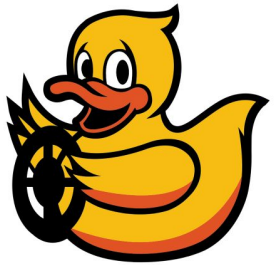


DUCKIETOWN

Learning Autonomy

PX4 Community Meeting

Jul 16, 2025

Davide Iafrate, MsC
Lead Robot Autonomy Engineer

Agenda

1. Low-cost PX4 FC on DD24-B
2. PX4 SITL in the Duckiematrix
3. PX4 Learning experiences

Duckietown

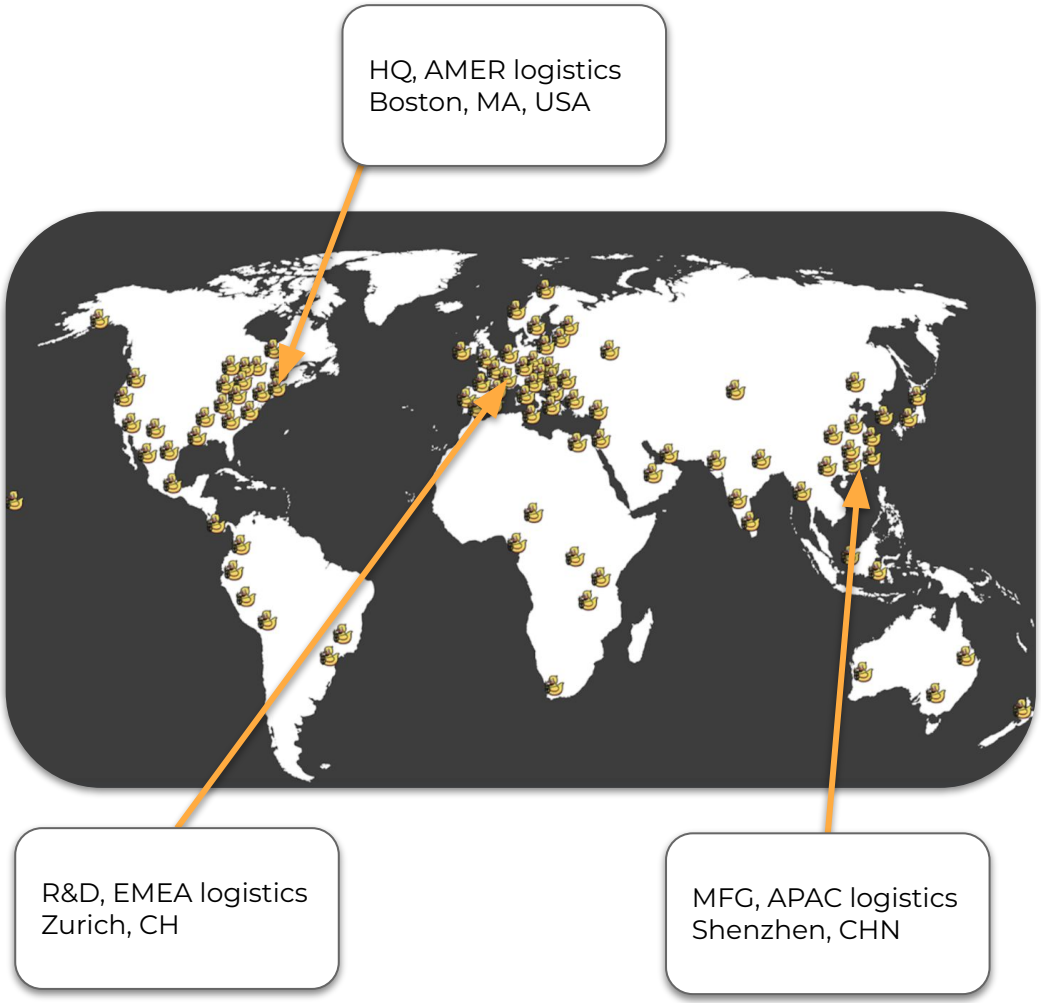
American-Swiss edtech startup

Democratizing access to the science and technology of **robot autonomy**

Started as a class at MIT in 2016

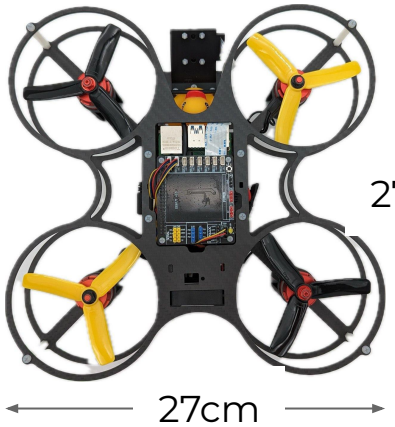
~200 universities, ~150 companies, ~10k alumni

Delivered robots in 68 countries



Duckiedrone DD24 (2024)

