#transparentbuckets

CSC 591, Spring 2019

Stage 4 - Prototype

Team

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Tools

In this stage, we wanted to develop an interactive prototype which gives the user a virtual experience of operating a construction vehicle. This would let the user interact with the vehicle like in the real-world scenario and can experience the cognitive feedback provided by the new interface.

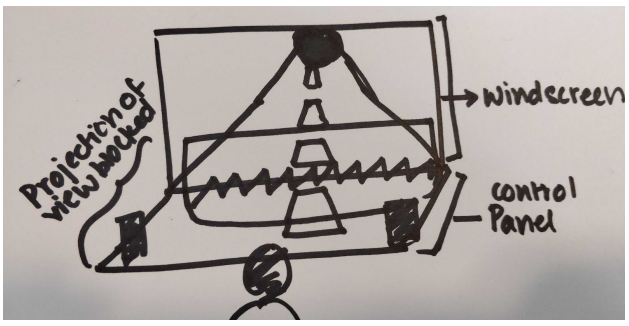
Unity is a real-time 3D development platform. It was a favorable choice to implement the prototype as it is a great tool that has a lot of features which allow us to build an interactive prototype, that would let the user move the truck and vehicle around in the virtual environment using control such as a keyboard or an actual joystick.
Unity's support for hardware controls make it such that we can use a flight controller (which is to a large extent similar to the actual controls on a CAT vehicle itself), which lets us present an even more realistic demo to the operators.
Makes

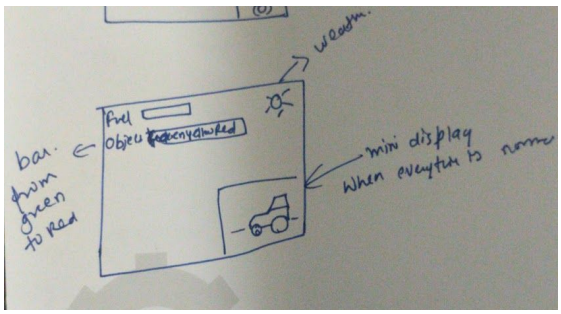
Adobe Photoshop was used to create icons and other graphic elements needs for the prototype.

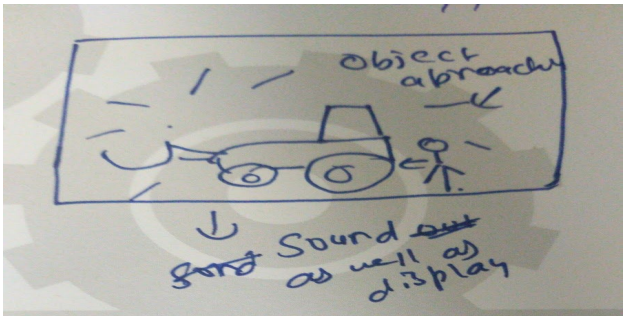
Roles

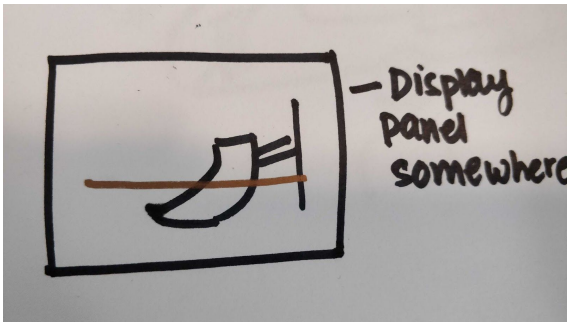
After our meeting with the client, we found that all our previous solutions were inclined towards implementation and accordingly we decided to work on what data needs to be shown to the user and how it should be presented. Based on our skillset we divided ourselves into 2 groups - one that came up with sketches of how the interface would look like and the other group that converted this into a working prototype.

Rahul, **Prachi, and Zelin** - They analyzed the data points suggested by David, to understand what they were and how they could be displayed on the screen. The trick was to model the data in such a way that is intuitive to the operator, thereby improving his visual experience and productivity. Below are some of the sketches they drew.









Arjun, Pooja, **and Zach** - After the data was analyzed and sketches were done, this group worked on transforming the sketches into a working prototype. First, they identified and created the required icons in Photoshop. Next, the scene was built in Unity and the icons were inserted into it. Further development was done to add various functionalities to the objects in the scene.

