

Victims search, identification, and evacuation with heterogeneous robot networks for search and rescue

Publisher: IEEE

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Abstract:

This paper presents a control strategy for multiple heterogeneous robots oriented to the assistance in situations of search and rescue from two complementary perspectives, the real time control and the discrete task allocation. The real time control laws are in charge of the correct execution of the tasks assigned by the reallocation algorithm respecting constraints in the connectivity range, the collision avoiding and the full completion of each task. The considered tasks are exploration of the mission environment, search and identification of victims, delivery of medical supplies to victims unable to move and evacuation of victims capable to move. During the development of each task, the robots take routes optimized considering distance metrics based on the breath-first search algorithm and an exploration algorithm for non-convex environments. In order to assign the tasks to the robots thorough the mission, we present an optimized task reallocation algorithm focused on the minimization of the time required to attend all the victims in the mission environment. This algorithm allows to assign each of the robots to an appropriate task considering that the robots may differ in the capability of completing each task as well as in their moving capabilities. This complete framework allows a team of autonomous robots to bring a valuable assistance in a search and rescue situation and its behavior is presented in a non-trivial simulation scenario.

Published in: 2017 IEEE 3rd Colombian Conference on Automatic Control (CCAC)

Date of Conference: 18-20 October 2017

DOI: 10.1109/CCAC.2017.8276486

Date Added to IEEE Xplore: 01 February 2018

Publisher: IEEE

► ISBN Information:

Conference Location: Cartagena, Colombia

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I. Introduction

The worst natural disasters and terrorist attacks of mankind history have motivated multiple researchers around the world to study the rescue robotics area, for example in [3] it is presented how robotics can impact on some events such as the attacks of the World Trade Center. Unfortunately, most of those disaster situations cannot be detected on time, causing populations to be unable to evict the area, to be unable to be ready for this kind of situations and to have problems avoiding a large number of human and animal casualties. When a disaster occurs, it is really important to have a solid contingency procedure as explained in the work presented in [2] which shows how the first hours and initial days are the most important in the rescue of survivors. Taking this into account the use of networked heterogeneous robots to collaborate the rescuers in a disaster area can improve the chance of survive for the people trapped in it. Also the area can be explored faster with the assistance of the robots giving precious time to the paramedics to attend the victims. The use of the robots can reduce the number of victims in the situation since more lives will not be risked when searching due to the area can still be dangerous, so we can lain over them to perform this tasks while the human resources are focused in the paramedical attention and the evacuation of people in difficult medical conditions.

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