WoodwindMania

D3: Angel Peprah, Judenique Auguste, Vivian Beaudoin
18-500 Capstone Design, Spring 2022
Electrical and Computer Engineering Department
Carnegie Mellon University

Product Pitch

WoodwindMania is designed to make the instrument learning experience more accessible to people of all backgrounds. Instrument education, including the cost of the instrument and lessons, is expensive. Our goal is a system that is beginner-friendly, affordable, and resembles a flute's dimensions and physical feel with functionality to simulate real lessons.

The system includes a flute controller made from a PVC pipe and a web application with several modes and real-time user feedback. Our product reached our initial requirements for accuracy with user feedback **greater than 90%** and all feedback is displayed **within half a second**.

System Architecture

WoodwindMania is broken into three main components: the physical controller, wireless communication, and web application.

The Arduino sends all the sensor data to a Raspberry Pi using BLE characteristics. The RPi processes the note being played, plays it using SonicPi, and sends this data to the web app by writing to a text file. From there, the web app displays the feedback to the user depending on the current mode being used.
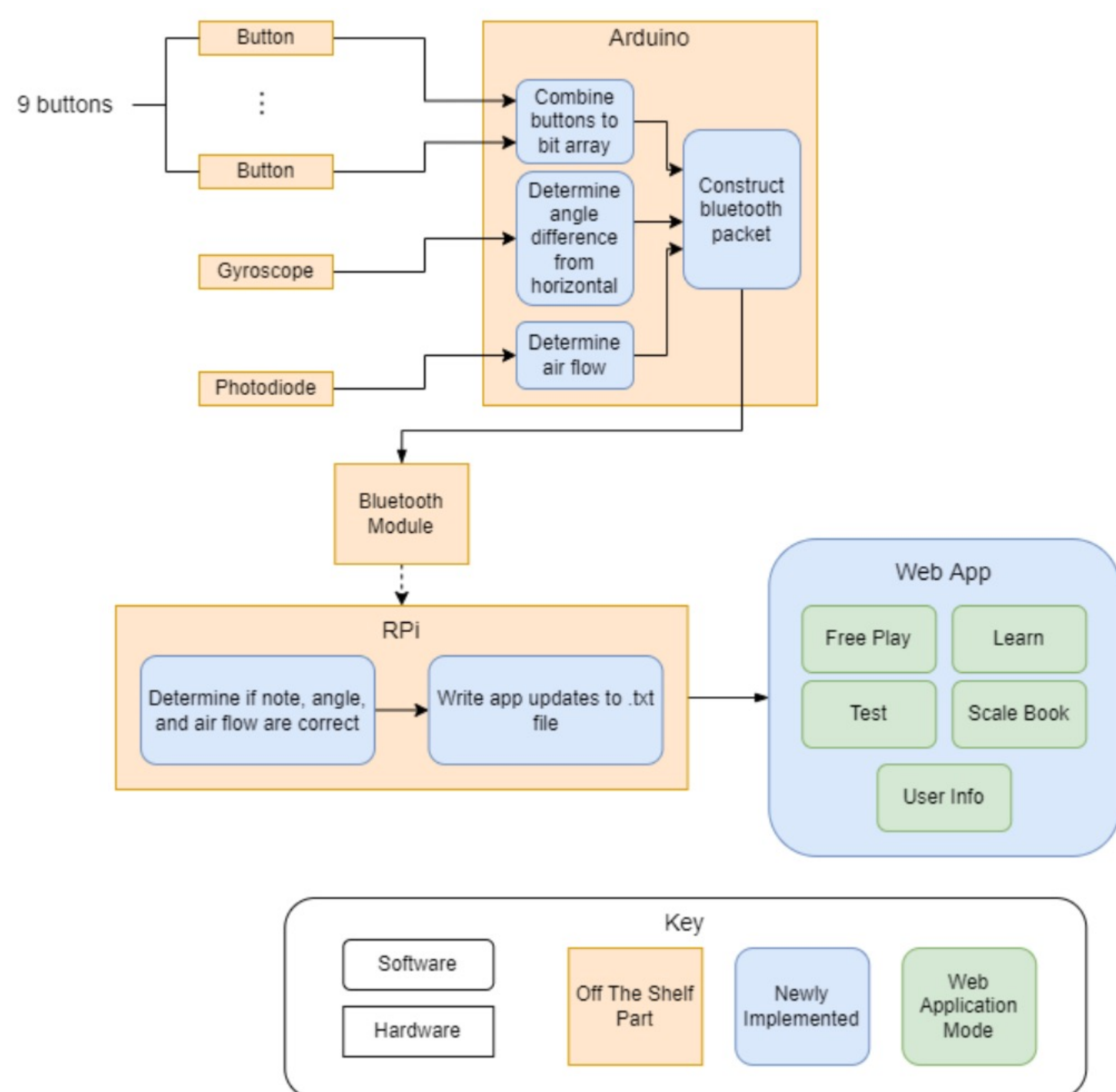

