HARP: A Framework for Visuo-Haptic Augmented Reality

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System Design

- Functional Requirements:
  - Precise augmentations and tracking
  - Accurate colocation of haptic device
  - Realtime operation (haptic 1000 FPS, visual 30 FPS)
  - Low latency
  - Support for haptic devices from multiple manufacturers

- Non-Functional Requirements:
  - Simplicity: suitable for undergraduate student projects
  - Reusability, Extensibility: component-based architecture
  - Record / Playback of realtime data streams
  - Efficient workflow for scene creation

Implementation

- External Dependencies:
  - H3DAPI / HAPI: haptic-enabled scene graph library, X3D compatible, Python Scripting
  - Canon MR-Platform: mixed reality toolkit for tracking, sensor fusion, and hand segmentation
  - ZeroMQ, Protobuf: Inprocess messaging layer for concurrent stream processing
  - HDF5: file database for temporal stream recording

Evaluation

- Latency of message passing for cascaded RGB image processors
- CPU load and frame rates for cascaded RGB image processors
- CPU load and frame rates for concurrent image processing using ARToolKitPlus with async capturing

Transformation Pipeline in VHAR

References: