A DUAL ARM ROBOTIC PLATFORM CONTROL FOR NAVIGATION, INSPECTION AND TELEMANIPULATION

Mario Di Castro[1,2], Luca Rosario Buonocore[1], Manuel Ferré [2], Simone Gilardoni[1], Roberto Losito[1], Giacomo Lunghi[1], Alessandro Masi[1]
[1]CERN, the European Organization for Nuclear Research, Geneva, Switzerland. [2]Centre for Automation and Robotics UPM-CSIC, Madrid, Spain.

ROBUST AND MODULAR CONTROL

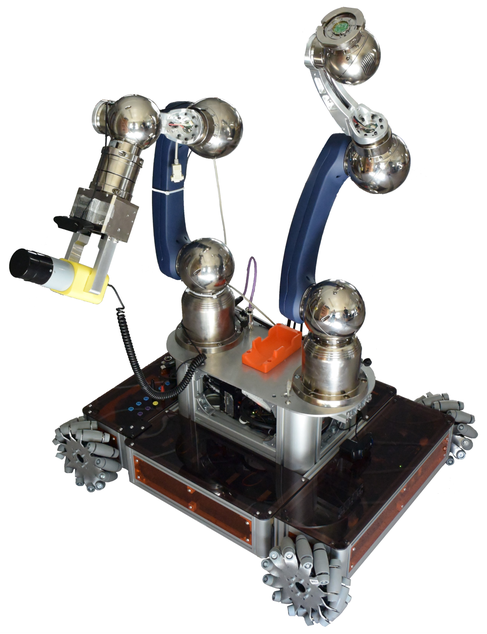
Control Architecture for CERN Robots

High intensity hadron colliders and fixed target experiments require an increasing amount of robotic telemanipulation to prevent excessive exposure of maintenance personnel to the radioactive environment. Telemanipulation tasks are often required on old radioactive devices not conceived to be maintained and handled using standard industrial robotic solutions. Robotic platforms with a level of dexterity that often require the use of two robotic arms with a minimum of six degrees of freedom are instead needed for these purposes. In this poster, the control of a novel robust robotic platform able to host and to carry safely a dual robotic arm system is presented. The control of the arms is fully integrated with the vehicle control in order to guarantee simplicity to the operators during the realization of the robotic tasks. A novel high-level control architecture for the new robot is shown. The work has been successfully validated through several hours of operation in CERN accelerators harsh environments.

60+ interventions | 160+ hours of operation | 100+ mSv of dose saved to the personnel

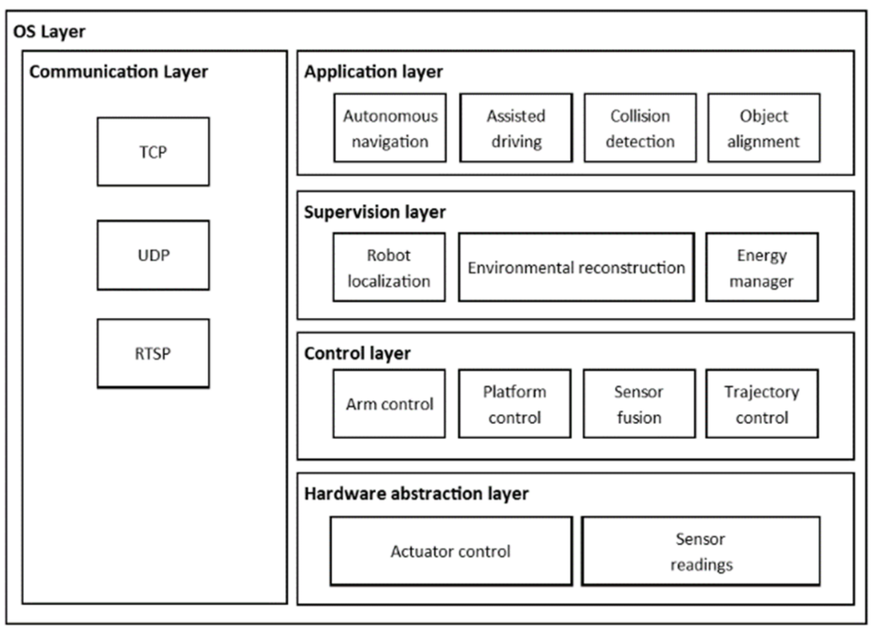
ROBOT FOR HARSH ENVIRONMENT

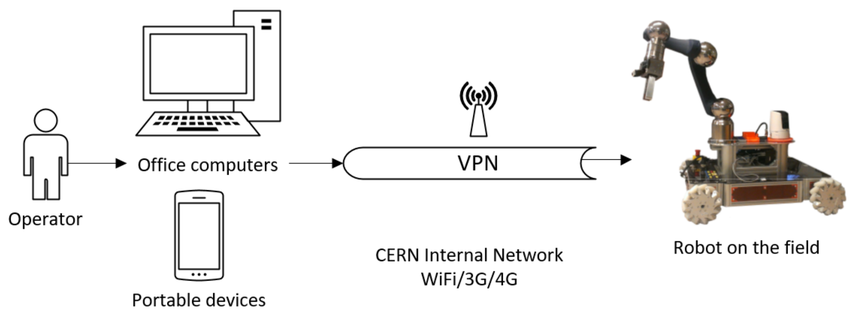
CERNbot v1.0



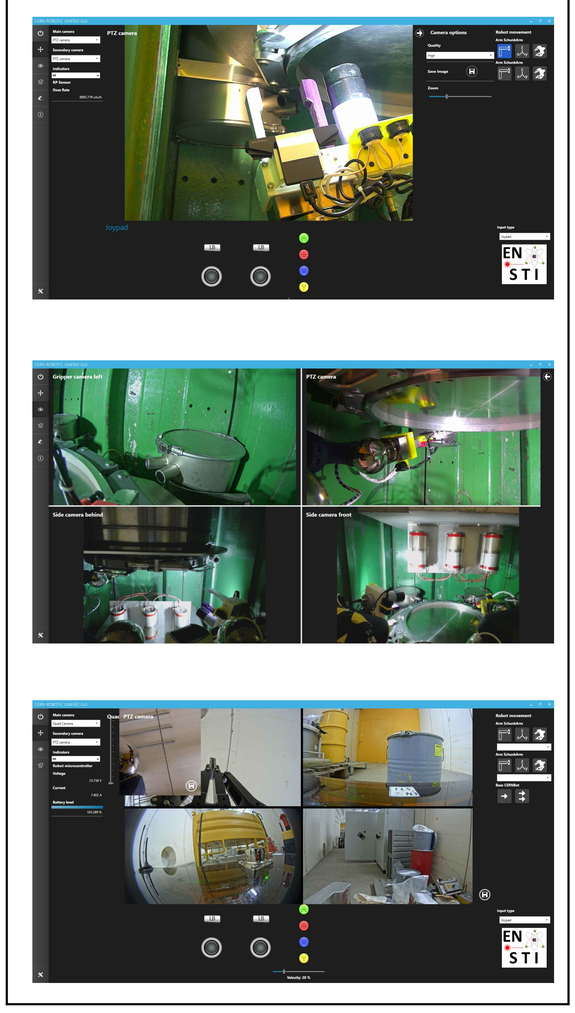
ADAPTIVE AND MULTIMODAL

Control system design and communication





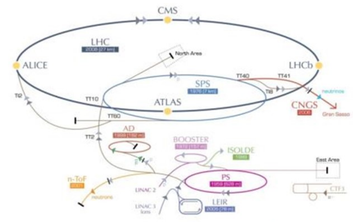
Human Robot Interface



CERN NEEDS

Needs for remote interventions

Reduce exposure of personnel to hazards



Maximize machine running time

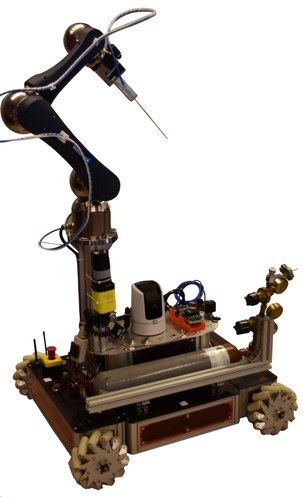
MAIN CONTROL FEATURES

CERN challenges vs CERNbot control features

Challenge	CERNbot control feature
Limited intervention time in very long distances	Variable speeds according to the time needs
Unexpected obstacles	Autonomous navigation and obstacle avoidance
