

MIT Medical Device Design Course 2.75 – 2019

Project Objective:

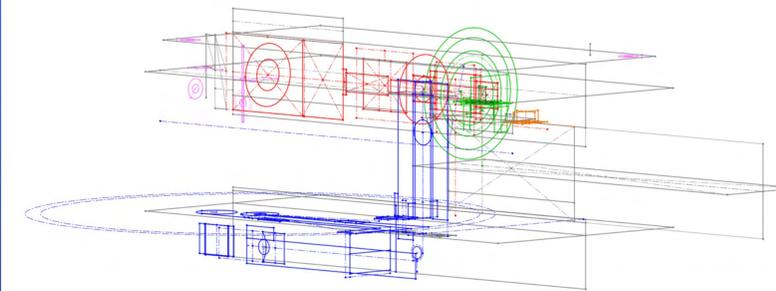
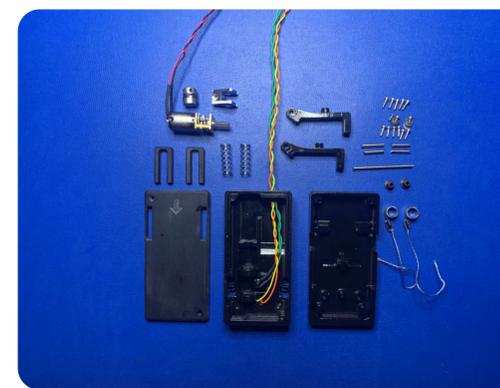
Dr Ryan Carroll from Mass General Hospital presented the need for a device to precisely measuring blood oxygen perfusion. Perfusion can help determine the severity of a health problem in cases of extreme dehydration, sepsis, and organ failure. Currently a doctor will pinch and release patient's finger and watch as the skin goes from a pale white back to a normal red. The time it takes for this transition is the capillary refill time (CRT) and is one method to determine perfusion.

Outcome:

My team demonstrated a small finger clip that could automate the process and produce precise time measurements CRT.

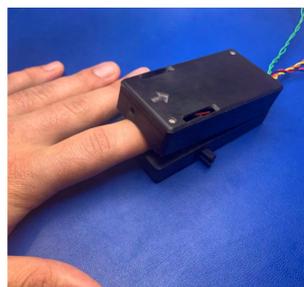
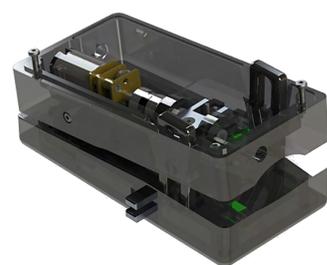
Team Role:

Team Leader, led experimentation planning, task formulation. Mentored less experienced teammates. Responsible for the mechanical design.



Final Presentation Slides:

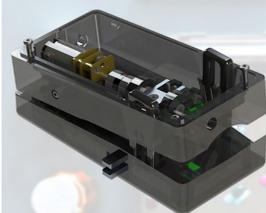
Our approach



A hand-held device with exterior features similar to a pulse oximeter that applies a certain force to the fingernail, and measures CRT with a photoresistor.

Design description

- Two modules:
- Sensor
 - Pressure applicator

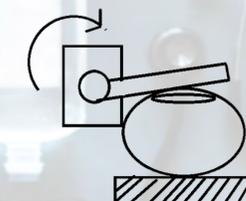


I. Sensor



Light intensity going through the photoresistor, placed above the nail, changes during the perfusion process.

II. Pressure applicator

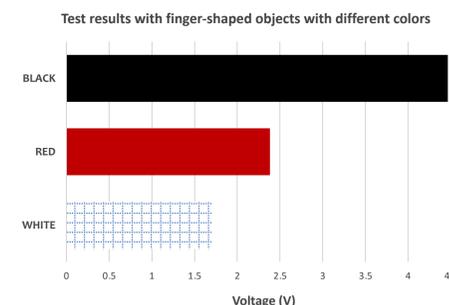


Force applied to the nail is driven by a motor.

