Logic & framework

Player hierarchy

Inspired by realistic head-up displays, HUD in the game simulates intuitive, minimalized holographic projection on the astronaut mask. As a component of human-computer interaction, the HUD provides essential visual feedback including motion state, equipment status, and spatial awareness.

Similar to real-life HUD, pure green (#00BF00) was chosen as theme color of the HUD. Studies suggested that human eyes are most sensitive to green colors and are best at distinguishing among them. As possible adaptation to natural life, human eyes also appeared to be less exhausted staring at green colors.

An attempted was made in early development stage to deliver HUD as conventional widget, a summary of Unreal Engine 2D entities. The outcome appeared to be complete failure in visual deliverance, as HUD elements were rendered at zero depth of field (referred as DoF below) on solely left VR goggle. With reference of multiple sources, this phenomenon was confirmed due to following UE4 rendering logics:

1. Widgets in UE4 are always rendered at post-processing stage, implying they are never involved in 3D rendering.
2. VR binoculus (double-eyed) display were divided into 2 separate screens (one per VR lens), with screen UVs respectively mapped to U value of 0-1 on left screen and 1-2 on the right. (The similar behavior also applies to dual screen setup based on conventional displays.) The default post-processing material of widgets only renders to screen UV of 0-1, namely all contents are delivered on the leftmost display.

It is also suggested by the sources that all visual items must be rendered in 3D world to form focusable, stereo vision.

The methodology was adopted in second attempt, where all HUD elements are represented by world entities with constant focal distance of approximately 60 meters, rendered occluding other world entities. This particular method, inspired by the game VTOL VR, eventually reached expectation of the proposer.

The rendering logics above were also utilized for monocular (single-eyed) rendering, inspired by early Apache Attack Helicopter’s monocular eyepiece. Phasmophobia, a thrill game, is also known for utilizing the mechanism for strengthening thrilling atmosphere. As a potential extension to human-computer interaction, players may choose to keep a single eye open to switch between HUD overlaid view and HUD-free view accordingly. Nonetheless, as being gradually replaced by binoculus display in real-life utility, monocular HUD is noticed for causing optical illusion and dizziness in stereo vision.

Jetpack is intended as primary approach player moves as an astronaut in the game. Similar to real-life astronaut jetpack, it provides 6 degree-of-freedom translational and rotation control by applying respectively linear and angular momentum to astronaut, with input by two hand controllers. In this game, differences are made where all controlling of the jetpack are assembled at a flight control stick located front left of player’s waist. This interaction model is supported by input set of Oculus motion controller, where sufficient buttons and input axes enabled rotation by rotating control stick, and locomotion using thumbsticks and buttons. The simplified interaction model also guarantees one spare hand for complex tasks.

Rotation control is simulated by rotation of player’s hand, with controlling logic similar to real-life aircraft control sticks. Yaw, pitch and roll are mapped to corresponding rotation actions.

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| --- | --- |
| Input | Action |
| Thumbstick Y | Move forward/backward |
| Thumbstick X | Move left/right |
| Y/B | Ascend |
| X/A | Descend |
| Trigger | Brake |
| Thumbstick press | Toggle rotation lock |

Grappling hook is intended as secondary approach that player maneuvers in environment. During development, its functionality was expanded to

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| Input | Action |
| Trigger | Fire |
| Y/B | Switch fire mode |