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Real-Time Index Authentication for Event-Oriented Surveillance Video Query using Blockchain

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ABSTRACT: Information from surveillance video is important for situational awareness (SAW). Nowadays, a prohibitively great deal of surveillance data is being generated continuously by ubiquitously distributed video sensors. it's very challenging to instantly identify the objects of interest or pore suspicious actions from thousands of video frames. Making the massive data indexable is critical to tackle this problem. it's ideal to get pattern indexes during a real-time, on-site manner on the video streaming rather than betting on the instruction execution at the cloud centers. the trendy edge-fog-cloud computing paradigm allows implementation of your time sensitive tasks at the sting of the network. The on-site edge devices collect the knowledge sensed in format of frames and extracts useful features. The near-site fog nodes conduct the contextualization and classification of the features. The remote cloud center is answerable of more data intensive and computing intensive tasks. However, exchanging the index information among devices in numerous layers raises security concerns where an adversary can capture or tamper with features to mislead the closed-circuit television. during this paper, a blockchain enabled scheme is proposed to guard the index data through an encrypted secure channel between the sting and fog nodes. It reduces the possibility of attacks on the little edge and fog devices. The feasibility of the proposal is validated through intensive experimental analysis.

Keywords: Blockchain, Video Indexing, Edge Computing, Smart Surveillance , Object Detection and Tracking.

I. INTRODUCTION

Thanks to the proliferation of cyberspace of Things (IoT) technology that links cyber-physical systems and social objects, the idea of sensible Cities becomes possible and provides high-value services that improve the life quality of its residents. along of the foremost actively researched sensible town topics, sensible police investigation permits a broad spectrum of promising applications, as well as access management in areas of interest, human identity or behavior recognition, crowd flux statistics and congestion analysis, detectionof abnormal behaviors,andinteractive polic einvestigation mistreatment multiplecameras. info fr om police investigation video is crucial to comprehend situational awareness (SAW). Aprohibitively tidysum of policeinvestigation knowl edge is being generated unceasingly each second by the ubiquitously distributed video sensors, thus it's a necessity to observe the issue of interest and zoom into a suspicious action in real time using a deep convolutionneuralnetwork(CNN) that is quick, econ omical and reliable for multilabel object detection .Using Associate in Nursing object frame and neural network we have a tendency to area unit ready to localize the labeled object in real time. to agitate the challenges in sensible television system running on cloud-based design, fog/edge computing has been recognized as a promising approach that migrates computation tasks to the sting of a network. Merging additional intelligence to the ubiquitously deployed networked cameras and sensible mobile devices permits additional jobs conducted by the localised nodes at the sting of networks.It permits the sensible television system to satisfythedelay-sensitive,mission crucial necessities. Thedistributededge/fogdevices domestically method raw video streams and makes the video indexable byextracting,recognizing,andlabeling helpful option s. The feature description and index knowledge area unit transferred to the nodes in higher layer to help advanced analytic tasks. However, the remote knowledge transmission additionally incurs i ssues in knowledge security and privacy as a result of it expose vulnerabilities to potential attackers to perform malicious operations, like Denial of Service

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(DoS) attacks, false video injection attacks, modifying pursuit mechanical phenomenon, and eavesdropping personal video streams.

II. II. BACKGROUND AND RELATED WORK

A. Smart Surveillance at the Edge

Most surveillance systems that are available today for purchase will function as an archive of footages and being used for off-line forensics analysis and depends on human operators in process loop.

Fig.1. Layered smart closed-circuit television hierarchy within the edge-fog-cloud computing paradigm.

Implementation of the on-line surveillance tasks are limited due to the time delay and uncertainties related to the approach of sending footage to distance servers. On the opposite hand, recent Machine Learning (ML) algorithms require less powerful processors for operation and promising results are achieved using them at the sting of the network. such human detection and tracking together with abnormal behavior detection analysis are feasible at edge or fog computing layers using various smart deep learning or other ML algorithms. In most cases the video streams are transferred to a cloud node for further processing that makes a burden on the communication network.

B.Current Scope: Nowadays the smart surveillance systems are deployed in a very distributed network environment, these smart devices are geographically scattered across near-site edge networks in an untrusted network environment. it's not suitable to enforce security on a centralized authority, which suffers from the performance bottleneck or the one point of failure. Thus, the smart closed-circuit television needs a brand new decentralized framework that has security schemes within the trust-less application network environments. The Smart surveillance systems are laid low with communicational overhead while transferring video streams to cloud node for further processing this not tolerable in many mission-critical, delay sensitive tasks, so as to beat of these problems a real-time index authentication scheme is proposed to smart closed-circuittelevision .

