CENTER ON Pervasive Personalized Intelligence

Together We Go Farther

Editing Reality:Empowering Users to Manipulate Reality through Addition, Erasing, and Modification with speech to prompt in Mixed Reality.

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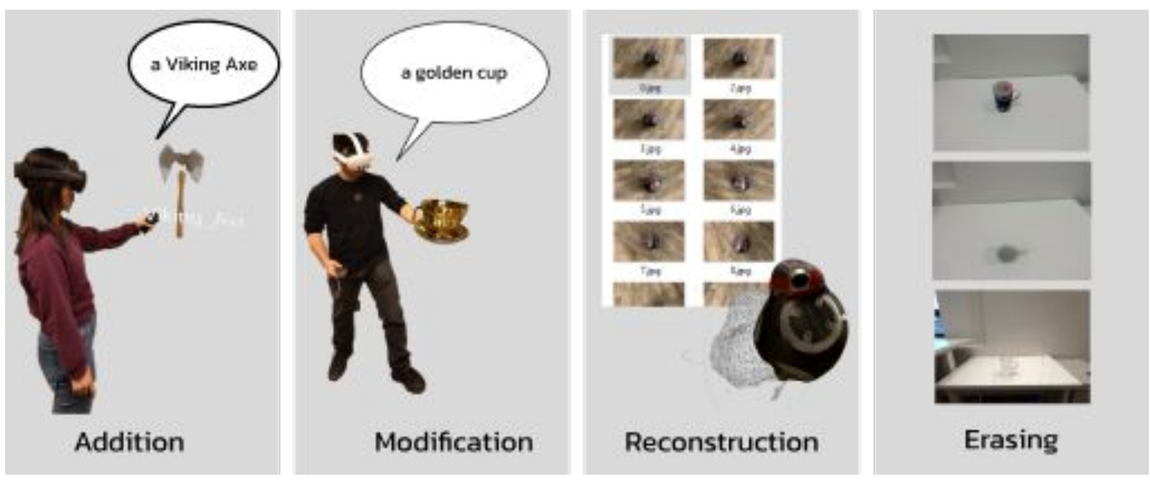
Abstract

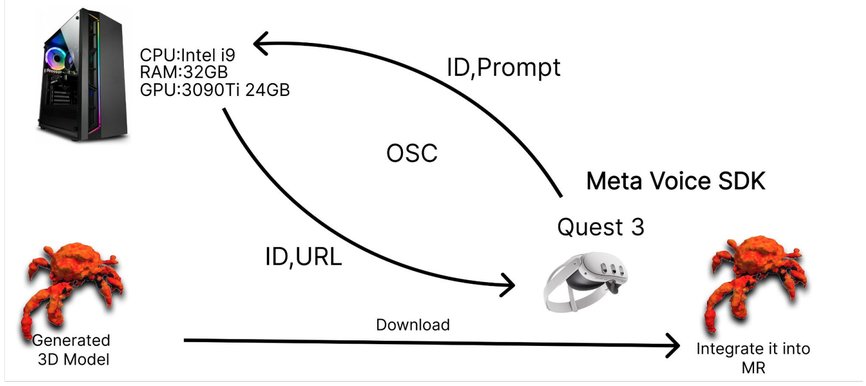
We present a Mixed Reality system called Editing Reality, which integrates multiple Generative A.I. (GenAI)models. We have identified three functions: Addition, Erasure, and Modification. These functions are employed to add generated objects to the real environment, hide or subtract actual objects, and alter the real environment. Through the combination of GenAI and Editing Reality, users gain the capability to virtually manipulate reality in real-time with their speech. We conducted a pilot workshop with 14 participants to gather their thoughts. Our results show the potential usage of Editing Reality for interior design, prototyping for products, accessibility use, and also the exploration of security issues in MR.

Contributions



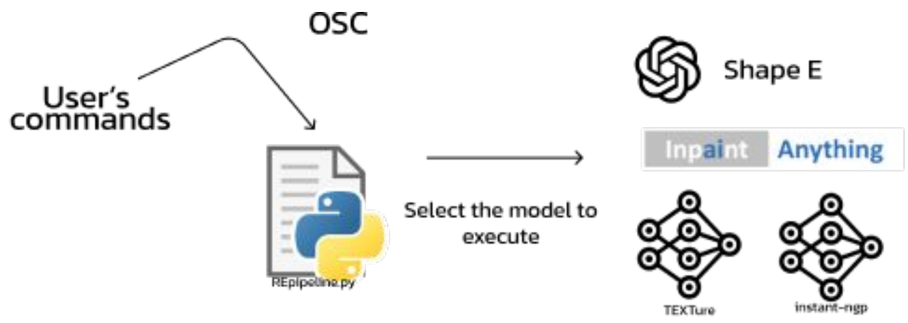
- Integration of Generative A.I. Model
- Comprehensive Functionality
- Practical Applications and Insights
- Promising Future for Enhanced Interaction

