

Transparent Education Data Management

A PROJECT REPORT

Submitted By

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

The "Transparent Education Data Management Using Blockchain" project aims to enhance the transparency and security of education data through the application of blockchain technology. By leveraging the decentralized and immutable nature of blockchain, this project seeks to provide a solution that ensures the integrity, privacy, and accessibility of educational records.

1.2 PURPOSE

transparent education data management using blockchain addresses the need for trust, security, and efficiency in handling educational records, benefiting students, educational institutions, employers, and

other stakeholders in the education ecosystem. Ensure data integrity, prevent fraud, and simplify verification of educational records while giving students control over their data.

2.LITERATURE SURVEY

2.1 Existing problem

Data Privacy and Security: Safeguarding sensitive student and faculty data from breaches and unauthorized access is a constant challenge.

Data Silos: Many educational institutions have fragmented data systems that don't communicate effectively, making it difficult to gain a holistic view of the education process.

Data Quality: Inaccurate or outdated data can lead to incorrect decisions, affecting student performance and institutional effectiveness.

Lack of Integration: Integration of various data sources and software applications can be complex and time-consuming.

Compliance and Regulation: Adhering to data privacy laws and educational regulations can be complex, and non-compliance can result in legal issues.

Data Accessibility: Ensuring that authorized individuals have access to the data they need while maintaining privacy is a balancing act.

Resistance to Change: Resistance from staff, faculty, or administrators to adopt new data management practices can impede progress.

Legacy Systems: Replacing or integrating legacy systems can be costly and complicated.

2.2 References

- . What Matters Most for Education Management Information Systems: A Framework Paper
 - . Analysis of Data Management in Blockchain-Based Systems: From Architecture to Governance
 - . Block chain-Based Application in Education: A Systematic Review
 - . Blockchain for Transparent Data Management Toward 6G
 - . Education Chain: A Blockchain -based Education Data Management
- ## 2.3 PROBLEM STATEMENT DEFINITION
- The current education data management systems lack transparency, making it difficult for stakeholders, including students, teachers, parents, and administrators, to access, understand, and trust

Page 6 the data. This lack of transparency hinders data-driven decision-making, accountability, and the overall effectiveness of education institutions. There is a pressing need for a solution that ensures the clear, secure, and accessible management of education data to enhance transparency and improve the education system's outcomes."

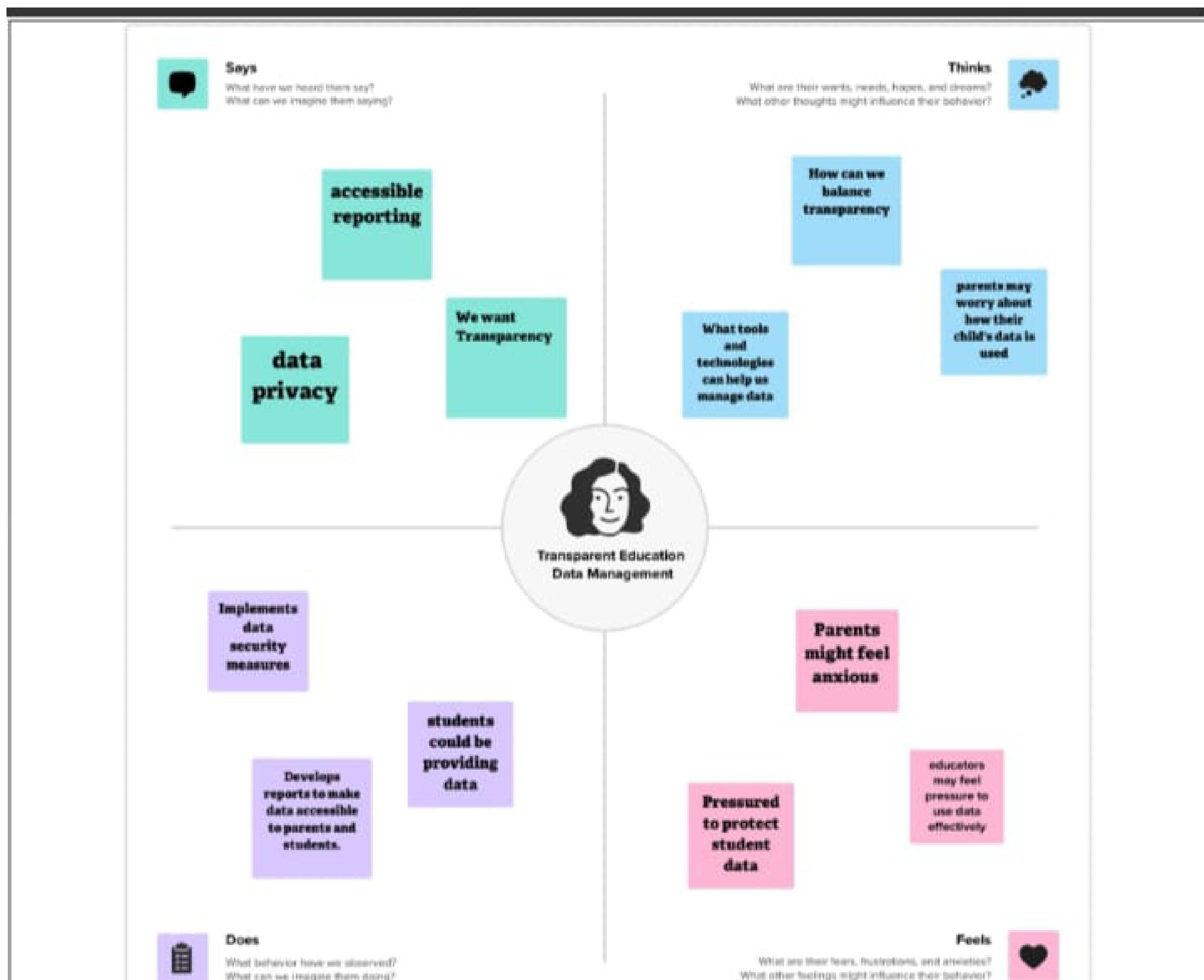
3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 Ideation & Brainstorming

Brainstorm & Idea Prioritization Template:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step 1: Team Gathering, Collaboration and Select the problem Statements

Collect feedbacks from stakeholders on different educational processes and make improvements accordingly



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

⌚ 10 minutes to prepare
💡 1 hour to collaborate
👤 2-8 people recommended

Before you collaborate
A little bit of preparation goes a long way with this session. Here's what you need to do to get going.
⌚ 10 minutes

- 1 Team gathering Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.
- 2 Set the goal Think about the problem you'll be focusing on solving in the brainstorming session.
- 3 Learn how to use the facilitation tools Use the Facilitation Superpowers to run a happy and productive session.

[Open article →](#)

Define your problem statement
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.
⌚ 5 minutes

PROBLEM

The lack of transparency and standardized data management in education systems creates barriers to informed decision-making, resource allocation, and accountability.



Key rules of brainstorming
To run a smooth and productive session

- ⌚ Stay on topic.
- 💡 Encourage wild ideas.
- 🚫 Defend judgment.
- 👂 Listen to others.
- ⌚ Go for volume.
- 👁️ If possible, be visual.

Need some inspiration?
See a finished example of this template to kickstart your work

[Open example →](#)

Step 2: Brainstorm, Idea Listening and Grouping

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⌚ 10 minutes

TIP
You can select a sticky note and hit the pencil icon to edit it.

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

⌚ 20 minutes

TIP
Find a comfortable spot to stick notes to make it easier to find, review, organize and categorize your initial ideas into themes within your model.

Person 1

Clearly define what data needs to be collected, including student demographics, attendance, performance, and more.

Implement data collection tools that minimize errors and reduce bias.

Implement data encryption and access controls to protect sensitive information.

Create user-friendly, publicly accessible portals for stakeholders to access relevant education data.

Clearly define what data needs to be collected, including student demographics, attendance, performance, and more.

Person 2

Create user-friendly, publicly accessible portals for stakeholders to access relevant education data.

Collect feedback from stakeholders on data management processes and make improvements accordingly.

Establish data quality assurance processes to ensure data accuracy and reliability.

Regularly review and update data management policies and practices to reflect evolving needs and best practices.

Establish data quality assurance processes to ensure data accuracy and reliability.

Stay informed about and comply with all relevant laws and regulations regarding education data management.

Seek feedback and input to make data management more accountable.

Person 3

Regularly review and update data management policies and practices to reflect evolving needs and best practices.

Stay informed about and comply with all relevant laws and regulations regarding education data management.

Security incidents to protect student information and maintain trust.

Implement data collection tools that minimize errors and reduce bias.

Collect feedback from stakeholders on data management processes and make improvements accordingly.

Person 4

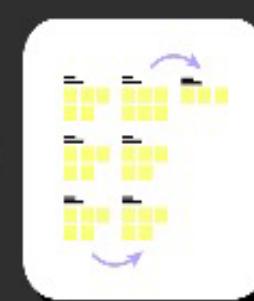
Seek feedback and input to make data management more accountable.

Create user-friendly dashboards and reports to present data effectively.

Use digital tools to collect and record data to reduce human errors.

Create user-friendly dashboards and reports to present data effectively.

Stay informed about and comply with all relevant laws and regulations regarding education data management.

