Chapter 7
Blockchain Towards Secure UAV-Based Systems

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ABSTRACT

During this last decade, the blockchain (BC) paradigm has been required in several use cases and scenarios in particular for security, privacy, and trust provisioning. Accordingly, several studies proposed the use of BC technology to secure and to assure the trustworthiness of unmanned aerial vehicles (UAVs). In this context, this chapter highlights several applications and scenarios for the deployment of UAVs within diverse smart systems. In addition, it illustrates the advantages of the integration of the BC within UAVs-based smart systems. This integration reveals new challenges and future research directions that are discussed in this chapter.

INTRODUCTION

During this last decade, the world witnessed an increasing in the number of Unmanned Aerial Vehicles (UAVs) (Hentati, and Fourati, 2020) with different sizes, models, functionalities, and sensing and communication capabilities responding to the global demand in different domains. Indeed, UAVs are being useful in complex mission and critical scenarios in particular for hostile areas supervision involving multi and cooperative UAVs. In addition, the typical UAV applications in 5G and beyond are mobile

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relay, aerial internet of things (IoT) data collector, aerial base station, aerial mobile user, aerial helper for traffic offloading or traffic caching. Besides that, the use of multi-UAVs in collaboration with terrestrial networks affords new ways for diverse context such as civilian, military, environmental, commercial, agriculture, smart city, healthcare, disaster monitoring, and telecommunication systems...However, UAVs based system face several technical challenges including cooperative computation offloading, QoE requirements, collision avoidance, mobility management, multi-node task scheduling, failure recovery, and security provisioning. The standard scenario of UAVs network is to have one or multi flying UAVs, which are supervised and managed by the user, via a ground control station (GCS) through a communication link (Krichen et al., 2018). MAVLINK is the standardized communication protocol between an UAV and a GCS and between UAVs. However, this protocol have several vulnerabilities (Chaari & al, 2018). BlockChain (BC) based solutions are the adequate paradigm that could mitigate vulnerabilities, threats and attacks within UAVs based systems. Accordingly, this chapter highlight the importance and the effectiveness of BC for securing UAVs communication. Indeed, the manifolds of this chapter could be summarized into three points:

- Providing a deep investigation regarding the various applications of BC technology in UAV systems. Indeed, this chapter discusses challenges pertaining UAVs scenarios, pinpoints how BC can enhance UAVs utility in each scenario and illustrates how certain BC features can help to overcome UAV security, trust and privacy issues.
- Giving a wider outlook to the readers, on how the correlation between BC and UAV technology can enhance the security level for smart systems environments.
- Highlighting potential open issues and future research directions that can be beneficial for the development and the deployment of BC-based UAV systems.

The rest of this chapter organized as follows: The second section overviews the fundamentals of UAVs with focus on UAVs communication systems, UAVs emerging applications and UAVs attacks. The third section presents the basic concepts related to BC technology with an insight on BC platforms, BC consensus and the role played by BC to enhance the UAVs-based systems security, privacy and trust. The fourth section discusses intensively various applications and scenarios of deploying BC within UAVs based systems. The fifth section affords the readers with a holistic vision of the ongoing research in BC-based UAV systems and assesses involved challenges, possible research opportunities, and future directions. Finally, the last section concludes this chapter and summarizes the lessons learned through this chapter.

UAVs FUNDAMENTALS

UAVs Communication Systems

Certain UAVs applications, such as surveillance of hostile areas, necessitate collaboration and synchronization between UAVs network and other types of networks for example Wireless Sensors Network (WSN), 5G networks, LEO satellite networks to enhance UAVs connectivity and coverage. Thus, a typical UAVs communication system will incorporate several networking technologies offering connectivity between UAVs and a GCS. In general, a continuous bidirectional link must be established between UAVs and a GCS to collect all the details about the aircraft status, real-time telemetry data and to send the suitable