Secured Taxation Operation Using Transaction Functionalities of Blockchain

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Abstract.

The conventional process of tax payment includes laborious steps and many participants which became a regular issue of public dissatisfaction. As a result of being sloppy monitoring and the involvement of many participants, the process has become the cause of irregularities among taxpayers and tax-collecting authorities. Moreover, the traditional taxation system raises security issues as it requires the involvement of third parties. Therefore, lack of monitoring can increase the rate of corruption in tax collection. In this modern world, people favour the digital system rather than the traditional system as it ensures fast and flexible transmission of data without any hassle. However, security is a major concern in the digitalized data transmission process. Consequently, providing a secured system should be our first priority as the taxation system is directly related to the development of a country. Nowadays, cryptocurrencies are operating secured transactions using the security protocols of blockchain. We implement a tax payment system using the functionalities of blockchain technology so that we can prevent fraudulent activities, multi-involvements, corruption, and all other infringement which are responsible for the mismanagement of the central taxation system. Along with this, the model which we are proposing will also ensure proper security, higher speed, and well-develop management for the transactions.

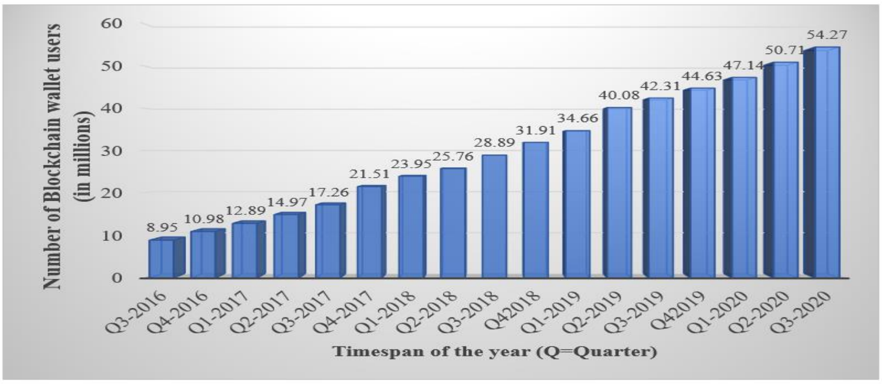
Keywords: blockchain, cryptocurrency, smart contract, TAXCOIN, PoA.

1. Introduction

The world economy has been facing a major financial crisis for the last decade. This financial crisis had turned into a global crisis in the year 2007-2008 as the financial stress was transmitted on a huge level and the whole world economy had faced a severe drop. Moreover, mismanagement in financial institutions, unsophisticated regulated monetary and unstructured fiscal policies play a vital role in this global crisis. Here, the concept of the digital system arises to prevent such occurrences. The digital system of blockchain technology can eliminate these problems. Moreover, it can be used to create a more secure system that can independently stable the economy without any government involvement. The digital decentralized network system can implement more regulated and secured taxation policies. In this digital world, digital currency and the decentralized network system support the thought

of cryptographically chaining blocks of knowledge relying solely on technology that is detached from any intermediaries. Bitcoin was the beginning of the first digital decentralized cryptocurrency. Today, blockchain has advanced from being a calm nearness behind Bitcoin to an innovation that might change how we direct installments, store information and perform exchanges. Figure 1 shows the increased number of blockchain wallet users (Rudden, 2020).

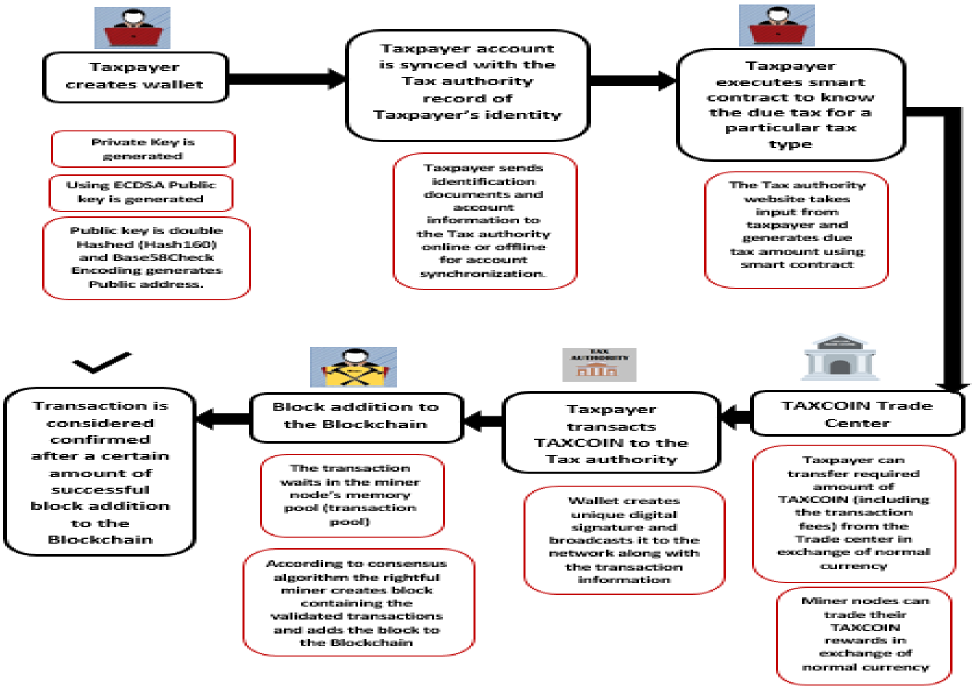
Figure 1: Number of blockchain wallet users worldwide



