Polygraph

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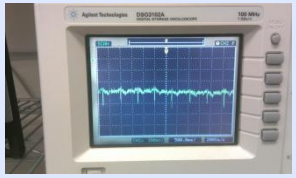
Objective

❖Combining skin conductivity and heart rate measurements to detect human's physiological changes due to nerve effect.

Background

❖People's skin conductivity varies when their nervous system activated
❖Stimulus triggers sweat in the sweat gland
❖Skin conductivity drops when people are nervous

❖Heart rate has its own rhythm of beating, but it can respond to stimulation of nerves.
❖Heart rate increases when people become nervous or influenced by circulatory substances, like adrenaline

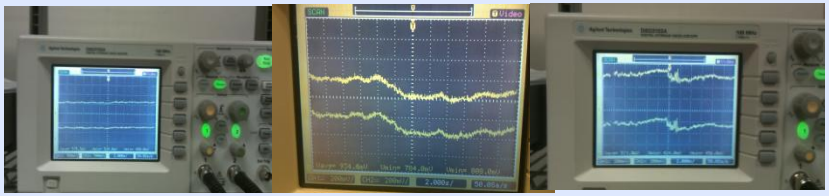


Measuring Methods

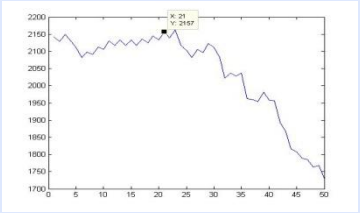
❖Measuring skin conductivity
-- designed amplifier circuit to measure the voltage difference across two fingers.
❖Measuring pulse rate
-- Attached ECG pads (Supplied by Professor Dennis Claflin) to left arm(+), right leg(-) and left leg(reference) to measure heart rate
❖Designing IIR low-pass filters for skin conductivity and pulse rate signals (both in DC voltage) with sampling rate of 1kHz
❖Algorithms
-- Updating heart rate at each heart beat and determine the average of skin conductivity at the same time
-- Calculating the change of vector [(Heart rate) (Skin conductivity)] to determine the physiological changes

Results

❖Human's skin conductivity stays relatively constant when not stimulated
❖Skin conductivity changes while people is nervous or stimulated
❖Skin conductivity curve may change due to variation of human body's contact area with the probe.



❖Skin conductivity has obvious variation when stimulated. It is quite easy to tell physiological changes with the help of calculating the standard deviation.



❖Human's heart rate remains constant in stable condition
❖Heart rate increases a little when under pressure and drops a little bit when depressed

Future Work

❖Integrating respiration and blood pressure measurements for further investigation on human's physiological changes
❖Figuring out a much more accurate way of combining polygraph measurements to determine the threshold of psychological fluctuation

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