INTRACRANIAL PRESSURE SENSOR

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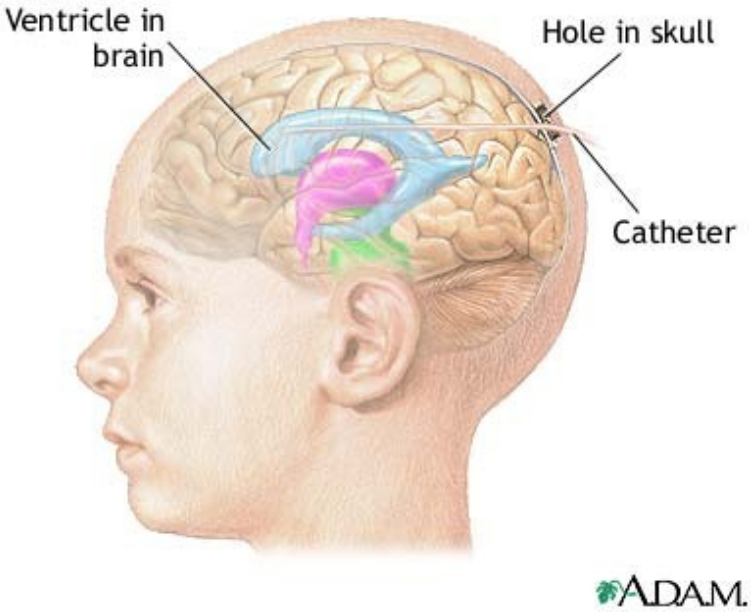
Outline

- Problem Statement
- Background Information
- Client Specifications
- Designs
  - Coil fabrication
  - User Interface
- Future Work

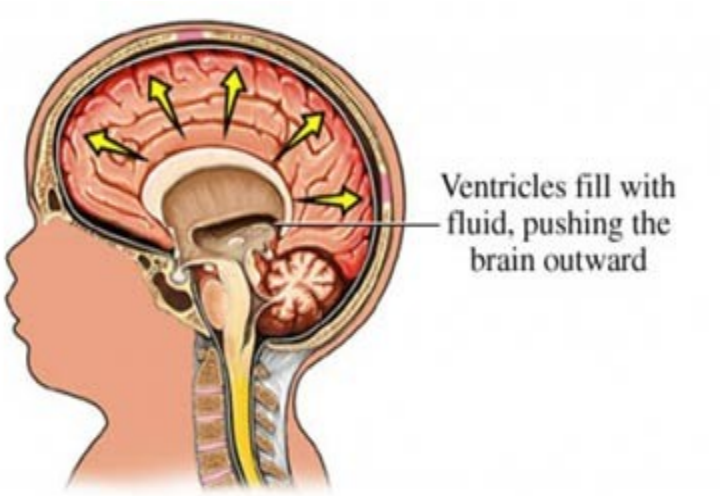
Problem Statement

- To develop a wireless intracranial pressure (ICP) sensor that passively monitors ICP, and a user interface that will display changes in pressure



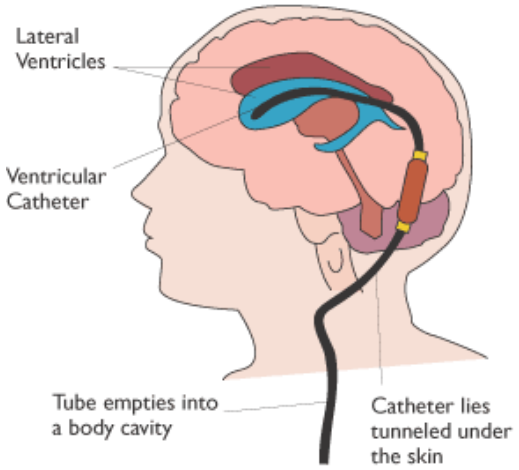
Hydrocephalus

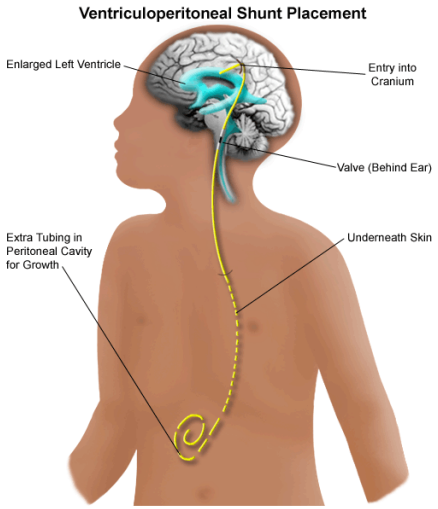
- Accumulation of cerebrospinal fluid (CSF) in brain
- Increased intracranial pressure
  - Enlargement of head
  - Convulsion
  - Mental disability
  - Death
- 1 out of 500 births



