**Droplet actuator system for molecular diagnostic applications**

# ABSTRACT

In biological research, significant human effort is required to perform routine liquid handling operations. For this reason, obtaining clinical results from a laboratory can take days. Recently, advances in point of care “lab-on-a-chip” systems have allowed more efficient sample analysis. Such systems often operate by automated manipulation of discrete droplet of liquid, which provides increased throughput, reproducibility, accuracy, and configurability. A variety of techniques have been developed to achieve droplet actuation, including digital microfluidics, surface acoustic waves, and texture ratchets. In this work, a novel droplet actuation system is presented which offers applications for molecular diagnostics. The system utilizes a motor-driven platform to manipulate droplets on a patterned hydrophilic and superhydrophobic surface. The design, operation, and capabilities of the system are presented. The results show that the system is able to perform the basic fluidic operation required for sample processing, including merging, mixing, dispensing, and splitting. These operations are used to demonstrate a colorimetric glucose concentration assay on the platform to analyze sheep serum samples. The accuracy of this experiment compares favorably with the gold standard spectrophotometric method, showing ~1.5% error in measured glucose concentration. These results suggest that the droplet actuator is a promising system for automating biological assays, especially when considering the low cost (~$200) and simple fabrication procedure.