Source: (Statista, 2020)

A blockchain is a record of data that is replicated across computers using a Peer-to-Peer network. The correspondence inside the system utilizes cryptography to give secure recognizable proof of who sends the data and who gets it. At the point when a peer needs to include a bit of information in the record, other peers must affirm the rightness of the data, which thus is added to a block. Each block contains a unique hash of the previous block, connecting them to make a chain of blocks. An overall flowchart of our project is shown in figure 2.

Figure 2: Overall Workflow of Our Proposed Taxation



A unique hash is like a digital fingerprint. blockchain technology eliminates the need for centralization through a mediator which enables parties to share data in a protected way (Frankowski, 2017). We are using this modern technology of blockchain and creating the digital system of Tax transactions. For this, we are using a decentralized network to develop digital currency for the transaction purpose and the smart contract which contains the algorithm for calculating different types of taxes. The users execute the smart contract to know the amount of tax they have to pay using the system. After verification, they get solid proof of the transaction. The transaction conducts in real-time, which significantly reduces the risk of mistakes, fraud, double spending, counterfeiting. Consequently, the multi-dimension checks of blockchain technology significantly reduce the chance of tax frauds during transactions.

2. Literature Review

This section discusses the previous works related to blockchain and tax. In this present era, the gradual maturation of some transformative emerging technology provides promises to reshape our society fundamentally. Our current era is already concerned with the 'second machine age'. These technologies include machine learning, computer science, and blockchain or distributed ledger technology. A model of the future taxation system using blockchain properties has already been proposed (Rijswijk, 2019).

Throughout the years, there has been a lot of illustration regarding the digital transmission of money using cryptocurrency. This cryptographic virtual currency almost makes it impossible for anyone to counterfeit or double-spend (Frankenfield, 2020). It uses the peer-to-peer transaction system. In modern days central banks are also showing their interest in digital currencies to innovate many new ways for online banking.

On another note, if we talk about the negative aspects, there are tons of problems that can occur because of digital currencies. But then again, there are also tons of policies that are being used to solve these problems. The key issue which is needed to be mentioned here is the anonymity surrounding cryptocurrencies. There should be a system where it will be mandatory for all of the users to complete their registration processes properly so that they can follow a proper framework (Bonneau & Miller, 2015).

Some countries are trying to overcome taxation fraud by tracking and matching data and enhancing the reporting system. They are investigating the use of blockchain for that. They are already conducting researches for using blockchain's potential in government sectors. In taxation management, "Permissioned Blockchain" plays an important role. Along with this, Hyperledger Sawtooth is considered to be useful in replicating systems and processes for real-world tax governance. Because it has on-chain governance features. Sawtooth can be used by managing bodies to ensure duties and approvals (Hoffman, 2018).

