

Analysis of the Application of Time Stamping Technology in Traffic Off-site Enforcement

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Abstract: This paper analyses the background of traffic off-site law enforcement and proposes the application of time stamping technology in this scenario, in view of the controversies of "large quantity", "difficult to preserve" and "easy to be tampered with" of the electronic evidence formed in traffic off-site law enforcement. It proposes to apply time stamping technology in this scenario. By analyzing the principle of time stamping technology, focusing on the advantages and challenges of time stamping technology in this scenario, we put forward suggestions covering the guarantee of regulatory compliance and transparent communication, the guarantee of system updating and upgrading and compatibility, and the enhancement of operator's skills and cognitive level, etc., so as to analyse the possibility of the application of time stamping technology in the off-site traffic law enforcement, to ensure the accurate recording and authenticity of the electronic evidences, and provide strong support for the application of time stamping technology. strong support for the application of time-stamping technology. Through the research of this paper, we deeply understand the key position of time-stamping technology in off-site traffic law enforcement, and provide a comprehensive and feasible solution for the authenticity and legality of electronic evidence.

Keywords: Traffic Off-site Enforcement; Electronic Evidence; Time-stamping Technology.

1. Introduction

Due to the extensive use of modern technology in the field of public security and traffic administration, digital cameras, video cameras and electronic monitoring equipment has gradually become a common tool for the traffic police to collect evidence, public security and traffic management authorities often based on digital photos, electronic video or electronic monitoring records as the only basis for the traffic violations to impose penalties in administrative litigation, often provide digital photos, electronic video and other electronic evidence to Prove the legality of the administrative punishment. Electronic data generation, storage, transmission of information is easy to be tampered with, in terms of information security has the characteristics of vulnerability, with the usual authentication method is difficult to find out whether it has been modified. Based on the vulnerability of electronic evidence, whether such evidence can be used alone as the basis for a decision, there is greater controversy in trial practice.

2. Traffic Off-site Enforcement Gives Rise to Widespread Use of Electronic Evidence

2.1. Background to Off-site Traffic Enforcement

Traffic off-site law enforcement is through all kinds of electronic law enforcement equipment (video surveillance system, card system, speed measurement system, etc.) automatically on the road traffic behaviour (speeding, red light, illegal use of mobile phones on the way, not the reasonable use of seat belts and other violations) data collection, evidence collection, so as to make the corresponding administrative punishment. 1997 the first set of red-light electronic police system in Shenzhen on-line operation, traffic law enforcement from manual investigation

and handling to camera enforcement, officially opened the era of off-site law enforcement. 2021 the revised "Administrative Penalty Law" article 41 for a certain degree of off-site law enforcement. In 1997, the first red light electronic police system was put on line in Shenzhen, and traffic law enforcement shifted from manual investigation to camera law enforcement, formally opening the era of off-site law enforcement. Article 41 of the revised Administrative Penalty Law of 2021 regulates off-site law enforcement to a certain extent, requiring that the monitoring equipment meets the standards, is set up reasonably, and the signs are obvious. Traffic off-site law enforcement reduces the time and cost of manual law enforcement and improves the efficiency of administrative law enforcement through the use of automation technology, and at the same time reduces the subjective judgement of law enforcement officers, records violations through technical means, reduces the human factors that may exist in law enforcement, and improves the objectivity and fairness of law enforcement.

2.2. Status of Electronic Evidence for Off-site Traffic Enforcement

As a product of the big data era, electronic data has the characteristics of "large capacity", "many kinds" and "low value density". With the transformation of traffic law enforcement scene from on-site law enforcement to off-site law enforcement, a large amount of traffic violation electronic captured pictures and videos will be generated, and the administrative organs need to screen, review and confirm these massive electronic data to form electronic evidence. With the transformation of traffic law enforcement scene from on-site law enforcement to off-site law enforcement, a large number of electronic capture pictures and videos of traffic violations will be generated, and the administrative authorities need to screen, review and confirm these massive electronic data to form electronic evidence, which will be used as the basis of administrative punishment by traffic administrative authorities to maintain the stability of traffic

order.

