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MULTISPECTRAL LIDAR SYSTEMS AND THEIR APPLICATIONS

Mashevskyi Igor, Myronchuk Galyna, Migalska-Zalas Anna

Lesya Ukrainka Volyn National University, Ukraine; Jan Dlugosz University in Czestochowa, Poland
igor.mashevskyi@vnu.edu.ua

The abstract highlights the principles of multispectral LiDAR (MSL) system design, implementation strategies for data collection and processing, and major avenues for real-world deployment. MSL systems incorporate laser emitters operating at different wavelengths, scanning and receiving optical components, photodetectors, and satellite positioning modules (GPS/IMU), enabling the capture of spatial and spectral data simultaneously with high precision. One of the core strengths of MSL is its capability to measure distances and record reflected signal intensity across several wavelengths, enhancing material differentiation and classification.

Techniques such as the application of supercontinuum lasers and frequency doubling are discussed for spectral range expansion. MSL configurations can rely on multiple discrete laser sources or broadband laser systems combined with wavelength-selective optics. Key data processing methods include radiometric calibration, atmospheric compensation, and artificial intelligence approaches for analysis, segmentation, classification, and visual interpretation of 3D spectral point clouds.

Application domains include precision agriculture (crop health and stress analysis), environmental and ecological monitoring, forestry inventory (canopy and biomass analysis), high-resolution topographic mapping, infrastructure diagnostics in urban planning, geological exploration (mineral composition and structural integrity), and archaeological site discovery. Recent market analyses reflect an increasing demand for MSL-based technologies and their integration within sensor fusion platforms.

It is concluded that MSL represents a next-generation remote sensing solution for accurate, large-scale, and non-destructive environmental assessment and monitoring, supporting innovation across research and industry.

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