

# Research and Application of Blockchain Technology in Transportation Administrative Law Enforcement

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**Abstract**—According to the overall goal of rule the society by law, combined with specific requirements such as the records of the entire process of law enforcement in the three systems, the information such as law enforcement evidence plays a key supporting role. When design a law enforcement case handling information system, it is necessary to fully consider the collection, generation, storage, and transmission of law enforcement information how to ensure that the information is safe and reliable and not tampered. "Let law enforcement data runs on the blockchain" which use blockchain, big data and other related technologies to store and transmit information such as law enforcement evidence securely, and comprehensively improve the effectiveness and security of law enforcement data.

**Key words:** *Transportation administrative law enforcement, blockchain, law enforcement evidence, informatization*

## I. INTRODUCTION

The comprehensive reform law of enforcement transportation has integrated law enforcement teams, equipment, and resources, providing a basis and guarantee for unified, standardized and efficient law enforcement. With the rapid development of the Internet, mobile communications, cloud computing, and the Internet of Things, and continuous investment in practical applications<sup>[1]</sup>, law enforcement has also generated a large amount of data, which is constantly increasing every day. Among them, law enforcement data storage, information security, and tamper resistance have become pain points and urgently need to be resolved to improve the security and reliability of law enforcement data, in order to increase the authority of law enforcement results, and increase satisfaction with law enforcement.

## II. CURRENT SITUATION OF LAW ENFORCEMENT SYSTEM

In accordance with the needs of law enforcement work, many places have carried out the construction and application of law enforcement information systems, including law enforcement cases, law enforcement supervision, law enforcement statistical analysis, law enforcement command and dispatch system, and so on. The core is the law enforcement case handling system, which accumulates and generates a large amount of law enforcement case data, and

stores a large amount of information such as law enforcement evidence.

At present, information such as law enforcement evidence is mainly stored in two modes: centralized and decentralized. The process law enforcement records are scattered in various places, and the evidence information directly used as cases is generally stored on the cloud server. The current model has many disadvantages. First, there are obvious security risks and tamper-proof risks. When judicial procedures such as administrative reconsideration and litigation are involved, it is difficult to prove the validity and authenticity of the data and the data has not been tampered with. The second is centralized storage, and much of it is video data, which takes up a lot of storage space, and is constantly growing. As a result, some information cannot be saved in accordance with the law enforcement archive period, and can only be deleted regularly or go offline. Which affects retrieval of historical data and case correlation, etc.

Therefore, a new model of safe and reliable decentralization needs to be introduced. Blockchain, as a decentralized, immutable, traceable, and commonly maintained distributed database, can establish reliable trust among multiple parties who do not understand each other, and achieve it in an epoch-making manner without the coordination of third-party intermediaries. It has trusted the value of data sharing and peer-to-peer<sup>[2]</sup>. Blockchain technology is very suitable for solving the above problems because of its decentralization, openness, and security.

## III. INTRODUCTION OF BLOCKCHAIN TECHNOLOGY

### 3.1 Blockchain technology overview

Blockchain involves many scientific and technological issues such as mathematics, cryptography, the Internet, and computer programming. From an application point of view, in simple terms, blockchain is a technology that collectively maintains a reliable distributed database through the trust of all members. Its core includes distributed ledger technology, asymmetric encryption algorithms, and smart contracts. It has the characteristics of decentralization, consensus mechanism, traceability, and high trust<sup>[3]</sup>. These characteristics ensure the "honesty" and "transparency" of the blockchain and lay the

foundation for the blockchain to create trust. The rich application scenarios of the blockchain are basically based on the ability of the blockchain to solve the problem of information asymmetry, and to achieve collaborative trust and concerted action among multiple subjects.

### 3.2 Blockchain technology features

**Centralization:** Block chain technology does not rely on additional third-party management or hardware, there is no central control, in addition to self-contained block chain itself, through distributed storage and accounting, information on each node to achieve a self-validation, transfer and management. Decentralization is the most prominent and essential feature of blockchain

**Openness:** block chain technology is based on open source, in addition to private information outside of the parties to the transaction is encrypted data block chain is open to everyone, anyone can through open interfaces and data query block chain and develop its application, So the entire system information is highly transparent.

