Augmented-Reality-Assisted Breast Tumor Cryoablation Navigation System

Overview

Cryoablation is emerging as an attractive minimally-invasive alternative to surgery for breast cancer. The procedure freezes the tumor with a cryogen, which takes less than 2 hours and does not require general anesthesia. However, positive patient outcomes are strongly dependent on accurate positioning of the cryoablation probe relative to the tumor(s). This can be improved with augmented-reality assisted navigation.

Objective

The objective of this project is to use motion tracking, sensor fusion, augmented reality, and pre-operative imaging to produce a real-time navigation system for breast tumor cryoablation procedures.

Materials and Equipment

- Breast phantom (for prototyping)
- Magnetic tracking system
- Ultrasound
- Breast fixturing system
- Ablation probe
- Microsoft HoloLens 2
- AR image targets
- Magnetic tracking sensors

System Design
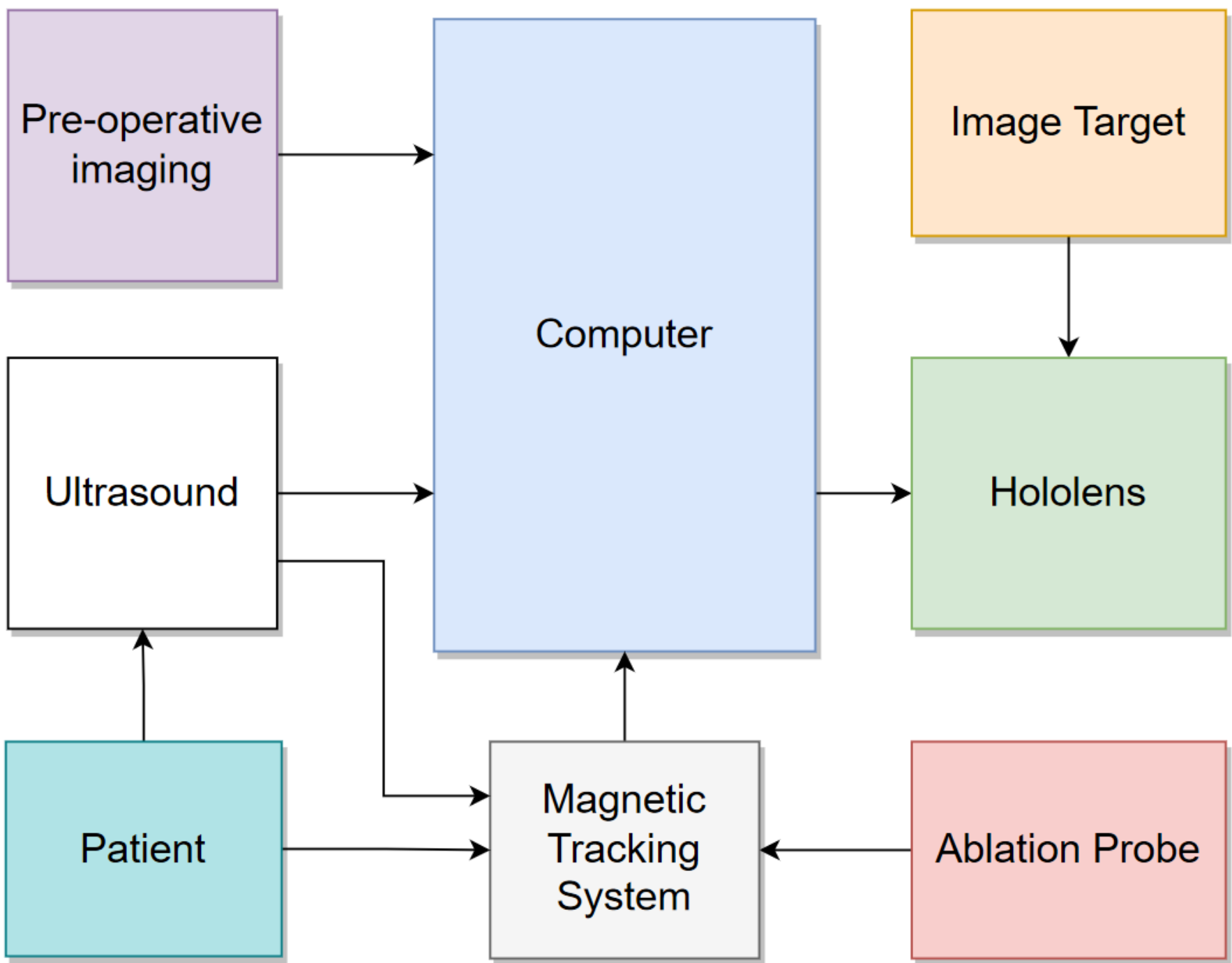
Features

- AR "x-ray vision" using pre-op imaging registered to patient regardless of movement or positioning
- Magnetic tracking system keeps tab on patient, tumor, and probe positions
- System can show simulation of cryoablation zone at probe tip to ensure tumor will be destroyed
- Precise targeting using AR-visible interface elements (lines, markings, measurements, etc.)