

Portable Breast Volume Measurement Device

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Overview

- ▶ Problem Statement
- ▶ Background
- ▶ Motivation
- ▶ Design Specifications
- ▶ Design Alternatives
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Problem Statement

- ▶ Estimating breast volume is challenging and essential—especially for inexperienced doctors.
- ▶ Intraoperative complications often arise
- ▶ Preoperative assessment of volume → increase symmetry
- ▶ Simple, portable device for quick estimation of healthy breast
- ▶ Used to estimate volume of flaps
- ▶ Low cost

Background: Breast Cancer

- ▶ 2nd most common fatal cancer in women
 - 182,400 women diagnosed/year
- ▶ Majority pursue mastectomy
- ▶ Breast reconstruction follows
 - Immediate or delayed
 - Types
 - Implant
 - Tissue flap procedures
 - Artificial tissue support material



Image from
http://www.carolsutton.net/pink/amiel_weisblum_pinkribbon.jpg

Background: TRAM flap

- ▶ Procedure
 - Portion of skin, muscle, fat relocated from abdomen
- ▶ 2 types of TRAM flaps
 - Pedicle flap
 - Free flap
 - Tissue very similar to an abdominoplasty (“tummy tuck”)

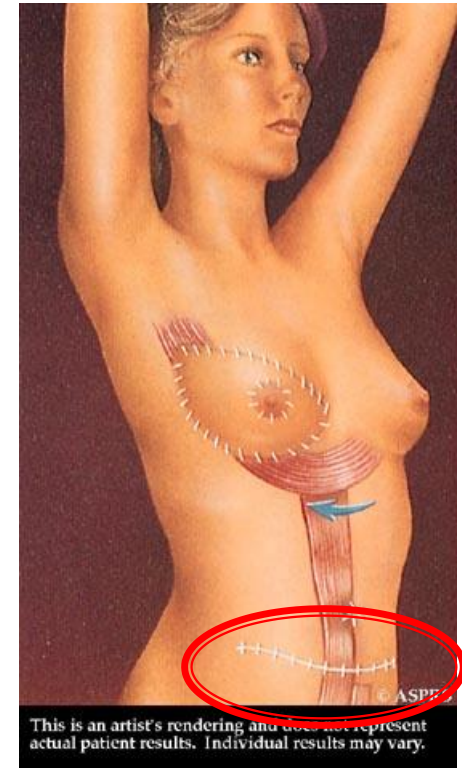


Image taken from
<http://www.breastreconstruction.ca/pictures/living%20tissue/tram2.jpg>

Motivation

- ▶ Inconsistency in methods currently used
 - Expensive
 - Inaccurate
 - Learning curve
- ▶ Eliminates need for numerous surgeries
- ▶ Decreases variability between surgeons
- ▶ Large number of mastectomies



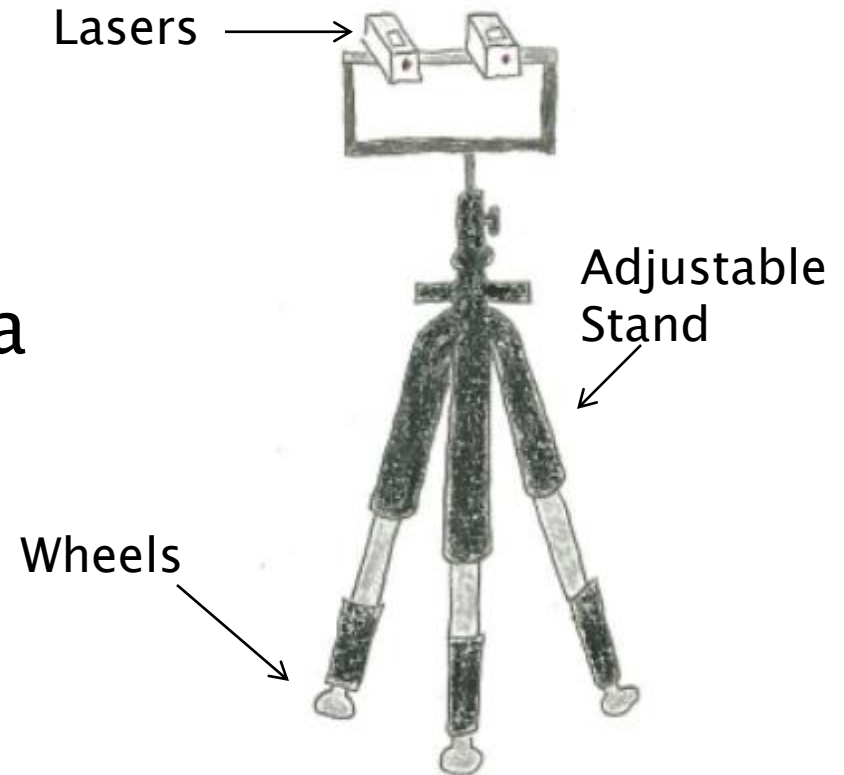
Image from:
http://www.geoconnexion.com/geo_news_article/Creaform-Democratizing-its-3D-Scanning-Technology/6594

