PROJECT REPORT

Team Id	NM2023TMID01505
Project Name	Transparent Education Data Management

1.INTRODUCTION

- **Project overview**

1. Introduction:

Implementing blockchain technology in education data management ensures secure, immutable, and transparent records. By leveraging its decentralized structure, it establishes trust, enhances data integrity, and enables seamless access, revolutionizing educational information management

2. Objectives:

- Develop a blockchain-based system for storing and managing educational records.
- Ensure data security and integrity by using blockchain's decentralized and immutable ledger.
- Create a user-friendly interface for students, educational institutions, and employers to access and verify academic records.

3. Key Features:

- Blockchain Integration: Implement a private or consortium blockchainnetwork to store and manage educational data.
- User Authentication: Establish a secure authentication system forstudents, educational institutions, and employers.
- Immutability: Blockchain ensures that educational records cannot be altered, maintaining their integrity.
- Decentralization:Eliminates the need for a central authority, enabling distributed and transparent data access.
- Enhanced Security: Utilizes cryptographic techniques, reducing the risk of data tampering or unauthorized access.
- Transparency: Offers a transparent and auditable system for educational data, promoting trust and accountability.
- Smart Contracts: Automates processes such as verification, certification, and data sharing, enhancing

4. Technical Stack:

- Blockchain Platforms: Ethereum, Hyperledger Fabric, or Corda for creating blockchain network.
- Smart Contracts: Solidity, or relevant smart contract language.
- Database: IPFS (InterPlanetary File System) for file storage.
- Authentication: OAuth, Single Sign-On (SSO) solutions.
- Cryptography : Public-Private key pairs,harshing algorithms for data security.
- Front end: HTML, CSS, JavaScript, React, or Angular.
- Back end: Node.js, Python, or other backend technologies.
- Off-chain Oracles : Bridges data from external sources to the blockchain for real world data integration.
- Security: Implement security best practices, encryption, and access controls.

5. Implementation Stages:
- Project Planning and Assessment
- Blockchain slection
- Blockchain Network Setup
- User Authentication System Development
- Data Upload and Verification System
- Smart Contract Development
- User Interface Development
- Security Implementation
- Testing and Quality Assurance
- Integration
- Deployment
- Maintenance and Updates

6. Benefits:
- Enhanced data security and integrity.
- Elimination of fraudulent academic records.
- Simplified and efficient record verification for employers and institutions.
- Reduced administrative burden on educational institutions.

8. **Challenges**:
- Data privacy and compliance with data protection regulations.
- Integration with existing education systems and databases.
- Ensuring user adoption and trust in the blockchain system.

9. **Conclusion**:

The "Transparent Education Data Management Using Blockchain" project has the potential to transform how educational records are managed and verified, ensuring data security, transparency, and accuracy. By ensuring tamper-proof records and automating processes,

blockchain revolutionizes educational data management, promising enhanced security, credibility, and efficiency in academic records and transactions.

- **PURPOSE**

1. **Data Integrity**: Blockchain technology ensures that education data, such as student records, certificates, and transcripts, remain secure and tamper-proof. Once data is recorded on the blockchain, it cannot be altered or deleted, ensuring the integrity of academic records.

2. **Credential Verification**: Employers, educational institutions, and other stakeholders can easily and securely verify the authenticity of academic credentials. This reduces the risk of fake diplomas and credentials, which is a common issue in many parts of the world.

3. **Ownership and Control**: Students have more control over their educational data. They can grant or revoke access to their records, allowing them to share their achievements with potential employers or other institutions without exposing unnecessary personal information.

4. **Reduction of Fraud**: The transparency and immutability of blockchain data help combat fraud in education, such as diploma mills and counterfeit certificates, by providing a trustworthy source of information.

5. **Efficiency**: Blockchain can streamline administrative processes in education, reducing the administrative burden on institutions. This includes the transfer of credits between institutions, simplifying enrollment, and automating verification processes.

6. **Global Recognition**: With blockchain, education credentials can be universally recognized and accepted, making it easier for students to pursue further education or seek employment internationally.

7. **Smart Contracts**: Smart contracts on blockchain can automate various educational agreements, such as payment of tuition fees or disbursement of scholarships, ensuring that these processes are transparent, efficient, and trustless.

8. **Data Privacy**: Blockchain allows for data to be stored in a decentralized manner, which can enhance data privacy and security. Students can have more control over who accesses their data, and data breaches become more challenging.

2. LITERATURE SURVEY

- **EXSISTING PROBLEM**

1. **Data Security**: Blockchain technology can enhance the security of student records, ensuring that personal and academic data is stored in a tamper-proof manner, reducing the risk of data breaches.

2. **Credential Verification**: It can streamline the verification of academic credentials, making it easier for employers and educational institutions to verify the authenticity of degrees and certificates, thus reducing fraud.

3. **Access Control**: Blockchain can provide granular access control, allowing students to share their academic records with specific parties, enhancing data privacy and control.

4. **Data Integrity**: Educational records stored on a blockchain are resistant to alteration, ensuring the integrity of the data, which is crucial for maintaining the trustworthiness of educational institutions.

5. **Reducing Administrative Overhead**: Automating record-keeping and verification processes can reduce administrative costs for educational institutions and improve efficiency.

- **REFERENCES**

1. **Immutable Records**: Blockchain stores data in a tamper-resistant manner. Each educational record, such as diplomas or certificates, is added to a block, making it nearly impossible to alter or delete historical academic achievements.

2. **Verification**: Employers or academic institutions can easily verify the authenticity of a candidate's educational qualifications by accessing the blockchain records, reducing the risk of fraudulent claims.

3. **Ownership and Control**: Students can have more control over their educational data. They can grant or revoke access to their records, ensuring their privacy and data security.

4. **Decentralization**: Unlike traditional centralized systems, blockchain operates on a decentralized network, reducing the risk of a single point of failure and ensuring data availability.

5. **Smart Contracts**: Smart contracts can be used to automate various processes in education, such as issuing digital transcripts when certain conditions are met, ensuring transparency in the process.

6. **Interoperability**: Blockchain can enable interoperability between different educational institutions and systems, facilitating data sharing while maintaining data integrity.

