Unmanned Aerial Systems and Its Application

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Call for submission. This editorial introduces the first issue of 2018 for *Embedded Selforganising Systems (ESS)* journal. Focus of this issue is discussion about unmanned aerial systems (UAS) and its application in different areas of science and engineering solutions.

Our journal used electronic publication, which provides a flexible way to submit and review contributions of authors from all of countries. The advantages of such an e-journal are multifarious. In comparison to traditional paper journals we replace the classic review and creation process with a new Sliding Issue model. Each issue starts with an initial editorial and an official call for papers. The submitted articles will be reviewed and, if accepted, published as soon as the final version is received by the committee. Based on this process, each sliding issue can be filled successively until the maximum number of article is reached. During this period, all accepted papers can, already be read by other researchers while other papers are still in the reviewing process. Accordingly, the time to publish shrinks to a minimum. In Addition, multiple issues with different focus can co-exist at the same time, which provides completely new possibilities to react on latest research topics. The journal allows also the integration of discussions and other reactions on published articles in the same journal issue.

Finally, we are looking for fresh ideas, on-going research technical reports and novel scientific works. We also intend to create a promising platform for creative and constructive discussions.

Unmanned Aerial Systems and Its Application

Before to talk about UAS, let us review a bit about an unmanned aerial vehicle (UAV). What is the UAV? What is the relation between UAS and UAV?

"…Unmanned Aerial Vehicles (UAVs) have been around for centuries and were solely used for defense purposes. The earliest recorded use of a UAV dates back to 1849…" noted Shea O'Donnell [1]. Until today idea of UAV developed and started to use in various nonmilitary areas, like journalism, filming aerial photography, monitoring, research, shipping, healthcare, structural safety inspections, precision agriculture and just for fun, too.

Nevertheless, people knew more different name of UAV as drone. *"Drones, also known as unmanned aerial vehicles (UAV), are pilotless and non-crewed aircraft that are capable of flight either by remote control or through the use of on-board computers. Other names for these types of aircraft are remotely piloted vehicle (RPV), remotely piloted aircraft (RPA), and remotely operated aircraft (ROA)"* [2]. The drone started to enter to daily life of people as tool for different kind of hobbies, for example making movies, photos from air and doing various type of demos.

"A drone, in a technological context, is an unmanned aircraft. Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASes). Essentially, a drone is a flying robot. The aircrafts may be remotely controlled or can fly autonomously through software-controlled flight plans in their embedded systems working in conjunction with

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onboard sensors and GPS" [3]. For short we can summarize that drone is the smallest version of UAV. From here we can call it as mini or micro aerial vehicle (MAV).

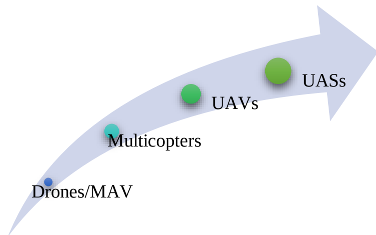

Fig. 1. Level of unmanned aerial systems

Fig.1 shows to us how developed unmanned aerial systems. Later UAS started to use in different solutions of engineering's tasks. One example is project, which is running in Professorship of Computer Engineering of TU Chemnitz. The project called APOLI and main aim of this project is to develop fully automated inspection system for HVTS with UAV [4].

The computer engineering group at Chemnitz University of Technology has been doing research on efficient hardware/software control applications since 2003. Results point out that the design of efficient systems optimizes the computing architecture, with respect to the application. This is especially true for high-performance applications such as autonomous mini aerial vehicles (MAV) missions, whereby the computing architecture must be composed with respect to this kind of application. The challenge is, to design a computation platform that provides sufficient computation power, e.g. for real-time online image processing within the tight restrictions of both power consumption and total weight. For this reason, we developed the adaptive research platform Aeriom. The Aeriom platform defines five separate architecture levels for specific MAV tasks, especially three control levels for the handling the rotors, the fight parameters and the navigation functions are distinguished. Additional architecture levels are introduced for safety supervision and the flight mission. Sensors and gimbal can be connected by standard interfaces.

In addition, previous discussed standard functions are implemented on the named control layers. The newly introduced flight mission layer offers computation resources for adaptable flight missions. Based on adaptability, autonomous missions for applications of limited complexity are implemented successfully. In this respect, applications in view are object inspections with optical and thermal cameras, industrial inspections, such as power lines and high voltage isolators. Also, railway inspections, control of huge aerials such as marshalling yards and private house security tasks can be implemented with Adaptive MAV technology. Such applications find an exponentially growing market in urban regions, if autonomous mission execution can be provided. Based on our Aeriom platform, the concept of adaptive MAV mission has been developed and provides:

- Flexibility: Adaptive MAV are not bound in their movements to a predefined infrastructure, such as streets or railways. Thus, MAV can be utilized independently of the costly infrastructure of urban environments. This reduces mission costs enormously.
- Agility: MAV are highly agile vehicles with the ability to operate within a small area. MAV flight control and navigations control ensure agility, within an accuracy of just a few centimeters. Vertical take-off and land, turn-on-the-spot, fly-over and fly-under hindrances are examples of the agile abilities of MAVs. In urban environments, small area scenarios are typical and with adaptive MAVs and such locations can be both accessed and inspected.
- Adaptivity: The ability to operate within a small area is imperative for professional MAV applications in urban environments today. Adaptive methods offer the necessary functions. In our research, we develop such adaptive methods.

This new approach of adaptable MAV boosts the application of this technology in urban environments and opens new markets rapidly growing.

This motivates researcher of different disciplines to focus their research on MAV technology and applications. Actual research and industrial applications are of high interest and we invite submissions from this area. In this way, this ESS issue will present recent research on MAV technology and applications.
Your contribution should cover topics of our main issues. Moreover each contribution should include clear parts about:

- State of the art of your field
- Methods or concepts of your idea
- Validation and implementation
- Need of application
- Outdoor and indoor experiments
- Future work

We are expecting your valuable contribution to our UAS issue! Looking forward to read your submissions.

Thanks in advance!

References

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