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Blockchain Role in Safeguarding and Streamlining Student Data Management

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Abstract – ***Keeping track of students' data is tedious in big countries like India. Different generations used different technologies and adopted various methodologies in organizing and storing this data. This data should be kept secure for diverse purposes so that it can be utilized in the future. That's why colleges and universities have to spend a lot of money preparing and managing this information. Blockchain is the next big thing in technology and it will take the world by storm. Using blockchain technology to store information helps ensure that information is stored in a secure, publicly accessible location. Document Search is the best way to organize and store student information at a college or other institution.***

Keywords – Blockchain, Ethereum, Solidity, Smart Contracts, Web3.js, Ganache, Transactions.

1. INTRODUCTION

Blockchain technology has become popular in managing and storing educational information. Since blockchain technology is a ledger, it can store information decentralized and independent of central authority. It is ideal for organizing and storing educational materials as it provides a secure, open and immutable data storage platform. . In addition to improving the certificate and certification process, blockchain technology also enables schools to securely verify and verify certificates. Blockchain technology can also be used to provide secure payment methods and improve financial communication between students and institutions. By leveraging the immutability and security of blockchain technology, institutions can increase the efficiency, security and trust of financial transactions. By leveraging the immutability and security of blockchain technology, institutions can increase the efficiency, security and trust of financial transactions. Finally, blockchain technology can also facilitate secure communication between students, parents, teachers, and administrators, and schools can use Output blockchain technology to control and manage communication for transparency and security purposes.

2. LITERATUTE SURVEY

The history of blockchain in storing student records of colleges and universities dates back to the early 2000s. At that time, blockchain technology was still in its infancy, but it was already being used for a variety of business applications. In the past two decades, blockchain technology has grown in popularity. Blockchain technology has been used to store student information at colleges and universities since the early 2000s. Since then, Blockchain technology has been used more frequently than traditional technology to store student information and educational information efficiently and securely. This is because blockchain technology provides enhanced data confidentiality and integrity. Blockchain ensures that information is immutable and can only be changed with the consent of all parties. This means student information is kept secure and cannot be tampered with or altered. Additionally, blockchain enables secure data exchange, allowing student data to be securely shared between schools and organizations. Blockchain's ability to store student information without intermediaries is one of its main benefits. By eliminating the middleman, the process is streamlined and the amount of data collected is reduced.
Hisam O Mbaidin (2023) et al in their cerebral research work on applications of Blockchain for banking sector have concluded that “Implantation of smart contracts, risk management, risk mitigation and faster payment are the opportunities for the banking sectors of developing countries to increase trust and transparency in their financial systems as well as formalization of their economy. Upon the adoption of Blockchain technologies, there will be ease in financial transactions and transfers of money for financial institutions.[7]

Additionally, students information stored in blockchain technology is encrypted, thus increasing their security. Although there are many benefits to using blockchain technology to store student information, there is still room for improvement. For example, scalability is an issue because the amount of data that needs to be stored and the number of transactions that can be made will reduce the size of the blockchain network. Additionally, organizations currently face problems in sharing information and coordinating projects due to the lack of a well-designed and well-structured blockchain network.

3. METHEDOLOGY

The methodology which is adopted for the development of the project which is associated with this research paper can be broadly classified into four parts:

- Setup of the Development Environment.
- Development of the Smart Contract.
- Deployment of the Smart Contract.
- Connection to a blockchain node.

Now let us look at a detailed explanation of the above-mentioned categories:

A. Setup of the Development Environment

As we are dealing with blockchain, what could be more suitable to employ the local development framework, namely Truffle? To develop our project in Truffle, we initially installed Node JS. After the successful set-up of Node JS, we installed Truffle from the npm package manager. Truffle is a framework that furnishes varioustools and files for forming a blockchain project.

Truffle offers us files to compose our Solidity code, JavaScript files to write the deployment code, testing files that are utilized to investigate the different elements of the project, and Truffle configuration files that assist us in selecting a particular network on which our project will be launched.

