21:16] "POST /addcertificate HTTP/1.1" 302 -
127.0.0.1 - - [03/May/2024 22:21:16] "GET /home HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:22:27] "GET /verify/0b82b374b48c52a3f0942e05525d9414e09a1debf5d33f797abe3c821d5a9159 HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:22:47] "POST /verify HTTP/1.1" 200 -
127.0.0.1 - - [03/May/2024 22:22:47] "GET /static/certificate.css HTTP/1.1" 304 -
```

# CHAPTER 7: CONCLUSION AND FUTURE WORK

# CHAPTER 7: CONCLUSION AND FUTURE WORK

## 7.1 Conclusion

Our blockchain-based certificate validation system, driven by Local Blockchain Nodes using Ethereum Network, web3.js, and Ethereum blockchain technology, represents a groundbreaking advancement in certificate validation. By leveraging these state-of-the-art tools and technologies, we've established a solution that not only ensures the authenticity and integrity of government-issued certificates but also sets a new standard for trust and reliability in certification ecosystems. The immutability of the blockchain guarantees that validation data remains tamper-proof, while its transparent ledger fosters trust among stakeholders. Moreover, the decentralization of the validation process, enabled by Truffle and web3.js, eliminates the need for centralized authorities, reducing the risk of single points of failure and enhancing overall security. This innovative system not only addresses the immediate need for reliable certificate validation but also lays the foundation for a future where trust and transparency are intrinsic to all certification processes. Our solution heralds a more trustworthy and dependable certification ecosystem, benefiting governments, organizations, and individuals alike, and with continued integration and refinement of blockchain technology, we're poised to revolutionize certificate validation worldwide.

## 7.2 Future work

As we advance, out goals for improving our blockchain-based certificate generation and validation system include:

- Integration with Government Databases: Strengthen connections for real-time validation against official records.
- User-Friendly Interfaces: Develop intuitive platforms tailored for government use.
- Democratized Access: Prioritize usability for effortless validation.
- Continuous Improvement: Remain innovative to meet evolving needs.

# CHAPTER 8: REFERENCES

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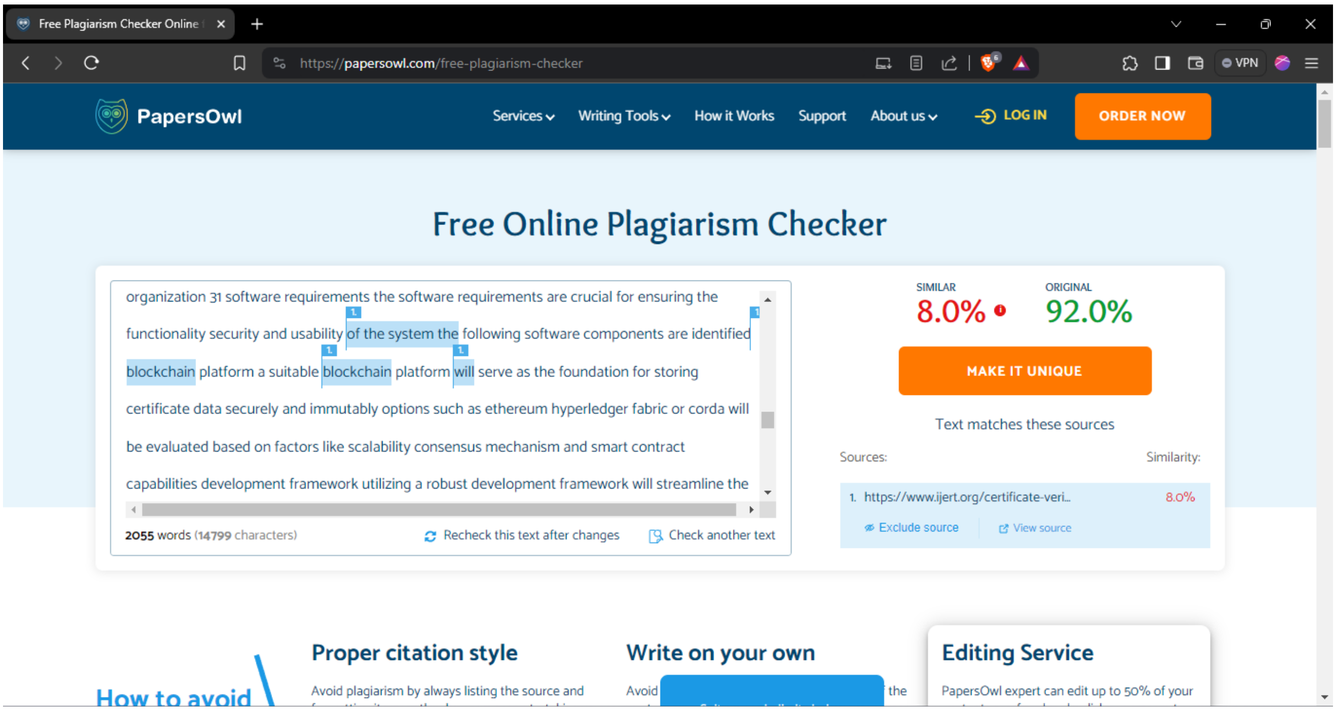
## 8.1 REFERENCES

1. https://aws.amazon.com/amplify/

2.https://lucid.app/lucidchart/a81d34ab-5810-43bc-8ece-82313333353a/edit?beaconFlowId=5892DD82E0815C51&invitationId=inv_84a793d4-95d0-42b2-8ece-599e000a7f7e&page=0_0#

3. https://www.youtube.com/watch?v=3eog1yxZpGE&ab_channel=Blocktical



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organization 31 software requirements the software requirements are crucial for ensuring the functionality security and usability of the system the following software components are identified blockchain platform a suitable blockchain platform will serve as the foundation for storing certificate data securely and immutably options such as ethereum hyperledger fabric or corda will be evaluated based on factors like scalability consensus mechanism and smart contract capabilities development framework utilizing a robust development framework will streamline the

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