

# The Reduction of Motion Sickness in Virtual Reality Applications



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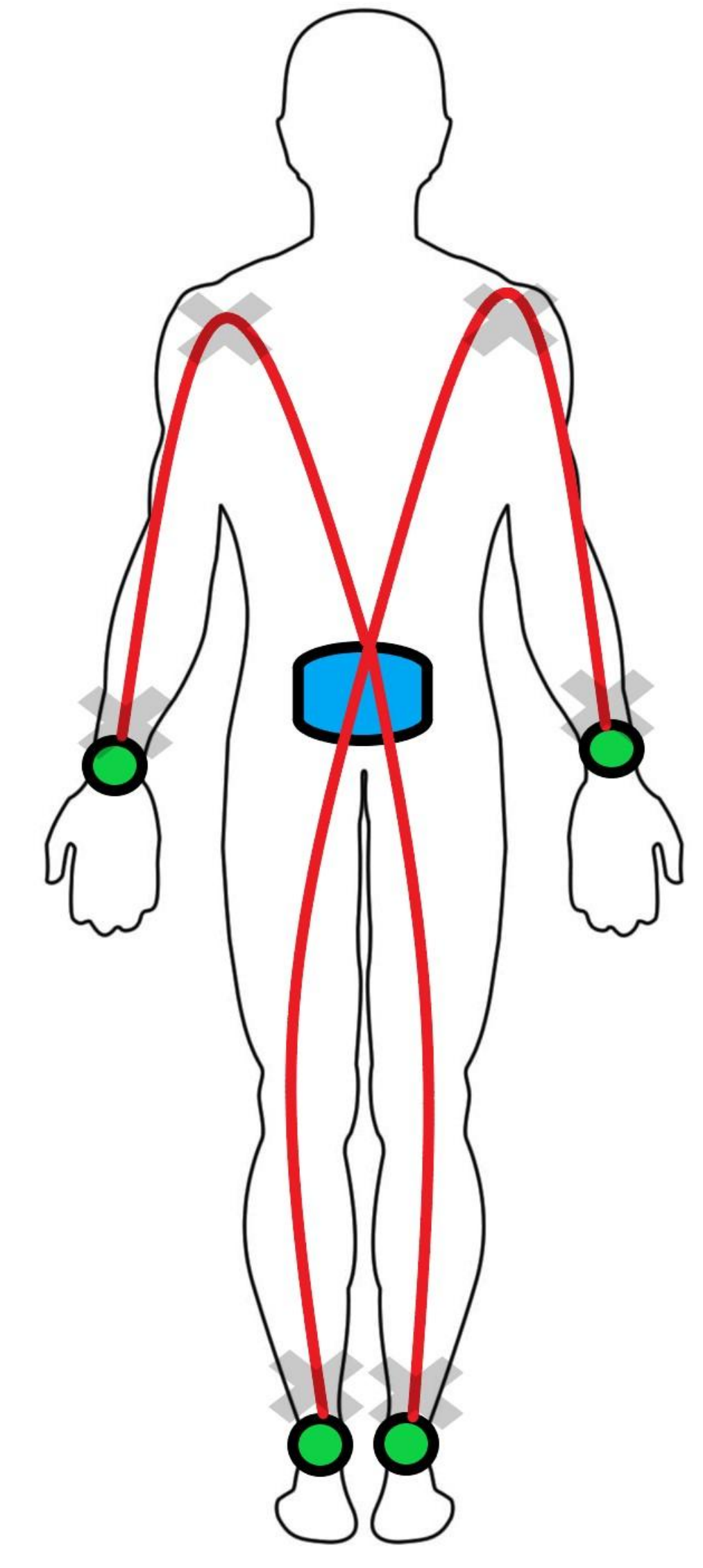
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## Introduction

