ASITA 2022

Drone Fleet Management for Emergency Response

Marianna Di Gregorio[1]

[1] University of Salerno, madigregorio@unisa.it

Abstract. Emergency response requires extensive knowledge of the crisis area and up-to-date information on structures, road access, victims location, and new threats. Collecting and sharing this information is challenging, especially in a hostile environment where there is often no reliable network infrastructure. A fleet of drones can then become a valuable tool to survey a critical area and transmit relevant information to the ground control station. The aim of our research is to create a system that can enhance emergency responders' activity providing an adequate level of situation awareness.

Unmanned Aerial Systems (UAS), commonly known as drones, are being employed in more and more civilian settings, from crowds monitoring activities, to road traffic control, to agricultural crop monitoring. As a single powerful UAS equipped with a large array of different sensors is limited to a single point of view, in the last years, the multi-UAS paradigm seems to be a more suitable approach for many applications, One of the emerging areas of the civilian use of UAS is public safety and services [1, 2]. In this work, we consider the application of UAS for emergency response after disasters such as fires, floods, or earthquakes. Drone technology is not ready to completely replace human emergency response systems yet, but it can be integrated with existing systems to perform operations faster, more efficiently, at a lower cost, and in many cases in safer way than traditional methods. Using drones for emergency and rescue operations can be very useful as drones can autonomously perform operations such as damage investigation, locating missing persons, reaching remote areas inaccessible through land and water, and even delivering emergency supplies.

The research we are conducting in the area of remote piloting of unmanned autonomous systems especially focuses on the added complexity derived from the control of multiple UAS by a single ground operator. Poorly designed user interfaces are recognized as a major cause for ground operators' errors and the domain of emergency management makes no exception [3]. From the analysis of human factors affecting remote piloting operations, the need has emerged to design innovative user interfaces, also encompassing new levels of automation, which could result in more dependable systems able to reduce the negative impact of erroneous human behaviors on the success of an emergency response actions.

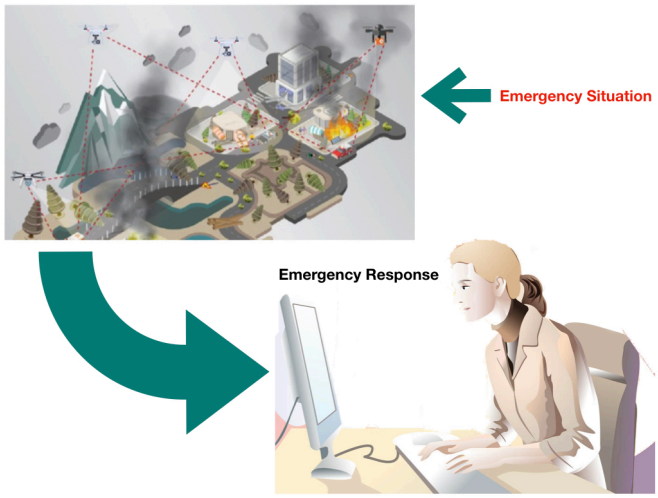

Fig. 1. Drone fleet management in the control room.

Adopting a User Centered Design methodology, we have developed a multi-UAS user interface, able to make the human-aircraft communication safe as well as functional to the objectives of the disaster data collection mission. In order to address the problem of one ground operator controlling multiple drones, our major concerns were:

- Correct degree of autonomy in the fleet of UAS,
- Ability to exploit cartographic information and data from Multi-UAS,
- Situational awareness properly supported by the Multi-UAS control interface.

References

1. Luongo S., Di Gregorio M., Vitiello G., Vozella A. (2019) Human Machine Interface Issues for Drone Fleet Management. In: Ahram T., Karwowski W., Taiar R. (eds) Human Systems Engineering and Design. IHSED 2018. Advances in Intelligent Systems and Computing, vol 876. Springer, Cham.
2. Mohammed F., Idries A., Mohamed N., Al-Jaroodi J., and Jawhar I. (2014). UAVs for smart cities: Opportunities and challenges. Unmanned Aircraft Systems (ICUAS), IEEE International Conference on. pp. 267–273.
3. Williams K.W. (2004) A summary of Unmanned Aircraft Accident/Incident Data: Human Factors Implications, Civil Aerospace Medical Institute, Federal Aviation Administration, Oklahoma City, OK 73125.