RASimAs newsletter

30th April 2016

Issue 5

Editorial

The release of this 5th newsletter comes after the RASimAs project passed the second year evaluation, again with certified success and good rate. Also, the assistant was introduced and demonstrated at the International Winter Symposium on Anesthesia and Perioperative Care Trauma in Leuven, in February, with a great interest of the public. A new virtual physiological human model was developed for the simulator, which is now fully functional. Evaluation begins soon in the clinical sites with all the partners working together to deliver two valuable tools for the clinicians: the simulator and the assistant. All the progress is published in this newsletter. All contributions by the partners show intensive and interdisciplinary interaction within the entire RASimAs team, composed of 11 partners from 10 European countries. Enjoy the reading and for regularly updates of the project please visit our website (http://www.rasimas.eu/) and follow us on twitter (twitter.com/RasimasEU) and Facebook.

Prof. Thomas Deserno

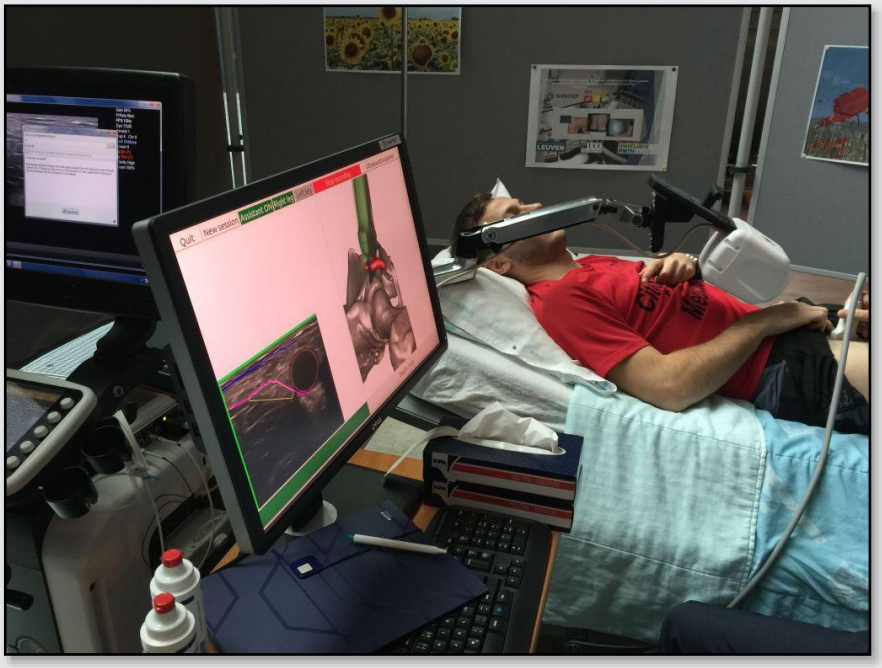
Content

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 610425.

Project Highlights

The RASimAs world's first assistant system was demonstrated at the International Winter Symposium on Anesthesia and Perioperative Care in Trauma in Leuven, Belgium in February.

Around 70 attendees from the symposium were able to try the assistant. Among specialist anesthetics and medical students it was agreed that the system is a helpful aid and that it would be useful in the daily practice.



The assistant system is built as a single rack system composed of an ultrasound scanner and a computer. Regarding the software, images and tracking data are streamed from the ultrasound scanner to the computer and structures like artery, fascia and nerve are detected and marked in real-time.

The project in numbers

39…achieved deliverables

13… milestones met

18…conferences

7…press releases

5…newsletters

24…publications

104…tweets

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Words from the partners

Dept. of Medical Informatics, Uniklinik RWTH Aachen, Germany

One of the challenges of working with non-rigid image registration at the Department of Medical Informatics Uniklinik RWTH Aachen was presented as the discovery of the insufficiency of the commercial models (Zygote and Anatomium) in meeting the project requirements. Several shortcomings were discovered, and the Zygote model was extended accordingly by (i) cleaning for inconsistencies and overlap, (ii) replacing the femoral nerve towards a more common position in regards to the blood system and the muscles and (iii) adding fascia, i.e., flat bands of tissue below the skin that cover underlying tissue, separate different layers of tissue, on endorse muscles. In face of these problems, a new model (Figure 1) has been created for RASimAs from computed tomography (CT) and magnetic resonance imaging (MRI) data and it is now used instead of Zygote. For this new model, fascia lata and fascia iliaca were added and the position of the nerve was corrected.

