VIETNAM NATIONAL UNIVERSITY, HANOI
University of Engineering and Technology
Faculty of Electronics and Telecommunications

2021

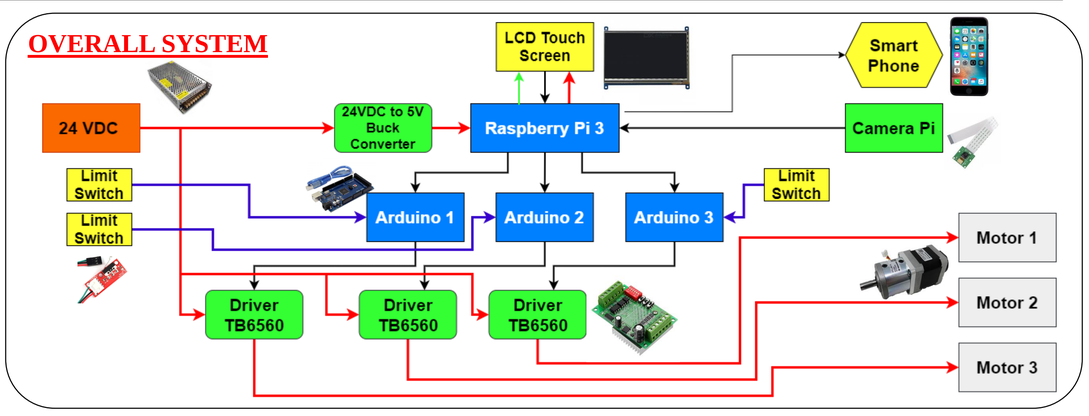
An automatic microinjection syringe pump for biomedical applications

Nguyen Dinh Duong – QH-2018-I/CQ-R
Nguyen Phuc Vinh – QH-2019-I/CQ-R
Tong Tran Hoang – QH-2017-I/CQ-ĐA-CLC

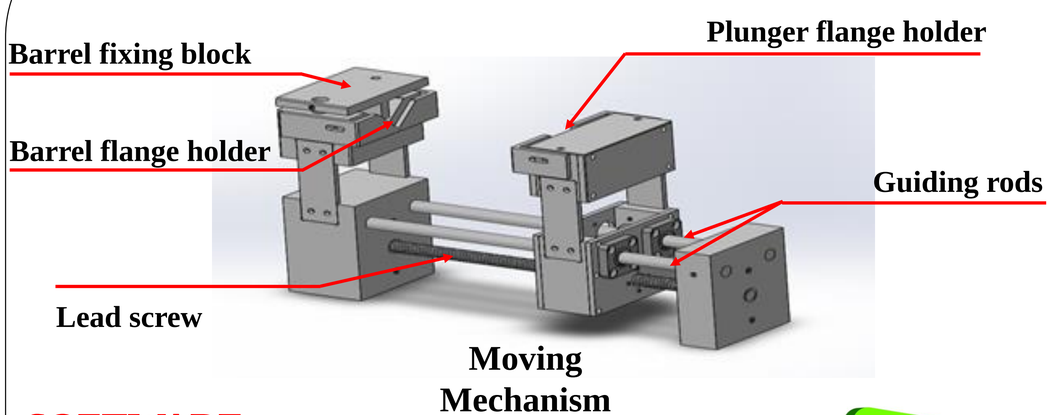
ABSTRACT:

- A microfluid pump designed and built entirely from the ground up, from the controlling algorithm to the mechanical parts choice, based on a commercially available system.
- The system can withdraw and infuse, or conducting the process of infusing and then withdraw immediately and automatically, and vice versa
- Use Raspberry Pi to allow communication between the touchscreen for displaying the interface to the users, and the Arduino microcontroller tasked with sending command to the stepper motor driver.
- A Raspberry Camera is connected serially to the Raspberry Pi, and by running a script in the background, allowing the user to see the live feed of the system in real time.
- Performances of the microfluid pump have been investigated by drawing comparisons between the commercial machine and ours in terms of time and accuracy.