7. **Transparency**: The distributed ledger nature of blockchain ensures transparency in data management. All authorized parties can view the data and its changes, promoting trust.

8. **Data Portability**: Students can easily transfer their academic records from one institution to another, streamlining the transfer process and eliminating bureaucracy.

9. **Security**: Blockchain's encryption and consensus mechanisms enhance the security of educational data, reducing the risk of data breaches or unauthorized access.

10. **Reduced Costs**: Blockchain can potentially reduce administrative costs associated with record-keeping, verification, and data transfer.

- **PROBLEM STATEMENT DEFINITION**

  Blockchain is a technology designed to manage education data that has the potential to support transparency and accountability. A blockchain is a ledger of transactions where an identical copy is visible to all the members of a computer network. Network members validate the data entered into the ledger, and once entered, the data is immutable.

  Design a solution where you can store the digital certificates of the students in a distributed and decentralized network. You should be able to add the certificated details into the blockchain query the certificate details from the blockchain.

3 . IDEATION AND PURPOSED SOLUTION

- **EMPATHY MAP CANVAS**

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

It is a useful tool to helps 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.

Blockchain can create an immutable record of educational data, including transcripts, degrees, and certifications that is verifiable and proof .

It allows you to create a portrait of your users by considering their thoughts, feelings, worries, aspirations, pain points or fears when using your product.

the blockchain, you can use a public certificate checker provided by DNV or other similar services. All certificates have an embedded QR code that can be scanned with mobile devices.

the possibilities are promising, issues such as data security, scalability, and cost all present challenges to the widespread adoption of blockchain in the education sector .

the technology continues to evolve, blockchain is likely to play a larger role in the field of education.

Think & Feel

Hear

See

However, the use of blockchain in education is still in its infancy, and there are several challenges to its widespread adoption.

As the technology continues to evolve, blockchain is likely to play a larger role in the field of education

There are still regulatory issues surrounding the use of blockchain technology in some countries.

In total, this creates an immutable transaction that is secure and highly transparent, making it easy to uncover fraud as the technology will expose any outdated or forged certificates

Say & Do

According to a survey conducted by Gartner in 2019, only 2% of higher education institutions were using blockchain, while another18%planned

One of the most promising applications of blockchain in education is record keeping. A certificate is issued, the data is digitized and assigned a digital

To design a solution for storing digital certificates of students in a distributed and decentralized network, you can use blockchain technology to create a digital identity for each certificate.

GAIN:

transparency by allowing all members

high-level security for data storage and transmission

Easy verification of credentials

PAIN:

networks can become slow when they grow too large

Implementing blockchain technology can be expensive.

Complex to understand & implement

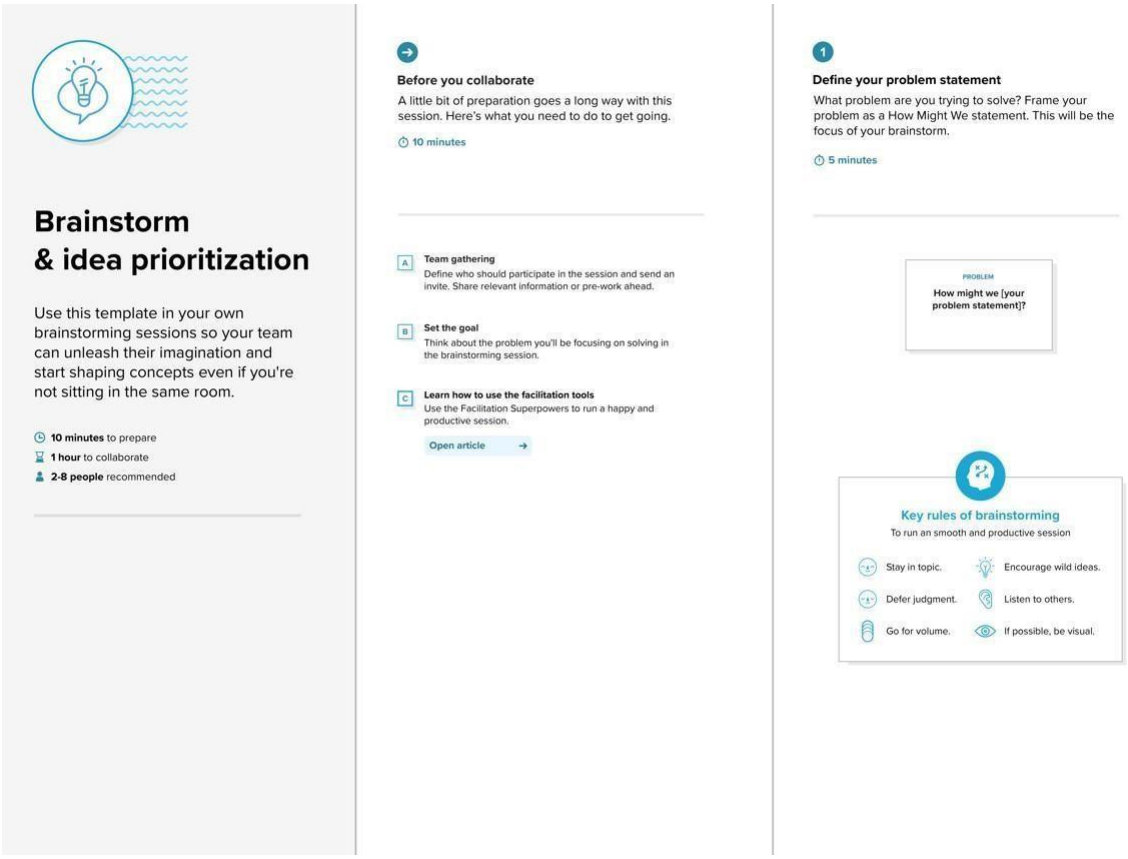
- **IDEATION AND BRAINSTROMING**

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.