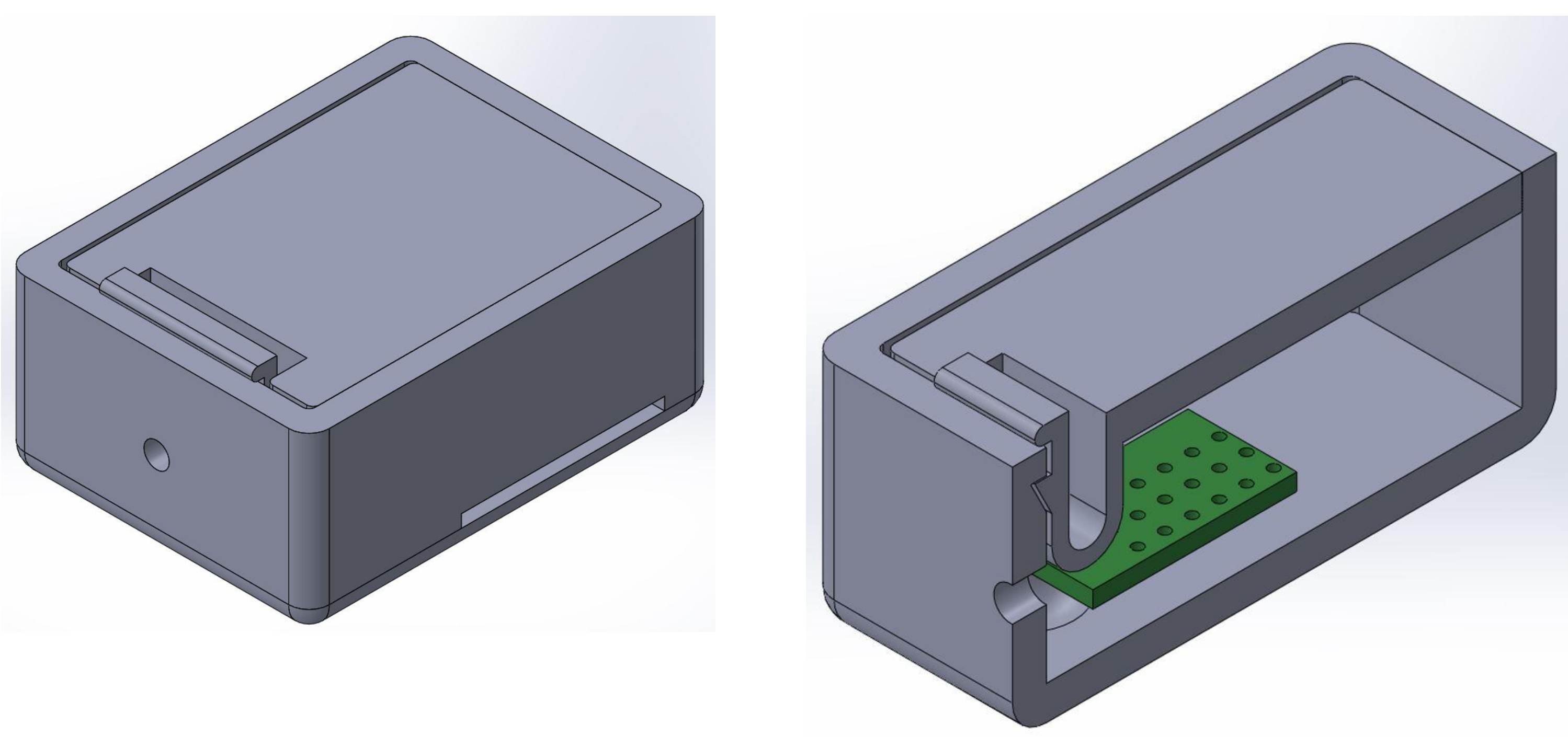
With the recent advent of 3 DOF (degrees of freedom) and 6 DOF movement in Virtual Space, VR devices and applications have become more immersive than ever before. But the largest limitation is that the user is restricted to a virtual space the size of the room they occupy. To combat this many applications introduce a system of locomotion typically controlled through joysticks or touchpads. But this method of control has its own drawbacks, the most troublesome being simulator sickness. We will be exploring the ways in which this locomotion is directly linked to simulator sickness in VR.

