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AN INNOVATIVE DASHCAM MULTIMEDIA PRESIDENCY TECHNIQUE USING BLOCKCHAIN TECHNOLOGY TO SHARE INFORMATION AND IDENTIFICATION OF INCORRUPTION IN V2V TRANSMISSION SYSTEMS

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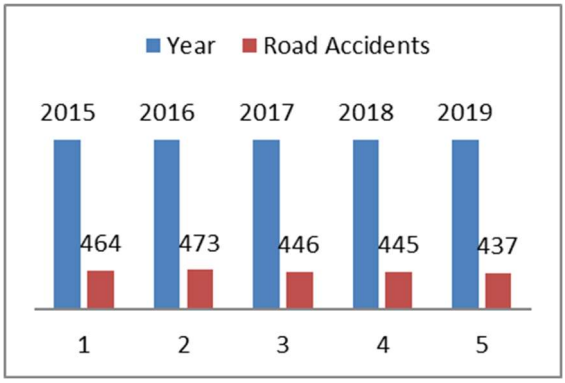
Abstract:
A Dashcam, which is a dashboard camera, is affixed to the front or rear of a vehicle for the purpose of capturing images and videos. Its utility spans crime deterrence, accident management, and even as a resource for teaching Traffic Accident Detection technology in Autonomous Vehicles. The practice of employing Dashcams to enhance Autonomous Vehicle technology is on the rise. However, due to the reliance on memory cards or cloud platforms for storing multimedia content, there exists an elevated vulnerability to information loss and fraudulent manipulation.
Although the application of blockchain technology and distributed storage can mitigate forgery and tampering risks, the integrity and confidentiality of visual data stored within the blockchain remain uncertain. To address this challenge, we propose an approach rooted in multi-signature-based access control. This technique involves organizing and retaining video data from multiple vehicles by leveraging GPS (Global Positioning System) data. The goal is to safeguard the privacy of video content preserved within the blockchain. Consequently, solely individuals who have uploaded videos tied to relevant GPS data and those with authorized access from pertinent authorities will be permitted to access Dashcam videos from nearby sources.
Keywords: Blockchain, Dashcam, V2V, Multi signature, Hadoop, Oracle.

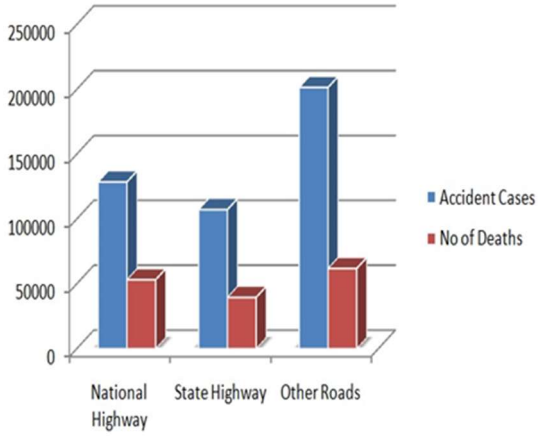
Introduction:

Blockchain functions as a decentralized framework incorporating secure hash technology, ensuring the immutability and transparency of records for digital assets. Operating as a public digital ledger, blockchain streamlines transaction procedures and asset monitoring within a corporate network. Within this network, nearly any valuable information can be documented and exchanged, lessening risks and amplifying effectiveness for all involved parties.
The ownership chronicle of diverse content is stored on a widely distributed, collaborative ledger through the utilization of blockchain technology. Given its inherent resistance to data manipulation, blockchain holds potential to substantially disrupt sectors such as finance, cyberwarfare, and healthcare, as the data housed within remains impervious to tampering.

Car accessory technology has undergone remarkable advancements, with the dash cam emerging as a particularly pivotal device for vehicles.



In countries characterized by disorderly traffic situations, a dashboard camera has grown indispensable. Referred to as a "Dashcam," this device captures video footage aimed at surveilling vehicular collisions. Beyond serving as concrete proof in cases of actual traffic incidents, in-car thefts, and similar offenses, this recorded video material holds potential as legal evidence. The technology capable of precisely identifying road accidents through Dashcam-recorded footage can also be harnessed to avert traffic mishaps in self-driving vehicles.