**3. Idea Prioritization**

4

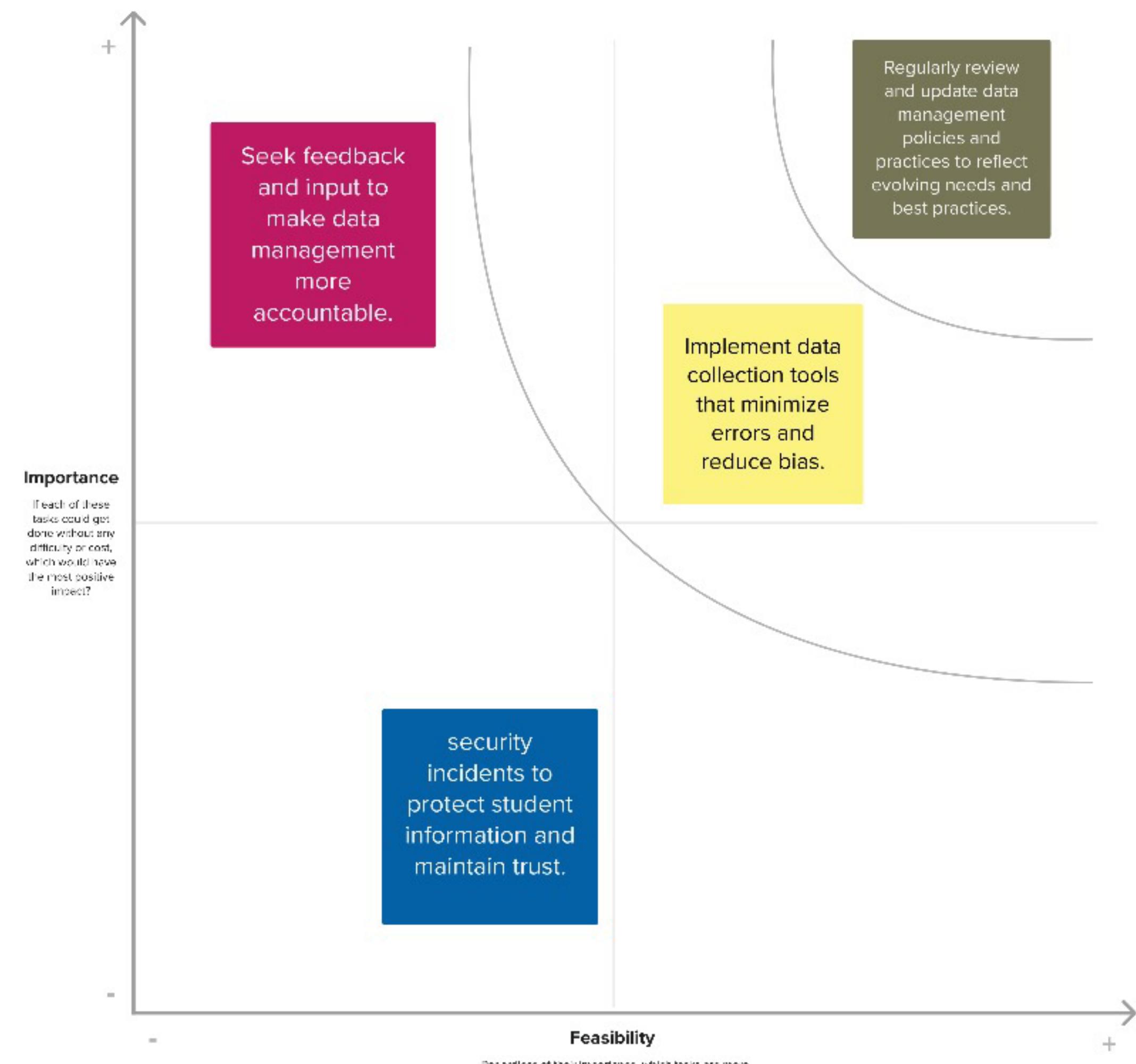
Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the H key on the keyboard.



4. REQUIREMENT ANALYSIS

4.1 Functional requirements

FR1	Data Visualization and Reporting	Provide dashboards and reporting tools for users to create and view visual representations of data.
FR2	Data Analytics:	Help educators and administrators make data-driven decisions to improve education quality.
FR3	Data Transparency:	Ensure data is easily understandable, with clear labels and explanations.
FR4	Data Security and Backup:	Regularly back up data to prevent loss due to system failures or disasters.
FR5	Scalability	Ensure the system can handle the growth of data and users over time.
FR6	Interoperability	Use industry standards to facilitate data exchange.

	Customization and Configurability:	Provide configuration options to adapt to different educational settings.
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NON FUNCTIONAL REQUIREMENT

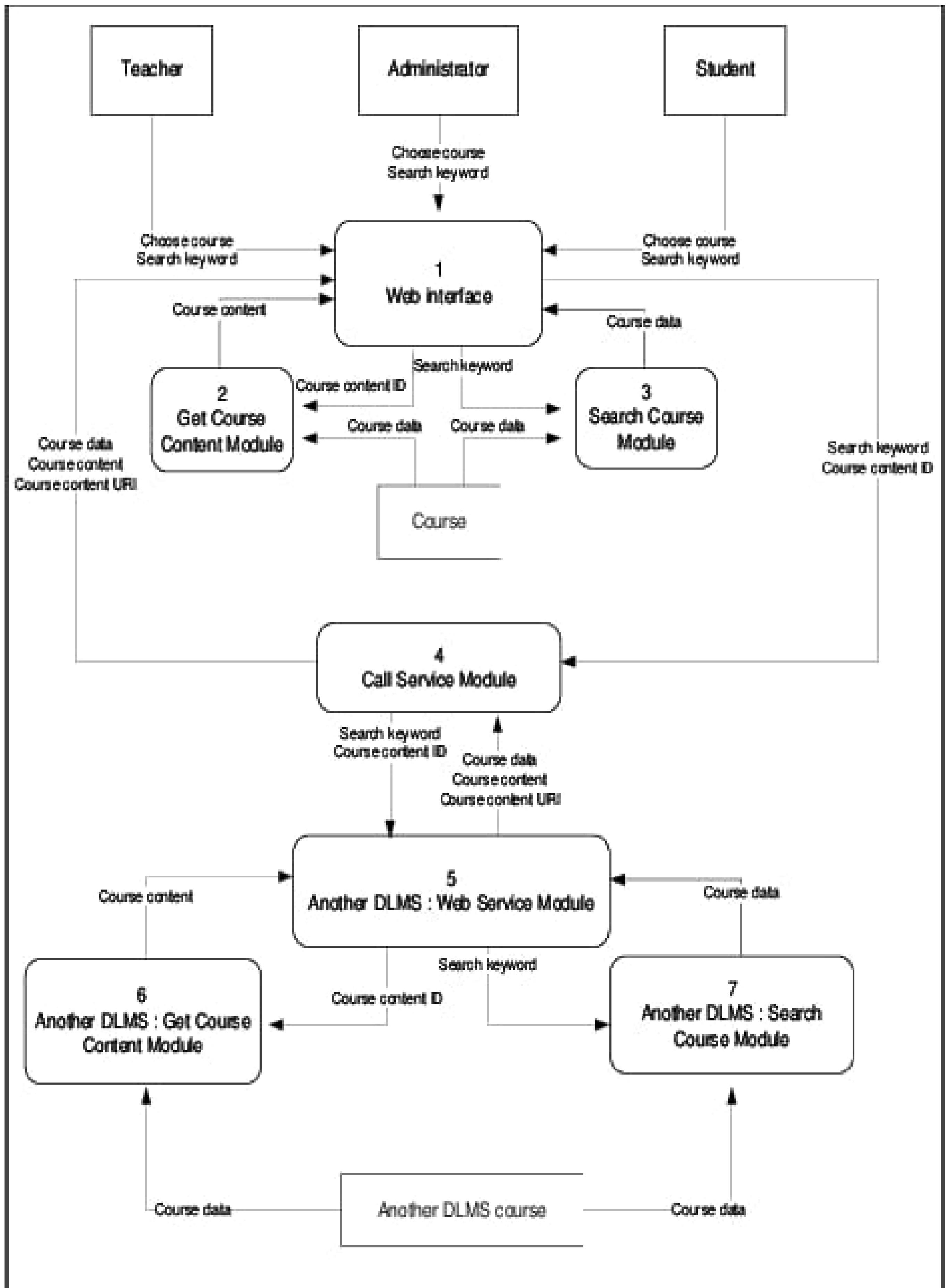
NFR1	Performance	The system should provide responsive and quick access to data, ensuring minimal latency, even during peak usage times. Scalability: It should be able to scale horizontally and vertically to
NFR2	Scalability	should be able to scale horizontally and vertically to accommodate increased data volumes and user loads.
NFR3	Reliability	The system should be highly reliable, with minimal downtime and data availability at

Page 14		all times.
NFR4	Availability	Ensure the system is available 24/7, with redundancy and failover mechanisms in place
NFR5	Data Integrity	Maintain data accuracy and consistency, preventing data corruption or loss.
NFR6	Security	Implement robust security measures to protect data from unauthorized access, including encryption, authentication, and authorization
R5DYHNFR7	Privacy	Adhere to privacy regulations

5. PROJECT DESIGNS

5.1 DATA FLOW DIAGRAMS & USER STORIES

data flow diagram (DFD) for transparent education data management is a complex task that would typically involve multiple processes, entities, and data flows. I can provide you with a simplified overview of a DFD for education data management:



User Stories

As a student: I want to have access to my own academic records and performance data so that I can track my progress and make informed decisions about my education.

As a teacher: I want a user-friendly platform where I can input and access student data to better tailor my teaching methods and provide timely interventions for struggling student.

As an administrator: I want to have a centralized data system that allows me to track enrollment, attendance, and performance metrics across the institution to make data-driven decisions for improvement .

