UAV Strategic Deconfliction System Documentation

1. Project Overview

The UAV Strategic Deconfliction System is a Python-based simulation framework designed to ensure the safe operation of Unmanned Aerial Vehicles (UAVs) in shared airspace. It provides a 4D (3D space + Time) strategic deconfliction capability, allowing mission planners to validate drone flight paths against the schedules of other drones.

The system's primary goal is to detect and visualize potential conflicts—instances where two drones violate a specified safety radius at the same time—before they occur in reality.

Key Features:

- 4D Trajectory Modeling
- Strategic Conflict Detection
- Interactive Visualization
- Extensible Architecture

2. System Architecture

Core Logic:

- models.py – Waypoint, Mission, Drone
- trajectory.py – interpolation and time assignment
- deconfliction.py – conflict detection

Visualization:

- visualizer.py – 3D animation with conflict markers

3. Data Structures & API

Waypoint, Mission, Drone defined using dataclasses.

4. Algorithms

Trajectory Interpolation using LERP.

Conflict Detection using time-stepped distance checks.

5. Usage Guide

Install dependencies and run demo.py. Create custom missions using provided classes.