Final presentation

January 23, 2026

GitHub repository: final status

All projects, code, simulation files, and supporting materials developed during the stay have been uploaded and organized. The repository is intended to function as a centralized record of the work, rather than as a single standalone project.

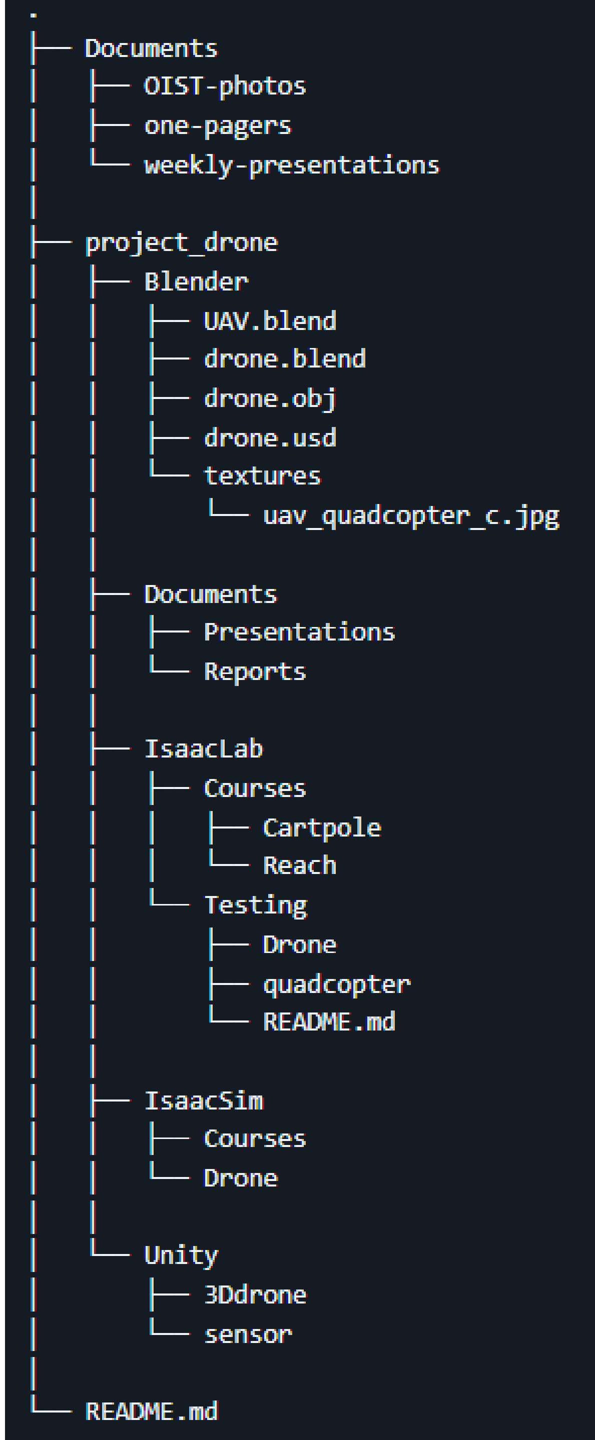
https://github.com/PaolaRojas24/SkySpec

GitHub repository structure overview

The repository is organized into two main sections: **Documents** and **project_drone**, supported by a main README.md.

- The **Documents** folder contains all non-code material from the research stay, including OIST photos, conference one-pagers, and weekly presentations.
- The **project_drone** folder groups all drone-related work by tool. It includes **Blender** files, **Unity** simulation, **Isaac Sim** projects, and **Isaac Lab** projects. Project-specific reports, presentations, and detailed README files documenting errors and limitations are included inside this section.

Overall, the structure provides a clear and organized view of all modeling, simulation, reinforcement learning, and documentation work developed during the project.



