TRANSPARENT EDUCATION DATA MANAGEMENT

TEAM ID – 75AAE42A61B3A6C9B9D4C495DC4F2542

A REPORT

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ABSTRACT

The management of education data has long been a complex challenge, marked by issues of data integrity, transparency, and accountability. This project delves into the transformative potential of blockchain technology in addressing these challenges. Blockchain, originally devised as the underlying technology for cryptocurrencies, offers a decentralized and secure digital ledger system that records transactions across a network. This project aims to showcase how blockchain can reshape education data management, providing a secure and tamper-proof environment that ensures data accuracy and authenticity.

The central objective of this project is to illustrate how blockchain Can enhance transparency and accountability within the education sector. By adopting blockchain technology, education-related transactions and records can be securely stored and accessed by all stakeholders, ranging from educational institutions to employers and regulatory bodies. This real-time access to verified and immutable academic records not only simplifies processes but also accelerates credential verification, reduces fraud, and promotes accountability throughout the educational journey.

1.INTRODUTION

1.1 PROJECT OVERVIEW

The management of education data has long been a complex challenge, marked by issues of data integrity, transparency, and accountability. This project delves into the transformative potential of blockchain technology in addressing these challenges. Blockchain, originally devised as the underlying technology for cryptocurrencies, offers a decentralized and secure digital ledger system that records transactions across a network. This project aims to showcase how blockchain can reshape education data management, providing a secure and tamper-proof environment that ensures data accuracy and authenticity.

The central objective of this project is to illustrate how blockchain can enhance transparency and accountability within the education sector. By adopting blockchain technology, education-related transactions and records can be securely stored and accessed by all stakeholders, ranging from educational institutions to employers and regulatory bodies. This real-time access to verified and immutable academic records not only simplifies processes but also accelerates credential verification, reduces fraud, and promotes accountability throughout the educational journey.

1.2.Purpose

Ensuring the protection of sensitive educational data, such as student records, grades, and personal information, and providing a transparent framework for data privacy and security to build trust among students, parents, and educators. Building trust among stakeholders by demonstrating a commitment to responsible data handling, which in turn fosters accountability for the use of data in education. Empowering educators and administrators with access to reliable and timely data for making informed decisions about curriculum, instruction, resource allocation, and overall educational improvements. Supporting educators in tailoring instruction to individual student needs, allowing for personalized learning experiences and improved student outcomes. Enhancing communication between educational institutions, students, parents, and educators by providing access to relevant data, such as progress reports, attendance records, and performance feedback.

2. LITERATURE SURVEY

2.1 Exsisting problem

Blockchain's role in education:

Blockchain technology can be used to create a secure and transparent system for managing education data. This can help to reduce fraud, improve efficiency, and enhance trust in educational records.

Benefits of blockchain in education:

Blockchain-based education data management systems offer a number of advantages.

Reduced fraud:

Blockchain's immutability and transparency can help to prevent unauthorized changes to educational records, such as grades and diplomas.

Efficient credential verification:

Blockchain can be used to create digital diplomas and certificates that can be easily verified by employers and other institutions.

Enhanced trust in educational records:

Blockchain-based systems can provide a tamper-proof record of academic achievement, which can help to improve trust in educational institutions.

Challenges of blockchain in education:

Despite its many benefits, blockchain also poses a number of challenges for the education sector.

Scalability issues:

Current blockchain networks are not yet able to handle the high volume of transactions required for large-scale education data management systems.

Privacy concerns:

The transparency and immutability of blockchain can pose privacy risks, as sensitive student data could be exposed on the public ledger.

Regulatory compliance:

Education data is subject to a variety of laws and regulations, which can make it difficult to ensure compliance with blockchain-based systems.

Real-world use cases of blockchain in education:

A number of real-world use case of blockchain in education are emerging.

Digital diplomas:

Blockchain-based digital diplomas can be easily verified by employers and other institutions.

2.2 REFERENCE

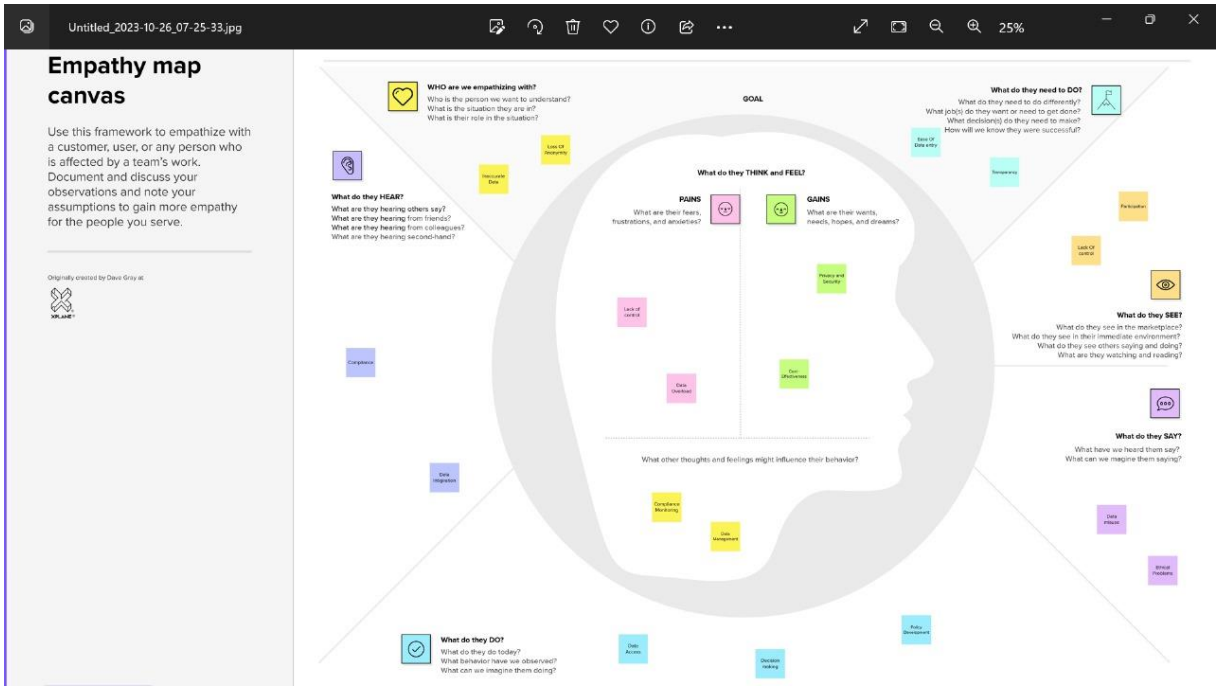
- Ifeoluwapo Aribilola, Iram Arshad, Muhammad Azeem, Ciara Buckley,"How transparent are quantitative studies in contemporary technology educat ionresearch? Instrument development and analysis",International Journal ofTechnology and Design Education (2023)
- Author links open overlay panelXuemin (Sherman) Shen a,"Blockchain for Transparent Data Management Toward 6G" Dongxiao Liu a, Cheng Huang a,Liang Xue a Han Yin a, Weihua Zhuang a, Rob Sun b, Bidi Ying
- Santosh Kumar Pani, KIIT Deemed to be University, Bhubaneswar, India Rajdeep Chatterjee,Nihar Ranjan Mahapatra, Bhubaneswar, India."Towards a Trusted, Transparent and Motivational Professional EducationSystem Through Blockchain".