**Independence:** Based on consensus specifications and protocols (similar to various mathematical algorithms such as the hash algorithm used by Bitcoin), the entire blockchain system does not rely on other third parties, and all nodes can automatically and securely verify and exchange data in the system No human intervention is required.

**Security:** As long as no control over 51% of all data node, you cannot modify the network wanton manipulation of data, which makes the block chain itself becomes relatively safe, avoiding the subjective human data changes.

**Anonymity:** Unless required by laws and regulations, technically speaking, the identity information of each block node does not need to be disclosed or verified, and information transfer can be performed anonymously.

### 3.3 Application scenario analysis

Currently, block chain technology-based applications can be divided into three scenes, first class transfer of value, such as the creation of virtual currency and transferred between different accounts; the second is as evidence ownership determination, the recorded information to the district On the blockchain, such as electronic contracts and copyright confirmation; third, authorization management, such as using smart contracts to control data access. Moreover, with the escalation of application requirements, there are multiple types of integration scenarios.

In law enforcement, there are many application requirements for blockchain. For example, blockchain

technology can prevent the leakage of data such as law enforcement evidence through multi-signature private keys and encryption technology. The security of the blockchain can be basically applied in all areas of law enforcement, especially in key and sensitive information management such as identity information, cases, etc., which can ensure the security of information and the normal use of information. As a technology, blockchain has distinct characteristics and advantages, but it is precisely because of these characteristics that it also causes corresponding legal issues<sup>[4]</sup>. Therefore, while applying blockchain technology, it is necessary to collect and store law enforcement data in accordance with legal and compliant processes in accordance with the business characteristics of law enforcement. Especially for law enforcement files and similar information, it is necessary to analyze the applicability of blockchain technology in electronic file management<sup>[5]</sup>, to ensure the application effect.

## IV. DESIGN OF LAW ENFORCEMENT SYSTEM BASED ON BLOCKCHAIN TECHNOLOGY

### 4.1 System Overview

The law enforcement coordinated case handling system serves as the core support of the comprehensive administrative information management system for transportation administrative law enforcement. In accordance with the current law enforcement regulations, it is mainly used in various categories of law enforcement agencies such as highway road administration, road transportation administration, water transportation administration, navigation administration, port administration, and engineering quality supervision Business Applications

Enforcement system based on the data center and mobile law enforcement Integrated Management System data for preparation before the inspection of law enforcement, law enforcement inspection calls and information collection and analysis of law enforcement check information summary provides ancillary support. The system realizes the collection of electronic evidence of various law enforcement cases, electronic circulation throughout the process and online processing, and standardization of document production, and achieves the standardization of law enforcement documents, the legitimacy of law enforcement subjects, the timeliness of case handling, and the rationality of discretion at all stages of the process automatic real-time monitoring and early warning, improve law enforcement investigators standardized. Convenience level and real-time supervision capabilities to meet the needs of law enforcement business handling, law enforcement supervision, etc.