Reference: https://www.mural.co/templates/empathy-map-canvas

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Problem statement

Limited Access to Educational Resources: High costs of textbooks, online learning platforms, and proprietary educational materials can be barriers to education. A lack of transparency in pricing and licensing models restricts access to crucial resources.Addressing these issues requires a robust transparent data education management system that promotes openness, accountability, and accessibility in the education sector. Such a system should provide clear insights into student performance, resource allocation, college admissions, financial data, and equitable access to educational resources, while also safeguarding data privacy

Step-2: Brainstorm, Idea Listing and Grouping

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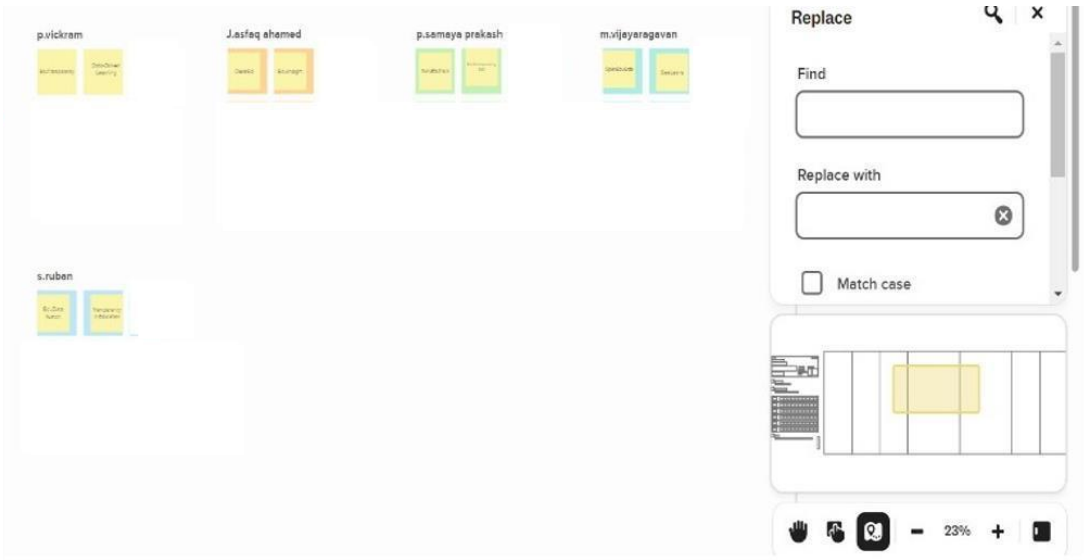
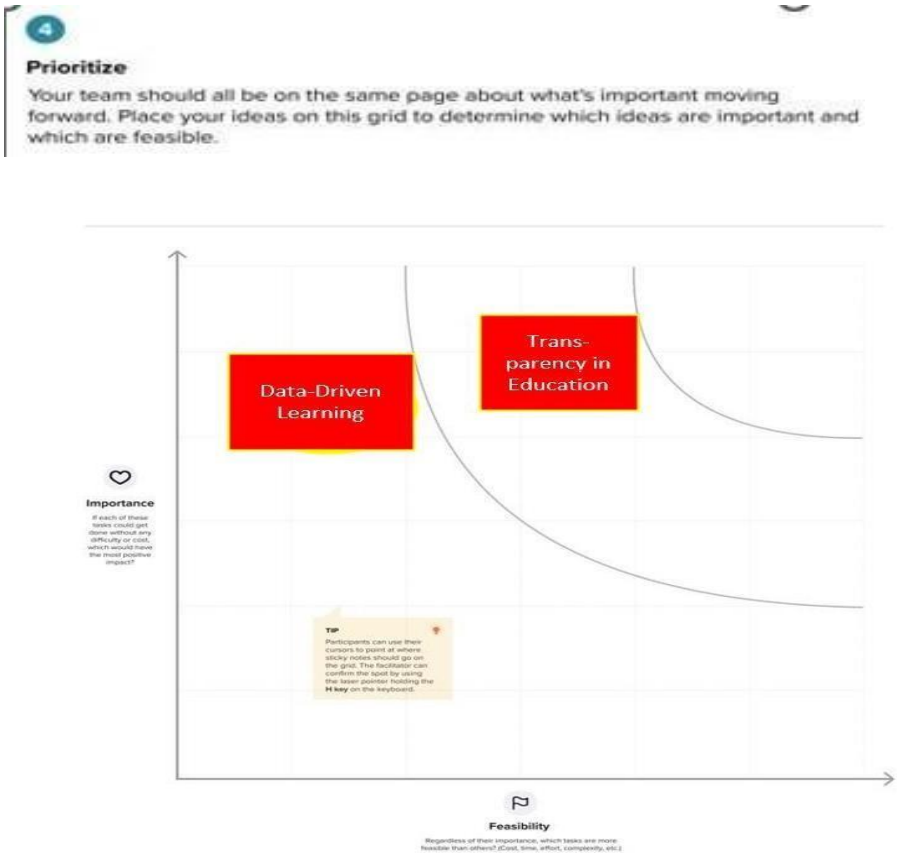


Step-3: Idea Prioritization



4.REQUIREMENT ANALYSIS

- **FUNCTIONAL REQUIREMENT**

1. **User Authentication**: Secure login mechanisms for students, teachers, and administrators to access the system.

2. **Student Information Management**: Capture and store student data, including personal details, academic records, attendance, and disciplinary records.

3. **Teacher Information Management**: Maintain teacher profiles, qualifications, and schedules.

4. **Course and Curriculum Management:** Define and manage courses, subjects, and curriculum content.

5. **Enrollment and Registration**: Enable student registration, course selection, and fee payments.

6. **Attendance Tracking:** Record and monitor student attendance, including automated notifications for absentees.

7. **Gradebook and Assessment:** Allow teachers to input and calculate grades, and students and parents to access and track academic performance.

8. **Communication:** Provide a platform for communication between students, parents, teachers, and administrators.

9. **Data Security and Privacy**: Implement robust data protection measures to ensure the confidentiality and security of student information.

10. **Reporting and Analytics:** Generate reports and analytics on student performance, attendance, and other relevant data.

- **NON-FUNCTIONAL REQUIREMENT**

  1. **Scalability**: The system should be able to handle a growing number of students, teachers, and courses without a significant drop in performance.

  2. **Performance**: The system should respond promptly to user requests, ensuring low latency and high throughput.

