

Vision

Use imitation learning to help mini Unmanned Aerial Vehicles autonomously navigate densely cluttered forested environments using only 2D vision.

Issues

- Hard to track running and dead nodes
- Existing implementation purely reactive
- Control input not intuitive - 'bird flies to open space'
- Over compensation because of lack of feedback

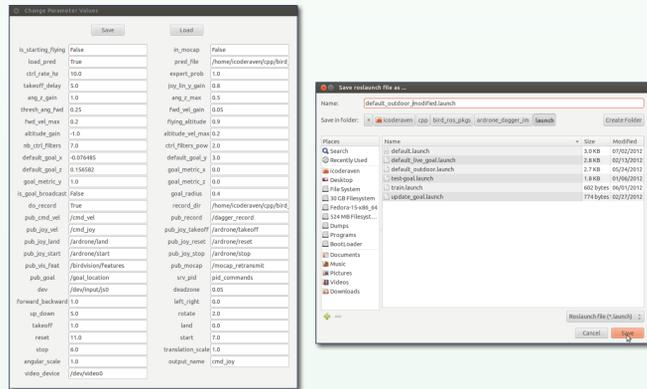
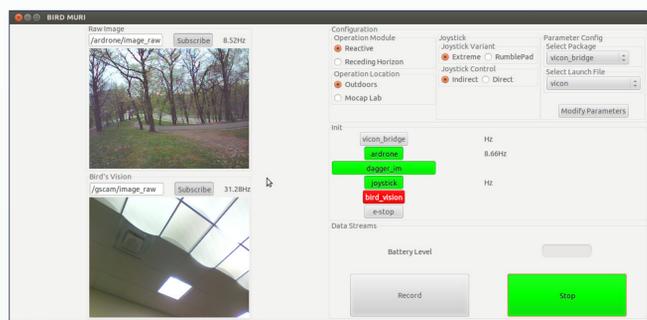
Solution

A Unified Command and Control Interface

- Dynamic GUI in wxPython, parses roslaunch files dynamically
- Individual nodes as separate threads with visual feedback on failure

More Intuitive Control Inputs

- Shifting window approach to select displacements for avoiding obstacles
- Mouse selection approach to select a ray in the image to head towards

