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Production of Blockchains as Well as their Implementation

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Annotation: It's exciting that a developing technology like Blockchain is being used in an innovative project like Blockchain manufacturing and implementation, but the mystery isn't gone yet. A fascinating aspect of this project is the way in which it is implemented, which plays a crucial role. While it is not unprecedented to write contracts and define programming logic in a blockchain's native programming language, the fact that we will construct a Blockchain using Java makes the project both interesting and concerning. When it comes to storing vast amounts of data in a compact format, hashes provide the highest level of security, which is why blockchain technology was developed. It is the most secure and unchangeable ledger system ever because it includes a hash chain in which each current block is related by the hashes of previous blocks. We establish each block's structure and introduce hashing techniques via libraries and packages in Java's blockchain implementation. To make Blockchain mining computationally robust and difficult, we additionally detail the block size, nonces, Merkel trees, and hashing algorithms with timestamps. Not losing sight of the forest for the trees, we should also count Miners as a type of participant who is compensated. To encourage them, we provide a reward system that ensures their computing resources aren't squandered, and we pay them in the cryptocurrency used by the Blockchain itself. Since consensus mechanisms, such as proof-of-stake (POS), play a crucial role in ensuring that all participants in a blockchain network agree on a specific type of mined transaction, it stuck with POS during my Java implementation of the Blockchain. In the consensus procedure known as "proof of stake," owners stake their currency in order to verify the validity of their mined blocks. Money is lost if a bad actor is found to be the owner, but it is refunded if the validation process goes well.

Keywords: Programming Languages, Production of Blockchains, Implementation, Hashing Techniques, Java.

Introduction:

It's true that there are issues with the original blockchain technology because it's still in its infancy, but our main focus is on those that affect the Java implementation of Blockchain [1]. Existing projects employ proof of work because other alternatives for the consensus protocols were still in the research phases [2-10]. However, as Java is a capable language implementation of consensus protocols such as Pow (Proof of Work), it becomes the costliest one for blockchain developers. This highlights the importance of having sufficient computational power. It's also important to place greater focus on cryptography, as prior hashing algorithms were readily cracked by attackers using high-computing power before Java 8 was released. There are a few other small issues, such as [11–17]:

- Troubles with User Intake
- Expertise is necessitated.
- Impasse in 51% of attacks
- Expensive to compute
- Phrases for development take practice.
- Work that goes way back

Existing System Vs Proposed System

Java is widely used in preexisting systems for Blockchain implementation and design. However, becoming noticeable is the first step in implementing an improved version of the projects [18-22]. In order to reduce exposure and user hesitance to join the network, I came up with the novel executable idea that the network would simply collaborate with the existing flexible blockchain network until the set of certain blocks is mined in the future, and then for mining computation is calculated with the help of those existing nonces and Merkel trees. Previous consensus algorithms had Pow (Proof of Work) [23-33], which was a serious issue. Due to the high computational costs of this agreement process, they created POS (Proof of Stake) as a consensus algorithm, which has proven to be both environmentally friendly and effective for Java Blockchain networks [34–45].

Below is the Statement from the previous Java Blockchain Implementation (figure 1) [46]:

Figure 1: Java Blockchain Implementation

Scope of the Project

This work has many potential uses, but as a component of the Java implementation of Blockchain, its potential uses and scope are enormous since it may be used for a wide range of industrial, socioeconomic, technical, etc. challenges [47–55]. Information security is a big issue in the medical industry, and this implementation could be an effective aspect of constructing a truly decentralised network for both private and public uses of blockchain [56-67]. Since it uses a distributed database, this project can also solve the problems with infrastructure and hardware expenses [68-79]. Data storage costs are eliminated, but the adoption of blockchain technology is moving at a slower clip; however, with the help of indexing methods and off-chain data storage solutions, we may overcome

this obstacle [80]. The cryptocurrency infrastructure can be built and deployed quickly on top of this network. Since Java is a fast and powerful language, it's great that we can create Daps, or decentralised applications, as part of this debate. Daps are the most effective and flawless runners [81-99].

Added Applications

- ✓ In addition to its potential in engineering, this research also has medical applications. Consider a blockchain-based EHR system [100].
- ✓ The military can utilise this to protect their communications, information, etc. [101-112].
- ✓ App architecture based on pluggable interfaces.

