Smart Technologies in the workplace: the sustAGE solution

V. Loutsetis[1*], T. Papadopoulos[1], M. Maniadakis[1], I. Varlamis[1,2], M. Pateraki[1], M. Lourakis[1#]

[1] Institute of Computer Science, Foundation for Research and Technology-Hellas, Greece

[2] Department of Informatics and Telematics, Harokopio University of Athens, Athens, Greece

Presenting author: M. Lourakis, email: lourakis@ics.forth.gr

* Corresponding author: V. Loutsetis, email: lutsetis@ics.forth.gr

ABSTRACT

The prevalence of health problems and impairments with increasing age, combined with the acceleration of population ageing, has significant financial and social implications. The prevention and appropriate handling of health conditions of ageing individuals is necessary to accommodate an ageing workforce, considering in addition to ageing work-related factors that may intensify health problems. Recognizing the importance of healthy workplaces, smart technologies can promote reactive working environments that provide appropriate and timely person-centric recommendations, act preventively, mitigate health risks, improve occupational safety and health and support decision making related to task/job role modifications. Motivated by the above observations, this work presents the building blocks of a person-centered smart solution, which is being developed in the framework of the European H2020 project sustAGE (www.sustage.eu). The sustAGE solution will be deployed in two industry domains with significant challenges and requirements, specifically (1) car assembly manufacturing and (2) container vessel operations at a port. These domains include tasks involving both manual labor and cognitive workload, as well as exposure to harsh working environments which may induce health risks.

The developed system functionalities build upon an IoT ecosystem based on off-the-shelf sensors integrated in everyday devices and in the work environment, considering both indoor (manufacturing) and outdoor (port docks) working conditions. The system gathers contextual information from the working environment and from the users' physiological signals, tasks, activities, and behavioral patterns, in order to support user profiling and provide personalized recommendations for better managing health, wellness and safety. The sustAGE technology considers information-rich micro-moments in order to process the short- and long-term aspects of human-computer interaction, identify patterns of human behavior, draw correlations between actions, predict what humans do and do not want, improve user's acceptance, and engage users in a successful long-term interaction.

The basic IoT ecosystem comprises of a number of different sensors. Environmental sensors are used for measuring air temperature, humidity, air quality, pressure, dust concentration and noise based on Raspberry Pi/Arduino custom sensors that are open source, low cost, accurate, and durable. Cameras installed in key working areas are used for monitoring stressing body postures during repetitive user actions in the case of the manufacturing indoor scenario, and the position of workers involved in loading/unloading of containers in relation to people and heavy objects moved by the crane operators in the case of the port outdoor scenario. Additionally, localization sensors (e.g. beacons) as well as sensors embedded in wristwatch and smartphone devices are also employed. An open source IoT platform is exploited with ready-to-use field protocols, supporting wireless and wired IoT networking technologies and MQTT connectivity for publishing data and events along with HTTP SSL/TLS protocols to ensure the privacy of established connections. The system supports raw data processing near the end-devices to prevent potentially privacy-sensitive information from being sent to the upper layers of the platform in the cloud. Ingested measurements from sensors and low-level components of the system are then abstracted and summarized from higher level components into meaningful representations or micro-moments. These allow to contrast past and current states and reveal abnormalities towards more effective, context-aware recommendations integrating temporal aspects.