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Blockchain Application in the Elimination of Scholarship-based Manipulation

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Abstract: Blockchain technology has many applications in terms of record-keeping, transparency, and cryptocurrency as well. Additionally, with one of its characteristics, manipulation or fraud can be eliminated. By decentralizing the data, the data becomes immutable, which means any traditional method of record-keeping that were susceptible to manipulation can be removed now. In this paper, a method to remove scholarship-based manipulation has been proposed. In many universities, there are scholarships based on the student's family income. To support the poor and deserving in getting an education, these scholarships are a must. However, paper-based income certificates used to justify family income can be easily manipulated. Therefore, with the help of the Ethereum Smart Contract, a framework to store income certificates has been proposed. This method can be used to enter income data from the student's family's employer's backend. Considering a fair and acceptable income for eligibility for the scholarship, the university can decide to go ahead with it without fearing the manipulation of income data.

Keywords: Blockchain Technology, Scholarship manipulation, fraud detection, Education, Smart contract.

I. INTRODUCTION

Scholarships are to reward a student's academic achievement and educational programs. Whether you're starting your career or you're studying in high school to grow new abilities, receiving a scholarship is a big achievement. Talking about the economic benefits, scholarships are especially appealing to young aspirants who are simply beginning their careers as employees. Furthermore, taking a scholarship can open the way to various educational centres as well as employment opportunities. This is a Golden opportunity for genuine aspirants.

Merit-based scholarships in India are available for students displaying exceptional performance in academics. The motive of providing such scholarships is to help rank achievers fulfil their career aspirations. Also, merit-based scholarships in India work to encourage students to pursue higher studies [1].

One widespread use of blockchain in education is record keeping. The number of student records is virtually endless, and verifying academic credentials can be time-consuming, with lots of paper documentation and case-by-case checking. According to a 2019 analysis conducted by Credential Engine, more than 738,000 unique credentials documenting learning can be counted, including degrees, certificates, digital badges, and apprenticeships [2].

Blockchain can eliminate much of the overhead associated with this process and streamline verification procedures, saving educators and administrators time when it comes to things like transfers between schools or states. Using blockchain, an institution accepting a transfer student could verify their record and the courses they took with a few simple clicks. The same concept applies to record sharing with an employer.

A digital transcript can be highly detailed, containing attendance information, courses taken, and even the results of specific exams or papers. Those with access to the student's transcript — other schools or potential employers, for example — can see how they performed on certain assessments [3]. This technology holds value not only for higher education; it could also be useful in primary and secondary education.

Blockchain, and particularly the concept of a permanent digital transcript, also holds great value for lifelong learners. With lifelong learning, education is more borderless and individuals are continuously learning new skills and refining old ones, whether that's by earning a degree or attaining a certificate or digital badge. Lifelong learning is poised to become increasingly vital in a world marked by technological dynamism, and, as a result, the need for blockchain-based credentialing may also increase [4].

Storing diplomas on a blockchain allows students to own and manage their academic achievements, providing them with the ability to share them when and where they choose. Blockchain's record-keeping capabilities to store scholarship data can be useful to universities in getting relieved of all the paperwork in addition to eliminating manipulation in data. Income-related data to score a scholarship can be easily manipulated on a piece of paper. The universities or colleges hardly have time to cross-check student data.

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Scholarships are given to deserving candidates who come from a less earning background to ensure proper studies within plausible earnings [5]. Manipulation in such conditions can be considered a huge fraud and would be considered unfair to the deserving students.

A. Blockchain Introduction

Life is increasingly moving online, as one of the challenges the internet users face is performing financial transactions in a setting where people cannot know or trust the other party. Some of these trust issues have been noticed through the development of cryptocurrencies like bitcoin. All transactions in the bitcoin economy are tracked in a ledger system called "Blockchain".

Blockchain is the backbone of the Digital Cryptocurrency Bitcoin[6], blockchain (Figure 1) is a distributed database of all records of a transaction. Each transaction is verified by a majority of participants of the system. It records every single record of each transaction. Blockchain is a shared and immutable ledger that facilitates the process of recording transactions and tracking assets in a business. An asset can be tangible like a house, car, or land or intangible like patents, copyrights, branding, Virtually anything of value can be tracked and traded on a blockchain network that reduces risk and cuts costs for all involved[7].

