Pharmaceutical Supply Chain Management System using Blockchain

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# Introduction

The pharmaceutical industry faces significant challenges related to the security and integrity of the supply chain. These challenges include issues such as counterfeiting, diversion, and theft, which can compromise patient safety, reduce the effectiveness of drugs, and result in financial losses for companies. To address these challenges, a more secure and transparent system is required.

Blockchain technology offers a promising solution to these issues by providing a transparent and immutable record of every transaction in the supply chain. This ensures that all data related to drug shipments is securely stored and easily traceable, preventing fraud, counterfeiting, and other illegal activities.

# Python Code Overview

The provided Python code implements a simple blockchain-based Pharmaceutical Supply Chain Management System. This system allows users to add drug shipments to a blockchain, simulate IoT data for temperature and humidity, and verify the integrity of the supply chain.

## Block Class

The `Block` class represents each block in the blockchain. A block contains an index, the hash of the previous block, a timestamp, data, and its own hash.

## Blockchain Class

The `Blockchain` class manages the chain of blocks. It contains methods to create the genesis block, add new blocks, hash blocks, validate the chain, and display the chain. Key methods include:

- `create\_genesis\_block`: Creates the first block in the blockchain with default values.  
- `add\_block`: Adds a new block to the chain by calculating its hash based on its contents.  
- `is\_chain\_valid`: Verifies the integrity of the blockchain by ensuring that all blocks are correctly linked and their hashes are valid.  
- `display\_chain`: Displays all blocks in the blockchain.

## PharmaceuticalSupplyChain Class

The `PharmaceuticalSupplyChain` class simulates the supply chain of pharmaceuticals. It uses the blockchain to track drug shipments. This class includes methods to simulate IoT data, add drug shipments to the supply chain, display the chain, and validate the chain.

Key methods include:

- `simulate\_iot\_data`: Generates random IoT data for temperature and humidity.  
- `add\_drug\_shipment`: Adds a new drug shipment to the blockchain, including IoT data and a timestamp.  
- `display\_supply\_chain`: Prints the entire supply chain, showing all drug shipments stored in the blockchain.  
- `validate\_supply\_chain`: Checks the integrity of the entire supply chain by validating the blockchain.

## Main Program

The main program provides a user interface for interacting with the supply chain system. Users can add new drug shipments, display the entire supply chain, validate the supply chain's integrity, or exit the program.

# Conclusion

This Python code provides a basic implementation of a blockchain-based Pharmaceutical Supply Chain Management System. It demonstrates how blockchain technology can be used to enhance the security, transparency, and efficiency of the pharmaceutical supply chain. While the code is a simple example, it could be extended to create a more robust system that addresses real-world challenges in the industry.