Virtual Globetrotter: Functional Analysis

Contents

Yahya Chaudhry, Tobias Pottier, Juliane Farmer

1. Problem Definition

Many children are unable to experience real-world travel due to health conditions, mobility limitations, or extended hospitalization. This lack of exploration can impact their education, social experiences, and emotional well-being. Existing solutions, such as Google Earth VR and educational VR platforms, provide immersive experiences but lack interactive adaptability and child-friendly accessibility for those with special needs.

2. Proposed Solution

Virtual Globetrotter is an immersive, voice-controlled/keyboard-controlled experience that enables children who cannot travel to explore the world virtually. Using a 360-degree projection setup, children can select destinations and interact with environments using simple voice commands (e.g., "Make it rain" or "Turn it to night") or by using the keyboard. This solution prioritizes accessibility for children with disabilities by eliminating the need for complex controls and providing a safe, interactive learning experience.

3. Target Audience Analysis Primary Users:

- Children of different ages with limited mobility due to medical conditions or disabilities.
- Hospitalized Children undergoing treatment who need engaging, educational activities.
- Children with sensory sensitivities who require controlled, predictable environments.

Secondary Users:

- Educators & Therapists who use Virtual Globetrotter for educational or therapeutic purposes.
- Parents & Caregivers looking for a safe and engaging experience for their children.

4. Comparison with Existing Solutions Competitor Analysis:

- **Google Earth VR**:
  Offers a vast virtual experience with high-quality 360-degree images but lacks interactivity tailored for children.
- **Educational VR Platforms:**
  Focused on learning but often lack immersive environmental transitions or child-friendly interfaces.

Key Differentiators:

- Virtual Globetrotter focuses on accessibility for children with disabilities.
- Offers voice-activated/keyboard customization of environments (weather, time of day).
- Provides an interactive, safe, and immersive physical setup (360-degree room).

5. Minimum Viable Product (MVP) Core Features:

- 360-degree environments (minimum one location per continent).
- Voice recognition for basic commands (e.g., "Make it snow").
- Ambient audio synchronized with the environment.

Yahya Chaudhry, Tobias Pottier, Juliane Farmer

- Computer-key-based navigation and voice activation.

6. User Flow Diagram:

Start Flow:

1. Child enters the immersive room.
2. Uses the designated computer to select a location from the world map.
3. The environment transitions to the chosen location.

Interaction Flow:

1. Child interacts with the environment using voice commands or keyboard.
2. Commands like "Make it rain" or "Turn it to night" trigger environmental changes.

Exit Flow:

