

Collab-SAR: A collaborative avalanche search-and-rescue missions exploiting hostile alpine networks

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ABSTRACT

Every year, Alpine experiences a considerable number of avalanches causing danger to visitor and saviors, where most of the existing techniques to mitigate the number of fatalities in such hostile environments are based on a non-collaborative approach and is time- and effort-inefficient. A recently completed European project on Smart collaboration between Humans and ground-aerial Robots for imProving rescuing activities in Alpine environments (SHERPA) has proposed a novel collaborative approach to improve the rescuing activities. To be an integral part of the SHERPA framework, this paper considers deployment of an air-ground collaborative wireless network (AGCWN) to support search and rescue (SAR) missions in hostile alpine environments. We propose a network infrastructure for such challenging environments by considering the available network components, hostility of the environments, scenarios, and requirements. The proposed infrastructure also considers two degrees of quality of service, in terms of high throughput and long coverage range, to enable timely delivery of videos and images of the long patrolled area, which is the key in any searching and rescuing mission. We also incorporate a probabilistic search technique, which is suitable for collaborative search assuming AGCWN infrastructure for sharing information. The effectiveness of the proposed infrastructure and collaborative search technique, referred to as Collab-SAR, is demonstrated via a series of computer simulations. The results confirm the effectiveness of the proposal.

KEYWORDS:

Air-ground collaborative wireless network; alpine scenario; sunmanned aerial robots; unmanned ground vehicles; WiMAX; α -level probabilistic search technique