

Minitrack: Collaborative Robots (Cobots) for Emergency Situations

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Abstract

This minitrack is dedicated to the employment of collaborative robots (cobots) in emergency situations. Cobots are robots that are built for direct human-robot collaboration (HRC) in a shared environment. It focuses on the idea that collaboration between people and robots must go much farther – rather than viewing robots as tools or mobile sensors, they must be viewed as team members especially in predictable environments such as production lines, towards disaster zones, and in emergency circumstances. In the aftermath of earthquakes, accidents, avalanches, or explosions, cobots can work with human counterparts to reduce the risk to human life and increase the possibility of rescuing people.

Keywords: Cobots, Search and Rescue Operation, Human Robot Collaboration, Grasping, Disaster Scenarios

1. Introduction

Welcome to the Minitrack on Collaborative Robots (Cobots) for Emergency Situations at the Hawaii International Conference on System Sciences (HICSS), which is a part of the Collaboration Systems and Technologies track. In order to save lives and lessen the effects of disasters, this minitrack explores the crucial intersection of human-robot collaboration (HRC) in emergency scenarios. A particular emphasis is placed on the use of collaborative robots, or cobots, in these situations.

Cobots have the potential to revolutionise emergency response efforts since they can work side by side with people in open spaces. These robots are envisioned as invaluable team members rather than as merely

tools or sensors, especially in predictable environments like production lines, disaster areas, and emergency situations like earthquakes, accidents, avalanches, or explosions. In these situations, cobots can greatly lower the hazards to human life while increasing the likelihood of saving those who are in need.

The core themes of interest within this minitrack encompass a wide array of topics, including but not limited to:

- Search and Rescue (SAR) collaborative robots (cobots): Exploring the capabilities of cobots in locating and rescuing individuals in distress.
- Human-robot cooperation (HRC) in emergency scenarios: Investigating the dynamics of collaboration between humans and cobots during high-stress situations.
- Haptics for emergency scenarios: Examining the role of haptic feedback in enhancing human-cobot interactions in emergency contexts.
- Robot control algorithms for emergency scenarios: Developing efficient control algorithms that enable cobots to navigate and operate effectively in emergency environments.
- Robotic sensors and actuators for emergency scenarios: Advancing sensor and actuator technologies that equip cobots with the sensory perception required for successful emergency response.
- Ethical issues for human-robot cooperation (HRC) in emergency scenarios: Addressing the ethical dilemmas and considerations associated with deploying cobots in situations involving human lives.

- Machine Learning (ML) and Artificial Intelligence (AI) for robotics in emergency scenarios: Harnessing the power of ML and AI to improve the decision-making and adaptability of cobots during emergencies.
- Robotic simulation for emergency scenarios: Utilising simulations to test and refine cobot performance in various emergency scenarios.
- Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), Extended Reality (ER) for robotics in emergency scenarios: Exploring immersive technologies that can enhance the training and operational capabilities of cobots in emergency response.

Through this minitrack, we hope to promote dialogue, exchange cutting-edge research, and create collaboration among academics, professionals, and decision-makers engaged in robotics and emergency response. We anticipate a lively and insightful conversation on these important issues.

2. Papers in the minitrack

In this minitrack, we are thrilled to present the following paper.

Paper Presentation: Collaborative Robots (Cobots) for Emergency Situations: a Snake Robot as a Team Member for Delivering First Aid in Emergency Situation

Authors: Syed Kumayl Raza Moosavi, Filippo Sanfilippo, and Muhammad Hamza Zafa

Abstract: Cobots are robots that are built for human-robot collaboration (HRC) in a shared environment. In the aftermath of disasters, cobots can work with humans to reduce risk and increase the possibility of rescuing people. In this work, the collaboration between a snake robot, first responders and people to be rescued is considered. The possibility of delivering first aid to a victim is implemented. The snake robot receives (from first responders or another robot) the site planimetry, the location of the person to be rescued, and an aiding good to be delivered. The snake robot plans the path to reach the victim. By using its prehensile capabilities, the snake robot grasps the aiding object to be dispatched. Consequently, the snake robot reaches the delivering location and releases the item. To demonstrate the potential of the framework, several case studies are outlined concerning the execution of operations that combine locomotion and grasping.

Key Contributions: The key contributions of this paper include:

- Integration of Snake Robot into Emergency Response: The paper demonstrates the seamless integration of a snake robot into the emergency response workflow, highlighting its potential as a valuable team member.
- Efficient Navigation and Locomotion: The snake robot's ability to plan paths and navigate challenging environments is showcased, emphasising its adaptability in dynamic emergency scenarios.
- Prehensile Capabilities: The paper explores the snake robot's prehensile capabilities, enabling it to grasp and manipulate aid items with precision.
- Case Studies: Realistic scenarios are provided to demonstrate how the framework can be used in real-life situations including both locomotion and grasping. These case studies offer tangible details about the utility of cobots in emergency scenarios.