The instruction of RoboMaster 2023-2024 University AI Challenge Competition's simulator

Abstract

The organizing committee provides a competition venue model, allowing participating teams to experience the event advance. Teams can use the model by simulator softwares(for example: gazebo). Besides, the organizing committee has developed a sample simulator based on the venue model. This simulator:

1. integrated with the ROS system, it is convenient to obtain the drone's pose, IMU data and image data through ROS nodes, while also controlling the drone by ROS node.
2. Real-time dynamic obstacle movement effect has been achieved.
3. When entering the zone from 8 to 0 boxes, sidewinds are generated.
4. The scoring logic of task boxes is not implemented.
5. The forward direction of the initial orientation of drone is the positive X-axis, the rightward directoin is the positive Y-axis, the downward direction is the positive Z-axis, and the initial position of drone is (0, 0, 0.8). The coordinate system in the simulator is inconsistent with that used in the actual competition.

Note: This simulator example is only for a preview of the competition content. The actual specifications and textures of the filed props should be referred to RoboMaster 2023-2024 University AI Challenge Classic Rules Manual V1.0.pdf.

URL of Competition Venue Model

```
wget https://sz-rm-rmua-dispatch-prod.oss-cn-shenzhen.aliyuncs.com/9f9e486a3cde4342d106b613509f2f13 -O RMUA2024-model.zip
```

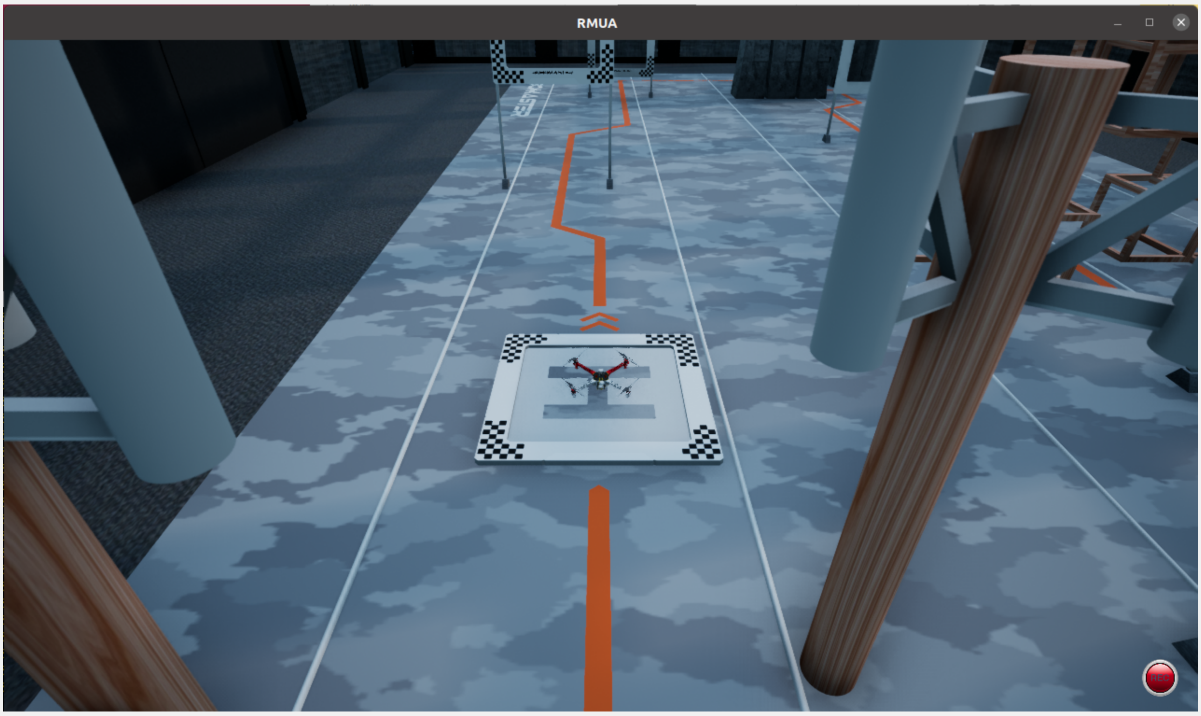
Instruction of Sample Simulator

1. Install ROS-Noetic

```
sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'
sudo apt install curl
curl -s https://raw.githubusercontent.com/ros/rosdistro/master/ros.asc | sudo apt-key add -
sudo apt update
sudo apt install ros-noetic-desktop-full
sudo apt install python3-catkin-tools
```

