

# Unmanned Aerial Vehicles—Platforms, Applications, Security and Services

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## 1. Introduction

The use of unmanned aerial vehicles (UAVs) has attracted prominent attention from researchers, engineers, and investors in multidisciplinary fields such as agriculture, signal coverage, emergency situations, disaster events, farmland and environment monitoring, 3D-mapping, and so forth. The use of this technology is playing an important role in supporting human activities. Man is concentrating more and more on intellectual work, trying to automate practical activities as much as possible in order to increase their efficiency. In this regard, the use of drones is increasingly becoming a key aspect of this automation process. A drone offers many advantages including agility, efficiency and reduced risk, especially in dangerous missions. Hence, this special issue focuses on applications, platforms and services where UAVs can be used as facilitators for the task at hand, also keeping in mind that security should be addressed from its different perspectives, ranking from communications security to operational security, and also keeping in mind privacy issues.

## 2. The Present Issue

In response to the call for papers, we received 11 submissions, and 7 of these manuscripts have been accepted for publication.

The first paper, titled “LoRaWAN Networking in Mobile Scenarios Using a WiFi Mesh of UAV Gateways” [1], proposes a double-layer network system called LoRaUAV. The system is based on a WiFi ad hoc network of Unmanned Aerial Vehicle (UAV) gateways able to act as relay for the traffic generated between mobile LoRaWAN nodes and a remote Base Station (BS). The core of the system is a completely distributed mobility algorithm based on virtual spring forces that periodically updates the UAV topology to adapt to the movement of ground nodes. The proposed system is implemented in NS-3 and the performance, evaluated in a wild area firefighting scenario, shows the improvement in terms of Packet Reception Ratio (PRR).

The second paper, entitled “Onboard Visual Horizon Detection for Unmanned Aerial Systems with Programmable Logic” [2], introduces a fast horizon detection algorithm suited for visual applications to be used on board a small unmanned aircraft. For this purpose, the designed algorithm has a low complexity in order to meet the power consumption requirements and to keep the computational cost low. The authors present formulae for distorted horizon lines. The performance of the proposed algorithm is tested on a real flight with the help of a FPGA implementation.

The third paper, entitled “A New FANET Simulator for Managing Drone Networks and Providing Dynamic Connectivity” [3], deals with the possibility of providing wireless connectivity using a flying ad-hoc network (FANET) in all those emergency situations where the traditional network can meet several difficulties. A software simulator is proposed implementing different models—footprint, human mobility and drone behavior.

The fourth paper, entitled “A Traceable and Privacy-Preserving Authentication for UAV Communication Control System” [4], proposes a traceable and privacy-preserving authentication to integrate the elliptic curve cryptography (ECC), digital signature, hash function, and other cryptography mechanisms for UAV application. The authors designed a traceable and privacy protection protocol to conduct the UAVs’ application in a sensitive control area. This study also analyzed the computation and communication cost to prove the proposed scheme is practical in the real world.

The fifth paper, entitled “An Efficient and Provably Secure Certificateless Blind Signature Scheme for Flying Ad-Hoc Network Based on Multi-Access Edge Computing” [5], proposes an efficient and provably secure certificateless blind signature scheme (CL-BS) based on multi-access edge computing (MEC) for a FANET environment using the concept of hyperelliptic curve. The scope of the paper is to resolve computational and communication issues of the existing security approaches. The authors propose the use of multi-access edge computing (MEC) in a UAV environment with the help of 5G mobile network enabling a secure communication between UAVs and the base station (BS).

The sixth paper, entitled “Accurate Landing of Unmanned Aerial Vehicles Using Ground Pattern Recognition” [6], presents a solution for high precision landing. The authors propose a vision-based landing solution that relies on ArUco markers that allow the UAV to detect the exact landing position from a high altitude (30 m). They evaluate their system through a platform based on Arduino hardware, and they show how their proposal improves the landing accuracy (offset of about 11 cm) compared to the traditional GPS-based one, whose offset is about 1–3 m.

Finally, the seventh and last paper, entitled “Design and Analysis of Refined Inspection of Field Conditions of Oilfield Pumping Wells Based on Rotorcraft UAV Technology” [7], deals with an oil well monitoring method. The authors propose using computer vision in the detection of working conditions in oil extraction by making use of UAV aerial photography images combined with the YOLO v3 framework for tracking detection. Through different experiments they prove the goodness of their proposal.

### 3. Future

In the next years UAVs are expected to keep gaining momentum, being adopted for an ever-growing number of tasks in different fields. This entangles multiple challenges in terms of system/navigation, requiring significant integration efforts, multiple testbeds and deployment results, and novel protocols. To enable such systems, communications play a vital role, and so issues like software-defined radio/networks, virtualized networks, heterogeneous networks and channel modeling will be key to make these systems possible, especially if we keep in mind the trend towards more network demanding applications, like video streaming for real-time monitoring. Finally, issues like UAV identification, authentication and network security always remain as critical factors, especially when the UAVs are deployed to provide aerial surveillance or civil security, among others.

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### References

1. Stellin, M.; Sabino, S.; Grilo, A. LoRaWAN Networking in Mobile Scenarios Using a WiFi Mesh of UAV Gateways. *Electronics* **2020**, *9*, 630. [[CrossRef](#)]
2. Hiba, A.; Sántha, L.M.; Zsedrovits, T.; Hajder, L.; Zarandy, A. Onboard Visual Horizon Detection for Unmanned Aerial Systems with Programmable Logic. *Electronics* **2020**, *9*, 614. [[CrossRef](#)]

3. Tropea, M.; Fazio, P.; De Rango, F.; Cordeschi, N. A New FANET Simulator for Managing Drone Networks and Providing Dynamic Connectivity. *Electronics* **2020**, *9*, 543. [[CrossRef](#)]
4. Chen, C.L.; Deng, Y.Y.; Weng, W.; Chen, C.H.; Chiu, Y.J.; Wu, C.M. A Traceable and Privacy-Preserving Authentication for UAV Communication Control System. *Electronics* **2020**, *9*, 62. [[CrossRef](#)]
5. Khan, M.A.; Qureshi, I.M.; Ullah, I.; Khan, S.; Khanzada, F.; Noor, F. An Efficient and Provably Secure Certificateless Blind Signature Scheme for Flying Ad-Hoc Network Based on Multi-Access Edge Computing. *Electronics* **2020**, *9*, 30. [[CrossRef](#)]
6. Wubben, J.; Fabra, F.; Calafate, C.T.; Krzeszowski, T.; Marquez-Barja, J.M.; Cano, J.C.; Manzoni, P. Accurate Landing of Unmanned Aerial Vehicles Using Ground Pattern Recognition. *Electronics* **2019**, *8*, 1532. [[CrossRef](#)]
7. Zhou, Y.; Wu, C.; Wu, Q.; Eli, Z.M.; Xiong, N.; Zhang, S. Design and Analysis of Refined Inspection of Field Conditions of Oilfield Pumping Wells Based on Rotorcraft UAV Technology. *Electronics* **2019**, *8*, 1504. [[CrossRef](#)]



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