Docket #: S12-162

LINAC-Compatible Robotic Ultrasound Manipulator for Radiotherapy Guidance

Stanford researchers have developed a patented imaging probe manipulator that consistently maintains probe-to-patient contact pressure and compensates for patient respiratory motion and anatomy shifts during External Beam Radiation Therapy (EBRT). The non-invasive, marker-less, real time image guidance system delivers precise radiation doses to internal moving targets while sparing surrounding healthy structures. The system is lower cost than conventional x-ray based guided systems, can be integrated with any existing radiation delivery system and as an image guidance tool for biopsies, surgeries, and other procedures.

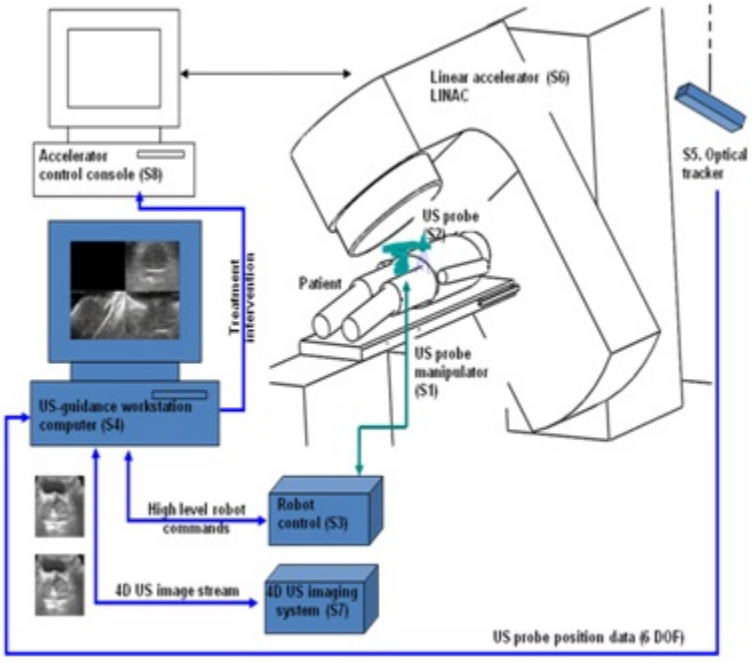


Figure 1 - Robotic ultrasound image guidance system in radiation therapy
(Image courtesy the Hristov Lab and Salisbury Robotics Lab)

Stage of Development - Prototype
Researchers demonstrated real-time, volumetric soft-tissue guidance during live radiotherapy delivery, with clinical viability confirmed through treatment planning analysis and seamless LINAC integration. Sub-3mm displacement detection aligns with clinical action thresholds in prostate radiotherapy, suggesting strong translational potential.

Applications

- **Radiation treatment:** Gantry-based radiotherapy, tomotherapy, Cyberknife radiotherapy
- **Trans-abdominal imaging** during radiation treatment
- Structure imaging such as skull, spine, etc.
- Hands-free image guidance tool for procedures such as **image guided biopsy, surgery, brachytherapy, needle insertion, catheter placement,** etc.

Advantages

- **Real-time** volumetric intra- and inter-fractional motion management based on soft-tissue 3D images
- **Non-invasive and markerless** - No use of ionizing radiation or need for implanted fiducial markers
- Compatible with existing radiation delivery platforms such as conventional C-arm LINAC as well as with Cyberknife radiosurgery robot or tomotherapy systems
- Compatible with existing radiotherapy workflows as an add-on device
- **Lower cost** than conventional x-ray-based guidance systems

Publications

- Schlosser, J., Salisbury, K., & Hristov, D. (2012). Online image-based monitoring of soft-tissue displacements for radiation therapy of the prostate. *International Journal of Radiation Oncology* Biology* Physics, 83*(5), 1633-1640. https://doi.org/10.1016/j.ijrobp.2011.10.049

- Schlosser, J., Salisbury, K., & Hristov, D. (2010). Telerobotic system concept for real?time soft?tissue imaging during radiotherapy beam delivery. *Medical physics, 37*(12), 6357-6367. https://doi.org/10.1118/1.3515457

Patents

- Published Application: WO2014018983
- Published Application: 20150209599
- Issued: 10,232,194 (USA)

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