POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

PNRR 118 PNRR Research Field: DEVELOPMENT AND EVALUATION OF CCAM SOLUTIONS USING DYNAMIC DRIVING SIMULATORS

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	One of the main objectives of the Italian plan for recovery and resilience (PNRR) is the development of a digital and modern infrastructure supporting a more sustainable and connected mobility (PNRR-Mission 3). Clearly, the achievement of this target would lead to the development of Cooperative Intelligent Transport Systems (C-ITS), which would allow road users and traffic managers to share information and use it to coordinate their actions. This cooperative element, enabled by digital connectivity between vehicles and infrastructure, is expected to significantly improve road safety, traffic efficiency and comfort of driving, by helping the driver to take the right decisions and adapt to the traffic situation. The present research project falls within this framework, proposing to investigate solutions for Cooperative, Connected and Automated Mobility (CCAM), which promise to further increase safety and more inclusive mobility systems. A big challenge in the development of such systems, it is proving their effectiveness in a safe environment before on-road experimentation and the acceptance of the proposed solutions by the users. Under this point of view, driving simulators seem to offer an interesting opportunity and therefore are extensively used by car manufacturers and OEMs (Original Equipment Manufacturers) to develop innovative solutions, while reducing risks associated with outdoor tests and considering the feedback of the vehicle passengers.The DriSMi Lab of Politecnico di Milano (https://www.drismi.polimi.it/) hosts an innovative dynamic

	driving simulator, where the cockpit of a commercial car moves throughout a 6x6-meter platform thanks to a system of cables and electric actuators. The dimensions of the simulator allow to reproduce maneuvers like lane-change in 1:1 scale.Through its innovative features, the simulator provides an immersive and realistic test environment that can be safely experienced also by non-professional drivers. This last opportunity appears of particular interest for • assessing the benefits of cooperative connected systems on the performance of advanced driver-assistance system (ADAS) and of autonomous vehicles; • developing of modifying the above mentioned systems also considering considering the feedback from common users. In this way, the final costumer can influence the development of such systems so that they can be tailored on specific profiles to improve their acceptance.
Methods and techniques that will be developed and used to carry out the research	The dynamic simulator is a sophisticated system resulting from the integration of mechanics, electronics, control systems, computer vision and real-time applications. It is essential to develop interdisciplinary skills that include multi-body system dynamics, non-linear systems, control systems, real-time applications, vehicle dynamics, tire-road interaction models, powertrain and brake system models, vibration control, acoustics. The candidate will be involved both in numerical and in experimental activities.
Educational objectives	The challenges that the candidate will have to face are both theoretical and experimental: • development of hi-fi (high fidelity) models for vehicle components (e.g steering system to enhance the driver's feedback) and sensors (e.g. lidars, cameras); • development of innovative ADAS based on a sensor-fusion approach that are able to exploit V2X communication. • development of control algorithms for automated driving possibly based on a sensor-fusion approach that are able to exploit V2X communication;

	• objective evaluation of drivers' reactions and upgrade/tailor the settings of the control systems accordingly.
Job opportunities	Being the research carried out with the state-of-the-art of driving dynamic simulators, the primary job opportunity will be in the automotive field: • automobile industry • automotive suppliers (brake systems, suspensions, powertrain) • suppliers of control systems • developers of CCAM solution Besides this, job opportunities will be with national and international academic and non-academic institutions and organizations, engaged in innovation, research and technical development. Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared to Master of Science holders in the same field.
Composition of the research group	1 Full Professors 1 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Edoardo Sabbioni, prof. Stefano Melzi

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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)	
By number of months at the company	0
Institution or company where the candidate will spend the period abroad (name and brief description)	TU Graz (or) RWTH Aachen
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
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 euro 5.707, 13. 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.