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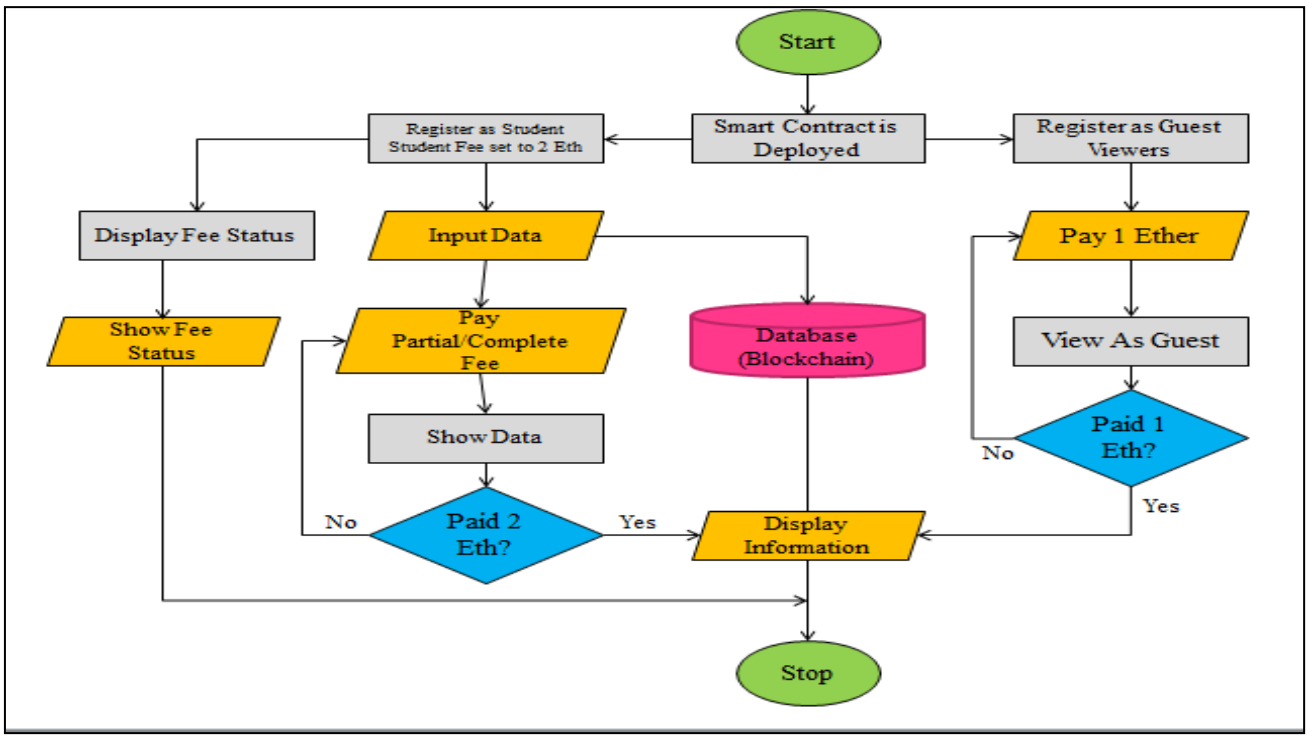

Flowchart

B. Development of the Smart Contract

A smart contract is a computer program, or set ofinstructions, stored on a blockchain that automates the performance of an agreement between two or more parties,without the need for a third party to facilitate.

These contracts are self-executing, meaning they carry outthe terms of an agreement without requiring any manual input from either party. The most common programming language that is used for writing Smart Contracts is Solidity and we'llbe using it too.

Once the Truffle framework has been installed, a project is created with several different files, including Build, Client, Contracts, Migrations, Test, etc. All Solidity files should be saved under the Contracts folder with the ".sol" extension.

Our Smart Contract is a piece of code that manages the data that the admin or students wish to store. There are three types of users who can interact with the contract: the Admin, the Student(s), and the Guest Viewer(s). The address of the Account that deploys the smart contract is allocated to the Admin, who has the ultimate authority over the operations.The Student(s) are the individuals who will be inputting their data. The Guest Viewer(s) is an external individual who wishes to gain access to the data for various purposes. Accounts to be utilized as Students must have their address registered as Students through the RegAsStudent() function, so as to enable the program to determine which account belongs to the Student. Likewise, the Guest Viewer(s) must register the address of their account with the RegAsGuest() function in order to gain access to the data. Furthermore, as they are a third party, they must pay a specified sum, in this case, 1 Ether, to register themselves.