  3. **Reliability**: The system should be highly available and should minimize downtime. It should also be fault-tolerant to handle unexpected failures.

4. **Security**: Data must be protected, and access controls should be in place to prevent unauthorized access to sensitive information.

5. **Data Privacy**: Compliance with data privacy laws (e.g., GDPR, HIPAA) to protect the personal data of students, teachers, and other stakeholders.

6. **Accessibility:** The system should be designed to be accessible to users with disabilities, adhering to accessibility standards.

7. **Usability:** The user interface should be intuitive and user-friendly to ensure that all stakeholders can use the system with ease.

8. **Compatibility**: The system should work seamlessly across different web browsers and devices.

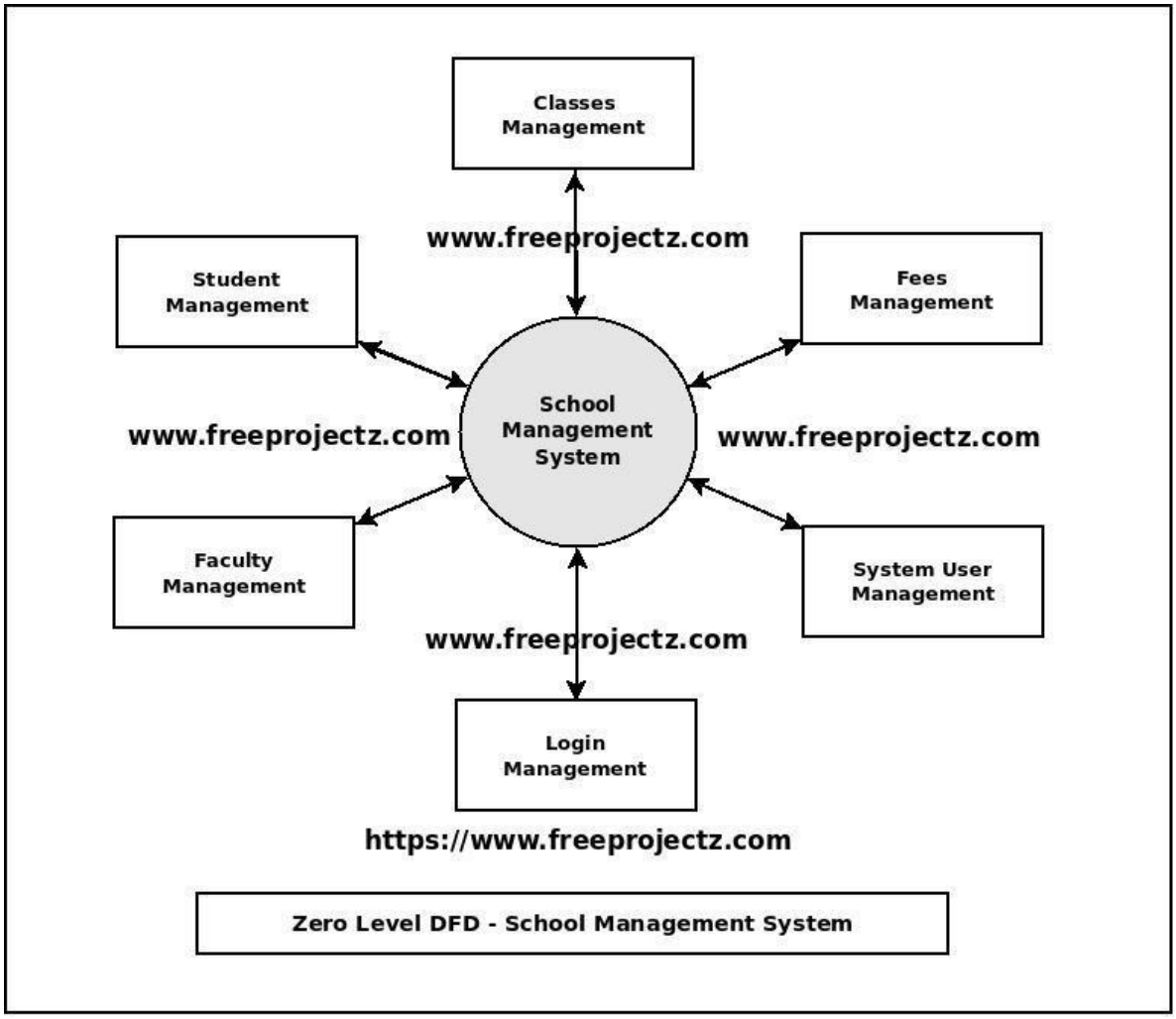
9. **Interoperability**: It should be able to integrate with other systems and tools used in the educational institution.

10. **Load Handling:** The system should handle peak loads effectively, such as during registration periods or exam result announcements.

