

Automation algorithms for microfluidic operations and cell analyses

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Category: In-house

Project description

Microfluidics is a relatively new technology emerged in the past two decades. This technology focuses on the technical approaches handling fluidics samples and phenomena in the micro-meter (10^{-6} m) scale. The foreseeable significant applications of microfluidics opened doors in a wide range of biomedical applications (e.g. bio-sample analysis and drug delivery). Fluidigm Co., Advanced Microlabs LLC and Advanced Liquid Logic Inc. are examples of recently established international microfluidics-based companies. Clearly, microfluidics has been creating tremendous potentials in the future market worldwide.

Here we have planned to apply a software package to automate and optimize the microfluidic operations (e.g. liquid manipulation and image processing) and further the cell analyses using our existing microscope system as shown in Fig. 1. While the hardware instrumentation will be provided by the supervisor, the selected students will need to develop a function set to achieve particular microfluidic goals: (1) liquid delivery within microfluidic devices, (2) automated microscopic imaging and video capturing, and (3) post-processing and quantification of the images/videos. The integrative knowledge of various engineering aspects involved in this project can upgrade the student's insights to general engineering problems.

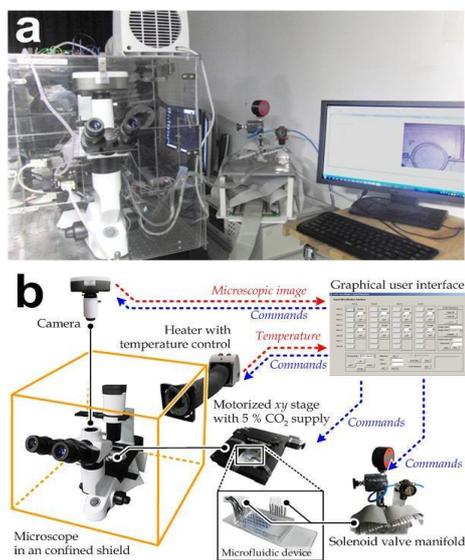


Figure 1. (a) Photograph and (b) schematics of the automated microscope system.

Preliminary sub-tasks

The followings are very brief tasks breaking down the overall objective into multiple achievable sub-goals. They are yet unconfirmed, but are listed to provide an idea of what the works are about.

- Image acquisition for the microfluidic components using a microscopic camera.
- Feature extraction of the acquired images using image processing techniques.
- Correlate the dynamics of the image features with the device performance.
- Design and implement operation strategies to control the microfluidic operations.

Technical contents

These are the components that the students are expected to acquire (mainly provided by the supervisor), therefore only minimal or no prerequisite knowledge of the candidate is required.

- Basic solid mechanics, fluid mechanics, and heat/mass transfer.
- Interface programming using C++ (for the communication between a computer and its external devices)
- Graphic user interface developed using Visual C++
- Image analysis and processing techniques

Students are welcome to contact the supervisor for details of the project.