Contents

VISUAL PERCEPTION AND OBSTACLE AVOIDANCE DECISION 2

SUPPORTS MULTIPLE SENSORS 3

MAVROS COMMON INTERFACE 4

DETECTION AND RECOGNITION OF YOLO TARGET BASED ON RFLYSIM 5

SIMULTANEOUS LOCALIZATION AND MAPPING (SLAM) BASED ON RFLYSIM 5

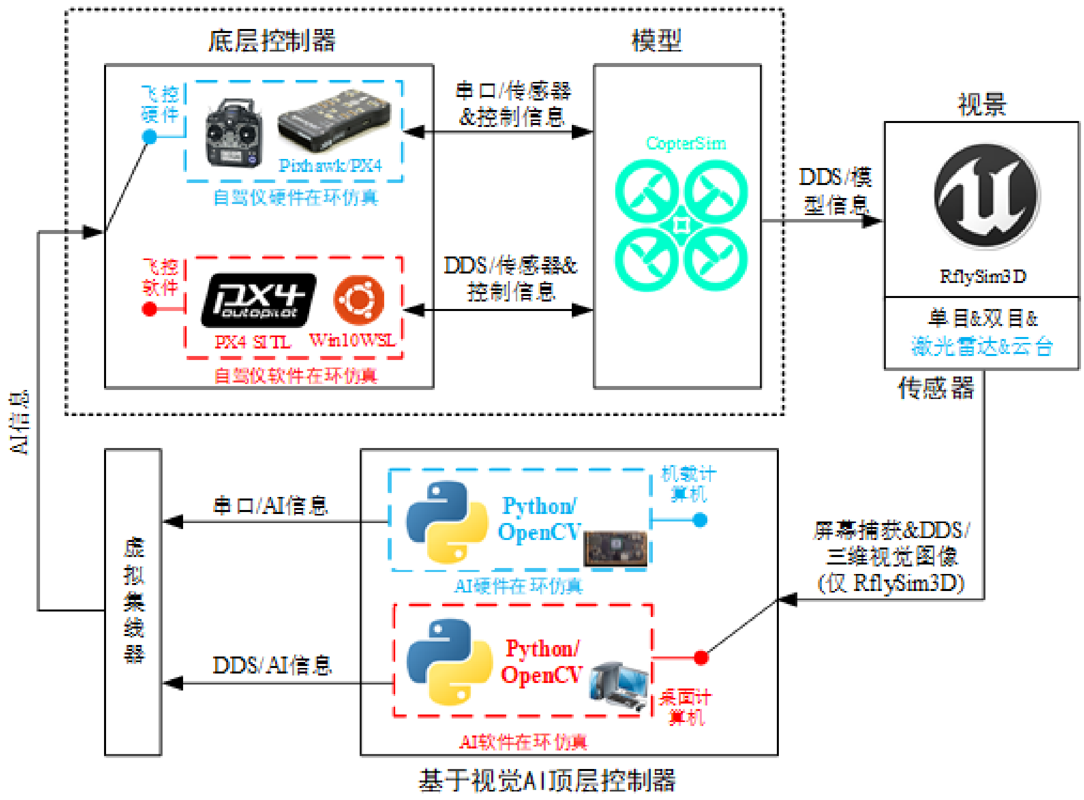
OBSTACLE AVOIDANCE DECISION-MAKING FLIGHT BASED ON RFLYSIM 5

SUPPORT VISUAL SERVO CONTROL 6

Visual Perception and Obstacle Avoidance Decision

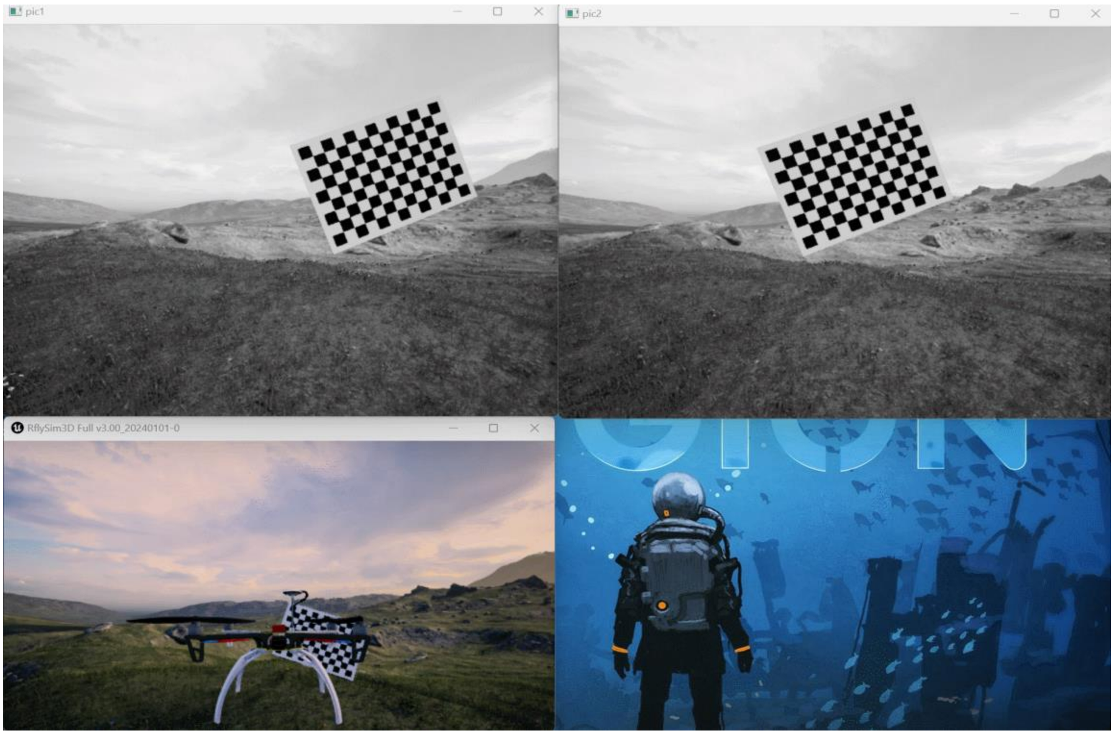
Visual perception is a process in which machines obtain environmental information through sensors and use computer vision technology to analyze and understand the image. It includes target detection, object recognition and other tasks, which provides the system with the ability to recognize the environment. Obstacle avoidance decision-making is based on the environmental information obtained by visual perception, through environmental modeling, path planning and intelligent decision-making algorithms, to develop behavioral strategies that can avoid obstacles, avoid collisions and achieve predetermined goals.

RflySim allows the simulation of various sensors, such as cameras and lidars, providing users with a platform to test visual perception algorithms. Users can create virtual environments in RflySim, including buildings, terrain, and obstacles, to test and evaluate the performance of visual perception algorithms under different environmental conditions. With RflySim, developers can validate and optimize computer vision algorithms, such as target detection and object recognition, to meet the perception needs of UAVs in different scenarios. RflySim allows users to simulate path planning to test the ability of UAVs to choose safe paths and avoid obstacles in virtual environments. Using simulation, developers can verify and adjust obstacle avoidance decision algorithms to ensure that UAVs can make intelligent decisions in the face of different environments and obstacle configurations.