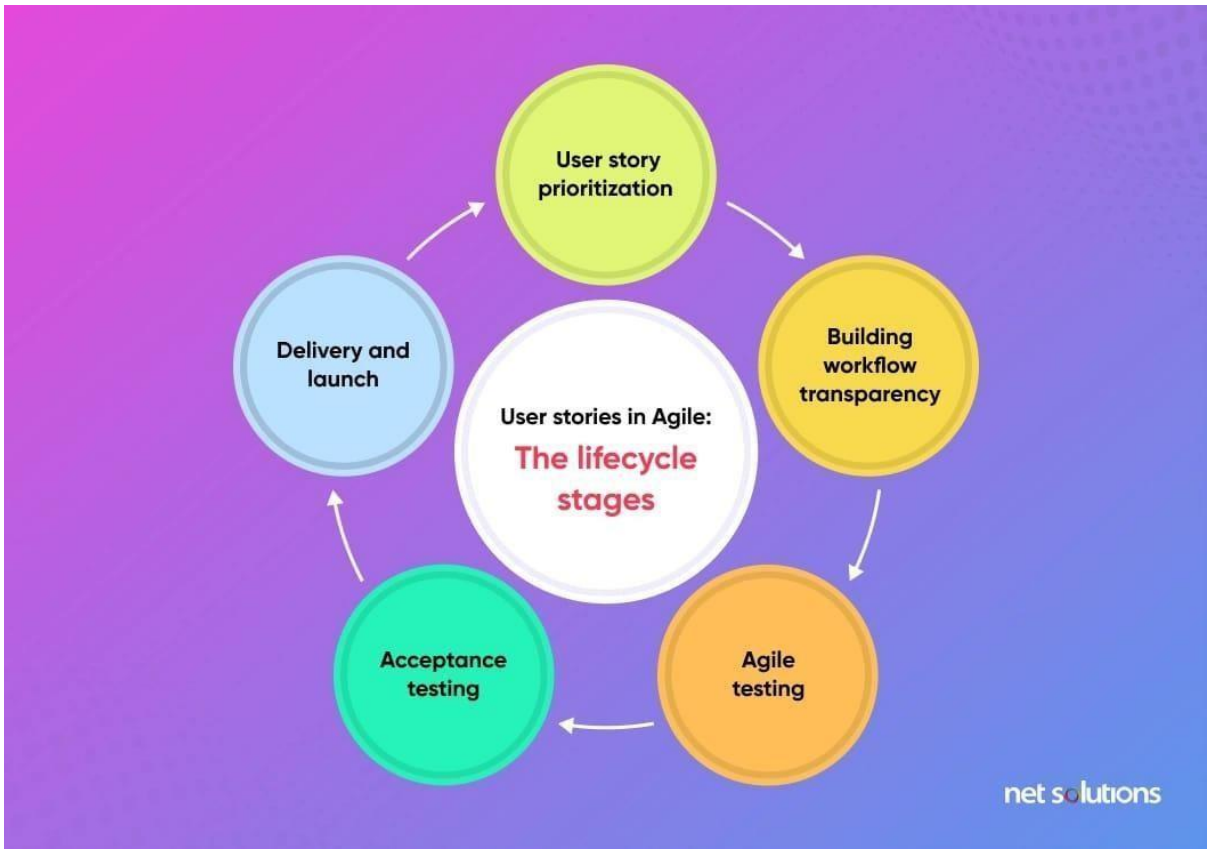
5.PROJECT DESIGN

- **Data Flow Diagrams & User Stories**

- **DATA FLOW DIAGRAM**



- **USER STORIES**



- **SOLUTION ARCHITECTURE**

Implementing a transparent data education management system using blockchain technology can provide secure and immutable records while enhancing transparency. Here's a simplified solution architecture:

Components:

1. Blockchain Network:

- Use a public or private blockchain network depending on your requirements for access control.
- Public networks like Ethereum or private networks using Hyperledger Fabric are options.

2. Smart Contracts:

- Create smart contracts to handle core functionalities like student registration, attendance, grading, and course enrollment.

- These smart contracts execute automatically based on predefined rules and can be audited for transparency.

3. Decentralized Identity (DID):

- Implement DID for students, teachers, and administrators to ensure secure and privacy-preserving authentication.

- DID allows users to have control over their personal data.

4. Data Encryption:

- Encrypt sensitive data before storing it on the blockchain, ensuring data privacy and security.

5. User Interface (UI):

- Develop a user-friendly interface for students, teachers, and administrators to interact with the blockchain system.

6. Database Integration:

- Combine blockchain with traditional databases to store non-sensitive data efficiently.

Key Functionality:

1. Student Registration:

- Students create a DID for secure identity management.

- Registration details are hashed and stored on the blockchain.

- Transaction history is transparent and immutable.

2. Attendance Tracking:

- Teachers record attendance on the blockchain, making it tamper-proof.

- Students can view their attendance records.

3. Grading and Assessment

- Smart contracts execute grading based on predefined criteria.

- Grades are stored transparently on the blockchain.

4. Course Management:

- Course details and enrollment data are managed on the blockchain.

- Transparency in course availability and enrollment.

5. Communication:

- Implement a secure messaging system within the platform, using blockchain for message authenticity and security.

6. Financial Transactions:

- Utilize blockchain for transparent billing and payment processing.

- Ensure secure transactions and financial data storage.

7. Auditing and Reporting:

- Generate transparent audit trails of all actions performed within the system.

- Create reports for administrators and authorities.

Benefits:

1. **Data Transparency**: Blockchain ensures that all actions and data changes are transparent and immutable.

2. **Data Security**: Sensitive data is encrypted and only accessible to authorized users.

3. **Privacy**: Decentralized identity management provides users with control over their data.

4. **Tamper-Proof Records**: Records of student achievements, attendance, and grades cannot be altered.

5. **Efficiency**: Automation of processes through smart contracts reduces administrative overhead.

6. **Auditing and Compliance**: Easy auditing and reporting capabilities for educational authorities.

7. **User Control**: Students, teachers, and administrators have more control over their data.

8. **Immutable Records:** Critical data, once recorded on the blockchain, is permanent.

It's important to collaborate with blockchain developers and experts to design, develop, and implement such a system, as blockchain technology can be complex and requires careful consideration of your specific needs and regulatory requirements.

6.PROJECT PLANNING AND SCHEDULEING

- **TECHNICAL ARCHITECTURE**

  A transparent education data management system using blockchain would have the following technical architecture components:

  1. **Blockchain Network:** This is the foundation of the system. It consists of a decentralized ledger where all education data is recorded. It can be a public blockchain like Ethereum or a private one, depending on the requirements.

  2. **Smart Contracts**: Smart contracts are self-executing contracts with the terms of the agreement directly written into code. In education, these could be used for tasks like verifying student credentials, managing access rights, and executing certain predefined actions automatically.

  3. **Decentralized Identity**: Each student and educational institution would have a unique digital identity stored on the blockchain. This identity contains information about the individual's educational history, achievements, and certificates.

4. **Data Storage:** Actual data, such as academic records, certificates, and transcripts, can be stored on decentralized or distributed storage systems, and the links to these files are recorded on the blockchain.

5. **Consensus Mechanism**: To ensure data integrity and security, the blockchain network would use a consensus mechanism like Proof of Work (PoW) or Proof of Stake (PoS) to validate and add new blocks to the chain.

6. **Encryption:** Data on the blockchain should be encrypted to protect sensitive information and ensure privacy.

