



# **Biomedical Engineering Projects - 2014/2015**

Department of Electronic and Telecommunication Engineering

University of Moratuwa



## Study of endothelial function by non-invasive monitoring at the fingertip

**Supervised by: Dr. Anjula C. De Silva**

Team members

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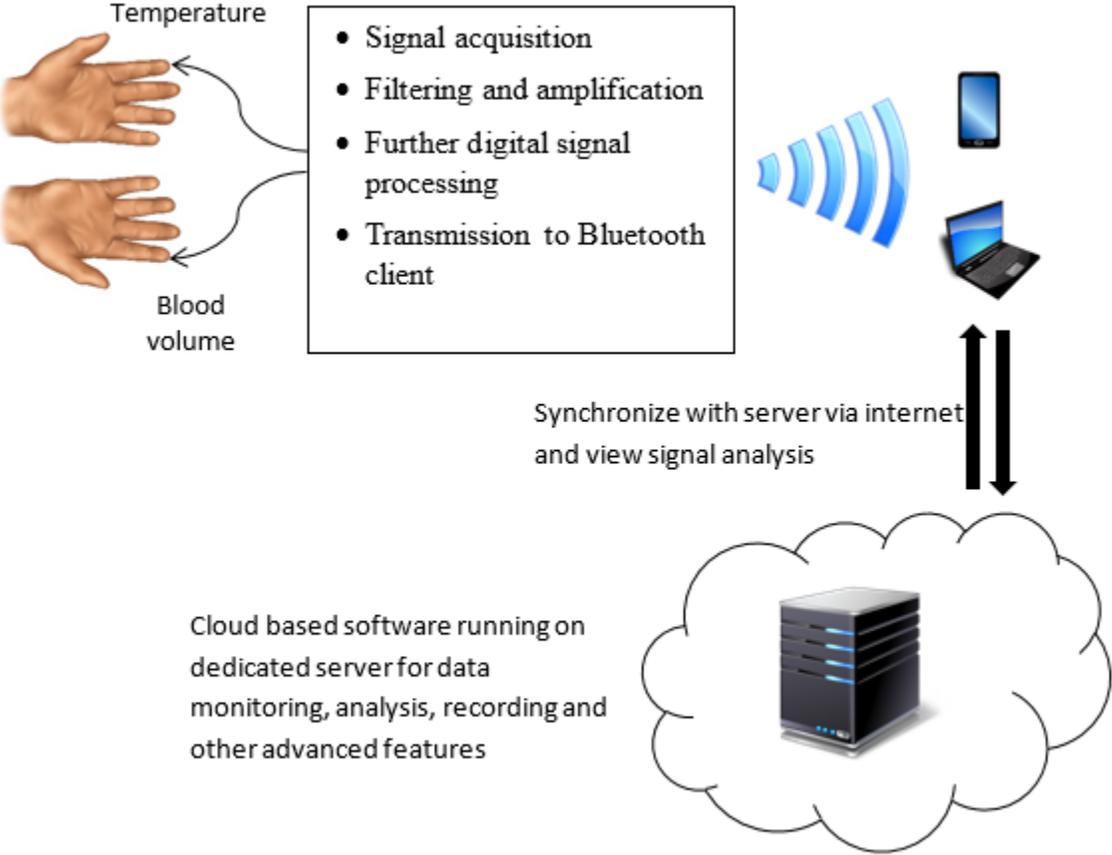
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*Collaborator:* Prof. Saroj Jayasinghe (Department of Clinical Medicine, Faculty of Medicine, Colombo)

The endothelium is a highly active monolayer of cells which forms the interior of blood vessels and plays a key role maintaining vascular homeostasis. Endothelial dysfunction systemic pathological state of the endothelium, which is well known as the indication of early stage formation of atherosclerosis (plaque formation and hardening of the arteries) . Plaque rupture can produce blood clots that block the arteries finally leading to thrombosis in coronary arteries (myocardial infarction or heart attack), carotid arteries (stroke), renal arteries (chronic kidney diseases) and in peripheral arteries (usually legs). Studies have also indicated the importance of endothelial dysfunction in the pathogenesis of dengue and leptospirosis (rat fever) , both of which are common diseases in Sri Lanka. A device which identifies and quantifies endothelial dysfunction may have a predictive value in diagnosing severe disease states of these infections. Moreover, since endothelial dysfunction is reversible, its early detection and quantification may have greater therapeutic and prognostic value. Methods to study endothelial dysfunction range from invasive methods such as coronary endothelial function testing and venous occlusion plethysmography to non-invasive methods such as brachial artery reactivity test, peripheral artery tonometry, pulse wave analysis, pulse contour analysis with digital volume pulse and digital thermal monitoring . The focus of this research is the development of a methodology to study endothelial dysfunction by thermal monitoring at the fingertip, which has shown promising results and is non-invasive in nature.

