

ABSTRACT

A distributed digital diploma verification system based on Blockchain was designed and implemented as a decentralized application (DApp) on the Ethereum Sepolia Testnet using Solidity v0.8.20, React.js, Node.js, IPFS, and DID:ethr to address the limitations of centralized verification systems that are vulnerable to data manipulation and single point of failure. The primary technical contribution of this study is a one-call verification mechanism that enables simultaneous verification of document integrity, issuer DID validity, and credential status in a single smart contract function call without incurring gas fees. Functional testing results demonstrate a 100% success rate across ten test scenarios, with an average verification latency of 14.97 ms based on 30 trials and a standard deviation of 3.43 ms indicating consistent performance. All seven security attack scenarios were successfully detected and prevented by the system. This study demonstrates that the integration of Blockchain, DID, and smart contract can deliver a diploma verification system that is secure, efficient, and distributed with minimal dependence on a central authority.

Keywords: Blockchain; Smart Contract; Diploma Verification; Decentralized Identifier; IPFS

ABSTRAK

Sistem verifikasi ijazah digital terdistribusi berbasis Blockchain dirancang dan diimplementasikan dalam bentuk decentralized application (DApp) pada jaringan Ethereum Sepolia Testnet menggunakan Solidity v0.8.20, React.js, Node.js, IPFS, dan DID:ethr untuk mengatasi keterbatasan sistem verifikasi terpusat yang rentan terhadap manipulasi data dan kegagalan layanan. Kontribusi teknis utama penelitian ini adalah mekanisme one-call verification yang memungkinkan pemeriksaan integritas dokumen, keabsahan DID penerbit, dan status kredensial secara simultan dalam satu pemanggilan fungsi tanpa biaya gas. Hasil pengujian fungsional menunjukkan tingkat keberhasilan 100% pada sepuluh skenario pengujian, dengan latensi rata-rata verifikasi sebesar 14,97 ms berdasarkan 30 percobaan dan standar deviasi 3,43 ms yang mengindikasikan performa yang konsisten. Seluruh tujuh skenario pengujian keamanan berhasil dideteksi dan dicegah oleh sistem. Penelitian ini membuktikan bahwa integrasi Blockchain, DID, dan smart contract dapat menghadirkan sistem verifikasi ijazah yang aman, efisien, dan terdistribusi dengan ketergantungan minimal pada otoritas pusat.

Kata kunci: *Blockchain; Smart Contract; Verifikasi Ijazah; Decentralized Identifier; IPFS*