

Summary

The CENTAURO project aims at development of a human-robot symbiotic system where a human operator is telepresent with its whole body in a Centaur-like robot, which is capable of robust locomotion and dexterous manipulation in the rough terrain and austere conditions characteristic of disasters.

The CENTAURO robot will consist of a four-legged basis and an anthropomorphic upper body and will be driven by lightweight, compliant actuators. It will be able to navigate in affected man-made environments, including the inside of buildings and stairs, which are cluttered with debris and partially collapsed.

The Centauro system will be capable of using unmodified human tools for solving complex bimanual manipulation tasks, such as connecting a hose or opening a valve, in order to relieve the situation. A human operator will control the robot intuitively using a full-body telepresence suit that provides visual, auditory, and upperbody haptic feedback. Rich sensors will provide the necessary situation awareness. Robot percepts and suggested actions will be displayed to the operator with augmented reality techniques.

For routine manipulation and navigation tasks, autonomous robot skills will be developed. This will allow for taking the operator partially out of the control loop, which will be necessary to cope with communication latencies and bandwidth limitations and to reduce the operator workload.

CENTAURO

Partners:



Acknowledgement:

This project has received funding from the European Union's Horizon 2020 Programme under Grant Agreement 644839 (ICT-23-2014 Robotics).



Horizon 2020

Contact:

Coordinator:
University of Bonn
Prof. Sven Behnke

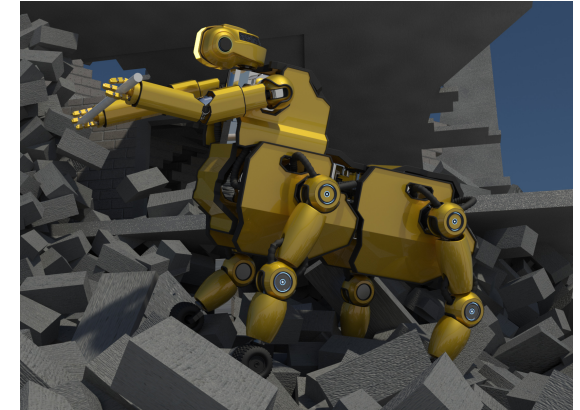
Autonomous Intelligent
Systems
Computer Science VI
Friedrich-Ebert-Allee 144
53113 Bonn
Germany



<http://www.centauro-project.eu>

CENTAURO

Robust Mobility and Dexterous Manipulation in Disaster Response by Fullbody Telepresence in a Centaur-like Robot



Design study by RWTH Aachen.



Momaro robot by University of Bonn.

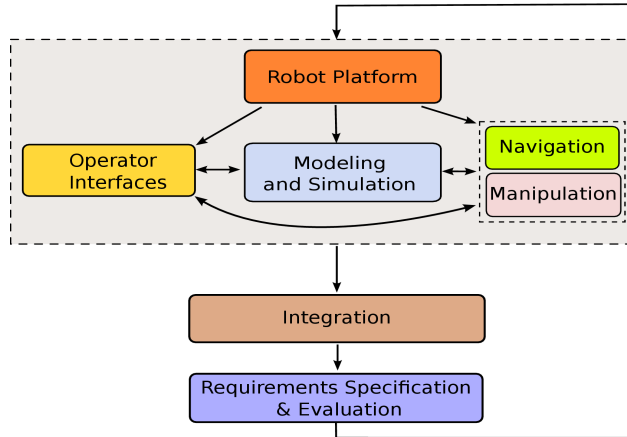
Objectives

- Versatile Robot Platform:**
 Flexible and highly articulated robot to support different modes of locomotion and manipulation. A base with four legs ending in wheels, anthropomorphic upper body, with two 7-DOF arms, movable sensor head.
- Robust Mobility:**
 Able to navigate in affected man-made environments, combining legged and wheeled locomotion.
- Dexterous Manipulation:**
 By telemanipulation unmodified human tools can be used to solve bimanual manipulation tasks.
- Intuitive Control:**
 A full-body telepresence suit allows for intuitive control by the human operator.
- Situation Awareness:**
 Robot sensors provide necessary awareness of the situation supported by augmented virtual reality.
- Virtual Testbed:**
 A physics-based simulation of the robot and its environment allows for verification of navigation and manipulation plans.
- Evaluation Methodologies:**
 Systematic benchmark scenarios and performance measures guided by the end-user requirements.

Expected Impact:

Breakthrough in the introduction of robots for disaster relief applications.

Implementation



- Robot Platform**
 - Whole-body control with balance
 - Wheeled and legged locomotion
- Operator Interfaces**
 - Telepresence suit
 - Main operator interfaces
 - Support operator interfaces
- Navigation**
 - Rough terrain SLAM
 - Terrain classification
 - Full-body navigation
- Manipulation**
 - Object perception
 - Object pick & place
 - Two-arm manipulation
- Modeling & Simulation**
 - Virtual testbed and world model
 - Robot and environment simulation
 - Predictive robot model
- Integration**
 - Communication link
 - Disaster response system integration
- Requirement Specification & Evaluation**
 - Definition of benchmarks
 - Evaluation of components & system

Concept and Approach

The CENTAURO system consists of two main components:

- The CENTAURO robot
- The CENTAURO control center