Blockchain technology helps businesses to run on information. The faster it is received and the more accurate it is, the better and blockchain is ideal for delivering that information because it provides immediate, shared and completely transparent information stored on an immutable ledger that can be accessed only by permission of network members [7].

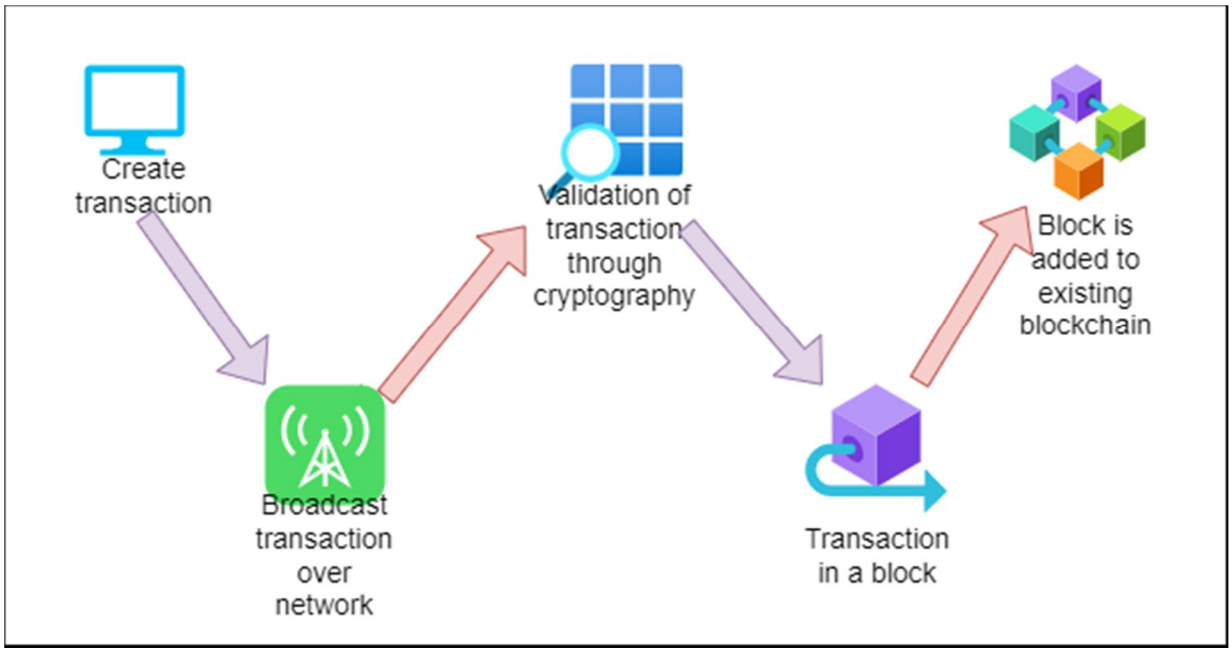


Figure 1: Working of Blocks in Blockchain

1) *Ethereum*: Ethereum is a decentralized blockchain platform that establishes a peer-to-peer network that securely executes and verifies application code, called smart contracts. Smart contracts allow participants to transact with each other without a trusted central authority. Transaction records are immutable, verifiable, and securely distributed across the network, giving participants full ownership and visibility into transaction data. Transactions are sent from and received by user-created Ethereum accounts. A sender must sign transactions and spend Ether, Ethereum's native cryptocurrency, as a cost of processing transactions on the network [8].
2) *Smart Contract:* Smart contracts are programs which govern the behaviour of accounts within the Ethereum state [9]. Smart contracts have the potential to introduce radical change in the way international business and trade are executed by speeding up transactions, reducing paperwork, and bringing about cost-efficiency. Industries like art, music, real estate, finance, manufacturing, retail, supply chain, and telecom could benefit significantly from smart contracts. The adoption of smart contracts would be hastened if the platforms which host them accept payments in all currencies instead of just cryptocurrencies, and brought them under the purview of the current judicial system.

3) *Solidity:* Solidity is an object-oriented and high-level language for implementing smart contracts, solidity is a curly-bracket language designed to target the Ethereum Virtual Machine(EVM). It is influenced by C++, Python and JavaScript.You can find more details about which languages Solidity has been inspired by in the language influences section and with the help of solidity you can create contracts for uses such as voting, crowdfunding, blind auctions and multi-signature wallets [10].
4) Solidity is statically typed and supports inheritance and libraries and complex user-defined types among other features.
5) *Remix:* Remix [11] is a solidity online compiler, access through remix online, the user need not be install anything. Remix is also a convenient option for testing nightly builds without installing multiple solidity versions.

