Advanced Robotics and Autonomous Mobile Systems

2021 S.S.

Project Document on

Autonomous FPV racing

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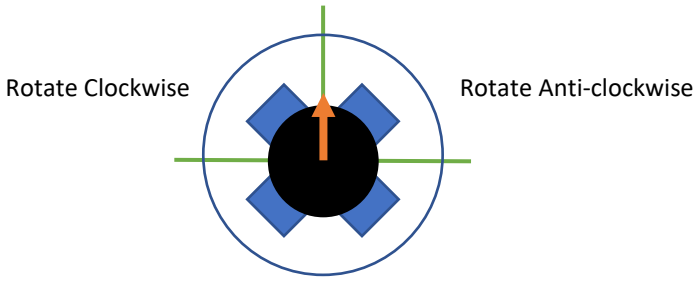
Methodology

1. Start from HOME position
2. Takeoff and reach certain height
3. Start Yaw
4. Find Gate with respective color (Blue).
5. Make Box around Gate and align bottom left corner of Gate to center of screen
6. Move towards Gate keeping center aligned
7. When reach particular distance from gate, initiate loop function to loop through the gate.
8. Move forward through gate after loop, change yaw to face next gate (approx.)
9. Detect Objects while moving (Lidar)
10. Repeat Step 4 – 8 for rest colors (Green, Purple, Red, Yellow) in order.
11. Once all gates passed, Reach origin
12. Land at Origin



Lidar Implementation

Top View
Arrow head is UAV's front (In direction of Camera)

Image Processing Methodology

1. Subscribe to Camera Topic
2. Convert stream to OpenCV format with correct color encoding
3. Blur received image
4. Create HSV filter
5. Create Mask from Image and Selected Color
6. Detect Contour over the masked image
7. Create Fixed Size Rectangle around contour
8. Add circle at bottom left corner of rectangle
9. Use the bottom left corner of rectangle to align with screen center and reach gate.
10. Send masked image with drawn contour as stream for debugging

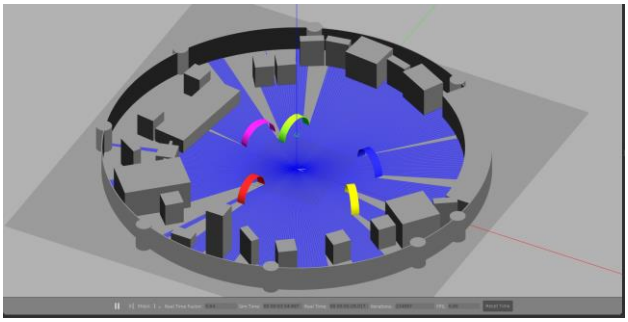
Resources

- Open CV
- Python Tutorials
- PX4 Tutorials
- ROS2 Tutorials
- Concepts of Laser Scan and Lidar
- ILIAS Course on ROS2 and ARAMS 2021

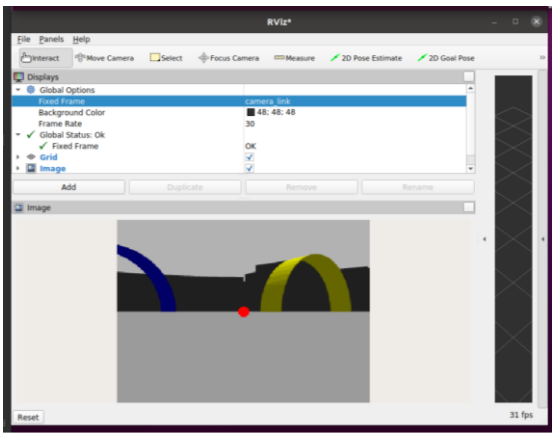
Future Improvements

- Improved process flow.
- Optimized (precise) Commands for UAV movement with position.
- Reduced code length with function overloading.

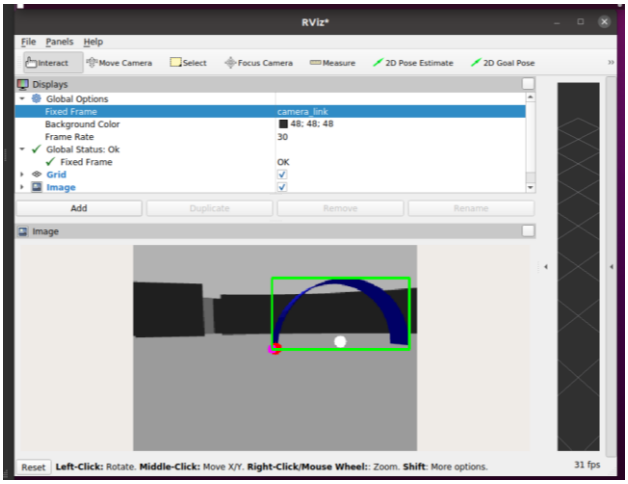
Screenshots for Reference



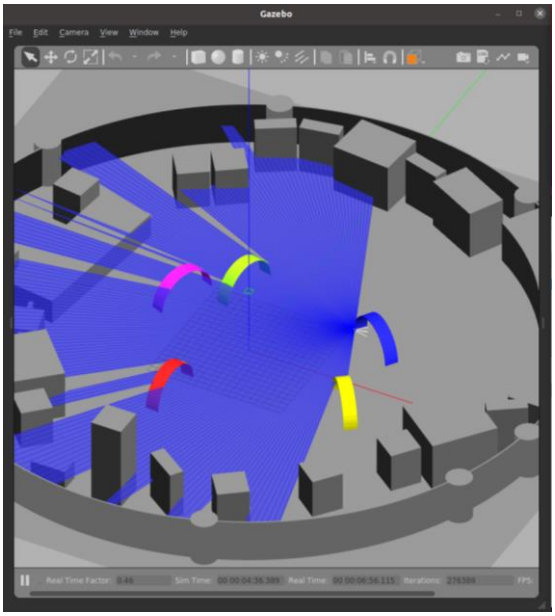
1. Initial Setup



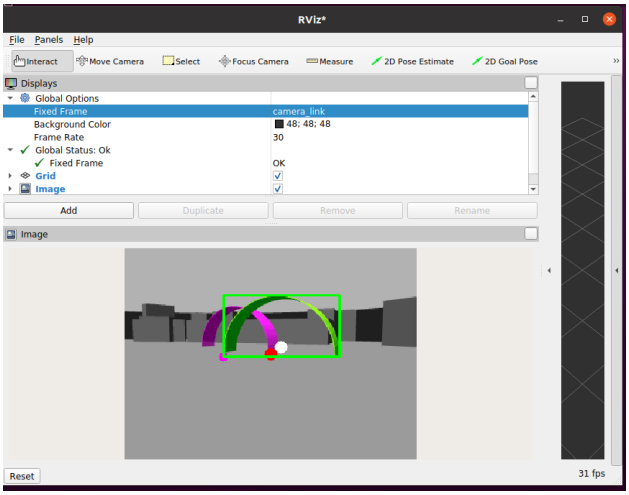
2. Turning till not found Gate



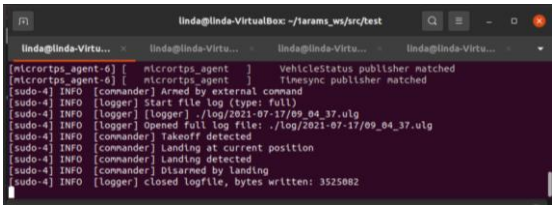
3. Gate Found and aligned



4. Movement through Gate



5. Next Gate Detection



6. Land at Origin