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Mapping & Visualization of Education Systems Using Blockchain Technology

Deepak Gupta[1], Suraj Chaubey[2], Abhishek Ram[3], Abdul Raheman Shaikh[4]
[1, 2, 3, 4]*Computer Engineering Department, University of Mumbai, Alamuri Ratnamala Institute of Engineering & Technology, India*

Abstract: ***The blockchain technology, proposed by Satoshi Nakamoto, is being regarded as a possibility by businesses, including the financial training, and medical services industries, due to its decentralization and non-altering features. The current admission process of students involves hard copies of students and those documents are provided after their graduation, which can be eliminated by using blockchain technology for the storage of student data on IPFS. While many colleges are migrating to cloud storage, there are various threats associated with the clouds. Most schools and colleges store their student's data locally with no backup and some even don't use backup storage. COVID*19 has recently caused DDOS attacks and ransomware attacks to various colleges. Besides the fact that these traditional database practices often create a mix-up of the students' data, there is also the problem that the data can be misplaced. The purpose of this project will be to implement a model for using blockchains to implement Mapping & Visualization of Education System that maintains students' privacy and confidentiality. As a result of using hashes and decentralized data storage, the proposed model provides greater security. Additionally, the use of a blockchain based technology to maintain Student Management System's data a highly trusted and reliable model.***

I. INTRODUCTION

Education is a middle vicinity in which development takes place on extraordinary levels of training. Blockchain may be implemented within the computerized control systems of person better training establishments or groups of tutorial group sections. Student's information is important plus sensitive and to retrieval data of general administrative framework, learning and research may additionally time consuming that cased very problematic. In conventional education framework, there's a number of the challenges are recordkeeping. The ledger era or blockchain generation lays a better way for the implementation of our project with the assist of its features like transparency, immutability and distributed manner of storing the statistics. Each business enterprise has vital records which desires to be included. The existing system which is centralized garage is the one which wishes backups of the records stored in the central sever. On the other hand, if the records (may be a record or folders) modified in the server the up-to-date file may be accessed by using everyone which has to be prevented. Our purpose is to create college/university framework efficient with decentralized way of storing the info and certificate verification. To prevent tampering of student data and prevention from third party members or organizations in a very transaction that's most vital blockchain technology we are implementing.

II. PRODUCT FUNCTIONS & METHODS

The backbone of any blockchain project is its contract, contract is a code that runs on an Ethereum node. This code is written in Solidity Language which is a high-level language which is derived from JavaScript and strongly typed languages and is mainly used to write contracts. The code mostly contains two smart contracts file Migration.sol and Certification.sol. The migration.sol is the default solidity file that comes along with Ethereum setup and contains code about how transactions should happen and keeping track of transactions. The Certification.sol file contains the main code of the system and consists of generate Certificate () and is Verified (). generate Certificate takes information and details which are to be included in the certificate. The is Verified () function takes a hash as an input which it uses to check if the hash is associated with any document or not. If the function will be original the function will return Boolean value True denoting the hash is associated with a verified block else will return false which lets the user know that the document has been tampered.

A. Storing IPFS Hash on Blockchain

The Certification.sol file contains a struct Certificate which will be the structure of our data block. This provides a blueprint for the data to be stored in the Ethereum block. This contains a byte32 IPFS_hash which is associated with the generated document and will be used further for verifying the originality of the document.

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These solidity files are once written can be compiled on platforms like Remix IDE online which understands how to compile Solidity. Here Truffle compiles the solidity and converts the given solidity files to something called abis. This contains the machine code of the solidity functions and based on the computation and space consumption, the cost of the transaction is determined. These files will generally after compilation and execution have the same name as the solidity file name but with JSON extension. This JSON file is then used to create a web3 instance of executing solidity code on Ethereum blockchain. The next most important part of the system is IPFS (Inter Planetary File System) which is used to upload documents. Since it's distributed in nature and no single user stores the document the uploaded documents are secured and can be accessed with the help of hash code. Each node in the IPFS system will have a part of the file hence no one can have access to a document at a time.

