Chapter 39
Drones in Healthcare:
An Extended Discussion on Humanitarian Logistics

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ABSTRACT

This chapter discusses the use of drones in healthcare with a specific focus on humanitarian logistics. Drones have already been used in healthcare in different aspects, including transfer of blood products, search and rescue missions, or collecting different types of data including aerial photographs, air quality, or radiation levels. Even though the published research evidence in the area of "drones in healthcare" is almost 1% of the broader area of "drones," the progress in public acceptance, regulations, as well as technology is undeniable. This chapter summarizes the different aspects regarding the use of drones in healthcare, while specifically focusing on humanitarian logistics. The SWOT analysis indicate that the strengths and opportunities weigh more than the weaknesses and threats, suggesting that drones will revolutionize the way medical supplies are delivered within the coming years.

INTRODUCTION

Airspace ownership is a topic under spotlights for centuries, from the Roman times in 27BC to the present day. Each technological progress leads to a regulation structuring how that technology should be used. It is not surprising to see that after the first aircraft, which was a hot-air balloon leaving the ground in 1783, the relevant regulations followed it in 1784 (Engvers, 2001). In today's context, the debate is much more heated as the airspace could be commercialised to an extent that have never endured before, thanks to the prospects provided by the adoption of drones. Therefore, it is not surprising to hear a senior engineer from NASA stating that "we need to accommodate drones" in air traffic control systems (Schneider, 2017) or see global challenges funded by Bill & Melinda Gates Foundation to support the distribution of vaccines by low cost drones (Global Grand Challenges, 2012).

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Some researchers differentiate the words “remotely piloted vehicle”, “drone” or Unmanned Aerial Systems (UAS) (Rosser, Vignesh, Terwilliger, & Parker, 2018). However, this chapter does not make a distinction between them. The definition relied on throughout the chapter is: a system composed of an air vehicle and a mission planning/control station, in which the air vehicle could potentially carry a load for Beyond Visual Line Of Sight (BVLOS) distances and could be operated at different levels of automation (Fahlstrom & Gleason, 2012, p. 8).

The research and development activities surrounding this topic is wide and its implications are substantial. The renowned TIME magazine had a special issue entitled “The Drone Age”, which was printed on the issue of June 11, 2018. A total of 958 drones created the logo of the magazine as well as the red border in mid-air. The cover image depicting this spectacular event was also shot with a drone (TIME, 2018).

The word “drone”, which was coined due to the similarity of its sound to a male bee, has initially been associated with a military unit, thus took a negative connotation (M. Benjamin & Ehrenreich, 2013; Rosser et al., 2018). However, there is a growing number of research on small, human-friendly highly automated drones that fly in confined spaces and in close proximity to people. The emergence of drones in public use is facilitated by their miniaturisation and reduced costs. Consequently, the prototyping and commercialization of civilian drones had already happened and many different drones could be bought online.

Drones can be classified in different ways, such as their landing and take-off type (horizontal or vertical), weight (small, medium, large), propulsion (electric or internal), flight time and their specialization such as surveillance or package delivery (Fahlstrom & Gleason, 2012; Rosser et al., 2018). A thorough comparison of 30 different UAS based on their manufacturer, type (rotor or fixed wing), size, weight, flight time and cost is provided in Kim and Davidson (2015).

The integration of drones in a civilian context would add value to economy not only in terms of research and development but also in job creation. The economic impact of this endeavour is estimated to be $13.6 billion in its first three years of integration and will grow to $82 billion in the next 10 years. As a result, more than 70,000 new jobs will be created in the first three years of integration (Jenkins & Vasigh, 2013). Another article proposes a different projection, where size of the market will reach to $82.1 billion by 2025, and generating more than 103,000 jobs (Rosser et al., 2018). These values suggest an expected and natural outcome since drones can perform many different tasks ranging from logistics to crop monitoring to infrastructure surveillance, most of which can be highly automatised.

Logistics would probably be the key sector in which the utilisation of drones would revolutionise our lives (Anbaroğlu, 2017; Barmpounakis, Vlahogianni, & Golias, 2016). The advantages of using drones to transport packages include reduced congestion in urban areas, rapid transport of packages where road infrastructure is poorly developed or access to remote areas in a safe way. Researchers proposed heuristic algorithms to handle the operational challenges such as optimal routing and scheduling of drones and delivery trucks by minimizing the delivery time (Murray & Chu, 2015).

The nature of the spatial data generated by a drone is referred to as a ‘trajectory’, which contains the position and timestamp of the drone at specific time intervals. Therefore, a trajectory would constitute of a series of four-dimensional points (latitude, longitude, elevation and time), which necessitates the use of Geographical Information Systems (GIS) to store, query and visualise the data. Especially, legal bodies need to store such data for long times in case of an enquiry.

The growing number of resources regarding do-it-yourself drones adds further support to the vision of ‘drone deliveries’ (Lim, Park, Lee, & Kim, 2012). Combined with societal efforts, such as AirShare

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