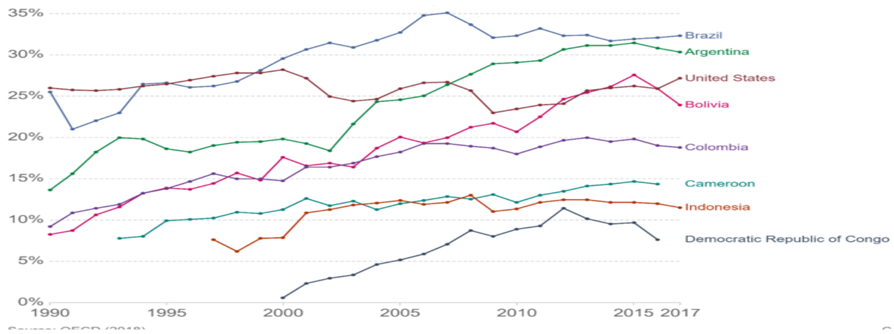
One good thing to be noted here is that tax digitalization is getting speedier. And this is happening because of the adaption of several electronic tax reporting systems in not only developed countries but also in developing countries as well. As a result, now it seems like it is only a matter of time when taxation on all forms will be achieved by implementing blockchain technology (Frankowski, 2017).

3. An Overview of Tax and its Importance

Section III enlightens us about tax and its value in a country. Tax is a mandatory financial charge which is imposed by the government upon its eligible citizens so that they can earn some revenue from the people of the country. In monetary terms, taxation converts capital to the government from individuals or corporations. This has implications that can both improve and decrease long-term economic growth welfare.

As a way of increasing money, governments levy charges on their people and corporations, which are then used to meet their fiscal demands. This involves funding public and government programs, as well as making the country's market climate conducive to economic development. In a country, taxes help raises the standard of living. The stronger the standard of living, the deeper and higher the most likely level of consumption is. When there is a demand for their goods and services, businesses prosper. With a better standard of living, firms will also be assured of increased domestic demand. In figure 3 a graph of total tax revenues are shown as a percentage of GDP (Ortiz-Ospina & Roser, 2016).

Figure 3: Total tax revenues as a percentage of GDP.



Source: OECD (2018)

Without taxation, it would be difficult for governments to fulfill the demands of their populations. Taxes are important because this revenue is collected by governments and used to support social programs. Taxes usually contribute to a country's gross domestic product (GDP) that sets the benchmark of the economy of the country.

4. Methodology

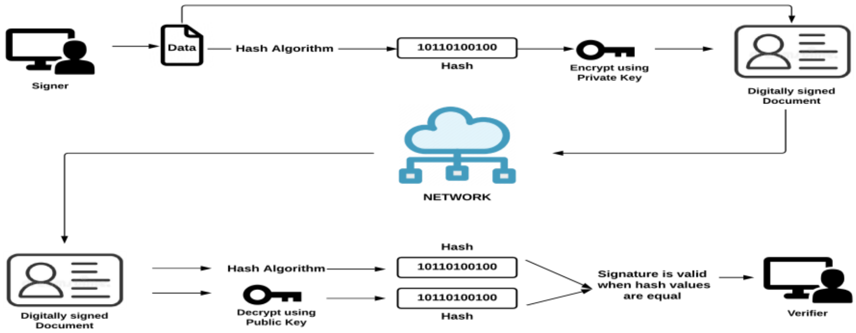
4.1 Wallet Creation

Firstly, for our system, we create a wallet. Principally, a blockchain wallet is a digital software system that stores and manages cryptocurrencies for users. The wallet will perform transactions simultaneously. While creating a wallet a user generates a public key through a private key. The private key is the secret key and must be kept secret as it proves the ownership of the wallet account. Public keys are transformed into an address that is used to send cryptocurrency. There can be two types of wallets, a hot wallet, and a Cold wallet (Simplilearn, 2020). In our work, we used a hot wallet to implement our system. In short, private keys are used to prove ownership and redeem the received fund. Private keys are also used to digitally sign the transaction for the receiver. Wallet software makes day to day transaction easy and convenient. Moreover, it uses cryptography to encrypt and decrypt data which makes it highly secure.

4.1.1 ECDSA

In the wallet creation process, we are using the ECDSA algorithm to generate a unique public key for a particular private key. It follows the Elliptical curve cryptography (ECC) system. Fundamentally, the idea is to create a digital form of the signature so that anyone can sign a file digitally and the signature cannot be forged by anyone else including very well-resourced attackers. It is based on asymmetric cryptography where our signer will have a private key and will use this key to produce the signature. The signer will be the only one who has the private key. Figure 4 shows the working mechanism of ECDSA.