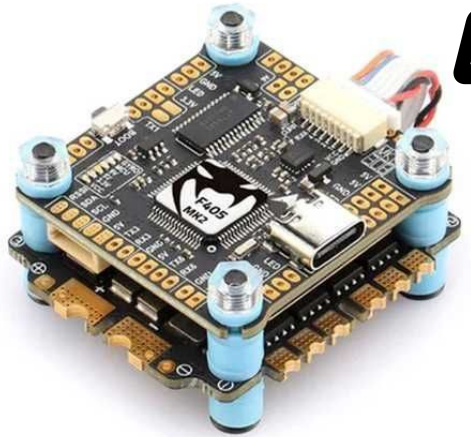
- Monocular camera
- 5 ToF sensors (bottom, sides, top)
- Onboard computing and autopilot
- Containerized software architecture
- ROS based stack
- All-inclusive* DIY kit (soldering required)
- $429 (without the RPI 4B)
  (complete kits available for 479$)
- Weight: ~800g



Duckiedrone DD24 hardware

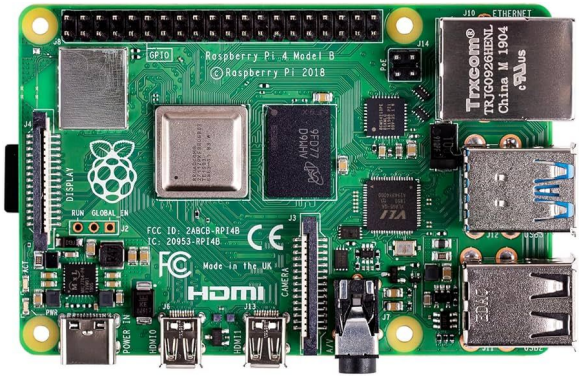
Flight controller

- Mamba F405v2 mk2 Flight controller
    - **PX4** [hw support PR]
    - Interface to ROS2 using `mavros2`
    - Pre-configured settings file



Computation

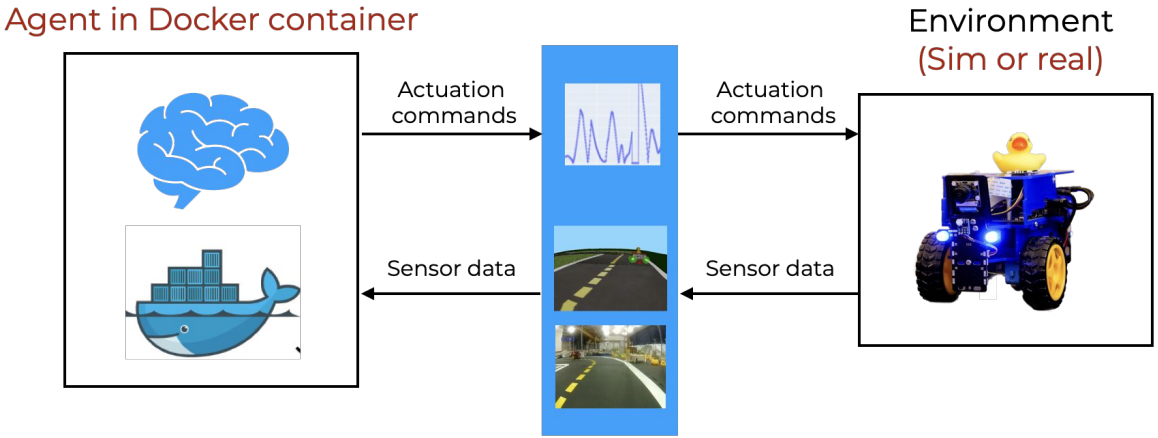
- Raspberry Pi 4B / **Raspberry Pi 5***
    - Quad-Core ARM platform
    - Good power/weight balance
    - Flash-and-fly OS image

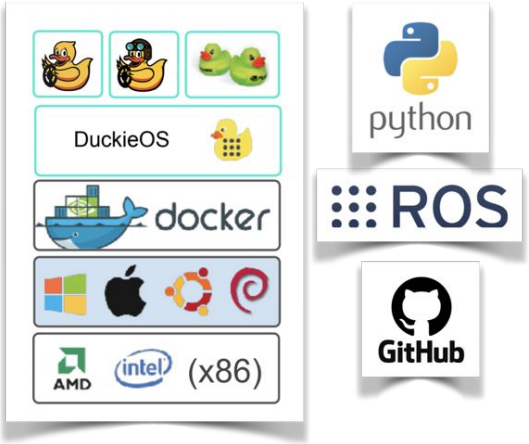


* [Support in beta]

