

Secure E-Prescription System Using Blockchain Privacy Groups and Permissioned Networks

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Abstract—Blockchain technology has greatly advanced, emerging as a crucial component for secure and transparent digital transactions across various sectors. In healthcare, prescription systems often contend with issues such as errors, fraud, and privacy breaches. A novel e-prescription management system utilizing the Hyperledger Besu platform has been developed, which employs a private blockchain network. This system features private transactions within privacy groups and leverages permissioned network capabilities to ensure that access to prescription data is restricted to authorized users only. Performance evaluations conducted using Hyperledger Caliper reveal that the system can efficiently handle 228 transactions per second with a latency of 1.72 seconds, while maintaining strong security and scalability even during high-load scenarios. These results underscore significant improvements in data handling and security, affirming the system’s potential to revolutionize healthcare prescription management.

Index Terms—Blockchain, E-prescription management, Private transactions, Privacy groups, Permissioned networks

I. INTRODUCTION

Blockchain technology has significantly enhanced the security and efficiency of digital systems, particularly in Federated Learning (FL), where layer 2 solutions address scalability and transaction speed challenges of networks like Ethereum [1]. In e-prescription management, innovations such as Non-Fungible Tokens (NFTs) have improved prescription traceability and security on public networks [2], showcasing blockchain’s capacity to resolve longstanding data exchange and management issues.

Current prescription management methods, both paper-based and electronic, suffer from errors, fraud, unauthorized access, and privacy breaches [3]. These issues underscore the need for a system that secures sensitive medical data and improves interoperability across healthcare providers. A novel e-prescription management system using a private blockchain network has been introduced to address these challenges. This gas-free system boosts cost-efficiency and incorporates features such as private transactions within privacy groups and a permissioned network from Hyperledger Besu, ensuring prescription data access is restricted to authorized entities only.

Moreover, the impact of blockchain in revolutionizing prescription systems is also highlighted by projects like SecureRx, which uses the Ethereum blockchain to monitor opioid prescriptions and enhance drug safety [4]. Unlike SecureRx, which operates on a public blockchain, this new system

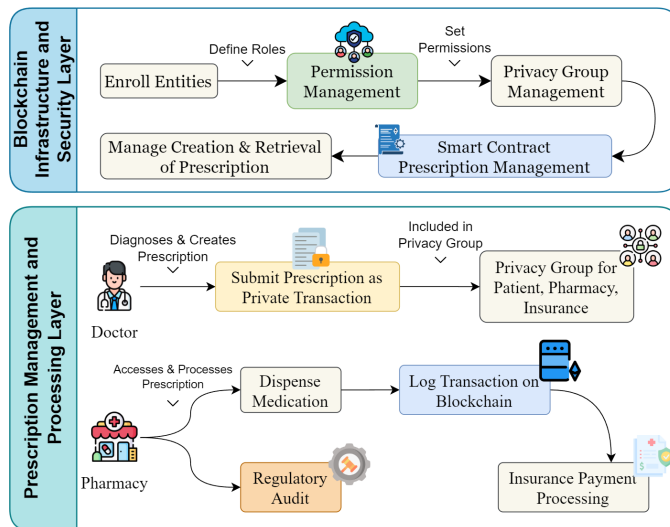


Fig. 1. System Architecture

uses a private blockchain approach to enhance security and privacy by limiting network access to verified participants, thus creating a more controlled environment for managing sensitive health information.

II. PROPOSED SYSTEM

The proposed e-prescription management system utilizes a private blockchain network, Hyperledger Besu, to enhance security, privacy, and efficiency in managing prescription data. The system architecture is structured into two main layers: the blockchain infrastructure and security layer, and the prescription management and processing layer, as illustrated in Figure 1. This architecture incorporates advanced blockchain functionalities and insights from existing frameworks to securely process sensitive healthcare transactions [3].

The blockchain infrastructure and security layer is essential for registering entities and defining their roles. It integrates permission management and privacy group management to maintain a compliant operational environment. Besu uses Tesseract, a private transaction manager, to implement privacy by ensuring that private transactions are encrypted and distributed point-to-point only among participating Tesseract nodes. Each participant in this privacy-enabled network operates their own Besu and Tesseract nodes, with permissions tightly

