RE-INVENTING PENSION SCHEME FOR WORKERS WITH BLOCKCHAIN AND SMART CONTRACTS.

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Abstract

The pension scheme in Nigeria has faced a lot of problem since inception. Delay of payment after a workers retirement, bribing of some officials to ensure payment of a person's pension are some of the problems often encountered in the scheme and even with the digitalization of some of the processes involved in the scheme; there still abounds some challenges like a cybercriminal breaking into the system to corrupt information such as time of service, salary or date of birth, thereby making the system compromised. Deploying a temper proof blockchain system to the pension scheme will go a long way to address these issues. This paper tends to present proposed blockchain architecture for payment of retired workers pension.The system will be deployed in the Ethereum virtual machine (EVM), and the front end of the system is designed with react and the backend- the smart contract was developed using solidity. This system when deployed solves most of the corrupt practices involved in the pension scheme.

Keywords: Temper proof, Blockchain, Digitalization, EVM

Introduction

The Pension Scheme in Nigeria has come a long way but even with its intended goals, they have not really been achieved this is mainly due to the corruption in the system. Like Fapohunda (2013) rightly said,the pension scheme in Nigeria has been hunted by many problems like insufficient funding, , poor documentation and filing in pension offices, not finding a safe investment portfolios, lack of accountability, diversion of funds and many more.Adenmosun (2018) also noted that many private enterprises fail to remit their employee's monthly pension contribution to their pension account which they often find hard to pay because of the accumulated backlog. Another issue in this scheme is the returns on investment and the losing of the monetary value of employee's contribution over the years because of inflation(Adenmosun, 2018).

Though the digitization of some of the pension process has somewhat made it easier, there are still problems like delay in the payment of pensions to retiree, database and technology issues (multiple pins), delay/non-remittance by the private sectors as pointed out by pensionNigeria (2019).

Looking at all these problems, it can be said that it results from Non automation of the payment system of the employers to the Pension Scheme account which results to failure of remittance by these employees, non-automation of the payment system to the retirees which results in the delay in the payment of pension to them, non-transparency of the system resulting in the embezzlement of pension funds.

A system to automate (using a computer code called smart contract) and make transparent the process to all the actors involved will eliminate these problems and introducing the blockchain technology- a decentralized platform in the scheme will automate and make the process transparent.Nofer et al (2017) opined that the areas for blockchain technology application seem vast, most especially in fields or application that always relied on third parties for trust among the participants of a transaction. They also said that public administration of government services can be greatly improved through the use of decentralized permissioned blockchains.

Therefore deploying a pension smart contract system in the blockchain technology will go a long way in addressing these problems pointed out above totally.

2.0 Literature review

Pension

Pension is simply the money set aside either by an employer of labor or a worker or both to make sure that at retirement, there is money for employees to fall back on as income and It ensures that at old age workers will not be financially handicapped.

Mechanism of the present scheme

Adebayo (2013) gave the mechanism of the Nigerian pension scheme as below:

- Compulsory minimum contribution of 7.5% employees and 7.5% employers of employees' salary, housing and transport allowance in to individual retirement savings accounts (RSA).
- Contribution is remitted monthly, to designated Pension Asset Custodians (PAC)
- PAC notifies the Pension Fund Administrator (PFA) appointed by the employee within 24 hours of remittance of contribution
- PFA issues a PIN (Personal Identification Number) to the employee, manages the contribution and credits the returns into the account (RSA).
- The PAC, PFA and Employers activities are regulated and supervised by National Pension Commission (Pen Com)

Blockchain

Blockchain system is a tamper proof distributed system of digital records (ledgers or database) without a central authority (Yaga et al, 2018). Blockchains are also known as distributed ledger which is a linked chain of blocks- a group of ordered transactions. Every transaction in the blockchain network is digitally signed by the owner and a transaction ID is issued to it. All transactions are broadcasted so that all the nodes in the network maintain a copy of the ledger in the network. Miners verify transactions and do mathematical computations necessary to add a new block of transactions to the blockchain. They run a consensus mechanism to agree on the next block to add to the blockchain.