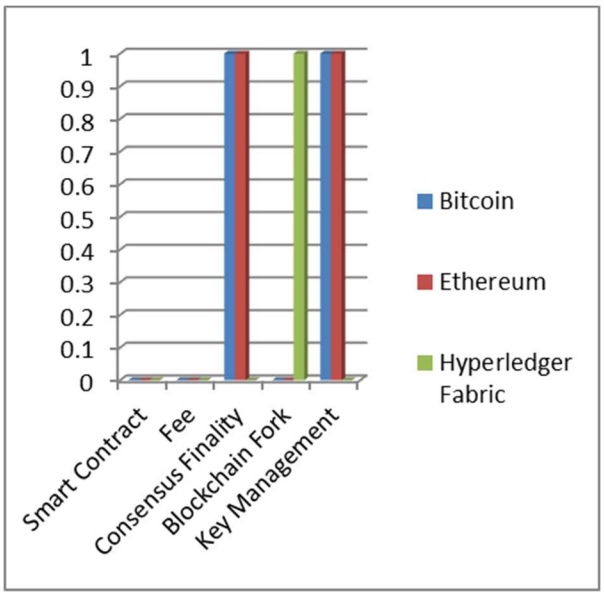


Presently, the gathered information is stored on a user's memory card, allowing them complete access to the dashcam's video data from the vehicle. The dashcam data could potentially find its storage on a solid-state drive (SSD) or within the dashcam's built-in storage. In situations of distress or trouble, the data on the dashcam's memory card might be purged or removed. There exists a substantial likelihood that the owner might intentionally manipulate, modify, or selectively erase portions of the stored data on the memory card. The dependability and soundness of this data are compromised when it is hosted within a cloud-based platform.

Based on research discoveries, the majority of accidents involving commercial motor vehicles (CMVs) are a result of hazardous driving behaviors or driver errors, making them potentially preventable. The implementation of safety monitoring systems such as Dash Cams, which address unsafe driving behaviors, has proven to be highly impactful. This underscores the necessity for a secure storage solution for the dashcam recordings to ensure their integrity and security.

Literature Survey:

Yifan Sui et al.[1] tackled the issue of automatically and precisely identifying and detecting road accidents using surveillance cameras, and they executed the entire framework on an AI demonstration platform. They explored the utilization of surveillance cameras to autonomously and accurately detect and identify road accidents and carried out the entire framework on an AI demonstration board. The method of motion interaction field (MIF) was employed to discern crashed vehicles by analyzing interactions among multiple moving objects, thus enabling collision recognition within video footage. Subsequently, the YOLO v3 model was utilized to precisely locate the damaged vehicles in the correct positions. To reconstruct the motions of vehicles leading up to the collision, a hierarchical grouping technique was applied, allowing the recovery of relevant trajectories. Lastly, a perspective transformation was employed to project the route onto a longitudinal image, aiding traffic officers in making informed judgments.

