Privacy Control Transaction Using Blockchain

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ABSTRACT - Blockchain implements a simplified Central Bank Digital Currency (CBDC) system using Python andTkinter for the user interface. It consists of three main classes: Block, Blockchain, and CBDCApp. The Block class represents individual blocks in the blockchain, containing transactions, timestamps, hashes, and a mining process. The Blockchain class manages the chain of blocks, including creation, validation, and consensus algorithms. The CBDCApp class provides a GUI interface for users to send and receive CBDC transactions, interacting with the blockchain through block creation and validation. The project demonstrates key blockchain concepts such as hashing, mining, consensus, and transaction handling within a CBDC system context.

KEYWORDS: Central Bank Digital Currency (CBDC), Blockchain technology (BT), proof of authority (PoA), Proof-of-Work (PoW)

I. INTRODUCTION

Blockchains are considered as promising solution to the problems of secure storage, sharing and analysis of data, trusted network control and resource management[1]. Thus, blockchains have deeply penetrated people's daily lives and work through cryptocurrency, digital finance, supply chains, smart cities and the Internet of Things (IoT). Blockchain is a decentralized ledger system that records transactions across a network of computers. Each transaction, or block, is cryptographically linked to the previous one, forming an immutable chain[2]. A few years back, a protocol displayed advanced solutions to these issues and more in the form of blockchain, which was initially introduced as the electronic cash system for transactions through digital currency known as bitcoin[3]. While the economy is yet to gain confidence in cryptocurrency, people were excited to leverage the digital currency blockchain's underlying technology. As a result, it provides relevant stakeholders with the opportunity to contribute to improving issues related to openness, trust, and privacy[4]. The power of also known as distributed ledger technology (DLT) has been steadily growing, and it is becoming increasingly clear that its use will have a continually transformative significance in the world of business and society at large[5]. The real power of BT lies in its decentralized nature. Data and records are distributed across multiple nodes rather than being stored in a single location.Blockchain based data bases, such as those that form the backbone for cryptocurrencies, are data stores that enable both customer identification and financial transactions without the use of personal information[6]. The banking industry has significantly latched on to the idea that the blockchain will improve confidentiality.In response, many central banks (CBs) and monetary authorities worldwide have begun to conduct research on central bank digital currencies (CBDCs)[7]. In today's increasingly digitized world, privacy concerns loom large, especially in financial transactions. Blockchains could upgrade and transform bank payment clearing and credit information systems by revolutionizing their underlying technology. As the technology continues to evolve, advancements in privacy-focused protocols and standards will further enhance the privacy and security of transactions, paving the way for a more trust less and

decentralized future[8].

OBJECTIVE:

The objective of this paper is to create a graphical user interface (GUI) using Tkinter for a Central Bank Digital Currency (CBDC) system. Allowing the users to input recipient address and amount for sending or receiving CBDC. To update the displayed balance dynamically based on transactions and to provide functionality to send and receive CBDC, updating the balance and displaying transaction details in the console.

ALGORITHIM:

Step 1: Validator Selection
Step 2: Transaction Validation
Step3:Block Creation
Step 4: Block Validation and Addition
Step5:Reputation Management

EXPLANATION:

Step1:Validator Selection

Explanation: The network administrators or a designated authority identify entities with a strong reputation and expertise relevant to the blockchain's purpose.
These entities become validators and are granted permission to create new blocks.

Step2:Transaction Validation

Explanation: Users submit transactions to the network.
Validator nodes receive the transactions and independently verify their validity based on the blockchain's rules.

Step3:Block Creation

Explanation: Validators create new blocks containing a set of validated transactions.
Unlike Proof-of-Work (PoW), there's no competition to solve a cryptographic puzzle. Instead, validators take turns creating blocks in a predetermined order or based on a specific selection mechanism.