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├── Documents
│   ├── OIST-photos
│   ├── one-pagers
│   └── weekly-presentations
│
├── project_drone
│   ├── Blender
│   │   ├── UAV.blend
│   │   ├── drone.blend
│   │   ├── drone.obj
│   │   ├── drone.usd
│   │   └── textures
│   │       └── uav_quadcopter_c.jpg
│   │
│   ├── Documents
│   │   ├── Presentations
│   │   └── Reports
│   │
│   ├── IsaacLab
│   │   ├── Courses
│   │   │   ├── Cartpole
│   │   │   └── Reach
│   │   └── Testing
│   │       ├── Drone
│   │       ├── quadcopter
│   │       └── README.md
│   │
│   ├── IsaacSim
│   │   ├── Courses
│   │   └── Drone
│   │
│   └── Unity
│       ├── 3Ddrone
│       └── sensor
│
└── README.md
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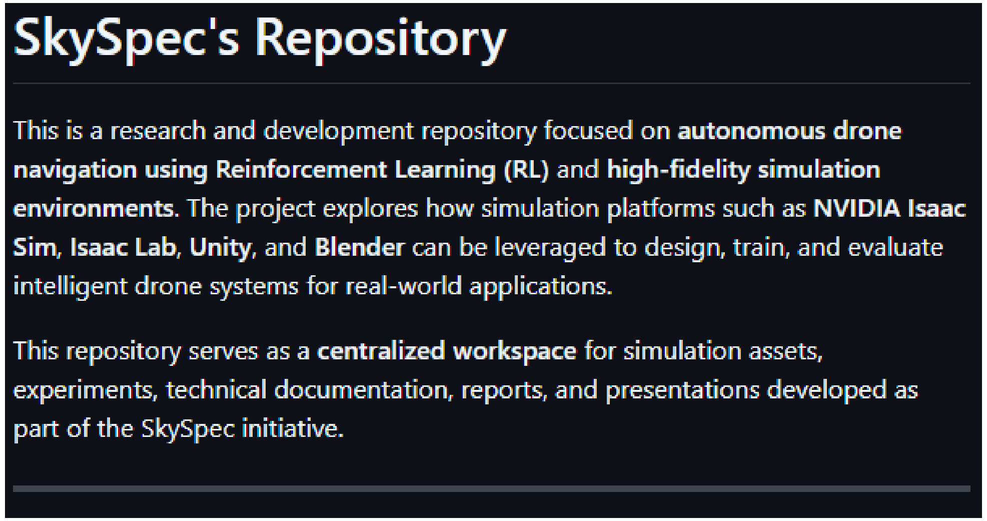
SkySpec's Repository



SkySpec's Repository

This is a research and development repository focused on **autonomous drone navigation using Reinforcement Learning (RL)** and **high-fidelity simulation environments.** The project explores how simulation platforms such as **NVIDIA Isaac Sim**, **Isaac Lab**, **Unity**, and **Blender** can be leveraged to design, train, and evaluate intelligent drone systems for real-world applications.

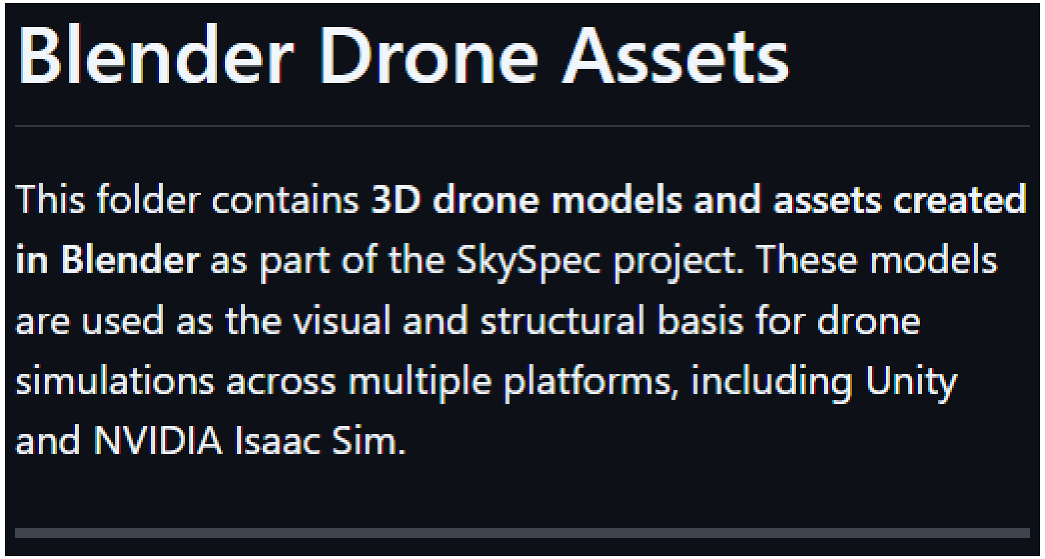
This repository serves as a **centralized workspace** for simulation assets, experiments, technical documentation, reports, and presentations developed as part of the SkySpec initiative.

The main README.md explains the purpose, goals, and organization of the SkySpec repository.

It includes:

- **Project description**: Introduces the focus on autonomous drone navigation using simulation and reinforcement learning.
- **Project goals**: Lists objectives like developing simulation environments, training RL agents, creating reusable drone models, and documenting experiments.
- **Repository structure**: Summarizes how the repository is organized.
- **Folder overviews**: Provides a short explanation of the purpose of each main folder and subfolder.
- **Technologies used**: Lists the key tools and platforms employed in the projects.