Current Treatment

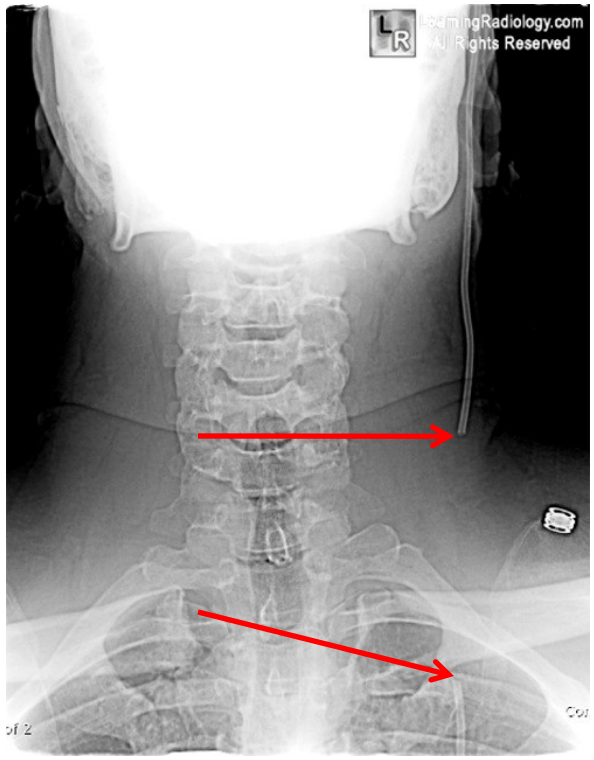
- Ventriculoperitoneal shunt systems
  - Relieves pressure inside the skull
  - Travels subdermally from ventricles to abdominal cavity
  - One-way valve controls drainage





Problems with current design

- Shunt
  - 50% of shunts fail within the first two years
  - Requires frequent medical evaluations
  - Hard to determine malfunctioning
- Pressure Sensor
  - Limited to temporary implantation
  - Hazardous



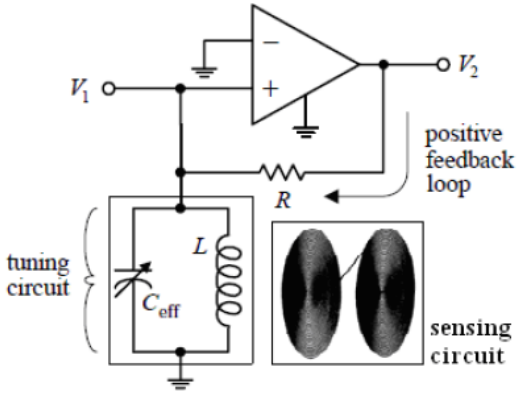
Shunt fracture

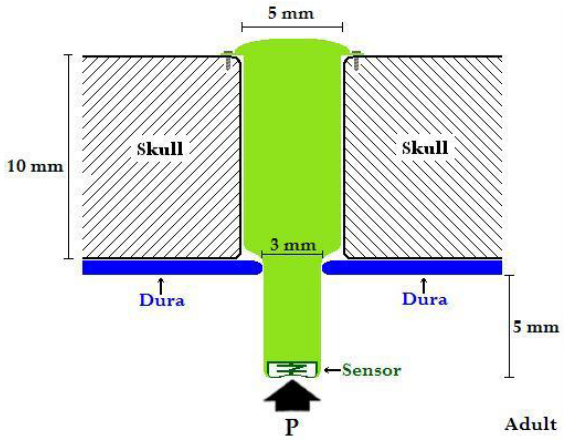
Client Specifications

- ICP Device
  - 3mm width; 15mm depth
  - Implanted and removed easily
  - Durable (10 to 20 years)
  - Cannot drift more than 0.5mmHg/year
- User Interface
  - Measure positive and negative pressure (-30 to 100mmHg)
  - Real-time measurements
  - Show graph of signal