2.3 .Problem Statement Definition

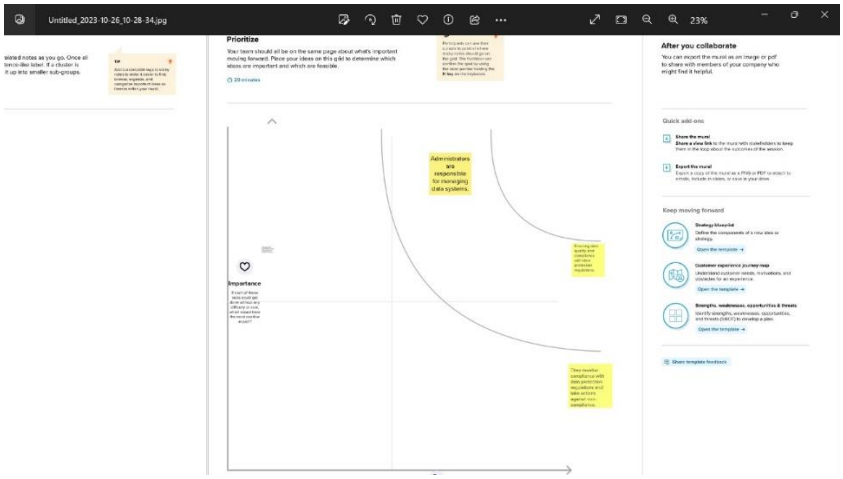
The business problem of Transparent Education Data Management is the need to establish a secure and accountable system for collecting, storing, and sharing educational data. This includes student records, academic performance, financial transactions, and administrative processes. Transparency is crucial to ensure data accuracy, privacy, and compliance with regulations while enabling stakeholders, such as students, parents, educators, and government agencies, to access and verify educational information easily. Solving this problem requires robust data management systems, blockchain technology, and data protection measures to maintain trust and integrity in the education sector.

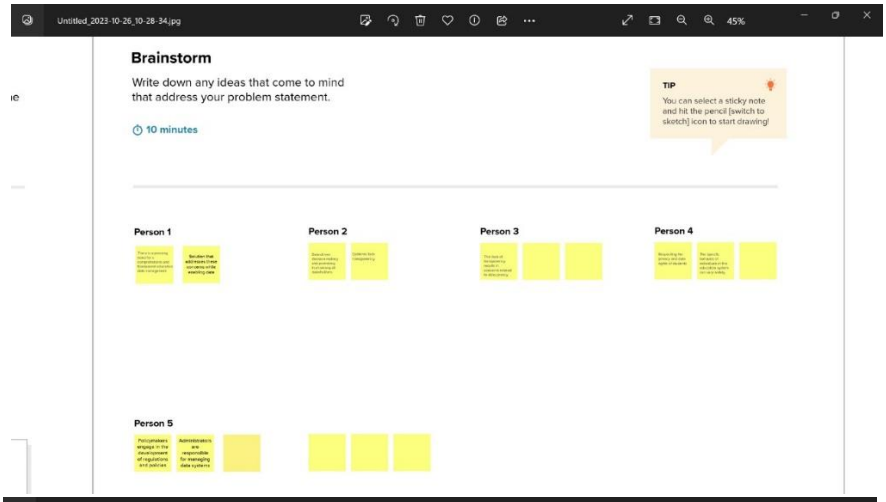
3. IDEATION & PROPOSED SOLUTION

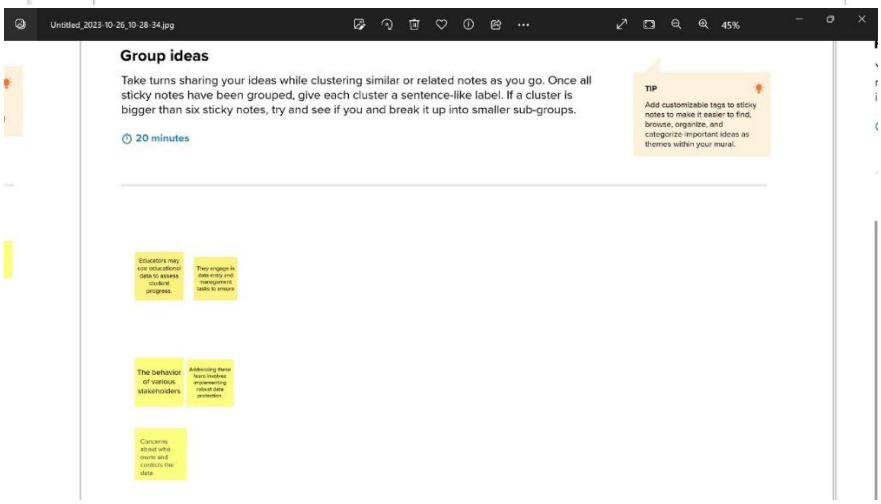
3.1 .Empathy Map Canvas

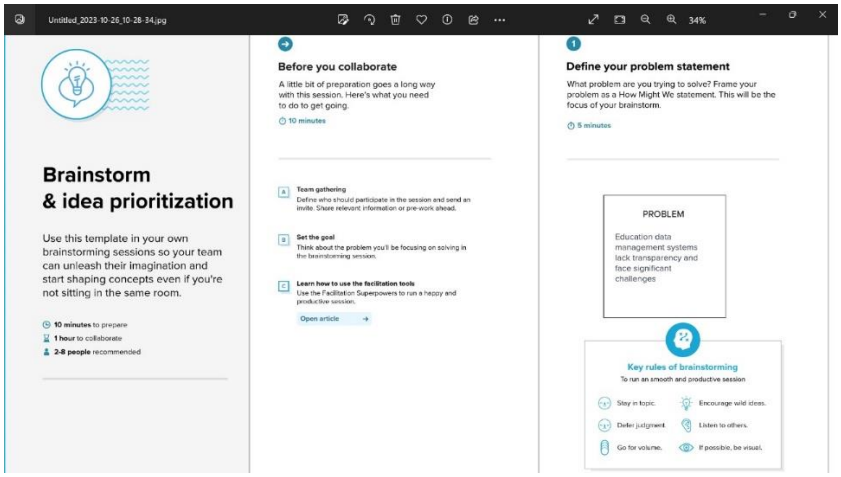


3.2 Ideation & Brainstorming









4. REQUIREMENT ANALYSIS

4.1. Functional requirement

Functional requirements in the context of transparent education data management typically outline the specific features and capabilities that a system or software should have in order to meet its objectives and address the needs of users and stakeholders. Here are some functional requirements for a transparent education data management system

1. **User Authentication and Authorization**:

User registration and login for students, parents, educators, administrators, and other authorized personnel. Role-based access control to ensure that users can only access data relevant to their roles.