7. **Interoperability**: Standards and protocols for interoperability with existing educational systems and databases should be established to facilitate data transfer and integration.

8. **User Interfaces**: User-friendly interfaces for students, educational institutions, and potential employers to access and verify educational data are essential.

9. **Auditing and Transparency Tools**: Tools for regulators and authorized entities to audit and ensure the transparency of the system.

10. **Access Control and Permissions**: Define who has permission to read and write data to the blockchain. This would include students, educational institutions, employers, and regulatory bodies.

11. **Scalability:** The architecture should be designed to handle a growing number of educational records and users efficiently.

12. **Immutable Records**: Once data is added to the blockchain, it should be immutable, ensuring that records cannot be altered or deleted fraudulently.

13. **Oracle Services**: These are necessary to connect the blockchain to external data sources, such as official government records for identity verification.

14. **Privacy Measures**: Implement mechanisms to protect user privacy while ensuring transparency. This might involve zero-knowledge proofs or similar techniques.

15. **Integration with Web 2.0 Systems**: Many existing educational systems and services are still based on traditional technologies. The architecture should allow for integration with these systems.

16. **Backup and Recovery**: Plans for data backup and recovery in case of unexpected outages or data loss are crucial.

- **SPRINT PLANNING & ESTIMANTION**

Sprint planning and estimation for a project involving transparent education data management using blockchain would typically follow an Agile approach. Here's a high-level overview of the process:

1. **Product Backlog:** Start by creating a product backlog. This is a prioritized list of all the features, user stories, and tasks related to the project. In this case, it might include features like data authentication, verification, and secure storage on the blockchain.

2. **User Stories:** Break down the features into user stories that define the functionality from an end user's perspective. For example, a user story could be "As an educator, I want to securely upload student records to the blockchain."

3. **Estimation:** Use a technique like story points or t-shirt sizing to estimate the effort required for each user story. Consider factors such as complexity, risks, and dependencies. Be sure to involve the development team in this process.

4. **Sprint Planning**: Based on the team's velocity (how much work they can complete in a sprint), select a set of user stories from the backlog for the

upcoming sprint. Make sure the team understands the scope and goals of the sprint.

5. **Tasks and Subtasks**: Break down each user story into smaller tasks and subtasks. This helps in tracking progress during the sprint.

6. **Daily Stand-ups**: Conduct daily stand-up meetings to keep track of progress and identify any obstacles. This ensures that the team stays on course.

7. **Review and Demo**: At the end of the sprint, have a sprint review and demo to showcase what was accomplished. This helps get feedback from stakeholders.

8. **Retrospective**: After the review, hold a sprint retrospective to identify what went well and what can be improved in the next sprint.

9. **Refinement**: Periodically revisit and refine the product backlog. Priorities may change, and new requirements may emerge.

10. **Repeat**: Repeat these steps for subsequent sprints until the project is complete.

- **SPRINT DELIVERY SCHEDULE**
  Developing a transparent data education management system using blockchain will require a series of sprints to complete the project. Below is a high-level sprint delivery schedule for such a project:

  Sprint 1: Project Initiation and Planning (2 weeks)

  - Define project objectives, scope, and requirements.

- Establish a core project team and roles.
- Identify stakeholders and their needs.
- Create a detailed project plan with timelines and deliverables.
- Decide on the blockchain platform to use (public or private).

Sprint 2: Blockchain Network Setup (3 weeks)

- Set up the chosen blockchain network (e.g., Ethereum or Hyperledger Fabric).
- Configure and deploy the necessary network nodes.
- Develop and deploy the smart contracts for basic functionality (e.g., user registration).

Sprint 3: User Identity and Authentication (3 weeks)

- Implement decentralized identity (DID) management for users.
- Develop the user authentication system.
- Test user registration and authentication on the blockchain.

Sprint 4: Data Encryption and Privacy (3 weeks)

- Implement data encryption mechanisms to protect sensitive information.
- Integrate encryption with the blockchain system.
- Conduct thorough testing for data privacy and security.

Sprint 5: User Interface (UI) Development (4 weeks)

- Create a user-friendly UI for students, teachers, and administrators.
- Ensure seamless interaction with the blockchain.
- Test the UI for usability and compatibility.

Sprint 6: Student Registration and Course Management (4 weeks)

- Develop smart contracts for student registration and course management.
- Implement transparency in course availability and registration.

- Test the registration and enrollment processes.

Sprint 7: Attendance Tracking and Grading (4 weeks)

- Develop smart contracts for attendance tracking and grading.
- Ensure tamper-proof attendance records.
- Implement automatic grading based on predefined criteria.

Sprint 8: Communication System (3 weeks)

- Create a secure messaging system within the platform.
- Implement blockchain for message authenticity and security.
- Test the messaging system.

Sprint 9: Financial Transactions (3 weeks)

- Utilize blockchain for transparent billing and payment processing.
- Ensure secure financial transactions.
- Test the financial transaction processes.

Sprint 10: Auditing and Reporting (3 weeks)

- Generate transparent audit trails of all actions.
- Develop reporting features for administrators and authorities.
- Test auditing and reporting capabilities.

Sprint 11: Final Testing and Quality Assurance (3 weeks)

- Perform comprehensive system testing, including security and performance testing.
- Identify and fix any remaining issues.
- Ensure the system meets all requirements and quality standards.

Sprint 12: Deployment and User Training (2 weeks)

- Deploy the education management system on a production environment.

- Provide training to users (students, teachers, administrators) on how to use the system.

Sprint 13: Post-Deployment Support and Optimization (Ongoing)

- Offer ongoing support and maintenance.
- Continuously optimize the system based on user feedback and evolving needs.