Expected outcomes: A device that measures blood volume and temperature signals at the fingertip and measure the health of endothelial function, an analysis of these signals to identify correlations with endothelial function



## Rapid diagnostic evaluation of hearing impairment in newborn infants using Auditory Evoked Potentials

**Supervisors:** Dr. Anjula C. De Silva and Dr. Nuwan Dayananda

Team members

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2 to 4 of every 1000 births affected by hearing loss in developing world .Without early intervention, children with hearing loss will show irreversible deficit in communication, psychosocial skills and literacy Auditory stimuli during the first 6 months of life are critical for the development of speech and language skills .AABR is a very effective method of screening auditory neuropathy in newborns which is recommended by the UNHS program.

Expected outcomes:

- Hardware implementation of a ABR acquisition system.
- Implementation of a fast stimulus delivery method.
- DSP/FPGA implementation of an ABR extraction algorithm with automatic peak detection.
- Perform a clinical study to validate functionality.



# Analyzing Gait in Lower Limb Amputees Using Inertial Measurement Units

Supervised by : Dr Pujitha Silva

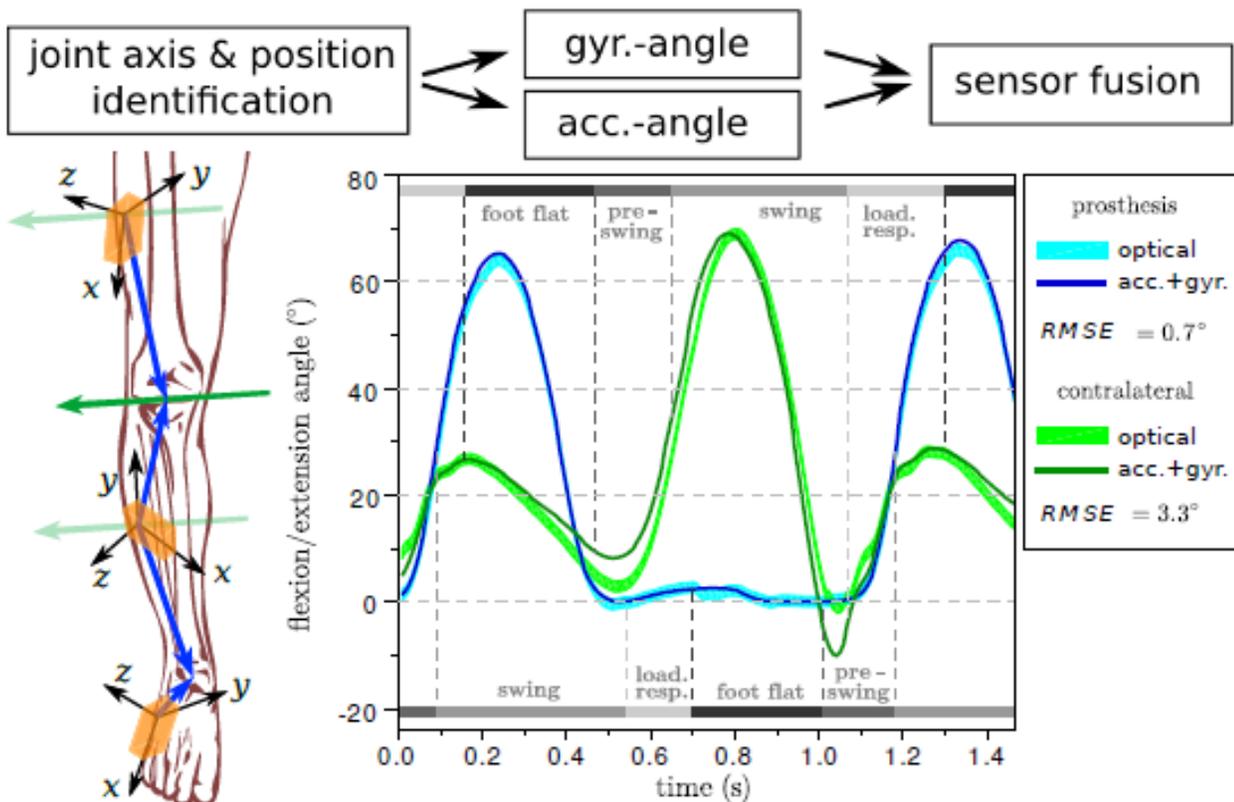
Team members:

- L.A.I.P Lihinikaduarachchi
- R.S.A Rajapaksha
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- K.M.V.R. Senevirathne

Lower limb disorders and amputations are common causes for abnormalities in human gait patterns. Currently recognizing these gait disorders at an earlier stage and carrying out rehabilitation process is mainly done by prior experience of the physician. The Inertial Measurement Units based Human Gait Analysis System, done in collaboration with SLSPPO (Sri Lanka School of Prosthetics and Orthotics) provides a more scientific way of identifying and monitoring Gait disorders in clinical study of Prosthetics and Orthotics. It helps the physician by providing real time measurements of human movement and analyzing the Human Gait in detail.

