

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

DM 630/TIM - Innovative Approaches to Quantum Computing for Complex Real-World Applications

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] TIM S.P.A. [P.iva/CF:00488410010]
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Context of the research activity	<p>The research project involves the development of advanced algorithms for Quantum Computing to efficiently process large amounts of data collected through the sensor network of a Smart City (as per PNRR M2C2 objective), with the aim of enabling digital applications that support human activities and provide benefits to the community and the environment.</p> <p>Progetto finanziato dal PNRR a valere sul DM 630/2024 - CUP E14D24002420004</p>
Objectives	<p>By leveraging the potential of quantum computing, the aim is to solve complex problems of predictive analysis, correlation, and optimization useful for offering innovative services that promote sustainable mobility, efficient use of energy sources, and improve quality of life, inclusion, and social cohesion.</p> <p>The research activity also aims to create proofs of concept, optimizing the installation of these "quantum-ready" algorithms on "classic" cloud infrastructures typical of a service provider to ensure the expected performance and demonstrate their applicability for offering innovative services (M1C2).</p> <p>Consistent with its objectives, the project is divided into two areas of activity, each with its own roadmap and milestones to achieve the expected results:</p> <p>a) Development of "quantum-ready" algorithms: modeling, algorithm and simulator development, computational complexity and performance analysis, scaling, and performance optimization.</p>

b) Hardware/software accelerators to solve quantum optimization problems: development of accelerators, creation of PoCs of "quantum" algorithms in an industrial context.

c) Hardware prototyping of systems based on FPGA for the characterization, control, and implementation of next-generation quantum devices and associated computation algorithms.

Skills and competencies for the development of the activity

Understanding of quantum computing principles

Knowledge and expertise in high-performance hardware-based processing systems, such as FPGAs and GPUs, along with knowledge of programming and design methods

Knowledge and expertise in semiconductor and superconductor-based quantum computing systems

Knowledge and expertise in the use of quantum computing platforms at an industrial level