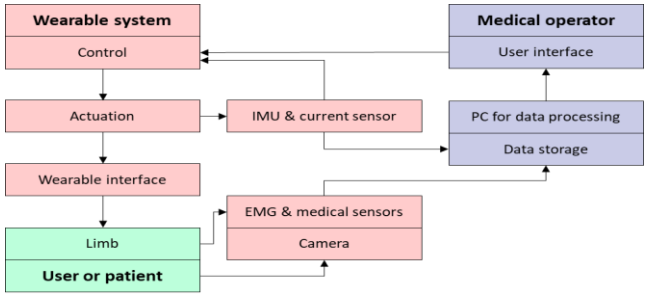
ASSIST motion assistance device

The ASSIST motion assistance device for limbs is conceived with a design solution that is characterized by high portability and user-oriented operation for autonomous use by a user considering that fastening rings on the limb can be made with suitable design solutions using commercial products such as pneumatic straps for blood pressure monitoring and adopting suitable cables or tensioning solutions to achieve the expected relative motion between limb parts. In order to be used at home by patients and to help therapists, a device must address mainly:

- Comfortability, portability and wearability, since they limit the both the functionality and the user autonomy
- Auto-regulation, since every patient is different, and so must be the therapy
- Monitoring and home use, since data is important for the log of the rehabilitation phase, and the user must be able to activate the exercise on its own
- Safety in terms of conditions for avoiding accident against user body and for ensuring proper sanitarian frames with easy sterilization after and before usage.

A conceptual design will be developed with component structure addressing the problems and requirements towards a feasible solution for a variety of users centered on elderly people. The components refer to each aspect as referring to an exoskeleton device with a cable-driven parallel architecture integrated with actuators, current sensors, and IMU motion sensors that are used for motion regulation by the control unit, that will be realized with microprocessor, very likely an Arduino Nano or similar. Additional medical sensors can be installed to monitor the physiological status and the effect of the motion assistance in addition to a commercial small EMG. The data can be acquired and processed in a suitable storage unit, that can be part of the electronic board. Very likely a Bluetooth or Wi-Fi data transmission can be used to have online monitoring and data transmission to external computer devices for post-processing and diagnostic analysis. The system in its configuration for portability and user-oriented features with proper elaboration code can be provided of a suitable control unit. An energy source in the form of a battery can be also included with the minimum size for the required power for the expected exercise duration.



DESCRIPTION OF ACTIVITY

The planned design and experimentation activities are planned with task distribution in accordance with the skills of the partners at the University of Rome Tor Vergata and at the University of Padova, as indicated in WP distribution.

WP1 is the coordination structure to support the coordinator to effectively monitor and guide the interaction and synergy between the technical-scientific WPs 2-4. WP1 is devoted to the coordination of the project activity also in terms of administration and dissemination: from the beginning, a website will be deployed to disseminate the results of the various phases. Moreover, several scientific papers will be produced, aiming both at high-tier journals and international conferences.

WP2 is focused on definition of requirements and design functionalities looking at the state-of-art and current new needs: mechanical design solutions and state-of-the-art industrial equipment will be analyzed with the aim of developing a device as advanced as possible.

WP3 is focused on developments of design solutions from conceptual schemes up to mechanical design with construction details: the mechanical design will be developed in solutions that aim at optimizing usability, wearability, and repairability.

WP4 is devoted to activity for designing and testing of prototype and its experimental demonstration of the feasibility as medical assisting device.

The activity is planned in phases with the following schedule determined by planned Milestones and Deliverables as related to WPs activity.

Phase 1 on analysis of state-of -art and requirement definition during months 1 to 6: requirements will come from existing literature and from the experience of both components and external contacts of the research units, such as doctors and therapist.

Phase 2 will be focused on design and testing of biomechanical aspects during months 6 to 16, for which conceptual and mathematical models will be conceived and designed as to be validated in the following phase.

Phase 3 will be devoted to prototyping solutions and testing for validation and characterization during months 13 to 24.

