Editorial: Wearable and Implantable Electronics for the next Generation of Human-Machine Interactive Devices

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Editorial on the Research Topic

Wearable and Implantable Electronics for the Next Generation of Human-Machine Interactive Devices

This research topic highlights emerging technologies related to Human-Machine Interface (HMI), such as machine learning, neural interfaces, and other novel electronics in the form of wearable and implantable devices that can create a seamless link between humans and intelligent systems. With over 25 authors’ contribution, five Original Research articles and one Mini Review has been published on this topic. The topic has attracted ample attention. As shown in Figure 1 below, at the time of writing, there have been 4,437 total views, 2,449 article views, and 310 article downloads recorded across the globe.

The published articles cover several topics and can be combined in three broad categories, with their findings and highlights listed as follows:

WEARABLE AND ASSISTIVE HMI SYSTEMS:

Son and Weiland proposes a new wearable system that can safely guide blind or visually impaired (BVI) individuals through crosswalks. Compared to prior studies that only detect crosswalks or classify signs, the light-weighted wearable device can localize BVI users into the map with the prior maps approach, while providing verbal instructions assisting road crossing in real-time. With brief training, all three BVI participants could use the system to navigate a crosswalk safely and successfully.

Yang et al. presents BodyWire for human body communication (HBC). Unlike previous works, where communication is between Earth ground devices and wearables, BodyWire connects two wearable devices using an electro-quasistatic technique. Using the HBC prototype developed, through-body interhuman channel loss is characterized for the first time. In addition, the smallest FOM factor HBC is also demonstrated.

Chen et al. Cleaning robots could be the new workforce in the labour-intensive janitorial industry. Through a video-based survey from 117 participants, this study investigates humans’ reaction and acceptance level to potentially large-scale commercial-grade cleaning robots operating nearby. It provides insight into future robot designs for the next generation of cleaning robots that can harmoniously coexist with surrounding humans.
BIOMEDICAL INSTRUMENTATION FOR HMI:

Liu et al. Due to safety reasons, charge balancing is critical to the neural stimulator. The proposed design uses a synchronous charge detection that features a current splitter and a short-time pulse insertion module to output ultra-small compensation current towards charge balancing. The measurement has shown that with the proposed technique, the residual charge remaining on the electrode-tissue interface is only 0.95 nC.

Gao et al. The number of wireless sensor nodes (WSNs) has increased significantly due to the industrialization of wearable electronics. Conventional battery-based powered systems no longer satisfy the requirement of large-scale WSNs in terms of battery life, leading to increasing demand for energy harvesting (EH) techniques. This mini-review article summarizes the current state-of-the-art EH techniques and future trends in the EH research.

FLEXIBLE MATERIAL FOR WEARABLES:

Khan et al. presents a comparative study on the treatment techniques for fine-tuning the surface of different polymeric substrates. On top of the two conventional methods, namely the oxygen plasma and ultraviolet ozone techniques, a new method based on surface cleaning liquid is also evaluated. Results show that the new process is advantageous in various aspects.

To conclude, we, the topics editors, would like to take this opportunity to thank all the reviewers for their invaluable effort and time devoted to our interactive review process and the Frontiers in Electronics team for their advice and support. We also want to thank George Smith from the Frontiers in Electronics team for his outstanding administrative assistance along the way. Finally, we wish you a fruitful and prosperous 2022!

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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