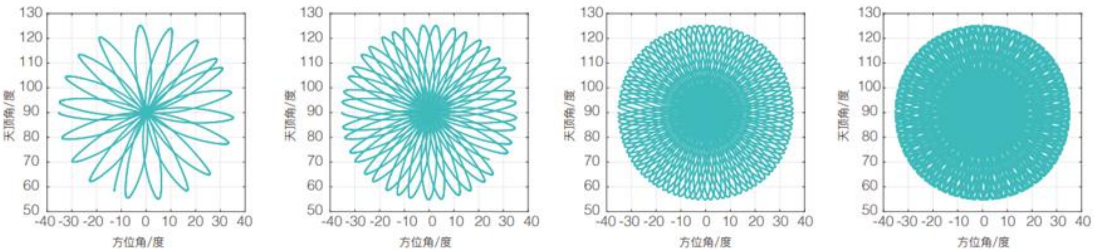


Supports multiple sensors

The sensor configuration of RflySim simulation platform can be used to set up sensors such as camera, depth camera, infrared and laser radar through the Config. JSON file of sensor configuration file. TypeID stands for sensor type ID, where 1: RGB map, 2: depth map, 3: grayscale map, 4: segmentation map, 5: ranging map, 20-22: laser radar, 40: infrared grayscale, 41: thermal map. The following figure shows the image calibration of the binocular camera sensor.



The following figure shows the point cloud of Livox Mid-70 for different integration times (0.1 s, 0, 2 s, 0.5 s and 1 s, respectively).



MavROS common interface

MavROS (MAVLink over ROS) is an ROS package for ROS (Robot Operating Syste m). It is used to communicate with MAVLink (Micro Air Vehicle Communication Protoco l) compatible aircraft. MAVLink is a lightweight, scalable, and open communication protoc ol designed to provide efficient communication for UAVs and other micro air vehicles.

Topic/mavros/state Obtain flight control state information Obtain aircraft attitude

Topic/mavros/local _ position/pose Get flight control pose data

Topic/mavros/IMU/data _ raw Obtain flight control IMU data

Topic/mavros/setpoint _ raw/local Send position, speed, acceleration, control command interface

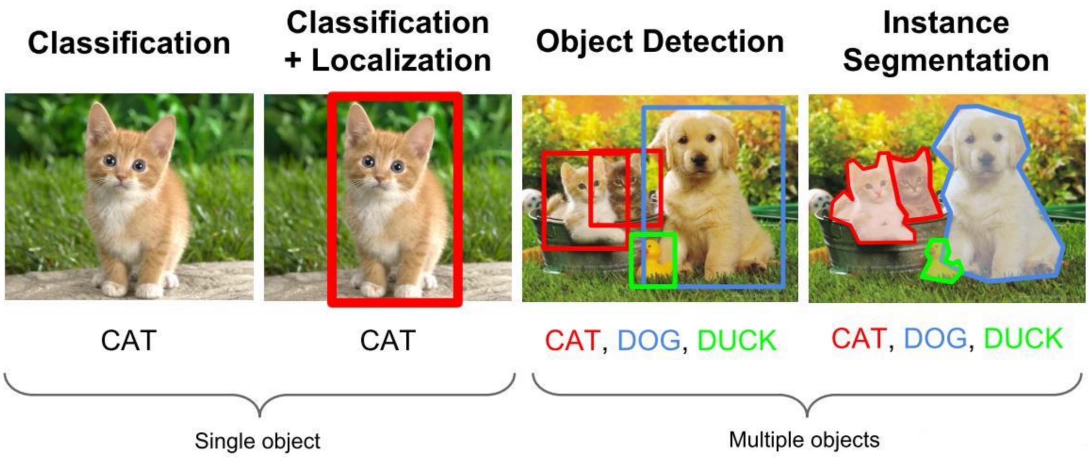
Topic mavros/setpoint _ raw/attitude Send Attitude Control Interface