2.**Data Collection and Storage**:

Data collection capabilities to capture and store student records, academic performance, attendance , and other relevant data. Support for various data formats and sources, such as manual entry, automated systems, and third-party integrations

3.**Data Transparency**:

Clear and user-friendly presentation of educational data to students, parents, educators, and administrators. Easily understandable data visualizations and reports for tracking progress and performance.

4.**Data Security and Privacy**:

Robust data encryption and security measures to protect sensitive data from unauthorized access. Compliance with data protection regulations (e.g., GDPR, FERPA) to ensure data privacy

4.2 Non-Functional requirements

Non-functional requirements in the context of transparent education data management are attributes or characteristics that describe how a system should perform, rather than specific features or functions. They are important for ensuring that the system operates effectively and meets certain quality standards. Here are some non-functional requirements for a transparent education data management system

Security:

Data Encryption: Data should be encrypted both in transit and at rest to protect against unauthorized access.

Access Control:

Strict access controls and authentication mechanisms should be in place to prevent unauthorized use.

Audit Trails:

The system should maintain detailed audit trails to track data access and modifications.

Data Backup and Recovery:

Regular data backups and a disaster recovery plan should be implemented to prevent data loss in case of system failures or disasters.

Compliance:

The system should comply with relevant data protection and privacy regulations, such as GDPR, FERPA, or other regional requirements. Compliance with accessibility standards to ensure that the system is accessible to individuals with disabilities.

Usability:

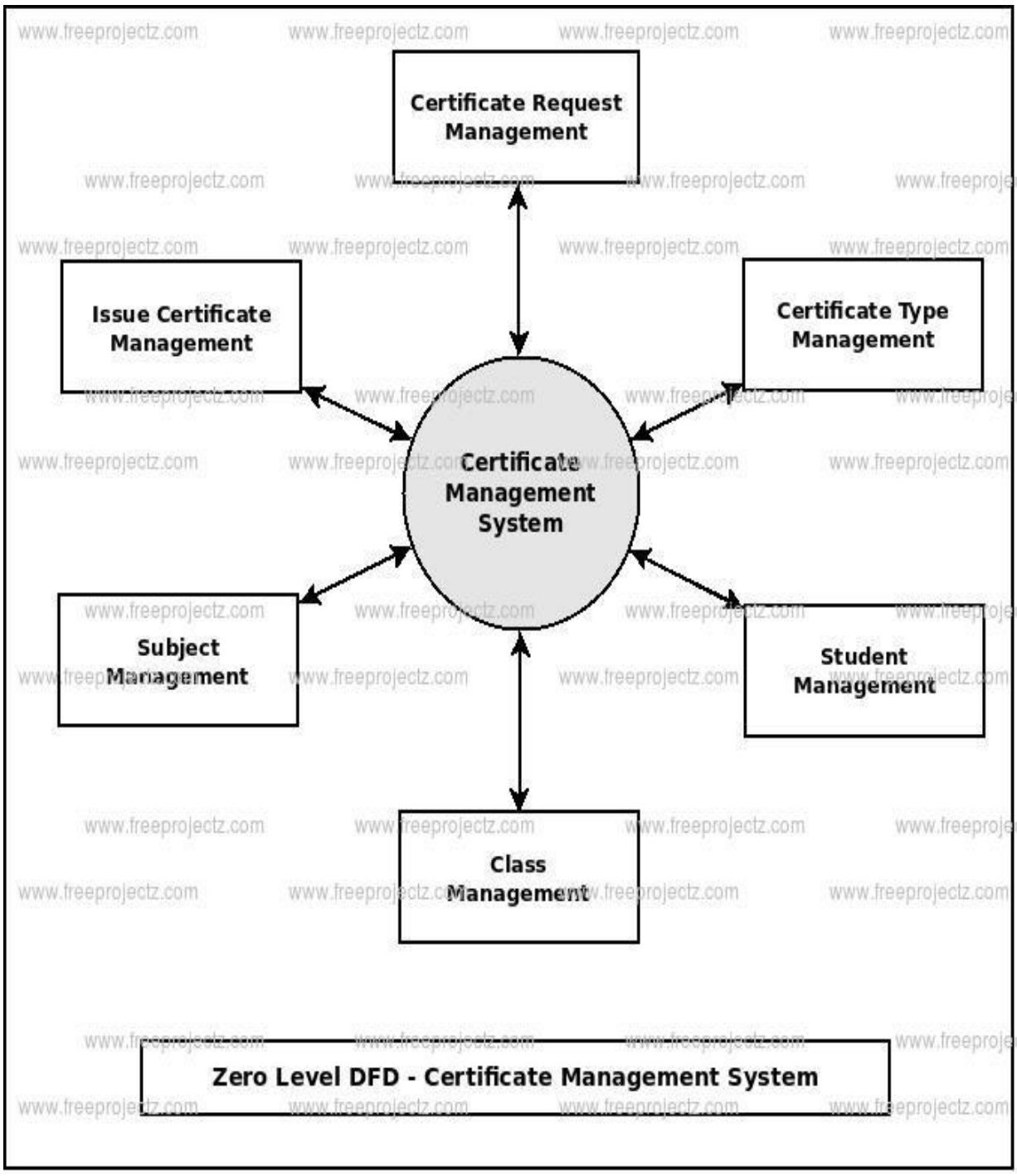
The user interface should be intuitive and user-friendly to ensure that users can easily navigate the system. Support for multiple languages and user preferences to accommodate diverse user groups.