II. MOTIVATION AND CONTRIBUTION

Working with an emerging technology brings far many productive results, especially when used for an existing technique. Any type of fraud is prevalent in many parts of the world where paperwork is still considered a practical way of work. Due to the extent of manipulation that cannot be avoided especially scholarship-based certificates, using a proper method is elimination is called for. Blockchain Technology is not only a crypto-based technology, it has far more advantages as record-keeping as well.

To solve the problems of manipulation, a blockchain-based record-keeping of income certificates has been proposed which will eliminate any level of manipulation for receiving scholarships. By using the proposed framework, the following contributions were made:

1) Learning the ways of using blockchain in record-keeping
2) Elimination of manipulation in income certificates for integrity in scholarships
3) Exploring Smart contracts and their ways of creating a blockchain-based framework.

III. LITERATURE REVIEW

Thus there are billions and billions of students undertaking education in various institutes in a year. It is the greatest task of maintaining records of those students' details in paper documents. When those records are on paper formats, it becomes a complex task to get back the details of students who studied 4-to 5 years back. It takes a lot more time to recollect the old data and record 0. Securely maintaining the certificates of students becomes difficult and requires manpower. The trouble-filled part of the education sector is accounting, which requires time and people to calculate and maintain the finance of an institute. This involves the calculation of employee/staff salary, student fees, maintenance and operational costs of that institute. Monitoring the scholarships for the students also became difficult as there are more students and also scholarships provided.

The paper by the author [12] Kamišalić et al., has presented a thorough overview of block-chain initiatives and solutions in higher education. They have shown how blockchain is used to immutably store student achievement data while making it available for authorized users. As this is most commonly used in the future. They have identified 25 projects, only four out of 25 are detected as institution-centric, while 11 as only student-centric projects. Ten projects are following both approaches, student- and institution-centric. Most of the projects within the educational domain deal with record-keeping issues while taking student-centric approaches. Block-chain technology is showing its potential to disrupt established business processes. Four types of block-chain initiatives have been identified: Recordkeeper, efficiency play, digital asset market, and block-chain disruptor.

The paper by [13] Honesti et al., has presented how they all want to connect the current scholarship system in every sector to the blockchain. In today's scholarship scheme they face many challenges which are as no detectable utilization structure, lack of openness between students and the Learning Board and no major novel confirmation.

In this paper, they have planned smart contracts and implemented a Blockchain-based gamification Scholarship Scheme for College Students. They have divided this scholarship scheme into 4 different categories like Study Boards, Students, Large Schools, and Banks. Block-chain-based Smart Contracts for Gamification scholarship schemes provide easy-to-understand weather for students as well as protect the direct bond between students and their dedicated Learning Board.

The paper by [14] Tekgüç et al., has explained how the world is getting transformed, and education becomes an unavoidable one among the people. Thus there are billions and billions of students undertaking education in the various institutions in a year. It is the greatest task of maintaining records of those students' details in paper documents. When those records are on paper formats, it becomes a complex task to get back the details of students who studied 4-to 5 years back. It takes a lot more time to recollect the old data and records. Securely maintaining the certificates of students becomes difficult and requires manpower. The trouble-filled part of the education sector is accounting, which requires time and people to calculate and maintain the finance of an institute. This involves the calculation of employee/staff salary, student fees, maintenance and operational costs of that institute. Monitoring the scholarships for the students also became difficult as there are more students and also scholarships provided.

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IV. THE PROPOSED FRAMEWORK

Proving the validity of any document is a difficult task. Because a lot of data manipulation occurs in government official documents, it would only be fair to deploy a method in eliminating such manipulations from the root.

