Frugal Biomedical Innovations Research Internships
Summer Projects 2023

Low Cost Remote Pulse Oxymetry Systems

Supervisors:

Dr. Michael Rieder, Robarts Research Institute
Dr. Ehsan Kamarn
Dr. Abdelbaset Elzagallai

Location of Study Robarts Research Institute

Project Description

This project is to continue our pilot work in developing robust small wireless pulse oximetry systems to provide continuous real-time readouts of blood oxygen content in mammalian systems including humans with a focus on children and infants. Determination of blood oxygen content is an important part of clinical care and also research studies. Current systems are primarily conducted using technology wired to dedicated and expensive monitors. Our work will establish a low cost point-of-care device for use in remote, rural and resource-constrained settings. This project is an extension of previous work establishing the hardware and software for system development to enable data to be collected on conventional laptop/desktop computers or mobile devices.

Skills Necessary

Familiarity with 3D printing, software development and prototype design

Non-Invasive Characterization of White Blood Cells

Supervisors:

Dr. Michael Rieder, Robarts Research Institute
Dr. Ehsan Kamarn
Dr. Abdelbaset Elzagallaai
Dr. Alejandro Lazo-Langer

Location of Study: Robarts Research Institute

Project Description

This project is to continue our pilot work in developing robust non-invasive wireless systems to characterize and count white blood cells with a focus on children and infants. Determination of white blood cell count is an important part of clinical care. Currently this is done by collecting blood using a needle, collecting the blood in a specialized tube, sending this tube to a laboratory when the white blood cells are separated and counted and then the result is sent back to the clinic or Emergency Department. This process is painful for the patient, time consuming for the clinician and significantly limits the availability of testing notably in remote or resource limited settings. We propose to address this issue by developing non-invasive systems for characterization of white blood cells. We propose to develop a system to direct light across the fingernail capillary bed which will generate images captured by a sensor on the other side of the fingernail. The images will be compared to an image library using software designed to characterize the number and type of white blood cells, which can then be read immediately in real time on a mobile device via wireless signal transmission. Our work will establish a low cost point-of-care device for use in remote, rural and resource-constrained settings. This will greatly increase diagnostic capacity in rural and remote settings and in urgent and emergency care settings.

This project is an extension of previous work establishing the hardware and software for system development to enable data to be collected on conventional laptop/desktop computers or mobile devices.

Skills Necessary

Familiarity with 3D printing, software development and prototype design

Open source 3D printed adaptive aids

Supervisors

Dr. Joshua Pearce, Electrical & Computer Engineering, Thompson Centre for Engineering Leadership and Innovation, and Ivey School of Business Project

Dr. Jacob Reeves, Thompson Centre for Engineering Leadership and Innovation

Project Description

Previous work has shown that distributed manufacturing with 3D printing radically reduces adaptive aid product costs, which makes them much more accessible to elderly. This project will build on this past work and create extensions of previous designs like walkers (i.e. converting to a rollator that would focus on wheel design and integration). Students will select from a list of requests for those that need products to assist with aging at home. They will then search the literature for standards, then design, 3D print, build, and test the limitations of their design and iterate until the standards are exceeded.

Skills/Experience Necessary

1-2 qualified engineering students will have past mechanical design and CAD experience. Ideally in parametric CAD packages like OpenSCAD, FreeCAD, or OnShape. 3D printing experiences is also beneficial.

Open-source bioreactor applications

Supervisor

Dr. Joshua Pearce, Electrical & Computer Engineering, Thompson Centre for Engineering Leadership and Innovation, and Ivey School of Business Project

Project Description

A bioreactor provides a controlled environment to ensure ideal growing conditions for organisms like bacteria and yeast. Enzymes, plant or animal cells, and microorganisms need specific environmental conditions within bioreactors to produce the desired output of organic material. The pharmaceutical industry uses bioreactors to create medicines, vaccines, produce antibodies and even food. Proprietary bioreactors are extremely expensive and rigid in what they allow users to do with them. This makes the innovation cycle slow and inequitable as those without financial resources simply do not have access to them. To overcome these challenges, our group has designed an open source bioreactor library. This project will involve selecting design specifications, build and test a new open source bioreactor using the library as a base and then apply it to applications that benefit human health.

Skills/Experience Necessary

1-2 qualified students will have either a Biomedical Engineering, Chemical Engineering, or Electrical or Computer Engineering and control systems background, be a persistent problem solver and an enthusiastic team player (joining the Free Appropriate Sustainability Technology (FAST) Research Group). Generally FAST members are in the top 10% of their class in GPA. The ideal candidate(s) would have previous experience with bioreactors.