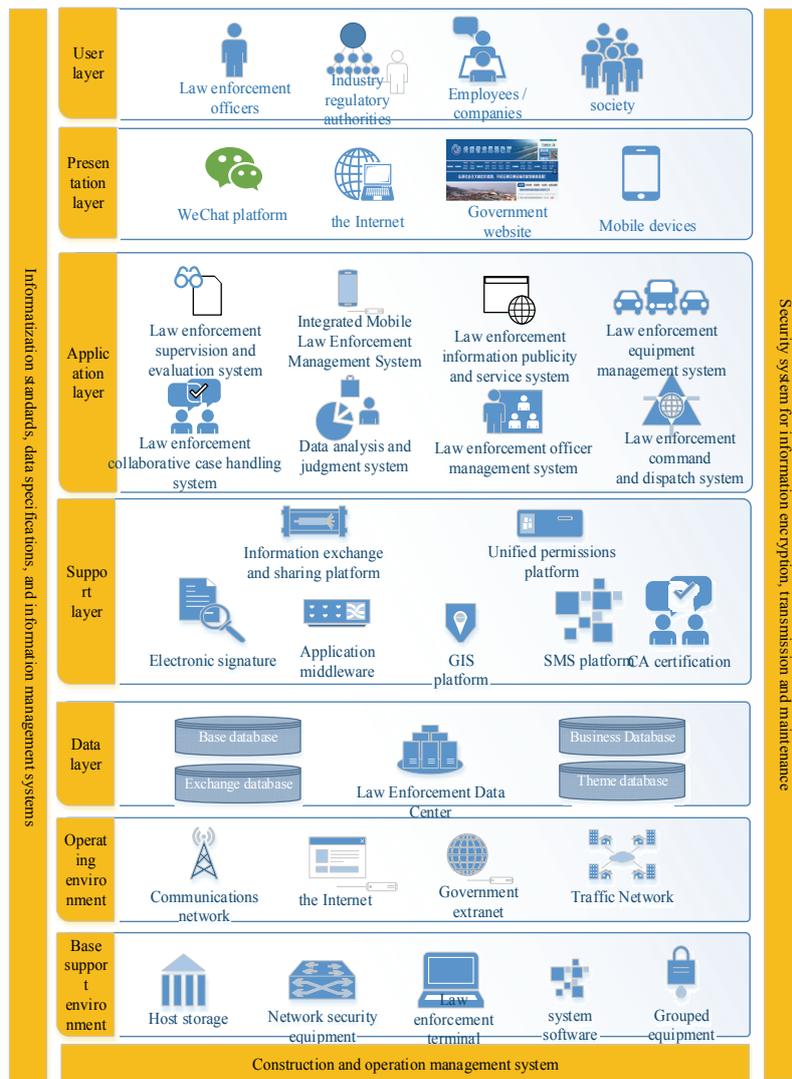


Fig.1 Overall framework

#### 4.2 Process Design

Transportation administrative law enforcement is divided into general procedures and simplified procedures. The figure shows the general procedures. The general procedures mainly include the main business links of administrative case filing, investigation and evidence collection, case review,

punishment decision, and enforcement of punishment. For cases involving defense, hearings, etc., it is necessary to deal with them accordingly; for cases with significant cases, complicated cases, and parties applying for reductions and exemptions, collective case discussions are required. After the case closed, case files involved in the process need to be archived.

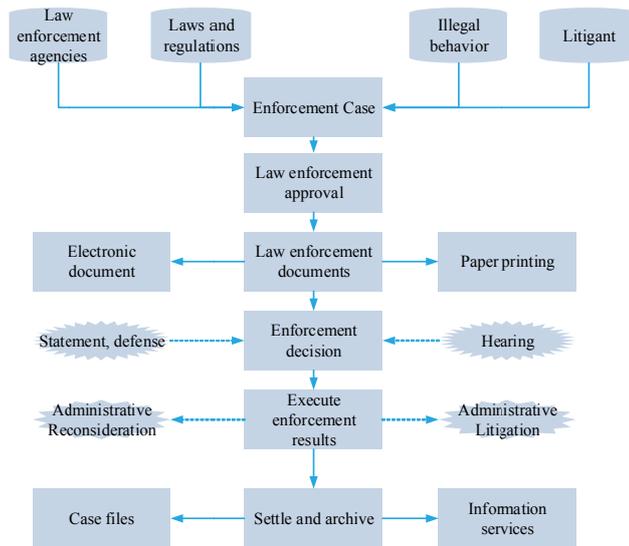


Fig.2 The business flow chart of the law enforcement

### 4.3 Application of Blockchain Technology

From different angles to law enforcement data classification, divided into categories according to the law enforcement agencies, law enforcement personnel, law enforcement cases, law enforcement supervision, law enforcement equipment and other data; divided according to the type of video, audio, images, text, and so on; follow links into filing, examination and approval illegal notifications, enforcement decisions, decided to implement, data such as closed; according to the purposes divided into basic data, business data, data and other topics.