OVERALL SYSTEM



MECHANICAL COMPONENTS

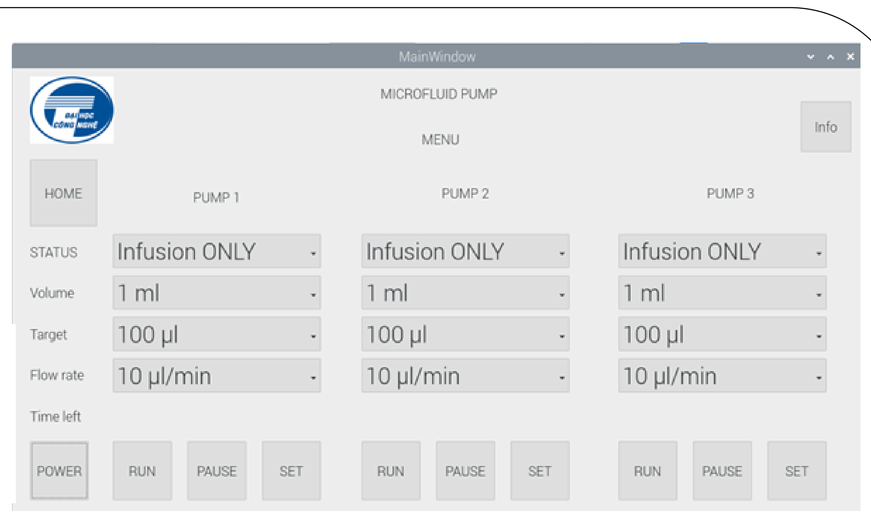


SOFTWARE

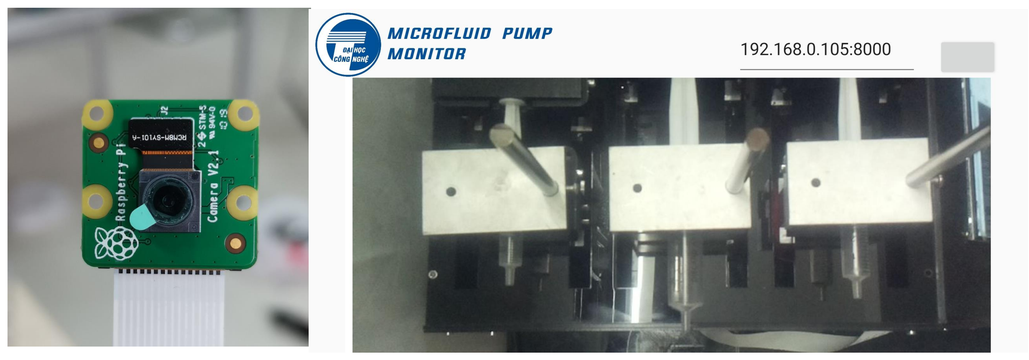
- Controlling program and algorithm are implemented using Arduino IDE and Qt Creator
- Raspberry Pi is programmed using Python and the application was developed using Android Studio