ICP Device Design

- Biocompatible
  - No interference with signals
- Sensor at base of probe
  - Two coils of wire form tank circuit
  - Distance between coils affects resonant frequency
- Device screwed into skull



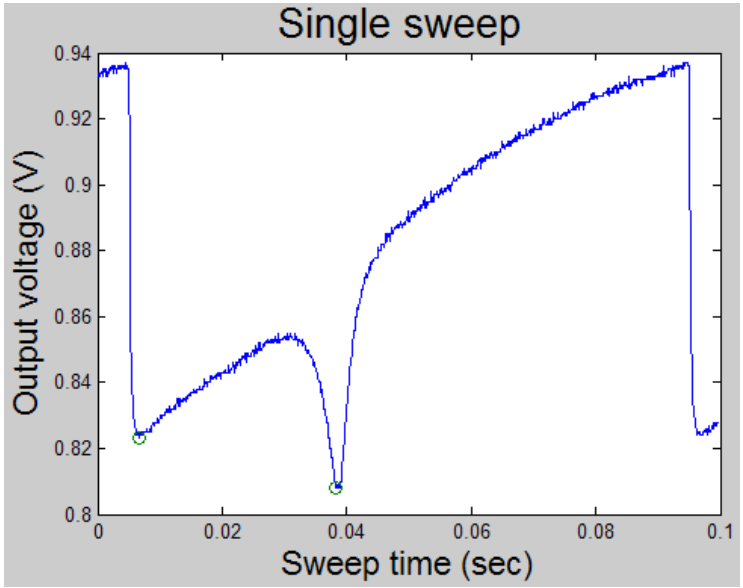


Coil Fabrication

- Photolithography
  - Uses etched grooves and light
  - Mass producible
  - Reliable and repeatable
  - Hard to obtain electrical connection between coils
- Hand-wound coils
  - Easily designed
  - Unreliable
  - Not mass producible

User Interface

- Measure resonant frequency peak
- User friendly
  - Ability to save data
  - Easily interpreted graphs



Peak Detection

- Detects peaks and valleys at a given threshold
- Finds amplitude
- Measures distance of where peak or valley occurs
- Pros
  - Accurate
  - Locate one signal
- Cons
  - Determining threshold value

Tone Measurement

- Finds highest amplitude
- Find frequency of a single tone
- Can scan a frequency range
- Pros
  - Accurate
  - Locate one signal
- Cons
  - Works best with sine waves
  - More research is needed

Amplitude

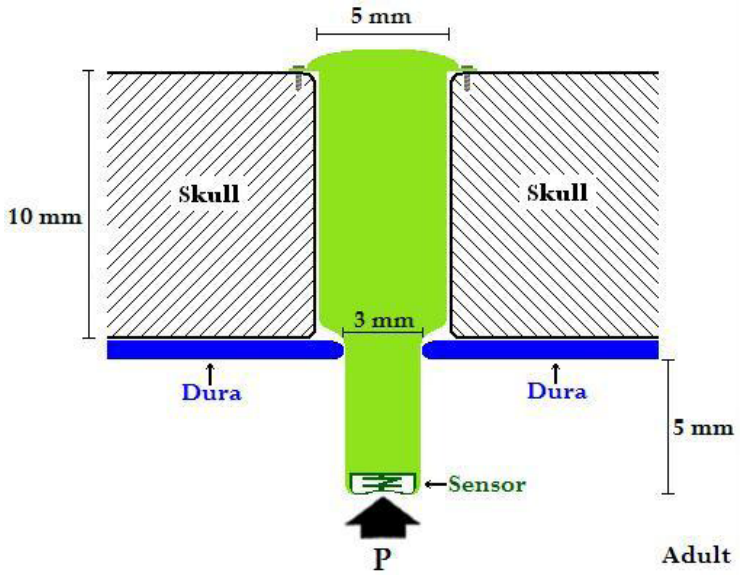
- Calculates average amplitude
- Pros
  - Simple
  - User friendly
- Cons
  - Unreliable

Design Matrix

LabVIEW Functions	Weight	Peak Detection	Tone Measurement	Amplitude
Accuracy	40	38	30	25
Ease of design	25	24	15	18
Simplicity	20	10	10	5
User Friendly	15	18	18	14
Total	100	**90**	73	62

Future Work

- Test tank circuit
- Finalize capsule design
- Finalize fabrication design
- Equation that relates pressure and frequency



Acknowledgements

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