

A Design Framework for Cyber-Physical-Human-Systems

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Abstract. Cyber-physical-human systems (CPHS) represent significant extensions of cyber-physical systems (CPS) to include aspects of human interactions and usage. A class of CPHS of interest here is smart products that offer services to their customers, supported by back-end systems (e.g., information, finance) and other infrastructure. We argue that although the domain of CPS relies on engineering and computer science as its foundations, the emerging field of CPHS does not have an underlying scientific foundation. Transdisciplinary teams of researchers are needed to integrate the engineering, computing, and human behavioral fields that are central to CPHS to develop new foundational theory and methodology. Furthermore, a new design methodology is needed for CPHS, given the transdisciplinary nature of the field, that anticipates human acceptability and usability considerations as well as emerging behaviors that result from human-system interactions. In this paper, we propose a framework for such a design methodology. The domain of assistive and rehabilitation technology is used in this paper to provide an example field of practice that could benefit from a systematic design methodology. A CPHS design example is provided to illustrate the application of the methodology framework.

Keywords. Cyber-physical-human system, design methodology, emergent behavior, usability, acceptability

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