DICOM in Brachytherapy

A DICOM module for SagiNova® Afterloader connectivity

ICT Healthcare supported the development of a fully integrated DICOM import and export module, that provides a seamless integration of the SagiNova® afterloader in the hospital networks. This enabled full usage of the existing hospital infrastructure.

Eckert & Ziegler BEBIG contacted ICT Healthcare because of the extended knowledge on DICOM and Radiotherapy to develop a new DICOM interface for the SagiNova® afterloader.

ICT Healthcare gained this knowledge/experience through the close cooperation with the IHE-RO technical committee (since 2007) and multiple DICOM-RT (RadioTherapy) implementations. This knowledge consists of the meaning of every single DICOM attribute, DICOM association or Transfer Syntax to be used in a clinical workflow to the knowledge of medical software development.

The SagiNova afterloader

The SagiNova® afterloader is a HDR (High Dose Rate) brachytherapy system that controls the very small radiation source from a shielded safe – located inside the afterloader – directly into or next to the tumor. A computerized treatment planning program calculates precisely how long the small radiation source must stay and radiate at the so-called dwell positions before this radiation source is driven back into the safe.

In close collaboration with the development team at Eckert & Ziegler BEBIG, ICT Healthcare developed a solution that would integrate with the existing SagiNova® database to allow the import of DICOM treatment plans and the creation of DICOM RT treatment records.

Challenges

During a short consultancy phase ICT Healthcare analyzed the current DICOM interface implementation of the other Eckert & Ziegler BEBIG product SagiPlan® and current non-DICOM interface implementation of SagiNova®. One of the challenges was to minimize the changes of the existing Eckert & Ziegler BEBIG data model that is part of

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the Treatment Control Console (the SagiNova® afterloader Windows 7 workstation). Another challenge was to hide as much DICOM specific details as possible. As the DICOM workflow for Brachytherapy based on the IHE profiles is still under development, the design of the DICOM module should also take into account future changes in the standard.

This resulted in a DICOM module for the SagiNova® with the following functionality:
- Offering a simple queue that represents all RT Plans that have been received by the internal hidden DICOM module Storage SCP and have not yet been dealt with.
- Handling any exceptions that may occur during the DICOM import.
- Representing each received RT Plan in the queue in a strongly typed way, hiding any unnecessary DICOM information. DICOM nesting by means of sequence attributes (which is used a lot in RT Plans) is represented by the DICOM module using a structured set of corresponding classes.
- Storage of the original RT Plan in the Eckert & Ziegler BEBIG data model to limit the changes needed in this data model.
- Using the information that is present in the Eckert & Ziegler BEBIG data model and received RT Plan, create a DICOM RT Brachy Treatment Record that can be stored in the Eckert & Ziegler BEBIG data model.
- Export the created DICOM RT Brachy Treatment Record to a remote Storage SCP.

To guarantee the quality of the software at different stages during software development, automatic tests have been created (using the DICOM Validation Toolkit) to test both the DICOM RT Plan import and DICOM RT Brachy Treatment Record export.

About Eckert & Ziegler BEBIG

Eckert & Ziegler BEBIG is a European-based group active in the medical device segment of the health care industry.

Keywords
Brachy therapy, DICOM RT, .Net, C#, , DicomObjects (native .Net DICOM library from Medical Connections), SVN (with customer access), Trac, Jira, Requirements, Design, Testing, DICOM Conformance Statement, DVTk (DICOM Validation Toolkit), IEC 62304, ISO 13485, ISO 27001.

PROJECT RESULT

The DICOM module software interface was tailored to the existing design of the SagiNova® afterloader resulting in an effective integration of the DICOM module. The design and created automatic DICOM interface tests proved to guarantee the quality of the software delivered, as only one minor problem has been reported (and solved within one day) during acceptance of the software. The last two years, no other problem has been reported. The software created by ICT Healthcare is now used by different SagiNova® afterloader models.

For more information, see:
www.bebig.com/home/products/hdr_brachytherapy

Its core business is the production and distribution of medical products for the treatment of cancer using brachytherapy. The company's products and equipment are intended for use by oncologists, radiotherapists, urologists, ophthalmologists and medical physicists. For more information, visit their website: www.bebig.com

Role of ICT Healthcare
ICT Healthcare was responsible for the complete DICOM connectivity. This resulted in the following tasks:
- Consultancy report on the DICOM workflow.
- Translate the customer user requirements into specific software DICOM requirements.
- Design an architecture and agree on the common software interface with the customer software.
- Use these requirements as input for the design and C# coding using the lower level DICOM library selected on advice of ICT Healthcare.
- Create test cases for verification of the requirements, some of them use the DICOM Validation Toolkit (see www.dvtk.org. ICT Healthcare is a main contributor).
- Take care of the traceability between requirements, design and test cases.
- Create the validated DICOM conformance statement.

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