Modular Expandable Programming Architecture for Interactive Web-Based EIT Data Exploration

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Abstract: We designed a modular and expandable programming architecture (PA) to favor code reuse and contribution. The PA is coded in Python, HTML, CSS and JavaScript langages while minimizing use of third-party solutions. Modules can be interconnected to provide custom interactive web-based solutions for EIT data exploration.

1 Introduction

EIDORS is a PA widely used to simulate EIT data and provide images and clinicaly-relevant information from simulated or real EIT data [1]. Ibex is a freely available software for EIT image analysis [2]. Most EIT equipment manufacturers also provide their own version of software for EIT data processing and exploration. However, no software tools exist to provide interactive web-based data processing and exploration for EIT while providing an open environment that can be fully customized to a user need. Such a PA was developped using an approach similar to the modular expandable multi-threaded architecture described in [3].

2 Methods

The PA is designed in Python, Javascript, HTML and CSS building on the strength of each language and minimizing requirements fo third-party libraries. Each module provides an arbitrary number of inputs, outputs and timers that are defined in the Python language. The architecture is event-driven: whenever new data is received at an input or a timer expires, some processing occurs to generate data that are transmitted to the relevant outputs. The python language is also used to connect the output from one module to the input of another module through channels than can be buffered or not. The HTML, CSS and Javascript languages are used to provide the web-based graphical interface for the python modules. The graphical user interface is therefore simultaneouslty accessible from any standard web browser.

3 Conclusion

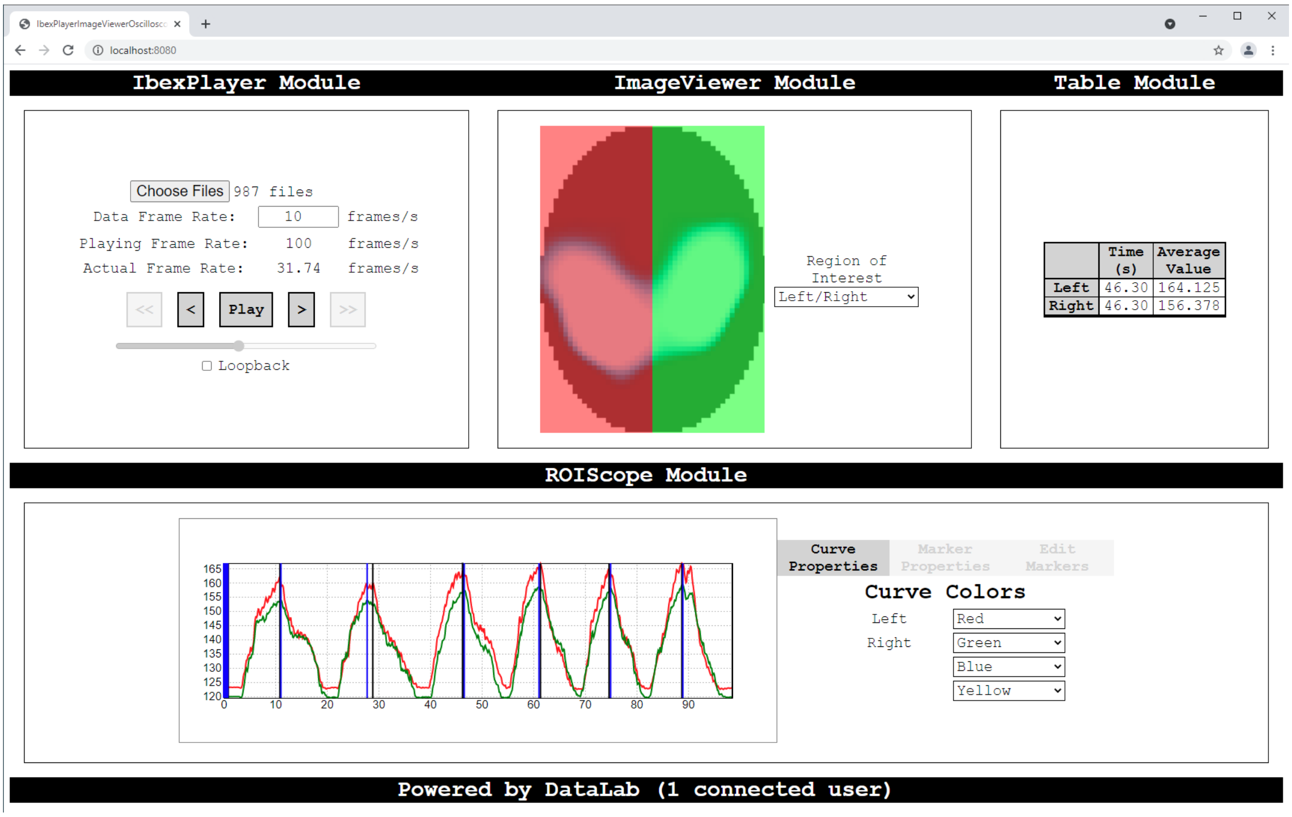
Several modules have been successfully realized to read, process and display EIT data using the described PA as shown in Figure 1. EIT images can be displayed and analyzed at real-time speed. The user can select different types of data processing, browse through the acquired data at his/her own rythm and explore the result of frame-by-frame, breath-by-breath or time-interval EIT data analysis.

References

[1] A Adler and WRB Lionheart *Physiol. Meas.*, 27:S25:S42, 2006.

[2] PL Róka, AD Waldmann, SH Bohm, C Karagiannidi, and F Ender *EIT2016*, p.59, Neuchâtel, Switzerland, Jun 2015

[3] H Gagnon, *Ph.D. Thesis*, Polytechnique Montreal, Canada 2003.



987 files

Data Frame Rate: 10 frames/s

Playing Frame Rate: 100 frames/s

Actual Frame Rate: 31.74 frames/s

☐ Loopback

Region of Interest: Left/Right

	Time (s)	Average Value
Left	46.30	164.125
Right	46.30	156.378

Curve Colors

Left	Red
Right	Green
	Blue
	Yellow

Figure 1: Example of an application for EIT data exploration designed with the described programming architecture.