Drones for Civil Defense: A Case Study in the City of Niterói

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Abstract: Nowadays, *drones* or *Unmanned Aerial Vehicles* (UAVs) are employed for several purposes such as deliver-
ing products, spreading pesticides on crops, providing internet access to remote areas, and taking videos and
photos for entertainment. In the context of smart cities it is not different. Some cities have adopted drones for
a number of important tasks, such as surveillance, traffic monitoring, and disaster management. Indeed, their
ability of reaching difficult places and the possibility of carrying different sensors and actuators make those
devices very flexible tools that can adapt to several use cases. Nevertheless, there are still obstacles — techni-
cal, regulatory or even social — that can hinder the applicability of drones to certain tasks. In this work, we
report and analyze the use of drones by the Civil Defense Office of the city of Niterói, Brazil, as a case study.
In recent years, the office has been increasingly adopting drones for automatizing or simplifying a number
of processes with varying degrees of success, and intend to adopt information and knowledge management
systems to support and optimize their use. We present a list of the current drone-aided tasks performed by
the office, as well some potential applications that are not yet feasible for one reason or another. We further
analyze those obstacles and discuss what can be done to address them.

1   INTRODUCTION

Popularly known as *drones*, Unmanned Aerial Vehi-
cles (UAVs) are flying devices that can be used for
a variety of purposes due to their mobility and abil-
ity to collect data from a region of flight. Either au-
tonomously or controlled by a pilot, drones can carry
out remote missions replacing the human presence,
which can either enable activities that were otherwise
impossible — *e.g.*, due to the impossibility of reach-
ing a certain region of interest — or, at least, mini-
mize risks and accelerate the delivery of services and
goods. For a few examples, drones have been used
for monitoring volcanic environments (de Moor et al.,
2019) and, famously, by the Amazon prime air ser-
vice (Shavarani et al., 2018).

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Those two examples help illustrate the wide range
of activities that can be enabled or aided by the use
of drones. This flexibility can be explained by three
particular characteristics of these devices: their abil-
ity to fly — thus allowing highly efficient and effec-
tive mobility —, as well as their capacity of carry-
ing different types of loads and their intrinsic com-
munication functionalities. More specifically, drones
can carry both sensors and actuators which can be
accessed remotely using the drone's communication
channel with the ground station. While recreational
drones often carry cameras for video or photogra-
phy, other types of payload can be added, such as
smoke detectors, temperature sensors, speakers, or
headlights. Therefore, armed with the right payload,
drones can be adapted to countless activities. This
has popularized their usage in several different fields,
including agriculture, entertainment, industry, mili-
tary, surveillance, maritime rescue and security in-