GITHUB LINK:https://github.com/Ag230602/ani/tree/main/Full_Reproducibility_Artifacts_W6-W8

Progress Report — *AI-Driven 3D Video Generation for Disaster Education (Florida Case Study)*

Team and Title

Team 5 — Florida Disaster Education AI
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1. Summary of Progress since PA3

After PA3 the project matured from basic data ingestion to a full multimodal educational pipeline. Key achievements:

- Integrated **Graph-RAG multi-hop reasoning** for factual retrieval and causal chains.
- Fine-tuned **Stable Diffusion + ControlNet + Stable Video Diffusion** on Hurricane Irma imagery for Florida.
- Added **voice-interactive LLM (Track A)** and **conversational visualization (Track B)** modules.
- Deployed unified Streamlit + FastAPI backend for reproducible demos.
- Completed ablation comparing baseline RAG (70 %) → Graph-RAG (87 %) → Multi-Hop (92 %) → UI (94 %).

2. Integration of Week 6 (Graph-RAG / Multi-Hop)

Week 6 added:

- **Entity extraction and graph construction** (`extract_all_entities`, `build_graph`).
- **Multi-hop QA (`multi_hop_qa`)** to connect storm → county → FEMA aid relationships.

- Streamlit tabs: *Answer / Evidence / Trace / Graph Visualization / Ablation / Florida Data* with real-time NOAA and FEMA feeds .
  Outcome: higher contextual accuracy and transparent explanation traces.

3. Integration of Week 7 (Stable Diffusion / Deployment / Agents)

Week 7 delivered:

- **LoRA-based fine-tuning on Hurricane Irma images** streamed from The Guardian & Tampa Bay Times.
- **ControlNet (Depth)** for scene conditioning and **Stable Video Diffusion** for temporal animation.
- Agent loop (Planner → Executor → Aggregator) connecting Graph-RAG retrieval to video generation decisions.
- Deployed via **Streamlit frontend + FastAPI backend**, exposing endpoints for query, generation & metrics.

4. Datasets

Source	Content	Update
NOAA NCEI & Open FEMA	Florida storm events + disaster declarations	Auto-refreshed via API
The Guardian / The Atlantic / Tampa Bay Times	Hurricane Irma imagery (scraped)	Streamed on-demand
DEMO Corpus	5 docs on methods/datasets for Graph-RAG demo	Expanded with Florida terms

Preprocessing includes captioning, deduplication, depth-map generation, and RAM-only caching to avoid GPU memory errors.

5. Prototype Improvements & Deployment

- **Graph-RAG UI**: answers + evidence + reasoning + graph viz.
- **Florida Dashboard**: NOAA satellite + FEMA heatmap with persistent session state.
- **LoRA/SVD module**: runs on CPU or GPU with automatic scraping and in-RAM training.

- **FastAPI integration**: connects LLM queries to SD generation tasks.
- **Reproducibility Artifacts**
    - `env_week7.json` — environment snapshot
    - `week7_run_config.json` — pipeline settings
    - `ablation_results_week7.csv` — accuracy vs latency table

6. Benchmarking & Ablation Results

Variant	Hop Limit	Accuracy	Latency (s)	Notes
Baseline RAG	0	0.70	3.2	Text-only retrieval
Graph-RAG	1	0.87	3.8	Entity link reasoning
Multi-Hop	2	0.92	4.5	Cause–effect chains
Streamlit UI	2	0.94	4.7	Human-validated trace

Usefulness of image generation confirmed via educator feedback: visual Irma damage videos raised awareness and trust .

Hack-A-Roo (Nov 7)

- Add **multi-modal RAG** (text + image embedding fusion).
- Improve **agent autonomy** via LangGraph routing.
- Extend SVD frames to ~24 FPS clips and auto-caption for accessibility.
- Publish final Streamlit demo and Docker container for reproducibility.
- Submit comprehensive evaluation report with FEMA case studies.

9. Prototype (GitHub Link)

Includes:

- LLM + RAG configs / env files
- Stable Diffusion + LoRA outputs
- Deployed Streamlit + FastAPI agent backend
- `env_week.json`, `week_run_config.json`, `ablation_results_week.csv`
- README with setup and demo instructions