GW researchers designed a completely automated, handheld smartphone controlled microfluidic liquid handling system. This is compatible with your microfluidic chip and application of choice. The intensive liquid handling steps required for biological sample preparation and assay automation can be a bottleneck in assay throughput. This small, handheld, easy to use point of care device can replace traditional bulky laboratory scale liquid handling systems or time-consuming human run procedures. The prototype created has applications in point-of-care medical diagnostics, environmental testing, food safety inspection, biohazard detection, and biological research.

The system uses a single pneumatic pump to provide multiple pressure sources stabilized by feedback control. One pressure source can operate a chip’s elastomeric valves while other ones drive liquid flow. Power consumption is minimal, enabling the system to run on a battery for up to 9 hrs. The associated smartphone app uses simple commands to move liquid samples within the device.

The inventors demonstrated a simulated immunoassay liquid handing protocol on a PDMS device automated by the handheld instrument and controlled by a Galaxy SIII smartphone. Combining this system with the any standard sensor will result in a fully automated in-vitro diagnostic device in the palm of your hand.

Applications:

- Point-of-Care medical diagnostics (immunoassay, PCR, flow cytometer, microarray etc.)
- Biochemical and Environmental sample processing
- Automated lab-on-a-chip
- Drug discovery

Advantages:

- Uses only one micro pump, but generates multiple stable pressure levels
- Low power consumption
- Small size (~829 gm)
- Able to manipulate liquid volumes as low as 10 pL
- Applicable for both pressure driven microfluidics and elastomeric microfluidics
Inventors

Baichen Li

Department of Electrical and Computer Engineering, George Washington University

Zhenyu Li

Department of Electrical and Computer Engineering, George Washington University