## The Setup

- **Blue** = Computer and power source contained in fanny pack.
- **Green** = Vibrator packs.
- **Red** = Wires.
- **Grey** = Strap locations.
- This design focuses on putting all of the components onto the users back. This will prevent entanglement with other components of the VR experience.



## Rumble Packs



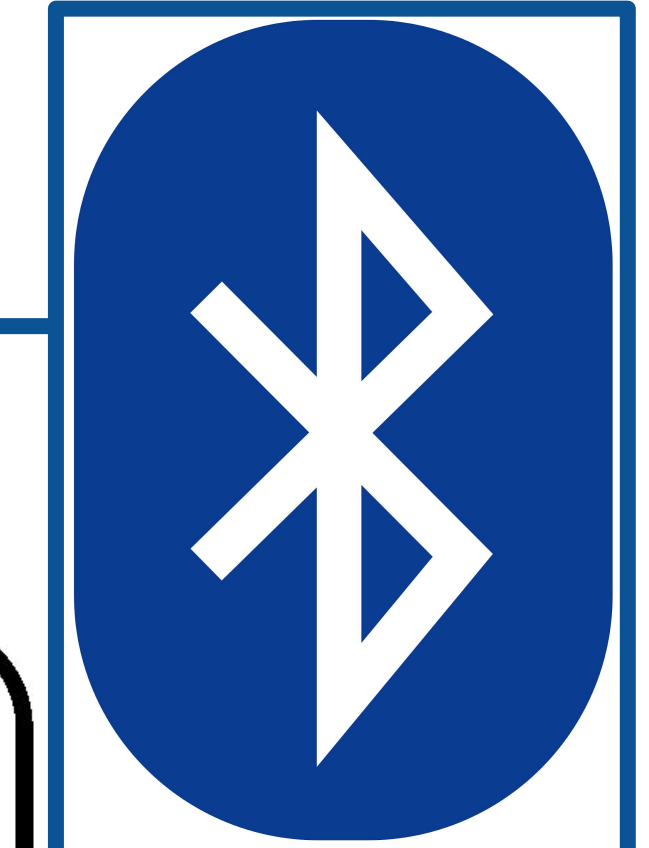
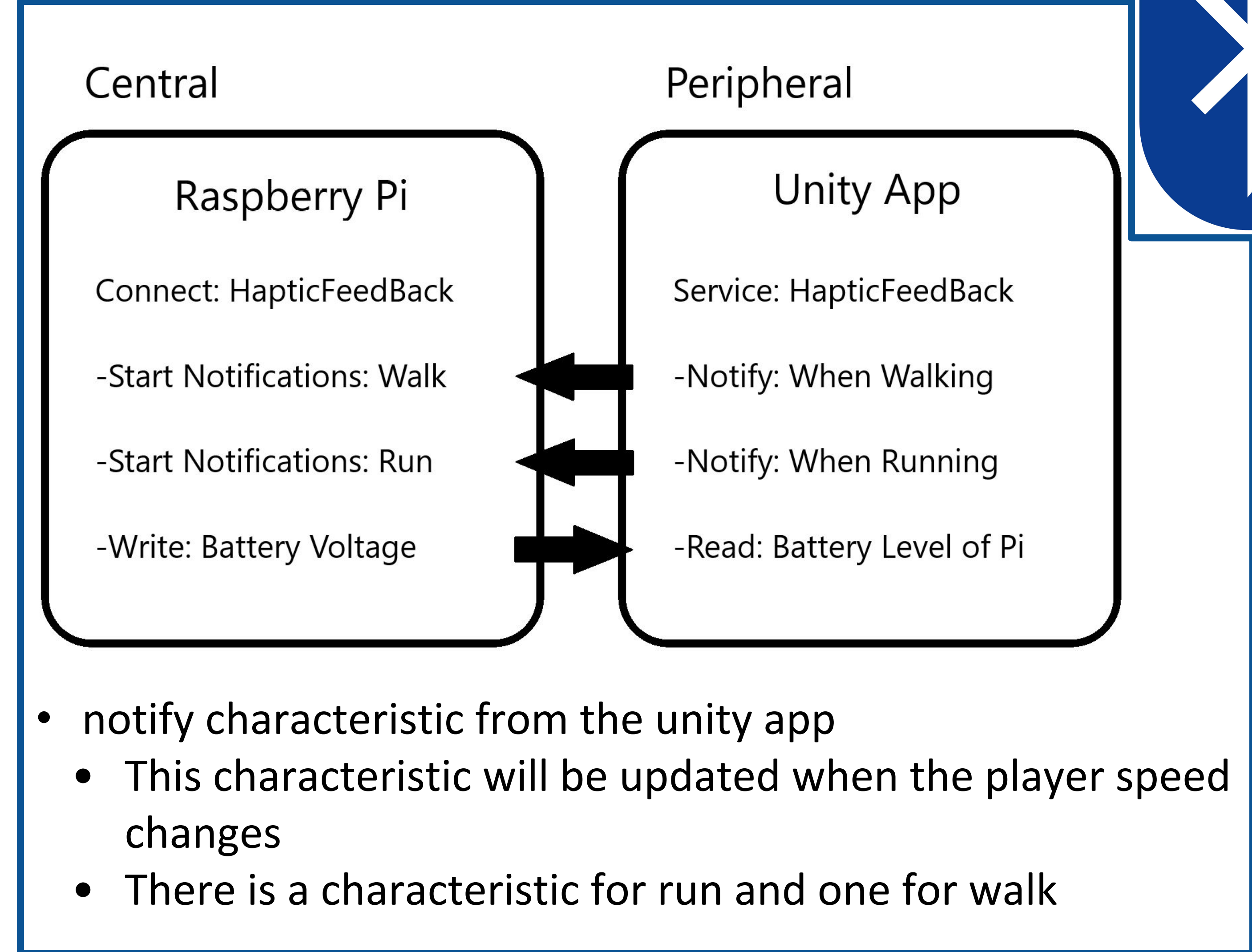
- Designed to keep the housing as small as possible to limit weight and keep it comfortable
- Originally a screw was used to hold down the top but it was replaced with a smaller push latch as the screw took up more space than preferred