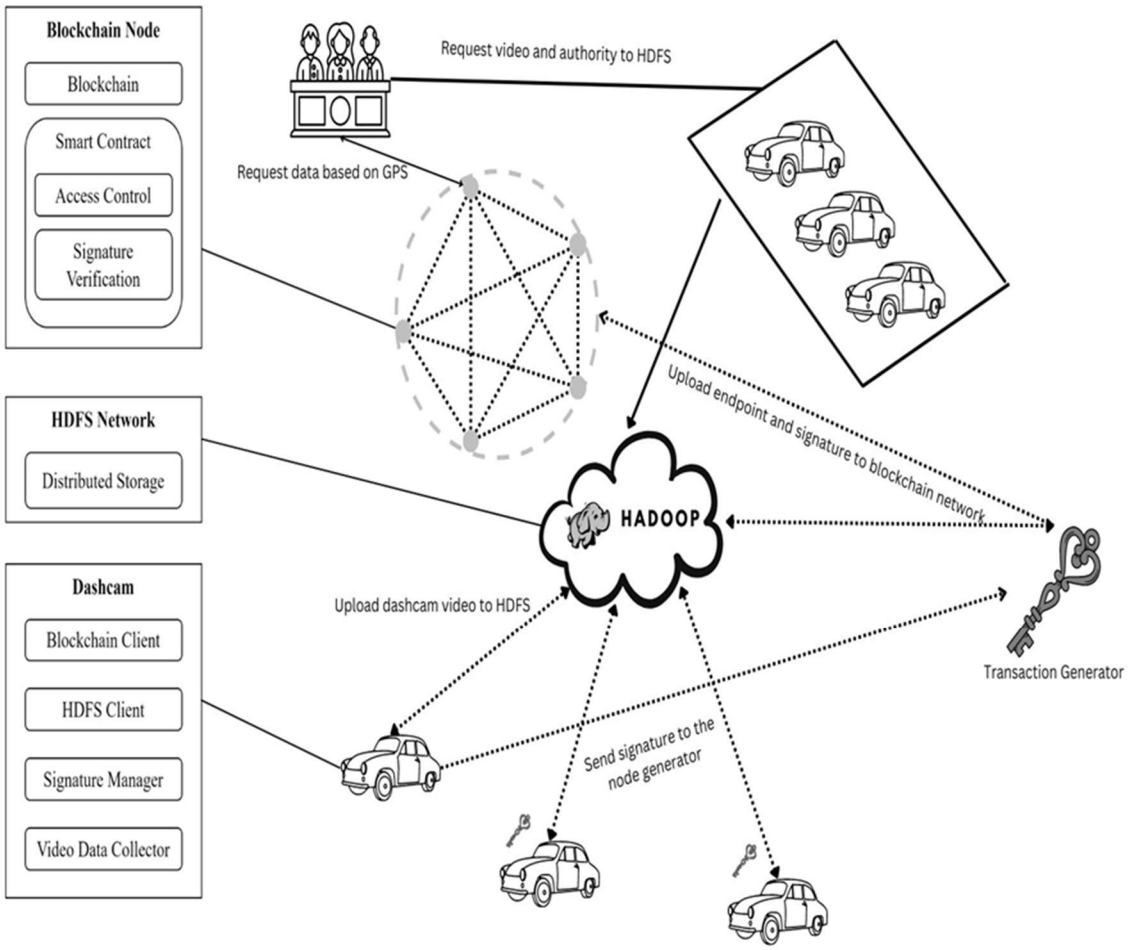


The effectiveness of the field will be reduced by the delay of traditional cameras when moving at high speeds. To enhance still RGB images, Jiaming Zhang et al.[2] propose acquiring dynamic context from event-driven data that offers a finer temporal resolution. This approach holds true even for situations like car collisions characterized by pixelation, impacts, lateral shifts, overturns, and more.

The arrangement of sensors holds significant importance in proactive vehicular safety monitoring systems. However, due to the unpredictable nature of vehicle accidents and variations in sensor performance, designing an optimal detector layout for transportation systems becomes complex. Qian Cao[4] introduces an innovative approach using a heterogeneous sensor template to tackle these challenges. The technique employs a model for evaluating the dispersion of road accident risks, aiming to reduce the impact of accident unpredictability and achieve consistent spatial distribution of incidents across the transportation network. Subsequently, a model is devised to design the ideal configuration of heterogeneous detectors, considering factors like sensor types, cost, collision recognition accuracy, and more. The goal is to maximize the reliability of detecting fatal crashes on road infrastructure within the given constraints.

Nighttime identification of expressway traffic incidents plays a vital role in improving rescue efficiency and averting subsequent accidents. With this objective in mind, Xianglun Mo[5] developed a deep learning network tailored for identifying vehicles on night highways. The network employs a dense optical flow derived from the flow of vehicle lights as the target for detection. This approach combines elements from classical optical flow techniques, YOLO-v3 model, and the methodology proposed in this research. While the focus of this study is predominantly on monitoring tools widely adopted on expressways due to their high detection accuracy, cost-effectiveness, and straightforward installation, there remain shortcomings in terms of hardware infrastructure and detection technologies.

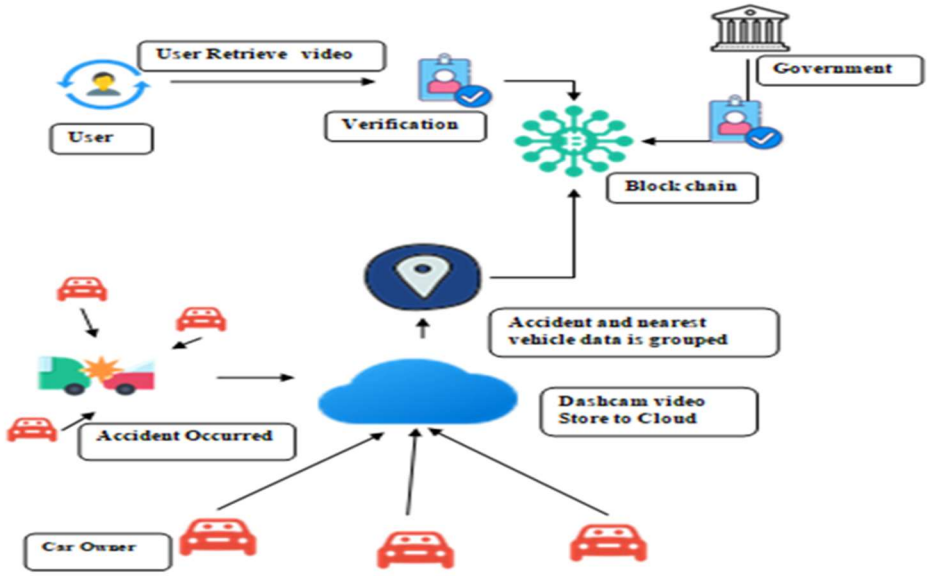
In driving videos, traffic incidents usually occur within a brief timeframe of a few seconds, and the environment is often intricate and constantly changing. These factors make the identification of road accidents challenging. Zhili Zhou[6] and colleagues propose an approach for recognizing collisions that revolves around encoding spatio-temporal patterns using a multi-layered neural network. This technique aims to accurately and efficiently identify accidents within driving footage. To aggregate the video frames, a multi-layer neural network is specifically utilized to capture the temporal dynamics of the video. Frames on the boundaries are pinpointed as potential accident frames based on gathered pixel clusters. The spatial relationships among objects observed in these potential accident frames are then compiled and encoded to determine if they correspond to images of accidents.



