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SimCardioTest - Simulation of Cardiac Devices & Drugs for in-silico Testing and Certification

SIM CARDIO TEST

Technical Report
D1.4: Cloud-based platform for LAAO simulation

Work Package 1 (WP 1)
Model Standardisation & Interoperability

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EXECUTIVE SUMMARY

A first version of the SimCardioTest Cloud-based in-silico trials platform is released as a milestone of the SimCardioTest project. Specifically, the platform has been developed to host the three Use Cases developed within the project, and a user-friendly interface for each Use Case has been created. Users will be able to run simulations on the browser leveraging the models created by the SimCardioTest partners.

This deliverable consists in a recorded demo demonstrating the first version of the Cloud-based platform developed for Use Case 2, showing the results of fluid simulations in the left atria for the optimisation of the implantation of left atrial appendage occluder (LAAO) devices. The video is available in YouTube: SimCardioTest UC2 demo video on Cloud-based platform for LAAO simulation - YouTube and on SimCardiotest website

1- Introduction

In WP1, a Cloud-based in-silico trial platform has been developed to host the three Use Cases developed within the project, and a user-friendly interface for each Use Case has been created. The interface serves as the interconnection layer between the models developed by the SCT partners and the input provided by the user through the web-interface. With this Cloud-based platform, users will have the ability to run model simulations by simply accessing the platform via any browser, without the need of computational expertise and solvers/IT infrastructure. Also, users cannot download or modify the original models, thus preserving the intellectual property of the model creators.

In this deliverable, the UC2 Cloud-based platform is presented. The workflow has been developed by IST in close collaboration with WP3 partners, who provided support to the integration of the model, as well as suggestions, feedbacks and comments on the user interface throughout the development process.

2- Objectives

This deliverable consists in a recorded demo demonstrating the first version of the Cloud-based platform for fluid simulations in the left atria to optimise the implantation of left atrial appendage occluder (LAAO) devices.

In this workflow, the user uploads a new patient's anatomy into the platform to find out the closest case in the virtual database to find out the optimal LAAO configuration in pre-computed cases. The best match search is performed in the UPF cluster directly, with .stl and .json files data exchange between IST and UPF platforms via API.

Simulation results for the most interesting samples are visualised through a newly developed 3D viewer, including the LA anatomy with the implanted LAAO device. Computational cost in this workflow is very low since it takes advantage of pre-computed fluid simulations.

In the workflow, the inputs required by the user are: CAD geometry (.stl file format), numbers or choices from a drop-down list, which are collected and passed to the back-end infrastructure. When the simulation is finished, results are stored in the database and can be viewed through a specific user interface which has been designed specifically for each Use Case.

Moreover, user access and management have been implemented, as well as the possibility to monitor of the status of an ongoing simulation and to retrieve the results of all simulations previously run, which are securely stored in a private database within the dedicated SimCardioTest environment.

3- Methodologies

To develop the platform, the following activities have been performed:

- Demos, meetings and documents exchange with UC2 partners to discuss and agree on a final simulation workflow.
- Setup of a dedicated, isolated and white-labelled environment for SimCardioTest.
- Creation of Login page and user account management.
- Implementation of the standardised pipelines for Use Case 2 into cloud-based high-performance computing clusters (making use of Microsoft Azure virtual machines).

- Creation of all required interfaces, from homepage to model results.
- Design and development of the first version of 3D viewer component.
- Definition and mapping of input and output parameters in the web-interface and in the model.
- Definition of the interchange standard format of input and output files between IST and UPF platforms.
- Definition of the communication interfaces between IST and UPF platforms. Standard REST over HTTPS API with JWT authentication has been used.
- Use Case testing and bug fixing.

4- Results

The result of the activities described is shown in the video recording available on the Youtube/SimCardioTest channel: SimCardioTest UC2 demo video on Cloud-based platform for LAAO simulation - YouTube and on SimCardioTest website: In-silico trials – SimCardioTest

5- Conclusion

In this deliverable, we presented the demo of the Cloud-based platform for fluid simulations in the left atria to optimise the implantation of left atrial appendage occluder (LAAO) devices. The platform has been created by integrating UC2 models within a dedicated Cloud-based environment. Following steps foreseen until M48 will include the refinement of the platform and running in-silico trials.

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