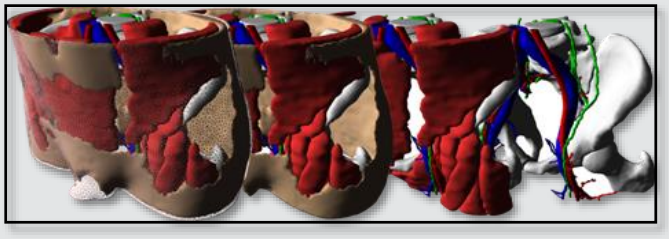

Figure 1. RASimAs model reconstructed from CT and MRI data

FORTH, Greece

Upon completion of the Integrated Platform (final) component and the Java-based desktop application enabling the fusion of distinct modelling toolkits towards the realization of the so called patient-specific virtual physiological human (VPH) model, FORTH proceeded to the deployment of the Integrated Platform Prototype. Through this process, FORTH and its partners had the opportunity to extensively test the functionality and overall operation of the platform prior its formal release. The platform was also enhanced with an additional functionality for the secure communication between every training center and the central RASimAs server during data exchange. The selected technology used is JSON Web Tokens based on public/private key pair using RSA cryptography (Figure 2).

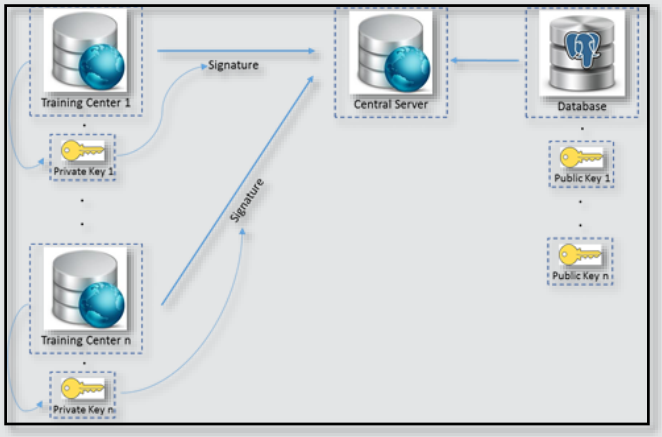

Figure 2. Integrated Platform Secure Communication Protocol

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According to this design every training center generates a signature-based on a private key, which is sent to the central server prior data exchange. As soon as the signature is validated by the central server, using the corresponding public key, data exchange is granted.

University of Zilina, Slovakia

The UNIZA team participates in the investigation of the correctness of generic anatomical models used in RASim. Preliminary analysis of these models showed that there are issues in the layout of some body organs. Typical errors are intersected organs (a lymphatic vessel intersects a bone, like Figure 3, a bone intersects another bone, etc.). The UNIZA team has proposed a methodology for quantification of these errors in the models. This quantification showed that the models have several geometrical and anatomical issues (2% of the lymphatic vessels intersect bones, 3% of the bones have self-intersections, etc.). Now, the UNIZA team is working on the qualitative analysis of these issues.