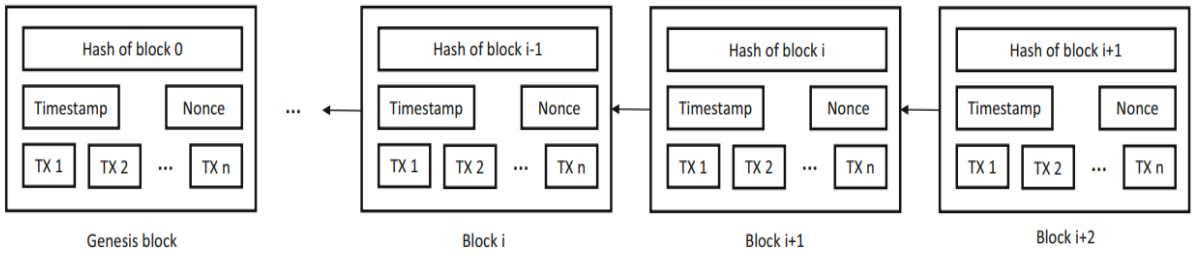


Fig1:A blockchain ledger

Categories of blockchain

Blockchain networks can be categorized based on their permission model, which determines who can maintain them (e.g., publish blocks). If anyone can publish a new block, it is permissionless example bitcoin blockchain and Ethereum blockchain. If only particular users can publish blocks, it is permissioned example hyperledger and corda. In simple terms, a permissioned blockchain network is like a corporate intranet that is controlled, while a permissionless blockchain network is like the public internet, where anyone can participate. Permissioned blockchain networks are often deployed for a group of organizations and individuals typically referred to as a consortium.

Smart contract

Rajat et al (2019) defined a Smart contract as a computer protocols that are designed to automatically facilitate, verify, and enforce the negotiation and implementation of digital contracts without central authorities.

Smart contracts possess two qualities namely: value and state. A conditional statement (if-else statement) contains the preset contract's terms and agreement when all the conditions pertaining to the contract's execution are met is

activated and the required actions of the contract will be executed. The developers of the smart contract deploy it to a blockchain network like the EVM and in return get what is called a contract address which users invoke by sending a transaction. When a transaction has been sent, the smart contract is agreed upon and endorsed by all the validating nodes in network. Smart contracts mainly get their input from an oracle (a trusted data feed) and the system state. When the inputs are gotten, the contract ascertains if the current state meets the triggering conditions for the contract to execute and if so, Immediate and strict execution of the contract's term happens. After the approval of a transaction, it is packaged into a new block and once the whole network reaches an agreement (consensus), this new block is added and chained into the blockchain.

The operational mechanism of smart contracts are based on two mainstream platforms—Ethereum and Hyperledger Fabric.

Related works

Pensioners can have more say and influence over their money and the complicated layers of the pension scheme can be brought to the barest minimum through the blockchain technology and by using cryptocurrency as a pension portfolio investment, it appeals to the younger working class because of its flexible and accessible retirement plan (Liebkind, 2022).

IBM developed a Primary school teacher's blockchain solution e-pension system for the Bangladesh Computer Council (BCC). The system uses a proof of concept (POC) for verification and the network is permissioned for teachers and other stakeholders for keeping and managing pension resources. It takes advantages of the blockchain's transparent, security-tight and tamperproof distributed ledger technology to safe guard against unauthorized access and verify that teachers receive correct disbursements.Parthapratim Deb (2020).

3.0 Methodology

Proposed system

To determine if a blockchain solution is really necessary in the pension scheme, we used a flow chart designed byWust&Gervais (2018)as in fig.2 below:

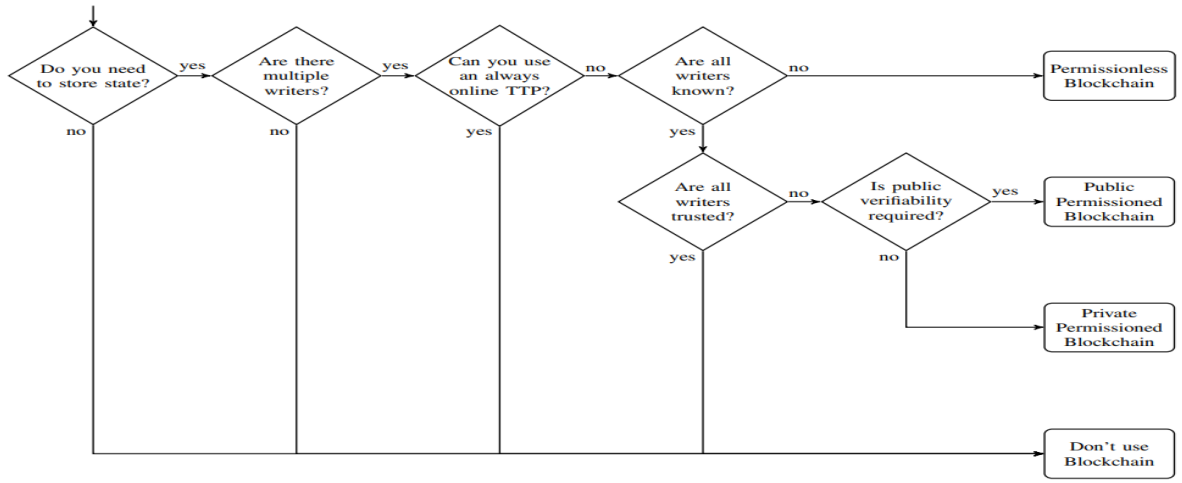


Fig. 2: A flow chart to determine if a blockchain is the appropriate technical solution to solve Pension Scheme problem.

From the diagram, a blockchain solution is required and the type of blockchain required is a private permissioned blockchain according to the answers given in the flow chart.

Our proposed system is going to work as the traditional one but data will be stored in a blockchain and the execution of agreements will be done by a smart contract.

The use case diagram of the system is as in fig.3 below:

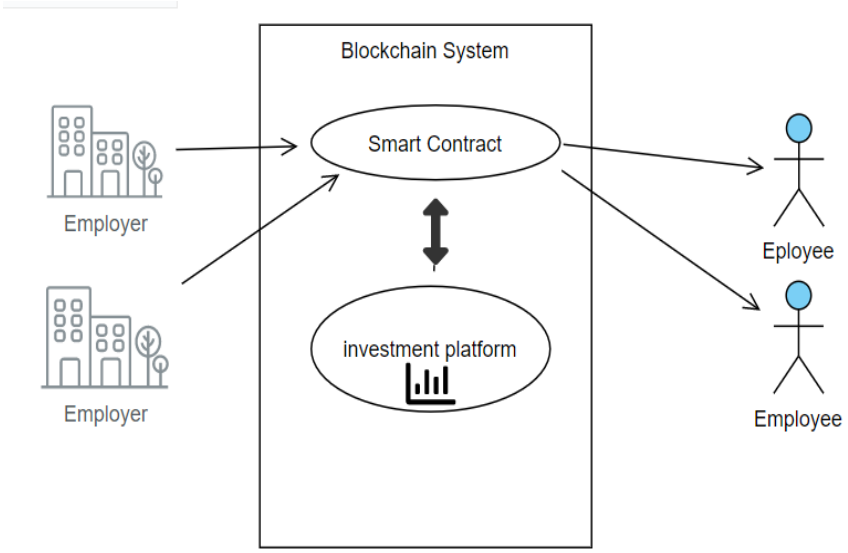


Fig.3: Use case diagram for the proposed system.

The smart contract: This is a computer code written in solidity language and deployed in the corda blockchain. The smart contract enforces the agreement when all the terms of the contract has been reached and an appropriate data has been gotten from an Oracle(in this case the employer)

The Employers: Each employer has an Externally Owned Address (EOA) assigned to it on joining the platform. This address can only send money (15% of an employee's salary in this case) to the smart contract but cannot receive back from the smart contract.

Investment platform:these are the Low risk investment cryptocurrency schemes where the funds in the smart contract are invested in for returns. Funds/ data can be sent to and fro the smart contract and these preselected and agreed upon platforms.

The Employee: Each employee also has an Externally Owned Address (EOA) assigned to it on joining an employer. This Address is a one-time address that can be submitted to another employer on leaving a former place of work. This address can only receive funds from the system either in parts or fully only after a specified period of time.

Conclusion:

A blockchain payment should be deployed in the pension scheme due to the many advantages offered by this technology. The system will ensure proper involvement of workers in the pension scheme and also ensure speedy payment of pensions with little overhead cost of managing the pension scheme.

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