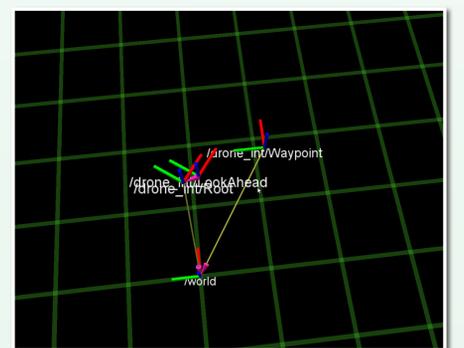
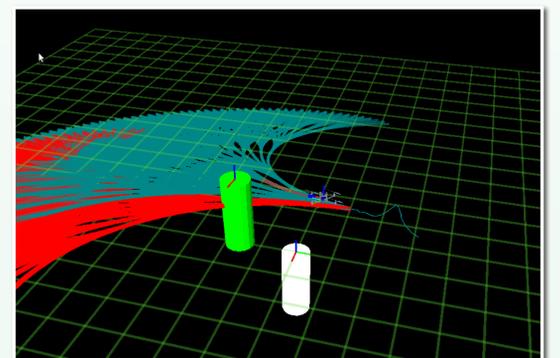
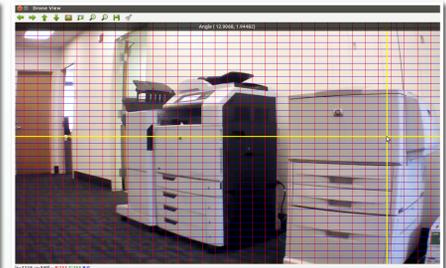
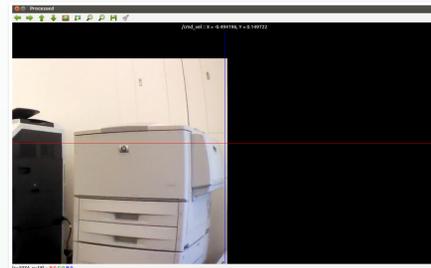
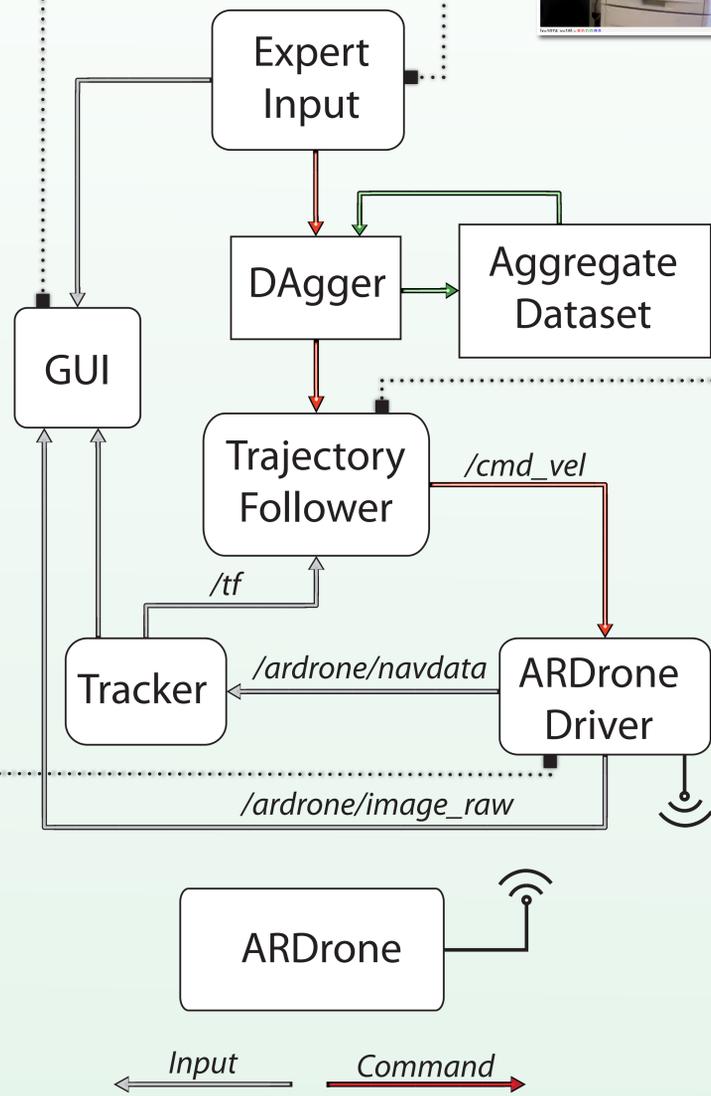


- 1 GHz 32 bit ARM Cortex A8
- 800 MHz DSP
- Linux 2.6.32
- 1 Gbit DDR2 RAM
- WiFi b,g,n
- 3 Axis Gyroscope, Accelerometer and Magnetometer
- Pressure Sensor
- Ultrasound Sensor
- 1080p Resolution camera



ROS ARDrone Driver

- Exposed IMU navdata stream at 200 Hz and HD video.
- Hovering toggle to maintain attitude



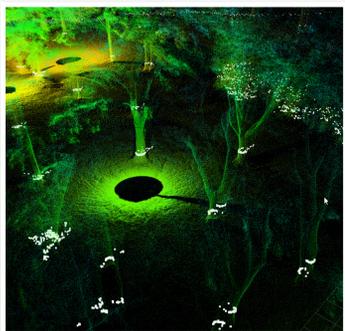
Follow Trajectories

- Pose estimate by integrating IMU velocities over time.
- Dangling carrot PD controller for smooth motion.

Additional Research

MLE of Tree Density

- ANN using a KD tree to determine the distance to the farthest tree in a n-tree neighbourhood.
- Characterized area associated with each tree and its neighbours for binning



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Feedback

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