Objectives

Continuing the development of ongoing projects while incorporating extra layers of protection and future-proofing plugins [113–121]. Consensus is the protocol to be followed by miners in mining a new block of transactions, and it is crucial to both the goal of this project and the key impacting feature of blockchain initiatives. Previous blockchains handled Pow (Proof of Work) as the permanent mining protocol to be followed because other protocols or consensus were not fully implemented and were in their respective development stages; we will use this to our advantage by implementing the (Proof Oo Stake) POS as the permanent mining protocol to be followed [128-131]. To restate our overall goals,

- ➢ Modular, pluggable framework for constructing Daps
- ➢ Retail Point-of-Sale Plugin Development and Implementation
- ➢ Accepting the protocol of miners

Methodology to Be Followed

To begin, it is crucial to have an understanding of the foundational activities involved in bringing the Blockchain to life in Java. A methodical procedure to achieve the project's goal is outlined in the following sections [132-141].

Implementing a block

The fundamental features of a block are declared, including a timestamp, a string hash, data in the form of a string, and a nonce. The first phase is connecting the preceding section [142-157].

Calculating the Hash

The hash value for a fixed-size output is computed using block-level data such as a timestamp etc., as defined and calculated in the block [158].

Storing and implementing blocks

Following the completion of the preceding procedures, the blockchain cycle can be implemented, which involves the sending and receiving of messages [159].

Miners definition

A crucial next step is establishing the miner's programme and implementing rewards via any specified third-party transfer [160].

Validation

We use consensus and start stake methods [161] to verify the miner's legitimacy.

Message Passing

Message forwarding is used to spread blocks to other nodes after validation has been completed successfully [162-171].

Expected Outcomes

Once all of the blocks have been successfully implemented and defined, miners will be allowed to mine them, hashes will be generated in a linear fashion, and miners will receive their rewards via the third-party or native cryptocurrency transfers they designated [172-181]. Each block, regardless of when its transactions occurred in time, has its own distinct set of transactions, which are represented by unique hashes as the blocks are formed [182-195]. Moreover, we will be able to get rid of the malicious miners on the Java blockchain and put in place the consensus method for verifying ownership authority. It's certain that more leading zeroes will appear as block mining continues along its path. To enhance the consensus difficulty, we can move from POS (Proof of Stake) to PoET (Proof of Elapsed Time) [196-201] when the number of blocks and miners grows. Both POS and PoET use staking to secure their networks, but while in POS, we use physical currencies, in PoET, time is staked [202].

Java Package and Blockchain Frameworks

Below is the list of required packages and frameworks for project implementation [203-211].

- ✓ Package com. balazsholczer.blockchain;
- ✓ package com. ajlopez.blockchain;

Code Snippets-1

```
public class Start {
    private static NodeRunner nodeRunner;

    public static void main(String[] args) throws IOException {
        ObjectContext objectContext = new ObjectContext(new MemoryKeyValueStores());

        Wallet wallet = createWallet(objectContext);

        ArgumentsProcessor argsproc = processArguments(args);

        NetworkConfiguration networkConfiguration = new NetworkConfiguration((short)1);

        int port = argsproc.getInteger("port");
        List<String> peers = argsproc.getStringList("peers");

        launchNodeRunner(objectContext, port, peers, networkConfiguration);

        boolean isMiner = argsproc.getBoolean("miner");

        if (isMiner) {
            String coinbaseText = argsproc.getString("coinbase");
            Address coinbase = coinbaseText.isEmpty() ? Address.ZERO : new Address(HexUtils
                .hexStringToBytes(coinbaseText));

            MinerConfiguration minerConfiguration = new MinerConfiguration(isMiner,
                coinbase, 12_000_000L, 10);

            launchMinerProcessor(objectContext, minerConfiguration);
        }

        boolean rpc = argsproc.getBoolean("rpc");

        if (rpc) {
            int rpcport = argsproc.getInteger("rpcport");
            launchRpcServer(objectContext, wallet, networkConfiguration, rpcport);
        }
    }

    private static Wallet createWallet(ObjectContext objectContext) throws IOException {
        AccountStore accountStore = objectContext.getStores().getAccountStoreProvider
```