Figure 4: ECDSA working Mechanism

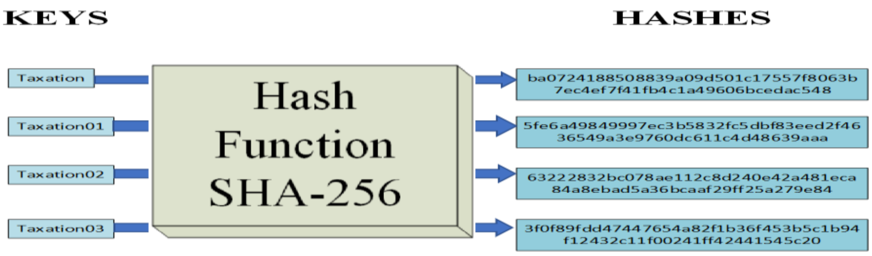


This algorithm ensures data integrity as if a single byte is changed on the file which is signed by the signer the sign will no longer remain valid. After this, anyone who will receive the file will validate the signature by using the public key of the sender.

4.1.2 Hash Function

Henceforth, for encryption purposes, the public key is hashed using cryptographic hashing algorithms and converted to public address with the help of other encryption algorithms like RIPEMD 160, Base58Check, etc. Generally, the cryptographic hash function is an algorithm that takes an input and converts it into a fixed-length output value. The fixed-length output, we call it hash. The hash is an encrypted text. There are many types of hash functions but we are proposing to implement SHA-256 in our work. SHA-256 generates a fixed-length hexadecimal value as a hash. It takes any input as large as 2^64 bits and calculates the hexadecimal output. The output is a fixed length of 256 bits represented by 64 hexadecimal digits. The special feature of SHA-256 is unpredictability. If we change any bit of the input, it will generate a unique value and the output seems random. However, it also ensures the same output for any particular input. Another feature of the hash function is infeasibility. It is extremely difficult to reverse the hash value as the output is unique for any subtle change in input. In figure 5, the hashes are generated from a hash function SHA-256 and the hash function takes the keys as input.

Figure 5: Hash Function.



4.2 Synchronization of Taxpayer Account

Before the taxpayer pays his tax, it is important to synchronize his identity properly. That is why our proposed system will make sure that the taxpayer's identity is synchronized with the Tax authority's record of his identity. For this purpose, the taxpayer may send his identification documents along with the account information to the tax authority online or offline.

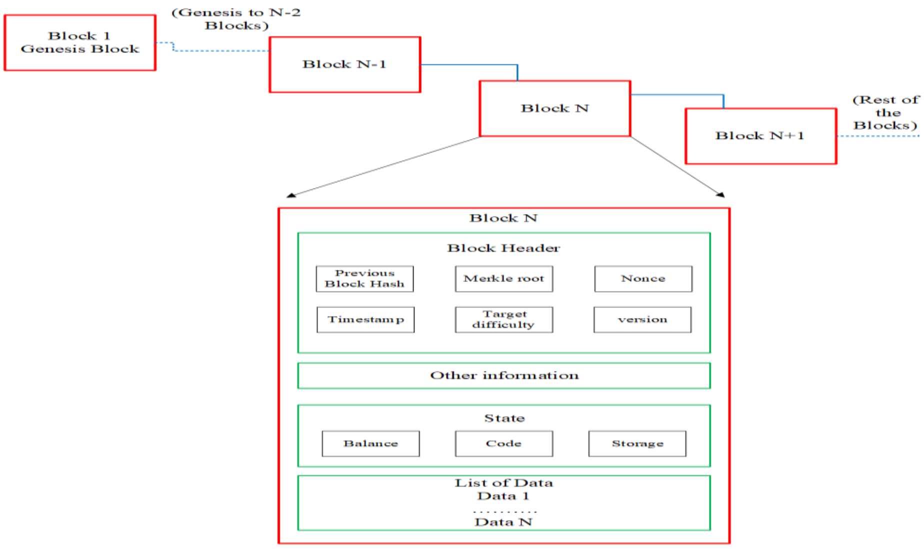
4.3 Network Modelling

For the network modeling purpose, we are using Distributed Ledger Technology (DLT). It is the digital way of storing data in a decentralized and synchronized manner that is independent of geological location. It is an append-only ledger and features immutability if proper protocol is imposed. It also provides transparency on transactions across the distributed network. Currently, blockchain is the popular type of DLT used by Bitcoin, Ethereum, Ripple, Lite coin, and other platforms.

