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Blockchain in Pharmaceutical Supply Chains: A Path to Transparent Drug Traceability

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Abstract: Drug authenticity becomes very vital in the safety of patients and at the same time ensures efficiency in healthcare. Generally, conventional drug supply chains are prone to illicit counterfeit activities and poor visibility in the delivery of drugs that affect productivity due to manual inefficiencies. There, centralized systems are really not capable to guarantee traceability, transparency, and even data security across diverse participating actors. Therefore, addressing such challenges, this project proposes a decentralized drug traceability system powered by Ethereum blockchain and smart contracts in order to imitate the operations carried out from the sourcing of the raw materials through the entire commercial stages that a pharmaceutical product usually undergoes before reaching its end consumer. In this environment, smart contracts will enable smooth and automated ownership transitions; precise access control; and real-time verification of each entity's role in the supply chain. There is a custom-built pruning mechanism for sustainable growth of the blockchain while there are role-based modules to increase accountability. The proposed system by recording every interaction as a verifiable blockchain transaction would be an effective tool to combat fraud and at the same time reduce operational inefficiencies enabling compliance with regulation like DSCSA. This solution completely redefined an approach to restore trust, transparency, and integrity in the global pharmaceutical supply chain

Keywords: Blockchain Technology, Pharmaceutical Supply Chain, Drug Traceability, Ethereum Smart Contracts

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