Mixed Reality Hardware for Hands On Virtual Science Labs
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Research question
As more and more classes transition online how can online science labs evolve and utilize new technologies to better emulate in person labs in order to close the gap in learning between online and in-person learning?

Background
- The number of students taking college fully online has increased by 5% since 2008 [1].
- Students taking at least one online class has increased from 20% to 50% since 2008 [1].
- VR equipment has dropped from $529 to $357 on average since 2016 [2].
- VR education experiences have been shown to be more engaging and interesting to students[3].

Challenge
Online science labs when compared to their in-person counterparts lack in many aspects:
- Lack of real equipment to perform the lab experiments
- No sense of movement or temperature
- Limited to only seeing what is happening in the experiment not interacting physically

Solution
In order to close the gap between virtual labs and online labs, virtual lab scenes in Unity will be developed to work with SWISH, a mixed reality device that can simulate fluid motion through haptic feedback. These components working together will create a more “in-person” experience.

SWISH Mixed Reality Device
Left photo: shows the internals of the smaller SWISH device. The weight can be seen mounted on 2 axis which will move to simulate the changing center of mass of a virtual liquid.
Right photo: This is how to assembled SWISH will look

Titration Color Change/Menu
Left photo: Color change in the liquid as a result of the titration experiment
Above Photo: GUI dropdown menu for experiment

Progress
- Titration lab experience is playable, titration color change works
- Basic GUI for the user
- SWISH has been built and can respond to Arduino inputs

Future Work
- Further flush out the GUI
- Program Unity scene to send commands to SWISH device
- Program SWISH to correctly shift center of liquid mass
- Finish QA testing to optimize lab performance
- Pre and post lab experiences

References