



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 40th cycle

Research Area n. 2 - Electronics

**THEMATIC Research Field: NON-OPTICAL WEARABLE EYE TRACKING: NOVEL SENSING
CONCEPTS AND ELECTRONICS**

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 goal of the research project is the exploration of non-optical sensing technologies for wearable eye tracking (ET), primarily capacitive and ultrasound ones. The motivation mainly relies in the potential issues associated with infrared (IR) radiation reaching the eyes for all-day operation in terms of eye safety, eye irritation and robustness to outdoor usage. Furthermore, such technologies can be either a replacement or complementary (i.e. combined cooperatively) of IR ones in order to better address the performance/power consumption compromise, which characterizes the application of ET to all-day tracking. The project targets the development of one or more experimental demonstrators, allowing to proof the concept, assess its performance and show the compatibility of the studied sensing technologies with the form factor and the power budget of smart eyewear.

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

The research will focus on the design of novel configurations of electrodes, sensing schemes and miniaturized readout circuits for measuring capacitance around the eye, that will fit in the volume and power dissipation constraints of wearable smart glasses. The key research activity will be the design of electronics circuits and system for ultra-low-power applications. In



	addition to the analog front-end, embedded processing solutions, such as tiny Machine Learning, for real-time and robust extraction of facial expressions, as well as for the estimation of blinks and of the direction of gaze from the set of charge measurements will be studied and experimentally validated in different conditions.
Educational objectives	The educational objectives are multiple: (1) strengthening a vertical expertise on high-sensitivity low-power electronic design, (2) opening the candidate to cross-disciplinary research, including academic and industrial R&D perspectives, (3) learning to self-organize, lead a research project, interact with several other teams, disseminate technical results.
Job opportunities	PhD candidates with expertise in wearables, electronics, sensors and embedded processing are highly requested by companies developing electronic systems in multiple application areas spanning from industry, IoT, to the field of medical and extended reality devices.
Composition of the research group	1 Full Professors 1 Associated Professors 2 Assistant Professors 15 PhD Students
Name of the research directors	Prof. Marco Carminati

Contacts

Prof. Marco Carminati
marco1.carminati@polimi.it

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

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information



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.

5.707,20 Euro

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.

COMPUTER AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes

DESK AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes

The student will carry out the research activity within the Smart Eyewear Lab jointly established between Politecnico di Milano and EssilorLuxottica in a dynamic and stimulating environment composed of both academic and company researchers, several PhD students and Master students coming from different degrees (Electronics, Telecom, Computer Science, Biomedical, Physics?) and working in different topics, from electronics to machine learning.