## The Software

### Unity3D

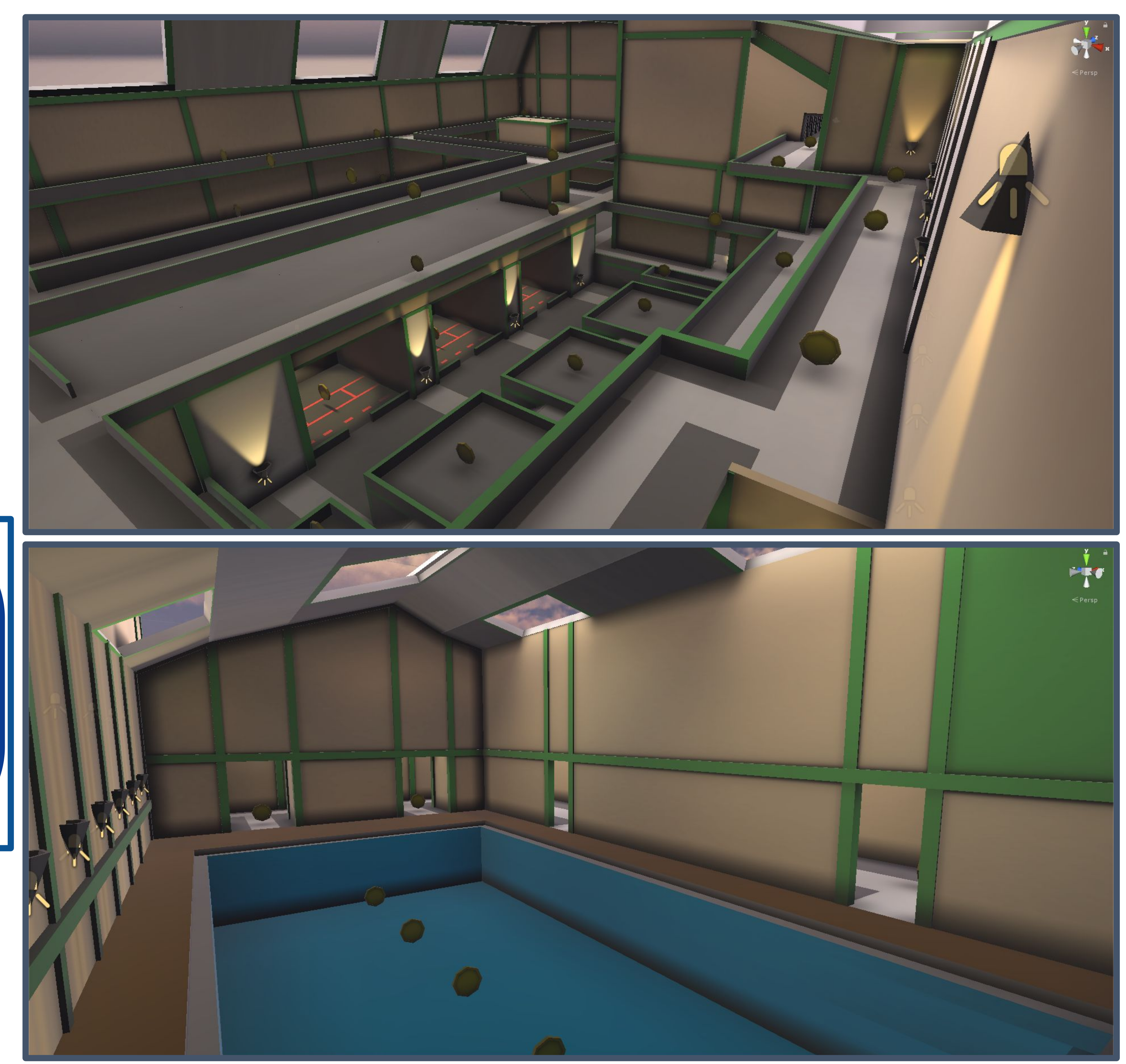
- Why Unity?
  - ProBuilder plugin allowed for relatively fast creation of environments
  - Oculus has a freely available plugin for VR integration with their devices (this plugin required significant tweaking but the basis it provided was invaluable)
  - Lower performance requirement than other engines available on the market (I.E. Unreal Engine 4)
    - This was extremely important as the GearVR that was used is driven primarily by a Samsung smartphone
  - The engine is free to use for Non-Commercial products
  - Ability to easily collaborate on a single project across multiple users (similar to a google drive project)