The proposed framework (Figure 2) is named the Blockchain-based Scholarship Manipulation elimination system and has been prototyped using the Ethereum Smart contract. The working of this system could be elucidated through these components:

1) *The University/College:* If any university or college is providing government-based scholarships based on the students' parent's income then the foremost task is to gather substantial proof regarding the eligibility of that scholarship. For a parent, the proof of income would be generated from their workplace, and to obtain validation over it, the proof has to go through formal drafting from the municipality office on general power of attorney/ agreement paper. Further, the processing of scholarships from universities doesn't include any formal cross-checking for the plausibility of the income document. To eliminate the chances of manipulating data in the income certificate, the proposed framework has introduced a blockchain-based recordkeeping system. The parent's income certificate shall be verified and uploaded from his organization itself in the blockchain ledger creating a unique ID for fetching that data.
2) *Parent's Workplace:* The role of the parent's workplace here in this framework is to make sure correct and valid information about the income of the parent is updated in the blockchain ledger. A paper-based income certificate can be manipulated easily without the knowledge of the workplace or the university. However, the data sent to the ledger from the workplace cant be manipulated. Hence, giving a sense of integrity to the income certificate.
3) *Student Participant:* The student has the role of applying for the income certificate to prove his validity of obtaining a scholarship. As the income data will be uploaded from the parent's working organization itself, the student can submit the unique ID obtained from the workplace to validate his scholarship eligibility.
4) *The Framework:* The framework is made using a smart contract, where functions have been created for the usability of the parents' workplace and the university /college. The function for the workplace can be used to store income data such as organization name, working years, service type, position in the department, total income per year, date of validity, along with a unique ID. This Unique ID can be then used by the university/college to fetch or retrieve data regarding the income from the blockchain ledger.

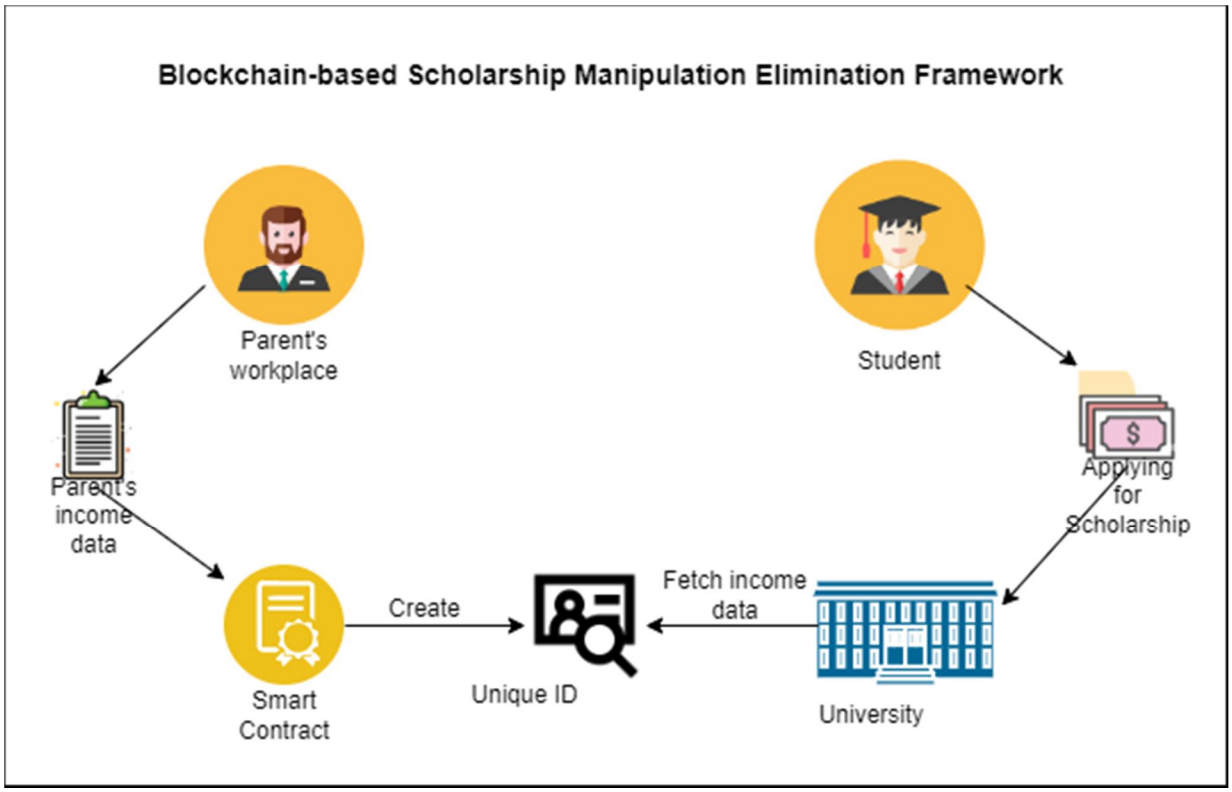


Figure 2: The proposed Blockchain-based Scholarship manipulation elimination

V. RESULTS

The prototype of the Scholarship manipulation elimination framework was made using Ethereum Smart Contracts. The Solidity programming language was used to make a smart contract. The program was run on Remix Integrated Development Environment. For deploying the smart contract, the Remix IDE's inbuilt Javascript Virtual Machine Environment was used. For deploying the code, Pragma version 0.4.22 to 0.7.0 was used.

