

Chapter 9

Enhancing Smart Toll Security Improved Ecliptic Curve Algorithm in Intelligent Transportation Networks

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ABSTRACT

Intelligent Transportation Systems (ITS) employ cutting-edge technologies like the Internet of Things (IoT), Artificial Intelligence (AI), and cryptographic security to improve mobility and public safety. ITS combines intelligent toll collection, real-time traffic monitoring, and automated payment mechanisms to make transportation efficiency smoother and secure financial transactions. The use of cryptographic protocols, e.g., the Enhanced Ecliptic Curve Algorithm (IECA) to secure key exchange and the Enhanced Hash Function (EHF) for data integrity, enhances security within ITS networks. Such innovations avert cyber attacks, i.e., data tampering, replay attacks, and unauthorized intrusion. Additionally, blockchain technology improves transaction immutability, providing toll payment transparency. By marrying effective encryption techniques with real-time observation, ITS reduces congestion, improves toll management, and also increases commuter safety.

DOI: 10.4018/979-8-3373-0245-4.ch009

INTRODUCTION

Intelligent Transport Systems (ITS) use the most advanced technology to enhance transportation mobility, efficiency, and security on rural and urban roads. ITS combine sensor information, cameras, and communication network data to offer optimum traffic patterns and minimize traffic congestion. Real-time surveillance, predictive analytics, and automation characterize ITS, which offers greater public safety and traveling experience. GPS, AI, and IoT enable the authorities to monitor road conditions more effectively. Traffic signal coordination, dynamic speed limit adjustment, and automatic charging are a few ITS implementations that improve efficiency. Connected vehicle technology enables automobiles to talk to one another, eliminating crashes and enhancing road safety. Self-driving vehicles are also being integrated into ITS infrastructure to provide safer, more efficient transport networks. Implementation of these technologies minimizes travel time, fuel usage, and emissions. Governments and companies are investing in ITS to develop smart, responsive transport infrastructure. ITS, by virtue of ongoing innovation, is an absolute necessity in molding the mobility and safety of the future.

Public safety is a crucial aspect of ITS, facilitating safe travel experiences for commuters, pedestrians, and cyclists. AI-based monitoring in CCTV cameras picks up suspicious activity and accidents in real-time. ITS is utilized by police authorities to increase response time, enhance highway and city emergency management. V2I communication alerts drivers to road conditions, traffic, and weather. Historical accident data are employed by predictive systems based on AI to warn high-risk locations so that preventive actions may be undertaken by the authorities. ITS helps the police monitor car theft and enforce speed limits through automatic systems. Intelligent intersections with sensors pick up on pedestrian activity, fewer accidents at intersections. Integrated emergency response systems in ITS enable quick dispatch of rescue and medical personnel. Cybersecurity is also an important aspect, providing privacy of information as well as protection from cyber attacks. With advancements going on, ITS offers an important contribution to improved as well as safer mobility within cities.

Traffic jams are the biggest challenge for expanding metropolitan cities, affecting productivity and quality of life. ITS relieves congestion with real-time-based dynamic control of traffic lights. AI-based algorithms maximize the flow of traffic and minimize bottlenecks and wastage of time. Smart parking systems assist drivers to find vacant parking space, eliminating unnecessary driving and fuel consumption. ATMS gives real-time information on road conditions and suggested routes. Dynamic tolling regulates freeway congestion through fare adjustments depending on demand. ITS enhances mass transit through effective bus scheduling and passenger traffic monitoring. Integration with mobile apps enables passengers to receive real-

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