



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 2 - Electronics

**PNRR 118 INTERDISC Research Field: WEARABLE DEVICES FOR LONG-TERM
MONITORING OF CARDIOVASCULAR DISEASES EARLY SIGNS**

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

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

The research objective is to develop wearable systems for the long term monitoring of physiological parameters to detect early signs of cardiovascular diseases. The parameters of interest are heart rate, the SpO2, blood pressure and body temperature. A compact hardware platform will be developed to measure these parameters, through electrocardiography (ECG), Photoplethysmography (PPG), and inertial measurement units (IMU). Algorithms for data analysis will be based either on classical filtering, on parameter extraction and on neural networks. The system will be technically validated with specific experimental protocols.

Methods and techniques that will be developed and used to carry out the research

The research includes purely electronic aspects, linked to the hardware development of systems and the real-time implementation of processing algorithms on microcontrollers and characteristic aspects of bioengineering, such as the analysis of biomedical signals, the definition of experimental protocols and the analysis of results.

Educational objectives

The Students will learn how to design compact and low power PCBs with processing units, battery management and sensors. Will developed algorithms for data analysis, will prepare experimental protocols and discuss the



	results of the experimental measurements.
Job opportunities	Many job opportunities are disclosed by this PhD, both in the electronic system design field, and also in the biomedical field, for data analysis and processing.
Composition of the research group	1 Full Professors 2 Associated Professors 1 Assistant Professors 4 PhD Students
Name of the research directors	Federica Villa

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	700.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	ETH Zurigo, Svizzera
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	ETH Zurigo, Svizzera
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The aim of the research is to develop wearable systems for monitoring physiological parameters in order to reveal early signs of cardiovascular diseases. The main parameters to be analysed will be heart rate and its variability, respiratory rate, blood oxygenation, blood pressure and body temperature. For this, a compact hardware platform will be developed for the measurement of these parameters, through ECG, PPG and inertial systems (IMU), and data analysis algorithms based on classical filtering, signal feature extraction and neural networks will be developed. The system will be technically validated with appropriate experimental protocols.



EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student

TEACHING ASSISTANTSHIP: availability of funding in recognition of supporting teaching activities by the PhD student There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.