ForceBot: A Robotic Platform for Body-Scale Human Physical Interaction in Embodied Virtual Reality

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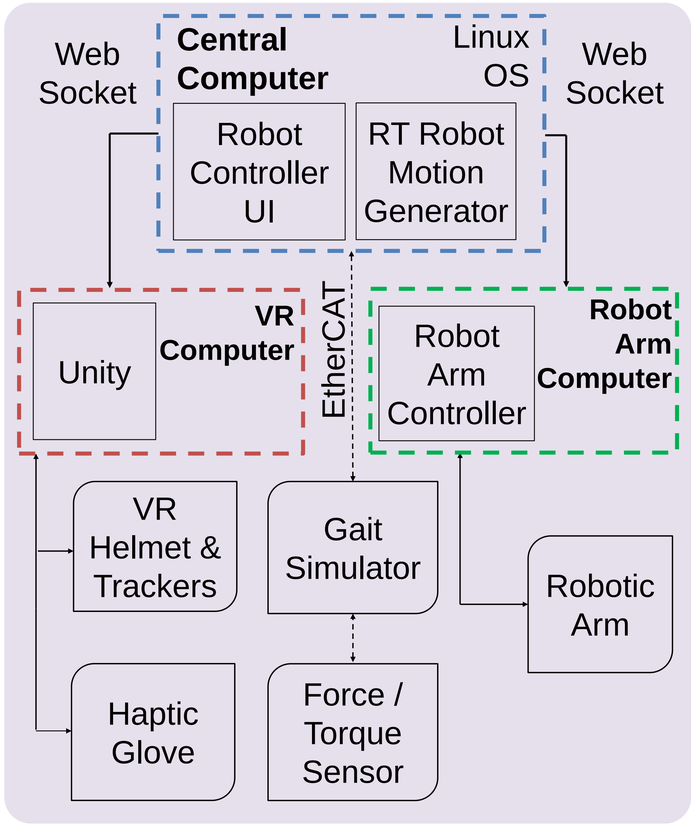
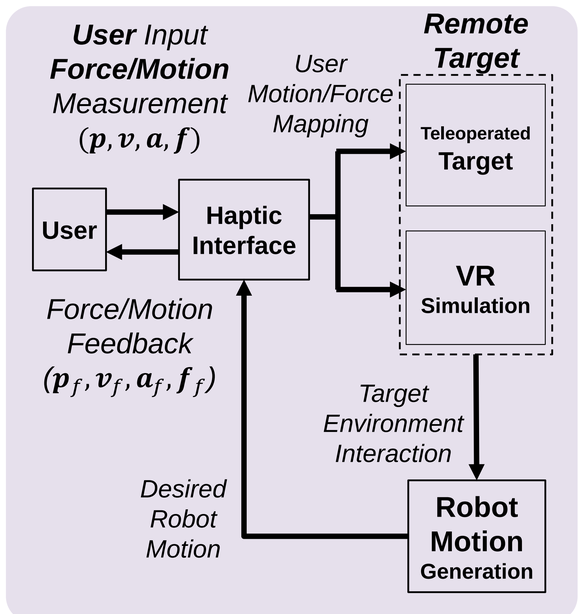
[Challenges]

- **Physical Human-Machine Interface Design:** Establish an interface to dynamically interact with a remote target (e.g., virtual environment, teleoperated robot) in a human-robot aligned workspace.
- **Human-Robot Coupled System Control:** Develop a control algorithm that interprets user intention to provide responsive force feedback and motion, while maintaining system stability.
- **Multi-Robotic Sub-Systems Integration with VR:** Integrate multiple sub-systems with a scalable and low-latency communication field to guarantee simultaneous manipulation between the robots and VR.

[Scientific Impact]

- **A Comprehensive Human-Machine Interface** for VR interaction and human biomechanical study: User cognition in VR paired with physical interaction can benefit rehabilitation and training purposes.
- A control algorithm that **utilizes biomechanical measurement** (COP, ZMP) to **regulate human-robot interaction**.





[Solutions]

- **Admittance**-based **haptic interface** for realistic ground simulation with low power consumption.
- **Adaptive** admittance based on user intention that **improves system stability** and **transparency**.
- **Scalable** robotic framework for robotic and VR system integration with low-latency communication field.
- Use of **motion captured data** to design a safe and unrestricted human-robot workspace.

[Broader Impacts]

- Aid various sectors of industry and government to **train personnel** with **virtual reality simulation**.
- Assist the scientific community in **understanding human behavior** and motion with biomechanical data.
- **Educate** and gather interest from STEM students with experience in advanced robotic systems.
- Benefit the society with the embodied virtual reality for enhanced **rehabilitation** training.

Video Demo

2023 FRR & NRI Principal Investigators' Meeting
May 2-3, 2023

Award ID#: 2024772