



The goal of DeTOP is to push the boundaries of osseointegrated, neurally controlled prostheses technology - made in Europe - to the next TRL and to make it clinically available to the largest population of upper limb amputees, namely transradial amputees. This objective will be targeted by developing a novel prosthetic hand with improved functionality, smart mechatronic devices/features for safe implantable technology, and by studying and assessing paradigms for natural control (action) and sensory feedback (perception) of the prosthesis through the OHMG.

The novel technologies and findings will be assessed by three selected patients, implanted in a clinical centre, in Gothenburg, Sweden. Within the consortium the partners are capable of achieving a number of important and tangible results, both in terms of enhanced basic knowledge and in terms of technological and clinical implementations. These results will produce significant impact on technology innovation, design criteria for biologically-inspired machines and industrial spin-off companies. The project could also have a major socio-economic impact for disabled people in general by providing new human-machine-interfaces with increased bandwidth communication channels, resulting in better quality of life.



The Consortium



Project Coordination

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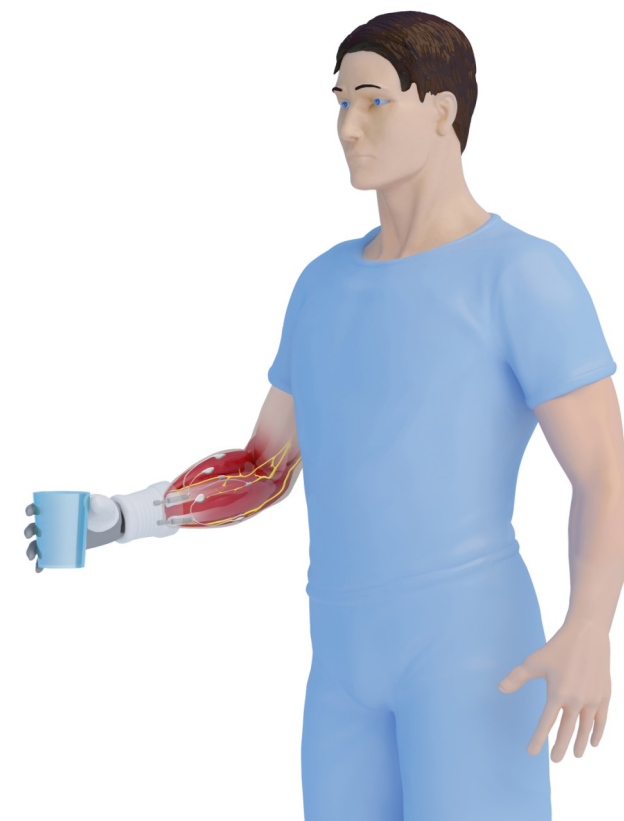


