



Aerial Robotics Working Group

October 11th 2023
Discussion/Developer meeting

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The Agenda

- Introduction topic **Simulation**
- Discussion
- Conclusion
- Announcements
- Next meeting

Simulation for aerial robotics

- Many simulators out there, and most of them support some kind of aerial dynamics
- Used for different purposes:
 - Vision based navigation
 - Control design
 - Swarming
- Each of these simulators need a different set of qualities tailored to the application or topic



GAZEBO



List of Simulators

- **General robotics simulators:**
 - Gazebo (<https://gazebosim.org/>)
 - Webots (<https://www.cyberbotics.com/>)
 - Isaac Sim (<https://developer.nvidia.com/isaac-sim>)
- **Simulators meant for aerial robotics**
 - AIRsim (<https://github.com/microsoft/AirSim>)
- **From the piloting training community**
 - Flightgear (<https://www.flightgear.org/>)
 - XPlane (<https://www.flightgear.org/>)
- **From the RC community**
 - RealFlight (<https://www.realflight.com/>)
- **For reinforcement learning**
 - Pybullet (<https://pybullet.org/wordpress/>)

And many more...

Simulation packages

- RotorS (https://github.com/ethz-asl/rotors_simulator) (ROS1)
- Flightmare (<https://github.com/uzh-rpg/flightmare>) (ROS1)
- Gym-pybullet-drones
(<https://github.com/utiasDSL/gym-pybullet-drones>)
- Pegasus Simulator (<https://pegasussimulator.github.io/>)
- Any more?

Comparison papers

C. K. Liu et al., "The Role of Physics-Based Simulators in Robotics," Annual Review of Control, Robotics, and Autonomous Systems, vol. 4, no. 1, pp. 35–58, 2021.

J. Collins, et al., "A Review of Physics Simulators for Robotic Applications," IEEE Access, vol. 9, pp. 51 416–51 431, 2021

2023 ICRA workshop 'The Role of Robotics Simulators for Unmanned Aerial Vehicles' <https://imrclab.github.io/workshop-uav-sims-icra2023/>

Discussion topics

- Initial thoughts, experience with these simulators?
- What is important in a simulator for you?
- Rendering vs dynamics model vs parallelism?
- ...

Initial thoughts, experience with these simulators?

What is important in a simulator?

- Physics gravity
- Interaction objects with aerial robotics
- Vision based but real is better
- Interaction with water
- Aerial manipulation
- Load real world environments
- Network simulation
- Aerodynamic effects
- System ID
- Easily define new vehicles
- Simulation electronics and battery
- Ground station simulation
- SITL/HITL interfaces

Rendering vs dynamics model vs parallelism?

Depends on the application

- SLAM indoor. Unreal rendering engine / Unity. Sim to real
- GPS driven, then minecraft quality is fine
- Ultrawideband simulation network simulation
- Multipath for mountains navigation
-

Announcements

- ROScon 2023 next week! Who is going?
- Don't miss these two presentations on Thursday!
 - 9:00 keynote: Up, Up, and Away: Adventures in Aerial Robotics - Ramon Roche
 - 10:00 Aerostack2: A framework for developing Multi-Robot Aerial Systems - Miguel Fernandez-Cortizas

Next meeting

Scientific meeting

- Wednesday 25th of November is cancelled!
- Next one is **Wednesday 8th of November at 2 pm UTC**
 - be aware of daylight savings!
- Scientific presentation: Ramon Roche will have a presentation about PX4

Github organization for this working group: <https://github.com/ROS-Aerial>

- Aerial robotics landscape: Add a info page if you like
- Community: Add yourself as member

Wanna do a presentation? Email to kimberly@bitcraze.io & rroche@linuxfoundation.com