

# An energy-efficient object detection system for UAVs based on edge computing

September 1 2023, by Ingrid Fadelli

---



The flight path of UAVs at varying altitudes is depicted by the red line, while the uniform square segments represent the detection zones as captured by the camera at higher altitude (left) and lower altitude (right). An increased altitude corresponds to an expanded field of view, consequently leading to a reduced detection path length. Credit: Suo et al.

Unmanned aerial vehicles (UAVs), commonly known as drones, are already used in countless settings to tackle real-world problems. These flying robotic systems can, among other things, help to monitor natural environments, detect fires or other environmental hazards, monitor cities

and find survivors of natural disasters.

To tackle all of these missions effectively, UAVs should be able to reliably detect targets and objects of interest in their surroundings. Computer scientists have thus been trying to devise new computational techniques that could enable these capabilities, using deep learning or other approaches.

Researchers at Yunnan University and the Chinese Academy of Sciences recently introduced a new object-detection system based on edge computing. Their proposed system, introduced in the *IEEE Internet of Things Journal*, could provide UAVs with the ability to spot relevant objects and targets in their surroundings without significantly increasing their power-consumption.

"While most existing research studies only focus on a subset of the challenges inherent to UAV-based object detection, there are few studies that balance various aspects to design a practical system for [energy consumption](#) reduction," Jiashun Suo, Xingzhou Zhang, Weisong Shi and Wei Zhou wrote in their paper.

"We present the E3-UAV, an edge-based energy-efficient object detection system for UAVs. The system is designed to dynamically support various UAV devices, edge devices, and detection algorithms, with the aim of minimizing energy consumption by deciding the most energy-efficient flight parameters (including flight altitude, flight speed, detection algorithm, and sampling rate) required to fulfill the detection requirements of the task."

The object detection system devised by this team of researchers, dubbed E<sup>3</sup>-UAV, is based on an increasingly popular approach known as edge computing. Edge computing leverages multiple networks or nearby devices to perform computations faster and consuming less energy. In

the case of the team's system, these networks are leveraged to determine parameters (i.e., the UAVs altitude, speed of flight, etc.) that would enable the system to detect objects in the surroundings while consuming the least possible amount of energy.

"We first present an effective evaluation metric for actual tasks and construct a transparent energy consumption model based on hundreds of actual flight data to formalize the relationship between energy consumption and flight parameters," Suo, Zhang and his colleagues wrote in their paper. "Then we present a lightweight energy-efficient priority decision algorithm based on a large quantity of actual flight data to assist the system in deciding flight parameters."

Suo, Zhang and their colleagues trained and evaluated their system in a series of simulations ran on an NVIDIA GPU. They specifically applied it to the Mavic Air 2, a drone created by DJI and often used to take aerial shots and videos.

"We evaluate the performance of the system, and our experimental results demonstrate that it can significantly decrease energy consumption in real-world scenarios," Suo, Zhang and his colleagues wrote.

"Additionally, we provide four insights that can assist researchers and engineers in their efforts to study UAV-based object detection further."

In the future, E<sup>3</sup>-UAV could be implemented and tested on other UAVs, to further assess its potential and generalizability. In addition, this work could inform the development of similar object detection techniques based on edge computing for robotics applications.

**More information:** J. Suo et al, E3-UAV: An Edge-Based Energy-Efficient Object Detection System for Unmanned Aerial Vehicles. *IEEE Internet of Things Journal*(2023). [DOI: 10.1109/JIOT.2023.3301623](https://doi.org/10.1109/JIOT.2023.3301623).

© 2023 Science X Network

Citation: An energy-efficient object detection system for UAVs based on edge computing (2023, September 1) retrieved 6 May 2024 from <https://techxplore.com/news/2023-08-energy-efficient-uavs-based-edge.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.