Title: Wireless powered thermo-pneumatic micropump using frequency-controlled heater

Author/Authors: Peisong Chee, Marwan Nafea M. M., Peiling Leow, Mohamed Sultan Mohamed Ali

Abstract: This paper reports a novel, wirelessly powered micropump based on thermo-pneumatic actuation using a frequency-controlled heater. The micropump operates wirelessly through the energy transfer to a frequency-dependent heater, which was placed underneath the heating chamber of the pump. Heat is generated at the wireless heater when the external magnetic field is tuned to the resonant frequency of the heater. The enclosed air in the chamber expands and forces the liquid to flow out from the reservoir. The developed device is able to pump a total volume of 4 ml in a single stroke when the external field frequency is tuned to the resonant frequency of the heater at the output power of 0.22 W. Multiple strokes pumping are feasible to be performed with the volume variation of ~2.8% between each stroke. Flow rate performance of the micropump ranges from 1.01 µL/min to 5.24 µL/min by manipulating the heating power from 0.07 W to 0.89 W. In addition, numerical simulation was performed to study the influence of the heat transfer to the sample liquid. The presented micropump exclusively offers a promising solution in biomedical implantation devices due to its remotely powered functionality, free from bubble trapping and biocompatible feature.