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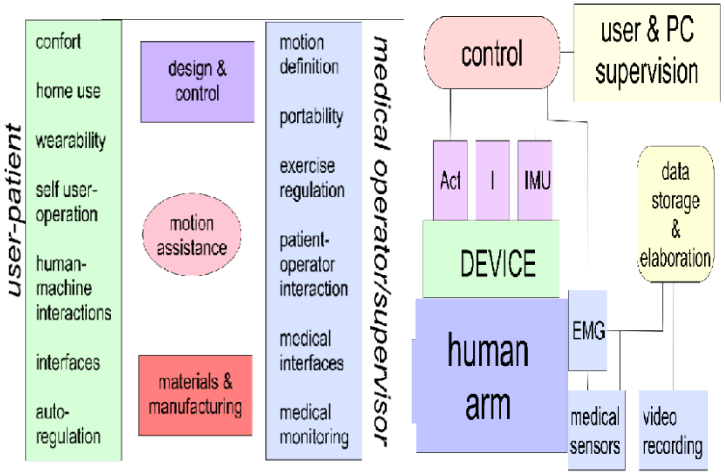
mesi/WP	1	2	3	4	5	6	7	8	9	10	11	12
WP 1	M1.1 D1.1		D1.4			M1.4						M1.2 D1.2
WP 2						M2.1 D2.1						
WP 3										M3.1 D3.1		
WP 4												

mesi/WP	13	14	15	16	17	18	19	20	21	22	23	24
WP 1											M1.3 M1.4 D1.3	M1.2 D1.2
WP 2												
WP 3				M3.2 D3.2								
WP 4		M4.1 D4.1								M4.2 D4.2		M4.3 D4.3

Work Package - name	Leader unit	Man-months	Start month	End month
Coordination, Administration, Dissemination	TORVERGATA	5,5	1	24
Requirements and functionalities	PADOVA	11,5	1	6
Design and performance analysis	TORVERGATA	17,5	6	16
Prototype and testing	PADOVA	19,5	13	24

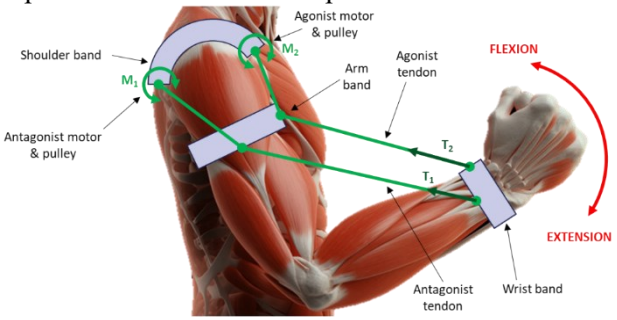


DISSEMINATION ACTIVITY

The visibility and dissemination activities of the project results are planned in terms of visibility in social media, publications in national and international contexts, meetings with stakeholders and interested entities, organization of a workshop. The results of the project will be documented with presentations at both national and international congresses with proceedings published for distribution not only to the congress participants. Visits and meetings with interested stakeholder identities are planned to promote interest in the project's activities also with the aim of proposing future collaborations for further research and application in the local, national, and international context, even in European projects. A workshop at the end of the project will be organized with the aim of discussing the problems of the project activities and at the same time sharing the perspectives of the project results in a colloquial context. Each partner of the project will organize seminars in their academic, local and regional frames, to attract interest for further developments even of a professional nature in the new generations.

AIMS OF THE PROJECT

The ASSIST project is aimed at the development of ASSIST exoskeleton, a modular structure portable cable system for easy wearing on arms and legs in limb motion assistance. The ASSIST exoskeleton that we intend to define as a result of the project is based on an idea presented at a conceptual level in an Italian patent application and will be further elaborated in the activities of this project in an efficient solution to be designed with user-oriented features for practical implementation of a market product in a near future.



A conceptual scheme for the research activity as referred to the arm implementation as emblematic example of the design and operation ideas.

PROJECT PARTNERS

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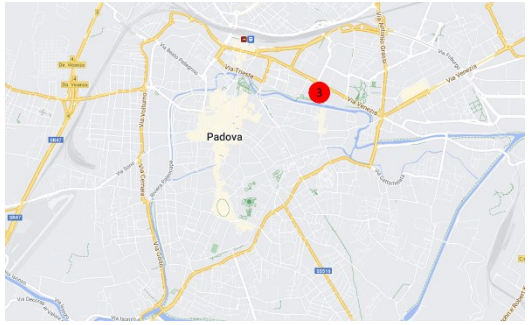
1- Building with LARM2: Lab of Robot Mechatronics
2- Map with 1:Rectorate Tor Vergata building, 2:LARM2



3- Building with Department of Industrial Engineering

Università di Roma Tor Vergata
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
LaRM² Tor Vergata

DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

Progetto P2022A3ELB – PRIN 2022 PNRR

ASSIST:
Development of modular cable-actuated system for motion assistance of limbs

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