Prior to beginning any project, it is essential to select the appropriate platform for its development. In this instance, we decided to use the renowned VS Code Editor.

C. Connection to a Blockchain Node

It is not feasible to deploy a smart contract without connecting to a Blockchain node due to the fact that they are always "deployed on" the Blockchain. If the Blockchain is not in existence, where would the contract is deployed? Consequently, as developers, we are practically unable to work with the main Ethereum Network, instead, we opt to use Test Networks or Developer Blockchains. 'Ganache' is a private Blockchain that we will be utilizing to deploy our smart contract. By default, Ganache instead, we opt to use Test Networks or Developer Blockchains. 'Ganache' is a private Blockchain that we will be utilizing to deploy our smart contract. By default, Ganache provides us with 10 accounts, each possessing an amount of 100 Ethers.

Now, the assignment is to link the Ganache Blockchain with Truffle. This can be accomplished with the aid of the truffle-config file. The truffle-configuration or truffle-config file is a JavaScript file that oversees the configurations that influence the Truffle project. The Ganache is constantly connected to the RPC Server and has a network ID as well. Example is shown below

i. Ganache connected to the RPC Server and has a network ID

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Apart from financial industries, blockchain technology also has a bright future in other sectors. Letus have a look at the future scope of Blockchain technology in different sectors:

- Blockchain in Digital Advertising.
- Blockchain in Cyber Security.

- Blockchain will remove the requirement of the third party.
- Governments will provide their digital currencies.
- Blockchain beyond the world of computing.
- Managing World trade with the help of Blockchain Technology.
- Supply chain Management.
- The Blockchain in Forecasting.
- Use of Blockchain in the Internet of Things and Networking.
- Blockchain in Cloud Storage.

4. RESULTS

The system created using the overhead methodology is capable of storing information about a particular student. When this code is deployed on a private blockchain, such as Ganache, we can interact with the various functions we have written.
Firstly, the account registers itself as a student through the RegAsStudent() function, and its address is registered. Now, the student's data can be entered by both the Student and the Admin, as this is a practical approach that allows the Admin to upload data in case the student is unable to do so. As Students should have access to their personal data, they can view their information through the dedicated

DisplayData() function. However, if any third party wishes to view the data, they first need to register as a Guest Viewer through the RegAsGuest() function and make a payment of 1 Ether.

After completing the registration as a Guest Viewer, they can access the data in view mode using the ViewAsGuest() function.

```
2_Deploy_Contract.js
====================
Replacing 'StudentData'----------
> transaction hash:
0xdbe599a70c5c8ead9f823d026a52c64d054c50b
b31c0f771b87468edcf32a073

> Blocks: 0            Seconds: 0

> contract address:
0x96Ce5118B470CBc8b28b1346EF5a65d5ee53C1
53

> block number:          1

> block timestamp:       1671452501

> account: 0xC11E70D40bDC62A78dDD57Bf72b15657AdbC9

> balance:           99.97597622
> gas used:          1201189 (0x125425)
> gas price:         20 gwei
> value sent:        0 ETH
> total cost:        0.02402378 ETH
```

5. CONCLUSIONS AND FUTURE SCOPE

Blockchain's potential for managing student records is very bright. Educational institutions can do away with traditional paperwork by using blockchain technology to securely store, manage, and track student records. This technology also provides an immutable record of data. This can simplify the student life cycle, facilitating quick access to information and cutting down on record-keeping expenses. Universities may also prevent data manipulation and unauthorized access to student records, as well as guarantee data privacy and security, by implementing blockchain technology. Additionally, by lowering the possibility of fraud and identity theft, this can ease the minds of institutions and students. Due to its capacity to handle and preserve sensitive data in a secure manner, blockchain can be a very useful tool for educational Organizations.

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