4.3.1 Block and Blockchain Generation

In our system, we are using Blockchain technology for ensuring the secured taxation operation. In the Blockchain, we are using a peer-to-peer network to maintain a single data ledger over a centralized data server system. This peer-to-peer network prevents the risk of a data breach as the data in the ledger is updated in all the full nodes of the network. All the blocks in our Blockchain contain the cryptographic hash value of the previous block except for the "Genesis Block" (Starting block). Therefore, it serves the functionality of immutability as changing a bit in the block invalidates the later chain of blocks including the changed block. The block is verified by nodes and the consensus algorithm ensures the consent among the nodes to confirm the block miner. For each block, the miner node gets incentives (block reward + transaction fees). "Target Difficulty" in block header denotes the amount of computing power needed to mine a block to the blockchain. Brute force technique is required to acquire the hash to fulfil the Target Difficulty. After meeting the target difficulty in a given time the block becomes the candidate block and appended to the ledger if it is valid. Besides, we use the Timestamp field records the time for our candidate block. Figure 6 shows the general block structure of a blockchain network.

Figure 6: Block Structure



The block contains the data of transactions in the data field. The cryptographic hash of all transactions is sequentially hashed to obtain the Merkle root of all the transactions which represents the whole summary of transactions. The block can also contain other information, code, state of transactions, smart contracts, version, and necessary data to run a particular protocol. The *Nonce* field in the block header is used to brute force and compute the hash of the block. Nodes alternate the Nonce and the extra Nonce in the coin base transaction (The first transaction of the Merkle tree) to achieve the target hash to generate candidate blocks. We are using blockchain technology as it ensures better security, provides faster settlement, guarantees immutability, and anonymity by using a decentralized peer-to-peer network system.

4.3.2 **Consensus Algorithm**

We are using Proof of Authority (PoA) as the consensus algorithm in our implementation. This algorithm chooses some blockchain nodes and gives them the power to validate and add the new blocks of the transactions. One or multiple validating devices are in charge of that. There are two ways a block can be accepted. The first one being accepted after being elected by the majority of the network. And the second one is being accepted after being validated by the block generators. One positive thing to be noticed here is, there is no technical competition among the block generator nodes. An appropriate reason behind choosing to implement this algorithm in real-life is: it costs a very low amount of computing power and electricity. In a situation where the nodes are unknown to each other and are having a trust issue regarding each other's validity, there is no better alternative than using PoA.

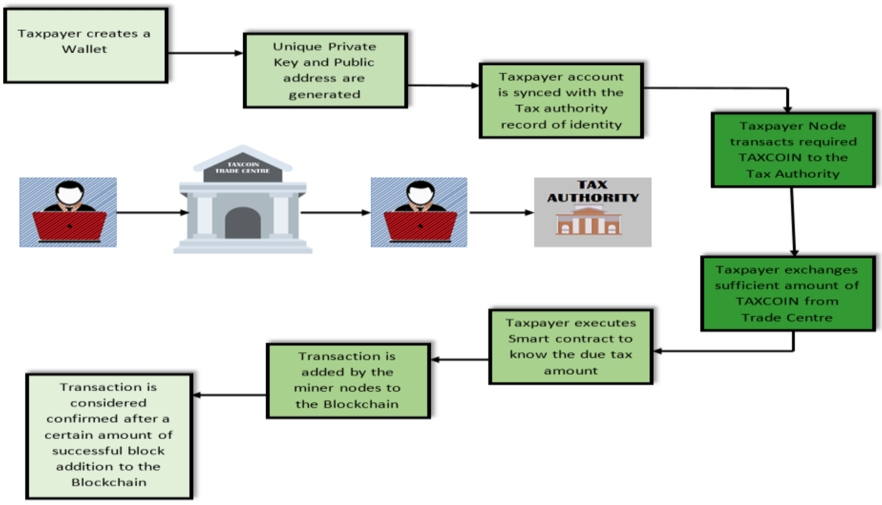
4.4 **Smart Contract Execution**

In this section of our paper, we are going to explain how our system executes the smart contract to know the due tax amount. After synchronizing the taxpayer's identity, the smart contract checks its predetermined conditions. As we already know smart contracts resemble the third-parties (e.g. brokers) involved in a deal. It ensures trust among the parties. But both parties need to trust the smart contract regardless of their trust in their counter-party. According to the pre-determined set of conditions, there are different amounts of tax for people of different sectors. Giving an example is the easiest way to explain the way it works in our case. So, here it is: Let us assume that a woman employee wants to pay her income tax in Bangladesh, the amount sets after checking the conditions that match with the state of her account. Here, the state of account is represented by various variables, such as income, gender, NID, age, etc. These are the variables that are taken as inputs from a user/taxpayer. The amount is different from her corresponding male employee. It will also vary from country to country. For different countries, the pre-determined conditions for calculating the due tax amount will be different. One thing to be noticed here is that the whole process is being monitored by the other existing nodes of the network. That's why altering it after the amount has been fixed is almost impossible. It works following some if/when then conditions. When all of the conditions are met and verified, the network executes the actions with the help of its active nodes. However, one can update his smart contract by simply extracting all the previous information from the old contract and entering those into the new/updated one. After that, he has to update the address of the new contract so that the other users can see the updated contract.

