

AI-Enhanced Virtual Crime Scene Generation

This project explores how AI-driven scene generation can enhance crime scene training by automating room layouts and seamlessly integrating with VR platforms.

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Introduction

Traditional crime scene investigation training often requires physical setups that are time-consuming and have limited flexibility. Virtual Reality offers a more adaptable solution. However, manually creating realistic VR environments is labor-intensive and requires proficiency in game development.

This project leverages AI to assist in generating digital room layouts, which are then imported into Unity and manually refined to create immersive VR environments. The goal is to streamline the creation of training scenarios, making VR-based CSI training more accessible and efficient.



Objective

The objective of this project is to streamline the creation of virtual crime scenes for training purposes by leveraging indoor scene synthesis models. The generated layouts are imported into a game engine and are manually refined to ensure realism and interactivity. By reducing the time and effort needed for scene creation, this approach aims to make VR-based CSI training more accessible and practical.

Challenges and Limitations

Developing virtual crime scene generation presents several challenges:

1. Realism and Accuracy: Automatically generated scenes may lack nuanced realism needed for effective CSI training requiring manual adjustments to enhance immersion.
2. Performance Optimisation: Rendering complex scenes in VR can cause performance issues, particularly on standalone devices like the Meta Quest 3.
3. Balancing Automation and Manual Adjustment: While the goal is to streamline scene creation, a fully automated process is not yet feasible, making manual refinement a necessity.
4. Interactivity Challenges: Simulating physical elements of an investigation remains a challenge for VR training scenarios.



Potential Impact

This project aims to improve CSI training by making the development of virtual crime scenes faster, more accessible and less reliant on technical expertise. By using AI systems, such as scene synthesis models, CSI instructors can generate realistic environments much quicker than through manual design, reducing the overall preparation time. The process also lowers the barrier to entry, as generated scenes only require modification instead of full development.

Using standalone VR devices, such as the Meta Quest 3, eliminates the need for high-end computer hardware. This increase in flexibility allows digital training exercises to be conducted remotely. As a result, training can overcome geographical limitations and scheduling conflicts, potentially making CSI simulations a more practical approach for some institutions.

Methodology

1. Scene Synthesis: Using InstructScene, an indoor scene synthesis model, generates a realistic room layout . The model is trained to produce arrangements that resemble real-world environments.
2. Unity Integration: The generated layout is imported into the Unity game engine, where assets are added to improve realism and environment interaction is introduced.
3. VR Deployment: The final scene is deployed on the Meta Quest 3, allowing immersive and interactive crime scene training in a standalone VR environment.

Future Work

This project represents an early step towards automating virtual crime scene generation. Future work will focus on the areas:

1. Improving Scene Realism: Enhance the quality of generated layouts and integrate more varied room types.
2. Increasing Interactivity: Simulate more environment interactions and evidence examination.
3. User Evaluation and Feedback: Conduct user testing with law enforcement professionals and CSI trainers to gather feedback on realism and usability

