

Cyber-Empathic Pen Design

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Introduction

Cyber-Empathic Design- The integration of sensors and information technologies with existing products to allow products to observe themselves and report these observations in the form of quantitative data to researchers.

Motivation- Reduce hand fatigue when writing for extended periods of time. Identifying correlations between user features and optimal pen design.

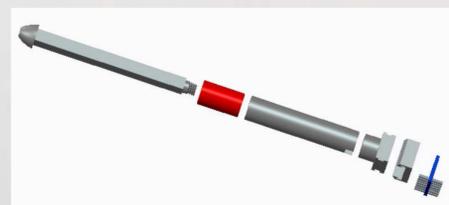


Problem Statement- The purpose of the project is to be able to design and produce customized writing instruments, the broader impact is exploring methods of design that can support mass customization of products for many different types of applications.

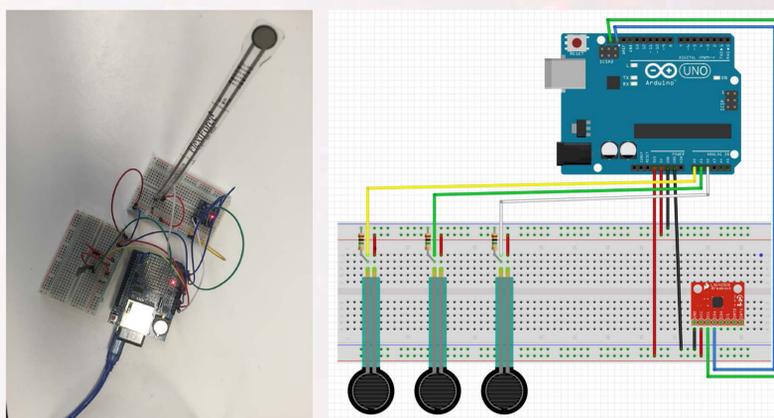
CAD Model



Pictured to the left is the CAD model of the prototype cyber-empathic pen. There are 2 force sensors in the pen located underneath the grip. There is another force sensor at the back of the pen measuring the force being used to press down. There will also be an accelerometer attached to the back of the pen to track user movements when writing.



Circuit



The circuit for the pen consists of 3 force sensitive resistors and 1 GY-521 accelerometer/gyro. These are connected to an Arduino Uno R3. The voltages read by the Arduino are collected by CoolTerm (a data logging software) to be graphed in Matlab.

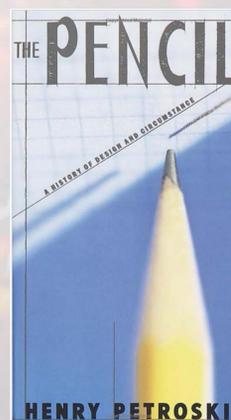
Methods

Phase 1: Consisted of reviewing pertinent research in the area of pen design.

Phase 2: Designing the circuit, designing a 3D pen model, printing the model, and integrating the circuit onto the pen.

Phase 3: The testing of the pen with subjects. Once approved for human research studies, experiments will be conducted to gather user data.

Phase 4: From the data collected in phase 3, any trends relating force over time, motion over time, writing quality, and any other apparent trends in the data will be observed.



Future Research

This experiment was designed to probe into the field of biomechanics penmanship and see what further research can be done.

Following the results of this experiment, any correlation between use of the pen over time with the forces and motion will be further explored. For example, finding fluctuating grip forces over time would lead to a future experiment testing how grip shapes and sizes affect grip forces over time. Finding a correlation between the motion of the pen over time would lead to an investigation on how possibly pen weight, length, and center of mass affect writing.

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