ROTIE (Robot Teleoperation through Immersive Environments)

Abstract

ROTIE is a containerised platform for immersive robot teleoperation. It allows mobile robots to be controlled via HID interfaces and to obtain a virtual representation of the environment with sensor data. It is integrated in the framework of the **European SPIRIT project and** enables the development of digital twins for remote planning and analysis.

Fig.1 : ROTIE tested with Dogbot Unitree Go1 and AR Glasses Quest 3

Objectives

- Control robots immersively using XR and HID devices.
- Recreate the robot environment in VR scenes.
- Facilitate planning and analysis with digital twins.
- Ensure a scalable, multi-system platform.

Fig. 2: Virtual Reality scene with robot

HID based Robot Control and VR environment generation

ROTIE allows the Dogbot to be controlled with HID devices (AR Quest 3 glasses, Katwalk VR strap, joysticks), translating user movements into intuitive robotic commands without the need to know control details.

The platform uses API Rest and WebSocket interfaces to send navigation commands (Euler for rotations, speed, spin rate or height) and receive real-time robot data (position, battery, IMU, temperature).

Simultaneously, it generates a photorealistic VR environment from 2D/3D video and spatial audio, integrating Gaussian Splatting techniques to reduce latency and optimise visualisation.

Fig.4: Generated 3D representation of ITG office through captured image processing using Gaussian Splatting

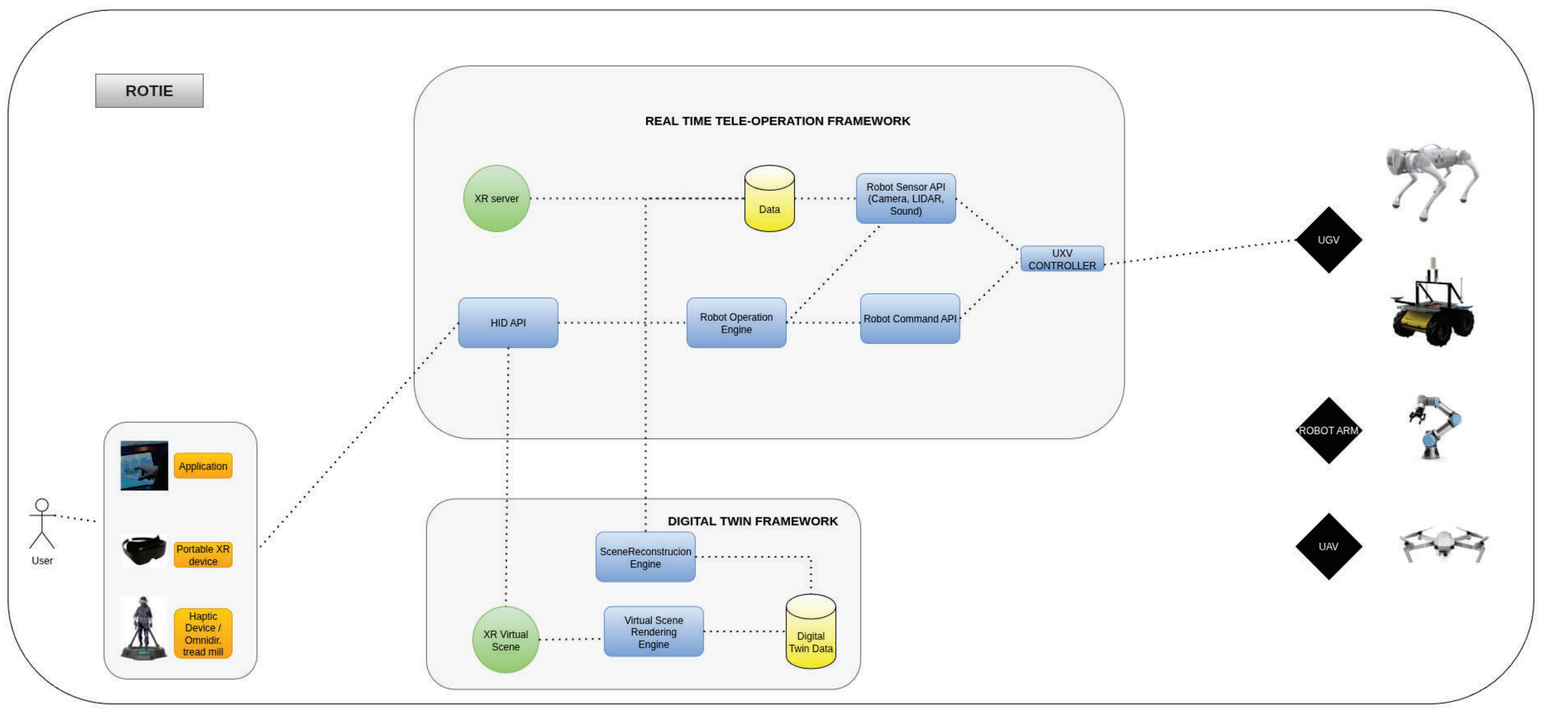

Fig. 3: Architecture of ROTIE framework

Integrations and conclusions

Services are being developed and integrated to capture, process and fuse data from robot sensors, such as cameras, generating immersive virtual scenes. These services are optimised for GPU servers to reduce display latency.

ROTIE is currently being integrated with the Husky robot, which is part of T-Systems' testbed in the SPIRIT project, thereby extending its compatibility beyond quadruped platforms.

As a result, ROTIE is a flexible and easily scalable solution for collaborative teleoperation based on extended reality (XR).

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