Tobii Pro VR Integration – based on HTC Vive
Development Kit Description

tobii pro

1 Introduction

This document describes the features and functionality of the Tobii Pro VR Integration, a retrofitted version of the HTC Vive head mounted display (HMD) with a seamless and complete eye tracking integration from Tobii Pro. The hardware together with communication interfaces makes a development kit for eye tracking applications in virtual reality. This solution allows researchers to use eye tracking in a fully controllable virtual reality, enabling a wide range of research scenarios to be studied.

1.1 Overview

The Pro VR Integration based on HTC Vive is only intended for conducting eye tracking research, development, demonstration, and/or evaluation in virtual reality. The eye tracking technology integrated is designed to deliver robust and accurate eye tracking performance at 120 Hz without interfering with the user experience of the HTC Vive. It contains hardware components and fine-tuned algorithms designed to deliver consistent high performing eye tracking in various scenarios for a large majority of the world population. The solution uses advanced slippage compensation that handles movements of the headset to maintain the accuracy and calibration, allowing the user to move naturally during the experience without losing performance in eye tracking.

1.2 Development Kit Package

The Pro VR Integration is a development kit containing:

- HTC Vive standard peripherals package
- HTC Vive HMD retrofitted with Tobii Eye Tracking
- Tobii Pro SDK, with support for the popular VR engine Unity

The Tobii Pro SDK offers a broad set of tools that makes it possible to develop a variety of niche applications or scripts across multiple platforms, using a wide range of programming languages. This SDK gives the researcher access to the full set of relevant gaze data streams for each eye, such as gaze direction and pupil data.

For integration into VR projects we provide a Unity Package to help you get started. This allows researchers to enable eye tracking in VR experiences for both interactive scenarios and analytical purposes.

1.3 Application Areas

The Pro VR Integration is our offer to combine the possibilities of eye tracking with virtual reality. The combination of eye tracking and virtual reality opens new possibilities for researchers and new research scenarios that were not possible to study before. The intended use is in research and development activities regarding human behavior that include eye movements. When using our Tobii Pro SDK or compatibility with the VR engine Unity, eye tracking data can be accessed for post processing as well as live for creating interactive scenarios. Tobii Pro VR Integration is compatible with the two analysis software's Tobii Pro VR Analytics for Unity based environments and Tobii Pro Lab VR 360 Edition for 360 videos and images, to learn more please visit www.tobiipro.com

Tobii Pro VR Integration is suitable for research applications in areas such as:

- Psychology research, especially in phobia and trauma treatment
- Neuroscience
- Market research
- Professional performance
- Way finding
- A/B testing
- Gaze contingency and interaction

1.4 Basic Operating Principles

Eye trackers from Tobii Pro use infrared illuminators to generate reflection patterns on the corneas of the subject's eyes. These reflection patterns, together with other visual data about the subject, are collected by image sensors. Sophisticated image processing algorithms identify relevant features, including the eyes and the corneal reflection patterns. Complex mathematics calculate the 3–D position of each eyeball and the gaze direction from the eye.

To be able to run virtual reality experiences, a PC must meet the PC requirements of the HTC Vive system. These requirements can be found in Appendix A, or, for the latest information, visit the HTC Vive web site.

2 Technical Specifications

2.1 Eye Tracking Specifications

The characteristics of the gaze data from an eye tracker can be described in terms of accuracy and precision. Accuracy describes the angular average distance from the actual gaze point to the one measured by the eye tracker. Gaze precision describes the spatial variation between successive samples collected when the subject fixates at a specific point on a stimulus.

Gaze data output frequency (binocular)	120 Hz
Estimated accuracy	0.5°
Calibration procedure	5 point (Flexible with Pro SDK)
Trackable field of view	110° (Full HTC Vive field of view)
Slippage compensation	Yes
Latency	Approx. 10ms (time from mid exposure to data available on client interface)
Pupil measurement	Yes, absolute pupil size
Tracking technique	Binocular dark pupil tracking
Data output (for each eye)	Timestamp (device and system) Gaze origin Gaze direction Pupil position Absolute pupil size
Interface	Tobii Pro SDK (.Net/Matlab/Python/C)
3D engine compatibility	Unity, WorldViz Vizard

2.2 Integration Specifics

The Pro VR Integration is a HTC Vive with Tobii Eye Tracking retrofit hardware. Following below is the information about the eye tracking integration into the HTC Vive HMD. For the full HTC Vive specifications see Appendix A or visit the HTC Vive website.

Hardware integration	HTC Vive with Tobii Eye Tracking retrofit hardware, no external devices or connectors needed (See note below).
Number of IR illuminators	10 per eye
Eye tracking sensors	1 per eye
Eye tracking processing	Tobii EyeChip™ASIC
PC Requirement	HTC Vive-ready PC, see appendix A for general requirements

The eye tracking integration removes the possibility to use the USB port on the HTC Vive headset.

3 Compliance & Warranty

Note that this Development Kit (the "Tobii Pro VR Integration") is not a certified product (although the underlying HTC Vive is a certified product). The retrofit process to enable Tobii Eye Tracking in the HTC Vive HMD void all certifications and limited warranty related to the HMD that comes with the purchase of the HTC Vive. Tobii provides a one (1) year warranty on the Development Kit from the date of shipment.

The eye tracking integration as such is designed, although not formally certified, to meet the following safety and EMC standards:

EMC Emissions

- EN55032:2015: Class B
- EN61000-6-3:2007+A1
- FCC 47 CFR Part 15: 2015: Class B
- ICES-003 Issue 6: Class B

Eye Safety

- IEC 62471:2006 (exempt group classification)

For information on certifications and standards of the HTC Vive itself, we refer you to the official product information provided by the manufacturer.

The power cables shipped with the Development Kit are recommended and certified for use only in their country or region of manufacture, which may be the US, the UK or the EU. Tobii does not take any responsibility or provide any guarantee on functionality for use of the power cables outside their region of manufacture. If an additional power adapter is needed for use outside the power cable's region of manufacture, it is the responsibility of customer to ensure such compatibility.

Appendix A HTC Vive Specifications

Here you will find the general specifications and requirement for the HTC Vive. To run a virtual reality experience there are performance requirements for your PC. For latest updates please visit the HTC Vive website. The eye tracking integration does not add any extra requirements on the PC.

Display	OLED
Resolution	2160x1200
Display refresh rate	90 Hz
Platform	Steam VR, VivePort
Field of view	110°
Tracking area	15x15'
Built-in audio	Yes
Built-in mic	Yes
Controller	Vive controller, any PC—compatible gamepad
Sensors	Accelerometer, gyroscope, Lighthouse laser–tracking system, front-facing camera
Connections	HDMI, USB 2.0, USB 3.0
The HTC Vive includes these standard peripherals package items (see note below)	○ Two base stations ○ Two hand controls ○ 2 face cushions (1x narrow and 1x wide) ○ Link box ○ Earbuds ○ Cables, chargers, and accessories
PC requirements (Check the HTC Vive website for the latest information)	
Processor	Intel™ Core™ i5-4590 or AMD FX™ 8350, equivalent or better
Graphics	NVIDIA GeForce™ GTX 1060 or AMD Radeon™ RX 480, equivalent or better.
Memory	4 GB RAM or more
Video output	1 HDMI 1.4 port, or DisplayPort 1.2 or newer
USB	1 USB 2.0 port or newer
Operating system	Windows™ 10

Please note, the peripherals included in the HTC Vive are subject to change by HTC.