Blender - README



Blender Drone Assets

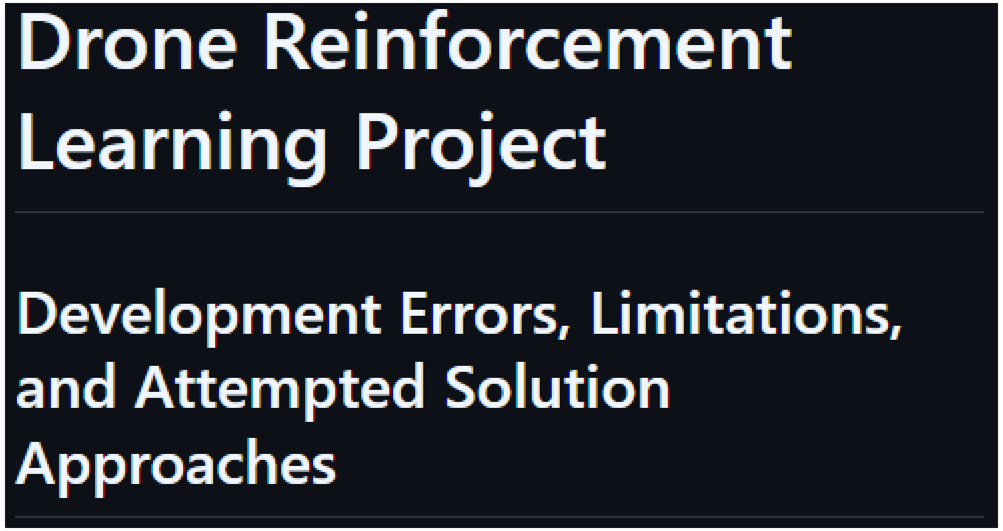
This folder contains **3D drone models and assets created in Blender** as part of the SkySpec project. These models are used as the visual and structural basis for drone simulations across multiple platforms, including Unity and NVIDIA Isaac Sim.

The Blender README.md explains the 3D drone models and assets in the Blender folder.

It includes:

- **Project description**: Shows that the folder contains 3D drone models used for simulation across multiple platforms.
- **Main files**: Highlights UAV.blend as the core quadcopter model, with clean geometry suitable for simulations and export to .obj and .usd.
- **Notes**: Explains that textures and exports are included for cross-platform use, and the models are intended for simulation and experimentation.
- **Demo link**: Provides a video demonstrating the UAV model.

IsaacLab/Testing - README



Drone Reinforcement Learning Project

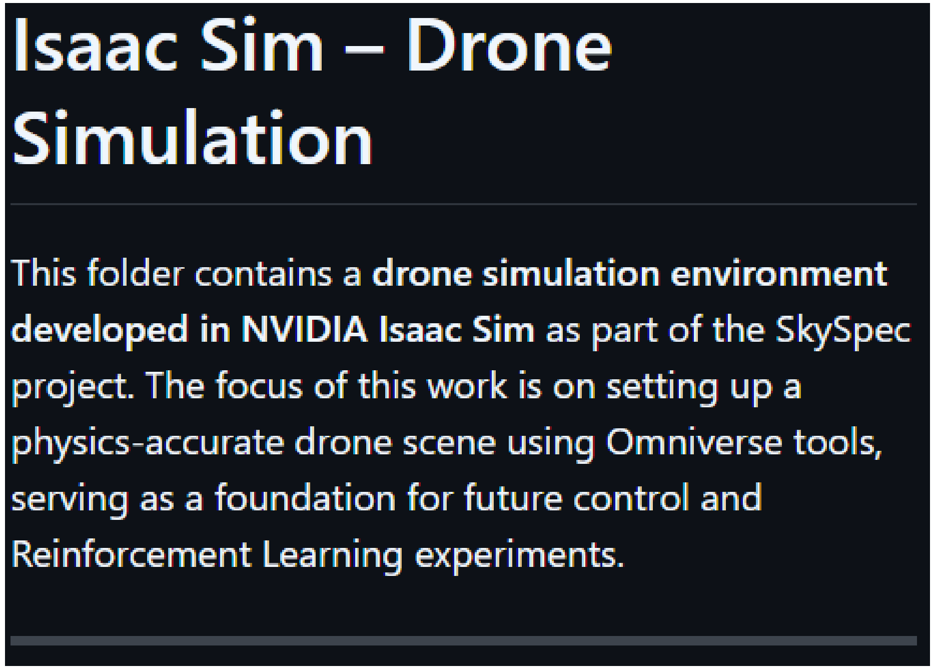
Development Errors, Limitations, and Attempted Solution Approaches

This README explains the Drone Reinforcement Learning project and details the development errors, limitations, and attempted solutions.