5 PROJECT DESIGN

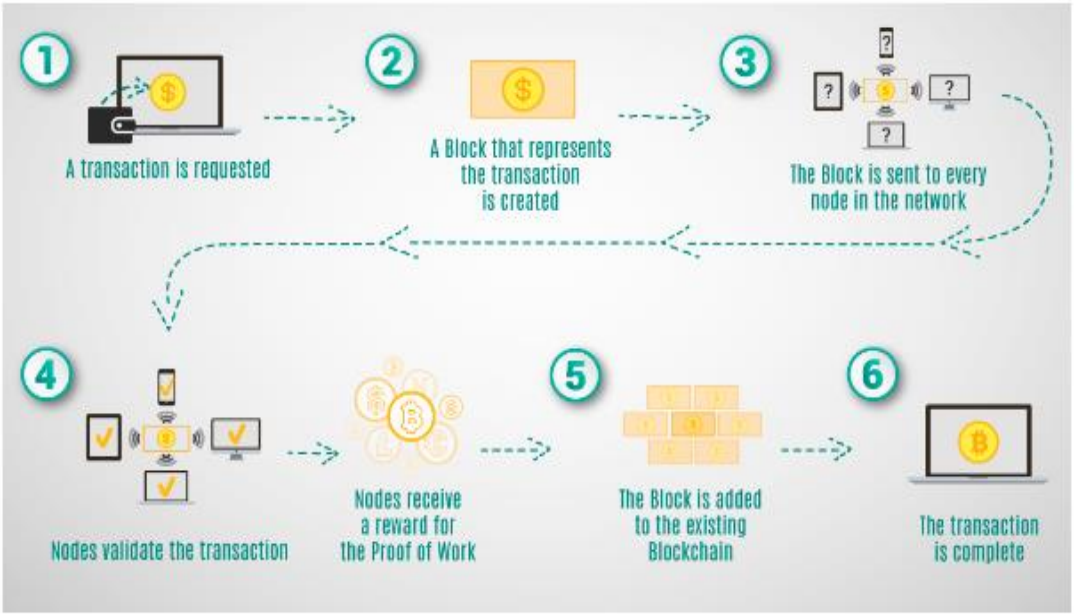
5.1. Performance:

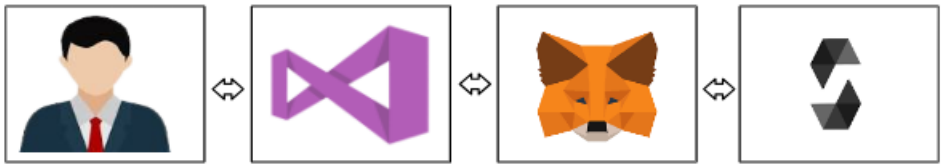
- **Response Time:** The system should provide quick response times for data retrieval and interaction to ensure a smooth user experience.
- **Scalability**: The system should be able to handle increased data and user loads as educational institutions grow or as user numbers increase.
- **Reliability:** The system should be highly reliable, with minimal downtime and robust failover mechanisms in place.

5.1. Data Flow Diagrams



5.2 Solution & Technical Architecture





End User

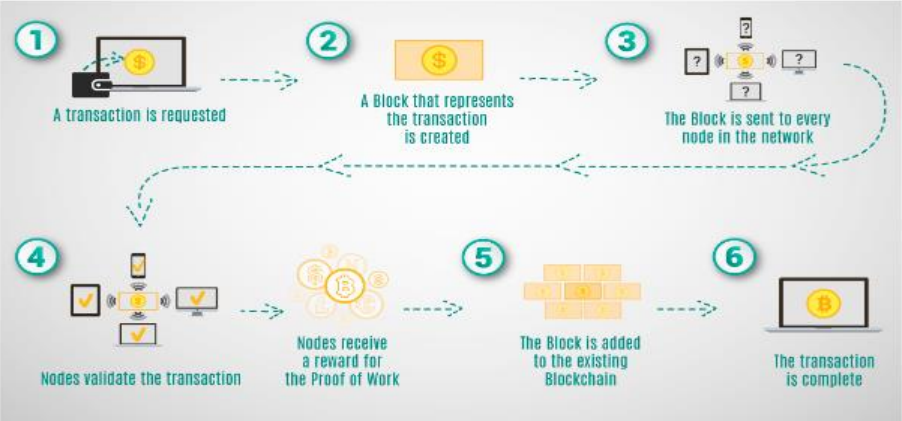
Frontend (VS code)

Metam ask

Solidity code (blockc hain code)

6. PROJECT PLANNING & SCHEDULING

6.1 Technical Architecture



6.2 Sprint Planning & Estimation

Sprint Planning:

Backlog Refinement: Before sprint planning, ensure that the product backlog is well-prioritized and contains well-defined items.

Sprint Goal: Collaboratively define the sprint goal with the Product Owner and Development Team, representing what the team aims to achieve in the sprint.

Selecting User Stories: Based on the sprint goal, choose user stories or backlog items from the product backlog that collectively contribute to the sprint goal.

Breaking Down User Stories: If necessary, break down user stories into smaller tasks that are clear and actionable.

Estimation: The Development Team estimates the effort required to complete tasks, often using techniques like story points, ideal days, or hours.

Capacity Planning: Assess the team's capacity for the sprint, considering their velocity and individual availability.

Task Allocation: Assign tasks to team members based on their skills and capacity.

Definition of Done (DoD): Agree on the criteria that define when a task is considered "done" to ensure consistent quality.

Sprint Estimation:

Story Points: Assign relative values to user stories to represent complexity, risk, and effort.

Ideal Days: Estimate how many ideal workdays a task will take to complete.

Hours: Estimate the number of hours required for each task.

6.3 Sprint Delivery Schedule

Sprint Number and Duration: Indicate the sprint number (e.g., Sprint 1, Sprint 2) and the duration of each sprint (typically 2-4 weeks).

Start Date and End Date: Specify the start and end dates for each sprint. These dates determine when the sprint activities begin and when they are expected to conclude.

Sprint Goal: Define the specific goal or objectives for each sprint. This should align with the project's overall goals and user stories selected for the sprint.

User Stories and Tasks: List the user stories and tasks that the development team plans to work on during the sprint. Include a brief description of each.

Priority: Indicate the priority of user stories or tasks within the sprint. This helps the team focus on the most critical items first.

Team Assignments: Specify which team members are responsible for each user story or task. This clarifies roles and responsibilities.

Estimated Effort: Include the estimated effort in terms of story points, ideal days, or hours for each user story or task. This helps in capacity planning.