Criminals might exploit the wireless networks and the internet through which interactions occur among vehicles, Street Side Units (SSU), and Border Servers (BS) in the Internet of Automobiles (IoA) ecosystem, leading to tampering with the information shared across different entities. Consequently, there arises a need for encrypted communication among all participants within the IoA-based Intelligent Transportation System (ITS) setup. An innovative authentication method called BCAS-VADN has been developed by Anusha Vangala[7] and her team, employing certificates, to address accident detection and reporting in the automotive domain within ITS.

When a vehicle identifies an accident on the road either independently or through a neighboring vehicle, the BCAS-authenticated VADN protocol ensures that each vehicle securely notifies the nearest Collection Head (CH) responsible for disaster-related procedures. The CH then securely forwards the received vehicle activities to its respective Street Side Unit (SSU), which, in turn, securely forwards the data to the Border Servers (BSs). The BS takes charge of constructing a temporary component containing transactions, the root of a Merkle tree, and a cryptographic signature. This component is transmitted to the associated Cloud Platform (CP) in the Blockchain Hub (BH) for the creation, validation, and expansion of a complete block utilizing the designated consensus mechanism.

The integration of blockchain technology underscores that BCAS-VADN not only provides protection against a broad spectrum of potential threats but also upholds the visibility, data integrity, and decentralization of the information.



Research Gap:

From the papers discussed earlier, it can be deduced that although diverse topics have been explored, there has been a lack of focus on ensuring the integrity of acquired footage. This includes precise identification and detection of road accidents, creation of a diverse sensor layout, nighttime identification of vehicles on highways, mishap detection within driving videos, establishment of encrypted communication, and more. The literature review reveals a notable gap in addressing the aforementioned aspects.

Performance Metrics:

The study's findings indicated the establishment of a framework that encompasses both a blockchain network and a vehicle-to-vehicle (V2V) network. The foundational technology for the blockchain was Hyperledger Fabric, which served as the underlying structure. Within the V2V network, the Hyperledger Fabric network is involved in O(n2) consensus processes for each activity transmitted by a customer. Nonetheless, the proposed clustering method introduced in this analysis aids in diminishing the volume of transactions. This involves grouping transactions and then transmitting them to the Hyperledger Fabric system through the V2V network. The efficiency of the network is influenced by the size of the transactions during transmission. To address this, a shared file system was employed to reduce the size of the connectivity signal, subsequently resulting in a reduction in the volume of visual data transmitted.

A multi-signature authorization method based on GPS (Global Positioning System) data that organizes and stores multimedia data from multiple vehicles. Only subscribers uploading video belonging to the relevant GPS can access neighbouring Dashcam videos, guaranteeing the

confidentiality of the video files stored in the blockchain network. Once the video files are uploaded, only those who are permitted will be able to access or view or download them.

Conclusion:

Blockchain technology is a revolutionary and captivating innovation known for its capacity to enhance transparency, prevent fraud, and minimize security risks. Hence, this research endeavors to tackle the challenges that can arise when utilizing blockchain to ensure the accuracy of dashcam video recordings. To overcome these challenges, the study proposes a solution involving the segmentation of connected vehicles within the V2V network using GPS data. The selection of the blockchain operation initiator is performed from the available terminals. During the process, multiple image data instances of a scene are captured by the user and stored on the blockchain. Additionally, to mitigate security concerns, access to these images is controlled through an admission management system, ensuring limited access to authorized users and individuals authorized by relevant authorities.

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