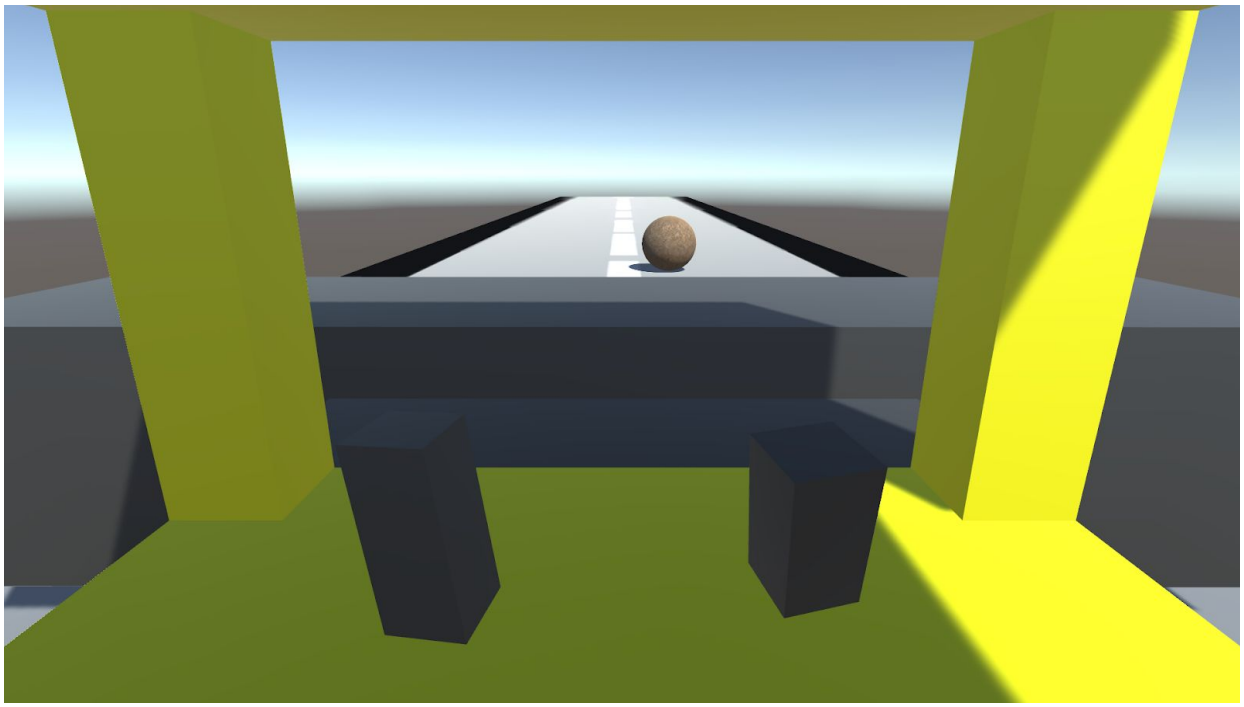
Prototype

The demo can be played on a windows OS and can be found at the following link.
https://drive.google.com/file/d/1N40uXvE0_F0RsZ2Ddp-82NTFHczkIPru/view
Once the zip has been downloaded, extract it and run the TractorDemo.exe file, and you should be able to start right away.

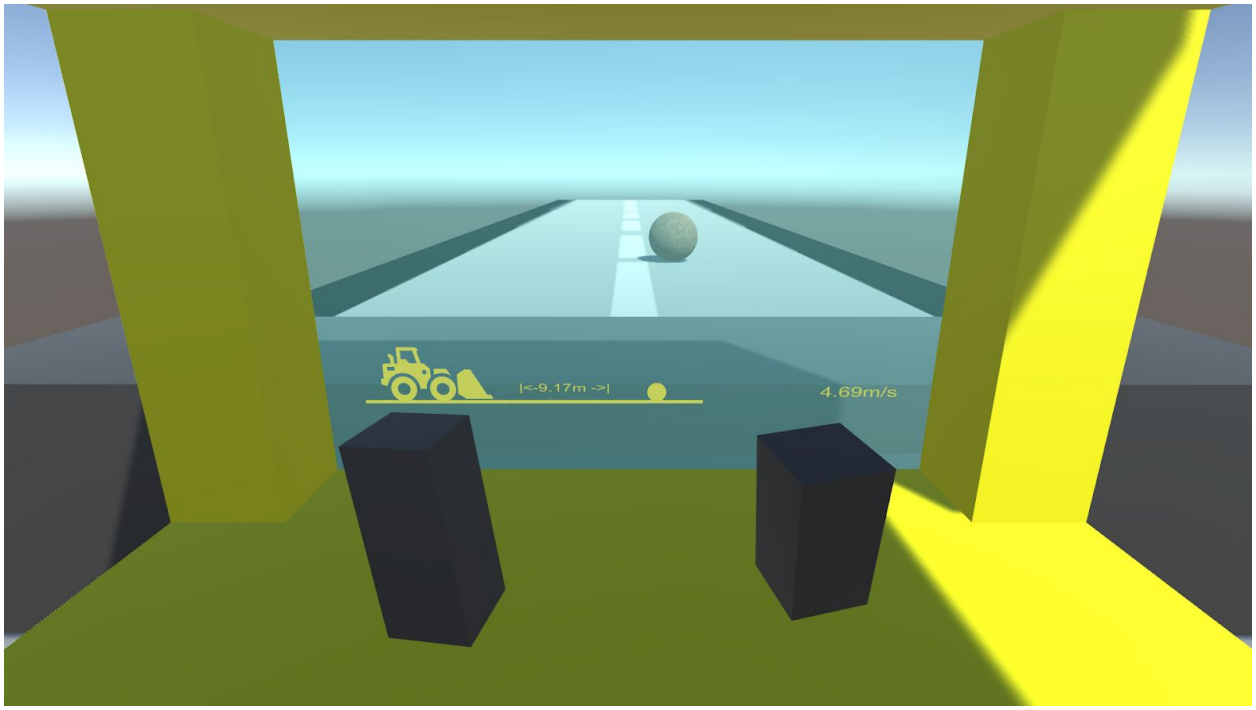
Although using the windows version is definitely recommended for a much better experience with a higher quality as well, if for any reason the windows version is unaccessible, we also do have a WebGL version that can be run on any browser (Google Chrome is recommended, as we tested it on Chrome).
The online version can be found at this link: https://arjunptm.github.io/TractorDemo/