Figure 2: Code Snippets-1

Code Snippets-2

```
    private static void launchMinerProcessor(ObjectContext objectContext,
        MinerConfiguration minerConfiguration) throws IOException {
        MinerProcessor minerProcessor = new MinerProcessor(objectContext.getBlockChain(),
            objectContext.getTransactionPool(), objectContext.getStores(),
            minerConfiguration);
        minerProcessor.onMinedBlock(blk -> {
            nodeRunner.getNodeProcessor().postMessage(new BlockMessage(blk));
        });

        minerProcessor.start();

        Runtime.getRuntime().addShutdownHook(new Thread(minerProcessor::stop));
    }

    public static ArgumentsProcessor processArguments(String[] args) {
        ArgumentsProcessor processor = new ArgumentsProcessor();

        processor.defineInteger("p", "port", 0);

        processor.defineBoolean("r", "rpc", false);
        processor.defineInteger("rp", "rpcport", 4445);

        processor.defineStringList("ps", "peers", "");

        processor.defineBoolean("m", "miner", false);
        processor.defineString("k", "coinbase", "");

        processor.processArguments(args);

        return processor;
    }

    public static void printBlock(Block block) {
        System.out.println(String.format("Connecting block %d %s", block.getNumber(), block
            .getHash()));

        for (Transaction transaction: block.getTransactions())
            System.out.println(String.format("With transaction%s", transaction.getHash()));
    }
}
```

Figure 3: Code Snippets-2

Databases vs Blockchain Ledger

The section about the database was present on the website header, so we were previously familiar with it. Blockchain technology's primary benefit is that it eliminates the need for extra funding to maintain the database [212-219]. It can be simply kept on the blockchain node network as it is a distributed ledger (figures 2 and 3). We need to bear in mind that the blockchain database has a very sluggish access time compared to centralised storage methods. Numerous solutions have been offered to these problems, including the use of an off-chain storage system like IPFS (interplanetary File system) to identify and store documents and other data in a blockchain. Private blockchains employ a different method, indexing approaches [220–225]. Extracting and deploying data is conceivable with the help of preexisting blockchain-offered database languages like Graph query language, as well as data extraction being possible with Mongo database software, etc. [226-231]. Data querying and analytics are two more uses for Blockchain besides the database services that can be deployed on such a network. Java's support for blockchain technology makes it possible to use the Python programming language's plugin for data pipelining utilising authentication tokens. Python's accessibility tokens also allow us to use the language for data analytics and data pipelining [232]. With the help of plugins in Java-based blockchain query languages, we can mine the Blockchain for data.

The Terminal

Terminal/PowerShell

All of the features were released and made available via the terminal in the designated versions.

Java for Development

Android only requires the development of code once, but in order to run, it must compile and optimise native code for optimal performance across a wide range of devices. Due to Java's platform-independent characteristics, we were able to use it to create Android. Due to its Java foundation and the prevalence of Java programmers, it allows rapid application development. This results in lightning-fast contract execution and the loading of features.

Solidity for Contracts

The behaviour of Ethereum wallets is regulated by smart contracts written in Solidity, a high-level programming language based on object-oriented programming. C++, Python, and JavaScript are the foundations of this language, which is meant to be run on the Ethereum virtual computer. Each and every blockchain library is compatible with Solidity, and inheritance is also supported. Use cases for Solidity include voting, crowdfunding, and more.

Check Version Compatibility

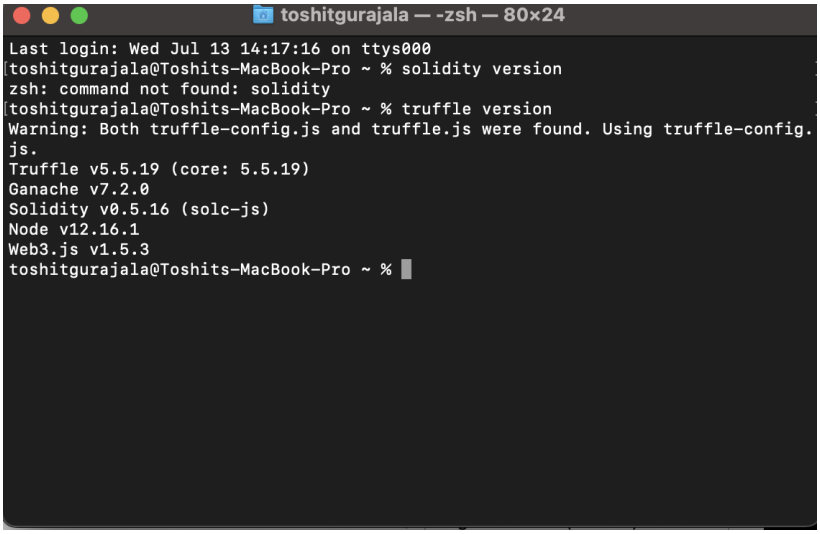

Figure 4: Check Version Compatibility

Implementation

Module 1: JDK For Block Creation

First, visit https://www.oracle.com/java/technologies/downloads/ to download and install Java on your computer. Using a package manager, we must set up all the necessary components. Make sure the Java Development Kit was installed correctly by configuring all of the paths. Once the setup is complete, you can launch the IDE of your choice (shown in Figures 4 and 5).

