Multi UAV System for Wide Area Object Identification

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The purpose of this investigation is to design, build, and test a multi unmanned aerial vehicle (UAV) system for wide area object identification. Wide area object identification has applications in a large number of tasks, such as search and rescue missions, which are often time-intensive and dangerous for those involved. In this system, multiple custom-built UAVs communicate with a Mission Control Server (MCS). Each UAV is an autonomous quadcopter drone with a camera and an image-processing computer. These drones used computer vision and an AI model trained on application-specific data to process the image feed from the camera to perform object detection. The MCS allows the operator to select a search area and then computes the area each UAV is responsible for searching. The MCS coordinates them all while monitoring their position and any targets found. Then, each drone creates its own optimized flight path from the coordinate points received from the MCS while also considering its flight altitude in conjunction with the camera's field of view. After validation, a statistical measurement of accuracy known as the F1 score was calculated for both the stock YOLO model and the VisDrone-trained model, and it was determined that the model trained on the VisDrone dataset was more accurate than the stock model; the custom-trained model achieved an F1 score of 0.96, while the stock model achieved an F1 score of 0.87. When tested with multiple drones, the system saw a 57.87% increase in the search area covered per second while achieving a perfect F1 score of 1.00, meaning no detections were missed or incorrect. Moreover, with its object detection capabilities, this technology may be used for other tasks, such as wildlife identification and other forms of environment mapping.

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