



# PhD in DESIGN - 40th cycle

## PNRR 630 Research Field: DESIGN FOR WEARABLE SYSTEM FOR HUMAN HEALTH AND ERGONOMICS

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1300.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

**Context of the research activity**

**Motivation and objectives of the research in this field**

Wearable devices constitute an emerging approach, and are excellent candidates for supporting human activities and improving quality of life. They represent a new means of addressing the needs of many industries, and have the potential to increase work efficiency among employees, improve workers' physical well-being, and reduce work-related injuries. Wearable technology extends our capabilities as humans, and epitomises the interaction of humans and technology. An industrial wearable system supports real-time, trusting, and dynamic interaction among operators, machines, and production systems, providing a human-centric empowering technology within the Industry 5.0 context. Compared to computers and mobile phones, wearable technology can provide many different ways of human computer interaction for users to strengthen their overall experience.

At present, this field results to be more technological-driven than design-implemented, so that current solutions suffer from usability, acceptance and compliance.

Therefore, a new and design-oriented approach is needed. At the same time, applications in ergonomics are urgently required to tackle the wellbeing and safety of workers in several fields:

- Prevention of stress and psychological issues (e.g., burn-out, quitting);
- Prevention of musculoskeletal disorders, specifically for spine and lower limbs so to increase human health and reduce the dramatically increasing social costs (due to severe injuries – even deaths – and absence from work);
- Promotion of corporate welfare and wellbeing actions.



	<p>This research aims at targeting these challenges to provide:</p> <ul style="list-style-type: none"> <li>- An up-to-date state of the social needs (for companies, for users, for healthcare system) of ergonomic actions;</li> <li>- An up-to-date analysis of the current enabling solutions, from both the user’s perspective and technology vision;</li> <li>- New methodological perspectives in the field of design for wearable ergonomics devices and services;</li> <li>- The identification of case studies within specifically defined fields;</li> <li>- The development of specific solutions;</li> <li>- The validation of the developed innovative approaches.</li> </ul>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The project will adopt the so-called Double Diamond model involving the different stakeholders since the beginning of the research activities.</p> <p>Key points of the methodological approach will be considered, including:</p> <ul style="list-style-type: none"> <li>- a literature review and a technological benchmark following also the trends provided by the most recent report of the POLIMI Technology Foresight working group on Healthcare in 2040;</li> <li>- the definition of personas and related user journeys;</li> <li>- the ideation phase with codesign and focus group session to tackle the real needs and expectation of all involved stakeholders;</li> <li>- the use of advanced early prototyping technologies for testing early solutions;</li> <li>- the development/refinement of assessment methods to the specific field and use case.</li> </ul> <p>Whereas several examples and suggested methodologies will be provide to fulfill these objectives, the student will be encouraged to adopt the following methods:</p> <ul style="list-style-type: none"> <li>- User interviews, involving workers, companies and experts in Occupational Medicine;</li> <li>- Expert interviews;</li> <li>- Focus groups and codesign sessions;</li> <li>- Surveys and questionnaires for UI/UX testing and assessment;</li> <li>- Techniques for early prototyping such as 3D printing of physical interfaces, the design of software for virtual interfaces (e.g., Unity), easy platform for responsivity and</li> </ul>



	<p>interaction analysis (e.g, Arduino, microbit).</p> <p>The methodological approach must keep more and more the focus on the needs of the end-users from the very beginning of the project. Where possible, observation of health processes is included to assess environmental factors and their impact, if any, on the user's experience. The information emerged by interviews and observations must be translated into guideline for the design process. Users will be invited to participate in active focus group sessions. Human-centric approach must be adopted during all the phases of the design process, in order to develop a flexible, resilient and above all human-friendly system.</p> <p>At the end of the design phase, the expected results include prototyping and testing of the interactive product-service system, developed through the above-mentioned codesign process. The student must plan and manage pilot tests involving all target users in practical trials, semi-structured interviews, and observations.</p> <p>Severak of the planned research activities will take place directly in the company which is actively involved in the design and development of wearable solutions to increase efficiency and safety of logistic operations.</p>
<p><b>Educational objectives</b></p>	<p>The objectives can be divided in three disciplinary areas: scientific, technical-practical, and educational.</p> <p>The development of the product-system solution requires a solid theoretical basis obtained through the combination of various research activities, including literature analysis, benchmarking investigation and the observation and involvement of target users. The researcher must be able to merge the various information collected and define a comprehensive overview of the framework, highlighting the research and marketing gaps in which the present study can be placed and provide valuable scientific contribution. The results obtained will have to be declined to be relevant to different clinical contexts and exploitable by different professionals.</p> <p>To have the opportunity to engage more actively target users, they will be involved in focus group session. The student will have to keep the participants' attention on the topic of patient's well-being and how improving it,</p>



	<p>establishing a favourable context for the exchange of ideas and opinions.</p> <p>The subjective data that will emerge will become the guideline for the development process aimed to define a preliminary prototype of the product-service system.</p> <p>Technical expertise is required to achieve a prototypical solution that is as similar as possible to the desired final product. Prototyping and its management have a crucial role in the development process allowing the organisation of pilot tests. The testing phase plays an important role in defining the final product because some problems only arise during the actual user experience.</p>
<p><b>Job opportunities</b></p>	<p>The present proposal, due to its multi-layered nature, offers the candidate the opportunity to meet and collaborate with people from different professional backgrounds. This assumption is the starting point for implementing and improving the ability to work in a multidisciplinary team, a very common feature in both academic and scientific research groups.</p> <p>During the PhD, the student will acquire a solid competence that will enable him/her to achieve a greater autonomy in organising the creative process from the early stages. Moreover, the high level of autonomy achieved will allow the researcher to enter the labour market as a senior figure and no longer as a junior one.</p> <p>The researcher could also aim to be employed in research and development offices of companies dealing with the same topic.</p> <p>In today's labour market, there are constantly expanding sectors dedicated to innovative physical devices and interactive services for users and workers, where the researcher will be able to apply after PhD course.</p> <p>In addition, thanks to the analysis of environmental factors carried out during the PhD journey, companies producing wearable devices will also represent a valid job opportunity.</p> <p>Finally, the internship abroad, which is mandatory during the PhD period, represents a great opportunity to reach a wider range of job opportunities.</p>
<p><b>Composition of the research group</b></p>	<p>1 Full Professors 1 Associated Professors</p>



	1 Assistant Professors 1 PhD Students
<b>Name of the research directors</b>	Lopomo Nicola Francesco

<b>Contacts</b>	
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	650.0 €
<b>By number of months</b>	6

<b>National Operational Program for Research and Innovation</b>	
<b>Company where the candidate will attend the stage (name and brief description)</b>	PARTITALIA S.r.l.
<b>By number of months at the company</b>	6
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	
<b>By number of months abroad</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student per year max 5.300,25 euros per student (total for 3 years)</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student there are various forms of financial aid both for research and teaching activities. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p> <p>Computer availability: 1st year, 2nd year and 3rd year: Each research group will supply PhD student with a computer, if necessary.</p> <p>Desk availability: 1st year, 2nd year and 3rd year: Each research group will supply phd student with a desk.</p>