Sensory Abnormality Mapping

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Client: Miroslav “Misha” Backonja , MD
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Abstract

Dr. Miroslav Backonja, a neurologist who works in pain medicine at UW Hospital, has expressed the need for a more accurate method to measure the surface area of cutaneous sensory abnormalities. Currently, transparency paper is used to trace the affected area and a planimeter is used to measure surface area. Dr. Backonja is looking to be able to measure surface area on contoured regions of the body in a more accurate and repeatable manner.

Background

- Damaged nerve fibers create neuropathic pain
- Cutaneous sensory abnormalities
  - Pain, tingling, burning, numbness
- Important to accurately measure affected area
- Area is used in assessing effectiveness of treatment
- Current method:
  - Map sensory anomalies on patient
  - Trace area with tracing paper
  - Determine surface area using planimeter

Motivation

Problems with the current system :

- Paper does not easily trace contoured areas (ie. face)
- Commercial competition costs $50,000
  - Zcorp Zscanner 800
- Tracing paper not accurate enough for clinical use
- Results not reproducible for unique shapes

Client Requirements

- Minimally invasive
- Accurate measurement (error rate: 5–10%)
- Cost effective
- Consistent, reproducible results
- Clinical use
- Data should be collected and displayed
- Under $1000 if possible

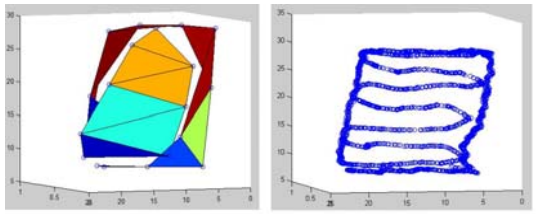
Final Design

- Design uses system of three infrared cameras
- Cameras track position of LED stylus
- Points captured while tracing affected area
- Points used to make interpolated surface
  - Surface formed by natural neighbor triangles
- Surface area calculated by summing areas of triangles

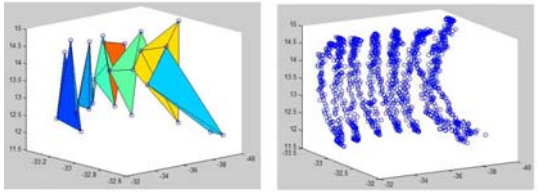
LED stylus used to trace affected region

Three-camera setup during calibration

Testing



Test done using a rectangle. Triangles used for surface area calculation on left, all points on right. Calculated area = 373.82 cm^2 Actual area = 385.86 cm^2



Test done using part of a silly string can. Triangles used for surface area calculation on left, all points on right. Calculated area = 10.0 cm^2 Actual area = 27.72 cm^2

Budget

Markers and LED’s w/ shipping - $39.88
2 Pen LED lights - $9.72
Camera System w/ shipping - $2,058.39

Grand Total: $2,157.59

Future Work

- Write software to better interface with cameras
- Properly mount cameras
- Perfect calculation algorithms
- Determine best tracing method

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