

HeartCycle Sensors

The HeartCycle integrated data acquisition platform aims to provide a variety of medical measurements, which are collected by several sensing devices. Activity and lifestyle measurements such as time spent walking, lying down or running, the amount of oxygen contained in a subject's blood at any given time, fluid accumulation in the body, the pulse and breathing rates are all measurements of particular interest to cardiologists following the progress and recuperation of their patients.

Increasing hardware integration, miniaturization and power autonomy of such medical data acquisition devices enable their end users to incorporate them into their lifestyle, dramatically improving the amount and quality of acquired data. The portable and wearable HeartCycle system enables physicians to telemetrically obtain readings from their patients while they are working, resting, exercising or sleeping in their regular surroundings, away from the medical centre.

The IMAGE device:

The IMAGE integrated sensing device developed by CSEM SA, a Swiss partner participating in the HeartCycle consortium, is a platform developed to achieve the aforementioned targets. It incorporates a 2-lead electrocardiograph, bioimpedance measurements and 3D accelerometry into a versatile wearable device which is worn on the chest using a specially designed elastic sleeveless shirt developed by another

HeartCycle partner, the Finnish company Clothing+. It is capable of acquiring data for time intervals longer than 8 hours, on board data processing and storage, as well as wireless transfer of acquired data to a nearby personal digital assistant (PDA) in near-real time using the IEEE 802.15.4 transmission protocol.



Depiction of the wearable 3-lead IMAGE sensing device attached to the sleeveless exercise shirt (picture courtesy of CSEM SA, Switzerland)

The wearer of the device, be they a physically exercising subject or an HF patient under medical observation, is kept within the information loop via their portable PDA device such as a smart mobile phone. User alerts are generated to alert or motivate the user and maintain a log of their daily physical activity, for instance regarding the estimated duration and quality of performed daily exercise, unusual trends in fluid accumulation in the chest or excessive stress suffered by the cardiovascular system, etc.

Current Status:

The IMAGE device is at an advanced prototyping stage and is currently being pre-clinically tested by CSEM, AUTH and VTT. The AUTH team is con-

tributing to the hardware troubleshooting and optimizations and has further established a pre-clinical trial protocol involving primarily healthy subjects. The protocol involves lying, sitting, standing, walking and running activities and has been designed to be experimentally compatible with standardized stress tests used by clinicians as diagnostic tools for HF and

other cardiopathy patients. The IMAGE device is currently undergoing evaluation and will consequently be concurrently validated against regular cardiography equipment, on healthy subjects undergoing gold-standard cardiac stress tests. Once this research is completed, the next step is expected to be the user guided exercise and clinical trials planned within the HeartCycle consortium.

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