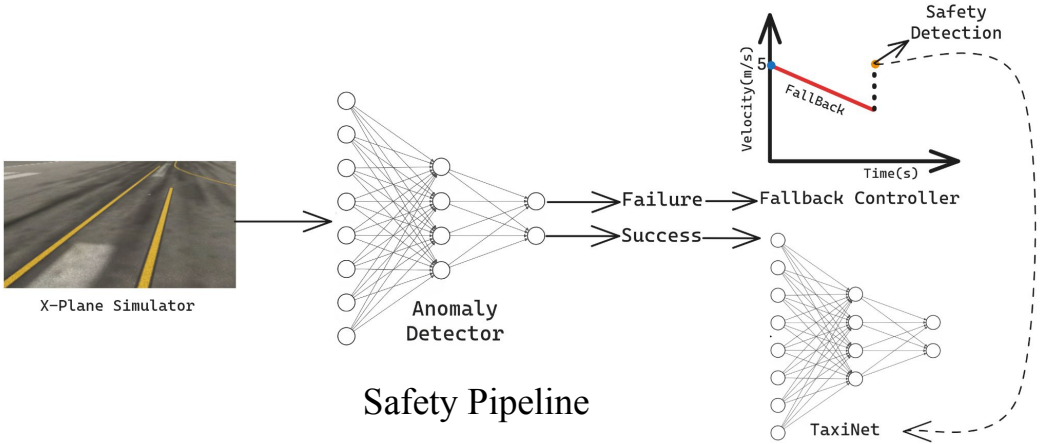
Safety Assurances of Visual Controllers

- Vision-based controllers are widely used in robotic applications. However, these controllers undergo closed-loop system safety violations when integrated in safety-critical applications.
- Train an Anomaly Detector which can detect "Potential Failures" and design Fallback Controllers for maintaining safety in aircraft taxiing and ground navigation tasks.



Safety Pipeline

- Paper is **Accepted** in "**ICRA 2024**".
- Extending framework for "Ground Navigation" and implementing "Conformal Prediction" to submit to RA-Letters.

[Paper] [Presentation] [Video] [Website] [Code]

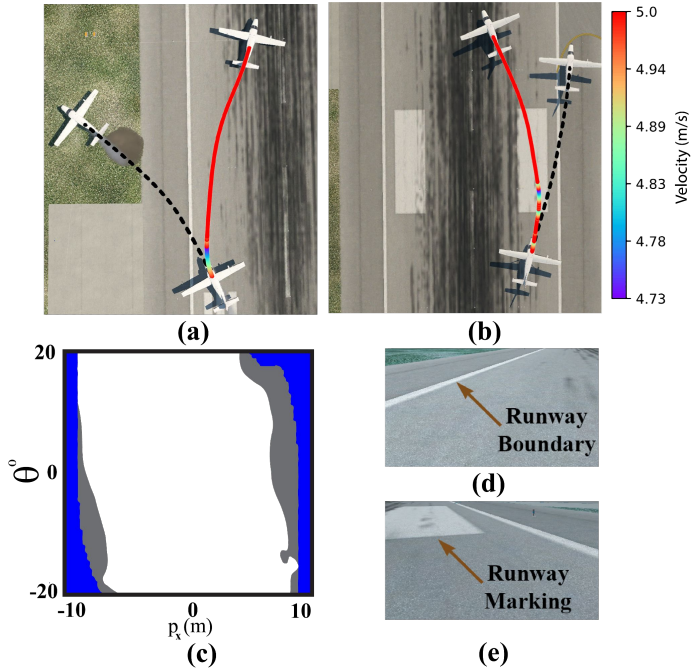


Fig.(a,b) Aircraft Trajectories under perception controller(black) and safety pipeline(red), Fig.(c) BRT comparison showing decrease in failure volume, Fig.(d,e) Failures due to runway boundary and markings