Figure 4: System Block Diagram

Conclusions & Additional Information

http://course.ece.cmu.edu/~ece500/projects/s22-teamd3/

We are satisfied with how this project turned out; however, we can work to improve a few things. The main issue is the latency when comparing our system to a real flute. There are two main factors contributing to this: the Bluetooth connection and the web application. If someone were to work on this in the future, we would want to find another way to host the web app, or to try a device with more RAM as the RPi we used only had 4GB.
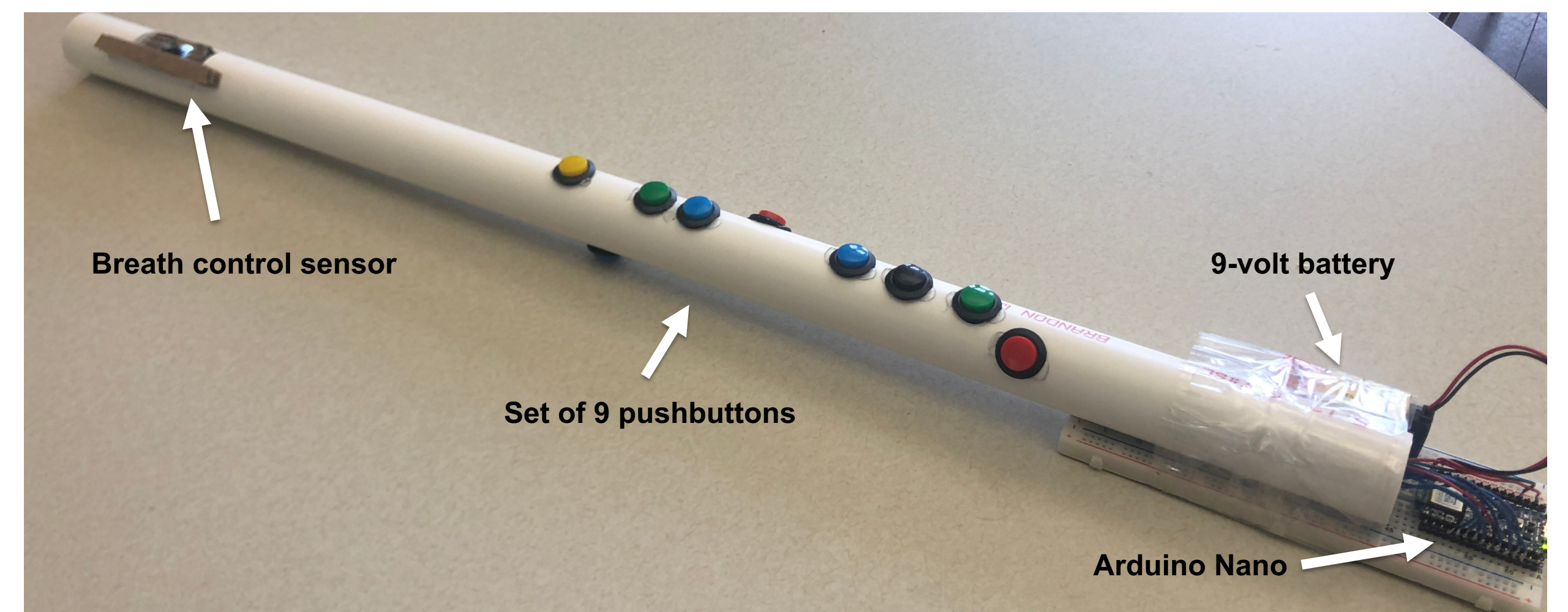
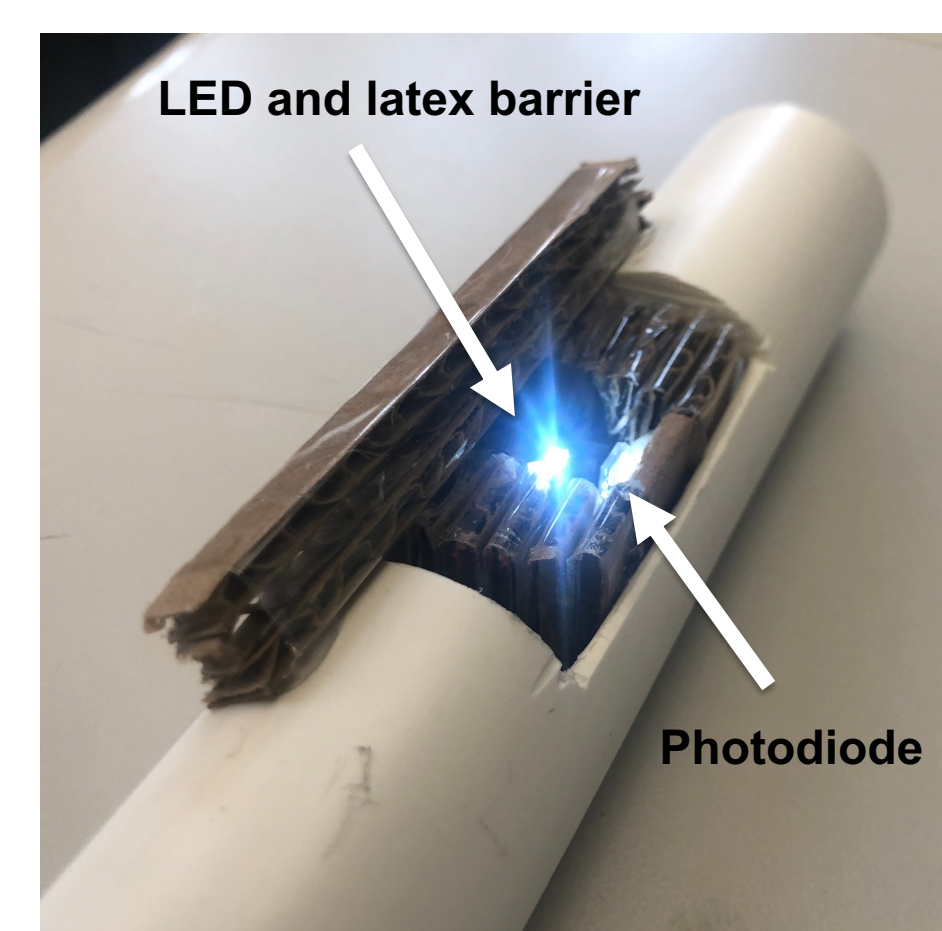## System Description

