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# A Blockchain-Based Framework for Secure Digital Record Management: BirthChain and Soulbound Token Authentication

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## ABSTRACT

Digital birth registration and medical-document verification require records that are authentic, traceable, and accessible only to authorized parties. Paper-based procedures and isolated databases can delay verification and complicate information exchange across institutions. This paper presents a blockchain-based framework comprising two complementary applications: BirthChain, a smart-contract-enabled workflow for birth registration and certificate management, and a Soulbound Token (SBT)-based mechanism for medical-document authentication. BirthChain coordinates an administrator, authorized hospitals, and municipal authorities through participant registration, newborn-record submission, municipal approval, and certificate issuance. The medical-document mechanism associates a document reference and SHA-256 hash with patient-related identifiers and a non-transferable credential. Verification compares the submitted document and associated identifiers with the corresponding blockchain record; a match results in a verified status, whereas a mismatch or missing credential results in an unverified status. The framework is implementation-oriented and illustrates how blockchain can support auditability and integrity checking. However, comprehensive quantitative benchmarks and large-scale field deployment evidence are not available. Therefore, the paper does not claim measured improvements in processing time, fraud reduction, or cost. Privacy protection, secure key management, interoperability, legal compliance, and operational validation remain essential before deployment.

**KEYWORDS**: Blockchain, BirthChain, smart contracts, digital birth certificates, Soulbound Tokens, medical-document authentication, SHA-256, digital identity.

## 1. INTRODUCTION

Digital records are increasingly used in public administration and healthcare. However, information is often distributed across hospitals, municipal offices, clinics, and other organizations. In birth registration, information submitted by a healthcare institution must be reviewed by the responsible authority before a certificate is issued. In medical-document workflows, a recipient needs to determine whether a document corresponds to a previously registered record and whether its contents have been altered.

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