

Wireless Sensing and Control of Actuation for Machines and Humans

Nenad Jovičić

Abstract—To a greater or lesser extent, wireless sensors and control systems have been used for decades in various areas of life and work. First implementations in the industry were intended for reliable transmission of simple remote control commands. Manipulating machines without complicated wiring has encouraged the creation of many ideas for applying wireless technologies in biomedical engineering. However, biomedical systems were often unpredictable, the operation in the environment in which they were applied was not always controllable, and as it turned out that simple technology transfer between industry and human applications was not trivial, sometime even inappropriate.

Expansion of consumer market and development of computer networks and mobile telephony in the last decades led to the rapid growth of many wireless standards resulting in broadband, narrowband, personal, local, global, and other wireless technologies. The development of technology gives a new impetus to its applications in industry and afterward in life sciences and medicine.

The talk is a retrospective of historical, past, present, and future challenges faced by wireless systems used in industry and biomedicine. Typical industrial and biomedical applications will be analyzed where different parameters like high bandwidth, low latency, or high energy efficiency are essential. Insights on how new wireless standards enable us to apply modern methods of big data processing, cloud computing, and artificial intelligence will be given. The special attention will be put on the bottlenecks in domains of security and reliability.

Finally, the theoretical analysis will be supported by two examples of use of Wi-Fi wireless communication, on one industrial and one biomedical system.

Index Terms—wearable system, wireless communication, industry, biomedicine, standards, security, reliability