China has stipulated, at the legal and specific normative levels, the specific provisions for the use of electronic data generated by traffic off-site law enforcement as electronic evidence, from its generation and circulation to its final use as electronic evidence after being manually screened and reviewed. Firstly, the legal level: in November 2014, the revised Administrative Procedure Law added electronic data as one of the eight types of evidence. 2021 Administrative Penalty Law, Article 41 from the collection and review of electronic evidence to explain the administrative organs to make administrative penalties of the specific provisions of this provision of the legislative intent is to introduce science and technology into the administrative norms at the same time to protect the legitimate rights and interests of the parties. Secondly, the industry norms: GA/T832-2014 "Road Traffic Safety Violations Image Forensics Technical Specification" Article 3.6.1 provides that the information superimposed on each picture should at least include the time of the offence, the location of the offence, the code of the offence, the number of the image forensics equipment, and anti-counterfeiting information. Article 3.9 stipulates that each image of a traffic offence shall contain original anti-counterfeiting information to prevent the original image from being artificially tampered with during transmission, storage and proofreading.

In specific judicial practice, the regulator electronic forensics generally have two ways: one is in the road junction or highway installation "electronic eye", the second is the traffic management department in the roadside or in the civilian car using digital camera camera, both are used as evidence of punishment. The author in the Chinese law referee documents network to "electronic capture" "electronic eye" "electronic police" as the key words, the case is set as "road traffic Management (road)" search. Through browsing the case found that, at present, China's courts on the traffic off-site law enforcement electronic evidence for review and determination, first of all, the legality of the evidence, authenticity, completeness and reliability of the assessment, at the same time on the electronic evidence of the process of generating, preservation of the environment, technical equipment, data extraction, and other factors for review, in order to ensure that the validity of the evidence.

In summary, both the legislative level and the judicial practice level, have highlighted the importance of China's traffic off-site enforcement of electronic evidence generated, so the author believes that the introduction of timestamp technology in traffic off-site enforcement application scenarios, for its integrity, authenticity endorsement, and thus effectively avoid disputes and improve the efficiency of judicial review.

3. Advantages and Challenges of Applying Time Stamping Technology in Traffic Off-site Enforcement Scenarios

3.1. Principles of Time-stamping Technology

3.1.1. Timestamp Concept

Timestamping, also known as electronic time-stamping, refers to a means of electronic authentication that binds a specific electronic data file to a specific time and generates an encrypted file to prove that the information contained in that

electronic data file was in existence at that specific time, similar to a stamp or postmark containing a date and time. Timestamping marks the time of an event or data, and this marking helps to record the occurrence of an event and the time of creation or modification of a file to ensure the chronology, integrity and traceability of the data.

3.1.2. How Timestamps Work

How timestamps work, including the generation and verification processes. The generation process begins with event triggering or data creation, where the user calculates the digest of the data file through a hash algorithm, sends the digest to the time stamping agency DTS, which digitally signs the digest and its related information using the authoritative time of the National Timing Centre, and generates the digital signature to form the timestamp file. The National Timing Centre of the Chinese Academy of Sciences is a comprehensive astronomical research institution focusing on time-frequency research and timing services, and is a legal timing institution. In the verification process, digital signature technology is used to encrypt the timestamp and data to generate a unique signature. The user uses the public key in the public key certificate of the timestamp service centre to reverse the digital signature and extract the hash value in the timestamp file. At the same time, a new round of hash operation is performed on the electronic file, resulting in a new hash value, which is compared with the hash value in the timestamp file. If it is consistent, it indicates that the electronic document has not been tampered with since the trusted timestamp was obtained; if it is inconsistent, it proves that the electronic document has been tampered with, and then consistency detection is carried out by reversing the process, and the hash value comparison is computed link-by-link, in order to find the node where the document has been tampered with and to pursue the rectification of the document. This process provides an effective means to ensure the integrity and trustworthiness of data, enabling users to trace and verify the integrity of documents and safeguard data security.

3.2. Advantages of Time Stamping Technology in Traffic Off-site Enforcement Application

3.2.1. Time-stamping Technology Can Facilitate the Preservation and Proof of Electronic Evidence

Timestamp technology makes the preservation of electronic evidence for traffic off-site enforcement convenient and efficient. Timestamp technology provides accurate time stamps for each piece of electronic evidence, so that the traffic control department can easily manage a large amount of electronic evidence, and reduce the burden of the traffic control department in managing huge electronic evidence. As the timestamp technology for electronic evidence to provide a precise time mark, so that electronic evidence from the generation of each step to the archives are traceable, so that more rapid retrieval and archiving, to prevent the loss of or damage to the traffic electronic evidence, to ensure that the archived electronic evidence is more secure and reliable, to avoid the complexity of the traditional file management. As the traffic control department bears the burden of proof, through the time stamp technology for scientific management of electronic data, to provide a more simple process for evidence. Evidence with timestamps in the courtroom without the need for complex explanations and proofs, with the assistance of the hash function, can be

combined with credible timestamps to effectively assess whether the information has sufficient authenticity and reliability. Judges are able to learn more quickly about the whole process of generating and changing electronic evidence, improving the efficiency of the trial.