We have divided our prototype into three rounds - first and second rounds try to see if the new interface that we have built will improve productivity and the third demos the different feedback mechanisms we have incorporated.

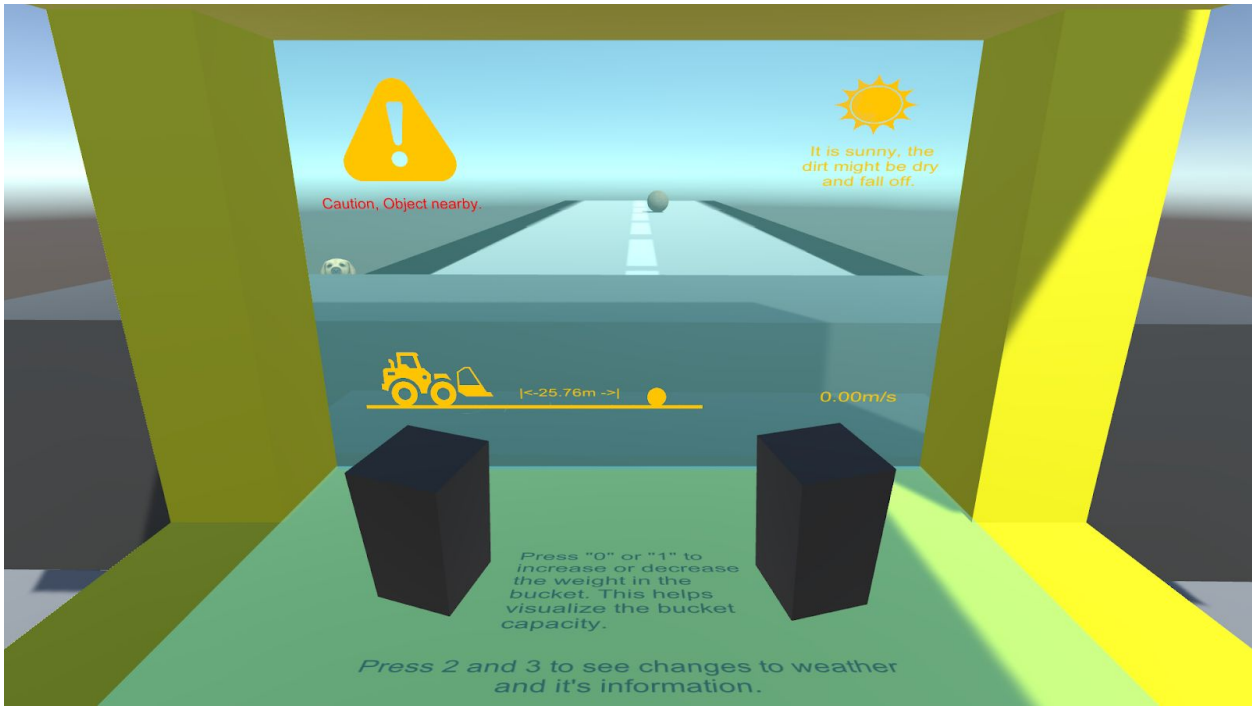
Round 1 - The objective of this round is to get the vehicle bucket as close to the mud pile (depicted by a sphere) as possible. This includes both the horizontal distance to the mud pile and the vertical distance to the ground. Note that the user has to do this without any feedback from the system, based on his intuition alone.



Round 2 - In this round, the user has the same objective as Round 1, the only difference being that the new interface is providing some feedback that will help the user. We hope that the feedback will yield better results.



Round 3 - This round demoes the other feedback mechanisms. User will be able to see the fullness of the bucket, proximity warning, weather, etc on the display screen.



Trial

We did a trial run on our prototype and found out the following mistakes:

Icon color

Initially, our icons were Black in color. While testing, it was observed that icons were camouflaged with the road color. Hence, it was difficult to locate the icons clearly while focussing on other tasks. So, we changed the color to bright yellow.

Side pillars

In the beginning, the side pillars of the ROPS were thick and were limiting the user's field of view. So, the obvious solution was to reduce the width of the pillars.