Step4:Block Validation and Addition

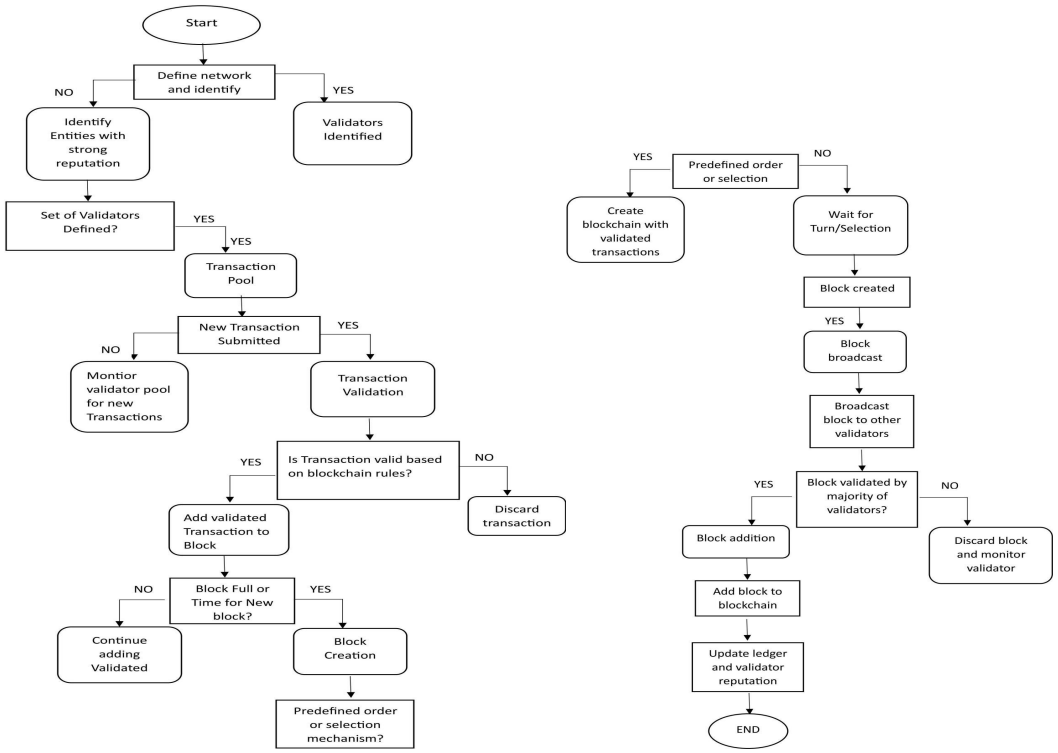
Explanation: Other validator nodes receive the newly created block and verify its legitimacy.This verification involves checking if the block adheres to the blockchain's rules and if the transactions within it are valid.
If a majority of validators approve the block, it gets added to the blockchain.

Step5:Reputation Management

Explanation: Validator nodes are constantly monitored for their actions.
If a validator attempts to add invalid blocks or disrupt the network, they may be penalized or even removed from the validator pool.

PoA offers faster transaction processing compared to PoW due to the lack of computational competition.
The reliance on pre-selected validators raises concerns about centralization, as the network's security depends on the validators' trustworthiness.PoA is well-suited for private or consortium blockchains where a known set of trusted entities participate.This is a general overview, and the specific implementation details of PoA can vary depending on the blockchain platform.

FLOWCHART:



PROGRAM ANDOUTPUT:

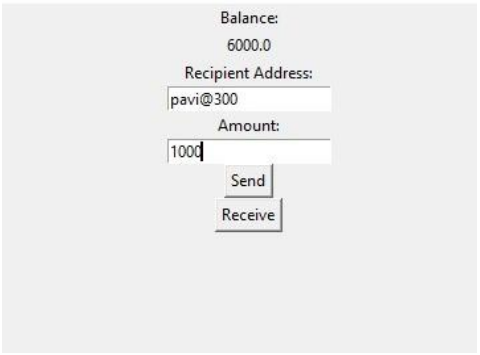
PROGRAM:

