Abstract: This editorial paper was a special issue of Applied Sciences belonging to the section of mechanical engineering in MDPI journal and summarized the collected manuscripts regarding the unmanned aerial vehicles (UAVs) related technologies, including communication, control, collision avoidance, modeling, path planning, human-machine interface (HMI), artificial intelligence (AI), etc. Chronologically, this special issue was started to be coordinated at the end of Oct 2018, prepared for a month and opened to collect manuscripts from the middle of Nov 2018 until the end of Dec 2019. During almost a year, 26 papers were published online out of 50 submitted papers which results in 52% acceptance rate.

Keywords: artificial intelligence (AI); collision avoidance; communication network; control; human-machine interface (HMI); modeling; path planning; special issue; unmanned aerial vehicle (UAV)

1. Introduction

For the special issue titled “Unmanned Aerial Vehicles (UAVs)”, we invited articles on all aspects of these devices involving UAV services, including data processing and sensor fusion, obstacle and collision avoidance, trajectory generation single UAVs or groups of UAVs, communications and networks among UAVs, mission planning for various purposes, and so on.

Manuscripts with various UAV related technologies, including inspection of farms, vineyards, ranch animals, petrochemical refineries, oil pipelines, and battlefields; delivery of pesticides and herbicides, food in restaurants, and packages to remote areas and residences; the cutting edge of photography, filming, and journalism; the mapping of various fields—optical, magnetic, acoustic, and chemical; and reconnaissance and tactical bombing in the battlefield, have been proposed and published.

2. Advanced UAV Technologies

Unmanned Aerial Vehicle (UAV) services such as sensing, mapping, goods and equipment delivery, inspection, and monitoring have started to proliferate with the rapidly falling prices of both drones and the sensors mounted on them. Many of these services involve the gathering of data and its processing with complex algorithms either in real-time or on the cloud, and precise navigation and path-planning of the drones. Most of these applications are performed by single UAVs till now, though the use of a multiplicity of UAVs can significantly improve performance.

This special issue was introduced to collect the latest research on relevant topics, and more importantly, to address challenging present problems with all areas of technologies related to UAVs. There were 50 papers submitted to the special issue, and 26 papers were accepted (i.e., 52% acceptance rate). When looking back to the special issues, various topics have been addressed, mainly on communication (two papers), control (eight papers), collision avoidance (one paper), modeling (one paper), path planning (six papers), human-machine interface (HMI) (one paper), artificial intelligence (AI) (three papers), etc (four papers).
There are two papers focused on UAV communication technology [1,2]. D. Shin, K. Park, and M. Park present the risk assessment on autonomous vehicular V2V communication [1]. J. Lee, W. Lee, H. Kim, and H. Kim present an adaptive TCP transmission adjustment technique for the robust UAV communication network build-up [2].

There are eight papers focused on UAV control technology [3–10]. S. Sato, H. Yokoyama, and A. Lida present plasma actuators were introduced to simplify the complex feathering motion and to control the flow around insect’s flapping wings having simplified sinusoidal motion [3]. T. Huang, H. Jiang, Z. Zou, L. Ye, and K. Song propose an integrated robust adaptive Kalman filter, called the strong adaptive Kalman filter (SAKF), to solve the divergence and low accuracy issues of the existing Kalman filter (KF) for the high-speed UAV application [4]. S. Yeom and I. Cho present an interacting multiple model (IMM) filtering based empirical method to detect and track moving pedestrians using a small UAV (SUAV) in which the detection algorithm is consisted of frame subtraction, thresholding, morphological filter, and false alarm reduction processes and the tracking algorithm uses the output from the detection algorithm processes [5]. A. T. Nguyen, N. Xuan-Mung, and S. Hong present a step by step empirical processes for the adaptive trajectory tracking control of SUAV, in particular, by using the Euler-Lagrange based backstepping control technique [6]. Z. Ma, X. Zhu, Z. Zhou, X. Zou, and X. Zhao present a lateral-directional control method for the high aspect ratio full-wing UAV without any aileron and rudder using the differential thrust of propellers as the control output and the yaw angle as the controlled attitude angle [7]. H. Chuang, D. He, and A. Namiki present a direct visual servoing system for the UAV using a single onboard high-speed monocular camera to accomplish the autonomous flight in GPS denied area [8]. N. Xuan-Mung and S. K. Hong present a robust backstepping trajectory control of the SUAV based on both the parameterized uncertainties and external disturbances by solving the control input saturation issue with a new auxiliary system [9]. Q. Zhang, X. Chen and D. Xu present an adaptive neural fault-tolerant tracking control scheme for the yaw control of the multicopter type UAV, which is a non-affine nonlinear system, to manage actuator faults, input saturation, full-state constraints, and external disturbances [10].

