OPTICAL METHODS FOR DETECTING EXPLOSIVE OBJECTS USING AUTONOMOUS UNMANNED SYSTEMS

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Optical methods for detecting explosive materials in unmanned aerial vehicles (UAVs) have significant potential to enhance safety during various operations, including military missions, humanitarian demining, and search and rescue operations. With advancements in computer vision and deep learning technologies, optical systems have become crucial components of autonomous solutions, offering high accuracy and real-time threat detection [1].

Modern optical methods rely on the use of various types of cameras, such as RGB cameras, infrared (IR) cameras, and multispectral cameras. RGB cameras analyze the shape, texture, and color of objects in the visible spectrum [2]. IR cameras, on the other hand, detect objects based on thermal radiation, making them particularly effective in low-light conditions or for identifying hidden objects. Multispectral cameras allow for the analysis of the spectral properties of materials, significantly improving the accuracy of explosive material identification [3].

Deep learning, especially the use of convolutional neural networks (CNNs), plays a key role in these detection systems. Trained on large datasets, these networks can accurately classify objects based on their visual characteristics. One of the most effective architectures for real-time object identification is YOLO (You Only Look Once), which simultaneously determines the location and type of objects in an image, offering high-speed data processing-critical for use in autonomous systems.

In conclusion, optical methods for detecting explosive materials show great promise for improving the efficiency of autonomous UAV systems. Future research should focus on combining these methods with other sensor technologies to increase adaptability to diverse environmental conditions.

References

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