3.2.2. Time-stamping Technology Ensures Authenticity of Electronic Evidence in Traffic

Time-stamping technology ensures the authenticity of electronic data captured by off-site traffic enforcement equipment by providing accurate time labels for each piece of electronic data captured by the off-site traffic enforcement equipment. Timestamp technology uses digital signatures to associate each piece of electronic data collected with a specific point in time, and immediately generates a timestamp file when the electronic data is generated. Any tampering or modification of the electronic data will be detected because the timestamp is based on its own encryption algorithm, which results in a change in the hash value data once the data marked with the timestamp has been altered. This non-tampering characteristics make the timestamp technology become a powerful tool to ensure the integrity and authenticity of the electronic data collected by the traffic off-site law enforcement equipment, effectively preventing the administrative relative from questioning its authenticity. Thus, to ensure that the traffic control department in the future may appear in the administrative reconsideration, administrative litigation and other legal procedures to provide electronic evidence is true and reliable, increasing the impartiality and credibility of the traffic control department off-site law enforcement.

3.3. Challenges of Applying Time-stamping Technology in Traffic Off-site Enforcement

3.3.1. Judicial Recognition of Time-stamping Technology

Time-stamping technology can improve the accuracy and non-tamperability of law enforcement records, but the degree of acceptance of this technology in the judicial system still varies. On the one hand, some courts may have accepted timestamp technology as an effective means of evidence, believing that it can ensure the authenticity of records. In China's legal documents network, using "timestamp" as a keyword to search, the number of cases has increased by a spurt every year since 2015, and by January 2024, there were more than 89,711 cases in which timestamp technology was used to preserve evidence. The increase in the number of cases reflects the general recognition by the courts of time-stamped evidence preservation. On the other hand, some judges and legal professionals may have doubts about the working principle and technical reliability of timestamp technology, for example, in "Jinan Zhongjia Intellectual Property Agency Inc. v. Migu Media Co. Ltd. Infringement of the Right to Dispute over the Distribution of Information Networks", the defendant, Migu Media, argued that the timestamp authentication certificates could not prove that the uploaded In "Huagai Company v. Baolong Company Copyright Dispute Case", the defendant Baolong Company believed that, from the generation process, the forensic operation before the plaintiff Huagai Company uploaded the preservation evidence to the timestamp website was operated by its own staff, and it could not be ruled out that the forensic operation was carried out by Huagai Company on its own before the operation of the infringing evidence. Before the operation, Huagai Company tampered with the microblogging website page involving the infringing facts. In

the time-stamping electronic evidence service platform, the applicant must complete the forensic operation alone in the private device, which is different from the traditional notary mode, therefore, in judicial practice, the accused infringers often questioned the forensic process. In traffic off-site law enforcement, the traffic control department unilaterally screens the data, if applying timestamp technology and completing the unilateral forensic operation by themselves, it may trigger the fined relative to question the forensic process.

3.3.2. Technical Aspects of Equipment for Time-stamping Technology

Introducing new time-stamping technology into our existing traffic off-site enforcement equipment may face multiple problems. Firstly, the equipment is lagging behind. These old traffic off-site law enforcement devices face both technical and hardware updates to meet the requirements for embedding timestamping technology. Technically, the old traffic off-site law enforcement system does not support the digital signature and encryption algorithms required by time-stamping technology, and also cannot meet the real-time demand required by time-stamping technology, so the traffic off-site law enforcement system is facing a technical update. Equipment, the application of time-stamping technology needs to provide clear and accurate images, the need for the current equipment to carry out an investigation, for does not meet the requirements of the equipment in a timely manner for the replacement, while the time-stamping technology is a huge amount of electronic data time marking, and stored as a time-stamped file, so it needs to meet a certain storage capacity, which requires upgrading the storage equipment or optimise the storage method. In addition, the skills training and awareness training of the administrative staff of the traffic control department is also a consideration. The staff may lack training and understanding of timestamping technology, and a comprehensive training programme is needed to improve their knowledge and ability to use timestamping technology, so that they can better apply timestamping technology in the off-site traffic law enforcement system.