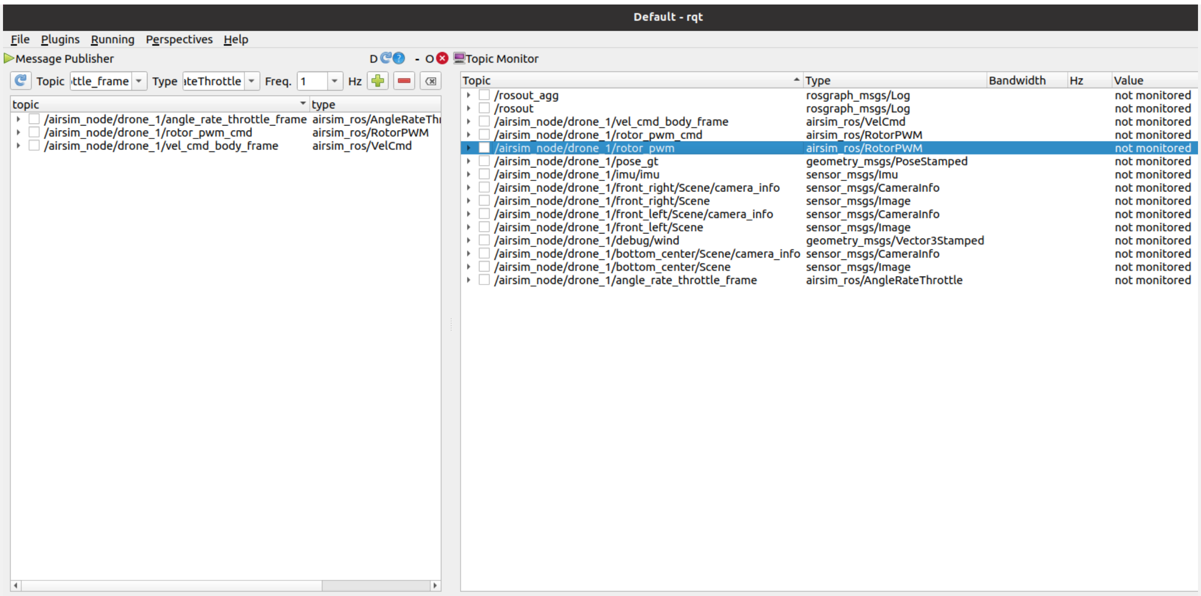
2. Usage

```
mkdir ~/simulator && cd ~/simulator
```

> - `wget https://sz-rm-rmua-dispatch-prod.oss-cn-shenzhen.aliyuncs.com/a5b9033cf7aeb347e43a08f07992cf22 -O uasim_student_240204_r1_shipping.zip`
> - `unzip uasim_student_240204_r1_shipping.zip`
> - `mkdir ~/Documents/AirSim`
> - `cp settings.json ~/Documents/AirSim`
> - `source /opt/ros/noetic/setup.bash`
> - `roscore`
> - open a new ternimal
> - `./Build/LinuxNoEditor/RMUA.sh`
>
> 
>

ROS data

> - Load the custom data types
>   `source devel/setup.bash`
> - Use rqt to check data and control drone
>   `rqt`



Topic ttle_frame Type ateThrottle Freq. 1 Hz

topic	type
/airsim_node/drone_1/angle_rate_throttle_frame	airsim_ros/AngleRateThr
/airsim_node/drone_1/rotor_pwm_cmd	airsim_ros/RotorPWM
/airsim_node/drone_1/vel_cmd_body_frame	airsim_ros/VelCmd

Topic	Type	Bandwidth	Hz	Value
/rosout_agg	rosgraph_msgs/Log			not monitored
/rosout	rosgraph_msgs/Log			not monitored
/airsim_node/drone_1/vel_cmd_body_frame	airsim_ros/VelCmd			not monitored
/airsim_node/drone_1/rotor_pwm_cmd	airsim_ros/RotorPWM			not monitored
/airsim_node/drone_1/rotor_pwm	airsim_ros/RotorPWM			not monitored
/airsim_node/drone_1/pose_gt	geometry_msgs/PoseStamped			not monitored
/airsim_node/drone_1/imu/imu	sensor_msgs/Imu			not monitored
/airsim_node/drone_1/front_right/Scene/camera_info	sensor_msgs/CameraInfo			not monitored
/airsim_node/drone_1/front_right/Scene	sensor_msgs/Image			not monitored
/airsim_node/drone_1/front_left/Scene/camera_info	sensor_msgs/CameraInfo			not monitored
/airsim_node/drone_1/front_left/Scene	sensor_msgs/Image			not monitored
/airsim_node/drone_1/debug/wind	geometry_msgs/Vector3Stamped			not monitored
/airsim_node/drone_1/bottom_center/Scene/camera_info	sensor_msgs/CameraInfo			not monitored
/airsim_node/drone_1/bottom_center/Scene	sensor_msgs/Image			not monitored
/airsim_node/drone_1/angle_rate_throttle_frame	airsim_ros/AngleRateThrottle			not monitored

The topic for obtaining data

- Bottom Camera `/airsim_node/drone_1/bottom_center/Scene`
- Left Camera `/airsim_node/drone_1/front_left/Scene`
- Right Camera `/airsim_node/drone_1/front_right/Scene`
- IMU `/airsim_node/drone_1/imu/imu`
- Real Pose of Drone `/airsim_node/drone_1/debug/pose_gt`
- PWM Signal (0:right front, 1:left back, 2:left front, 3:right back) `/airsim_node/drone_1/rotor_pwm`

The topic fot controlling drone

- PWM controlling `/airsim_node/drone_1/rotor_pwm_cmd`
- Velocity Contrilling `/airsim_node/drone_1/vel_cmd_body_frame`
- Angle Rate Throttle Controlling `/airsim_node/drone_1/angle_rate_throttle_frame`

Note：

The simulator provides a chessboard and a AprilGrid board to calibrate the drone's camera.
The number of inner dot of chessboard is 8*11, while the length of the squares is 20mm.
The AprilGrid has 6*6 big squares, whose length is 88mm, while the length of small squares is 26.4mm.