There is one paper focused on UAV collision avoidance technology [11]. Y. Wan, J. Tang, and S. Lao present a collision avoidance (CA) algorithm for a cooperative fixed-wing UAV based on the maneuver coordination and planned trajectory prediction by generating and predicting three trajectory candidates [11].

There is one paper focused on UAV modeling technology [12]. M. Wu and M. Chen present nonlinear dynamic modeling of a small-scale compound helicopter with the first physical principles and linear modification method by considering the ducted fan, free-rotate wing, and horizontal stabilizer [12].

There are six papers focused on the UAV path planning technology [13–18]. F. Yan, X. Zhu, Z. Zhou, and J. Chu present an empirical hierarchical mission planning to decouple and solve the simultaneous arrival of a multi-UAV coalition problem [13]. S. Xie, A. Zhang, W. Bi, and Y. Tang present an improved mathematical model for UAV mission allocation by considering the difference in each target’s importance, constraints of the time window, and an indicator of reconnaissance reward [14]. Z. Shao, F. Yan, Z. Zhou, and X. Zhu present the distributed cooperative particle swarm optimization (DCPSO) algorithm with an elite keeping strategy to generate a safe flyable path of a single UAV in the multi-UAV rendezvous mission [15]. S. Jung presents the energy-efficient path planning by considering the distance between waypoint nodes, the minimum and maximum speed of the UAV, the weight of the UAV, and the angle between two intersection edges [16]. M. Zhu, X. Zhang, H. Luo, G. Wang, and B. Zhang present step by step optimization processes to achieve the safe shortest Dubins path using a multi-UAV rapid-assessment routing problem (MURARP) by considering the multi-depot revisit-allowed Dubins team orienteering problem (TOP) with variable profit [17]. M. Sun, X. Ji, K. Sun, and M. Zhu present a flight strategy optimization model for the high-altitude long-endurance (HALE) UAV based on the gravity energy reserving and mission altitude by incorporating integrated models including the five
flight path phase models, three-dimensional kinematic model, aerodynamic model, solar irradiation model, and energy store and loss model [18].

There is one paper focused on UAV HMI technology [19]. B. Chen, C. Hua, D. Li, Y. He, and J. Han present an intelligent human-UAV interaction system, the so-called HMI system, by using a deep learning-based action-gesture joint detection system [19].

There are three papers focused on UAV AI technology [20–22]. J. Moon and B. Lee present a cooperation framework between the UAV and unmanned ground vehicle (UGV) that connects deep learning techniques and a symbolic planner for heterogeneous robots by using the planning domain definition language (PDDL) planning with natural language-based scene understanding method [20]. W. Yue, X. Guan, and L. Wang present the UAV cooperative search mission for multi-dynamic targets in sea areas using a reinforcement learning (RL) algorithm [21]. H. Ahn, H. Choi, M. Kang, and S. Moon present a machine learning-based framework to detect and monitor abnormal behaviors during UAV swarm operation [22].

There are four papers focused on non-specific UAV technology [23–26]. W. Choi and S. Jung present the degradation of launch performance caused by the remnants of a missile canister cover with a sabot interface, on interference with adjacent structures [23]. C. Luo, W. Zhao, Z. Du, and L. Yu present the UAV design, implementation, and testing of a soft-landing gear together with a neural network-based control method for replicating avian landing behavior on non-flat surfaces [24]. P. Cwiakala presents an experimental test campaign using a UAV and measuring the obtained UAV positions during different flight tasks and in other operative conditions [25]. F. I. Llerena, A. F. Barranco, J. A. Bogeat, F. Segura, and J. M. Andujar present a method converting a fixed-wing UAV’s internal combustion engine into an electric lithium-ion battery-driven remotely piloted aircraft systems (RPASs) [26].