C.ProposedWork: during a Blockchain Technology a fundamental protocol of Bitcoin , which was the first digital currency, the blockchain protocol has been recognized because the potential to revolutionize the basics of IT technology thanks to its many attractive features and characteristics like supporting decentralization and anonymity maintenance. during this paper, a blockchain enabled index authentication scheme for real-time event-oriented surveillance video query is proposed to boost the safety of smart closed-circuit television. Through executing detection and tracking tasks on the embedded edge devices, event-oriented surveillance service extracts featured information by processing input frames. Then, a real-time indexing service generates unique index for every frame to forestall malicious modification on image. Finally, the frame indexes are imprinted to a block-chain network and verified by a decentralized smart contract based authentication mechanism. The major contributions of this work are complete architecture of real-time index authentication scheme for smart closed-circuit television is proposed, which has event-oriented surveillance video query, real-time indexing, and blockchain-enabled authentication; A proof of concept prototype supported smart contracts is implemented and deployed on a neighborhood private blockchain network and A comprehensive experimental study has been conducted, andthus the experimental results validate the feasibility of the proposed scheme in IoT environments without introducing significant. Real-TimeIndexAuthentication A real-time index authentication for event-oriented surveillance video query system is proposed to supply a decentralized video streams security mechanism within the untrusted edge network environment. Fig.2 illustrates the proposed system framework, which demonstrates a scenario including two isolated IoT-based video surveillance domains without a pre-established trust relationship. With object detection and tracking tasks conducted by the smart cameras, low-level feature information is extracted on-site by processing surveillance video streaming at the network edge, then transferred to fog devices for data aggregation and further analysis. In each domain, the fog device not only enforces pre defined security policies to manage domain related devices and services, but also acts as an intermediate to

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interact with public blockchain and cloud to enable the index authentication for event-oriented surveillance video query. the most components of the framework include the event-oriented surveillance video query, real-time indexing and secure data transferring, and blockchain enabled authentication.

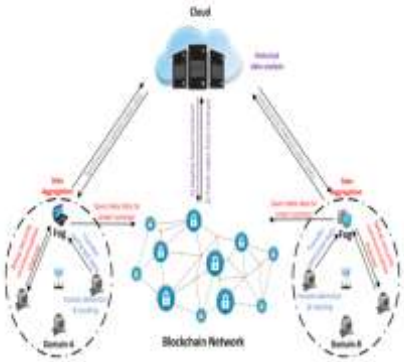

Fig. 2. Diagram of the System Architecture

A . Smart Surveillance System

Processing the video instantly gives better understanding of the event going down in real time. The surveillance camera captures the video and transfers it to the edge/fog devices of choice in real-time. the sting device is connected through Local Area Network (LAN) to the camera and is found on site. It takes each frame because the first point of the automated abnormal detection mechanism. After the reception of the frame, the sting device is answerable of extracting low-level features for abnormal behavior detection. so as to possess a functional system for anomalous behavior detection or prediction, the closed-circuit television has to accurately identify objects. Otherwise the system may miss anomalies or incur a high warning rate. supported oblique human movement and alter of appearance, pedestrian detection using less recourses still is taken into account a challenging question in computer vision. Also, within the application of the smart surveillance the sting device that's liable for human object detection has constraints on the computing power and storage resources available for this job.

B. Secure Communication Channel

Symmetric encryption includes a secret key which may be variety, word or simply a string supported user preference. The key's shared only between the trusted sender and receiver that produces it possible for less than these two nodes to encrypt and decrypt the text. the matter with symmetric encryption is that the key could represent wrong hands while sharing via the net and anyone with the key can decrypt the text. Asymmetric encryption includes a key pair referred to as the general public and personal key. The text encrypted with the general public key can only be decrypted with users private key which is simply known by the user. The private key provides no other key sharing through the web. The trade-off with asymmetric encryption is that it requires way more processing power and it's slower than symmetric encryption. Therefore, so as to leverage the benefits from both of the encryption techniques, a hybrid solution is promising. during this work, we decide the AES (Advanced Encryption standard) and RSA (Rivest Shamir Adleman) encryption algorithm because the symmetric and asymmetric key encryption algorithms.

the information transfer from the sting node to the fog node is administrated during a secure line encrypted with AES and RSA algorithms. The advantage of using both encryption algorithm is that it provides a brief key establishment time and is more robust to the network sniffing attacks. The shared key encryption is established without the attacker having the ability to intercept the key. The fog node's public key's accustomed encrypt the shared key and this encrypted data is employed to send the shared key to the fog node to determine the secure shared key channel. The hashes of the shared secret's exchanged to verify that the key has been established. The impact on the efficiency of the channel is incredibly low and that we can establish double layer encrypted channel. The encryption techniques like AES and RSA are utilized in cloud computing security and image steganography to boost the safety performance. AES has been adopted to come up with random pixel position similarly on decide the scale of least significant bits for embedding information dynamically. Cryptography and steganography are used simultaneously for encoding, within which the hash of the info and AES encrypted secret's encrypted with public key encryption. This encrypted data is embedded in images using the smallest amount significant bit technique in steganography. the same technique was proposed that uses a mixture of AES and RSA in secure cloud systems, which improves the knowledge transmission performance between the user and also the cloud data storage.

