Blockchain Enabled UAV Assisted Unregistered Vehicle Identification System using Mobile Edge Computing

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Abstract

Unregistered vehicle identification is one challenging issue to solve in the perspective of a smart city as it is responsible for different consequences like a traffic accident, vehicle hijacking, illegal drug transfer etc. A surveillance camera can try to capture the video and transfer it to the mobile edge computing (MEC) server for identification purpose based on the valid number plate of the vehicles. Unmanned aerial vehicle (UAV) can work together with the surveillance camera to increase the accuracy of the vehicle detection on the road. Blockchain technology can help to create a trusted network with the user information where third-party is unable to modify any data inside the network. MEC server can validate the identified vehicles using image processing techniques and send a notification to the user based on its registration information. If the vehicles are not identified successfully, the preventive measure will be taken by the authority to avoid any disruption on the road.

I. Introduction

One of the major challenges of the smart city is to identify the unregistered vehicles using the surveillance camera that are responsible for different issues like traffic contretemps and illegal activities on the road [1]. However, due to the obstacle or fixed angle of the camera, unmanned aerial vehicle (UAV) can be used in surveillance purpose [2]. Image processing algorithm can be used to identify the unregistered vehicles. Due to hardware limitation of the UAV, mobile edge computing (MEC) server can be used to run the image processing algorithm. However, security issues need to be considered whenever the video data is transferred between the client and the server [3-5]. Additionally, blockchain can be employed to store the vehicle user information. User information can be stored in the blockchain to make the system more transparent [6]. In this paper, blockchain enabled UAV assisted unregistered vehicle identification system is proposed using Mobile edge computing.

II. Proposed Methodology

The basic functionalities of the proposed system are explained in Fig. 1. Surveillance camera and UAV are used to capture the video of the road. It takes the image of different vehicles and send it to the nearest MEC server for checking the validity. It has been considered that all of the vehicles is registered in the system with personal user information like name, ID, contact number etc. The alert of vehicle detection is provided to the user whenever his/her vehicles will be detected in the system. It helps to identify not only the unregistered vehicle but also the fraudulent case of stealing or hijacking the vehicles.

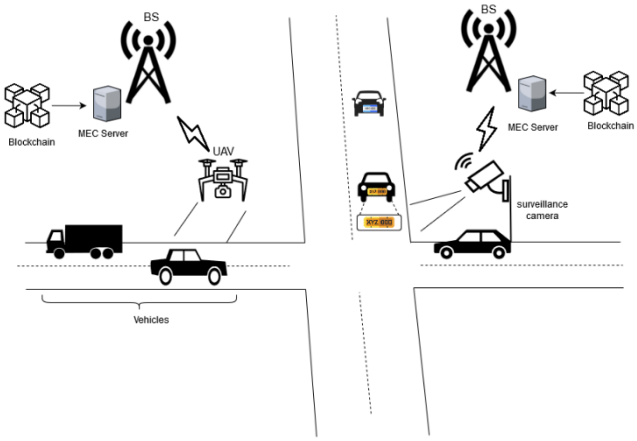

Fig. 1. System Design

The user registers his information in the system with all of the basic information. User information is very sensitive therefore, it is stored as a chain of block in the server to create a trusted network. Each MEC server is connected with the other server via a backhaul network so that they can share their data easily with other servers. Both the surveillance camera and UAV captures the image and transfer it to the MEC server for further processing. The security issues must be considered whenever the

surveillance camera or UAV transfers the data to the base station. Public key cryptographic technique is used to make the data processing technique more secure between the camera/UAV and MEC server. MEC server uses the image processing technique to validate the car. Whenever the car is validated by the server, one notification message is sent to the user. If the vehicle information is not validated by the server or the license plate is missing, the MEC server sends a signal to the authority about the unregistered vehicle.

III. Result Analysis

The experiment was done using parrot bebop 2 as a UAV. Raspberry pi 4 model B was attached with the UAV for communicating with the MEC server. An Intel (R) core (TM) i5-4590 CPU @3.30GHz with 8 GB memory was considered as a MEC Server. Hyper-ledger blockchain technique was used to store the data of the user inside the network. YOLO object detection algorithm was applied to detect the vehicle in the road. After applying the algorithm, the MEC server successfully detected the vehicles with previously stored data. Additionally, as calculating throughput is one of the major challenge in the network, both the throughput of secured channel and unsecured channel was analyzed in Fig. 2. AES cryptographic technique is considered in the secured channel as a session key of the public key cryptography. From Fig. 2, it was observed that the x-axis represents the time in second and y-axis represent the throughput in kilobits/second and throughput in unsecured channel was higher than the secured channel. However, as the secured channel was provided more security in the network, this small differences can be overlooked by transferring the data through the secured channel.

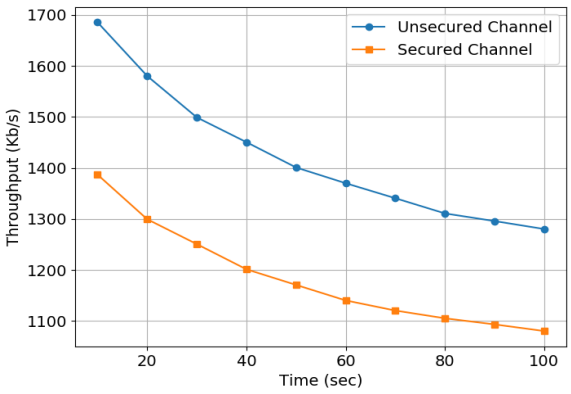

Fig. 2. Throughput results analysis for secured and unsecured channel

IV. Conclusion and Future Work

Our propose system can contributed in the society by detecting the unregistered vehicles to avoid any unwanted issues on the road. It can alert the valid user as well as aware the authority after detecting any unregistered vehicles. As blockchain technology is employed in this experiment to store only the user data, it can be extended by proposing blockchain based real time vehicle tracking system as the future work of this paper.

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Reference

[1] Khan, M.A.; Ectors, W.; Bellemans, T.; Janssens, D.; Wets, G. Unmanned Aerial Vehicle-Based Traffic Analysis: A Case Study for Shockwave Identification and Flow Parameters Estimation at Signalized Intersections. Remote Sens. 2018, 10, 458.

[2] A. Islam, K. Sadia, M. Masuduzzaman and S. Y. Shin, “BUMAR: A Blockchain-Empowered UAV-Assisted Smart Surveillance Architecture for Marine Areas,” 2020 International Conference on Computing Advancements (ICCA), 2020. doi: 10.1145/3377049.3377062

[3] Masuduzzaman, Md., Ashik Jamil Mahmud, Anik Islam and Md. Mofijul Islam. “Two Phase Authentication and VPN Based Secured Communication for IoT Home Networks.” ArXiv abs/1910.13625 (2019).

[4] M. Masuduzzaman, A. Islam, and S. Y. Shin, “A blockchain-enabled CO_2 controlling scheme with the assistance of the internet of things,” Journal of the Korean Institute of Communication Sciences, pp. 114–115, 2020.

[5] A. Islam, M. Masuduzzaman, A. Akter, and S. Y. Shin, “BUAG: A blockchain-empowered unmanned aerial vehicle-unmanned ground vehi- cle cooperative search and rescue scheme,” Journal of the Korean Institute of Communication Sciences, pp. 116–117, 2020.

[6] K. Sadia, M. Masuduzzaman, R. K. Paul, and A. Islam, “Blockchainbased secure e-voting with the assistance of smart contract,” in IC-BCT 2019, D. Patel, S. Nandi, B. Mishra, D. Shah, C. N. Modi, K. Shah, and R. S. Bansode, Eds. Singapore: Springer Singapore, 2020, pp. 161–176.