Summer Internship Report 2022

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***Abstract*—Blockchain is a promising breakthrough technology that focuses on the decentralization of data ledgers and information and has caused a rise in the growth of the blockchain technology market. The market simplifies the susceptibilities of the database functions by making transparent interactions.**
A blockchain is a promising approach to developing systems for several applications within cybersecurity. In Blockchain-based systems, data and authority can be distributed, and transparent and reliable transaction ledgers are created, some of the key advantages of Blockchain over cybersecurity applications are in conflict with privacy properties, yet many of the potential applications have complex requirements for privacy. This paper is a report on a two-month research summer internship on a blockchain-based web application.

I. Introduction

A blockchain is essentially a distributed database of records or public ledger of all transactions or digital events that have been executed and shared among participating parties which can also be used for tracking assets in a business network.

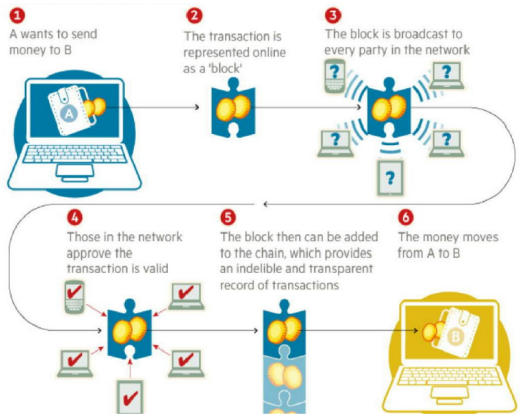

Fig. 1. Transactions using the Blockchain technology

Blockchain has the potential to revolutionize the digital world by enabling a distributed consensus where every online transaction, past and present, involving digital assets can be verified at any time in the future. It does this without compromising the privacy of the digital assets and parties involved. In general, decentralization enables involves shifting power and authority away from a single central institution. And make the authority available to the appropriate community members.

As a part of our research intern, we developed a web application of Class-Aid and finally included the Blockchain technology into the Class-Aid as an immutable database for the user functionality and as a financial transaction for the admin. Next, we spoke about how our Class-Aid web application was developed utilizing block chain, the technology employed, the work done during the research internship, and finally, we talked about potential future developments for this application.

II. Technologies employed

We used Metamask, Hardhat, Solidity, and Ether. Js and python as a part of our backend and Html, CSS, and Javascript as the frontend for creating Class-Aid and integrating it with blockchain. We will discuss these technologies in brief:

A. Ethereum

Ethereum is a technology that's home to digital money, global payments, and applications. The community has built a booming digital economy, bold new ways for creators to earn online, and so much more. It's open to everyone. Ethereum's decentralized finance (Defi) system enables you to send, receive, borrow, earn interest, and even stream funds anywhere in the world.

B. Smartcontracts

Smart contracts are programs that execute the program precisely as it was written with no danger of fraud, third-party intervention, censorship, or downtime.

C. Solidity

Solidity is an object-oriented programming language for implementing smart contracts on various blockchain platforms, most notably, Ethereum. Unlike programs in traditional programming languages, which can be debugged, in Solidity contracts mistakes cannot be edited or fixed; transactions cannot be reversed. Solidity runs on the Ethereum Virtual Machine(EVM).

D. Metamask

MetaMask provides the simplest yet most secure way to connect to blockchain-based applications. Metamask allows users to store Ether and other ERC-20 tokens, enabling them to transact with any Ethereum address. MetaMask is likely still preferable to storing your cryptocurrency in exchange because it gives the user greater control.

E. Hardhat

Hardhat Network is a local Ethereum network designed for development purposes. It consists of different components for editing, compiling, debugging, and deploying your smart contracts and dApps, which mainly provide explicit error messages and catch mistakes before you even run your code by switching to a typed language. Hardhat provides full native support for TypeScript.

F. Ether Js

The Ethers. js library aims to be a complete and compact library for interacting with the Ethereum Blockchain and its ecosystem. The library includes utility functions in JavaScript and TypeScript and has all the capabilities of an Ethereum wallet.

III. Class-Aid DApp

A. Functions

1) Admin: Once after successful login, Admin can create a new class if need be, or select an existing course. After selecting the course, Admin can add assignments. Now the main aim of the admin is to evaluate the submitted assignments, insted of evaluating by the admin through our web application ,the submitted assignments of students are randomly distributed among them for its evaluation. Every student's assignment is randomly distributed to the other 3 students for its evaluation and its average is recorded as the final mark. Here to use the random distribution of assignment feature, the admin needs to pay an amount according to the no of students, here the Blockchain comes to play for transactions.