III. SYSTEM DESIGN

A. *System Architecture*

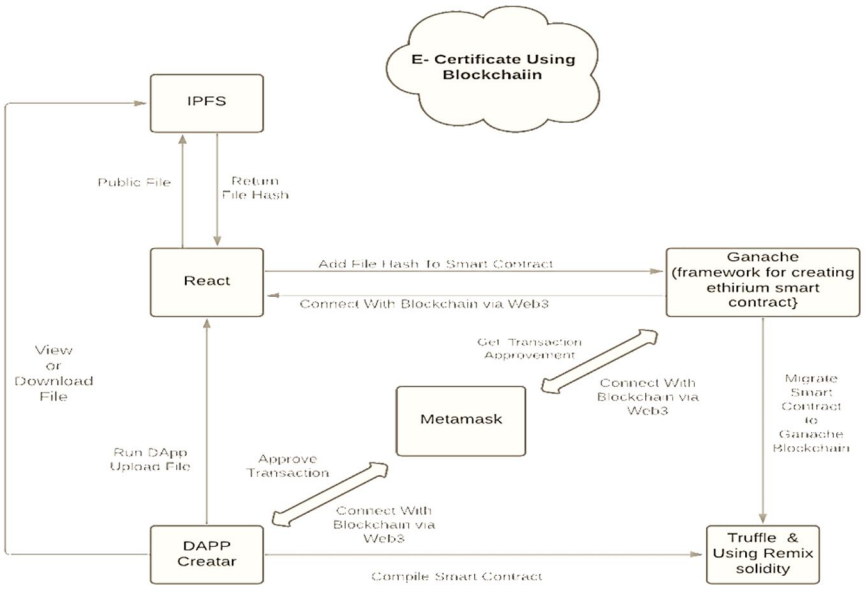


Figure: Advance System Architeture

1) *Simulation Setup:* The specifications for implementation setup are: Intel(R) core (TM) m3-7Y30 CPU 1.61 GHz, 8 GB RAM, 64-bit operating system and X64-based processor. The programming language is solidity to write smart contract. Front-end web GUI is developed using Bootstrap 4.0 and JavaScript for user interactive forms. The primary tools used to develop this system is given below:
2) *Visual Studio Code:* A lightweight cross-platform code editor designed by Microsoft for multiple operating systems. It allows powerful debugging with a variety of tools, highlighted syntax, intelligent completion of code, build in Git control and code refactoring.
3) *Smart Contract:* Smart contracts are the scripts which are self-executing and can be written in programming languages such as the JavaScript, python or solidity. Smart contracts are generally used to specify the rules while to parties communicate with each other. It can overall reduce the degree of security and helps us to lower the transaction cost.
4) *Solidity:* Solidity is the object-oriented programming language and it has syntax which resembles mostly to the languages like the C++, python and JavaScript. Generally, the remix IDE is used to write the smart contracts in the solidity. It has various inbuilt tools which helps the environment more active and useful for handling the solidity programming environment
5) *IPFS:* The celestial body filing system could be a peer-to-peer network for storing and sharing knowledge in a very distributed filing system. IPFS uses content-addressing to unambiguously establish every go in a worldwide namespace connecting all computing devices.
6) *Truffle:* Truffle provides straightforward compilation, linking, deployment, and binary management of sensible contracts written in solidity language.

7) *Ganache:* A blockchain-based emulator used to execute several tests and commands. It controls the blockchain operation by inspecting the states of system. Formerly, its name was Test RPC, which was later renamed to ganache. It provides information such as; Visual MNEMONIC (key phrase for ganache accounts) and account addresses.
8) *Meta Mask:* It is a browser extension that allows a connectivity to distributed web. Instead of running the full Ethereum node, it run Ethereum decentralized applications in browser.
9) *Implementation Details:* In this section, the implementation details are provided. The proposed system is a private network of Ethereum blockchain. Ethereum is open-source distributed platform that makes efficient use of solidity. A programmable language that allows to write smart contracts (scripting language).
10) *Communication Interfaces:* User will interact with react application will talk to blockchain. We are going to talk Ganache framework (which is development version of Ethereum) for creating Ethereum smart contract through solidity programming language, react also talk to IPFS (Inter Planetary file system). On IPFS we will upload files to develop smart contract and store location of the files/documents on Ganache. User can view as well as download file through IPFS.

IV. RELATED WORK

A. *BlockIPFS - Blockchain-Enabled Interplanetary File System for Forensic and Trusted Data Traceability*

Author, Emmanuel Nyaletey, Reza M. Parizi, Qi Zhang, Kim-Kwang Raymond Choo

In their study, they explored the possibility of integrating blockchain with a distributed file system (such as IPFS) in order to develop a system that combines the efficiency of distributed file systems with the security and traceability of blockchain technology. While distributed file systems are efficient and fast at sharing files, they lack transparency and security. Blockchain, on the other hand, provides traceability and security. The BlockIPFS protocol combines these capabilities of both technologies in order to provide file traceability, integrity, and authorship protection for files uploaded to distributed file systems.

B. *Blockchain and smart contract for digital certificate*

Author, Jiin-Chiou Cheng, Narn-Yih Lee, Chien Chi, Yi-Hua Chen

Based on Ethereum's blockchain, they designed a decentralized application and a certificate system. Furthermore, this technology is incorruptible, encrypted, and trackable, as well as allowing data synchronization. The system improves the efficiency of operations through the integration of blockchain features. Paper consumption is reduced, management costs are cut, document forgeries are prevented, and the system provides accurate and reliable information about digital certificates.

C. *Blockchain-Based Identity Verification System*

Author, Arshad Jamal, Rabab Alayham Abbas Helmi, Ampuan Siti Nurin Syahirah, Mariam-Aisha Fatima

In this paper, they discussed how a system that enhances the area of blockchain identity would help society gain control over their lives. Taking into consideration that most of the research is focusing on the storage systems of businesses utilizing blockchain, personal identities of people should also be digitized. By placing identities in a decentralized system, users will be able to own as well as control their identity and prevent data breaches by applications and services. The trust in genuine, reliable data is increased when the identity verification system is entirely owned by the individual. A transparent and open system will also contribute to it being trusted.