Duckiedrone (DD24) - Assembly Tool

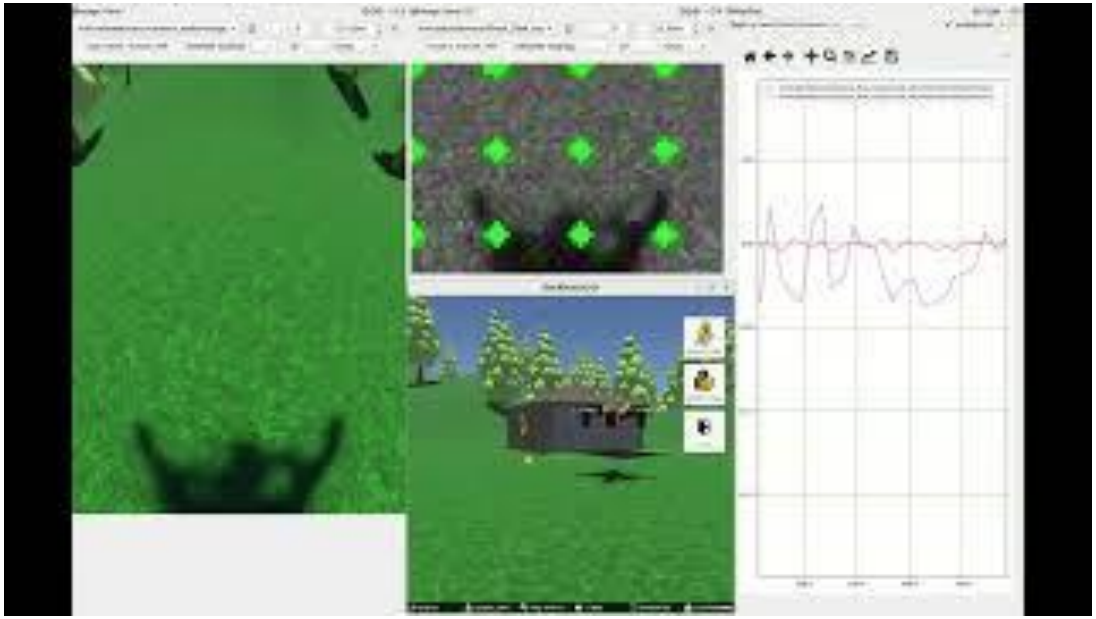
Software architecture





SIL Simulation in the Duckiematrix*

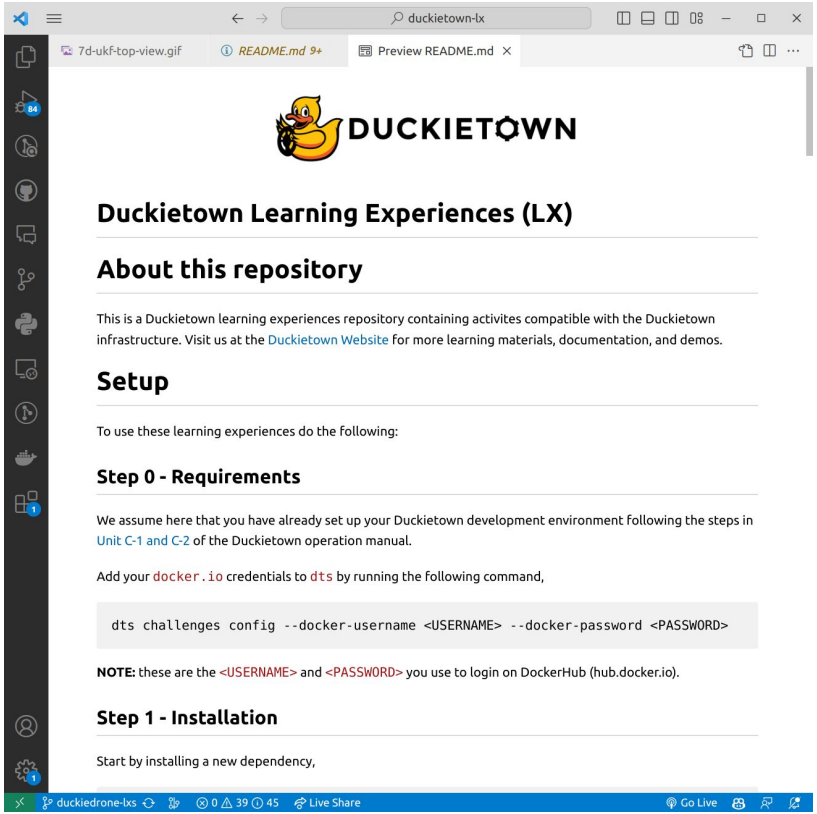
- 3D simulation for Duckietown
- Software-in-the-loop (SIL) sensing and acting of a Duckiedrone in a Duckietown
- Scalable architecture for parallelization
- Gym API (in development)
- Custom Maps
- **rotorpy** physics simulator
  - **PX4 support** in development (thanks @mrpollo [PR])



* [Private beta]

Learning Experiences (LX)*

- Jupyter notebooks + Python
- Modular learning activities
- Deploy in simulation and on hardware
- Dockerized VSCode (with dependencies) / VNC
- Several LXs:
  - Sensors, PID, Filtering, Localization, SLAM
- Developer manual available
  - Instructors can develop their own LXs



Future goal:

- PX4 control/EKF LX (C++?)
- control/estimation in PX4, perception on Raspberry

https://docs.duckietown.com/daffy/opmanual-duckiedrone/learning-experiences/supported-lxs.html

*porting to v2 SW stack ongoing.