

Virtual Batting Cage

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Elevator Pitch

My goal is to create a Virtual Reality batting cage, where a user can practice hitting baseballs. In a batting cage, a machine constantly shoot baseballs at a hitter who is practicing his or her swing. The hitter can change the settings on the machine to adjust how fast the next pitch will be. An additional feature I want to include is an indication of how far the baseball traveled after every hit. All of this combined should make for a relatively fun demonstration. The biggest technical challenge for me would be implementing the kinematics involved.

Extended Overview

[Here](#) is a link to a video that summarizes what I want to build. This game is obviously more detailed than what I intend to build, but it shows how I want my project to behave. In addition to being a fun game, a VR batting cage is also a way that professional baseball players prepare for baseball games. [Here](#) is an article for more detail.

Technical Challenges

Here are the main technical challenges that are involved with my project:

- The physics involved with baseball are not super simple. I will need to use kinematics to determine how fast a ball should travel after being hit, what the launch angle is, and the direction it should travel after being hit. The launch angle is especially tricky, since that is determined by where on the bat the ball hit, and the swing path created by the hitter. All of these numbers will need to be estimations since achieving real world accuracy would be very challenging.
- There needs to be some sort of collision detection involved with the bat and the ball. For this to work, the virtual baseball needs to know when it has come into contact with the bat.
- The pitch speed should be adjustable. This should be relatively simple compared to the previous challenges, but is still important.
- The hitter should be told how far they hit a ball. While hitting a ball is fun, it is more satisfying to know just how much oomph you put into it.

Key Risks and Mitigation

Here are the biggest risks involved with my project:

- I plan to use Unity to develop this project, but I have never used Unity before. I have no idea just how difficult it will be to fit all of the pieces together. Luckily, there are lots of tutorial videos on how to get started. I also spoke briefly with Andrew and Terrell in the class, and they said they created VR baseball as their capstone project, so I will definitely consult them if I have questions.
- Getting the kinematics to work will also be a challenge. If I am making a bunch of mathematical estimations, then will the simulation feel realistic enough? One idea I had is that I could ask my former physics professor any questions I may have. It would be awesome if they could walk me through the steps needed to determine the trajectory of the baseball.

Hardware and Software

The hardware I will need:

- A VR headset. I am not 100% sure which one I will need, but Doug mentioned that I should only need one that uses a phone as the screen.
- I don't know if there are two handed controllers that exist, but that is what would be preferred, since you hold a bat with two hands. If not, then I might have to get creative.

Software:

- Unity, luckily this is free to download

Team Responsibilities

I am my own team, so I am responsible for everything.

Development Plan

I would like to get started next week, so that I have extra time to work on the project.

- February 24: watch tutorial videos on VR development in Unity
- March 2: load up a VR scene of a baseball stadium, bind controller to baseball bat
- March 9: implement kinematics equations to simulate real world physics
- March 11: implement an adjustable pitch speed
- March 13: display statistics of each hit to the user.

References

Kaplan, Michael. "Major Leagues Find Secret Weapon in VR Training." *The Official NVIDIA Blog*, 1 Apr. 2016, blogs.nvidia.com/blog/2016/03/21/baseball-vr-training/.

"Virtual Reality Batting Practice Head-Set Is Dodgers' Real-Life Preparation Tool." *Los Angeles Times*, Los Angeles Times, 22 Aug. 2019, www.latimes.com/sports/dodgers/story/2019-08-22/virtual-reality-batting-goggles-headset-dodgers-baseball-chris-dan-odowd.

vrgamecritic. "Everyday Baseball VR - Trailer [VR, HTC Vive, Oculus Rift, WMR]." *YouTube*, 13 Sept. 2018, www.youtube.com/watch?v=-CqrGvFxiRw.