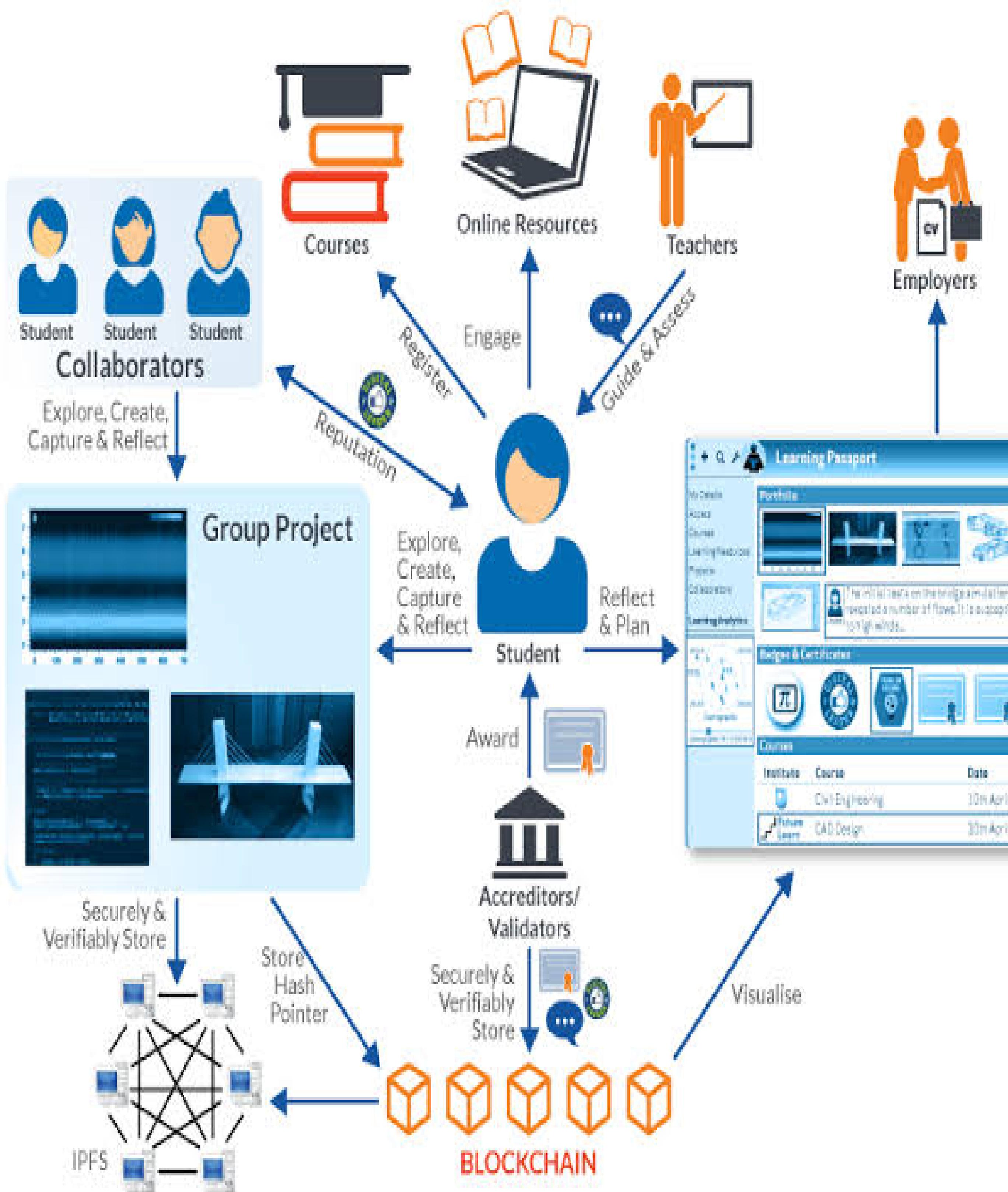
As an IT manager: I want to ensure the security and integrity of educational data by implementing robust data protection measures and access controls.

As a data analyst: I want to access raw data in a standardized format to perform in-depth analysis, identify trends, and provide insights that support institutional goals.

As a researcher: I want access to anonymized and aggregated educational data to conduct studies and contribute to educational advancements.

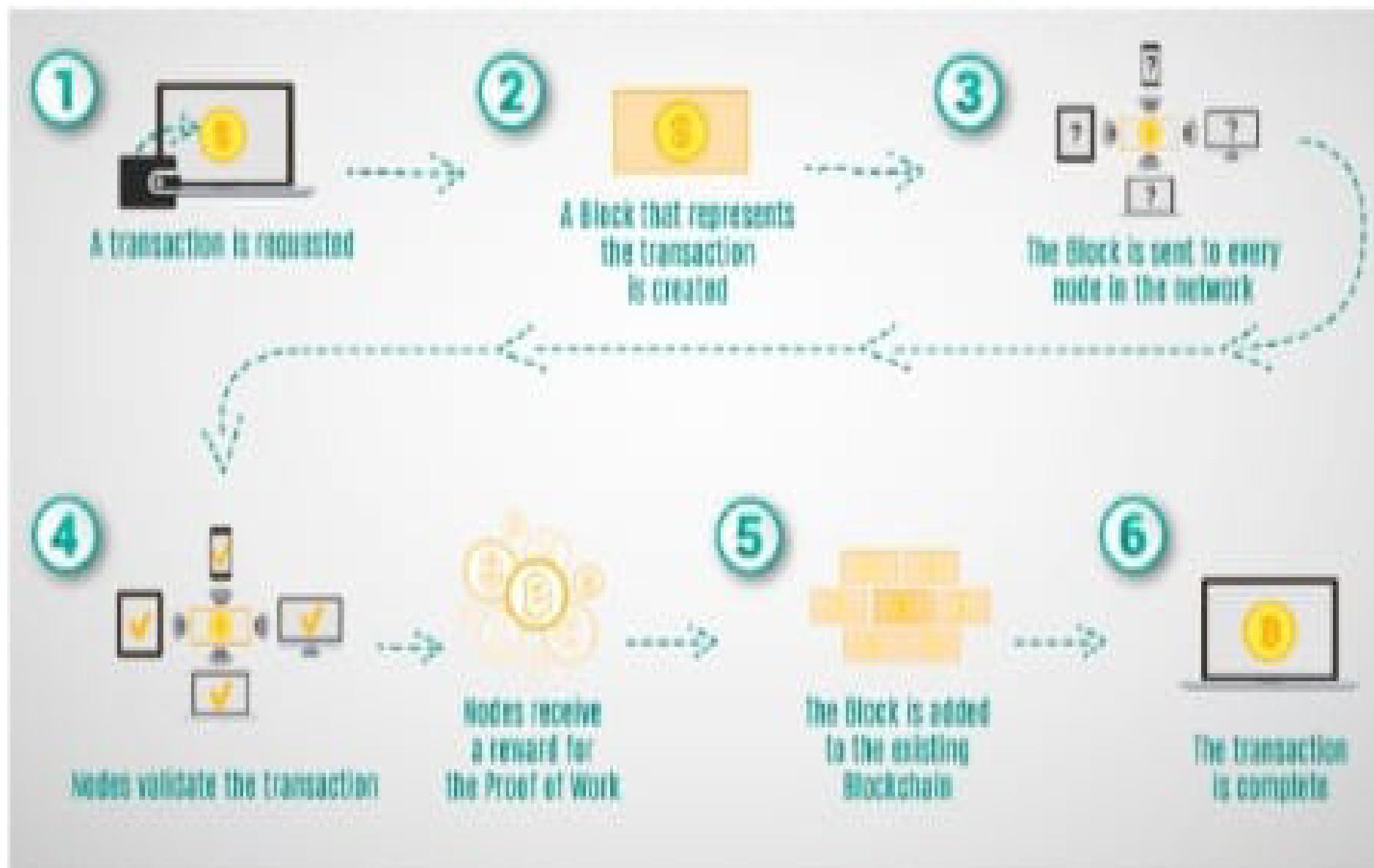
As a prospective student: I want to access information about the institution's past performance, graduation rates, and student success data to make an informed decision about enrollment.

5.2 SOLUTION ARCHITECTURE

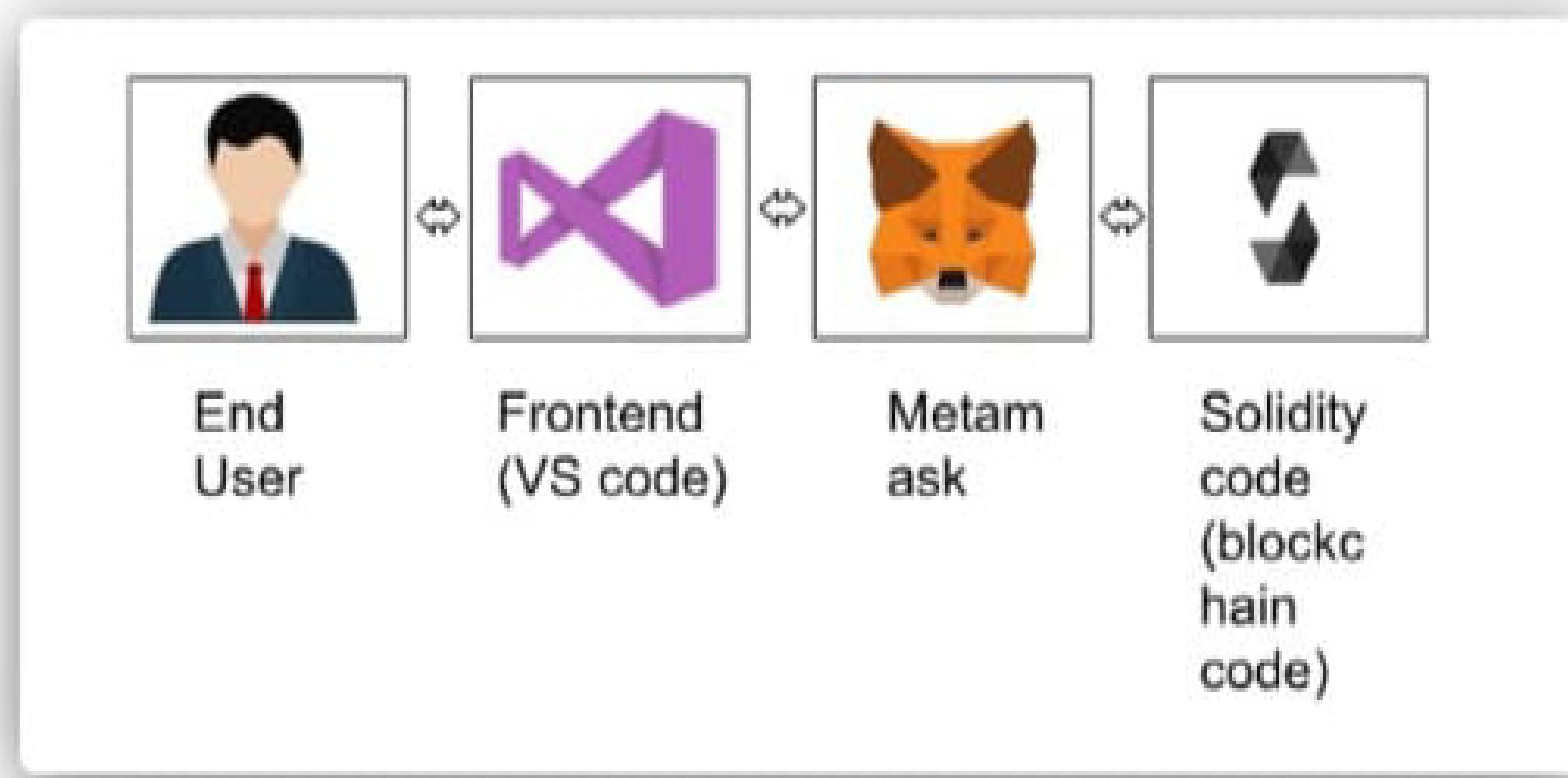


6. PROJECT PLANNING & SCHEDULING

6.1 TECHNICAL ARCHITECTURE



Technical Stack:



6.2 SPRINT PLANNING & ESTIMATION

Page 12 It seems like you're interested in various aspects of Agile project management. Here's a brief overview of these terms:

Sprint Planning: This is a regular meeting in Agile where the team decides what work they can accomplish in the upcoming sprint. It involves selecting user stories or tasks and setting the sprint goal.

