OPTIMAL CONTROL FOR MULTIDIMENSIONAL MICROSCOPY

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Today, in optical microscopy, it becomes essential to increase the capacity of microscopes in terms of acquisition speed to suit the needs of different actors in this field, especially biologists. This ability allows to track dynamic events observed in live specimens or to increase the quantity of image flow coming from microscopes. Therefore, there is a challenge of optimizing the multidimensional image acquisition speed (time, Z, wavelength, XYZ positions...).

Many software solutions exist to control different devices during a multidimensional acquisition process, but they have several limitations: (i) the device controlling process is centralized, which means that all signals between hardware and software are managed by a computer CPU that manages also an operating system and many other things, the CPU cannot completely focus entirely on multidimensional acquisition process; (ii) in order to communicate with a device, the acquisition software calls a software driver of that device which represents a required link that allows communication to take place. There is no direct link between both sides generating a delay and the software driver which is directly dependent on OS version has to be constantly upgraded; (iii) during a multidimensional acquisition process managed by a software, communication between the software and all devices is sequential, the software cannot communicate with two or more devices in parallel.

To deal with these limitations, we have developed a new technology that increases image acquisition speed during a multidimensional acquisition process by optimizing the communication between the different devices of a microscope. This technology is based on an innovative principle which relates to a method for controlling a plurality of functional modules included in a microscopy imaging device [1]. In details, it consists in communicating with the different microscope components outside the computer in a parallelized bidirectional asynchronous communication. The implementation is based on a microcontroller entirely dedicated to multidimensional acquisition process. It has a library of functions allowing communication with many devices with possibility to add many others. The communications do not require any device software driver to operate and provides various types of interfaces (COM, TTL, and USB) with the possibility to add many others. The system controls optimally many different devices during an acquisition sequence with its principle of parallel management based on state machine.

Reference: