

# ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

## MUR DM 118 - Accessible and inclusive solutions for remote musical education

<b>Funded By</b>	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
<b>Supervisor</b>	ROTTONDI CRISTINA EMMA MARGHERITA - cristina.rotondi@polito.it
<b>Contact</b>	PASERO EROS GIAN ALESSANDRO - eros.pasero@polito.it
<b>Context of the research activity</b>	<p>The topic of this scholarship is the design and development of inclusive hardware/software solutions for real-time remote musical interactions aimed at enabling web-mediated music teaching and collaborative activities of musicians from distant locations, with emphasis on those with disabilities.</p> <p>Progetto finanziato nell'ambito del PNRR – DM 118/2023 - CUP E14D23001720006</p>
<b>Objectives</b>	<p>Information and communication technologies are introducing dramatic changes in the way pedagogical processes are conceived: distance education and computer-based learning have started proliferating in the last decade and are expected to further expand, thus requiring a global rethinking of the fruition modalities for educational services. Focusing on musical education, various categories of subjects would benefit from the long-term adoption of distance learning frameworks for music-related subjects. Among those, there are students with visual/auditory/mobility disabilities or special needs, for whom traditional in-presence access to musical education is difficult or even impossible.</p> <p>The topic of this scholarship is the design and development of inclusive hardware/software solutions for real-time remote musical interactions aimed at enabling web-mediated music teaching and collaborative activities of musicians from distant locations, with emphasis on those with disabilities. Such solutions will include, e.g., interfaces specifically designed to ease accessibility for visually/auditorily/mobility-impaired users, such as graphical interfaces adherent to the accessibility standards for web applications, enhanced with tactile feedbacks; interface control systems based on a camera feedback and computer vision, or on motion sensors/actuators, to</p>

enable interactions with virtual environments and/or musical instruments by means of motion tracking techniques.

It must be remarked that remote music teaching and Networked Music Performance (NMP) scenarios, where musicians play together in real-time from distance by exploiting Audio/Video (A/V) streaming over wide area networks, require latency, reliability and scalability guarantees that state-of-the-art videoconferencing solutions cannot meet. Therefore, dedicated frameworks tailored for the specific needs of NMP must be devised, also leveraging Artificial Intelligence techniques implemented via fast microcontrollers and FPGAs integrated in dedicated hardware circuits (currently already developed by the Politecnico Neuronica labs). The adoption of such ultralow-latency hardware implementations will foster the integration of Extended Reality (XR) components to address the above-mentioned accessibility requirements while paving the way for networked musical interactions in the Metaverse, to achieve novel and more inclusive forms of musical expression and foster music composition, performance, and education.

**Skills and competencies for the development of the activity**

Electronic circuits design, FPGA design and programming, advanced software programming;