The following Screenshots from the code explain the working of the prototype:

Figure 3 explains the creation of income detail structure to store income details namely: name of the employee, their unique ID (UID), the name of the organization, the code of the organization to ensure legal workplace, the type of service the employee is entailed in, the number of years the employee has worked in the organization, along with the current salary and the date up to which the salary is valid.

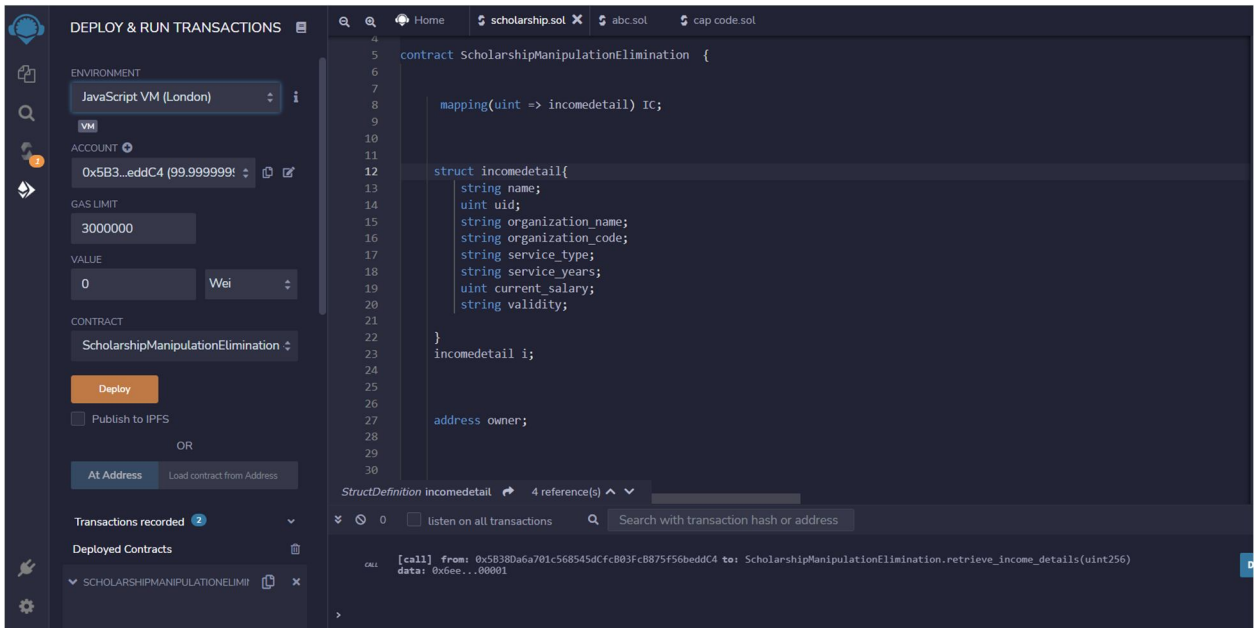


Figure 3: Creation of Struct in Solidity

Figure 4 below includes store income detail functions that will record all the aforementioned data in blockchain when deployed. This contract will be deployed by the parent's workplace with correct and verified information about their employee's income and employment data. A unique ID for a transaction will be created to fetch the records.

