Unmanned Aerial Vehicle Configurations in Crisis Management

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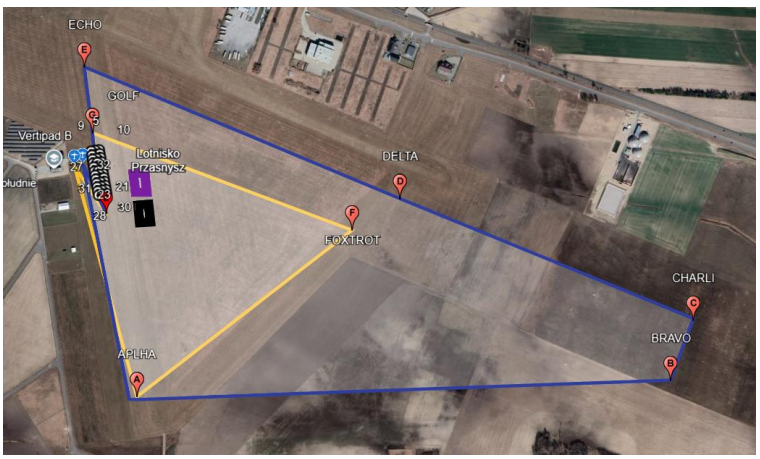
Abstract:

Unmanned Aerial Vehicles (UAVs) are increasingly employed across a wide range of sectors and have emerged as crucial tools for public services during crisis management operations, particularly in response to natural disasters, major technological failures, or ecological catastrophes. Their ability to operate in hazardous environments makes them indispensable in scenarios where human intervention is either limited or poses significant risk. The versatility of UAV technology is vast, yet the optimal choice of UAV design for specific applications remains a critical factor. Not all types of UAVs are equally suited for every mission, and as with manned aviation, the characteristics of different UAV configurations – such as multirotors and fixed-wing aircraft – offer distinct advantages and drawbacks depending on operational requirements.

This paper conducts a comparative analysis of the utility and performance of these two primary UAV types – multirotors and fixed-wing drones – focusing on their application in a simulated ecological disaster scenario. Specifically, the study examines the efficacy of using UAVs to construct a buffer zone around an area affected by chemical contamination. The comparative evaluation is based on data gathered from the Droniada ObLot training and research project, a technologically focused competition involving student teams from various technical universities in Poland. In this competition, teams were tasked with deploying UAVs to establish an illuminated boundary using beacons dropped from the air. These UAV systems, incorporating innovative design and technical solutions, were assessed by a panel of engineers and experts from the Łukasiewicz Research Network – Institute of Aviation. The assessment criteria included the precision of beacon placement, time required to complete the mission, operational reliability, and overall effectiveness in achieving the mission objectives.



The results of this analysis highlight key design characteristics that are particularly beneficial for this type of crisis response operation, while also identifying the specific limitations inherent to both multirotor and fixed-wing UAVs. The insights gained from this study are intended to provide valuable guidance for the UAV industry and emergency response services, aiding in the selection of the most suitable, reliable, and versatile UAV systems for use in challenging and potentially hazardous operational environments.