



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

**INTERDISCIPLINARY Research Field: OUTDOOR DYNAMIC MONITORING SYSTEM FOR  
MOTION TRACKING IN SPORT**

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

**€ 1500.0**

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**

Interdisciplinary PhD Grant

The PhD research will be carried out in collaboration with research groups of the PhD programme in "**INFORMATION TECHNOLOGY**".

See <https://www.dottorato.polimi.it/?id=422&L=1> for further information.

In competitive sports, optimizing athletic movements to maximize performance is crucial. In this context, the use of monitoring technologies, such as marker-based video systems or IMUs, is key to studying and optimizing movement. However, these systems can only be used in closed environments and limited spaces or require athletes to wear devices that make movements less natural and impractical for use in competitions. For monitoring and optimizing outdoor sports that take place in large spaces (such as skiing or rowing), non-intrusive measurement systems are currently unavailable. This project aims to develop and test a mobile technology, initially based on drones and computer vision, capable of:

- i) tracking athletes in extensive and dynamic environments;
- ii) monitoring movements without interfering with the athlete to identify and track the position of the body's joints and reconstruct their 3D shape from image sequences;and
- iii) providing coaches and technicians with accurate information on athletic movements to improve performance.



<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research will involve developing and utilizing several methods and techniques. These include creating a mobile flying technology with measurement instruments for outdoor athlete monitoring, devising image analysis algorithms for athlete tracking and monitoring of kinematic and biomechanical variables, analyzing obtained data to provide athletes with accurate feedback on their motor gestures, and integrating control and tracking skills for mobile technology with advanced machine learning techniques for data extraction from video streaming.</p>
<p><b>Educational objectives</b></p>	<p>The main educational objectives of the research project are:</p> <ul style="list-style-type: none"> <li>•enhancing students' proficiency in developing and implementing advanced technologies for athlete monitoring and performance optimization;</li> <li>•fostering skills in image analysis algorithms and data processing techniques for tracking and monitoring athlete movements;</li> <li>•providing hands-on experience in integrating various measurement instruments and technologies into a mobile flying platform for outdoor athlete monitoring.</li> </ul>
<p><b>Job opportunities</b></p>	<p>Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary compared MSc holders in the same field. These job opportunities span various disciplines such as engineering, sustainability, materials science, and project management, offering diverse career paths for individuals interested in advancing sustainable practices in the field of electric vehicle technology.</p> <p>List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research include: Technical University of Munich (TUM) - Germany; University of Oxford - UK; ETH Zurich - Switzerland.</p>



<b>Composition of the research group</b>	1 Full Professors 0 Associated Professors 1 Assistant Professors 2 PhD Students
<b>Name of the research directors</b>	Proff. Francesco Braghin, Giacomo Boracchi

<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>	750.0 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>Financial aid is available for all PhD candidates (purchase of study books and materials, funding for participation in courses, summer schools, workshops and conferences) for a total amount of € 5.707,13. Our candidates are strongly encouraged to spend a research period abroad, joining high-level research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month- net amount). Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD candidate. 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.</p>