**Titolo**: MuSe: Multi-Sensor wearable device for telemedicine

**Codice Progetto:** 2022WT443M

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**CUP**: C53C24001100006

**Bando**: PRIN 2022 - Decreto Direttoriale n. 104 del 02-02-2022

**Durata**: 05/02/2025 – 04/02/2027 (24 mesi)

**Budget totale progetto:** 196.420,00 €

**Budget UNIPD:** 63.164,00 €

**Abstract del Progetto:** Telemedicine represents a unique opportunity and a pervasive challenge to support active aging. Considering the constant increase in the average age, the percentage of adults over 65 in Italy is expected to rise from the current 23% of the total to about 35% in 2050, with a considerable impact on the national healthcare systems, due to significant increase in the need for professional services, social care and healthcare provision. In this scenario, it is essential to exploit the possibility to monitor elderly patients from home, without the need to frequently perform costly medical analyses in hospitals. Among the opportunities offered by new technologies and interdisciplinary research, wearable devices represent a unique tool for telemedicine thanks to their intrinsic ability to combine accurate feedback on a person's health status with ease of use and comfort [1]. Even though several wearable devices have been already proposed during the last decade, still few of them have been specifically designed for addressing the elderly as end-users. Thus, to gain acceptance of wearables as a reliable tool for telemedicine, a step ahead is required in terms of device robustness, accuracy, integration with microfluidics for sample processing, ease of use, and comfort [2].

In this picture, the present proposal addresses the design and the realization of a stand-alone wearable device to monitor hydration and health status of the elderly by exploiting a multi-sensing approach. In particular, electrodes for Bio-Impedance Analysis (BIA), sensors for skin hydration monitoring, and electrochemical sensors for ions and metabolites will be combined. Thus, they can all be miniaturized and easily integrated into a single wearable device (e.g., bracelet, patch). Portability, ease of use, accuracy of measurement, robustness, and flexibility will be primarily addressed in the design of the device. An approach based on printed electrodes interfaced with a multi-channel portable front-end will be exploited. In detail, impedance spectroscopy will be employed to quantify skin hydration, body composition, and validate sweat sample volume, while potentiometry and chronoamperometry will be employed to quantify ions and metabolites, respectively. Laboratory characterization of each of the sensors will be performed to assess their metrological characteristics. After that, the design of the portable front-end will be addressed, integrating electronics for signal processing and wireless data transmission. In vivo tests will be then performed, exploiting both exercise-induced and natural sweat sampling. All obtained results will be compared with those collected using certified instrumentation. The final aim will be to implement a prototype of a stand-alone low-power device able to upload in real-time the logged data on a dedicated remote cloud platform and to provide warning alarms of critical situations when defined thresholds for the target analytes are overcome.