INTERFACE

The interface is written using Python that runs as a script on the Raspberry Pi

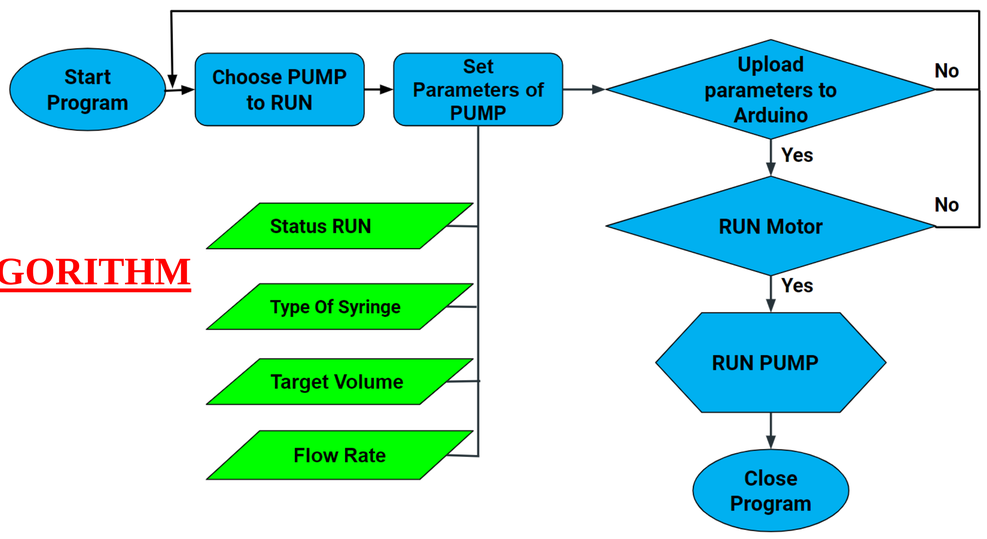


ANDROID MONITORING APPLICATION



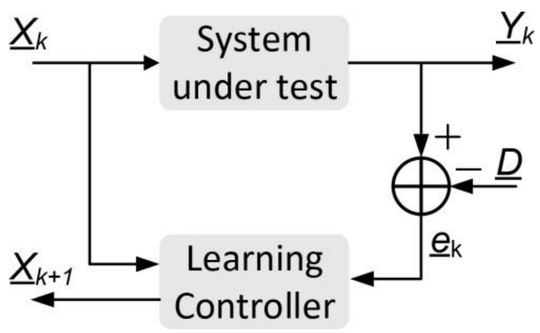
The application accesses the camera stream via the IP address of the Raspberry Pi

ALGORITHM

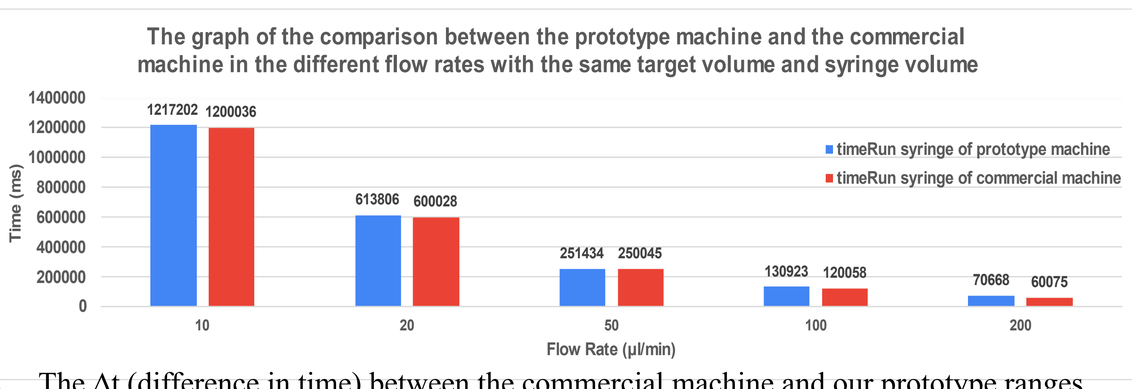


ITERATIVE LEARNING CONTROL

ILC utilize the situation that the system to be controlled will carry out the same operation several times.
It will then be possible to gradually improve the performance of the control system by using the results from one operation when choosing the input signal for the next operation.

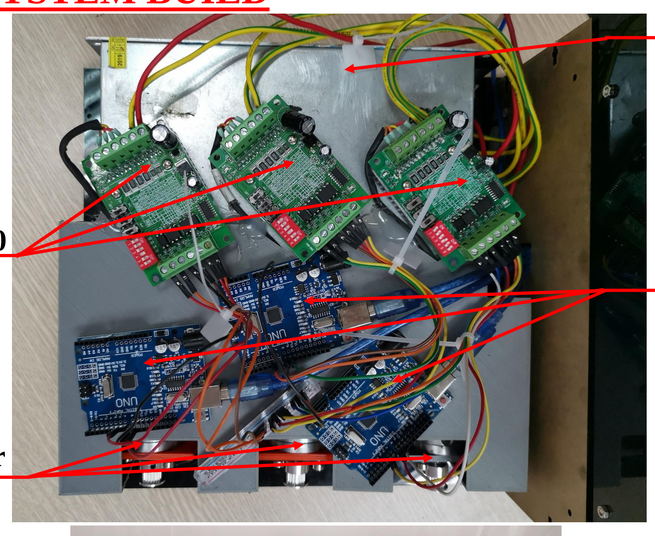


MEASUREMENT RESULTS



The Δt (difference in time) between the commercial machine and our prototype ranges from a maximum of 17 seconds at 10µl/min to 600 milli-seconds at 200µl/min.

COMPLETED SYSTEM BUILD



Advisor: Dr. Nguyen Ngoc An
Co-advisor: Post-grad student. Tran Thanh Hang

Address: E3 building, 144 Xuan Thuy road, Cau Giay district, Hanoi, Vietnam
Tel.: +84-24-3754 7461. Website: http://www. uet.vnu.edu.vn