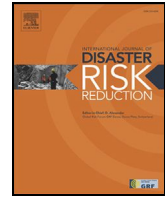




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Unmanned aerial systems in search and rescue: A global perspective on current challenges and future applications

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ABSTRACT

Unmanned Aerial Systems (UAS), commonly known as drones, have become essential assets in Search and Rescue (SAR) operations due to their versatility, rapid deployment, and high mobility. This study reviews drones' current and emerging uses in SAR, with a focus on advancements in sensor integration, payload capacity, and multi-UAV coordination. It further explores how Artificial Intelligence (AI) can enhance operational efficiency. A comprehensive review methodology is employed to analyze recent progress in drone technology, AI, and digital twin simulations aimed at optimizing SAR missions. The review highlights the current capabilities, strengths, and limitations of existing systems while identifying potential innovations to address persistent challenges. Drones are now effectively deployed to survey vast areas, locate survivors, and assess hazards. Coordinated multi-drone systems have the potential to expand coverage, enhance efficiency, deliver essential supplies, and establish temporary communication networks in inaccessible regions. Future advancements in AI and autonomy will enable drones to perform complex tasks with minimal human intervention. Enhanced sensor technologies will improve detection capabilities, including infrared imaging, radar, and biometric monitoring. However, challenges such as regulatory restrictions, limited battery life, and payload constraints persist. Addressing these challenges will require ongoing research and technological breakthroughs. This study underscores the transformative potential of evolving drone technologies in SAR operations, paving the way for faster, more efficient responses, ultimately saving lives through improved real-time decision-making and operational capabilities.

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