1. Child presses a key on the computer to return to the world map.
2. Selects a new destination or exits the experience.

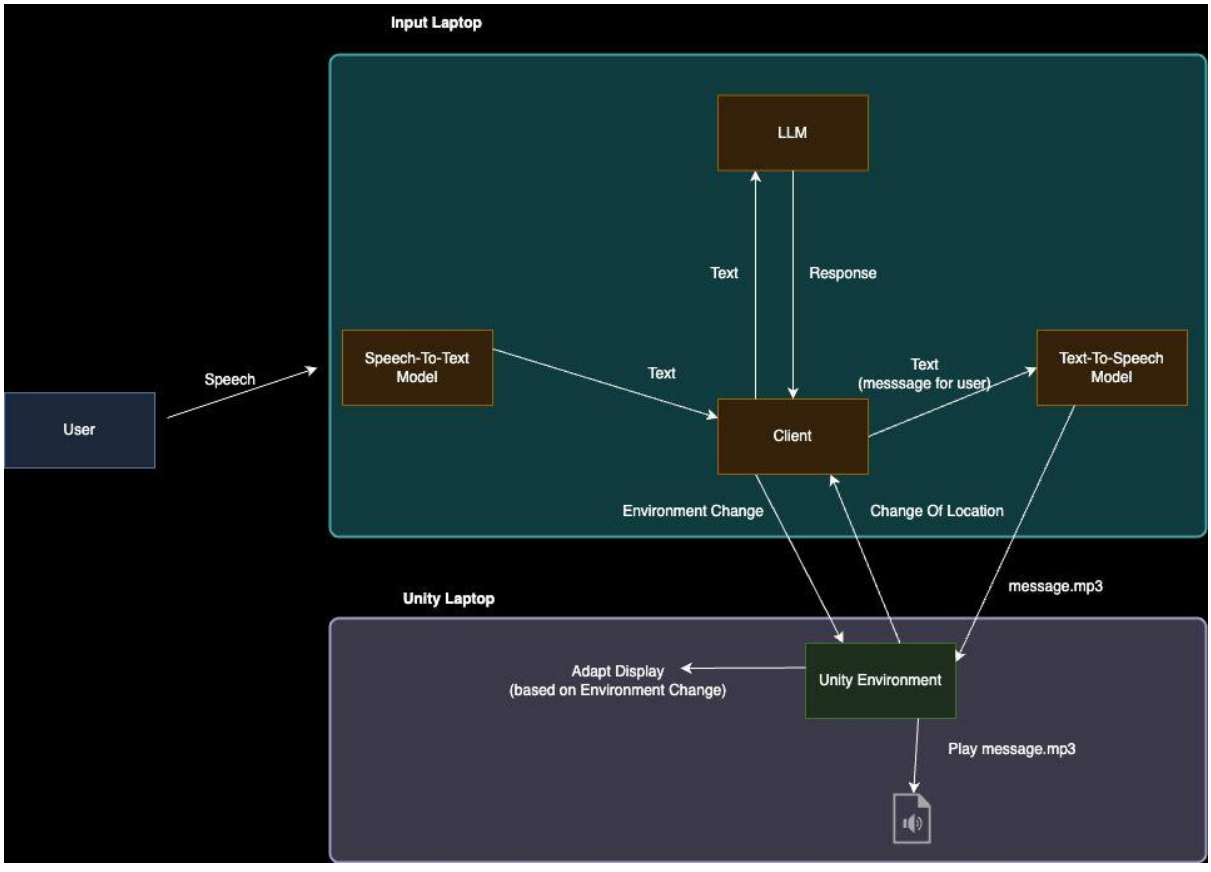

Figure 1: System Interaction Flow

7. Wireframes

- **Room Layout:**
  Four walls equipped with projectors displaying synchronized 360-degree visuals.
- **Computer Interface:**
  Designated keys for navigation, voice activation and keyboard input.
- **Environment Screens:**
  Panoramic visuals with subtle overlays for transitions.

8. Prototype

The Unity-based prototype includes:

- Imported 360-degree images for different locations.
- Transitions (e.g., from day to night or sunny to snowy).
- Basic interactivity using sample voice commands or keyboard input.

8. User Testing Process:

1. Sprint 1:
   - Feedback highlighted the need to upscale the resolution of the images for better clarity
   - Make environment more child-friendly
2. Sprint 2:
   - Upscale AI-generated 360 images
   - Fix seams of AI-generated 360 images
   - Add environmental audio
   - Reduce world map spinning after location selection
   - System worked smoothly without crashes
3. Sprint 3:
   - Include more dynamic effects
   - More randomized 3D LEGO objects
   - Adjust layers of LEGO models and text
   - Make use of audio system of immersive room instead of speakers
   - Prevent models/ text from splitting between the screens,

9. Updated Hardware and Software Setup

4. Laptops:
   Set up two laptops to handle AI models and Unity environment.
5. Input Laptop:
   - Serves as the input device where the child can either type their request or press a key button to turn on the microphone.

- Converts the Speech-to-Text (STT), sends the text to the LLM, parses the response, performs TTS.
- Send following to the unity Laptop:
    - The processed command for environment change
    - The raw audio data from the generated speech file

6. **Unity Laptop:**
    - Handles all Unity scenes.
    - Receives environment change requests and adapts scenes accordingly.
    - Sends confirmation of changes back to the input laptop.
7. **Separate Microphone:**
    - Used to capture the child's voice more clearly.
    - Reduces background noise for better speech recognition.