Contribution for AT-Rasc 2015 (session:S-F2)

Aerial Drones Fleet for Rescue Operations

Daniel Câmara

Institut Mines-Telecom - Telecom ParisTech. LTCI UMR 5141 CNRS
Sophia Antipolis, Alpes Maritimes, France; daniel.camara@telecom-paristech.fr

This paper discusses the possibilities and methods required to provide a fully autonomous drone flying fleet to help on rescue operations. In particular, we focus on the use cases of such fleet and the minimum requirements so that the drones can be effectively useful over disaster scenarios.

Disaster scenarios are, in general, chaotic places, mainly for the first arrivals. The access may be hard and the resources for the rescue operation teams relatively limited. The first hours after a disaster are the ones where we have the biggest probability to find people alive, but, unfortunately, are also the more turbulent ones. Communication capabilities in the target region may be lost, the very map of the region may be outdates, the access to areas may have been compromised, e.g. debriefs, flooded roads, collapsed buildings. This combination of factors, plus the scarcity of human resources, the feeling of urgency in finding/contacting affected people demands an efficient and organized set of measures. Some of these, typically, require specialized rescue professionals, but automated drones could perform others. This would free the rescuers from their burden, and let them focus on the tasks their attention are fundamental.

The tasks drones can excel performing are, normally, non-intrusive ones, and can go from, for example, providing network access over the affected area and automatically mapping the changes on the region topography to the detection of victims using a series of distinct sensors. Drones should be as autonomous and independent as possible so that they are operational without draining the scarce human resources. By autonomous we mean that drones should have their own missions to be perform and they do each mission, or set of missions, without any human interference. Ideally, they would receive their mission, or set of missions and their priorities, from the command operation center, work on each one until and demand a new set of missions when they are over. Even recharging mechanisms should put in place so that the recharge of the drones are performed without human interference. This is an important point because, independently from the powering model used, e.g. electric or internal combustion engines. The available energy is always limited and, at some point, it will end. Moreover, drones may continuously work on their missions 24/24, fulfilling mission after mission. Human operators, on the other hand, cannot, so it is reasonable to assume automatic mechanisms to optimize drones availability.

On the paper we will discuss the scenarios where the drones can be useful the most such as: providing a temporary communication structure, creating up-to-date maps of the affected region and searching for hot spots where the rescue teams may have more chances of finding victims. We will provide the requirements drones should satisfy to be able to fully address these, and other, missions. Among the topics we will approach For example, we will discuss we can highlight, first, an overview of the radio properties for air-to-ground communications and air-to-air communication between drones, over different disaster scenarios, and a study over the expected altitude for different types of missions. Second, the needs in terms of topology management/control so that the nodes perform their missions the best way possible in a cooperative and efficient way. Third, the set of sensors required and their target application, for example, infrared cameras, deep penetration radars, or multiband radios to detect the radio signal from portable devices. Finally, the different drones, how adapted they are to the different types of missions and available sensors.