From Lab on a Chip to Point of Care Devices: The Role of Open Source Microcontrollers

Microcontrollers are programmable, integrated circuit chips. In the last two decades, their applications to industrial instruments, vehicles, and household appliances have reached the extent that microcontrollers are now the number-one selling electronic chip of all kinds. Simultaneously, the field of lab-on-a-chip research and technology has seen major technological leaps towards sample handling, sample preparation, and sensing for use in molecular diagnostic devices. Yet, the transformation from a laboratory based lab-on-a-chip technology to actual point-of-care device products has largely been limited to a fraction of the foreseen potential. We believe that increased knowledge of the vast possibilities that becomes available with open source microcontrollers, especially when embedded in easy-to-use development environments, such as the Arduino or Raspberry Pi, could potentially solve and even bridge the gap between lab-on-a-chip technology and real-life point of care applications. The profuse availability and extraordinary capabilities of microcontrollers, namely within computation, communication, and networking, combined with easy-to-use development environments, as well as a very active and fast moving community of makers, who are eager to share their knowledge, could potentially be the difference between a dreadful “chip-in-a-lab”-situation, and the next successful start-up. Here follows a brief insight into how open source microcontrollers could potentially have a transformative effect on the field of lab-on-a-chip research and technology. Details in some specific areas of application are briefly treated before addressing challenges and future perspectives.