7. CODING AND SOLUTIONING

- **FEATURE 1**

```
// 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
);

constructor() {
    owner = msg.sender;
}

modifier onlyOwner() {
    require(msg.sender == owner, "Only contract owner can call this");
    _;
}

function issueCertificate(
    string memory studentName,
    string memory courseName,
    uint256 _dateOfGraduation,
    uint256 issueDate
) external onlyOwner {
    uint256 certificateId = totalCertificates + 1;

    certificates[certificateId] =
        Certificate({studentName:
        studentName, courseName:
        courseName,
        DateOfGraduation : _dateOfGraduation,
        issueDate: issueDate,
        issuer: msg.sender
    });

    totalCertificates = certificateId;

    emit CertificateIssued(
        certificateId,
        studentName,
        courseName,
        issueDate,
        msg.sender
```

```
        );
    }

    function
        getCertificate(uint25
        6 certificateId
    ) external view returns (string memory, string memory, uint256,
uint256, address) {
        Certificate memory cert = certificates[certificateId];
        return (cert.studentName, cert.courseName,
cert.DateOfGraduation, cert.issueDate, cert.issuer);
    }
}
```

- **FEATURE 2**

```
const { ethers } = require("ethers");

const abi = [
 {
  "inputs": [],
  "stateMutability": "nonpayable",
  "type": "constructor"
 },
 {
  "anonymous": false,
  "inputs": [
   {
    "indexed": true,
    "internalType": "uint256",
    "name": "certificateId",
    "type": "uint256"
   },
   {
    "indexed": false,
    "internalType": "string",
```

```
  "name": "studentName",
  "type": "string"
 },
 {
  "indexed": false,
  "internalType": "string",
  "name": "courseName",
  "type": "string"
 },
 {
  "indexed": false,
  "internalType": "uint256",
  "name": "issueDate",
  "type": "uint256"
 },
 {
  "indexed": true,
  "internalType": "address",
  "name": "issuer",
  "type": "address"
 }
],
"name": "CertificateIssued",
"type": "event"
},
{
"inputs": [
 {
  "internalType": "string",
  "name": "studentName",
  "type": "string"
 },
 {
  "internalType": "string",
  "name": "courseName",
  "type": "string"
 },
```

```
 {
  "internalType": "uint256",
  "name": "_dateOfGraduation",
  "type": "uint256"
 },
 {
  "internalType": "uint256",
  "name": "issueDate",
  "type": "uint256"
 }
],
"name": "issueCertificate",
"outputs": [],
"stateMutability": "nonpayable",
"type": "function"
},
{
"inputs": [
 {
  "internalType": "uint256",
  "name": "",
  "type": "uint256"
 }
],
"name": "certificates",
"outputs": [
 {
  "internalType": "string",
  "name": "studentName",
  "type": "string"
 },
 {
  "internalType": "string",
  "name": "courseName",
  "type": "string"
 },
 {
```

```
  "internalType": "uint256",
  "name": "DateOfGraduation",
  "type": "uint256"
 },
 {
  "internalType": "uint256",
  "name": "issueDate",
  "type": "uint256"
 },
 {
  "internalType": "address",
  "name": "issuer",
  "type": "address"
 }
],
"stateMutability": "view",
"type": "function"
},
{
"inputs": [
 {
  "internalType": "uint256",
  "name": "certificateId",
  "type": "uint256"
 }
],
"name": "getCertificate",
"outputs": [
 {
  "internalType": "string",
  "name": "",
  "type": "string"
 },
 {
  "internalType": "string",
  "name": "",
  "type": "string"
```

```
 },
 {
  "internalType": "uint256",
  "name": "",
  "type": "uint256"
 },
 {
  "internalType": "uint256",
  "name": "",
  "type": "uint256"
 },
 {
  "internalType": "address",
  "name": "",
  "type": "address"
 }
],
"stateMutability": "view",
"type": "function"
},
{
 "inputs": [],
 "name": "owner",
 "outputs": [
  {
   "internalType": "address",
   "name": "",
   "type": "address"
  }
 ],
 "stateMutability": "view",
 "type": "function"
},
{
 "inputs": [],
 "name": "totalCertificates",
 "outputs": [
```

```
  {
   "internalType": "uint256",
   "name": "",
   "type": "uint256"
  }
 ],
 "stateMutability": "view",
 "type": "function"
}
]

if (!window.ethereum)
 { alert('Meta Mask Not
 Found')
 window.open("https://metamask.io/download/")
}

export const provider = new
ethers.providers.Web3Provider(window.ethereum);
export const signer = provider.getSigner();
export const address =
"0xb7336C490D74103bE978D086960DC453B0eeA875"

export const contract = new ethers.Contract(address, abi, signer)
```

8. PERFORMANCE TESTING

- **PERFORMANCE METRICES**

  1. **Data Integrity:** Measure the accuracy and consistency of educational data stored on the blockchain. Any unauthorized changes or tampering should be easily detectable.

  2. **Transparency:** Assess the level of openness and accessibility of educational records to relevant stakeholders. Blockchain ensures transparency by providing a decentralized and immutable ledger.

3. **Security**: Evaluate the security protocols in place to protect sensitive educational data from cyber threats and unauthorized access. Blockchain's cryptographic techniques enhance data security.

4. **Immutability**: Determine the permanence of data once it's added to the blockchain. Immutability ensures that once data is recorded, it cannot be altered, ensuring a reliable historical record.

5. **Decentralization**: Measure the degree of decentralization achieved through blockchain technology. A decentralized system reduces the risk of a single point of failure and promotes trust among users.

6. **Smart Contract Efficiency:** If smart contracts are used to automate certain processes, assess their efficiency in executing predefined actions when specific conditions are met.

7. **Scalability**: Evaluate the system's ability to handle a growing volume of educational data and transactions efficiently without compromising speed or performance.

