

Title: *Wearable Computing Systems based on Body Sensor Networks: State-of-the-art and Future Research Challenges*

Prof. Giancarlo Fortino,

University of Calabria, Italy

g.fortino@unical.it

Abstract:

Wearable computing is a relatively new area of research and development that aims at supporting people in different application domains: health-care (monitoring assisted livings), fitness (monitoring athletes), social interactions (enabling multi-user activity recognition, e.g. handshake), videogames (enabling joystick-less interactions), factory (monitoring employees in their activity), etc. Wearable computing is based on wearable computing devices/interfaces such as sensor nodes (e.g. to measure heart rate, temperature, blood oxygen, etc), common life objects (e.g. watch, belt, etc), smartphones/PDA.

Wearable computing has been recently boosted by the introduction of body sensor networks (BSNs), i.e. networks of wireless wearable sensor nodes coordinated by more capable coordinators (smartphones, tablets, PCs). Although the basic elements (sensors, protocols, coordinators) of a BSN are available (already from a commercial point of view), developing BSN systems/applications is a complex task that requires suitable design methods based on effective and efficient programming frameworks.

In this DL, we will first discuss the state-of-the-art of currently available wearable computing systems based on BSNs. Then, we will focus on the main results achieved in the SPINE project (<http://spine.deis.unical.it>), currently led by Prof. Fortino's research group, in terms of defined models, methodology, algorithms and real prototypes (e.g. activity/gesture recognition systems, fall detection systems, mobile ECG processing systems, elbow/knee rehabilitation systems, emotion recognition systems, etc.).

Based on SPINE, we also developed C-SPINE to support the development of collaborative systems based on BSNs and able to detect/classify multi-user activity. Examples will be given in the area of COVID-19 tracing and support platforms.

Finally, the DL will enumerate and discuss future research challenges along possible solutions in such exciting research domains.

Learning points:

- Body sensor networks: sensors (physiological sensors, inertial sensors, pressure sensors), architectures and communications patterns/protocols
- Body sensor networks programming and management issues
- The SPINE (Signal Processing In-Node Environment) framework: basic concepts (sensors hardware adaptation, drivers addition, sensors programming, data collection, in-node data processing)
- SPINE wearable sensor-based prototypes: from Human Activity recognition to Cardiac Defense Response detection and Limb Rehabilitation.
- C-SPINE for the Development of Collaborative BSNs and its application for humans' tracing/distancing platforms
- Future research challenges in BSNs: from wearable stretchable sensors to autonomic sensor platforms