Estimation: Estimation in Agile helps the team predict how much work can be done in a sprint. Techniques like story points or planning poker are used to estimate the effort required for tasks.

Transparency: Agile emphasizes transparency in all aspects of the project. This means that everyone involved should have a clear view of the project's progress, issues, and goals.

Education: Education in Agile refers to continuous learning and improvement. Team members should be encouraged to learn and adapt to new technologies or processes to enhance their skills.

Data Management: Data management involves handling and organizing project-related data effectively. This includes managing user stories, progress metrics, and other project information.

6. 3 SPRINT DELIVERY SCHEDULING

Sprint planning, scheduling, transparency, education, and data management are essential aspects of project management in the context of agile development. If you have specific questions or need guidance related to any of these topics, please feel free to ask, and I'll do my best to provide information and assistance.

7. CODING & SOLUTIONS (Explain features added in the project along with code)

7.1 FEATURE 1

1. Data Reporting a visualization: Effective tools for reporting and visualizing data, such as charts and graphs, make it easier for users to understand and interpret the information.

2. Standardized Metrics: Commonly agreed-upon metrics, like standardized test scores, graduation rates, and attendance records, allow for meaningful comparisons between schools or institutions.

7.2 FEATURE 2

1. User-Friendly Interface: The interface through which data is accessed should be user-friendly, making it easy for non-technical users to navigate and understand.

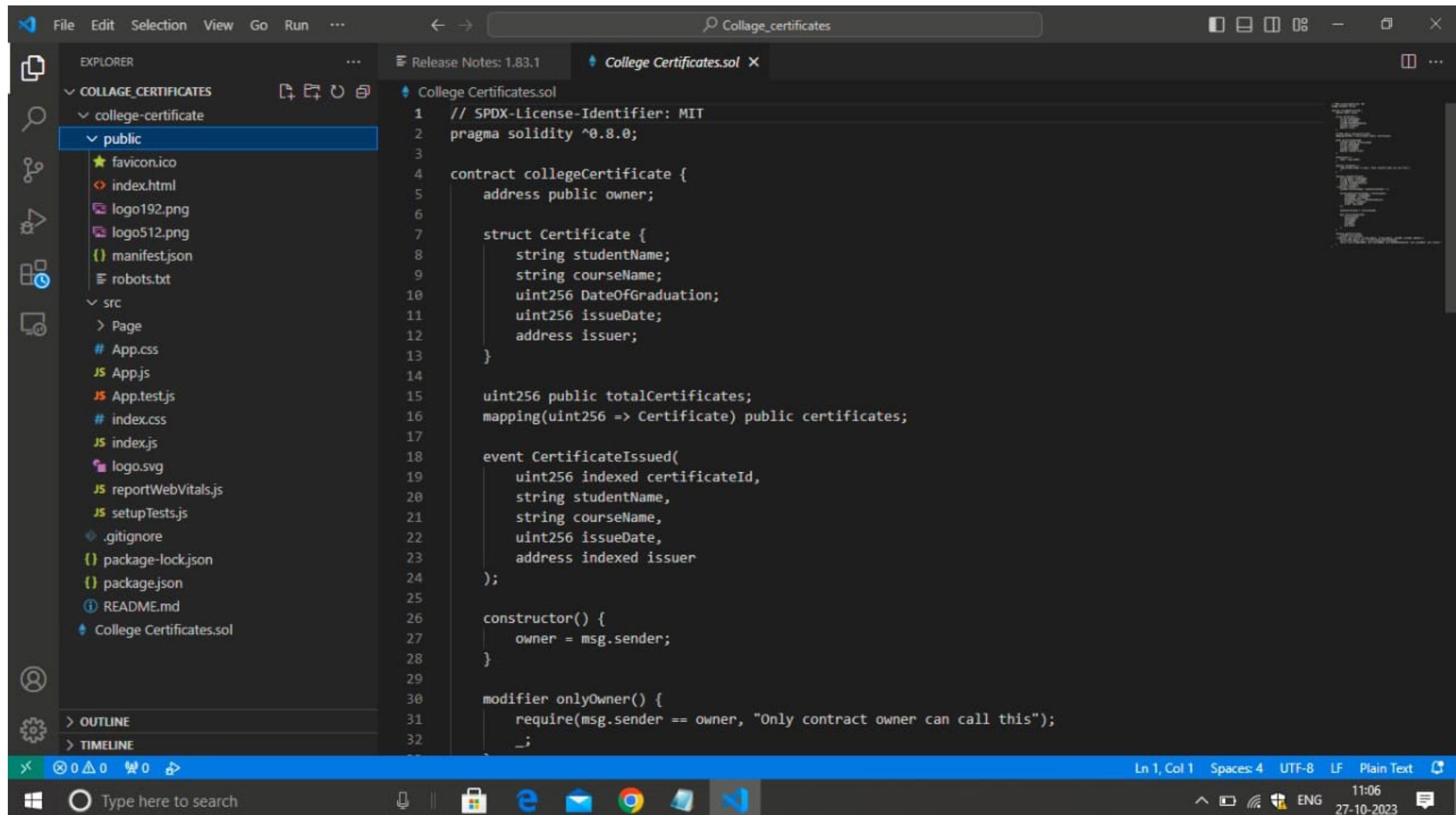
2. Granularity: The ability to break down data into smaller units (e.g., by grade, subject, or demographic) allows for more detailed analysis.

3. Compliance with Regulations: Adherence to relevant data protection and privacy regulations is essential to ensure legal and ethical data management.