Key points include:

- **Project goal**: Train a quadrotor drone using Reinforcement Learning in NVIDIA Isaac Lab, integrating physics, observations, actions, and rewards.
- **Attempt 1**: Tried controlling the drone as a rigid body with forces and velocities. Failed due to missing APIs and unsupported action terms.
- **Attempt 2**: Added four propeller joints and used joint velocity control. Failed due to API mismatches, lack of proper thrust modeling, and unstable simulation.
- **Asset and USD issues**: Confusion between Articulation and RigidObject configurations, deprecated arguments, and inconsistent handling of mass, inertia, and collisions.
- **Manager-based environment problems**: Observation and action APIs changed between versions, causing incompatibilities.
- **Attempt 3**: Tried multiple Python environments and execution methods, but persistent module errors (omni) and version conflicts prevented reliable execution.
- **Root causes**: Version mismatches, outdated documentation, lack of native drone/thrust support, and high implementation complexity.
- **Lessons learned**: Isaac Lab is optimized for ground robots, not drones; proper drone control requires first-class thrust and torque modeling; version alignment is critical.
- **Suggested next steps**: Consider simplified drone models, alternative simulators, higher-level control abstractions, and freezing a stable software stack before further experiments.

Isaac Sim Drone - README



Isaac Sim – Drone Simulation

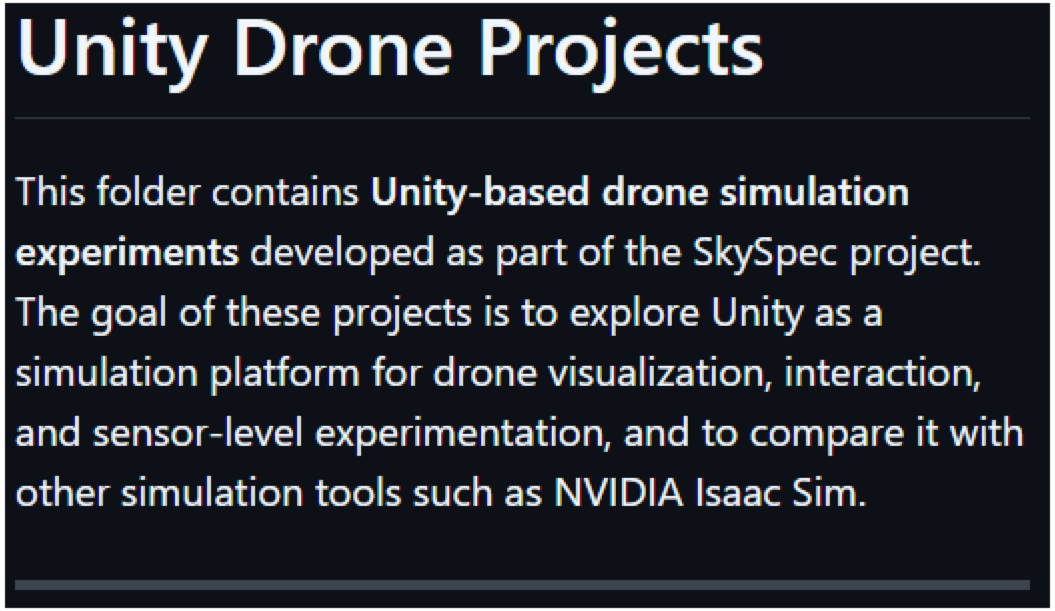
This folder contains a **drone simulation environment developed in NVIDIA Isaac Sim** as part of the SkySpec project. The focus of this work is on setting up a physics-accurate drone scene using Omniverse tools, serving as a foundation for future control and Reinforcement Learning experiments.

This README explains the **drone simulation environment** developed in **NVIDIA Isaac Sim** for the SkySpec project.

Key points include:

- **Purpose**: Set up a physics-accurate drone scene as a foundation for future control and Reinforcement Learning experiments.
- **Drone Simulation**: Integrates the drone asset into Isaac Sim, with scene setup and initial testing of drone behavior.
- **Notes**: The simulation is experimental and under development, serving as a first step toward RL-based drone control.
- **Demo**: A video shows the drone operating in the Isaac Sim environment.

Unity - README



Unity Drone Projects

This folder contains **Unity-based drone simulation experiments** developed as part of the SkySpec project. The goal of these projects is to explore Unity as a simulation platform for drone visualization, interaction, and sensor-level experimentation, and to compare it with other simulation tools such as NVIDIA Isaac Sim.

The Unity README.md explains the **Unity-based drone simulation experiments**.

It includes:

- **Project description**: Introduces the folder as a space for testing drone visualization, interaction, and sensor experiments in Unity.
- **Projects overview**:
  - 3Ddrone: A basic 3D drone simulation for environment setup and interaction testing.
  - sensor: Experiments focused on sensor data representation and visualization in Unity.
- **Notes**: Explains that these projects are exploratory, meant for early prototyping and platform comparison.
- **Demo links**: Videos showing each project in action.

Thank you