Titolo: Investigating the 5G-IoT paradigm shift in wireless sensing-based measurement applications for workplace safety

Codice Progetto: 2022EKEFX8 Responsabile scientifico UNIPD: Claudio Narduzzi Coordinatore nazionale: Università degli Studi di Siena Partner-Unità di ricerca: Università degli Studi di Padova, Università degli Studi di Udine CUP: C53D23000400006 Bando: PRIN 2022 - Decreto Direttoriale n. 104 del 02-02-2022 Durata: 28/09/2023 – 27/09/2025 (24 mesi) Budget totale progetto: 273.152,00 € Budget UNIPD: 92.611,00 €

Abstract del Progetto: In the context of safety in workplaces, this project proposes the realization of a distributed monitoring system designed for operation in large worksites, based on 5G technology. New-generation low-ower, widearea network (LPWAN) technologies supported by 5G protocols significantly impact on the design and performances of distributed and/or mobile sensing applications. This requires in-depth investigation and optimization of resources, protocols and configurations, in the network as well as in the sensing nodes, to pursue the expansion of operating envelopes for mobile multi-sensor applications and, ultimately, to enhance work safety.

The proposed system will consist of a two-level network architecture. The first level comprises mobile Wireless Body Sensor Networks (WBSN) embedding specific and different wearable environmental sensors (especially devoted to the detection of toxic gas or poor air quality), smart personal protection equipment (PPEs) and devices that monitor individual worker conditions, such as exposure to vibration, biophysical conditions and inertial data. This information is managed and processed in part locally, through devices belonging to the body networks (concentrators) and in part remotely after transmission through 5G connection, to fuse data about worker state with information related to environmental monitoring and extract synthetic parameters describing workers health and risk conditions.

The project will encompass all the activities needed to exploit the information gathered by the monitoring system with the aim of improving workers' safety, both by means of reduction in accident rates, obtained by alarm generation based on continuous connection with a surveillance system, and in terms of assessing the exposure to harmful conditions, through continuous monitoring of the relevant biophysical and environmental conditions.

With these aims, a part of the project concerns the development of an advanced platform, requiring some ad hoc hardware development, exploiting low power solutions, energy management strategies, accurate but wearable or portable device design, advanced interfacing implementation. Firmware development is required to satisfy some of the constraints posed by the application, such as efficient energy management and data transmission with strict timing requirements. Alongside the hardware/firmware platform, the project will develop the edge computing software tools needed for efficient data management and transmission, the tools needed for data interpretation including signal processing, fusion of signals received from a multiplicity of different peripheral devices (sensors and smart PPE) and ad hoc artificial intelligence techniques for risk profile assessment and alarm generation.





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