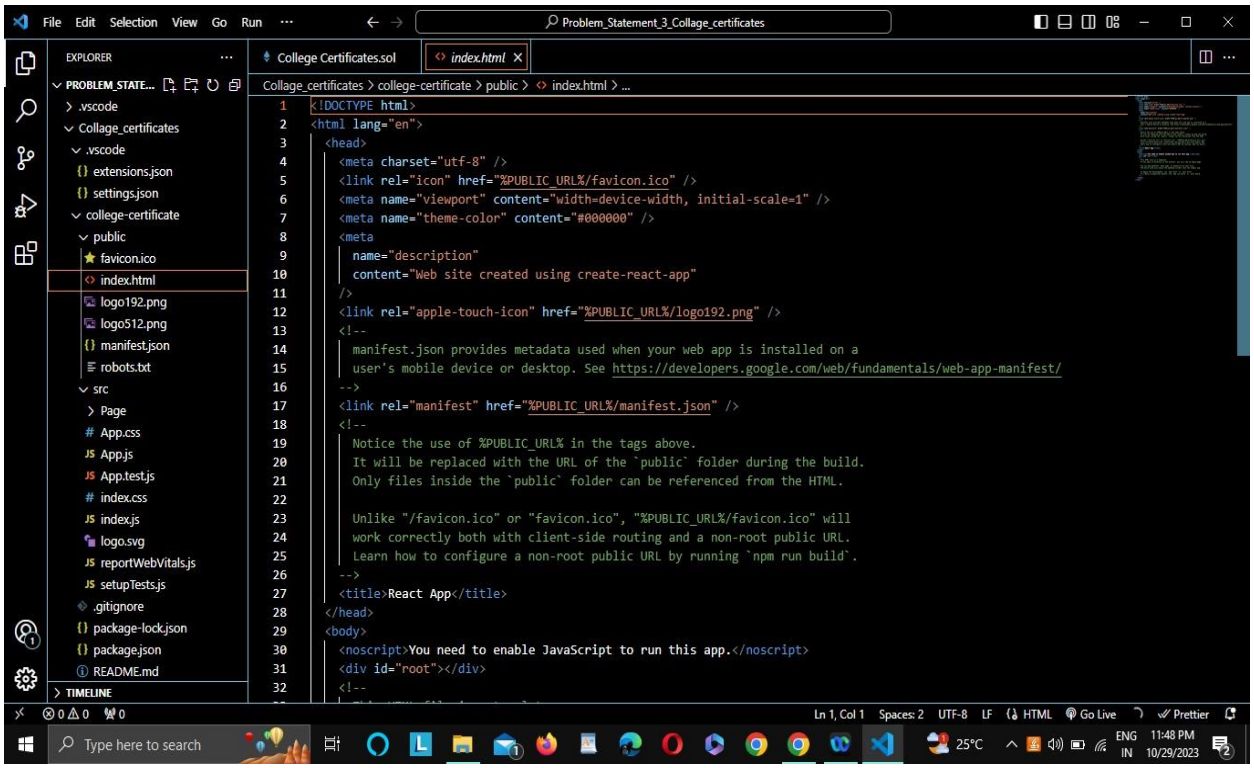
Dependencies: Note any dependencies between user stories or tasks within the sprint or with external factors.

Review and Demo Dates: Schedule the date for the sprint review and demo. This is when the team showcases the completed work to stakeholders.

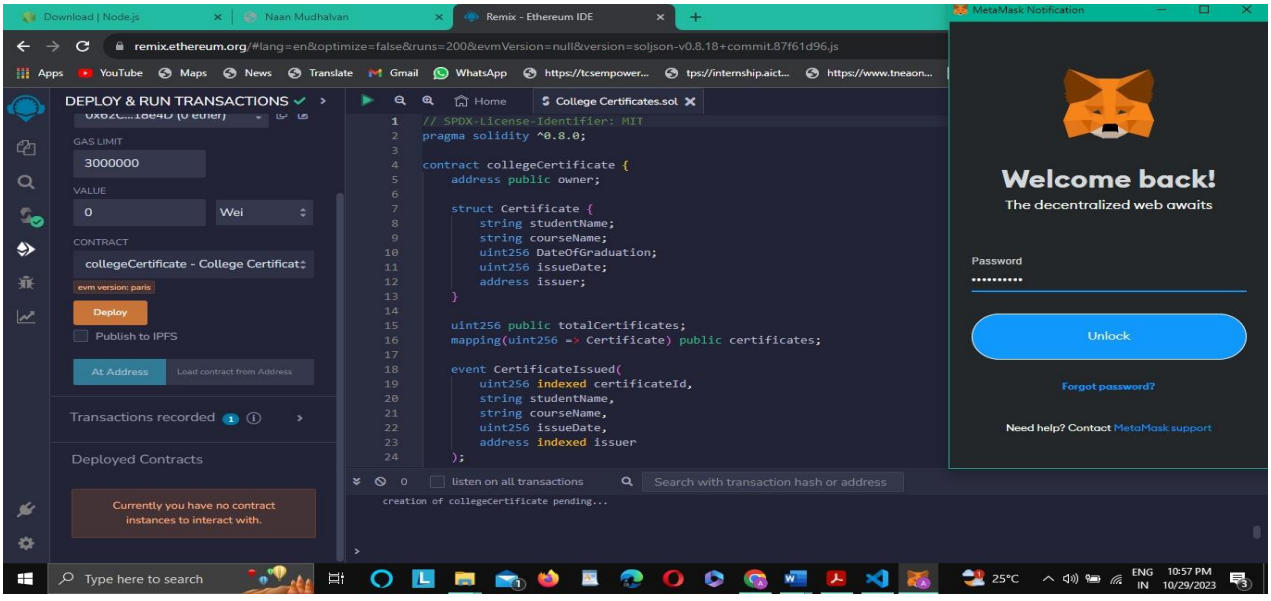
Retrospective Date: Plan a retrospective meeting at the end of the sprint for the team to discuss what went well and what could be improved.

7.CODING & SOLUTIONING

7.1 Feature 1



7.2 Feature 2



8.PERFORMANCE TESTING

8.1 Performance Metrics

Performance metrics are specific, quantifiable measures used to assess the performance or effectiveness of a system, process, project, or organization. They provide a means to track progress and make data-driven decisions.

Objective Measurement: Metrics are objective and based on empirical data, making them a reliable source of information for decision-makers.

Key Performance Indicators (KPIs): KPIs are a subset of performance metrics that are particularly critical to an organization's goals and strategy. They serve as benchmarks for success.

Types of Metrics: Performance metrics can vary widely depending on what is being measured. Common types include financial metrics, operational metrics, customer satisfaction metrics, and employee performance metrics.

Qualitative and Quantitative Metrics: Metrics can be qualitative (based on quality assessments, such as customer feedback) or quantitative (numerical data, like revenue, response times, or error rates).

Benchmarking: Metrics often involve comparing current performance to historical data or industry benchmarks to identify trends and areas for improvement.

Real-Time Monitoring: Some metrics are monitored in real-time, providing immediate feedback and enabling rapid response to issues or opportunities.

Balanced Scorecard: The balanced scorecard is a framework that incorporates multiple performance metrics across various perspectives, such as financial, customer, internal processes, and learning and growth.

Goals and Targets: Metrics are most useful when they are tied to specific goals and targets, helping organizations track progress toward achieving objectives.

Visualization: Data visualization tools, such as dashboards and graphs, are often used to present performance metrics in a way that is easily digestible and understandable.

Continuous Improvement: The analysis of performance metrics often leads to process optimization and continuous improvement efforts within organizations.

Dynamic Nature: As circumstances change, performance metrics may need to be adjusted to reflect new goals or shifting

Continuous Improvement: The analysis of performance metrics often leads to process optimization and continuous improvement efforts within organizations.

Dynamic Nature: As circumstances change, performance metrics may need to be adjusted to reflect new goals or shifting priorities.

Feedback Loop: Metrics provide a feedback loop that helps organizations learn from their performance, make adjustments, and refine strategies.

Cascading Metrics: In larger organizations, metrics can be cascaded down from high-level strategic metrics to departmental or team-level metrics, ensuring alignment with overall goals.

Confidentiality and Data Security: It's important to consider data confidentiality and security when collecting and reporting performance metrics to protect sensitive information.