Expected Outcomes:

- IMU based Wireless System for collecting real time Gait data in Lower Limb
- PC based GUI software to analyze and visualize Gait parameters for clinical uses



## Development of an IVF incubator (IN-VITRO FERTILISATION INCUBATOR)

**Supervisors: Dr. Nuwan Dayananda, Dr. Anjula De Silva**

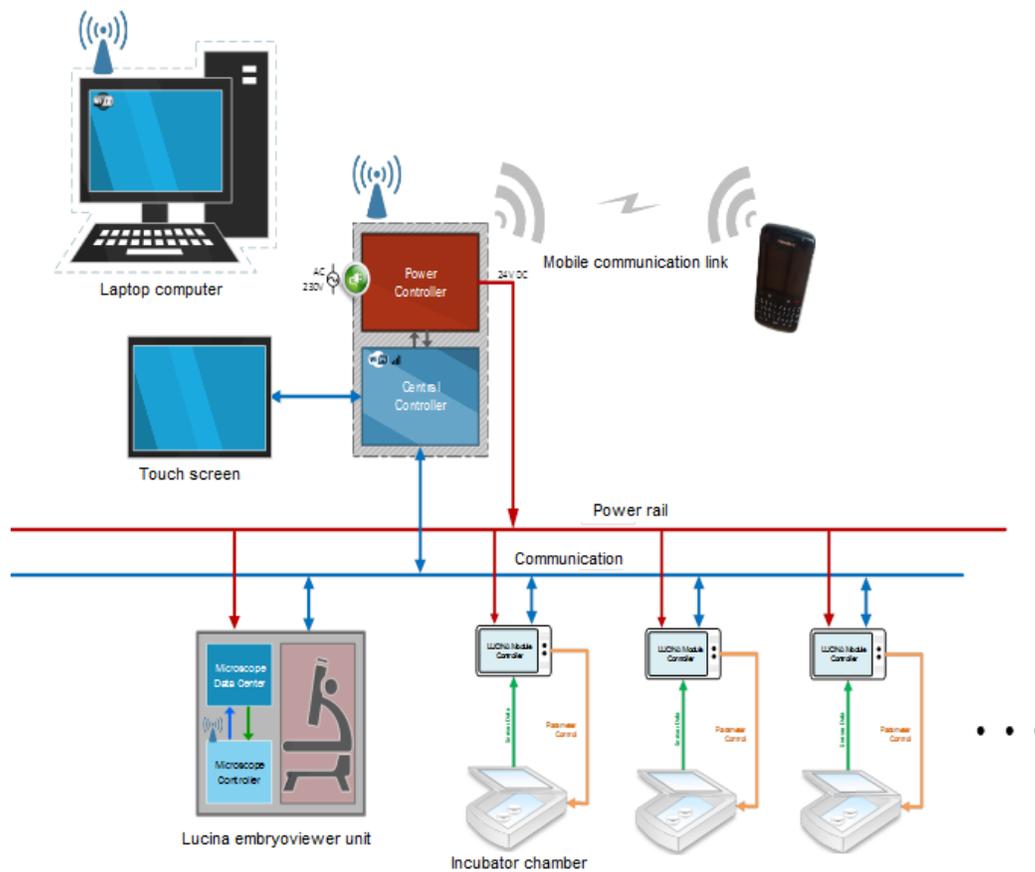
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In Vitro Fertilization (IVF) is the process of conceiving an embryo in a test tube. The process requires exact replication of the environment of the womb for the successful development of the embryo. Maintaining the embryo stress at a minimal level is of vital importance for high success rates of the IVF technique. Existing incubators have a common chamber which disturbs all the embryos when one is examined, while the highly advanced incubators are of premium prices.



The IVF incubator will provide a cost effective and an accurate solution for the IVF process, reducing the embryo stress by limiting the number of embryos per module to four. Opening and closing of the modules will be minimized with top and bottom sides of the module being made of heated glass, and by supporting embryo inspection without removal from chamber environment. All the necessary conditions such as temperature, humidity and gas composition will be maintained precisely at standard levels while the necessary networking, alerting and data management facilities will also be incorporated. Expected Outcomes: A PoC model of a minimal embryo stress IVF incubator.



## A plantar foot pressure and temperature measuring system for diabetic patients

**Supervisors: Dr Anjula De Silva, Dr Pujitha De Silva**

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Dr - Palitha Karunapema SLSPo Ragama

About 10% of the Sri Lankan adult population is affected by diabetes. If not properly monitored, chronic diabetes may lead to ulceration of the foot which could result in lower limb amputations. Among the fore mentioned diabetic population, foot ulceration is estimated to be 5.5 – 7.5%. However, early detection of these ulcers is possible by analyzing the pressure and temperature of the foot plantar in which case, remedial measures can be prescribed to prevent lower limb amputations.

A well-established method of estimating the risk of foot ulceration due to diabetes is by detecting abnormal pressure points on the foot plantar. As a secondary measurement, temperature variations of the foot plantar are found to be a good pre-detector of foot ulcers in diabetic patients. Our aim is to develop a low cost plantar foot pressure temperature measuring system for early diagnosis of diabetic foot ulcers.