8. PERFORMANCE TESTING

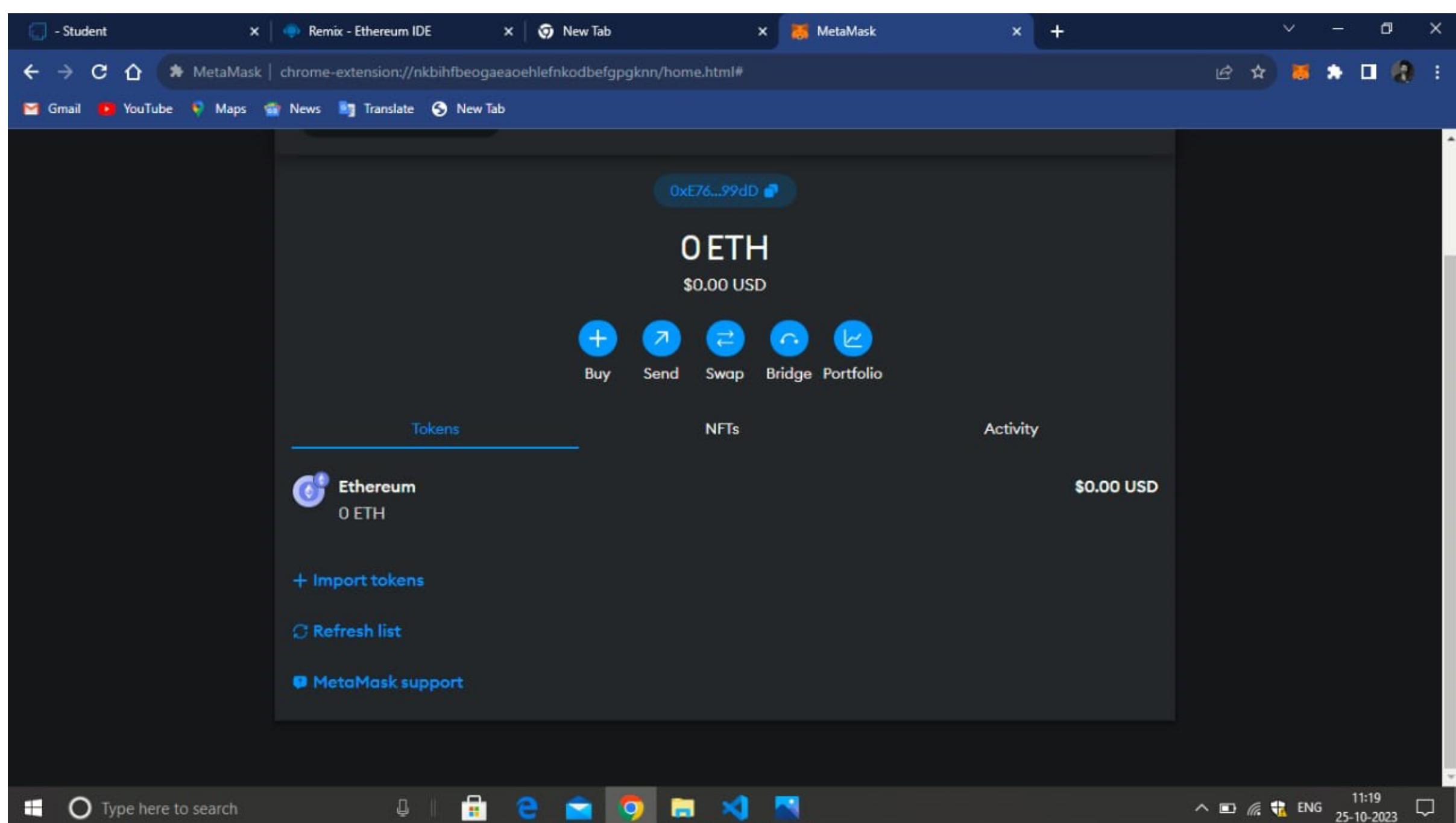
8.1 PERFORMANCE METRICS

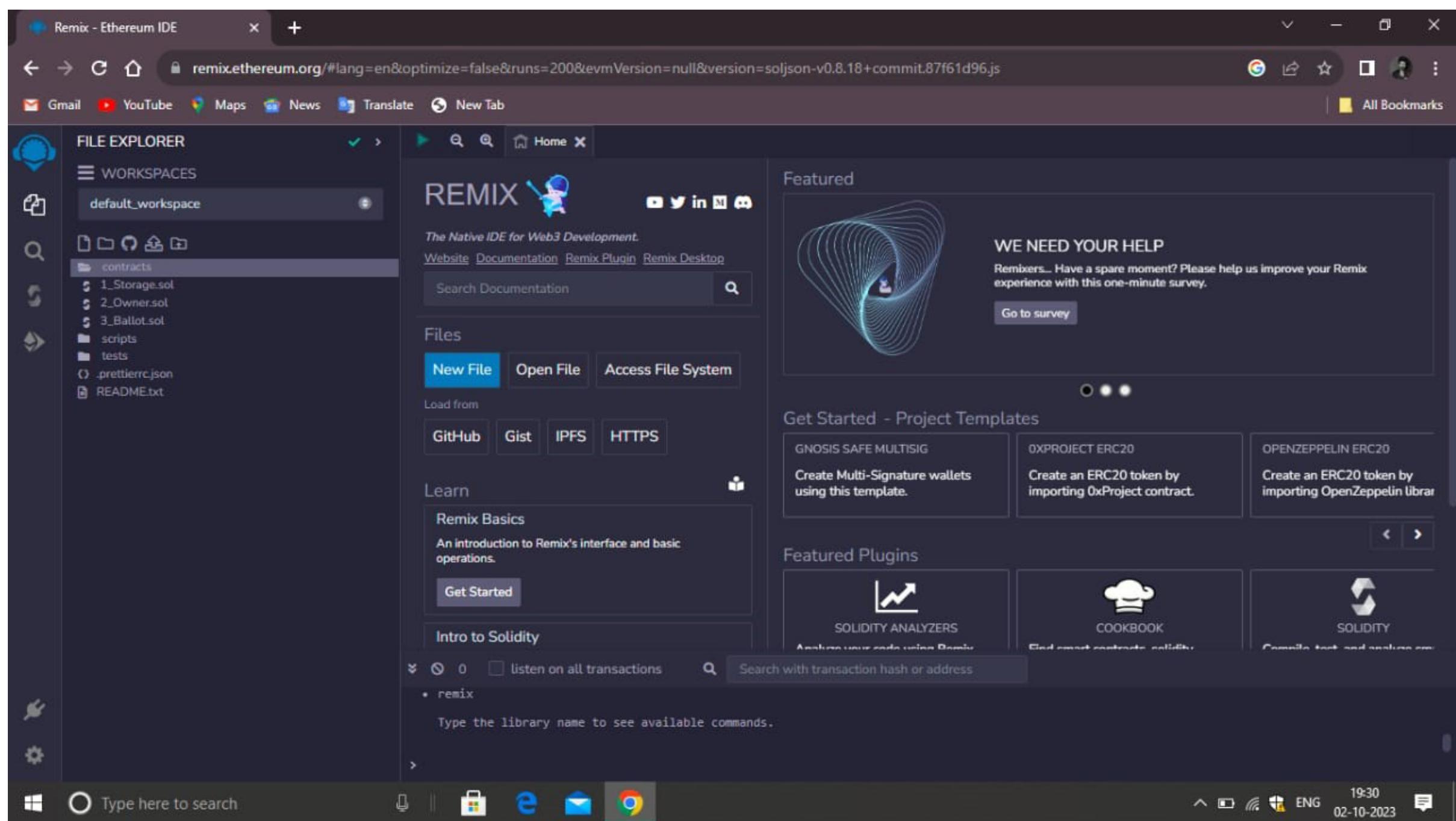
1. Information gathering



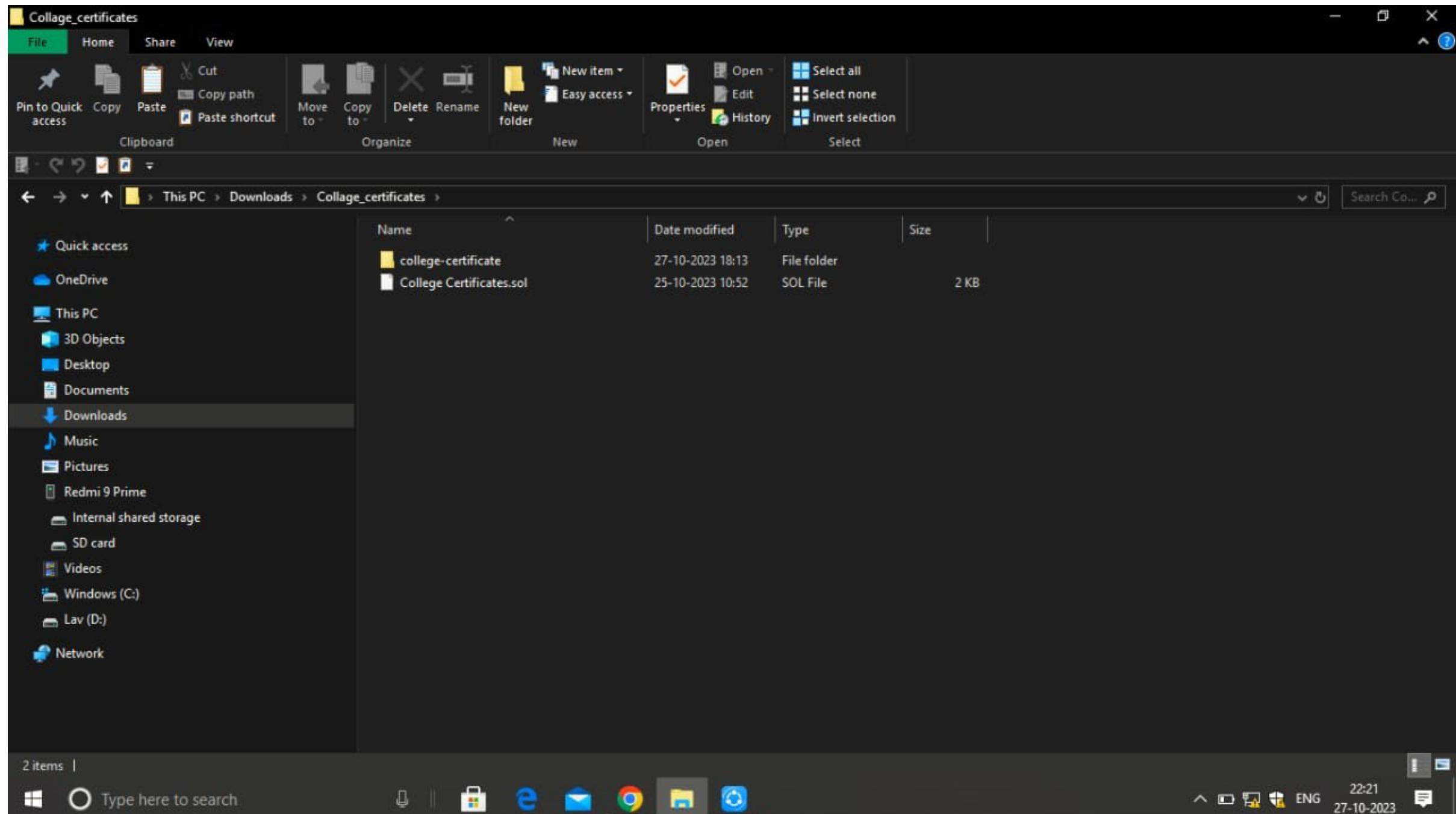
The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows the project structure under "COLLAGE_CERTIFICATES". The "public" folder is selected, containing files like favicon.ico, index.html, logo192.png, logo512.png, manifest.json, robots.txt, App.css, App.js, App.test.js, index.css, index.js, logo.svg, reportWebVitals.js, setupTests.js, .gitignore, package-lock.json, package.json, and README.md. A file named "College Certificates.sol" is also listed.
- Code Editor:** Displays the Solidity code for the "College Certificates.sol" contract. The code defines a contract "collegeCertificate" with a struct "Certificate" and an event "CertificateIssued". It includes a constructor and a modifier "onlyOwner".
- Bottom Status Bar:** Shows the current line (Ln 1, Col 1), spaces (Spaces: 4), encoding (UTF-8), and file type (Plain Text). It also displays the date and time (27-10-2023, 11:06).





2. Extract the zip files



The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows a project structure for "COLLEGE_CERTIFICATES" containing "college-certificate" and "src" folders. Inside "src", there are files like "App.css", "App.js", "App.test.js", "index.css", "index.js", "logo.svg", "reportWebVitals.js", and "setupTests.js".
- Code Editor:** Displays the content of "College Certificates.sol". The code defines a Solidity contract named "collegeCertificate" with a struct "Certificate" and an event "CertificateIssued". It includes a constructor and a modifier "onlyOwner".
- Bottom Status Bar:** Shows "Ln 1, Col 1" and "11:06 27-10-2023".