Employee Incentives: In some cases, organizations use performance metrics to drive employee performance and offer incentives or bonuses based on individual or team achievements.

Cost-Effectiveness: Metrics can help identify inefficiencies and areas where cost savings can be realized, improving cost-effectiveness.

Industry-Specific Metrics: Different industries and sectors may use unique performance metrics tailored to their specific needs and objectives

9. RESULTS

9.1 Output Screenshots

10. ADVANTAGES & DISADVANTAGES

Transparent education data management has several advantages and some potential disadvantages. Here are the key advantages and disadvantages

ADVANTAGES:

Data-Driven Decision-Making:

Education data management systems provide educators and administrators with valuable insights to make informed decisions about curriculum, teaching strategies, and resource allocation, leading to improved educational outcomes.

Personalized Learning: These systems can support personalized learning by tailoring instruction to individual student needs, helping students reach their full potential.

Improved Communication: Transparent data systems facilitate communication between students, parents, educators, and administrators, leading to better engagement and collaboration within the educational community.

Data Security: Properly implemented data management systems include robust security measures to protect sensitive student information and prevent data breaches.

Data Privacy Compliance: Such systems ensure compliance with data protection regulations, helping to protect the privacy of students and other stakeholders.

Efficiency: Data management systems streamline administrative tasks, reducing paperwork and improving the efficiency of educational institutions.

Accountability: Transparent data systems promote accountability in education by ensuring that data is used responsibly and ethically.

DISADVANTAGES:

While blockchain technology has the potential to enhance the transparency and security of education data management, it also comes with certain disadvantages and challenges. Here are some of the disadvantages of transparent education data management using blockchain:

Scalability Issues: Blockchain systems can face scalability challenges, particularly when handling a large volume of data. In educational institutions with numerous students, staff, and courses, managing all the data on a blockchain can become cumbersome.

Cost: Implementing and maintaining a blockchain system can be expensive. Education institutions may need to invest in hardware, software, and ongoing maintenance. This cost can be a barrier, especially for smaller institutions with limited budgets.

Energy Consumption: Many blockchain networks, especially those using proof-of-work consensus mechanisms, consume significant amounts of energy. This is an environmental concern and can be costly for institutions, both in terms of electricity bills and sustainability goals.

Complexity: Blockchain technology can be complex and may require specialized knowledge to set up and manage. Educational institutions may need to hire or train staff with blockchain expertise, which can be time-consuming and costly.

Privacy Concerns: While transparency is a benefit, it can also be a disadvantage when it comes to student and staff privacy. Storing educational data on a public blockchain may expose sensitive information to the public, which can lead to privacy breaches and concerns.

11 . CONCLUSION

In conclusion, transparent education data management is a critical component of the modern educational landscape. It is a multifaceted approach that involves collecting, storing, and using educational data in a responsible, secure, and transparent manner to benefit students, parents, educators, administrators, and policymakers.

Key points to consider include:

1. **Purpose:** Transparent education data management aims to protect data privacy, promote data security, and facilitate data-informed decision-making while building trust among stakeholders in the educational ecosystem.
2. **Functional Requirements**: Functional requirements define the specific features and capabilities a system should have, including data collection, storage, transparency, security, communication, and support, to meet its objectives.
3. **Non-Functional Requirements:** Non-functional requirements encompass attributes such as performance, security, compliance, usability, and scalability, which are essential for ensuring that the system operates effectively and meets certain quality standards.
4. **Future Scope**: The future of transparent education data management is promising, with advancements in data analytics, blockchain, artificial

However, it's important to be aware of the potential advantages and disadvantages of performance metrics, including their ability to provide objective insights while also carrying the risk of incomplete assessments or manipulation. In summary, the "Transparent Education Data Management" project, driven by blockchain technology, stands to revolutionize the education sector by enhancing transparency, security, and accountability in data management. It underscores the potential for innovative solutions to address complex challenges and transform traditional practices, ultimately benefiting students, institutions, employers, and regulators. The well-structured project components and features ensure its success and impact within the education landscape

12. FUTURE SCOPE

The future scope of transparent education data management is promising, as it aligns with the ongoing advancements in technology, education, and data management. Here are some key areas of future development and growth:

1.Enhanced Data Analytics: Advanced data analytics and machine learning techniques will play a crucial role in extracting meaningful insights from educational data. This will enable more personalized learning experiences, early intervention for struggling students, and better decision-making for educators and administrators.

2.Blockchain and Decentralization: Blockchain technology is being explored for securely managing educational data. It can provide a tamper-proof and decentralized ledger for academic credentials, ensuring transparency and authenticity in the verification of qualifications.

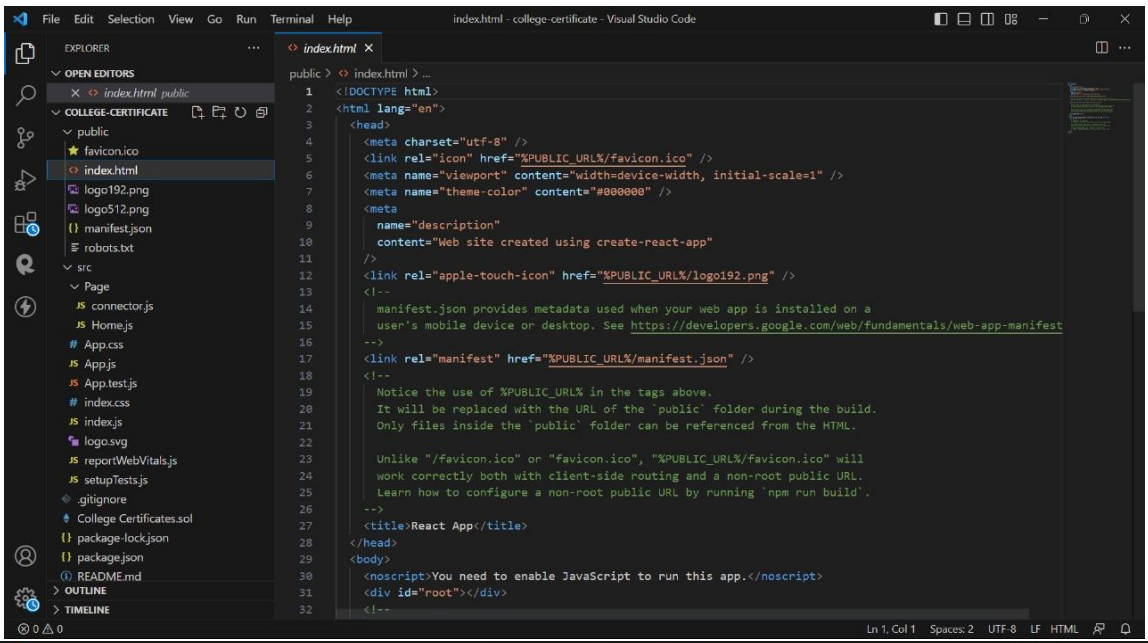
3.AI and Chatbots for Student Support: AI-driven chatbots and virtual assistants will become more common for providing students with real-time support and guidance, answering questions, and offering assistance in navigating their educational journey.

