A Handheld Hematology Analyzer Using Acoustic Enhanced Blood Smear Devices

Liu, Vick

Blood analysis is a primary test for disease diagnostics. Most conventional blood analyzers are expensive and bulky, limiting their use in clinical central laboratories. In this project, I developed a method to turn any smartphone into an inexpensive handheld analyzer that can concentrate and separate white blood cells (WBCs) from red blood cells (RBC), followed by automatic cell morphology recognition and cell counting using a cell image analysis software. The handheld analyzer consists of: 1) an acoustic enhance blood smear microfluidic device that has been successfully developed to concentrate and separate WBCs from red blood cells (RBCs). The microfluidic device, designed based on microvortex technology, was fabricated using soft lithography technology and consisted of pockets that were used to store air bubbles to generate microvortex force, which concentrated and separated blood cells around the air bubbles in the microchannel. By concentrating WBCs in a small area, it took far less time to analyze a blood sample on this device than on a conventional blood smear; 2) a smartphone-based handheld microscope (both 30x and 100x) that was used to take images of blood cells, which were then analyzed using automatic cell image processing programs to recognize and count blood cells. This handheld hematology analyzer was inexpensive with a total cost of $29 (excluding the smartphone cost). The analyzer has a potential to change how blood test is performed and save tens of thousands of lives in developing countries that need simple and inexpensive devices for blood tests to diagnose diseases such as Malaria.

Awards Won:
Third Award of $1,000