Introduction

- Modified robot system in order to achieve better radioactive seed placement in prostate brachytherapy
- Integrated TRUS (Transrectal Ultrasound) Robot for prostate brachytherapy with RadVision simulation and planning software
- Preformed accuracy study developed by Danny Song to measure accuracy of robotic system using graph paper and phantom

The Problem

- The American Cancer Society reports that 240,890 cases of prostate cancer were diagnosed and about 33,720 men will die from it.
- Prostate Brachytherapy is one of the most popular treatments for prostate cancer
- Conventional approach uses physical template that lacks flexibility and maneuverability, and lacks ability to insert needles as different angles
- Robotic systems allow for greater accuracy, flexibility, and maneuverability in radioactive seed placement theoretically resulting in better outcomes.
- Integrating simulation and planning software with robotic systems will allow for seamless and accurate surgery
- At the moment there is no standard for measuring the accuracy of these robotic systems.

The Solution

- Integration of RadVision, a planning and simulation software with the TRUS robotic system allows for good planning and execution of the surgery to ensure seeds are placed in planned location.
- Robot control software was modified in order to be compliant with the new Gall driver.
- OpenIGTLink protocol was used to talk between the robot need to be updated and debugged
- Fingers for holding needle needed to be redesigned, fabricated, tested, and installed.
- Accuracy study experiments involving graph paper had to be done
- Experiment was performed with breast phantom to test 3D accuracy

Outcomes and Results

- RadVision successfully integrated. Able to control robot through RadVision
- Conducted graph paper accuracy experiment with 20 samples
- Believe that improved encoder count conversion will lead to higher accuracy
- Phantom experiment needs to be redone in order to produce better image.

Future Work

- Calibrate encoder tick counts for more accurate motions
- Reinforce structure to reduce effect of wobbling on accuracy and repeatability
- Use a material with better x-ray attenuation in CT scan for more accurate results.
- Finish accuracy study with standardized phantom
- Try to work with company to integrate button controller into RadVision
- Seek IRB approval and conduct clinical trial

Lessons Learned

- Sturdy robotic frame increases accuracy of robotic movements
- Objects that attenuate x-rays are much better to use in CT scans work much better

Publications


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