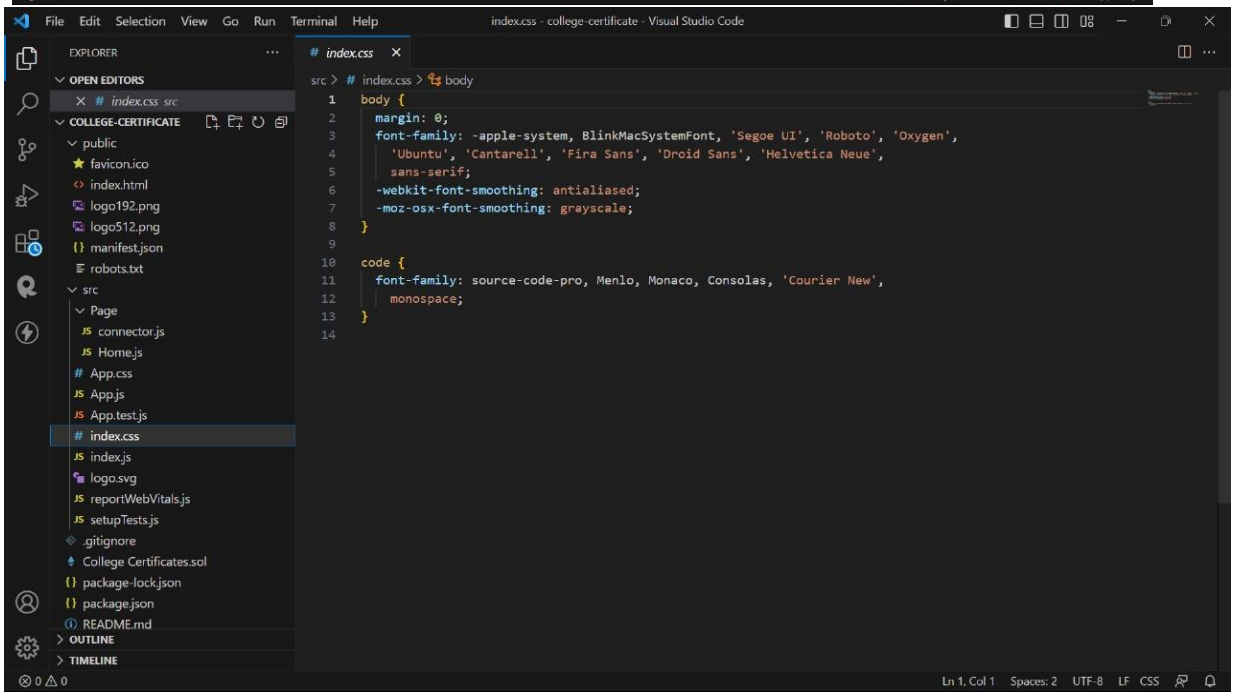
4.Cross-Institutional Data Sharing: The future may see more interoperability and data sharing among educational institutions, allowing for a comprehensive view of a student's academic history and facilitating smoother transitions between schools or higher education institutions.

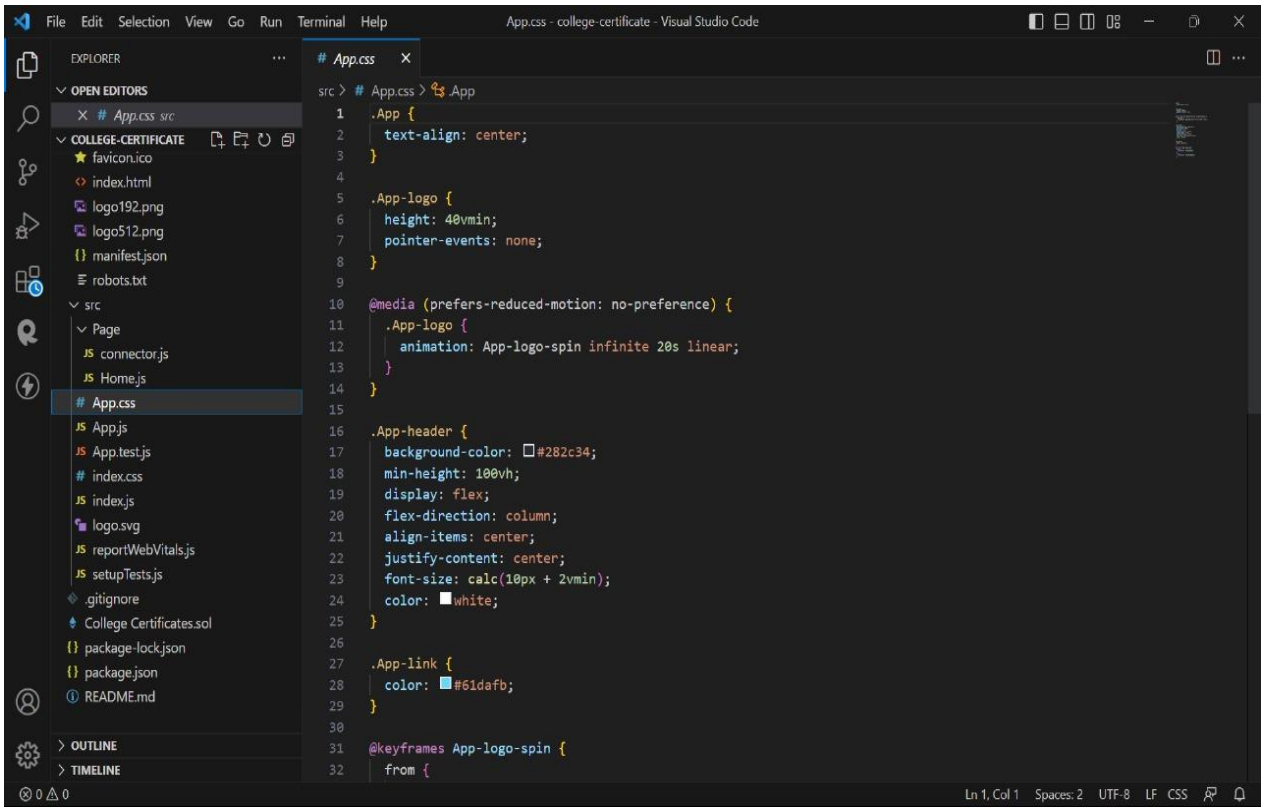
5.Data Portability: The ability for students to easily access and transfer their educational data between institutions will become a priority, allowing for a more seamless educational experience.