Design Specifications

- ▶ Portable
- ▶ Easy to use
- ▶ Cost efficient
- ▶ Safety
 - Sterilizable
 - Coverable

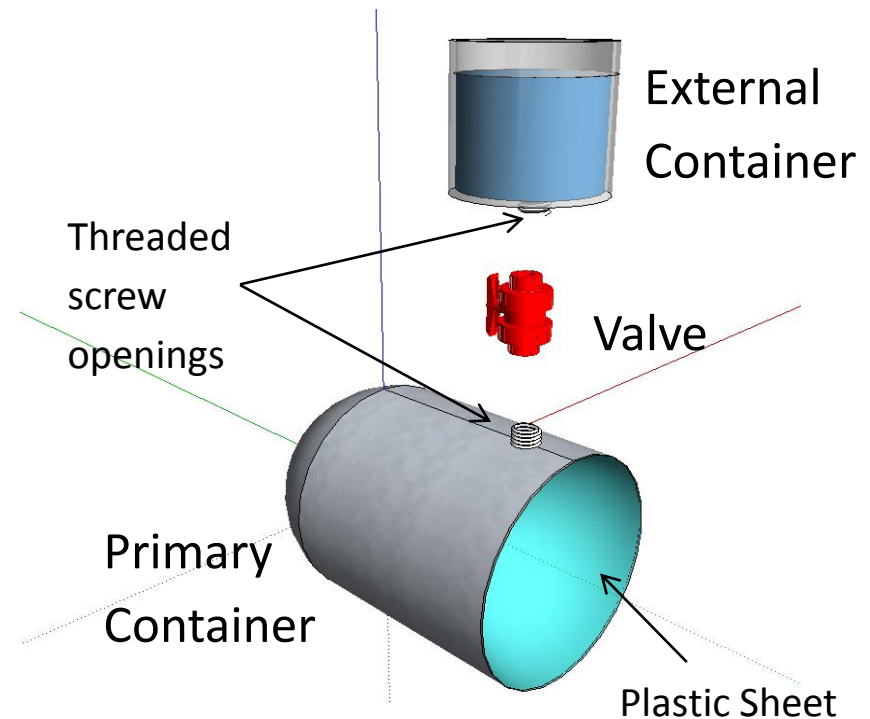
Design Alternative #1: Lasers

- ▶ Adjusts for different patients
 - Height of stand
 - Distance between lasers
- ▶ Volume computed on a computer program
- ▶ Problems
 - Cost
 - Ease of use



Design Alternative #2: Volume Displacement

- ▶ 1 primary and 1 external container
- ▶ Breast inserted into primary
- ▶ External to primary flow through valve
- ▶ Total primary - Change in external = Breast Volume
- ▶ Problems
 - Reusability issues
 - Water-tight seal



Design Alternative #3: 3D Imaging

- ▶ 3D-sensing technology
 - Chip
 - Depth sensors
 - RGB color camera
- ▶ 3D image
- ▶ Program to compute volume



KINECT™
for  XBOX 360.