digested and signed, and the results are transmitted to the law enforcement platform for unified storage, and the original large file data is stored locally. According to the application needs of law enforcement data, data openness, data authorization, and data services are stored in a distributed and decentralized form<sup>[6]</sup>. Begin gathering information from the case, the case officially on the chain, open to all law enforcement departments on collaborative chain, and then direct all automatically recorded by the process chains on all participating law enforcement and public process. Protect tamper-proof information such as files and the authenticity of law enforcement evidence.

Relying on the blockchain, the law enforcement data is

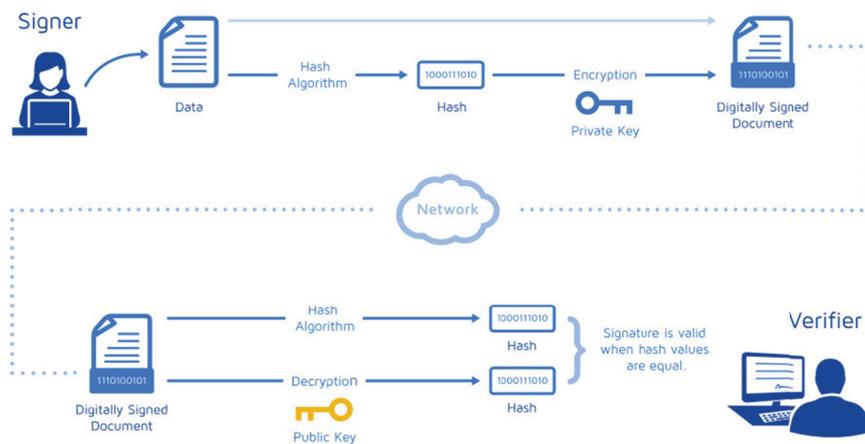


Fig.3 Interactive process diagram

Step 1: The sender processes the message hash function to generate a message digest. The digest information is encrypted using a private key to generate a signature, which is sent to the receiver along with the message. Step 2: The data is transmitted through the network. After receiving the data,

the recipient extracts the signature and message separately. Step 3: verify the signature. The verification process is to extract the message and do the same hash processing to get the message digest, and then use the public key to decrypt the signature sent by the sender. Success, otherwise verification

fails, indicating that it was not sent by the sender.

Realize intelligent electronic forensics of various law enforcement cases, standardized online circulation, standardization of document production, electronicization of law enforcement case files, strengthen on-site law enforcement supervision capabilities, and improve the level of frontline law enforcement investigation and evidence informatization and case handling efficiency. Relying on blockchain technology, build a law enforcement data sharing and exchange platform for various law enforcement categories in the transportation system, ensure vertical penetration, horizontal integration, and comprehensive sharing of law enforcement information, achieve cross-regional, cross-department collaborative law enforcement, joint prevention and control, and effectively form a joint force of law enforcement supervision. Compared with paper contracts based on stamps and signatures, digital signature technology based on cryptographic principle guarantees is more difficult to forge and tamper with, and has higher security and credibility<sup>[7]</sup>.

## V. CONCLUSION

Under the background of the network of law enforcement and "Internet + supervision", from the construction to the widespread application of transportation administrative law enforcement, a large amount of data has been accumulated, and it is constantly increasing every day. Data storage, information security, and tamper resistance in law enforcement informatization have become pain points and urgently need to be resolved. This paper proposes a "Let law enforcement data runs on the blockchain", by means of block chain, big data and other law enforcement-related technology transfer and preservation of evidence, to enhance the effectiveness and safety, administrative reconsideration, administrative litigation law enforcement data The proportion is effectively reduced, and satisfaction with law enforcement is improved.

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