ClimbVR

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Introduction

The goal of the project Originally was to simulate climbing environment using quest 2 headset and Capto gloves.

As the capto gloves never been used before, big part of the project was to see if capto gloves can be used with the quest 2 headset properly.

It was soon apparent that using the gloves with the headset was problematic more on that later…

It was decided to continue with the regular quest 2 controllers instead.

The Game has 2 climbable scenes with a different theme for each one.

One scene is a realistic snowy rescue mission, where the goal is to get to the rescue chopper.

The second scene is more cartoony, it depicts the story of Jack and the Beanstalk and its aimed for children.

System

CaptoGloves – Capto glove is a smart controller with advanced technology to precisely detect a wide variety of hand and finger movements. These gestures are translated into control commands which are sent directly to connected devices.

Quest 2 – All-in-one VR Headset and controllers. Uses android os and runs on a cellphones cpu and gpu. Runs apk just like a regular android phone.

Unity - is a cross-platform game engine developed by Unity Technologies, the engine supports a variety of desktop, mobile, console and virtual reality platforms. It is particularly popular for iOS and Android mobile game development.

Game Overview

The Game has 2 Levels, each level is a climbable scene with its own different obstacles. The game main purpose is to give the real feeling of climbing, which is achieved by realistic body to hand movement, haptic feedback from the controllers and animations.

The feeling of falling in game is realistic and frightening as in real life.

Realistic snow and sounds add a lot to the realism as well.

Game Development Process

stage 1

At the beginning I have tried working with the capto gloves and figure them out. Very quickly it was apparent that such connection between capto gloves and an android based vr headset was never done before.

Moreover all the information about the capto gloves was limited at best,

the best they could do is to be connected to a PC to a valve supported vr headset with a dedicated api.

The gloves track relative movements as appose to the regular vr controllers which emit infra-red and their real position in space can be tracked. This leads to jerkiness because small connectivity issues leads to inaccurate position readings of the hands and a recalibration of the gloves is required frequently.

The gloves can be connected to an android device and be used as a gamepad but can't be tracked in space or used in any other way because there are no software or api for that.

as of writing this page their website is steel down :/.

we decided to continue the project with the regular quest2 controllers

stage 2

Building a realistic hands movement and physics. Unity has 2 methods of moving objects.

1. is by transfer, giving a coordinate to transfer the object to, it's very smooth as no major calculations is needed each frame.

2. giving an object a rigid body and adding force in the desired direction.

to make the hands interact with the objects around it and not go inside them, the second method was required.

After testing it was apparent that this method worked somewhat ok when close to other objects but was very jerky when moving the hand freely.

The hands sometimes stuck to objects and teleported unnaturally after moving the hands further.
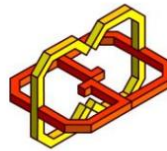
the solution: combining the 2 methods together and adding grabbing animations.

a. when the hand is near an objects they become rigid and moved by force, there for will not go through it.

b. if they come near a climbable object which previously got the hands stuck, the hand enter an animation which puts the hand on the climbable object in a natural way and gripping the fingers. This eliminates unnatural movements all together.

c. when not near any object the hands moves with transfer method smoothly.

stage 3

body movement. The hands have 2 components to them,

1. physical object as seen in game which moves as described in stage 2

2. transparent object that moves to where your real hand is.

When holding a climbable object on a wall the physical hand is stuck to the climbable object but the transparent object moves around to where your real hands are.

In the illustration we can see the body the physical hand in black, the climbable object in red, the wall in grey and the transparent object in green.

As we can see at first the physical hand and the transparent one are aligned and the body is not moving, next we move our real hand down (green object) and create a vector between the red object and the green one, the inverse of this vector is applied as force to the body.

The body is rigid hance moves by force applied to it and cannot go through other objects.
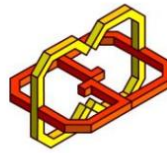
building the scenes. I have built the scenes and some effects for realistic feeling.

1. snow and snow spread effect from the helicopter.

2. ambient sound, grabbing various sounds depending on the object being grabbed, avalanche sound, helicopter sound.

3. grabbing particle effects like snow when grabbing snowy rock or colored leaves when grabbing a giant leaf.

4. animated obstacles like moving metal rods , falling apples and twisted metal ladder.

5. haptic feedback (vibration) when grabbing an object.

the scenes are big and loaded with a lot of objects there for frame drops started to occur, there for few optimizations were required.

1. lowering all textures resolutions.

2. limiting lighting and shadows.

3. declaring all nonmoving object as static.

Future Work

The climbable objects used in the project can be easily imported to any scene, therefore we can climb on any scene and add more levels to the game.