**Project Report: Overview of the Implementation of the PPO Model and the UAV Simulation Environment**

## **Overview:**

This document describes how a bespoke gym environment and the Proximal Policy Optimisation (PPO) algorithm implemented using the stable-baselines3 package were used to construct and evaluate a simulation environment for an Unmanned Aerial Vehicle (UAV).

1. **Definition of the Environment Setup Class:**
   * **Class name:** UAVEnv
   * **Parent Class:** gym.Env

**Features of the Environment:**

* **Target Position:** Configurable target position with a default value of (500, 500, 80).
* **Initial Battery Life:** Set to 6000 units for the initial battery life, which indicates longer operation times.
* **Environmental Boundaries:** To define the operational space, the numbers (800, 800, 120) are specified.
* **Wind Effects:** An optional setting to model environmental difficulties.
* **Static Obstacles:** Designed in advance and customisable, these obstacles facilitate navigation testing.

**Space of Action:**

* consists of six directional movements and a hover action, which are combined into a separate space of seven actions to perform basic UAV manoeuvres.

**Space of Observation:**

* Records the position, battery life, and wind impacts of the UAV. To account for limitations in the real world and the unrestricted influence of wind, the space is specified with lower and higher bounds.

**Logic for Battery Consumption:**

* Adapts according to the action performed, dividing the expense of vertical and horizontal motions to replicate accurate power consumption.

1. **Configuring the PPO Model and Initialising the Model:**
   * The model makes use of settings that are specific to the environment that has been specified; they include its neural network architecture and important training parameters. Optimisation methods and epoch durations are examples of specific parameters; nevertheless, this summary truncates detailed numerical values.
2. **Model Assessment Process of Evaluation:**
   * entails creating the UAV environment and assessing policies to gauge performance according to points earned and actions made each episode.
3. **Animation of the Visualisation Path:**
   * Plotting the UAV's route, impediments, and target locations within the surroundings is a component of visualisation. The flight route of the UAV is animated and stored as a GIF, offering a dynamic visual depiction of the navigational skills of the aircraft.
4. **Other Miscellaneous Features:**
   * Additional code cells improve the simulation's visual feedback and interaction by providing routines for plotting and animation updates.

**Conclusion:**

With the help of the PPO algorithm, the project effectively creates a UAV simulation environment with a complex AI model. Because of the environment's great degree of configurability, a comprehensive testing of UAV navigational tactics under many conditions is possible. Clear insights into the UAV's operational efficacy and the effects of environmental conditions on its navigation are offered by the visualisations.