4.5 TAXCOIN Transaction Process

In our proposed model, we introduce a blockchain-based currency, TAXCOIN which will be controlled by the Governing authority of the country. The responsible authority needs to build trade centers for TAXCOIN where the taxpayer and the tax authority can trade TAXCOIN in exchange for the normal currency. The number of Trade centers will be based on the population of the area. The taxpayer needs to create a wallet with their private key and the generated public address of the account which will be linked to the national identity record of the taxpayer in the tax department ledger according to the constitutional rules. The smart contracts for certain taxes are set by the tax authority based on the tax type. The taxpayer can generate the amount of their due tax of a corresponding year by executing the smart contracts in the blockchain. Smart contracts in the blockchain are immutable. Therefore, the taxpayer must trade the smart contract generated amount of TAXCOIN to the wallet from the Trade center and transfer the TAXCOIN amount to the tax authority node as shown in figure 7. As a result, the transaction will be in the blockchain with the receiver address as the authority node and sender as the Taxpayer node with the timestamp. This data is immutable and the authority has a transparent picture of the accurate amount of paid taxed.

Figure 7: Transaction process of TAXCOIN



Authority can keep track of the total tax revenue and identify corrupt activity in the system. In the system, the transactions are added by the miner nodes in the network. We are proposing Proof of Authority (PoA) for TAXCOIN. PoA will ensure the identity of the miner and keep the digital documents of the miner's identity. As a result, if any miner acts as a malicious node, the network will detect the malicious node and the rewards earned by the miner will be irredeemable. Moreover, there will be no block reward for the miner upon adding new blocks. The incentives of the miner are solely based on the transaction fees of the transactions. After a certain amount of block addition, the miner will be eligible for redeeming rewards. While redeeming the mining reward from the trade center, the identity of the miner must be cross-checked before further action.

4.6 Algorithms

In this part, we describe the algorithms of our project.

Figure 8: Algorithm 1 & 2

```
Algorithm 1: Upload Information
Connect → Blockchain
Input Data → taxpayer_name, taxpayer_gender,
  taxpayer_age, tax_type, tax_amount, taxable_salary
while x = 0 to number of attributes do
  | Read ← Data
  | Upload Data → Server
Display ("Data has been uploaded Successfully")
```

```
Algorithm 2: Executing Smart Contract
Connect → Blockchain
Execute Smart Contract
if Data match with tax Condition then
  | Calculate Tax
  | Display (Tax Amount)
  | Publish (tax_amount)
else
  | Display ("Tax not Applicable" )
```

The first and foremost step of our implementation part is to upload information to the server. Algorithm 1 in figure 8 (left) is used for uploading necessary information. The taxpayers will use this algorithm to upload their data by connecting to the blockchain network. As inputs, they will enter their name, gender, age, the type of tax they are going to pay, tax amount, taxable salary. The while loop will ensure to take all these attributes before jumping into the next operation. After successfully uploading all the data, a message will be displayed saying, "Data has been uploaded successfully". Moreover, Algorithm 2 in figure 8 (right) is used for executing the smart contract to know the due tax amount of a particular taxpayer. If the taxpayer's information falls under any pre-determined condition of the smart contract, it will calculate the tax and display the tax amount. Otherwise, the algorithm will display a "Tax not Applicable" message.

Figure 9: Algorithm 3 & 4

```
Algorithm 3: Transfer TAXCOIN to Wallet
Connect → Authority_Wallet
Connect → Blockchain
Verify Information
Input → TAXCOIN_amount
if Information Valid then
  | Transfer TAXCOIN_amount
else
  | Display ("Information Mismatched" )
```