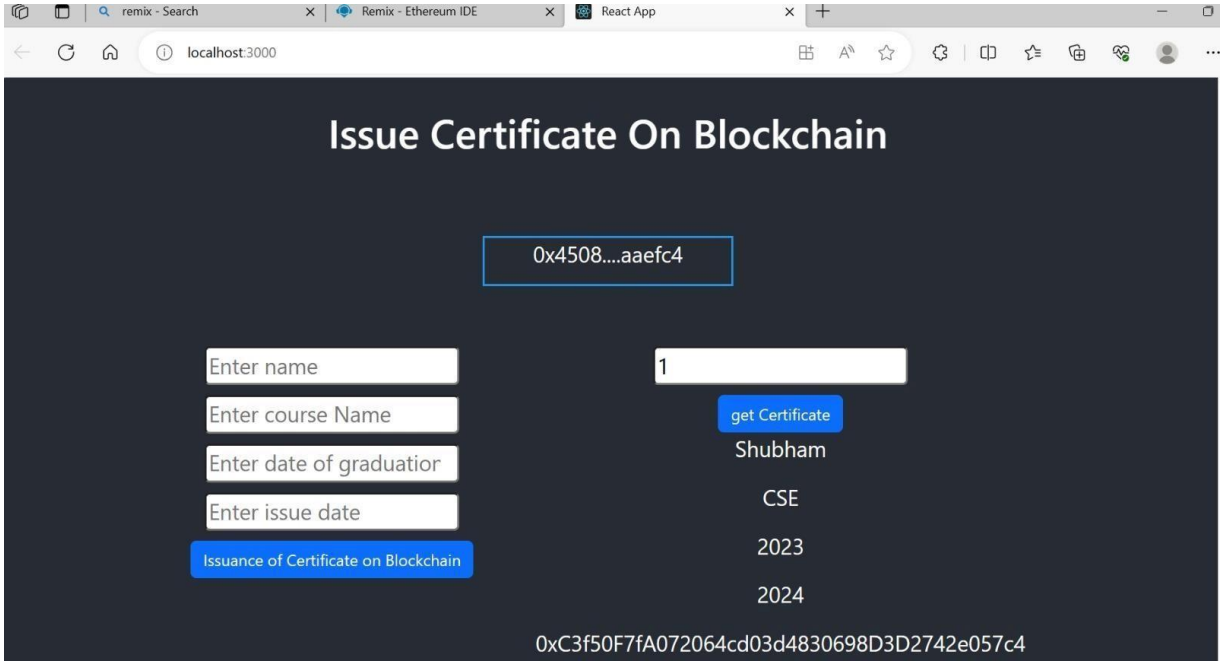
8. **Cost-effectiveness:** Compare the costs of implementing and maintaining the blockchain-based system with the benefits derived, including reduced administrative overhead and enhanced data accuracy.

9. **User Experience**: Gather feedback from end-users, such as students, teachers, and administrators, to assess their experience interacting with the blockchain-based education management system.

10. **Compliance**: Ensure that the system complies with relevant regulations and standards governing education data management, privacy, and security.

9. RESULT

- **OUTPUT SCREENSHOTS**



10. ADVANTAGES AND DISADVANTAGES

- **ADVANTAGES**

1. **Data Security**: Blockchain provides a highly secure and tamper-proof way to store and transmit education data. Each block contains a cryptographic link to the previous block, making it extremely difficult for unauthorized parties to alter or delete data.

2. **Data Integrity**: Education records stored on a blockchain can be trusted, as they are immutable and verifiable. This can help prevent fraud, such as the falsification of degrees and certificates.

3. **Ownership and Control**: Blockchain can give students greater control over their educational records. They can grant or revoke access to their data, which enhances privacy and data ownership.

4. **Reduced Fraud**: Academic fraud, like fake degrees, is a significant issue. Blockchain can help reduce this by providing a transparent, unchangeable record of degrees and certifications.

5. **Efficient Verification**: Employers and educational institutions can quickly and easily verify the authenticity of credentials, reducing the time and cost associated with background checks.

6. **Decentralization**: Blockchain is a decentralized technology, reducing the need for a centralized authority. This can make education data management more efficient and less susceptible to single points of failure.

7. **Streamlined Processes**: The use of smart contracts on the blockchain can automate processes such as transcript requests, degree verification, and credential issuance, reducing administrative overhead.

8. **Immutable Records**: Educational achievements recorded on the blockchain remain with the individual for life, ensuring that their history is not lost or forgotten.

9. **Global Recognition**: Blockchain can facilitate the recognition of credentials and qualifications across borders, making it easier for students to use their education internationally.

10. **Trust and Accountability:** The transparency of blockchain builds trust in the education system, as all stakeholders can see and verify the data, fostering accountability.

- **DISADVANTAGES**

1. **Data Security**: Blockchain provides a highly secure and tamper-proof way to store and transmit education data. Each block contains a cryptographic link to the previous block, making it extremely difficult for unauthorized parties to alter or delete data.

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11. CONCLUSION

Using blockchain for transparent education data management offers several benefits, such as data security, immutability, and trust. However, the ultimate conclusion depends on the successful implementation of the technology and addressing challenges like scalability and privacy concerns. If effectively executed, blockchain can revolutionize how educational data is stored, verified, and shared, enhancing transparency and reducing fraud in the education sector. Its success relies on collaboration among educational institutions, government bodies, and technology providers to create a robust, standardized system.

12. FUTURE SCOPE

The future scope of transparent education data management using blockchain technology is promising. Here are some key aspects of its potential:

1. **Immutable Records:** Blockchain ensures that education records are tamper-proof. This can be used for securely storing academic certificates, diplomas, and transcripts, reducing the risk of fraud.

2. **Verification**: Educational institutions and employers can easily and quickly verify the authenticity of a candidate's qualifications, streamlining the hiring process.

3. **Ownership and Control:** With blockchain, students can have more control over their educational data. They can grant or revoke access to their records, increasing data privacy.

4. **Global Credentials:** It can facilitate the recognition of qualifications across borders, making it easier for students to study and work in different countries.

5. **Micro-Credentials:** Blockchain can support the issuance and verification of micro-credentials, which are becoming increasingly important for continuous learning and career advancement.

6. **Smart Contracts:** These can automate various processes in education, such as payments, enrollment, and certification issuance.

7. **Data Analytics:** Blockchain can securely store vast amounts of educational data, which can be used for educational research and personalized learning.

8. **Reduced Administrative Costs**: Streamlined verification processes and reduced fraud can result in cost savings for educational institutions and employers.

9. **Interoperability**: Efforts are underway to make educational blockchains interoperable, creating a unified system for education records.

However, it's essential to consider the challenges, such as scalability, standardization, and regulatory issues, when implementing blockchain in education. The adoption of this technology will depend on collaboration between educational institutions, governments, and technology providers to establish a robust, secure, and widely-accepted framework.