3.3.3. Inadequacy of Regulations and Technical Standards

In traffic off-site law enforcement, there is the problem of imperfect laws and regulations and corresponding technical specifications. So far, China's off-site law enforcement is still in the state of law enforcement according to the administrative departments in the absence of legal authorisation in accordance with the procedures developed by themselves. At the local level, many procedural documents for off-site enforcement are only "red head documents" formulated by local law enforcement departments. Therefore, due to the lack of uniform laws, regulations and technical standards, different places may adopt different timestamping implementation schemes, which on the one hand leads to the difficulty of interoperability and cooperation of traffic off-site enforcement systems in different regions, and on the other hand also leads to the lack of consistency and comparability of off-site enforcement data. For the implementation scheme of timestamp technology, scholars Yu Zhun, Chen Yuefei, and Yu Hongfang propose to establish a safe and reliable channel by connecting the terminus of trusted timestamps in the regional traffic administrative law enforcement system to realise the trustworthy timestamp issuance request for the functions of traffic case handling, data analysis and research and judgement, information disclosure and service, comprehensive law enforcement service, law enforcement

supervision and evaluation and appraisal.

4. Recommendations for the Application of Time-stamping Technology in Off-site Traffic Enforcement

4.1. Ensuring Regulatory Compliance and Transparent Communication

In the process of introducing time-stamping technology, guiding it through relevant regulations and technical standards is a key aspect. Firstly, the provisions of laws, regulations and relevant technical standards should be improved, and the implementation plan of time-stamping technology should be clarified through adaptability assessment, followed by continuous updating of laws, regulations and technical programmes to ensure that the laws, regulations and industry technical standards are always in line with the evolving technological environment. At the same time, it is important to strengthen the communication between the two administrations in this process. Through regular meetings, seminars and information releases, clearly communicating to the public the reasons, advantages and operational details of the introduction of time-stamping technology not only accelerates people's understanding and application of the new technology, but also removes any doubts and misunderstandings that the administrative counterparts may have about the time-stamping technology. By collecting feedback from administrative counterparts on the time-stamping technology, the system will be adjusted to meet the needs of users and improve the effectiveness of the off-site law enforcement system in actual operation. Improving laws, regulations and industry standards, and enhancing transparent communication between the two sides not only provide broad social support, but also help to build positive social opinion and promote the smooth promotion of the technology.

4.2. Upgrading of Law Enforcement System Hardware as well as Software

The introduction of time-stamping technology necessitates both software as well as hardware upgrades to ensure that existing off-site law enforcement systems can smoothly integrate and be compatible with this new technology. Firstly, a comprehensive technical assessment of the existing off-site enforcement system is required to determine the hardware and software status of the current system. Based on the results of the assessment, necessary hardware and software updates will be made, including servers, databases, operating systems, and so on. Secondly, the hardware is upgraded. Through the assessment, cameras or other sensors that do not meet the requirements of time-stamping technology are updated so as to ensure that their resolution, performance and adaptability meet the requirements of time-stamping technology. Finally, the software of the traffic off-site enforcement system is upgraded to ensure that it can effectively store and manage time-stamped data, including offence records, image capture and evidence management, and that it supports the generation and storage of time-stamped data. By optimising the storage method to adapt to the data format and structure requirements of timestamp technology. By updating and upgrading the software as well as the hardware of the off-site law enforcement system, it is ensured that the traffic off-site law

enforcement system can efficiently process timestamped information and ensure the integrity and authenticity of electronic evidence.

4.3. Enhancement of Operator Skills and Cognitive Levels

In order to successfully introduce time-stamping technology, a series of measures are recommended to upgrade the skill level of operators and their awareness of the new technology. Firstly, a dedicated training programme should be designed to cover the principles of time-stamping technology, the application process and its organic integration with law enforcement operations. The training content is regularly updated to keep the information and operational methods up-to-date. In addition to technical training, it is also vital to focus on improving the level of awareness. Through education and communication activities, the advantages, usefulness and practical application scenarios of the new technology are explained to enhance operators' understanding of time-stamping technology. The significance of this series of training is to improve operational efficiency, reduce operational risks and ensure data accuracy. By deepening their understanding of time-stamping technology, operators will be able to respond more flexibly to the ever-changing law enforcement environment and ensure the smooth operation and continuous optimisation of the entire law enforcement system.

5. Conclusion

The application of timestamp technology in the system of traffic off-site law enforcement, by accurately recording the creation and modification time of the timestamp file, on the one hand, facilitates the management of electronic evidence by administrative organs, and on the other hand, effectively guards against the risk of the electronic evidence being tampered with and forged, ensures the authenticity and completeness of the electronic evidence of traffic off-site law enforcement, reduces the possibility of the authenticity of the electronic evidence being challenged, and enhances the efficiency of the review of electronic evidence of traffic by the court. Traffic electronic evidence review efficiency. By applying timestamp technology in traffic off-site law enforcement system, it not only contributes to the modernization of the law enforcement system and the construction of the rule of law, but also provides sustainable technical support for future law enforcement practice.

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