3. Future UAV Technologies

Although the special issue has been closed, more in-depth research in UAV technologies is expected. It can be anticipated that a more advanced level of autonomy, more increased flight time, and faster and more accurate data processing based on AI technology will be demanded the advanced UAV. Although the UAV technologies are in the autonomy level 2 (semi-autonomous) at the moment, the destination of UAV technology development, level 3 (autonomous), will come sooner than we think.

4. Conclusions

Based on the collected papers, we could conclude that UAV control and path planning are the most interested in researchers in modern UAV technology development trends. Following this special issue ended at the end of Dec 2019, we are currently collecting the second special issue regarding the UAV related technology, which will end at the end of Dec 2020.

Author Contributions: Investigation, S.J.; resources, S.J.; writing—original draft preparation, S.J.; writing—review and editing, S.J.; supervision, S.J.; project administration, S.J.; funding acquisition, S.J. The author has read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Research Foundation of Korea (NRF) grant funded by the Kora government (MSIT) (No. 2020R1F1A1074984).

Acknowledgments: This issue would not be possible without the contributions of various talented authors, hardworking and professional reviewers, and a dedicated editorial team of Applied Sciences. Congratulations to all authors—no matter what the final decisions of the submitted manuscripts were, the feedback, comments, and suggestions from the reviewers and editors helped the authors to improve their papers. We would like to take this opportunity to record our sincere gratefulness to all reviewers. Finally, we place on record our gratitude to the editorial team of Applied Sciences, and special thanks to Marin Ma, Section Managing Editor, from MDPI Branch Office.