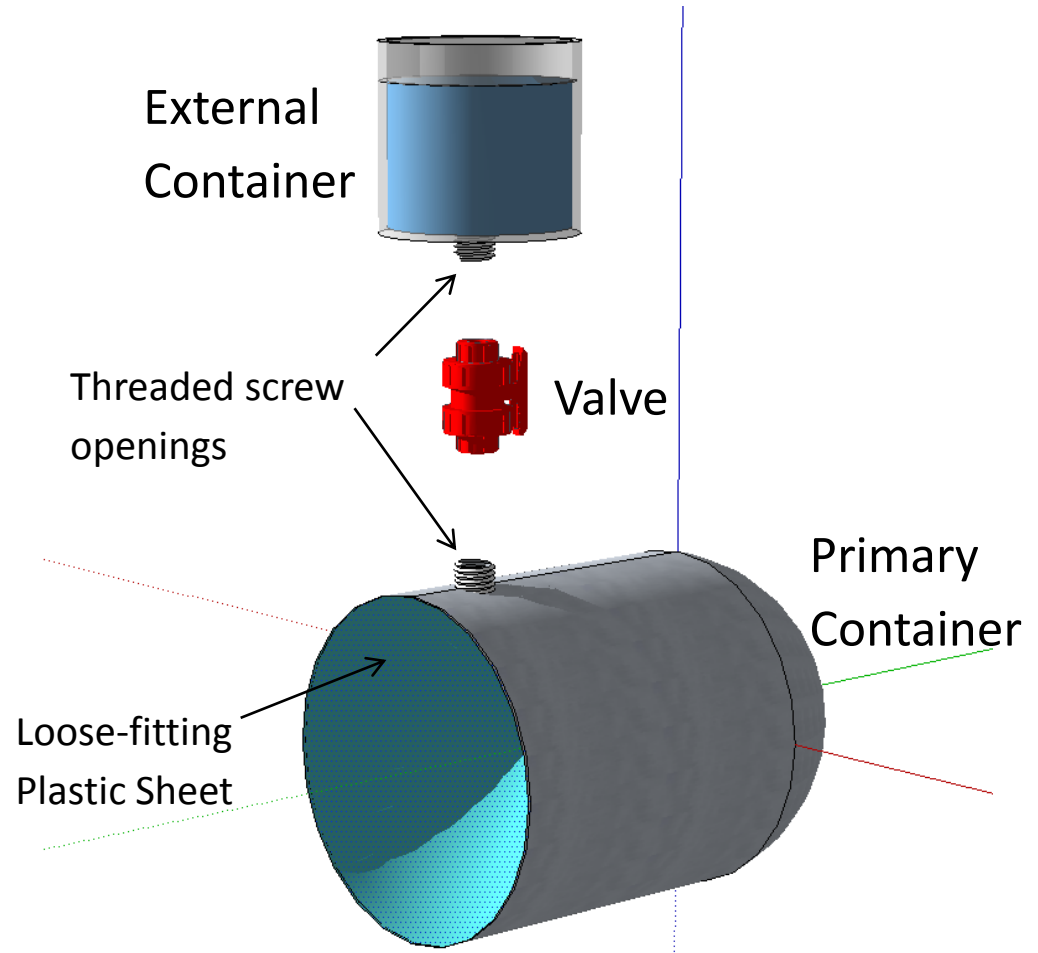
Image taken from
<http://www.xbox.com/en-US/kinect>

Design Matrix

Category	Lasers	Water Displacement	3D Imaging
Cost (25)	10	25	15
Portability (15)	7	12	7
Ease of Use (15)	5	12	14
Accuracy (20)	5	15	10
Maintenance (10)	9	5	9
Speed (5)	1	4	4
Patient Comfort (5)	5	3	5
Safety (5)	5	5	5
Total (100)	47	81	69

Final Design

- ▶ Most accurate
- ▶ Cheapest
- ▶ Highly portable



Future Work

- ▶ Research materials for final design
- ▶ Fabricate prototype
- ▶ Test final design
- ▶ Pursue patent
- ▶ Deliver to client

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- ▶ Tracy Puccinelli
- ▶ Dr. Ramzi Shehadi

Resources

- ▶ [1] University of Texas Anderson Cancer Center.
<http://www.mdanderson.org/patient-and-cancer-information/cancer-information/cancer-types/breast-cancer/index.html>. Access 10/18/2011.
- ▶ [2] “Breast Reconstruction After Mastectomy”. American Cancer Society.
<http://www.cancer.org/acs/groups/cid/documents/webcontent/002992-pdf.pdf>. Accessed 10/18/2011.
- ▶ [3] “TRAM Flap”. Reconstructive Breast Surgery.
http://www.breastreconstruction.ca/living_tram.htm. Accessed 10/18/2011.

Questions?