POLITECNICO DI MILANO

PhD in DESIGN - 38th cycle

PNRR_352 Research Field: HUMAN COMPUTER INTERACTION AND WEARABLE DEVICES

Monthly net income of PhDscholarship (max 36 months)
€ 1195.5 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 are considered one of the most growing markets of the last decade. Wearables are invisible computers which can be applied into different fields: sports, working environment, and especially health. People became used to fitness trackers and smart watches; smart glasses at now are not so smart but present a lot of opportunities; smart shoes are firmly infiltrating into the sports world, and Wearable 2.0 are approaching the market, with new devices that embed smarts into the clothing itself or placed directly on the skin. Despite this, wearable devices are often seen as a mere accessory, limited to occasional use during sports or for interacting with the smartphone. Why? One of the challenges for many wearables is providing enough value, or being convenient enough to use. The perceived utility by the user is often underestimated, and this leads to the abandonment or occasional use of these types of devices. Part of the problem may be forcing existing technology to be used rather than developing technology specifically for the required task. "I would characterise the wearable market as providing top-down solutions" says George Sun, CEO of Nextiles. That is, using solutions made from other industries and repurposing them for the body. An example is the accelerometer, primarily used for aircrafts and moving vehicles, but now miniaturised to be used as a step counter for humans. Another problem could be due to the inconsistency of the data collected, to the low quality of these or to a too high number of heterogeneous data to be used in clinics. Acceptability can be also related to digital illiteracy,

	which causes distrust of these devices. It is possible that the fragmentation of the various systems prevents the exploitation of the plethora of data collected by these devices; and non-homogeneous and variable quality data can jeopardise their real use in the clinical setting to improve prevention and diagnosis. How can we sort out the tangle of wearables so that we can exploit them to their full potential? Is it a question of systems, quality or UX? How can we enhance the data collected? Is it possible to exploit new technologies such as blockchain and NFT to give weight and truthfulness to these? This objective is part of the Mission 4 component 2 "From Research to Business"; Investment 3.3 "Introduction of innovative doctorates that meet the innovation needs of companies and promote the hiring of researchers from companies" of the PNRR program, for the training of graduates with high specializations in STEM subjects (Science, Technology, Engineering, and Mathematics), in the field of digitalization and new technologies for health.
Methods and techniques that will be developed and used to carry out the research	The doctoral research is guided by three research questions (RQ): RQ1: How is it possible to design a wearable system which can be used in clinics, through a cross-disciplinary approach that takes into consideration not only the device, but mainly the user experience and the clinical aspect? RQ2: How are wearables perceived by the various generations? Is there a difference in terms of acceptability and possibly how can this be improved? RQ3: Can wearable devices be used for medical data collection? In what clinical setting can these be most used? Is it possible to collect meaningful data to make preventive diagnosis? Can ML and AI techniques on data from low-cost devices be used in the clinical setting for prevention? How can data be enhanced? Can Blockchain and NFT help to valorise and create awareness of the data collected? The doctoral research will be performed by comparing three different realities: - the academic and research environment of the Politecnico di Milano, where the doctoral student will have the opportunity to integrate their doctoral

	research thanks to participation in national and international research projects in the field of wearable devices. - the professional reality, through the application of the knowledge acquired in industrial projects of Fifth Beat with national and international clients in the field of healthcare and wearable devices. - The Swiss cantonal reality, thanks to the 6-month period abroad at the Professional University School of Italian Switzerland, where the doctoral student will have the opportunity to collaborate in research in the health field, in one of the countries in the world with the highest per capita expenditure on health. The PhD student will have the opportunity to create prototypes of wearable devices in the TEDH (Technology and Design for Healthcare Lab) laboratory of the Politecnico di Milano, exploiting not only the laboratory equipment, but also the know-how of the researchers in the material and technological fields. These prototypes will have the purpose, through investigations with users (focus groups, clinical tests ...), to test new concepts and applications of wearable devices in the medical field.
Educational objectives	The doctorate represents a transitional step between a person's studies and their own research work. The PNRR industrial doctorate has the main objective to prepare a person for research-oriented work in the professional world and equips the candidates to take on a wide variety of demanding high professional duties and roles. In this case, it means acquiring knowledge and skills related to digital technologies, as well as those that cut across other areas or have more to do with methodology. The PhD program is also an opportunity to build networks within the academic and the professional community. The core focus of a doctorate is the acquisition of methodological skills by drafting a personal research project which includes not only the problems sought, but also all the professional and industrial aspects of the partner who co-finances this PhD program. The educational objectives of this program are:

	• Master of broad-based knowledge in Human Computer Interaction area, and especially digital technologies and wearable devices. • Master research methodology and advanced statistics, including quantitative and qualitative methods. • Design and conduct original research. • Master the capacity for critical analysis, assessment and synthesis of new and complex ideas. • Master the capacity to develop further the progress made in technological, design and art terms within an academic and professional context. • Demonstrate the ability to communicate the results of their research both in academic and professional environment. • Master new techniques for prototyping and testing with digital technologies.
Job opportunities	Nowadays, cross-disciplinary skills are one of the fundamental points required by the labour market, especially in the field of information technology and interaction design. This PhD in design aims to develop cross-disciplinary skills that make it possible to exploit the methodologies of design, for the optimization of products and services based on high-tech components. Furthermore, the PhD is proposed as a strategic tool for the transfer of advanced research skills to the professional world, in line with the PNRR which makes innovation the fundamental strategy for restarting and creating new opportunities for companies in the sector. At the end of his career, the candidate will obtain a professional and research background that he can exploit in the following areas: - Data designer: research and design of technological solutions that exploit and enhance user data. - Design driven innovator: knowledge of the technological field, as well as user-centred design for the generation of innovation.

	- UX technologist: rapid prototyping for the definition of engaging user experiences.
Composition of the research group	1 Full Professors 1 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Paolo Perego

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

Scholarship Increase for a period abroad	
Amount monthly	834.85 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Fifth Beat SRL
By number of months at the company	9
Institution or company where the candidate will spend the period abroad (name and brief description)	SUPSI - Scuola Universitaria Professionale della Svizzera Italiana (Istituto MeDiTech)
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student max 4.872,90 euros per student (total for 3 years) Teaching assistanship: 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. Computer availability: 1st year, 2nd year and 3rd year: Each research group will supply PhD student with a computer, if necessary.

Desk availability: 1st year, 2nd year and 3rd year: Each research group will supply phd student with a desk