13. APPENDIX

(Source Code Frontend – Vscode)



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App.css - college-certificate - Visual Studio Code
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logo512.png
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logo.svg
reportWebVitals.js
setupTests.js
.gitignore
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package-lock.json
package.json
README.md
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TIMELINE
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}
.App-logo {
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color: white;
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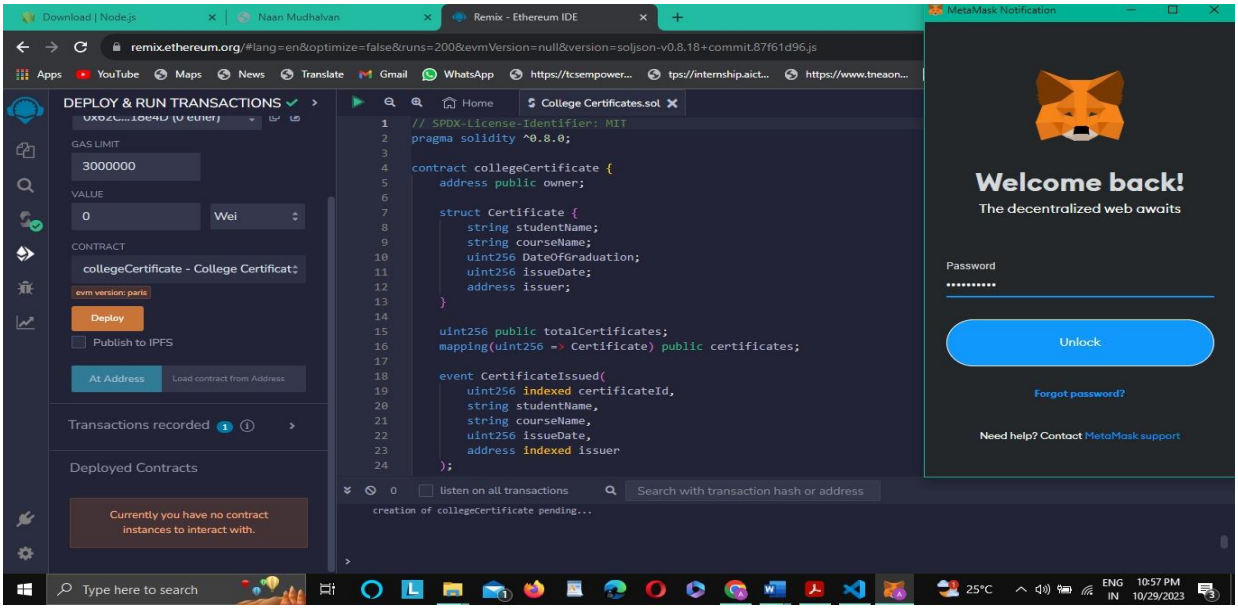
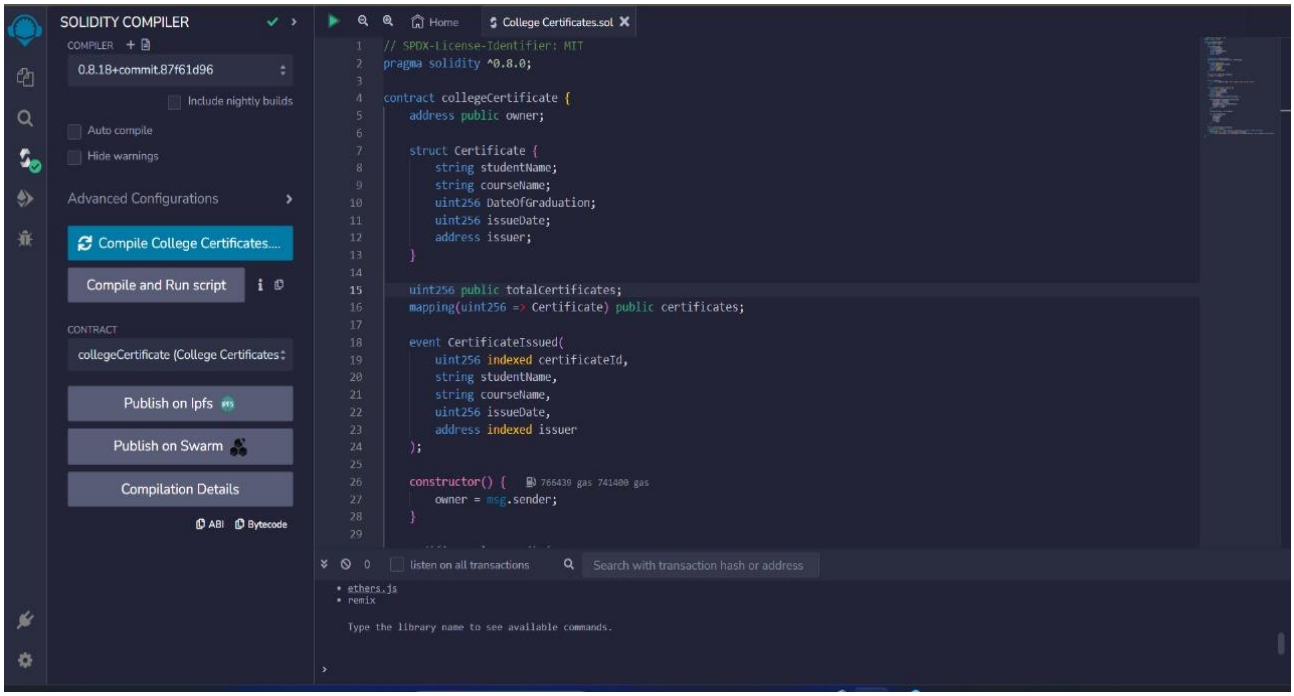
Remix IDE


Remix - Ethereum IDE
remix.ethereum.org/#lang=en&optimize=false&runs=200&evmVersion=null&version=soljson-v0.8.18+commit.87f61d96.js
DEPLOY & RUN TRANSACTIONS
GAS LIMIT
3000000
VALUE
0
Wei
CONTRACT
collegeCertificate - College Certificat
Deploy
Publish to IPFS
At Address
Load contract from Address
Transactions recorded
Deployed Contracts
Currently you have no contract instances to interact with.
College Certificates.sol
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;
contract collegeCertificate {
address public owner;
struct Certificate {
string studentName;
string courseName;
uint256 DateOfGraduation;
uint256 issueDate;
address issuer;
}
uint256 public totalCertificates;
mapping(uint256 => Certificate) public certificates;
event CertificateIssued(
uint256 indexed certificateId,
string studentName,
string courseName,
uint256 issueDate,
address indexed issuer
);
creation of collegeCertificate pending...
MetaMask Notification
Welcome back!
The decentralized web awaits
Password
Unlock
Forgot password?
Need help? Contact MetaMask support



Metamask Connection

GitHub & Project Demo Link

Github Repository

Link: https://github.com/sowndaryalakshmi42/nm-trans-edu

Demo link:

https://drive.google.com/drive/u/0/folders/1SE5qR3bNKD7gyePhxSk WJt_2MTtpBj61