Precision localization during environmental measurement	Precise on board odometry
Delicate equipment	Anti-collision systems and recovery scenarios
Loss of communication signal	Control through SMS, notifications/alarms via SMS, autonomy
Robot autonomy	Energy management system

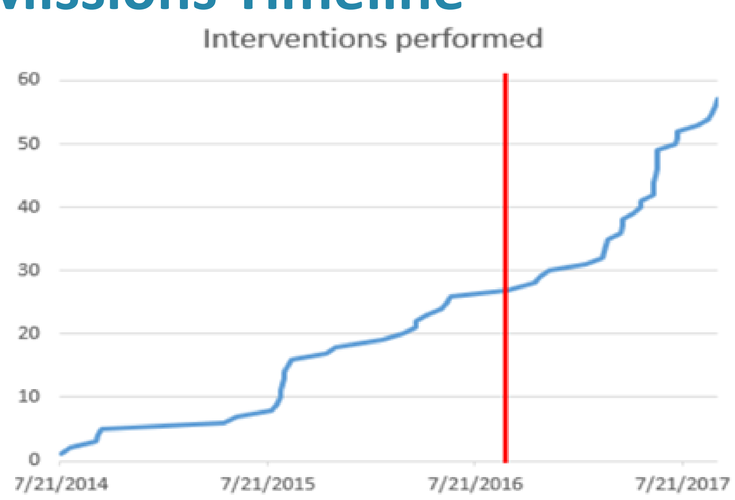
MODULAR CONTROL SYSTEM

CERNbot in different operational configurations

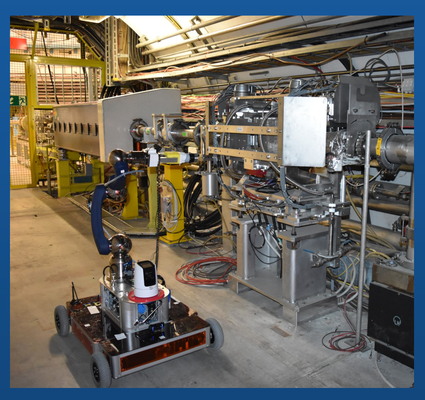


OPERATION IN CERN HARSH ACCELERATOR AREAS

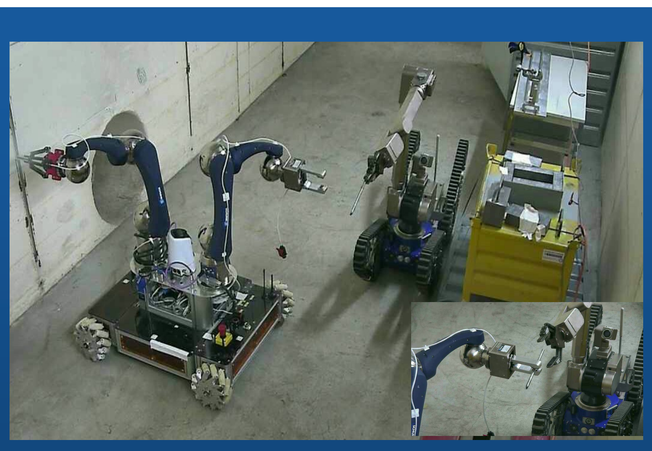
Missions Timeline



CERNbot Control System | Gallery



Autonomous navigation and environmental measurements



Telemanipulation

Several robotic arms integrated

Fusion of many sensors