Alternative Text Description

VR/AR Hardware and Software Diagram

There are 3 main headers at the top: Human, Hardware, and Software. Within Human there are 2 subcategories, Brain and Senses. Within Hardware there are 2 subcategories, Peripheral Hardware and Integrated Circuits. Within Software there are 2 subcategories, User Space (game and middleware) and Kernel Space (kernel).

There are both input and output devices in peripheral hardware. Input peripheral hardware devices include: keyboard and mouse, gamepad and joystick (accelerometers, tilt-sensors), VR/AR Head-mounted display (inertial measurement unit) and microphone. Output peripheral hardware devices include: TFT-Display monitor 60Hz, VR/AR Head-mounted display 95Hz, speaker/headphones and gamepad/controller.

Inputs from the input peripheral hardware devices go through the Integrated circuits (CPU's, GPU's) and use the input-output loop to process the requirements through Software. The software inputs are User Space, which is a combination of Game and Middleware for Drivers (system-level latency reduction, peripheral tuning, API acceleration) Gesture Recognition (i.e. game engines like Unity and Unreal) and Speech Recognition (i.e. Audio engines and libraries). The Kernel Space is the input and audio subsystems and also includes Graphic and rendering subsystem (i.e. OpenGL and direct render manager). The software input-output loop is processed back through the hardware (integrated circuits and peripheral hardware) which is how the senses and actuators receive the input and is processed in the brain.

The chart explains that the inputs from hardware determine how the software input forms outputs and loops back to hardware specifications which then lead to optimal outputs for the senses and brain to process. The outputs from software and hardware equate to a pixel response time = latency. Immersion into VR/AR at a high frame rate (at least 95 fps) leads to low latency. Furthermore, a pixel persistence lower than 3 ms could prevent users from feeling sick when moving their head around in an AR/VR environment.