Fraunhofer
PORTUGAL

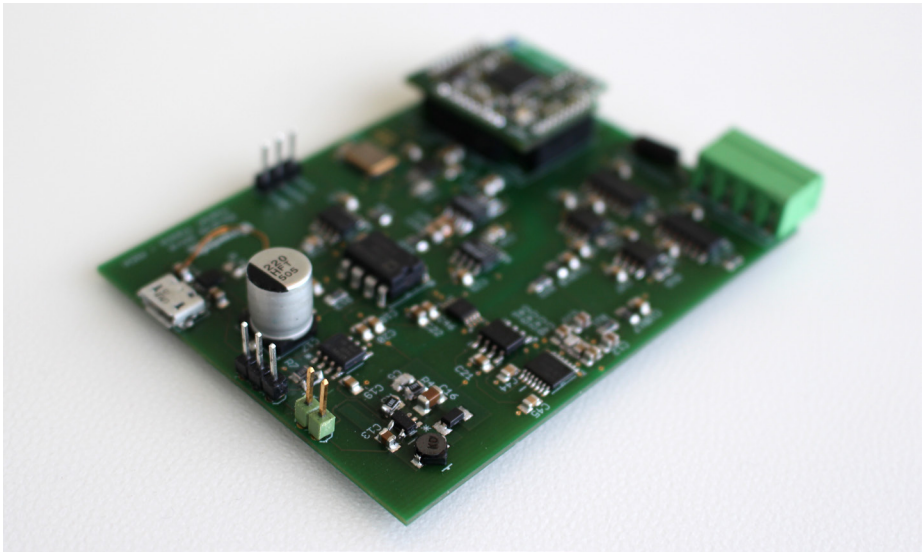

Fig1. Measurement Device.

MICH

MEASURING IMPEDANCE IN CONGESTIVE HEART FAILURE

The problem

The hospitalization of patients with Heart Failure represents an increasing burden for the healthcare system, more than 23 million worldwide suffer from HF and in Portugal there are approximately 260.000. Living longer with multiple chronic diseases such as diabetes, kidney disease and HF is now the norm and not the exception and explains why increases in life expectancy among older adults are slowing.

Bioelectrical Impedance

Measuring body impedance is becoming increasingly available in the clinical setting as a tool for assessing hemodynamics, and can be used to measure the thoracic impedance in order to identify patients at risk for decompensation of heart failure.

The disease progression is marked by a gradual retention of fluid in the lungs, long before symptoms of disease worsening occur. In order to prevent this significant mortality, morbidity and healthcare expenditures it is necessary to monitor patients at risk, in a way to detect congestion episodes before worsening of symptoms that will lead to hospitalization.

There is not available in the market a portable and low-cost solution that allows the common user to auto-diagnose in a continuous way, not needing to go to the hospital. This project proposes a low-cost, low-power and small size solution that can be controlled by a mobile device, for example a smartphone.

Contact
Rua Alfredo Allen, 455
4200-135 Porto, Portugal

+351 220 430 300
info@fraunhofer.pt
www.fraunhofer.pt

Pandlets

Pandlets is an hardware platform developed by Fraunhofer Portugal to measure human behavior and environmental context. It includes a set of sensing capabilities and an Android API that allows for seamlessly integration of external hardware into Android's platform.

Device Features

- Low-cost
- Low-power
- Small size
- Portability
- Android App

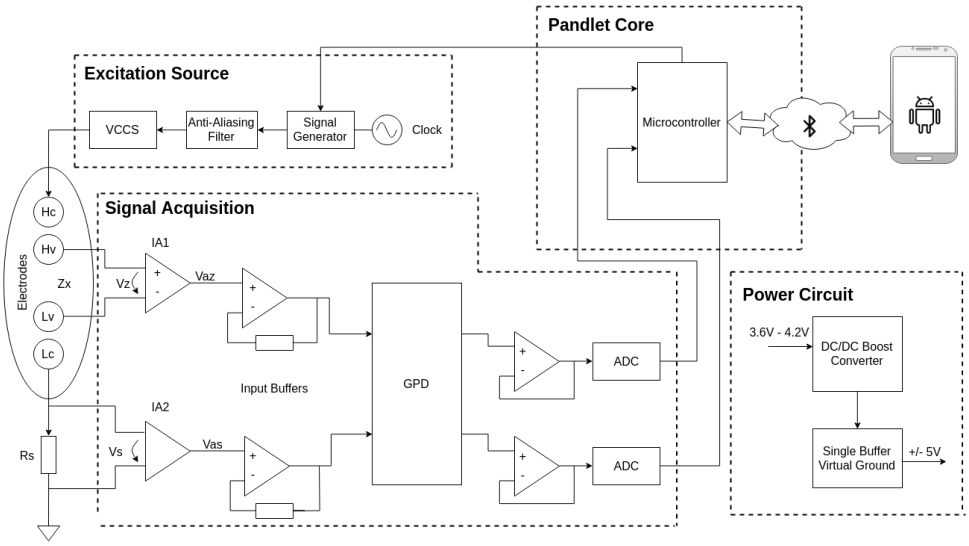

Fig2. Structural Diagram of the Device.

Structure Description

The circuit that generates the excitation source includes a sine wave generator and a Voltage Controlled Current Source (VCCS) and will be responsible for generating the excitation current in a range of frequencies from 20kHz to 1MHz.

Two equivalent Instrumentation Amplifiers (INA) will be used, one to amplify the signal measured by the pair of voltage electrodes and the other to amplify the voltage drop across the reference resistor, then the INAs two input buffers will be used to match the internal impedance of the Gain-Phase Detector (GPD).

The voltage from the pair of electrodes and reference resistor is compared using the GPD and calculates magnitude ratio and phase difference.

So the low-power feature can be achieved a power circuit is included in the design

Pandlets will be responsible for tuning the signal generator, acquiring the digital signal from the Analog to Digital Converters (ADCs) and transferring the data to a smartphone using Bluetooth Low Energy (BLE).

Results

The proposed solution has a low power consumption so it can be carried by the user on a daily basis and when compared with the other solutions available on the market has a low cost of production. The results of the tests allowed to validate bioelectrical measurement method and in the future it can be tested in a clinical setting, thus the cardiologists should validate the final solution.

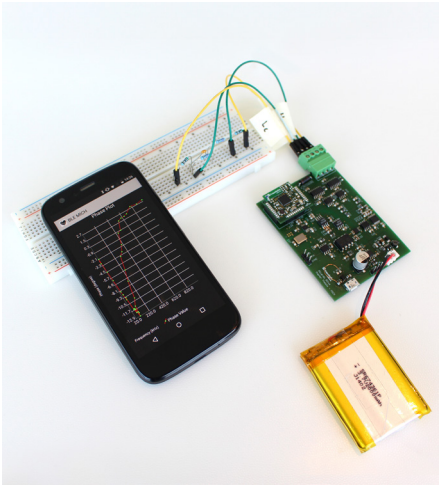

Fig3. Test Measurements Setup.