

EECG-3D-Visualization

Degree programme : BSc in Computer Science
Thesis advisor : Prof. Urs Künzler
Expert : Adrian Egli
Industrial partner : Pace Locator, Biel/Bienne

Currently, almost 20% of people who receive a pacemaker will develop further heart complications 2-3 years after receiving it. With current methods this is only detectable once these complications are present. The goal of this project is to develop an application that can help detect possible heart problems early enough to give more treatment options to the patient.

Introduction

Every year more than 600'000 new people will receive a pacemaker. This should lead to a healthy patient. But the reality is that around 20% of pacemaker patients will develop further heart complications. The pacemaker changes the origin of the electrical signal that triggers the heartbeat. This causes an electrical dyssynchrony, meaning that the left and right heart chambers beat out of sync. This will result in weaker heart muscles and later in heart failure. The startup company Pace Locator from the HuCE institute, is working on a method to detect an electrical dyssynchrony before it can damage the heart. For that they use an Isopotential Map, which shows the signal strength measured by the different sensors on the chest over time. This project is developed in collaboration with Pace Locator.

Goals

The goal of the application is to visualize these Isopotential Maps on a 3D heart. This visualization will show if the individual heart chambers are activating synchronously or beating out of sync. In its finished state, this application can be used by doctors to regularly monitor pacemaker patients and detect possible complications.

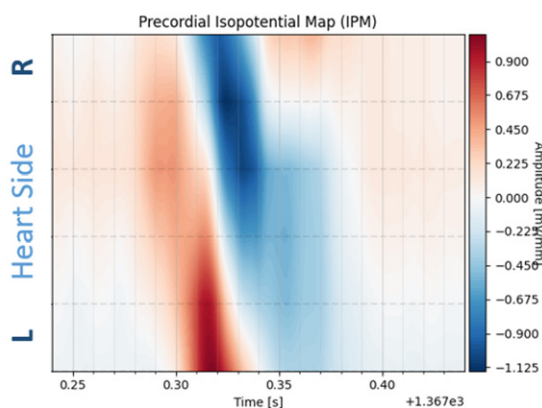
Results

The outcome of this project is a C++ application designed to visualize ECG data. Initially, the application displays a static grey heart model. Users can upload ECG data, after which they can initiate an animation that simulates the heartbeat based on the provided data.

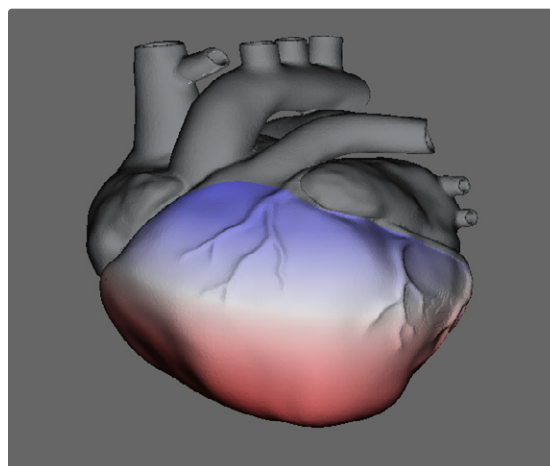
Currently, the application presents only a single, static heart representation. Future enhancements should include the ability to adjust the heart's size to better accommodate individual patient data. Additionally, an extension could allow for the display of two hearts simultaneously, enabling users to compare ECG measurements taken at different times.



Elias Ingold
Computer Perception and
Virtual Reality



Isopotential map. Each line on the y-axis corresponds to an electrode on the chest. (Image provided by the HuCE institute)



3D heart during a heartbeat