INACHUS: INTEGRATED WIDE AREA SITUATION AWARENESS AND SURVIVOR LOCALIZATION IN SEARCH AND RESCUE OPERATIONS

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Abstract

Emergencies and crises are an inevitable fact of modern life, with extreme weather events, fires, hazmat spills, and traffic accidents happening often and in every jurisdiction. The potential consequences are indisputable: serious injury and/or death to the public and to responding personnel, damage to public and private property, and the risk of long-term financial repercussions, among others. Under the resulting chaotic and difficult working conditions, Urban Search and Rescue (USaR) crews must make quick decisions under stress to determine the location of trapped victims as quickly and as accurately as possible. The EU FP7 project INACHUS presents a holistic approach in providing a system that aims at achieving significant time reduction related to the USaR phase by advancing wide-area situation awareness solutions for improved detection and localization of trapped victims, assisted by simulation tools for predicting structural failures and a decision support mechanism incorporating operational procedures and resources of relevant actors. In the proposed approach, structural damage analysis is performed based on input coming from 3-D airborne and ground-based laser-scanning images and their subsequent analysis through advanced photogrammetric and computer vision techniques and Structural Health Monitoring (SHM) sensors pre-installed inside the buildings. Furthermore, INACHUS involves new types of sensors and technologies for detecting and localizing trapped survivors in disaster situations (among others bio-chemical sensors, ground-based seismic sensors, infrared sensors, real-time locating systems, radars, etc.). Several miniaturized sensors are integrated into a snake robotic system capable of penetrating into rubble and providing useful information in order to locate possible trapped survivors. Robust snake robot design together with a novel control system enable operator-controlled robot operations in complex environments. This paper presents the general concept of the INACHUS solution together with the preliminary evaluation results of the applied techniques, evincing that the proposed system could significantly contribute in successfully addressing the societal demand to increase survival rates in the aftermath of natural or man-made disasters by tackling a plethora of practical operational challenges, including increased effectiveness of USaR operations with the same number of human resources and enhanced situational awareness.