Test results

– how we made sure it measures CRT

I. Photoresistor can differentiate different colors.

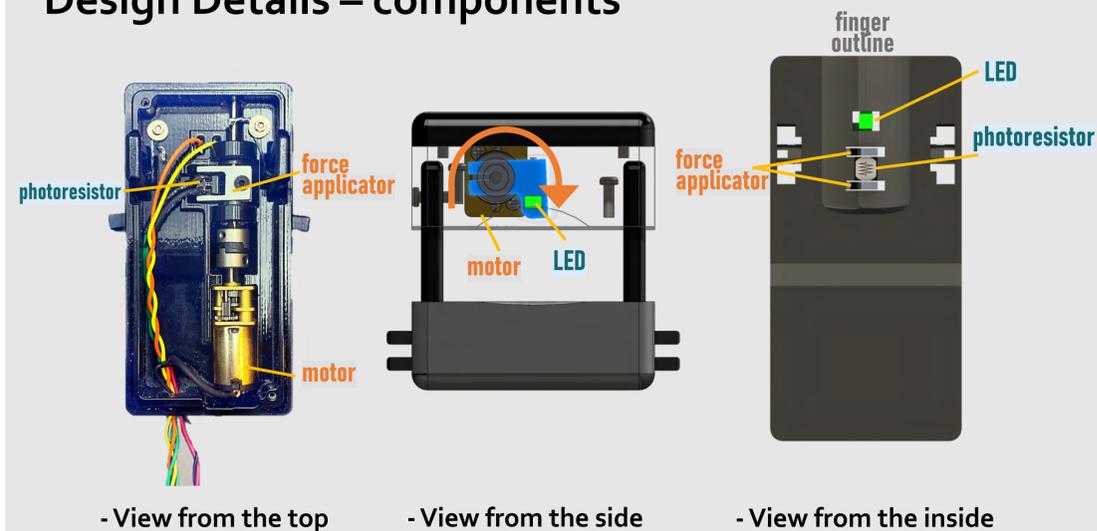


II. Voltage difference as a result of movement is insignificant compared with that of color change.

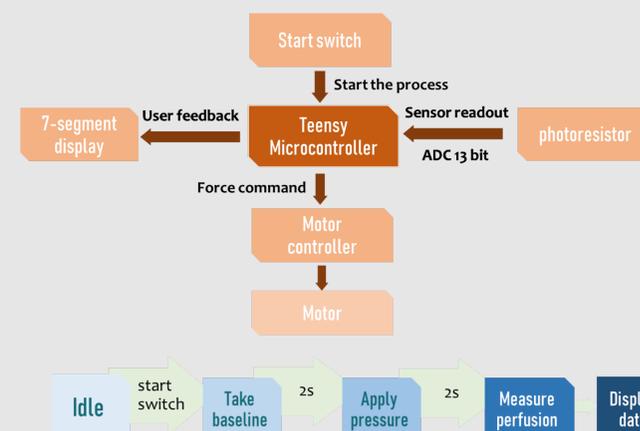
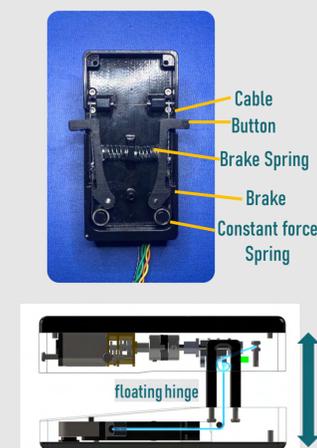
phantom test #1: hot dog



Design Details – components



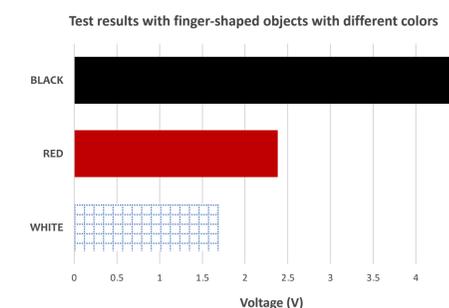
Design Details – mechanical / electrical



Test results

– how we made sure it measures CRT

I. Photoresistor can differentiate different colors.



II. Voltage difference as a result of movement is insignificant compared with that of color change.