Conflicts of Interest: The author declares no conflict of interest.
References

1. Shin, D.; Park, K.; Park, M. Effects of Vehicular Communication on Risk Assessment in Automated Driving Vehicles. *Appl. Sci.* **2018**, *8*, 2632. [CrossRef]
2. Lee, J.; Lee, W.; Kim, H.; Kim, H. Adaptive TCP Transmission Adjustment for UAV Network Infrastructure. *Appl. Sci.* **2020**, *10*, 1161. [CrossRef]
3. Sato, S.; Yokoyama, H.; Iida, A. Control of Flow around an Oscillating Plate for Lift Enhancement by Plasma Actuators. *Appl. Sci.* **2019**, *9*, 776. [CrossRef]
4. Huang, T.; Jiang, H.; Zou, Z.; Ye, L.; Song, K. An Integrated Adaptive Kalman Filter for High-Speed UAVs. *Appl. Sci.* **2019**, *9*, 1916. [CrossRef]
5. Yeom, S.; Cho, I. Detection and Tracking of Moving Pedestrians with a Small Unmanned Aerial Vehicle. *Appl. Sci.* **2019**, *9*, 3359. [CrossRef]
6. Nguyen, A.; Xuan-Mung, N.; Hong, S. Quadcopter Adaptive Trajectory Tracking Control: A New Approach via Backstepping Technique. *Appl. Sci.* **2019**, *9*, 3873. [CrossRef]
7. Ma, Z.; Zhu, X.; Zhou, Z.; Zou, X.; Zhao, X. A Lateral-Directional Control Method for High Aspect Ratio Full-Wing UAV and Flight Tests. *Appl. Sci.* **2019**, *9*, 4236. [CrossRef]
8. Chuang, H.; He, D.; Namiki, A. Autonomous Target Tracking of UAV Using High-Speed Visual Feedback. *Appl. Sci.* **2019**, *9*, 4552. [CrossRef]
9. Xuan-Mung, N.; Hong, S. Robust Backstepping Trajectory Tracking Control of a Quadrotor with Input Saturation via Extended State Observer. *Appl. Sci.* **2019**, *9*, 5184. [CrossRef]
10. Zhang, Q.; Chen, X.; Xu, D. Adaptive Neural Fault-Tolerant Control for the Yaw Control of UAV Helicopters with Input Saturation and Full-State Constraints. *Appl. Sci.* **2020**, *10*, 1404. [CrossRef]
11. Wan, Y.; Tang, J.; Lao, S. Research on the Collision Avoidance Algorithm for Fixed-Wing UAVs Based on Maneuver Coordination and Planned Trajectories Prediction. *Appl. Sci.* **2019**, *9*, 798. [CrossRef]
12. Wu, M.; Chen, M. Nonlinear Modeling and Flight Validation of a Small-Scale Compound Helicopter. *Appl. Sci.* **2019**, *9*, 1087. [CrossRef]
13. Yan, F.; Zhu, X.; Zhou, Z.; Chu, J. A Hierarchical Mission Planning Method for Simultaneous Arrival of Multi-UAV Coalition. *Appl. Sci.* **2019**, *9*, 1986. [CrossRef]
14. Xie, S.; Zhang, A.; Bi, W.; Tang, Y. Multi-UAV Mission Allocation under Constraint. *Appl. Sci.* **2019**, *9*, 2184. [CrossRef]
15. Shao, Z.; Yan, F.; Zhou, Z.; Zhu, X. Path Planning for Multi-UAV Formation Rendezvous Based on Distributed Cooperative Particle Swarm Optimization. *Appl. Sci.* **2019**, *9*, 2621. [CrossRef]
16. Jung, S. Development of Path Planning Tool for Unmanned System Considering Energy Consumption. *Appl. Sci.* **2019**, *9*, 3341. [CrossRef]
17. Zhu, M.; Zhang, X.; Luo, H.; Wang, G.; Zhang, B. Optimization Dubins Path of Multiple UAVs for Post-Earthquake Rapid-Assessment. *Appl. Sci.* **2020**, *10*, 1388. [CrossRef]
18. Sun, M.; Ji, X.; Sun, K.; Zhu, M. Flight Strategy Optimization for High-Altitude Solar-Powered Aircraft Based on Gravity Energy Reserving and Full-State Constraints. *Appl. Sci.* **2020**, *10*, 2243. [CrossRef]
19. Chen, B.; Hua, C.; Li, D.; He, Y.; Han, J. Intelligent Human–UAV Interaction System with Joint Cross-Validation over Action—Gesture Recognition and Scene Understanding. *Appl. Sci.* **2019**, *9*, 3277. [CrossRef]
20. Moon, J.; Lee, B. PDDL Planning with Natural Language-Based Scene Understanding for UAV-UGV Cooperation. *Appl. Sci.* **2019**, *9*, 3789. [CrossRef]
21. Yue, W.; Guan, X.; Wang, L. A Novel Searching Method Using Reinforcement Learning Scheme for Multi-UAVs in Unknown Environments. *Appl. Sci.* **2019**, *9*, 4964. [CrossRef]
22. Ahn, H.; Choi, H.; Kang, M.; Moon, S. Learning-Based Anomaly Detection and Monitoring for Swarm Drone Flights. *Appl. Sci.* **2019**, *9*, 5477. [CrossRef]
23. Choi, W.; Jung, S. Launch Performance Degradation of the Rupture-Type Missile Canister. *Appl. Sci.* **2019**, *9*, 1290. [CrossRef]
24. Luo, C.; Zhao, W.; Du, Z.; Yu, L. A Neural Network Based Landing Method for an Unmanned Aerial Vehicle with Soft Landing Gears. *Appl. Sci.* **2019**, *9*, 2976. [CrossRef]
25. Ćwiąkala, P. Testing Procedure of Unmanned Aerial Vehicles (UAVs) Trajectory in Automatic Missions. *Appl. Sci.* **2019**, *9*, 3488. [CrossRef]

26. Isorna Llerena, F.; Fernández Barranco, Á.; Bogeat, J.; Segura, F.; Andújar, J. Converting a Fixed-Wing Internal Combustion Engine RPAS into an Electric Lithium-Ion Battery-Driven RPAS. *Appl. Sci.* **2020**, *10*, 1573. [CrossRef]

**Publisher’s Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

© 2020 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).