POLITECNICO DI MILANO

PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

PNRR 118 TDA Research Field: IOT AND ARTIFICIAL INTELLIGENCE TO IMPROVE WORKERS SAFETY AND PRODUCTIVITY.

Monthly net income of PhDscholarship (max 36 months)
€ 1275.0 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 growth of the construction industry is severely limited by the myriad complex challenges it faces such as cost and time overruns, health and safety, productivity and labour shortages. Construction with its inherent complexity is regarded as one of the most dangerous industries. It is greatly susceptible to a variety of unpredictable factors, such as participants in different roles, the changeable environment in large uncertainty, struck-by-equipment hazard, and others. Therefore, the construction industry tends to cause a small scale of fatal accidents with higher frequency than other domains, which is even responsible for 30-40% of fatalities worldwide. An advanced digital technology, Artificial Intelligence (AI), is currently revolutionising industries such as manufacturing, retail, and telecommunications. The world has reached a tipping point when it comes to new technologies, and these are now gaining momentum in the construction industry too. Recently, the rise of the Internet of Things (IoT) and its accompanying technologies (e.g., wearable technologies) has enhanced interest in the occupational safety and health of construction work. In addition to the growing interest in research, the European Parliament and the Italian

	government have shown great interest in this area. **The first mission of the National Recovery and Resilience Plan (PNRR) is 'Digitalisation, Innovation, Competitiveness, Culture and Tourism'. One of the components of this mission is 'M1C2 - Digitalisation, Innovation and Competitiveness in the Production System'. This research, which aims to improve the safety and productivity of the construction sector through the use of innovative digital tools such as IoT and AI, fits perfectly with the M1C2 component of the PNRR.**
Methods and techniques that will be developed and used to carry out the research	Research on topics related to the characteristic aspects of site work and, more generally, the design, planning and execution of works, will necessarily be carried out through frequent visits to construction and infrastructure sites. These visits will then be accompanied by interviews and surveys of experienced operators, with the aim of identifying the state of the art and gaps in research, as well as testing and validating the methods developed by the research. Tests will be carried out during the research, with **a six-month internship at Francesco Rigamonti &Figli in Erba (CO)**, and at the end of the research. The PhD student will also **spend a period abroad (destination to be defined) of at least 6 months** to develop the research under the supervision of another supervisor and in an international research team.The title of the research clearly illustrates the main tools that will be used in it to improve the safety and productivity of operators on construction and infrastructure sites. The impulse comes from the many applications of the Industry 4.0 paradigms, where sensors of various types are used to create a digital twin that has monitoring but also predictive capabilities, i.e. one that is able to record what is happening on the site, predict possible accidents and improve worker productivity. In this context, the creation of a cyber-physical object that collects data from sensors and processes them using artificial intelligence techniques is the cornerstone of the entire research. Research that will have to define: 1. what parameters (user behaviour) to monitor

	2. what types of sensors are best suited to be used on the site, taking into account the limitations imposed by European privacy regulations; and 3. what machine learning techniques are best suited to be used.
Educational objectives	The main aim of this PhD is to train a researcher for the extensive field of Construction Engineering. The Candidate is trained to face complex questions, to develop in-depth analysis and reliable models (theories) of complex contexts, and to innovate rules and organisations of the construction sites. Moreover, this PhD position is aimed to work as a drive system between the university and other non-academic entities, activating a continuous knowledge transfer among the involved parties.
Job opportunities	The close cooperation with a construction company and experts in the field required to carry out the activities planned for this PhD opens up a wide range of employment opportunities as an expert in construction management. In addition, the doctorate is the first step towards a career in research, either at a university or in a private research company.
Composition of the research group	0 Full Professors 1 Associated Professors 0 Assistant Professors 2 PhD Students
Name of the research directors	Prof. Fulvio Re Cecconi

Contacts
Prof. Fulvio Re Cecconi fulvio.rececconi@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	637.5 €
By number of months	0

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Francesco Rigamonti & Figli in Erba (CO)
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	To be defined
By number of months abroad	6

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

Additional support:

Budget for the research activity (only for positions supported by scholarship):
total amount Euro 5197.60 per student
In detail:
- 1st year Euro 1732.53
- 2nd year Euro 1732.53
- 3rd year Euro 1732.54

Additional information about the organization and regultions of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD:
download is available at link:
https://www.dottorato.polimi.it/corsi-di-dottorato/architettura/architettura-ingegneria-delle-costruzioni-e-ambiente-costruito

Additional information about ABC department and ABC-PhD programme:
available at link:
https://www.dabc.polimi.it/

Desk availability:
The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.