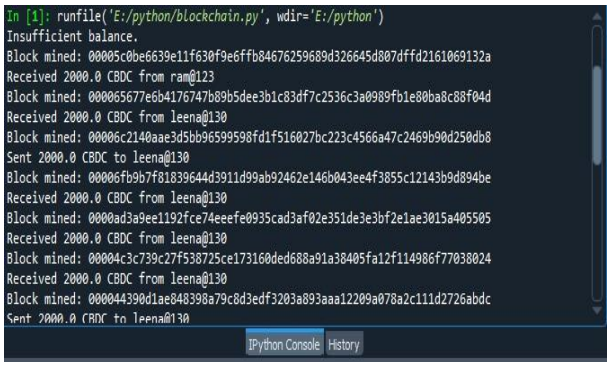
```
import tkinter as tk
import hashlib
import datetime
import random

class Block:
    def __init__(self, transactions, previous_hash):
        self.timestamp = datetime.datetime.now()
        self.transactions = transactions
        self.previous_hash = previous_hash
        self.nonce = 0
        self.hash = self.calculate_hash()

    def calculate_hash(self):
        block_contents = str(self.timestamp) + str(self.transactions) + str(self
        return hashlib.sha256(block_contents.encode()).hexdigest()

    def mine_block(self, difficulty):
        while self.hash[:difficulty] != '0' * difficulty:
            self.nonce += 1
            self.hash = self.calculate_hash()
        print("Block mined:", self.hash)


class Blockchain:
    def __init__(self):
        self.chain = [self.create_genesis_block()]
        self.difficulty = 4

    def create_genesis_block(self):
        return Block([], "0")

    def get_latest_block(self):
        return self.chain[-1]
```

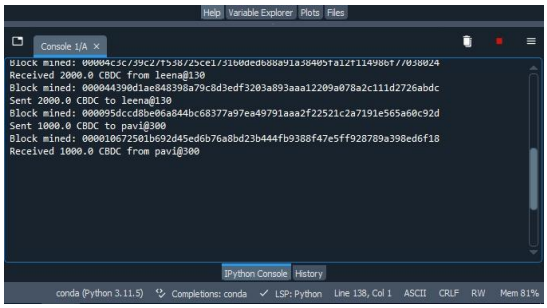
```
    def add_block(self, new_block):
        new_block.previous_hash = self.get_latest_block().hash
        new_block.mine_block(self.difficulty)
        self.chain.append(new_block)

    def is_chain_valid(self):
        for i in range(1, len(self.chain)):
            current_block = self.chain[i]
            previous_block = self.chain[i - 1]

            if current_block.hash != current_block.calculate_hash():
                return False

            if current_block.previous_hash != previous_block.hash:
                return False

        return True

    def consensus_algorithm(self, proposed_chain):
        # Choose the longest valid chain
        if len(proposed_chain) > len(self.chain) and self.is_chain_valid(proposed
            self.chain = proposed_chain
            return True
        return False


class CBDCApp:
    def __init__(self, master):
        self.master = master
        master.title("CBDC System")

        self.blockchain = Blockchain()

        self.balance_label = tk.Label(master, text="Balance:")
```

```
            self.blockchain.add_block(new_block)

            self.balance_var.set(str(sender_balance - amount))

            print(f"Sent {amount} CBDC to {recipient_address}")
        else:
            print("Insufficient balance.")

    def receive_cbdc(self):
        recipient_address = self.recipient_entry.get()
        amount = float(self.amount_entry.get())

        transaction = {"sender": "unknown", "recipient": recipient_address, "amou

        new_block = Block([transaction], self.blockchain.get_latest_block().hash)
        self.blockchain.add_block(new_block)

        sender_balance = float(self.balance_var.get())
        self.balance_var.set(str(sender_balance + amount))

        print(f"Received {amount} CBDC from {recipient_address}")


def main():
    root = tk.Tk()
    app = CBDCApp(root)
    root.mainloop()

if __name__ == "__main__":
    main()
```

OUTPUT:







CONCLUSION:

Blockchain implements a basic Central Bank Digital Currency (CBDC) system using a blockchain structure. It allows users to simulate sending and receiving CBDC transactions within the tkinter GUI framework. The blockchain functionality includes block creation, mining with proof of work, chain validation, and a simple consensus algorithm. The implementation serves as an educational tool to understand fundamental blockchain concepts and CBDC principles.

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