System Design



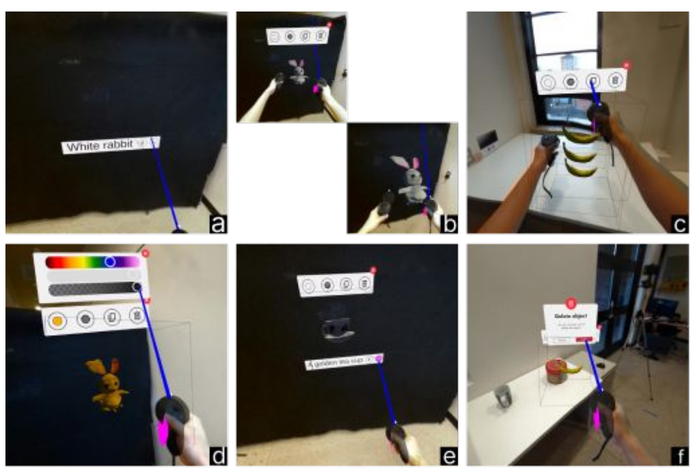
In our system design, we have integrated our MR headset with a local server to address computational limitations.This strategic decision stems from the MR headset's inherent constraints in running resource-intensive generative models.We separated the system into two parts. The MR headset processed the user input and sent the command via Wifi connection to the server.Then we offloaded the generative AI tasks to a local server equipped with a dedicated graphics card, efficiently processing the signals and downloading results back to the headset and displaying it in the MR environment .The generated result was uploaded to a cloud server and downloaded by MR headset.The reason of that is maintain all the multi players's generative results are consistency.

Implementation



Our GenAI Pipeline, named "REpipeline," operates locally and is developed in Python. It efficiently processes messages from the MR headset using OSC and leverages subprocesses to activate various generative models on the server, ensuring swift response times. The workflow begins when a user scans an object for texturing, generating a 3D model file stored for subsequent use. The system then gathers user preferences for the texture to apply. A yaml file detailing the 3D object's location and texture instructions is created and fed into the model, which textures the object. The enhanced object is then displayed in the MR environment, completing the process.

interaction



We introduce the "Generative Cube," a 3D outlined box created by pressing a button on the controller. Users can place, resize, and manipulate the cube in physical space using the controller's grabbing feature. The cube operates in two initial states:
Addition: Users trigger 3D model generation by speaking prompts into a dialogue bar. This state allows for color, grayscale, and transparency adjustments on the generated mesh.
Reconstruction: Enables scanning of real-world objects or importing reconstructed models from other applications. This state includes the Erasure feature, where users can specify objects to be removed from the scene. Instead of color adjustments, users can modify the erasure cover's brightness for scene matching.
Both states offer common editing functionalities—Copy, Delete, and Modification. Copy allows model duplication, Delete removes it, and Modification initiates a texture change through user prompts, enhancing object customization in the MR environment.

Senarios

Storytelling and MR Prototyping: Participants identified storytelling and mixed reality prototyping as prime applications for Editing Reality, beneficial in game design, theater, film storyboards, and meditation aids. Incorporating feature entity retrieval could dynamically translate narratives into visual models in real-time, enhancing experiences from board games to immersive storytelling.

Design Prototyping: Editing Reality has been recommended for uses in interior design, product development, and fashion, where designers can vocally command the creation or removal of virtual objects and materials. This real-time adjustment in virtual spaces enables collaborative design processes and experimentation with materiality and aesthetics in a mixed reality context.

Accessibility Use: Editing Reality offers solutions for accessibility challenges, such as aiding individuals with color blindness. By adjusting colors in environments from museums to workplaces, the system can make spaces more navigable and information more accessible, enhancing everyday experiences for those with visual impairments.

Security Concerns in MR: The potential for misuse of Editing Reality, such as obscuring objects or altering important signals, raises significant security considerations. Addressing these risks is crucial for the safe integration of Editing Reality into mixed reality environments, ensuring the technology enhances rather than compromises user safety and experience.