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RadVision integration with TRUS robot for Brachytherapy

600.446 Computer Integrated Surgery II

Project Proposal

Team Members: Adam Clayton

Team Mentor: Peter Kazanzides

Project Summary

The main goal of this project is to integrate the RadVision simulation software with the (Trans-Rectal Ultrasound) or TRUS robot. This integration should allow the surgeon to position the needle of the robot more accurately with the new system. In addition to the integration with RadVision I intend to participate in an accuracy study in which the accuracy of the TRUS robot in needle placement will be assessed.

Motivation and Significance

The American Cancer Society 240,890 cases of prostate cancer were diagnosed and about 33,720 men will die from it. Prostate Brachytherapy is a minimally invasive radiation therapy that used to treat prostate cancer. The therapy involves the injection of radioactive seeds directly into the prostate near the tumor using fine needles. Unfortunately attaining the level of accuracy required often takes the surgeon more than one attempt at inserting the needle. Increasing the accuracy of the needle insertion with a robotic system would allow faster surgeons with better results.

The conventional approach using a grid of holes located over the prostate to position and guide the needle for insertion. The needle itself is monitored in real-time by an ultrasound probe positioned below the prostate. Since the seed insertion must be very accurate and the final location of the end of the needle cannot be predicted, the surgeon often must insert the need multiple times using multiple holes in the grid. The TRUS robot replaces the function of the grid of holes by using two Galil 2-dimensional servo mechanisms to position and guide the needle.

The two dimensional grid allows the user to control both the 2 dimensional insertion location as well as the angle of the needle.

In addition to the integration with RadVision the accuracy study in which I plan to participate will assess the accuracy of the TRUS robot in needle placement. The results of this assessment could be used to compare this robotic system with other robotic systems that are used in the same proceduer.

Technical Approach

The first step in the project is to rebuilt the setup for the TRUS robot currently in the robotorium. Since I have chosen to use my laptop as the computer to complete this step I must install all of the necessary drivers resolve any comparability issues between my laptop and the TRUS robot. Since my laptop ran Windows 7, and the old Galil drivers were not compatible with windows 7 I was forced to rewrite the CISST wrapper for the new Galil drivers.

The second step in this project is to integrate the software that currently controls the TRUS robot with the RadVision software I should receive from the company. The RadVision software with receive movement commands from the button interface of the TRUS robot, and then send the position changes that will create the desired changes to the software, which control the TRUS robot. Eventually we also want to get the software working to a point where we can just specify the desired location for the needle position.

Once the system is completely integrated the final step should be to test the completed system on a phantom gel using the ultrasound system. The testing will have to be done at the hospital in order to use their ultrasound equipment.

List of deliverables

- ♣ Minimum Deliverable
 - User slicer or some other interface instead of Radvision with camera with phantom gel
 - Accuracy Study using TRUS Robot. (APM task group 132 protocol)
- ♣ Expected Deliverable

- Using RadVision and real ultrasound with phantom gel. (or with slicer if dependences are not available in time)
- Using button box to send commands to RadVision
- ⤴ Maximum Deliverable
 - IRAB approved ready for clinical trial

Key dates

- ⤴ Project Proposal Due – 2/23/2012
- ⤴ Project Presentation Due – 3/01/2012

Task\Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Assemble System														
Develop new CISST wrapper														
Integrate RadVision														
Accuracy Study														
Testing with Gel and Ultrasound														

List of dependencies & plan for resolving

- RadVision software – Currently waiting on company
- TRUS Robot – Already have robot
- Ultrasound equipment - Provided at hospital
- Phantom gel

Management Plan

- △ Meeting every other week with Professor Kazanzides

Reading List

- Gabor Fichtinger, Jonathan P. Fiene, Christopher W. Kennedy, Gernot Kronreif, Iulian Iordachita, Danny Y. Song, Everette C. Burdette, Peter Kazanzides, Robotic assistance for ultrasound-guided prostate brachytherapy, *Medical Image Analysis*, Volume 12, Issue 5, October 2008, Pages 535-545, ISSN 1361-8415, 10.1016/j.media.2008.06.002.

(<http://www.sciencedirect.com/science/article/pii/S1361841508000613>)

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