Figure 1: Complete length of flute controller

Figure 2: Breath control sensor

Hardware Interactions

The physical controller consists of a 26" piece of PVC pipe with 9 push buttons and breath control sensor. The breath control works by detecting obstructed light when the user blows on a latex barrier. The Arduino Nano at the end records the vertical position of the controller through an accelerometer.

Web Application Features

The web application receives sensor data from the controller and displays feedback based on the mode the user chooses to interact with. The sensor data is processed in the three modes with real-time feedback: free play, learn, and test. The user can view their progress and other flute resources without the controller connected.
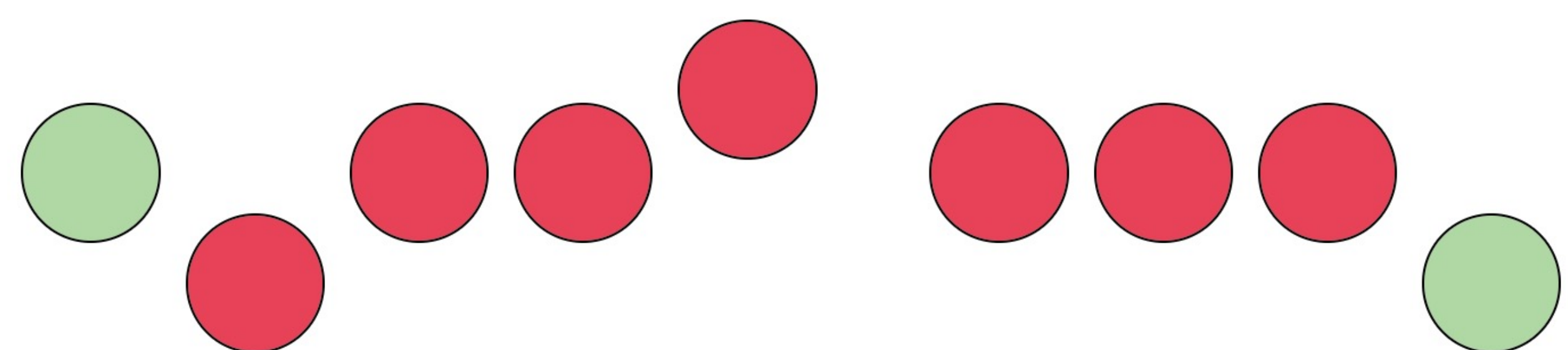
Your Fingerings:

Figure 3: Displayed user feedback

System Evaluation

Metric	Requirement	Measured Value
Length x Width	~ 26 in x 1 in	29 in x 1 3/8 in
Weight	~ 1.13 lbs	1.17 lbs
Button/Angle Feedback Accuracy	>= 90%	100%/90%
BLE Latency	< 100 ms	96.5ms
Web App Latency	< 400 ms	269 milliseconds
Cost	<$500	$150

Figure 5: Results

Electrical & Computer ENGINEERING

Carnegie Mellon