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C. Real-Time Indexing and Event-Oriented Video Query

The features extracted from each frame are encrypted and sent to the fog node, where it'll be decrypted and used for contextualization, which refers to the act of placing the features during a spatio-temporal context. as an example, someone walks within the hall ways of the university office area during business hours is normal, but the identical activity within the late night can be suspicious. aside from its use in classification, contextualization of the info before storing may be a key for search of activity or event of interest in video stream, like video clips with an individual captured during a time of concern. Therefore, the geo-location of the camera, time or sequence of the frame, total number of the objects within the frame, and their gestures are recorded as matrices in a very Key-Value manner. In each given frame, each object has Keys and every callable key encompasses a value assigned thereto. These information are going to be stored at the fog node where storage capacity is offered and may be used for future search supported the keys. In practice, these keys are called indexing data used for faster rummage around for information of interest. Querying the video are often done using the index table. This feature is extremely useful when trying to find a specific incident or activity of interest within the video stream. The common practice is to seem at the footage slowly and find the instant of interest that in most cases will take considerable amount of your time. Using the index table of features will efficiently reduce the search time of query video by querying for a string variable rather than looking into old video files. Once the contextualized data has been saved within the fog node, the target video clips are going to be indexed using the keywords supported the time, location or other attributes of interest. This approach can provide more powerful searching functions. as an example, once the time and also the camera ID is understood, the speed of the objects at that scenario could also be the query.

D.BlockchainenabledAuthenticationThe options extr acted from every frame ar encrypted and sent to the fog node, wherever it's going to be decrypted and used for contextualization, that refers to the act of inserting the options throughout a spatio-temporal context.as associate example, somebody walks insid e thehall waysinwhich oftheuniversity workplace sp ace throughout businesshoursis traditional, however the identical activity inside the late night can be suspicious. apart from its use in classification, contextualization of the information before storing is also a key for search of activity or event of interest in video stream, like video clips with a personal captured throughout a time of concern. Therefore, the geo-location of the camera, time or sequence of the frame, total range of the objects inside the frame, associated their gestures ar recorded as matrices in an passing Key-Value manner. In every given frame, every object hasKeys andeach due keyincludes aworth allotted th ereto.These info ar hold on at the fog node wherever storage capability is available and m ay be used for future search supported the keys. In apply,thesekeys ar knownas assortment knowledg e used for quicker explore for info of interest. Querying the video is finished mistreatment the indextable.Thisfeatureis extraordinarily helpful once attempting to seek out to seek out incident or activity of interest inside the video stream. The common apply is to look at the footage slowly and find the moment of interest that in most cases can take extensive quantity of some time. mistreatment theindextable of options can with efficiency scaleback thesearchtime of question video by querying for a string variable instead of trying into previous video files. Once the contextualized knowledge has been saved inside the fog node, the target video clips ar getting to be indexed mistreatment the keywords supported the time, location or different attributes of interest. This approach will offer additional powerful looking func tions. as an example, once the time and so the camera ID is known, the speed of the objects at that situation isadditionally the question.

E.Performance analysis andResult Once the video is streamed to the sting device, folks object detection is conducted in period using a CNN. The pedestrians ar ar and a chase formula uses the detection bounding boxes to follow the objects of interest till they exit the frame. The trackers ar quicker and run every frame, detection and chase done upto 13FPS in every second. Followingtheitemofinterest can extract options supp orted the movement of the pedestrians inside the frame. throughout thiswork, many options ar though t-about, together with their relative speed (calculated supported pixels of movement in one second and divided by the bounding box area) and direction, that is envisioned inFig.3.

The options ar written throughout a file to be sent to the fog node. throughout this file, every row shows the time stamp, frame sequence range, camera ID, pedestrian ID, then the options for that pedestrian as shown in Fig four.

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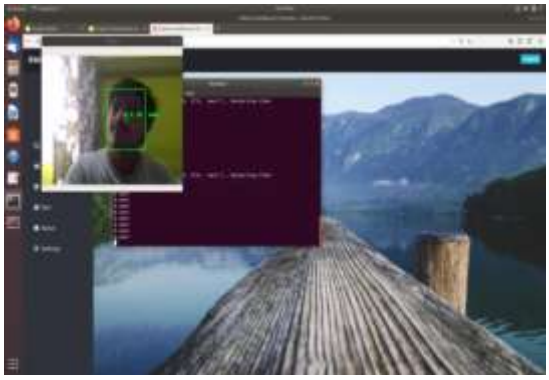

Fig.3. Visualization of the object detection and tracking.

Fig.4 Contents of the feature file extracted from the live video stream.

III. CONCLUSION AND FUTURE WORK

Technologicaladvancements squaremeasure dynami cal the means thathumanslive. thesedays several app lications squaremeasure affected towardautomation t oform it'seasierforusers. folks seeing centered good police investigation helps cut back the delay in detection and rise alert timely given the first answerer square measure given longer to react. therefore on notice this goal with minimum delays, additional computing tasks square measure migrated to the sting devices that square measure nearer tothecameraandabstracted options sq uare measure outsourced to a fog node for anomaly detection. throughout this method,
security considerations should be addressed to safeguard the data from being tampered or purloined and time period object detection and pursuit in an exceedingly} very moving frame is completed upto 13FPS. apart from this except situational awareness we'll do the violence detection in real time.

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