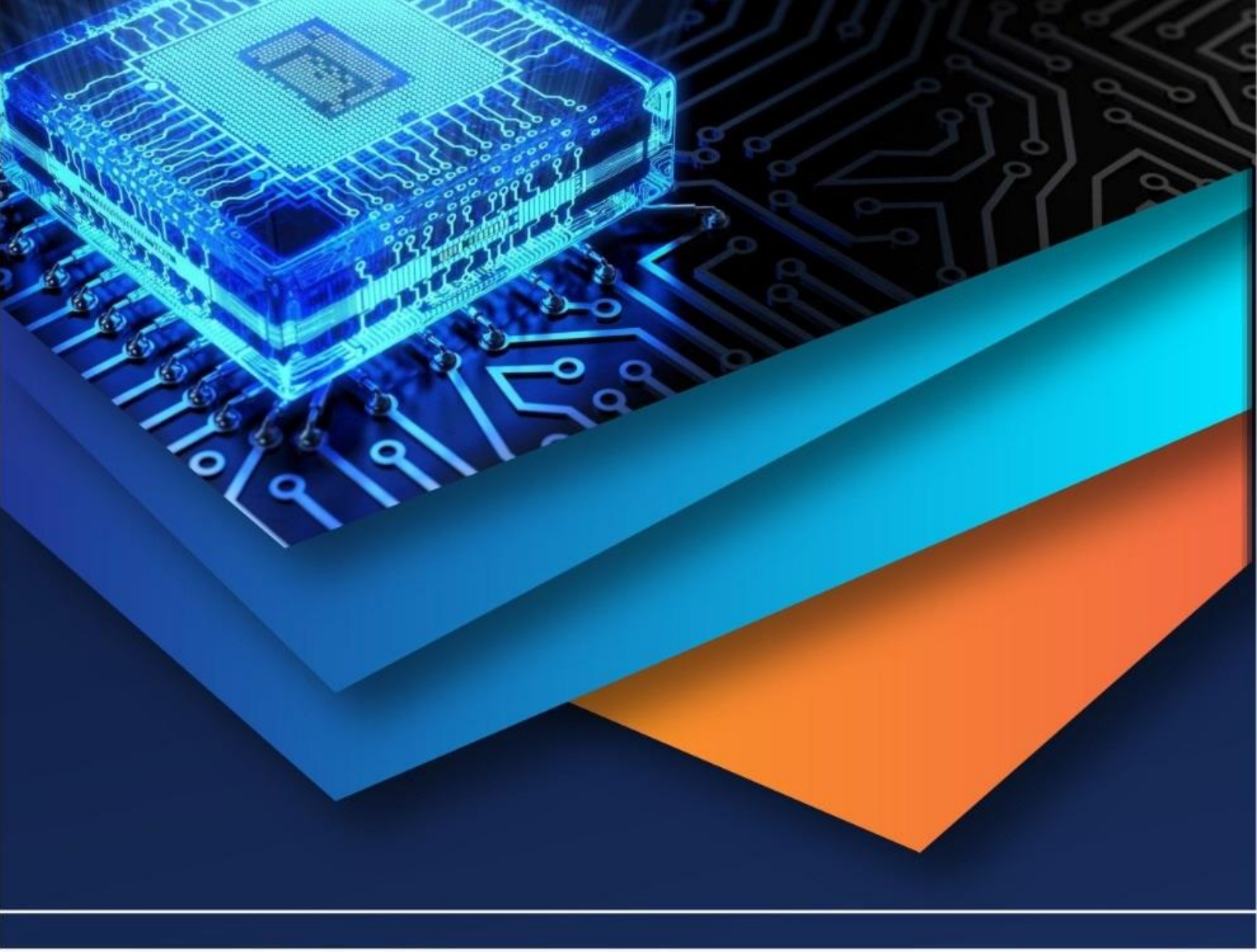
V. CONCLUSTION

We thoroughly read some of the interesting and unique research articles, which are dealing with securing records using IPFS and Blockchain. Different researchers are taking different approaches while solving this major issue of data security in education as we have recently seen heavy ransomware attacks on different universities across the globe. There are many models, implementations, and algorithms developed by researchers, which are solving many issues, but their models still have flaws that need to be addressed. One is cost-effectiveness. A system should be cost-effective as very less University spend on their IT budget, so we have to provide a cost-effective solution. Another thing is scalability, which is very important because we are dealing with a large amount of university's data globally. We need to think about energy consumption and resource management too as it is very important. Access to data during emergencies is also very important and one needs to find a robust solution for that. Lastly, we have to address different cyberattacks like insider attacks and more. Many researchers have already done some amazing jobs in solving this issue but there is still much more work to be done.

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