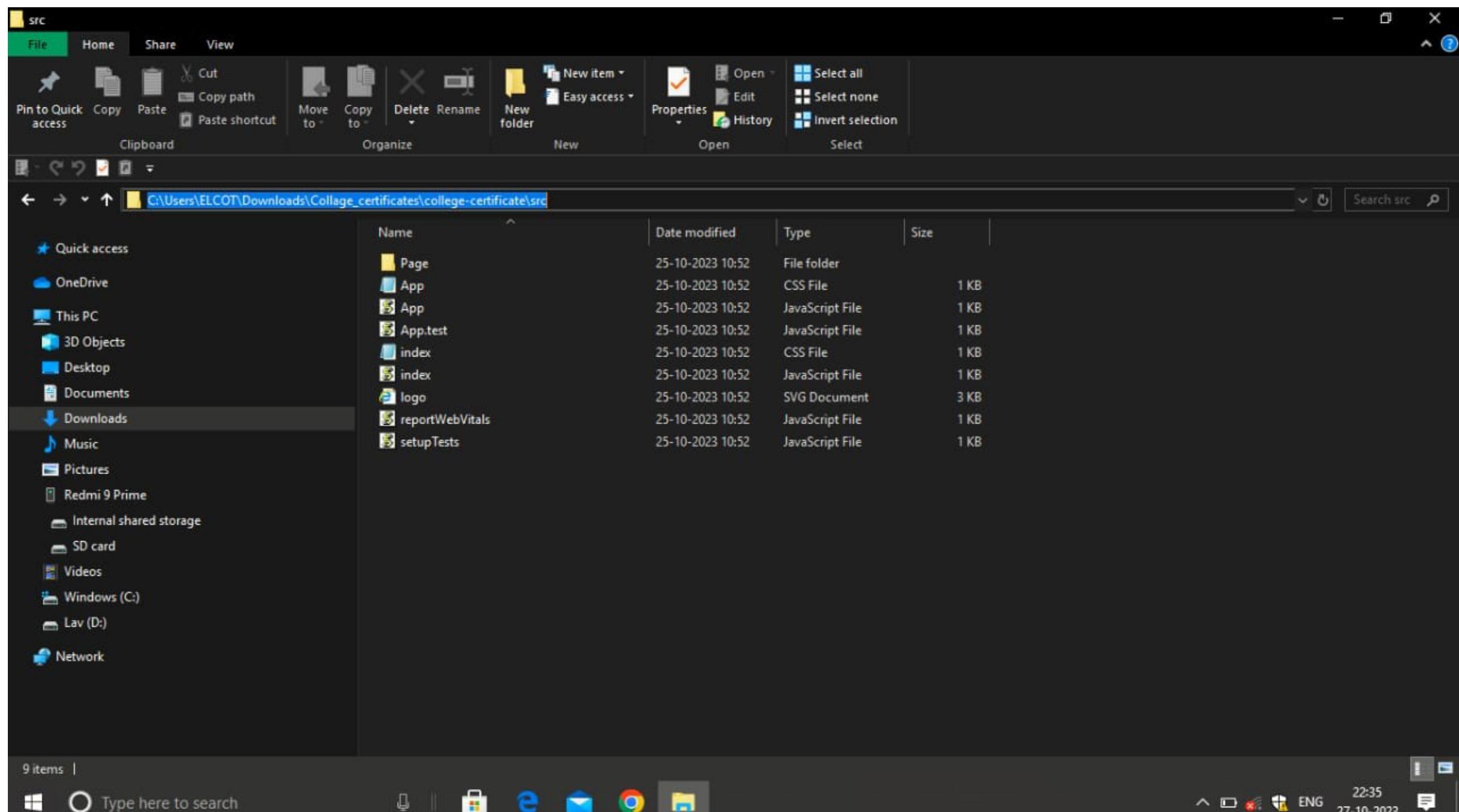
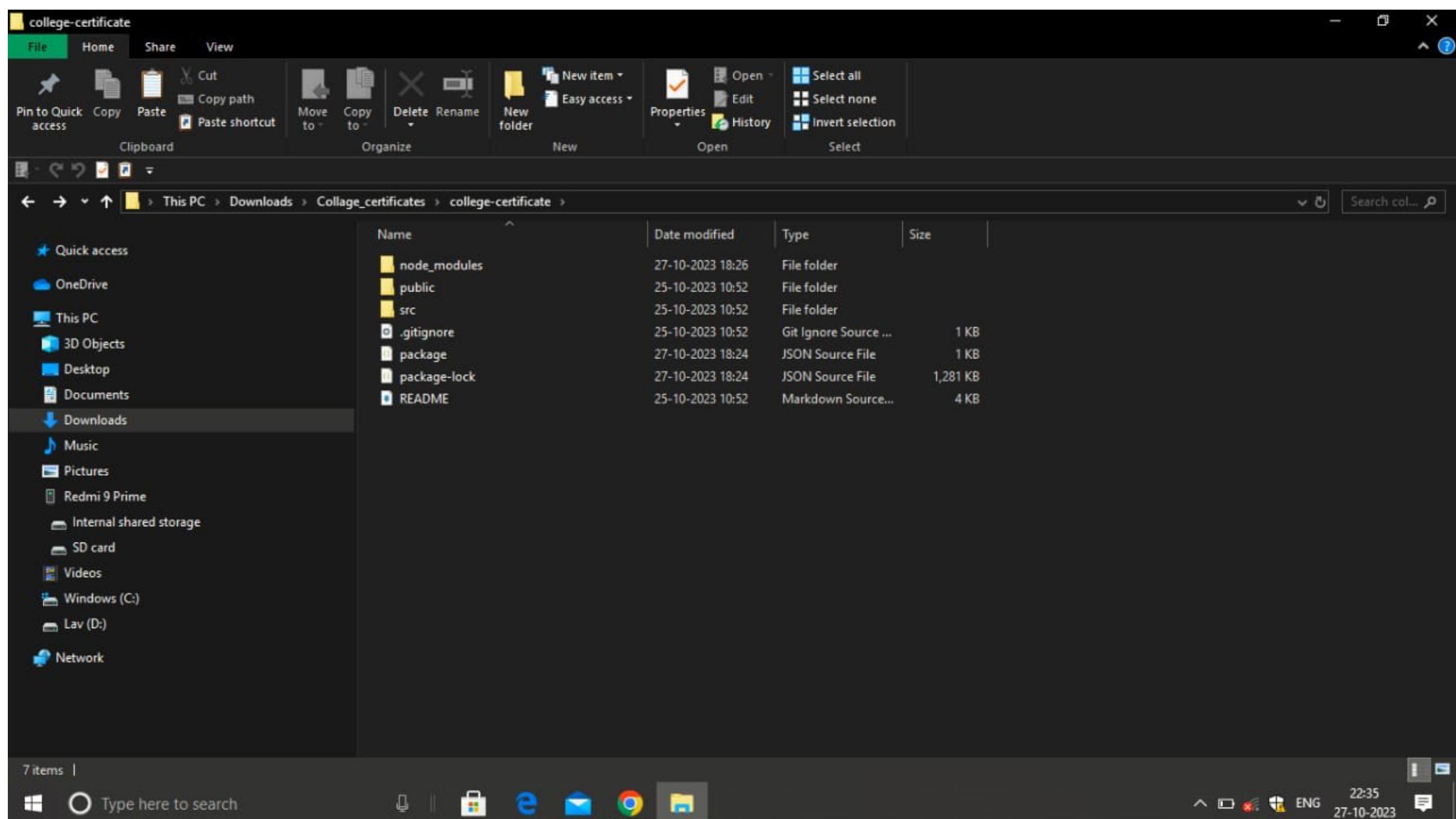
3. Remix ide platform explorting

The screenshot shows the Remix Ethereum IDE interface with the following details:

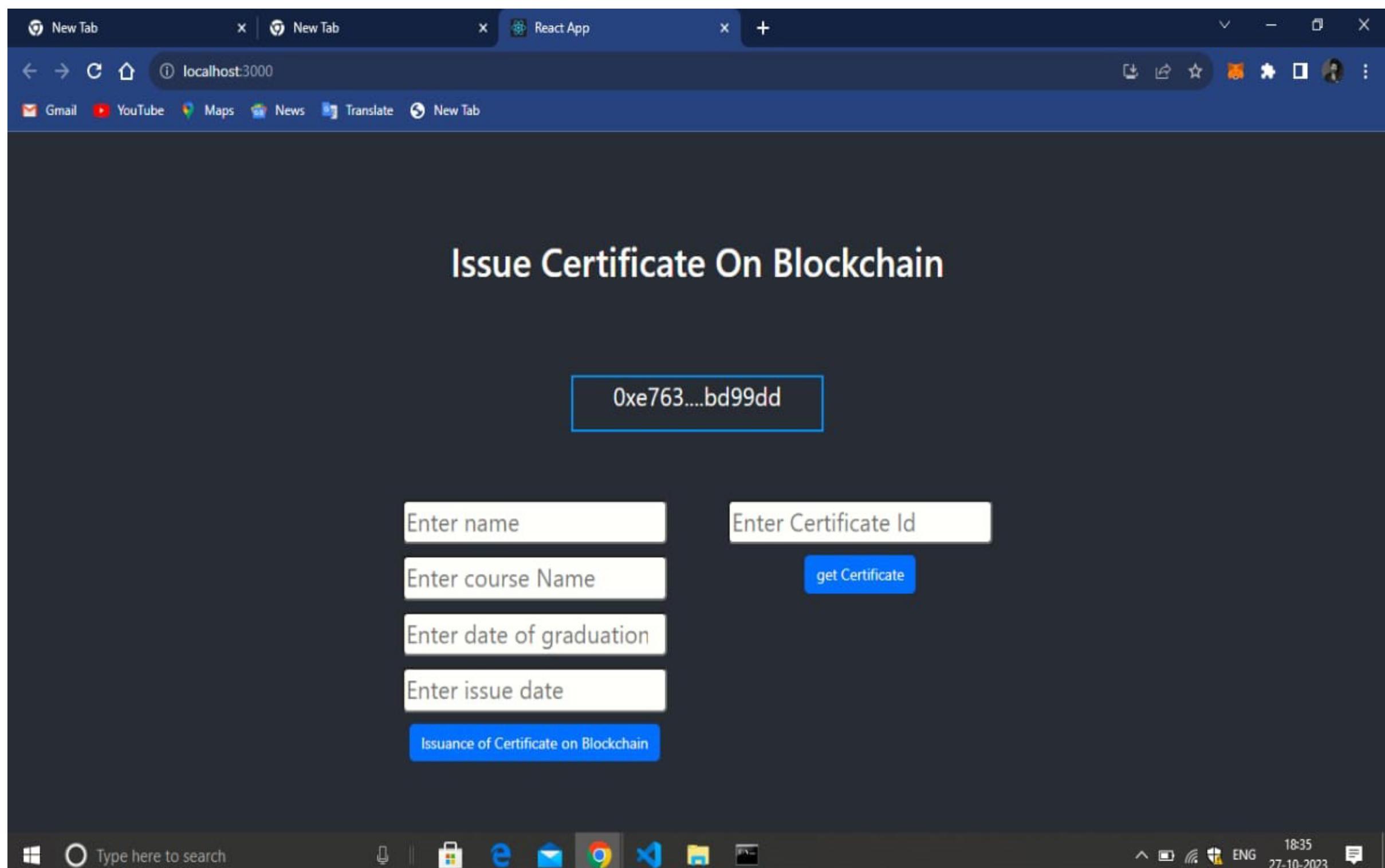
- Left Sidebar:** "DEPLOY & RUN TRANSACTIONS" section with "At Address" selected. It shows a deployed contract named "COLLEGECERTIFICATE AT 0xD91..." with a balance of 0 ETH.
- Middle Column:** A sidebar with buttons for "issueCertificate", "certificates", "getCertificate", "owner", and "totalCertificates".
- Code Editor:** Displays the same Solidity code as the VS Code screenshot.
- Bottom Status Bar:** Shows "18:00 27-10-2023".

