Purpose

The project consists in developing a radiation free system for training radiographers in positioning the patient correctly when taking an x-ray image. Two solutions have been considered, which are:

1. a simulator, which makes it possible to simulate taking an X-ray picture of a physical model (e.g. a foot) to use in the class room and/or at the different wards prior to taking an X-ray picture or as follow up after taking an incorrect picture.

2. an application for a mobile phone, a tablet or pc/mac, which allows virtual positioning training through interactive pictures.

Background

Students or newly qualified radiographers have difficulties in taking a perfect x-ray picture due to lack of routine. This exposes patients to additional radiation.

EasyViz is a software program used at Aalborg Hospital for displaying and manipulating pictures from various scanners. After a CT scan where the whole body or body parts are scanned (slices put together) it is possible for the program to calculate how an ordinary X-ray image would look like if it was taken at a given angle and distance. This can be used as theoretical training to get better pictures. It is only a theoretical exercise because you do not have the physical link between the person to be scanned, the distance from the head of the scanner to the body, and the rotation of the body.
Solution 1: X-ray simulator

Example: Simulation of a broken ankle

1. A CT scan of an object (leg) is open in the software.
2. A 3D representation is being generated. This can emulate every angle a single x-ray image could be taken in.
3. The radiologist positions the leg inside the x-ray mock-up. A pedal is pressed to take the picture.
4. The distances from the x-ray mock-up to the leg including the angle are measured and sent to the software.
5. A simulated x-ray image is generated from the information above.
6. The program provides advice on how to obtain the best image.
7. The result can be discussed interactively and a new image can be taken right away and thereby improve the feedback situation.

Issues X-ray simulator:

Issue 1: How do we represent the patient to be “scanned”? Could the patient for instance be represented by a doll (http://www.supertechx-ray.com/a245-r.htm) or maybe by a real person in a special suit? The model does not need to mimic 100% a real body. It could also be virtual, though a part of the training is also to put people in a possible position and e.g. help with pillows etc. The most important here is to determine the position in space with rather high precision and that it is economically possible for the hospital to acquire the system.

Issue 2: How do we track the position/rotation of the patient model? Could a system like Kinect for Xbox be used?

Issue 3: How do we map the x-ray picture according to the position/rotation of the patient model? The system must show how an x-ray picture would look like when it is taken of the patient in a given position. Depending on the speed of the system and interface a real-time interface where you can see directly the results could also be considered.

Issue 4: How do we evaluate the training? The system enables trainees to get direct feedback regarding correlation between the patient’s placement and the resulting x-ray picture. A Complete system has several perspectives. One could be to integrate different learning areas, for example, you can learn how to place the x-ray apparatus (positioning) or you can get examples of incorrect positioning, and then from the picture tell how to improve the image and see the results. E.g. different fractures to mimic and case studies.
Solution 2: App

Example: App for positioning training

1. A student needs to learn to take an x-ray of a specific bone or joint.
2. A CT scan of the bone or joint is open in the software.
3. The student alters the patients position in proportion to the x-ray beam by altering a 3D picture of the patient. The corresponding 2D x-ray picture is altered simultaneously.
4. The chosen position is evaluated.

Issues app:

Issue 1: How should the interaction with the picture be designed?

Issue 2: How do we evaluate the training?

Healthcare and economics benefits

- Reduce the number of unsatisfying pictures per patients
- Reduction of radiation dose for patients
- Hospitals will get more skilled employees or interns
- Hospital staff would optimise their time for coaching new employees and interns

Clinical supervisors:

- Dr. Henrik Echternach Gregersen, Executive consultant at the Department of Radiology has developed the idea of the project and can assist with the medical part of the project.
- Karina Baadsgaard Christensen, executive clinical instructor in charge of clinical training of students at the Department of Radiology or Elsebeth Herregaard, development radiographer within conventional radiography.

Technical supervisor:

- Michael Fravn, lecturer at the department of Radiography, University College North Denmark.
- Peter Juul Ørnstrup, lecturer at the department of Radiography, University College North Denmark.
- Susanne Hjorth Hansen, coordinator of development and lecturer at the department of Radiography, University College North Denmark.
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