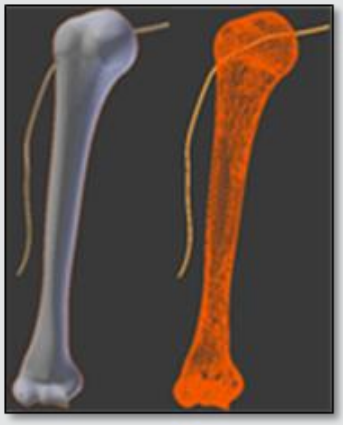

Figure 3. Lymphatic vessel intersection with bone

Bangor University, UK

The Bangor team has focused on the development of an effective haptic model for needle puncture in Regional Anaesthesia (Figure 4). It takes into account various forces to provide a realistic experience. Before the needle tip punctures the skin, the user feels some resistance. If the force is sufficient, the user will feel a "pop" as the needle goes through the skin surface. After puncture, the tissues resist against the axial motion of the needle. To improve realism, we prevent the needle to go side-way. Pulse can be felt when the needle is close to the artery. In practice, anaesthetists cannot rotate the needle much once it has been inserted. This is impossible to replicate with 3DOF haptic devices. To account for this limitation, the device vibrates when a high rotation is detected. The user interprets this signal and understands that something is not right. Finally, bone resistance is implemented separately to improve stability with hard surfaces.

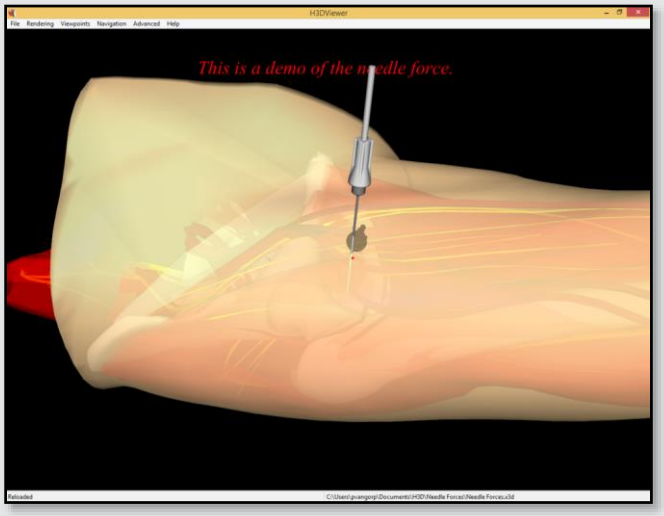

Figure 4. Needle puncture in Regional Anaesthesia

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University Rey Juan Carlos, Spain

Along the last thirty months, the Rey Juan Carlos University group has actively participated in work packages (WP) 3 and 4. Our first achievement was the Subject Posing System (WP3). This system transforms the different virtual patient anatomical data into the poses that are used for regional anaesthesia (RA).

Then, we focused our efforts on WP4. In the context of this WP, we developed the courseware which is charge of: (i) guiding the trainee through the RA procedure showing supportive information before, during and after the simulation, (ii) launching all the simulation modules, (iii) displaying the GUI, the US view and the US control pad (Figure 5), (iv) gathering the assessment metrics and (v) the communication with the local database in order to identify the trainees and storing their performance evolution. The courseware provides two simulation modes: the guided mode and the free practice mode (Figure 6). On the one hand, the first one is meant to be used by physicians with no previous experience on the procedure or the simulator. On the other hand, the second one is less restrictive and it will be used with a higher level of expertise. Additionally, with the intention of simplifying the interaction with the system, the courseware implements a voice recognition system. Currently the courseware has been integrated with the other simulation modules of WP4 and is ready for its release. Before the clinical trials, the URJC group will analyse the results in order to select the most important metrics for monitoring the progress of the trainees.

Moreover, during the last six months, we have been working on the anaesthetic spread simulation. Our first approach was based on physics but it was not included in the final prototype due to performance issues. Then, we implemented a screen-space procedural approach. This approach is less accurate than the first one but it runs at interactive rates.

Figure 5. GUI during the simulation

Figure 6. Guiding system on simulator mode selector

SINTEF, Norway

The last couple of month SINTEF has worked hard to get the RA-Assistant ready for clinical use. Two updates have been maid based on clinical feedback; first both novice users and experienced anesthesiologists tested the Assistant system extensively during the Leuven meeting and secondly one of the clinical partners in the

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RASimAs project visited Trondheim and provided important advises in terms of practical use. Assembling, packing and shipping the two new clinical assistant systems turned out be quite a challenge, especially the last part (Figure 7). Anyway, the two systems are now on their way to the clinical partners where they will be evaluated, RAAs 1 is going to Cork and RAAs 2 to Aachen / Leuven, we really-Really-REALLY hope that the systems will arrive their destinations safely.

Figure 7. RAAs 1 assembled (left), packed (right) and waiting to be shipped to Cork.

The other main event related to the Assistant is that the SME EyeLife (http://eyelife.no) is scheduled to receive funding from the Norwegian Research Council for adding «needle guidance» to their product in collaboration with SINTEF and St. Olav University Hospital (can only be Norwegian partners). EyeLife is developing next generation mobile ultrasound (really affordable probes wirelessly connected to an off-the-shelf tablet or smart phone where the ultrasound application can be downloaded from AppStore or Google Play). We think that this is an excellent opportunity to develop the RAAs functionality further and to provide a very affordable commercial needle guidance system at some point in the future (Figure 8).

Figure 8. Next generation ultrasound that will be augmented with needle guidance functionality.

University College Cork, Ireland

The UCC clinical partners attended the UZ Leuven 2016 31st International Winter Symposium on Anaesthesia and Perioperative Care in Trauma on February 4-6th. In conjunction with the SINTEF, Aachen and Leuven project partners, the Regional Anaesthesia Assistant (RAAs) prototype was demonstrated to attending clinicians, trainees and students (Figure 9), and survey data was gathered for two studies assessing the potential impact and utility of the RAAs system in clinical practice, as well as a study of clinician's anatomical knowledge of the peripheral nerve-block procedures: we anticipate publication of these studies later in the year. Preliminary responses from the Leuven Symposium attendees was positive among inexperienced or infrequent practitioners of regional anaesthesia, indicating that a potential market exists for the device.

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Currently, the RAAs device is being shipped to Cork for hand-on testing, using UCC's medical students as participant cohort for an early formal test of the RAAs' in-vivo functionality.

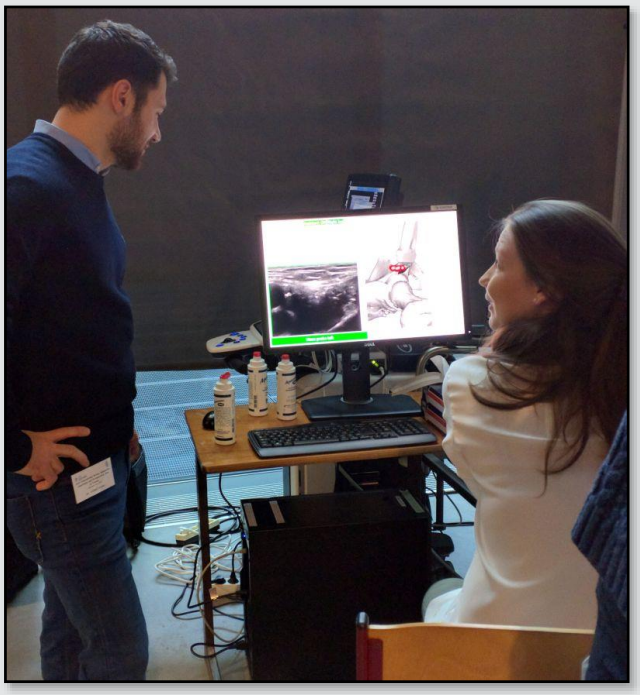

Figure 9. Regional Anaesthesia Assistant system in action

Virtual Reality Centre, RWTH Aachen University, Germany

In the last months, we performed together with our medical partners multiple interactions of fine tuning physical material parameters of sonoanatomy in the region of interest. In this process, we also determined anatomical entities of special interest that require a particularly high level of detail. In consequence, we extended these entities with additional structures, for instance, vessels inside the muscles. Furthermore, some existing structures have been exchanged by more detailed models, e.g., the fascia lata now consist of multiple layers and the femoral nerve from multiple nerve fibres (Figure 10).