Page | 26

4. Open files explorer

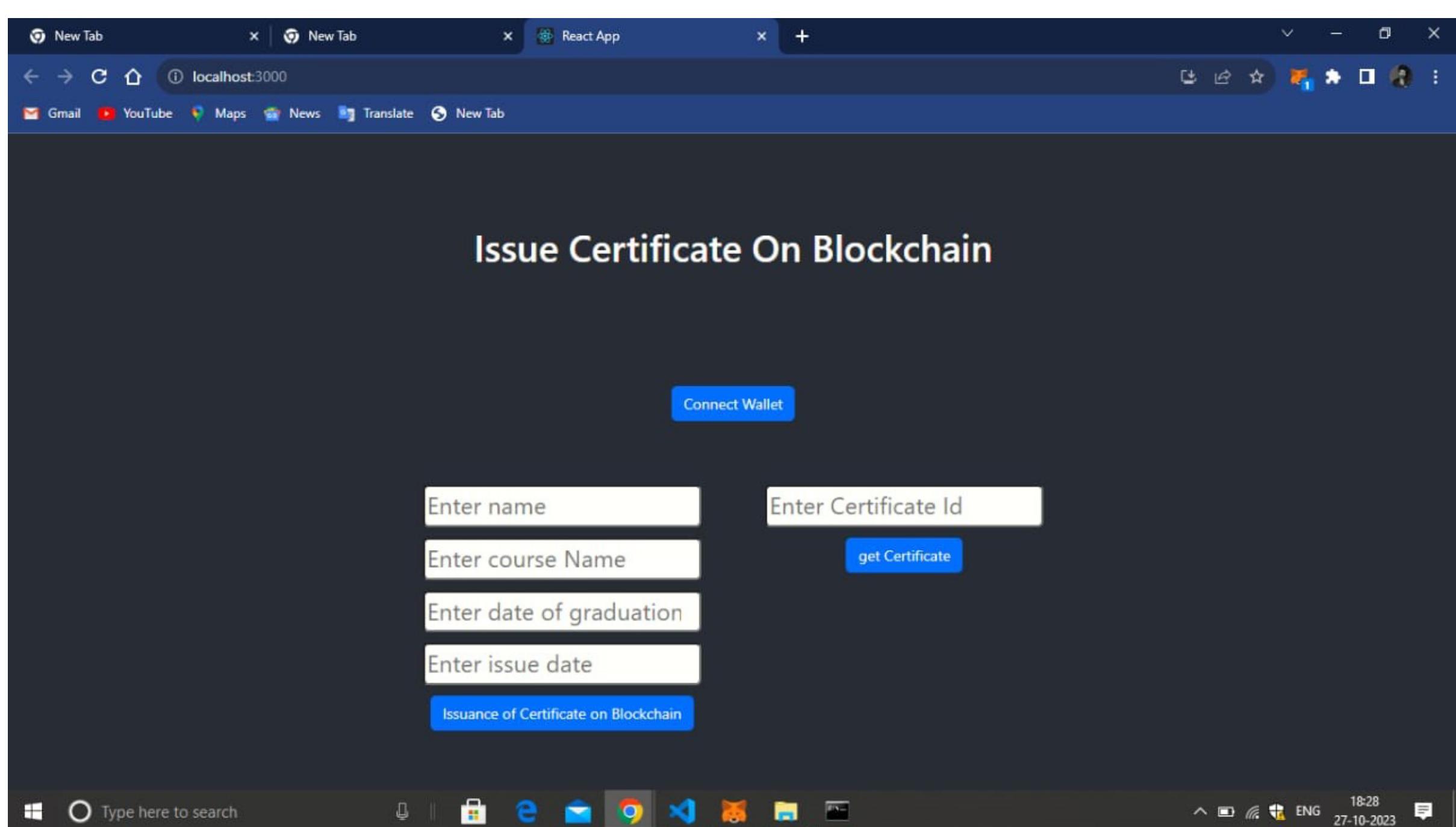


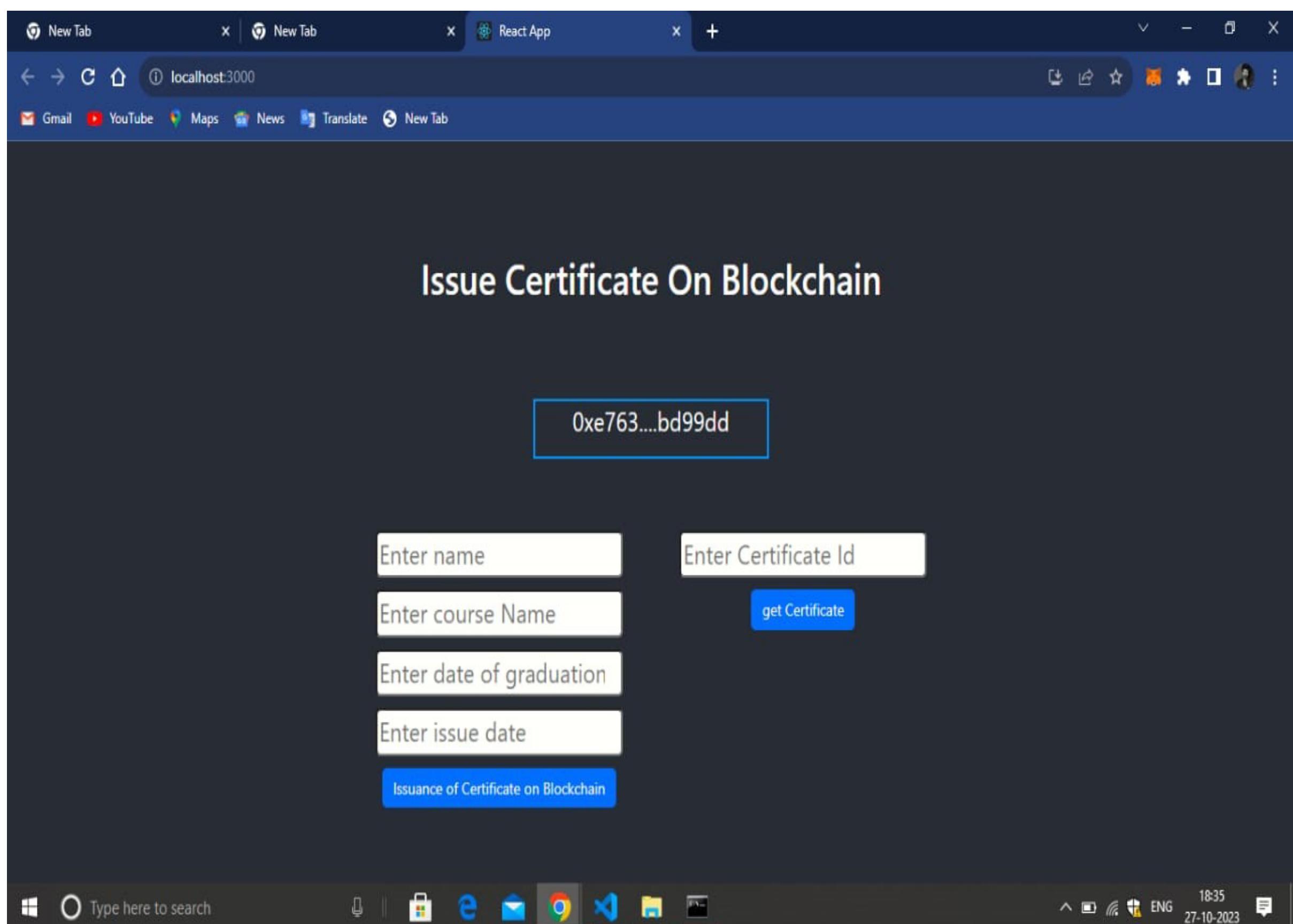
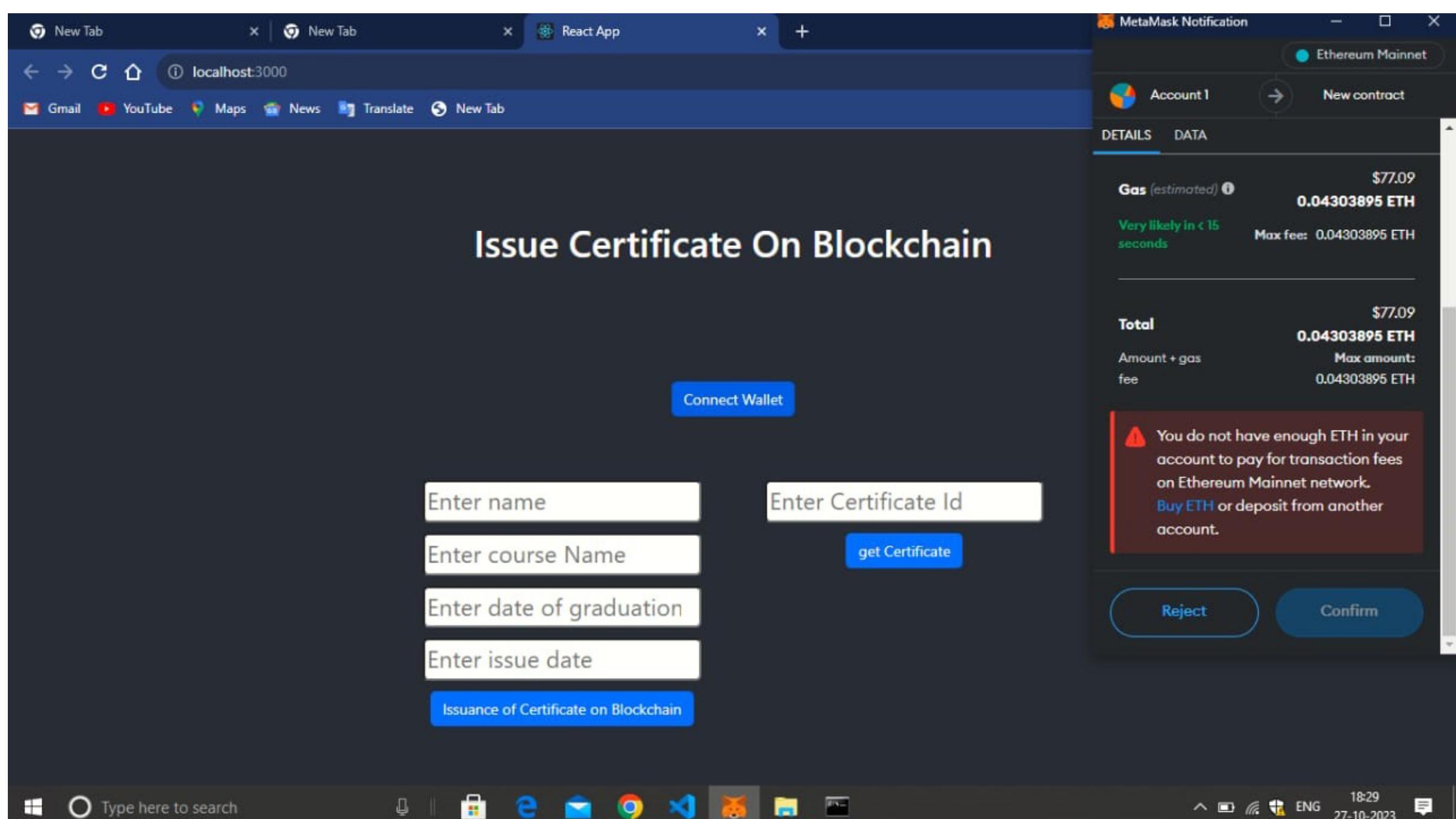
5. Local host IP address