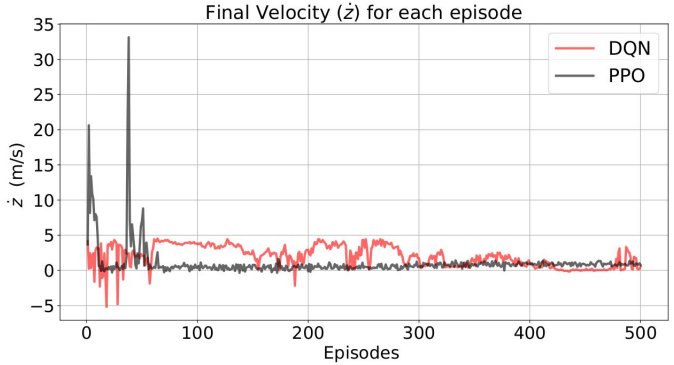
Docking Mechanism for VTOL-UAVs on Offshore Platforms

Developed a deep-RL based docking mechanism for UAVs on offshore charging platforms having hydrodynamic disturbances, modeled using JONSWAP(Joint North Sea Wave Project), a popular framework in ocean engineering.

- Formulated the reward function to land precisely and softly on docking station.
- PPO agent showcased better performance as compared to DQN agents.

Table 1: Performance Comparison of Trained Agents

Agent	Impact Velocity(m/s)	Landing Time(s)	Inference Time(ms)
PPO	0.327	**4.9**	**6.788**
DQN	0.820	5.4	9.854
Double DQN	**0.223**	7.7	7.220
Dueling DQN	2.419	6.3	11.296



Paper submitted to **Applied Soft Computing Journal**
Paper/Videos/Code are currently confidential

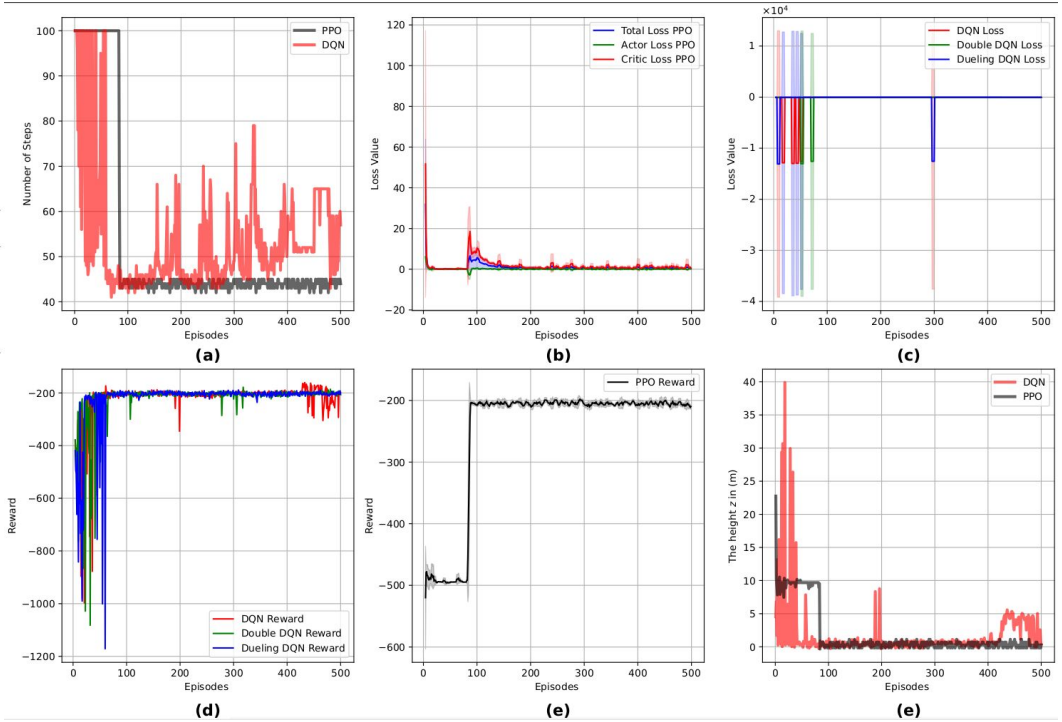


Fig.(a) Comparison between number of time-steps needed to land, Fig.(b) PPO agent loss, Fig.(c) DQN agents loss, Fig.(d) DQN agents reward, Fig.(e) PPO agent reward, Fig.(f) Final height achieved by DQN and PPO agents. Shaded parts in all figures represent the standard deviation of the moving average.