The femoral artery is an important landmark for the performing physician to find the close by nerve structure. Besides the dark round appearance of the artery, an important characteristic for its identification is its pulsation due to the fluctuating blood pressure inside. Therefore, we included an animation sequence of the artery pulse into the US simulation.

Recently, we have submitted a paper on validation of multi-component simulations for ultrasound to the EuroVis Workshop on Reproducibility, Verification, and Validation in Visualization, where we present the work in June.

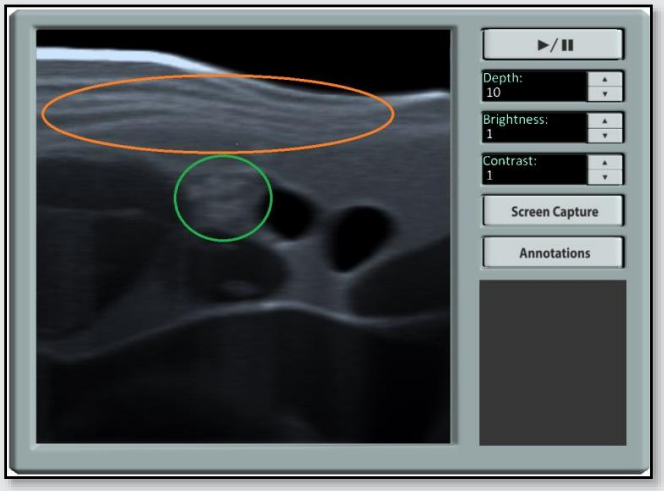

Figure 10. Simulated ultrasound image with new fascia layers beneath the skin (orange circle) and around the muscles and the nerve. The nerve's internal structures (green circle) are also included to show its honeycomb-like appearance

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Publications

A technological platform to support education in regional anaesthesia with patient-specific virtual physiological human (VPH)-based models

Christodoulakis G, Marias K, Notas G, Kampanis N, Sfakianakis S

In: Proceedings of XIV Mediterranean Conference on Medical and Biological Engineering and Computing, 2016 Mar 31 – April 02; Paphos, Cyprus; 2016. p. 926-29.

New methods for the reliability analysis of healthcare system based on application of multi-state system

Zaitseva E, Kvassay M, Levashenko V, Kostolny J

Studies in Computational Intelligence 606, Applications of Computational Intelligence in Biomedical Technology, Eds.: Bris R., Majernik J., K.Pancerz, E.Zaitseva, Springer, 2016, pp. 229-51.

Accurate and adaptive contact modeling for multi-rate multipoint haptic rendering of static and deformable environments

Knott TC, Kuhlen TW

Comput Graph. 2016; 57:68-80.

Surface mesh to voxel data registration for patient-specific anatomical modeling

Oliveira JEE, Giessler P, Keszei A, Herrler A, Deserno TM

In: Proceedings of SPIE 9786, Medical Imaging 2016: Image-Guided Procedures, Robotic Interventions, and Modeling; 2016 Feb 27; San Diego, California, United Stated; 2016. p. 978625.

Real-time automatic artery segmentation, reconstruction and registration for ultrasound-guided anaesthesia of the femoral nerve

Smistad E, Lindseth F

IEEE Trans Med Imaging. 2016 Mar; 35(3): 752-61.

Patient-specific anatomical modelling

Oliveira JEE, Giessler P, Deserno TM

In: Proceedings of 5th IEEE International Conference on E-Health and Bioengineering (EHB 2015); 2015 Nov 19-21; Iasi, Romania; 2015. p. 1-4.

Accurate contact modeling for multi-rate single-point haptic rendering of static and deformable environments

Knott TC, Kuhlen TW

In: Proceedings of the 12th Workshop on Virtual Reality Interaction and Physical Simulation; 2015 Nov 04-05; Lyon, France; 2015. p 71-80.