For transactions, we used some of the functions of Ether. Js package for connecting the Metamask with the Dapp. As the Class-Aid Dapp is still in progress we used the Hardhat network for deploying the smart contracts which are written in Solidity and are supposed to properly maintain the functionality of the transaction.

2) Student: Once after successful login, the Student could be able to join a particular class as instructed. After selecting any course, the student will be able to go through the material content, or through some of the assignments allotted which needs to be submitted for course completion. After submitting the particular assignment, in a certain period, we will be able to see the 3 documents assigned for us to evaluate. After evaluating the assignments the student names get disclosed, even after disclosure of student names, the particular student should not be able to modify the marks, so here comes the immutability nature of blockchain into play which we used for the user instance.

For immutable nature or marks entry, we are going to use blockchain as our database. we used some of the functions of Ether. Js package for connecting the Metamask with the Dapp. As the Class-Aid Dapp is still in progress we used the Hardhat network for deploying the smart contracts which are written in Solidity and are supposed to properly maintain the functionality of storing the marks and retrieving them if needed.

A front-end and a back-end are the two key elements in the architecture of our decentralized app. The user-side code of an application serves as the front end of a decentralized application. A digital wallet, most commonly referred to as Metamask performs several tasks and is also part of the front-end of dApps. For user authentication, the digital wallet keeps track of users' private and public keys. The execution of back-end or smart contracts can also be viewed by the digital wallet on the Dapp front-end.

B. Flow chart

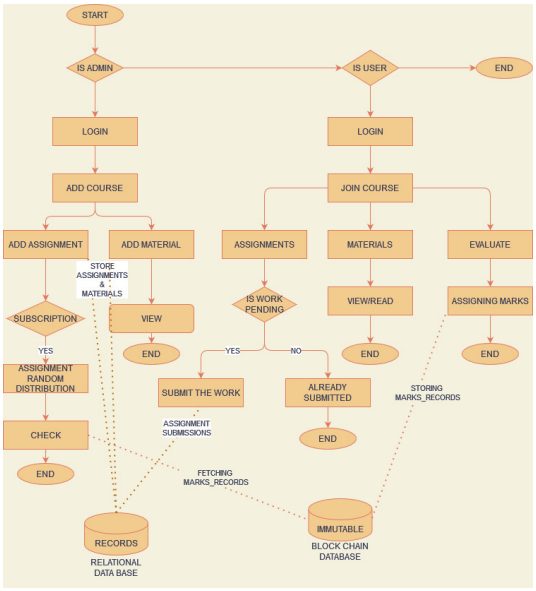

Fig. 2. Transactions using the Blockchain technology

IV. Work Carried Out

A. Learning - (2 Weeks)

We looked at all the necessary technologies such as Ethereum, solidity, metamask and developed few short smart contracts as a part of understanding how actually smart contracts work in applications.

B. Application - (2 Weeks)

Once after having a gaining the knowledge about basics of how to write smart contracts, we then looked deeper to construct more complex smart contracts and prepared a smart contract's which works exactly fine with out any error.

C. Development - (2 Weeks)

After having the smart contracts for our application, we started to deploy them, for which we studied Hardhat as a part development environment and a minimalistic level of front-end for the compilation of smart contracts rather than using Remix.Ide.

D. Test and Deployment - (2 Weeks)

At last we finally designed some front-end part for our application and integrated blockchain to it, we then tested it on local Hardhat network weather it is working fine, and finally deployed the project once all test cases had been passed.

V. Future Works

If the education system proposes blockchain technology, it can be used to create and manage a metadata system for libraries. This would allow peer-to-peer sharing of books, documents and information that can also be encrypted. A blockchain could easily manage access to certain material as well based on the permissions granted to certain users.

Generating the unique course certification for authenticated users if they completes the course in the certain period of time, not allowing others to make changes from the completed ones certificate because of its immutability nature.

VI. Conclusion

To conclude, blockchain in and for education is a plausible forecast of an upcoming all–encompassing mega transformation yet, as a technology. not only in academic section but also Blockchain with its distributed ledgers certainly promises greater efficiency and control over educational administration and management of education sector.

Acknowledgment

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