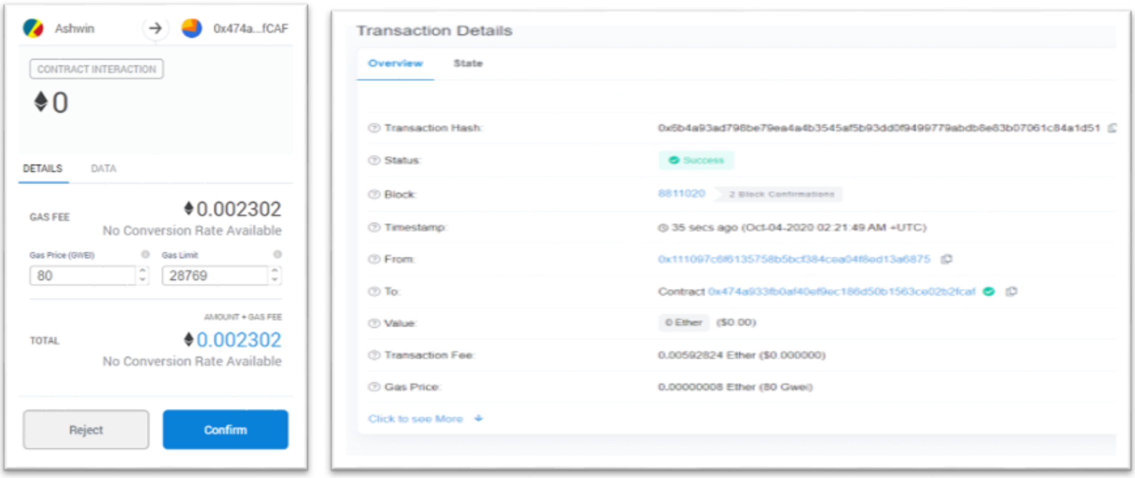
```
Algorithm 4: Pay Tax amount to Government
Connect → Wallet
Connect → Blockchain
Calculate Gas amount
amount = tax_amount + gas_amount
if Wallet balance is sufficient then
  | Transfer amount
  | Display ("Transaction Successful" )
  | Generate Receipt of payment
else
  | Display ("Insufficient Balance" )
```

One of the most important parts of our implementation is to transfer the TAXCOIN to the taxpayer's wallet. This algorithm 3 in figure 9 (left) connects the taxpayer's wallet to the tax authority's wallet. The tax authority will verify the taxpayer's information according to their records of identity. Also, the taxpayer will enter the amount of TAXCOIN as input. If all the information gets validated, the particular amount of TAXCOIN will be transferred to the taxpayer's wallet from the tax authority's wallet. The amount of TAXCOIN will be decided based on the amount of tax. The taxpayer will give the money/usual currency (their due tax amount) to the tax authority and only after that they will transfer the TAXCOIN. Otherwise, a message saying, "Information Mismatched" will be displayed. For this part to be successful, a taxpayer has to go to the Tax trade center. Finally, the taxpayer's wallet will be connected to the government's wallet. In figure 9 (right), Algorithm 4 will calculate the amount of gas needed for the transaction. The total amount will be tax amount + gas amount. If the taxpayer's wallet balance is sufficient, the tax amount is going to be transferred in TAXCOIN. After that, a "Transaction Successful" message will be displayed along with generating the receipt of payment. Otherwise, a message saying, "Insufficient balance" will be displayed.

5. Implementation

For implementing the idea of secured transactions via Blockchain, we have created a prototype by implementing this in a test network. We have used the IDEs 'Ethereum Remix' to run the whole code of the tax transaction. Figure 10 (right) shows that the transaction is confirmed which is generated from the IDE. Moreover, this is the same IDE where the smart contract has been developed and tested. For developing a smart contract, we have used the language, 'Solidity'. Additionally, we are using ''MetaMask' for creating a wallet for our implementation. In our prototype, at first, a user needs to give his details as inputs. The given data is inserted in a block. Figure 10 (left) shows the transaction confirmation receipt of our project. We have also created a wallet and from this wallet, the sample transaction has been tested.

