

Immersive AR/VR Training for Flash Floods: Fusing Lived Experience with Real-Time Geospatial Data

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MOTIVATION AND METHOD

Flash floods are sudden and destructive events that endanger lives and infrastructure. Traditional training often struggles to capture their speed, complexity, and emotional impact.

This project introduces an **immersive AR/VR platform** that merges **geospatial data, drone imagery, and survivor experiences** to improve preparedness and decision-making. Using **drone-based 3D reconstruction** enhanced by **Gaussian Splatting**, lifelike flood environments are created and integrated into **Unity** for real-time, interactive simulation (Fig.1).

Insights from survivor interviews shape adaptive scenario logic, allowing the training to evolve dynamically in response to user actions.

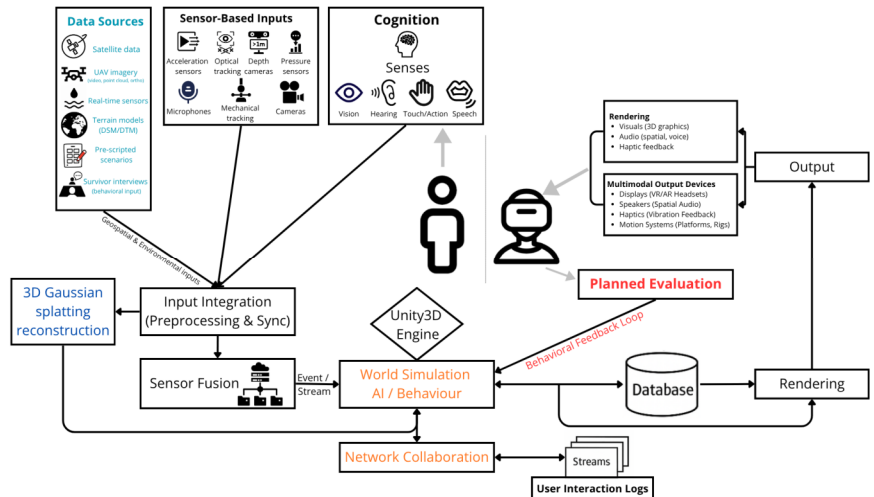
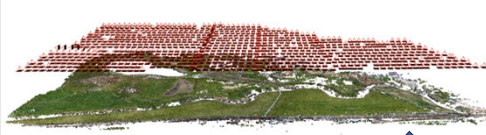


Figure 1 : From Real Flood Data to Immersive Experience: The FlashFloodBreaker Simulation Pipeline

RESULTS

Drone Flight & Feature Matching

High-resolution aerial imagery is collected and aligned to generate sparse point clouds for site modeling.



Processing script to train Gaussian Splatting model

Pipeline transforms Drone images into splatted 3D scenes with real-time rendering potential.



Photorealistic rendering with Gaussian Splatting
The trained GS model offers high-fidelity visuals optimized for immersive simulation in real time.

Flood scenario simulation in Unity3D

The 3D scene is imported into Unity to simulate real floodwater levels and interactive response cues for training.



Export to Unity3D environment

IMPACT AND RELEVANCE

Realistic Training: Turns real flood data into immersive VR/AR experiences.

Better Awareness: Helps users understand and react to flood events.

Faster Decisions: Builds confidence through safe, repeatable scenarios.

Bridging Data & Experience: Connects technology with human insight.

CONCLUSION

This project transforms real flood data into immersive 3D environments for training and awareness. By combining **drone imagery, Gaussian Splatting, and Unity-based simulation**, it enables users to experience and respond to realistic flood conditions safely. Upcoming work will integrate **sensor-based real-time updates** and **behavioral testing** with responders to strengthen community preparedness and resilience.