### Bluetooth Low Energy

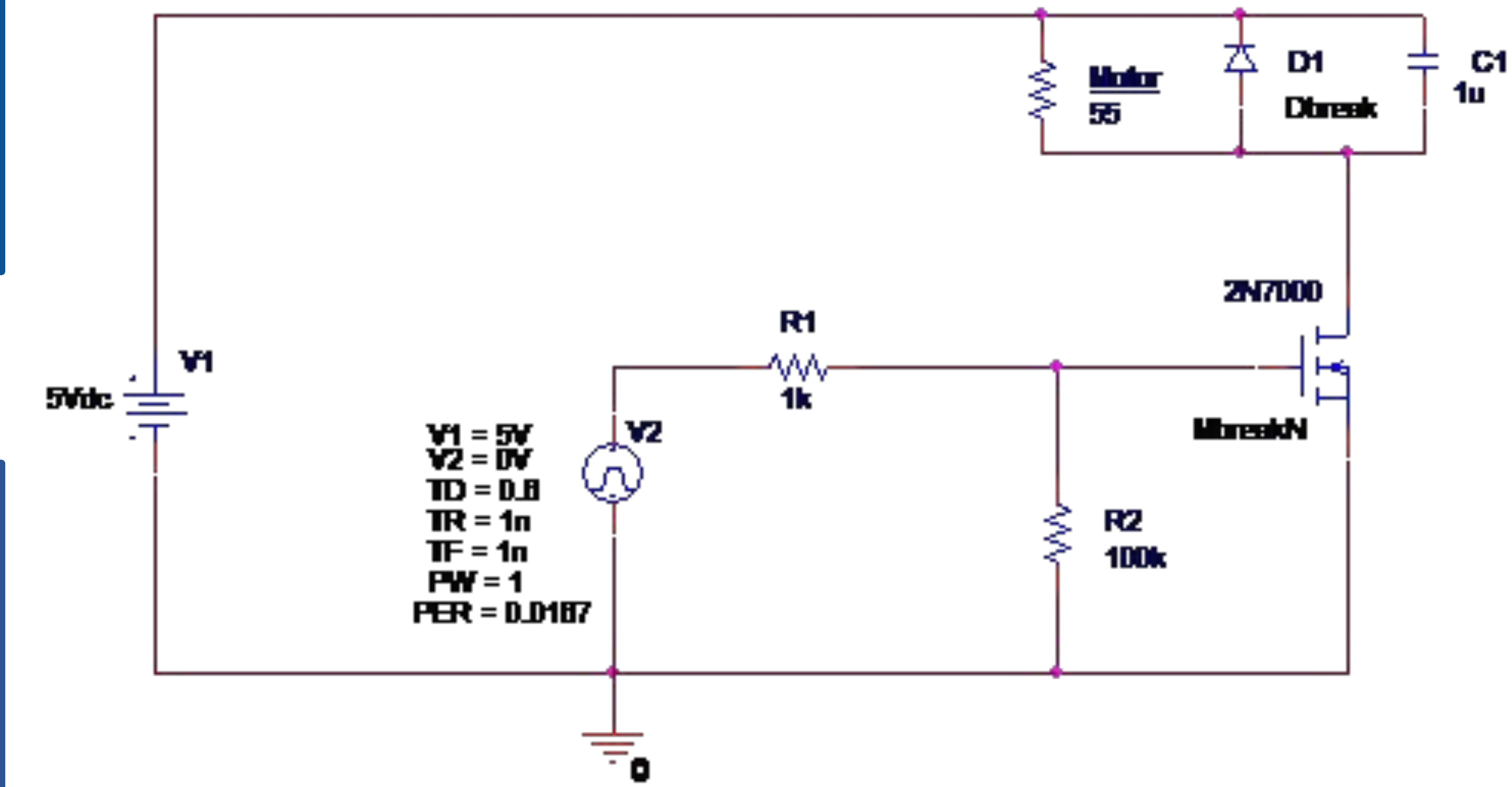


## Accentuating VR Sickness

### Unity Build



### Rumble Pack Circuit Schematic



## Accentuating VR Sickness

- VR applications are typically developed with Best Practices in mind to limit sickness causing events
  - Minimize the duration and frequency of acceleration
  - Prevent Smooth Locomotion
  - Keep Velocity to about the same as the average person's walking speed (1.4 m/w)
  - Limit Playing Time
- Avoiding Best Practice
  - The Unity project activity breaks these rules to accentuate simulator sickness for the purposes of this project
  - The player has free movement of body and camera with the use of an Xbox One Controller
  - The Camera speed is much faster than that of a moving person

## References

- Metry, Mark. "How to Eliminate Virtual Reality Motion Sickness." *VU Dream*, VU Dream, 20 Sept. 2017.
- Samit, Jay. "A Possible Cure for Virtual Reality Motion Sickness." *Fortune*, Fortune, 6 Feb. 2018
- Vestibular Disorders Association. "The Human Balance System." Vestibular Disorders Association, *Vestibular Disorders Association*, 25 Jan. 2018
- Unity Technologies