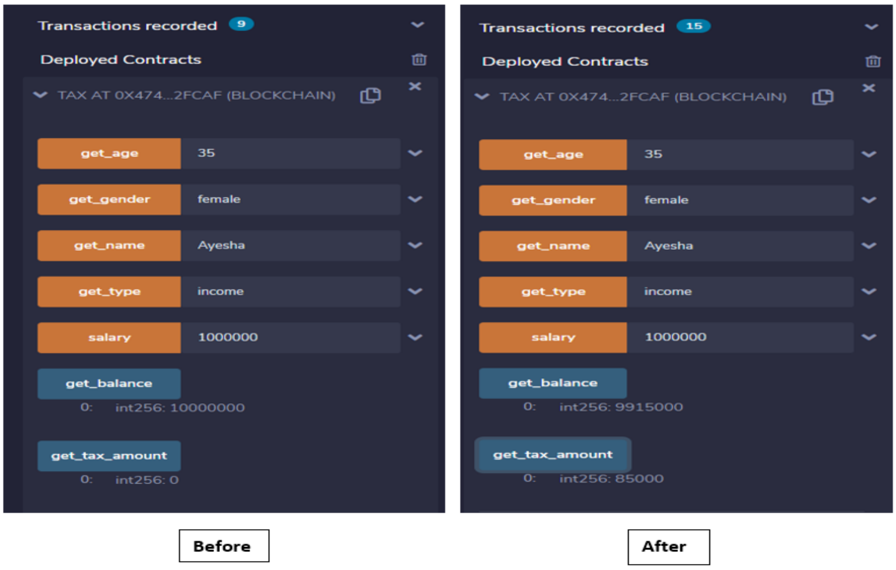
Figure 10: Transaction confirmation



6. Result and Analysis

Section VI describes the result of our project and the analysis view. The code that we have written on the smart contract for our implementation process automatically calculates the amount of tax to be paid by a specific user. It will update the amount in his wallet after successfully transacting the tax to the government's wallet/concerning the party's wallet. Let us dive into detail about how this process is being executed. After successfully creating a wallet in the Ethereum platform, using 'MetaMask', a user will be able to do a transaction.

Figure 11: Before transaction balance and tax amount



For this sample tax transaction, at first, the code will process the data of the user that is already stored in a block. In the next step, depending on the given user's info, the amount of tax to be paid will be calculated. Once all the calculations are done, it will show the amount of tax to the user. Then using the smart contract, the user will send the money to the government's wallet. A validated miner will add the transaction to the blockchain. After the transaction is successful, the amount of the user's wallet will be updated and a copy of the transaction will be stored in the ledger. Figure 11 (left) is showing the before transaction phase. Here the total balance is 10000000 before entering the field values. And figure 11 (right) shows the after-transaction phase where, when we have put every value in every field the total amount of tax for the particular individual is calculated and his tax amount is deducted from the total TAXCOIN. This is why in the second picture the total amount has decreased from 10000000 to 9915000 and the tax amount has increased from 0 to 85000.

7. Conclusions

This section gives an overview of our project and also describes the limitation which directs us to our future plans.

7.1 Summary

In our research, we have designed and implemented a model in which we have used decentralized blockchain technology to ensure the digital taxation system. Our prime concern was to develop a system that will guarantee a secure, safe, and fast transaction of tax to the central government with the help of cryptocurrency. Here, we have used the concept of a smart contract and consensus algorithm to establish our model. Again, we have used Remix-IDE to implement the smart contract and MetaMask to create a wallet. Then we have connected both for the transaction purpose.

Moreover, here the smart contract is being used to calculate the tax and with the help of the wallet, we are ensuring the transaction. Again, we have used the Proof of Authority consensus algorithm so that we can ensure a high transaction rate by using lesser resources and investing minimum stake. In addition to this, for better security, we have used SHA-256 for the hashing, and for making digital signatures we have generated the ECDSA algorithm.

7.2 **Limitations**

We are mainly concerned about the acceptance of our model as many countries in the world still do not have much knowledge regarding blockchain and cryptocurrency. For the developed countries, our system will give the best result but for the developing and the under developing countries, it will barely be able to make efficient use of this system.

Another concern might be here that the miners will get a reward based on the transaction fees. Consequently, if there is less transaction the miners will get less reward. Again, they will not be rewarded for adding any particular block as per the policy of our system and all these can create dissatisfaction among the miners and they can lose interest in our system.

7.3 **Future Work**

In our model, we have used blockchain technology for transaction purposes. Moreover, a new distributed ledger technology has been introduced by Leemon Baird, the co-founder and CTO of Swirlds in 2016 which is known as the Hash Graph. As per him, this hash graph will allow 50,000 times faster transaction than the blockchain which means if bitcoin can make 7 transactions per second the Hash graph will make 250,000+ transactions per second (Hemant, 2018). If this statement is valid we would like to use this superior network structure for our model so that we can have the transaction in the fastest manner and can solve a lot more problems than we are solving now. It will also allow us to solve the problems that we are now unable to solve because of the flaws of the consensus algorithm.

Again, we also think of proposing a new consensus algorithm for mining the block and creating the transaction. We have used PoA in our model but in the future, we will try to build an algorithm that will use lesser computational energy, ensure minimum investment of the stake, and as well as will allow us to transact the digital money in the fastest manner.

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