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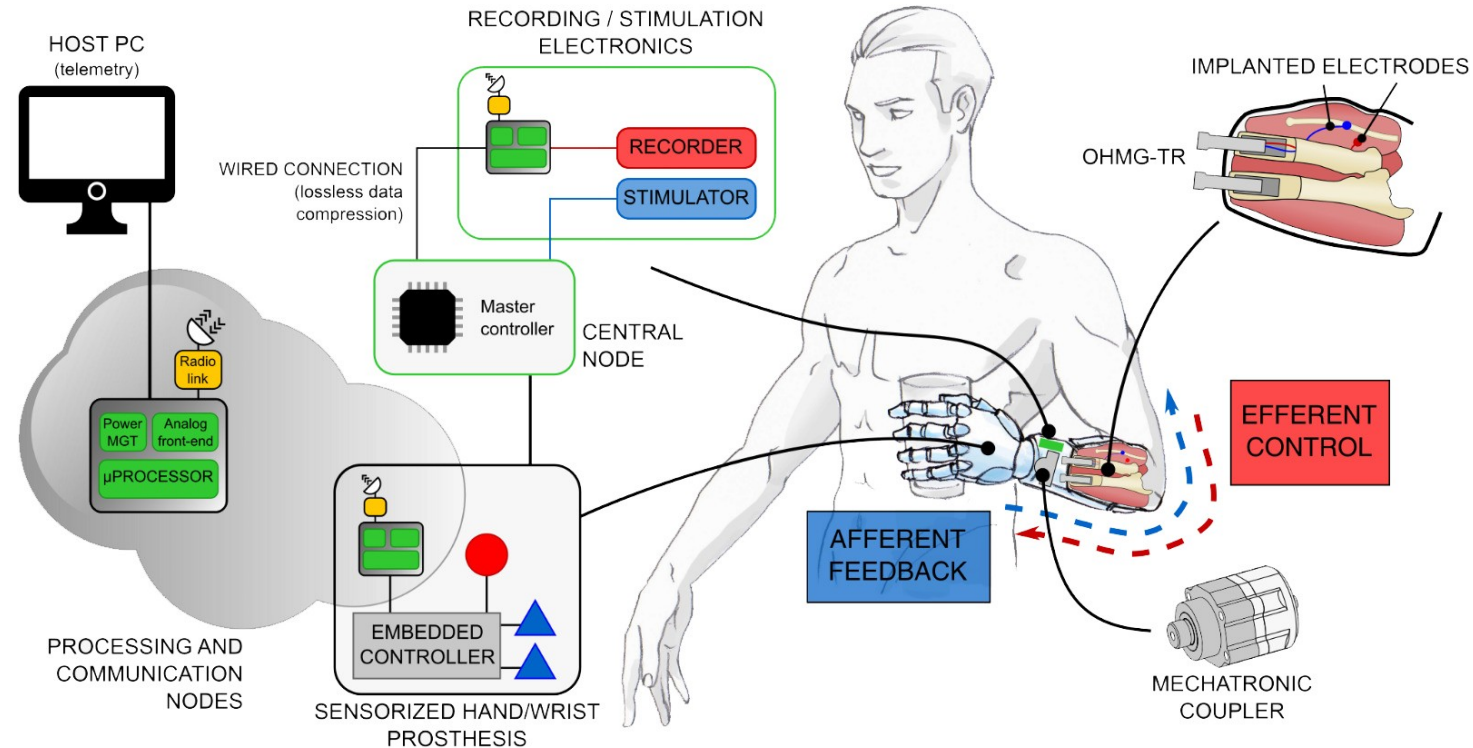
DeTOP

Dexterous Transradial Osseointegrated
Prosthesis with neural control
and sensory feedback



www.detop-project.eu

DeTOP is a Research and Innovation project coordinated by The BioRobotics Institute of Scuola Superiore Sant'Anna. The project targets people with reduced or absent hand sensorimotor capabilities, due to an amputation. It aims to develop and clinically implement robotic, sensing and long-term interfacing technologies for the next-generation transradial prosthesis. Core of the system will be an osseointegrated human-machine gateway (OHMG), able to create bidirectional physiological links between a human and a state-of-art dexterous robotic prosthesis with artificial skin. Key objective of DeTOP is to translate, exploit and appraise already proven technology for transhumeral amputation to the most frequent case of transradial amputation.



Despite decades of research and development on artificial limbs and neural interfaces, amputees continue to use technology for powered prostheses developed over 40 years ago, namely myoelectric prostheses controlled via surface electrodes. Indeed, this is today the most reliable and clinically viable technique: the use of the **electromyogram (EMG)**, i.e., the electrical activity produced by skeletal muscles as a by-product of normal muscle contraction, to control the movements of an electromechanical prosthesis. These prostheses are known for their poor functionality, poor controllability and poor sensory feedback.

The **DeTOP consortium** has pioneered the use of osseointegration as a long-term stable solution for the direct skeletal attachment of limb prostheses. This technology, aside from providing an efficient mechanical coupling, which on its own has shown to improve prosthesis functionality and the patient's quality of life, can also be used as a bidirectional communication interface between implanted electrodes and the prosthetic arm.

The **consortium** has demonstrated that neuromuscular interfaces developed decades ago can considerably improve prosthetic control and functionality, if made clinically viable by having a long-term stable osseointegrated interface; namely, the **osseointegrated human-machine gateway (OHMG)**. One patient with a trans-humeral amputation was the recipient of the OHMG system in January 2013.



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DeTOP will develop:

- The OHMG for transradial amputation
- A smart mechatronic coupling for connecting the OHMG to the prosthesis allowing safe wrist rotation
- A dexterous hand-wrist prosthesis with tactile sensors
- Physiological proportional myocontrol based on implanted electrodes
- Neural feedback for restoring natural tactile sensations
- Miniature Processing and Communication Nodes for control and sensory feedback



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