LPVR-DUO

LPVR Middleware for Differential IMU-based In-Vehicle Virtual / Augmented Reality

Building on the technology we developed for our IMU sensors and large scale VR tracking systems, we have created a full motion tracking and rendering pipeline for virtual reality (VR) and augmented reality (AR) applications. The LPVR middleware is a full solution for AR / VR that enables headset manufacturers to easily create a state-of-the-art visualization pipeline customized to their product.
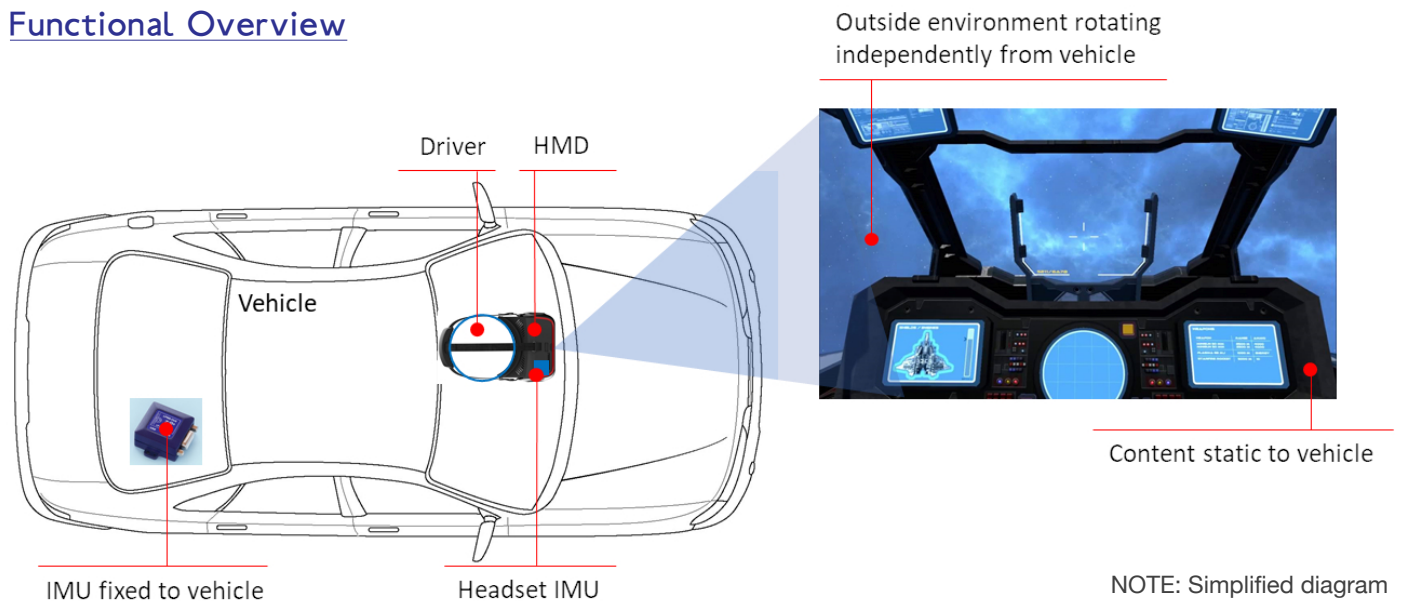
The tracking backend of the LPVR middleware solution for VR and AR is especially advanced in the aspect that it allows the flexible combination of multiple optical systems and inertial measurement units (IMUs) for combined position and orientation tracking. Specifically it enables the de-coupling of the head motion of a user and the motion of a vehicle the user might be riding in, such as a car or airplane.

In this way the interior of a vehicle can be displayed as static relative to the user, while the scenery in the environment of the vehicle moves with vehicle motion. For any application of augmented reality or virtual reality application in a moving vehicle, this functionality is essential to provide an immersive experience to the user. LP-Research is the industry leader for providing customized sensor fusion solutions for augmented and virtual reality.

Key Features

- Flexible zero-latency tracking adaptable to any combination of IMU and optical tracking

- Rendering pipeline with motion prediction, late latching and asynchronous timewarp functionality

- Calibration algorithms for optical parameters (lens distortion, optical see-through calibration)

- Full integration in commonly used driver frameworks like OpenVR and OpenXR

- Specific algorithms and tools to enable VR / AR in vehicles (car, plane etc.) or motion simulators

- Full update support for the latest SteamVR versions

Functional Overview

Driver   HMD

Vehicle

Outside environment rotating independently from vehicle

Content static to vehicle

IMU fixed to vehicle

Headset IMU

NOTE: Simplified diagram

System Specifications

Product name	LPVR-DUO
Compatible HMDs	HTC VIVE Pro, Varjo VR-1
Compatible tracking systems	ART, Optitrack, VICON, VRPN-based tracking solutions
Compatible software	Unity, Unreal, Autodesk VRED, all SteamVR-compatible applications
Controller support	VIVE controller
Headset IMU	LPMS-CU2, LPMS-ME1, LPMS-CURS2
Vehicle-fixed IMU	LPMS-IG1(P)
Positioning accuracy	1-10 mm (depeding on optical tracking setup)
Rotation accuracy	0.2°
Tracking latency	Zero-latency (using head motion prediction)
Tracking space	Unlimited (depending on optical tracking setup)
Driver software	OpenVR driver
Update rate	800Hz
Operating system	Windows 10 with latest SteamVR environment
System components	IMU sensor, HMD marker holder, hand controller marker holder, accessory cable and screws
Licensing	License tied to LP-Research IMU. Multiple IMUs can be used with same license.

NOTE: For detailed specifications, please refer to our product manuals.
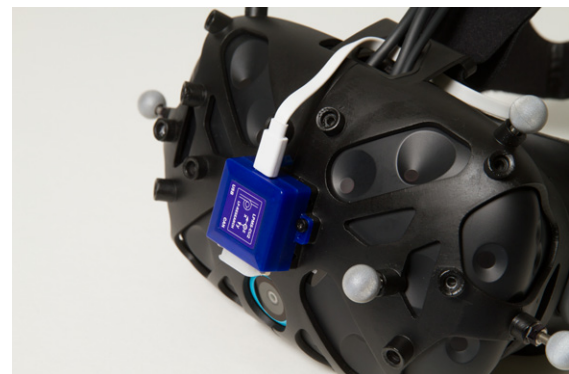
Applications

- VR/AR-based in-car guidance systems

- Immersive visualization for motion simulators

- In-vehicle entertainment systems

- Visual augmentation systems for aeropsace applications

System Components

Vehicle-fixed LPMS-IG1P IMU (incl. GPS)

Headset IMU LPMS-CU2