Figure 5: JDK For Block Creation

Module 2: Installing Solidity

We need NPM to install the development dependencies required for the backend. Since NPM is the easiest way to compile and install Solidity, follow the commands in the terminal to install Solidity (figure 6).

- npm install -g sold

For docker, configuration use the following commands

- docker run ethereum/solc:stable –help

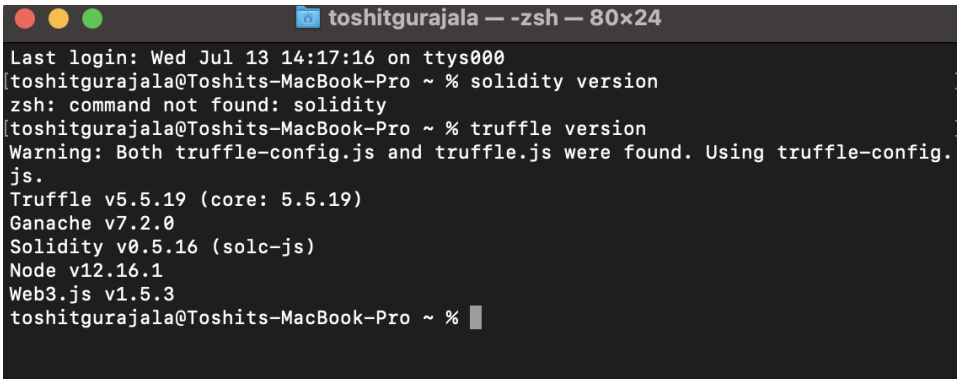

Figure 6: Module 2: Installing Solidity

Results and Other Added Features

Our generation was astounded by the efficiency of the Block system. It fulfilled its intended purpose and was even beyond our expectations. As a result, we were able to estimate the small risk and gain associated with the deals. In addition, the procedure for creating new blocks was simple and effective, and the maximum number of transactions allowed in each block was eight (figure 7).

Figure 7: Module 2: Installing Solidity

We developed the staking process so that in the future, anybody can build their own cryptocurrency and begin minting the actual coins, and we incorporated several plugins for future development reasons, such as decentralised applications. We also implemented a fast block generation process to evaluate Java's viability as a blockchain network development language, and the results were encouraging (figure 8).

Snap of the Result

```
57  blockchain = Blockchain()
58  t1 = blockchain.new_transaction("Satoshi", "Mike", '5 BTC')
59  t2 = blockchain.new_transaction("Mike", "Satoshi", '1 BTC')
60  t3 = blockchain.new_transaction("Satoshi", "Hal Finney", '5 BTC')
61  blockchain.new_block(12345)
62
63  t4 = blockchain.new_transaction("Mike", "Alice", '1 BTC')
64  t5 = blockchain.new_transaction("Alice", "Bob", '0.5 BTC')
65  t6 = blockchain.new_transaction("Bob", "Mike", '0.5 BTC')
66  blockchain.new_block(6789)
67
68  print("Blockchain: ", blockchain.chain)
```

Figure 8: Snap of the Result

Conclusion

Regarding this project, which involved building and enhancing the current technology systems, we had a very clear vision. By incorporating fresh, creative ideas and putting them in terms of

technology concepts, we were able to tackle the challenges that already existed. This project is still in the early stages of development. Thus, new solutions might also lead to new issues. The majority of the systems in use relied on various consensus procedures, which were ineffective and used a tonne of power. By implementing the POS staking algorithm, we were able to reduce the computational cost of the traditional systems, which made it less necessary for miners to use highly complex hardware and consume large amounts of electricity while also making it simple for anyone on the network to sign up as a miner. Another significant advancement that was declared and put into practice in this project was the addition of plugins allowing the creation of decentralised applications in the future.

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