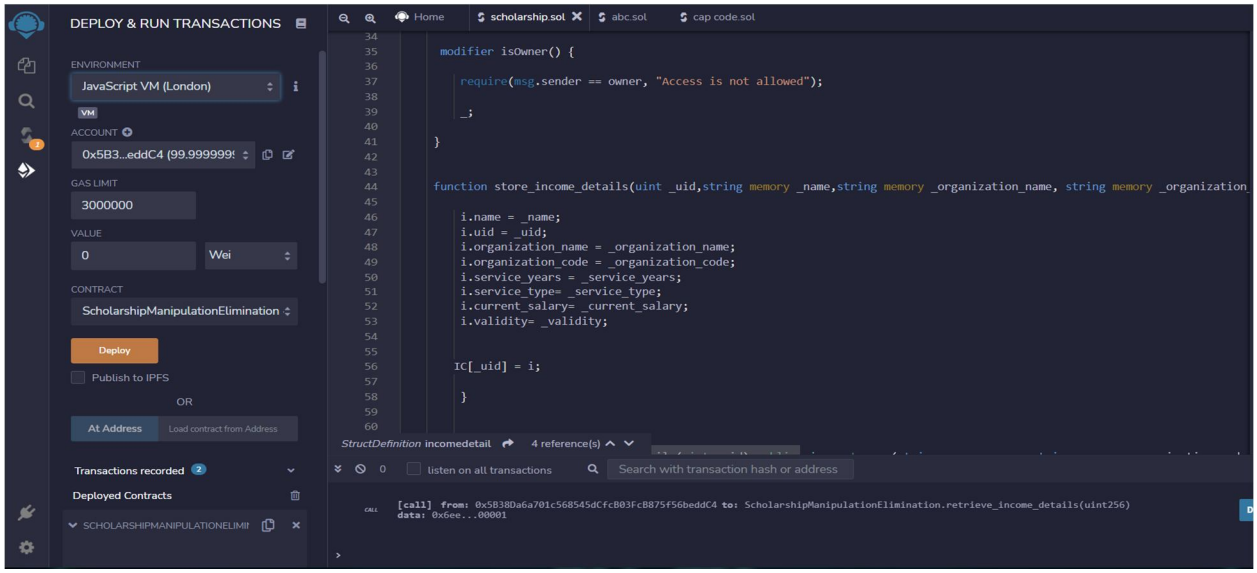


Figure 4: Storing Income details

Furthermore, the university or college where the student has applied for a scholarship would use the unique ID created by the parent's organization to retrieve data (Figure 5) about their income to provide approval for a scholarship. The figure below depicts the retrieve function using "uid" for a unique ID.