9.RESULTS

9.1 Output Screenshots





10. ADVANTAGES & DISADVANTAGES

Advantages:

1. Accountability: Transparent data management holds educational institutions accountable for their performance, ensuring they use resources effectively and maintain high standards.
2. Informed Decision-Making: Stakeholders, such as parents, students, and policymakers, can make more informed decisions based on accessible data, like school ratings and student outcomes.
3. Quality Improvement: Transparent data can drive improvements in the quality of education by highlighting areas that need attention and reform.

Disadvantages:

1. Privacy Concerns: Sensitive student and teacher data may be exposed, raising privacy concerns and potential data breaches if not adequately protected.
2. Data Misuse: Transparent data can be misused for purposes like profiling students, leading to potential discrimination and bias.

3. Simplistic Metrics: Overreliance on quantitative data can oversimplify the complexity of education, focusing too heavily on standardized testing and neglecting other crucial aspects of learning.

11. CONCLUSION

To effectively implement transparent education data management, institutions should ensure data accessibility, accuracy, and security. User-friendly interfaces, standardized metrics, and clear data governance policies are essential. Additionally, the database schema should be well-designed to organize and manage the data efficiently.

12. FUTURE SCOPE

Blockchain Technology:

Blockchain can enhance data security and transparency. It may be used to securely store and verify educational credentials, making it easier for students to share their achievements.

^{Page | 31}Open Educational Resources (OER):

The transparent sharing of OER materials can help reduce the cost of education and provide accessible resources for learners worldwide.

Virtual Learning Environments:

With the rise of online and hybrid learning, data management will need to adapt to track and improve virtual learning experiences.

Global Benchmarking:

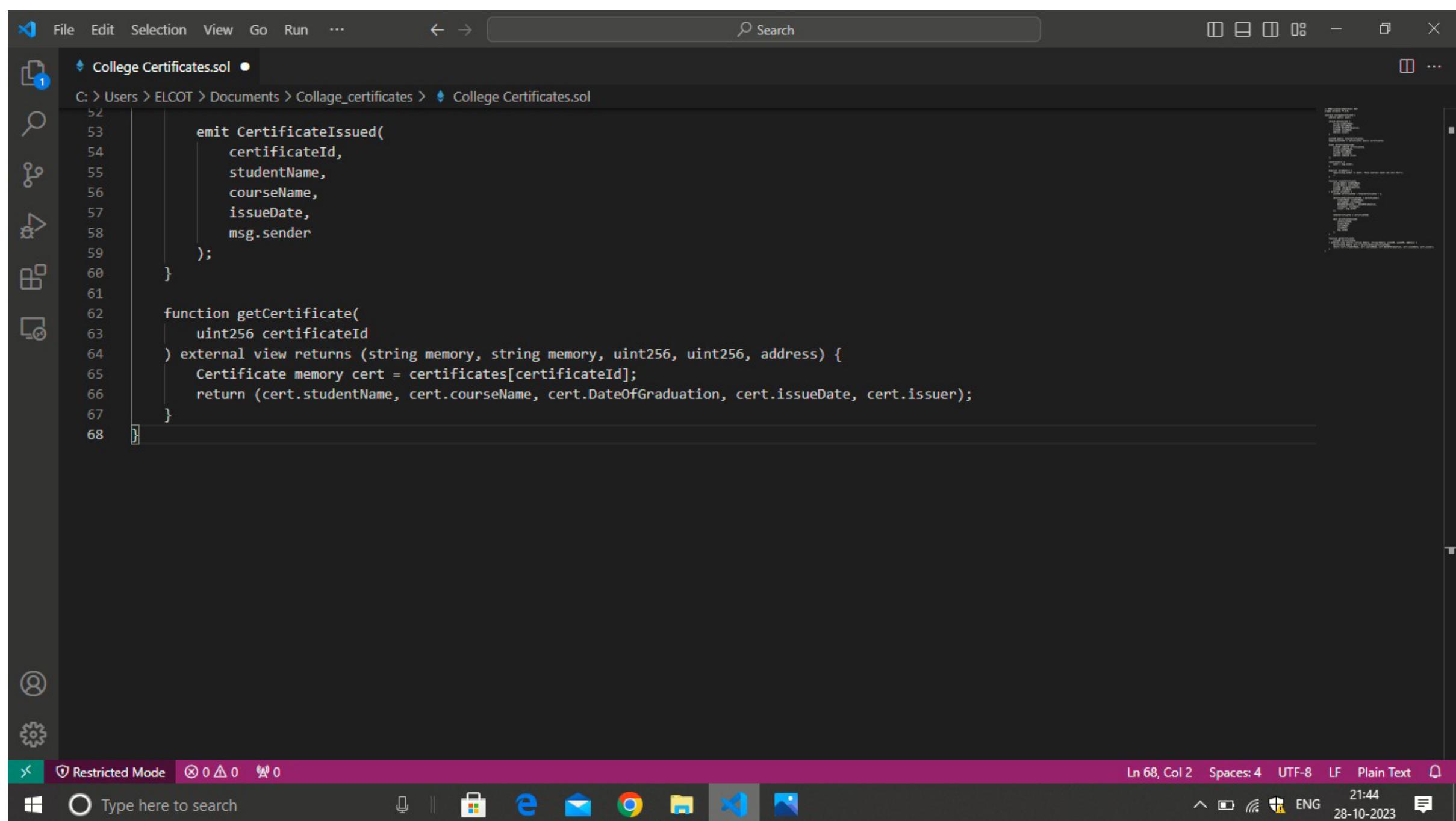
The ability to compare education data across countries will become more important, enabling global benchmarking and international collaboration.

13. APPENDIX

Source Code

```
File Edit Selection View Go Run ... ⏪ ⏩ Search
C: > Users > ELCOT > Documents > Collage_certificates > College Certificates.sol
1 // SPDX-License-Identifier: MIT
2 pragma solidity ^0.8.0;
3
4 contract collegeCertificate {
5     address public owner;
6
7     struct Certificate {
8         string studentName;
9         string courseName;
10        uint256 DateOfGraduation;
11        uint256 issueDate;
12        address issuer;
13    }
14
15    uint256 public totalCertificates;
16    mapping(uint256 => Certificate) public certificates;
17
18    event CertificateIssued(
19        uint256 indexed certificateId,
20        string studentName,
21        string courseName,
22        uint256 issueDate,
23        address indexed issuer
24    );
25
26    constructor() {
27        owner = msg.sender;
28    }
29
30    modifier onlyOwner() {
31        require(msg.sender == owner, "Only contract owner can call this");
32    }
Ln 8, Col 28 Spaces: 4 UTF-8 LF Plain Text
Type here to search 21:40 28-10-2023
```

```
File Edit Selection View Go Run ... ⏪ ⏩ Search
C: > Users > ELCOT > Documents > Collage_certificates > College Certificates.sol
33 }
34
35 function issueCertificate(
36     string memory studentName,
37     string memory courseName,
38     uint256 _dateOfGraduation,
39     uint256 issueDate
40 ) external onlyOwner {
41     uint256 certificateId = totalCertificates + 1;
42
43     certificates[certificateId] = Certificate({
44         studentName: studentName,
45         courseName: courseName,
46         DateOfGraduation : _dateOfGraduation,
47         issueDate: issueDate,
48         issuer: msg.sender
49     });
50
51     totalCertificates = certificateId;
52
53     emit CertificateIssued(
54         certificateId,
55         studentName,
56         courseName,
57         issueDate,
58         msg.sender
59     );
60 }
61
62 function getCertificate()
63     uint256 certificateId
64 ) external view returns (string memory, string memory, uint256, uint256, address) {
Ln 63, Col 6 Spaces: 4 UTF-8 LF Plain Text
Type here to search 21:41 28-10-2023
```



```
College Certificates.sol
C: > Users > ELCOT > Documents > Collage_certificates > College Certificates.sol

52     emit CertificateIssued(
53         certificateId,
54         studentName,
55         courseName,
56         issueDate,
57         msg.sender
58     );
59 }
60
61 function getCertificate(
62     uint256 certificateId
63 ) external view returns (string memory, string memory, uint256, uint256, address) {
64     Certificate memory cert = certificates[certificateId];
65     return (cert.studentName, cert.courseName, cert.DateOfGraduation, cert.issueDate, cert.issuer);
66 }
67
68 }
```

GitHub & Project Demo Link

Git Hub:

<https://github.com/mlavaniya7/Transparent-Education-Data-Management>

Demo Link:

<https://youtu.be/YqXZi0gWsY8?si=EfeQLw6AeT2VmVga>