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Upcoming events

Cork Cadaveric Regional Anaesthesia Course

Cork, Ireland, 17th and 18th June 2016

Showcase of the simulator and assistant.

General Assembly

Madrid, Spain, 19th and 20th September 2016

The fourteen partners of the consortium will meet in Madrid for the last general assembly of the project.

Conferences, seminars & workshops

Annual Ultrasound Symposium of the Norwegian Society for Diagnostic Ultrasound in Medicine

Bergen, Norwegian, 13th to 15th April 2016

Invited lecture (A fully automatic Assistant for ultrasound-guided nerve blocks) of SINTEF

XIV Mediterranean Conference on Medical and Biological Engineering Computing

Paphos, Cyprus, 31st March to 02nd April 2016

Participation of FORTH

SPIE Medical Imaging

Orlando, USA, 11th to 16th February 2016

Participation of the Department of Medical Informatics, Uniklinik RWTH Aachen, Germany

31st International Winter Symposium on Anesthesia and Perioperative Care in Trauma

Leuven, Belgium, 04th to 06th February 2016

Participation of the Department of Anaesthesia, Uniklinik RWTH Aachen, Germany; Department of Anaesthesiology, Katholieke Universiteit Leuven; Cork NeuroScience Group, University College Cork; and SINTEF.

International Workshop ATHEALTH: Information Technologies in Medical and Biomedical Applications

Zilina, Slovakia, 25th to 27th November 2015

Participation of the University of Zilina, Slovakia

E-Health and Bioengineering Conference

Iasi, Romania, 19th to 21th November 2015

Participation of the Department of Medical Informatics, Uniklinik RWTH Aachen, Germany

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Seen in the media

Uniklinik RWTH Aachen

February 2016

The project has been advertised on the web page of Uniklinik RWTH Aachen.

19.02.2016 - RASimAS-Projekt: Weltweit erstes Assistenz-System zur Regionalanästhesie vorgestellt.

Im Rahmen des 31. internationalen Winter-Symposiums „Anesthesia and Perioperative Care in Trauma", vom 04.-06.02.2016 in Leuven (Belgien), demonstrierte das von der Europäischen Union finanzierte Projekt „RASimAs" das weltweit erste Regionalanästhesie-Assistenz-System.

Weitere Informationen entnehmen Sie bitte der Pressemitteilung.

Nach oben Drucken

EU eHealth in Focus newsletter

January 2016

RASimAs demo at the Anaesthesia Winter Symposium, in Leuven, advertisement in the EU eHealth in Focus newsletter.

DIGITAL SINGLE MARKET
Digital Economy & Society

European Commission > World's first regional anaesthesia assistant system introduced

The strategy | Economy | Society | Access & connectivity | Research & innovation | DG CONNECT

Society
Skills & Jobs
eHealth and Ageing
eHealth
Research and Innovation
mHealth
Interoperability
Transatlantic Cooperation
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Studies
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Content and media
Emergency and support lines
Societal challenges projects

World's first regional anaesthesia assistant system introduced

Published on 05/02/2016

At the International Winter Symposium on Anesthesia and Perioperative Care in Trauma in Leuven, the EU-funded RASimAs project demonstrated the world`s first regional anesthesia assistant system.

According to the project experts the system aroused a great deal of public interest during the event on 5 February 2016. Almost 70 attendees from the symposium were able to try it; more than 30 of them described themselves as specialist anesthetists.

'Excellent training tool'

Over half of the surveyed delegates said they would be willing to use the Assistant in their daily practice. Medical students thought it was a useful training aid. Most trainees agreed that the RASimAs system is easy to use and particularly helpful in patients with a difficult anatomy and would be an excellent training tool.

Statistical analysis shows that with the Assistant, trainees are much better able to correctly identify the boundary of a nerve from an ultrasound image.

- Watch the Assistant in action in the video below
- RASimAs website: Press release and photos of the workshop

Share

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