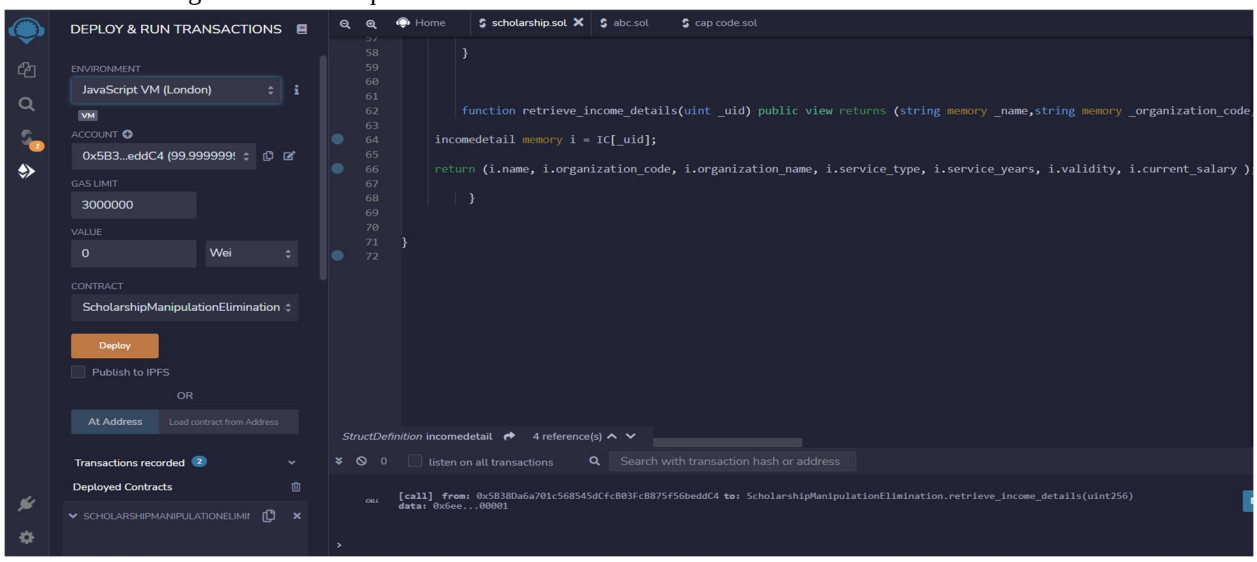


Figure 5: Retrieving Income data

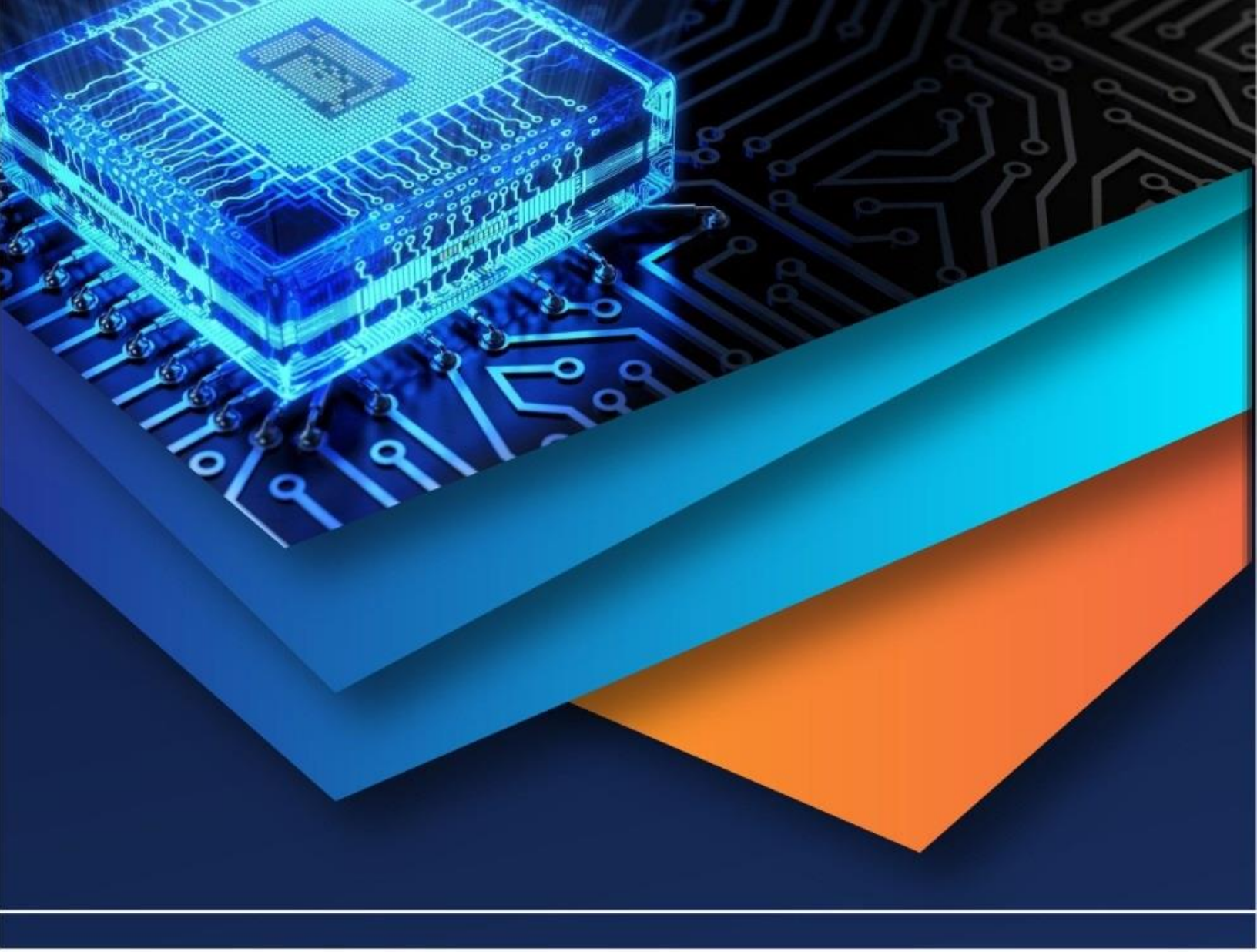
VI. CONCLUSION

There are many ways in which fraud can be conducted. However, not many ways to stop them. In this work, a method of stopping scholarship-based fraud, especially through traditional paper-work means was proposed. The paper discussed the various existing work in this area along with a proposed methodology on how scholarship manipulation can be eliminated. An Ethereum based smart contract was used to create a record-keeping system that would store income details on the student's parent from the organization of employment itself. BY using this method, the university would not have to worry about paper-based income certificate manipulation.

The prototype was created using the Ethereum Smart contract and can be further improved in future work. Other fraud elimination methods can be proposed using blockchain technology.

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