Service/mavros/set _ mode flight control mode switching interface

Service/mavros/cmd/arming flight control unlocking interface

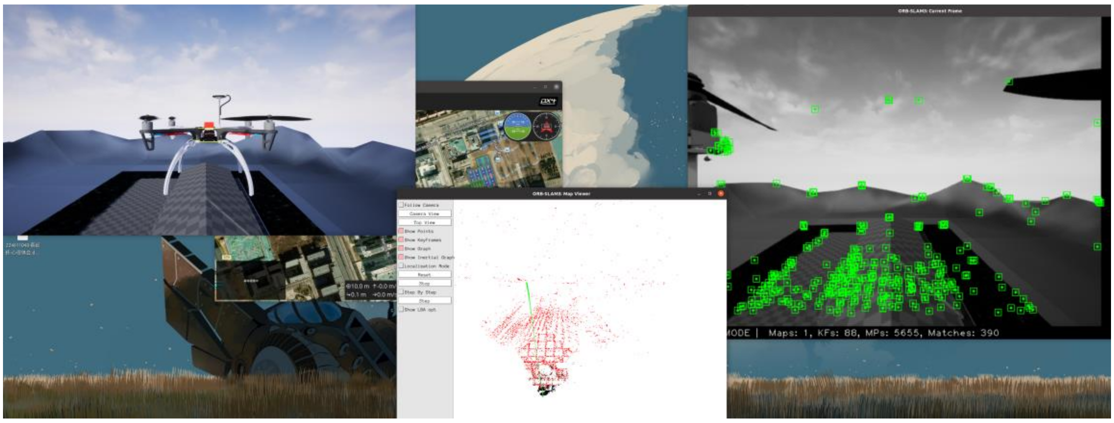
Detection and recognition of yolo target based on Rflysim

The integration of Rflysim and YOLO involves simulating aircraft and sensors in the simulation environment, embedding YOLO target detection algorithm into it, and realizing real-time detection and recognition of targets in the environment by aircraft. This integration makes it easier to test and validate target detection algorithms in virtual environments.



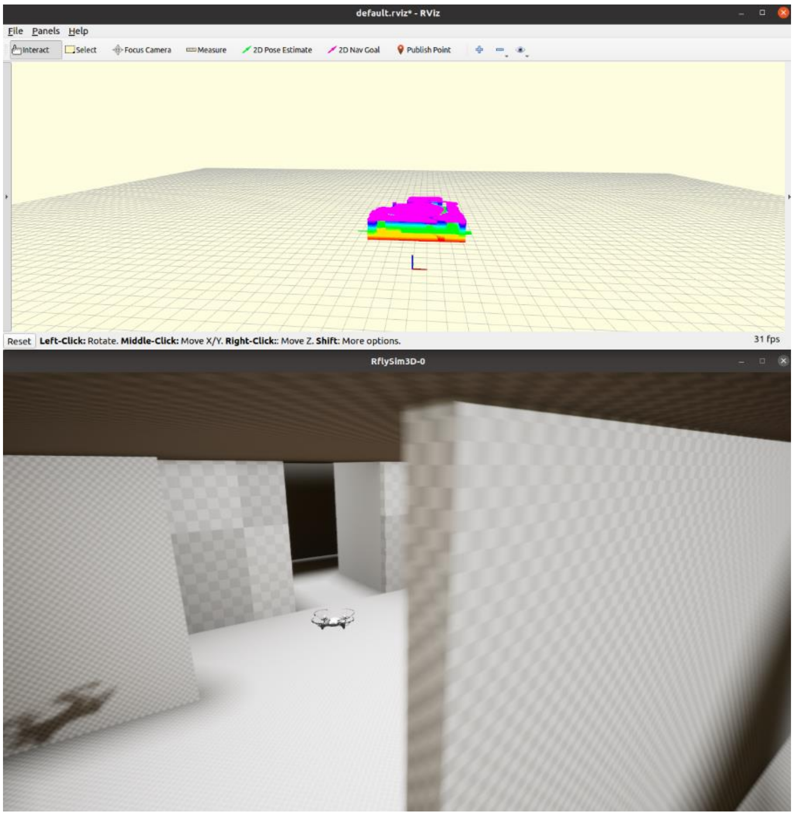
Simultaneous Localization and Mapping (SLAM) based on Rflysim

Simultaneous localization and mapping (Simultaneous Localization and Mapping, SLAM) is a technique used in robotics and computer vision to create a map of an unknown environment while tracking the position of a robot in that environment.



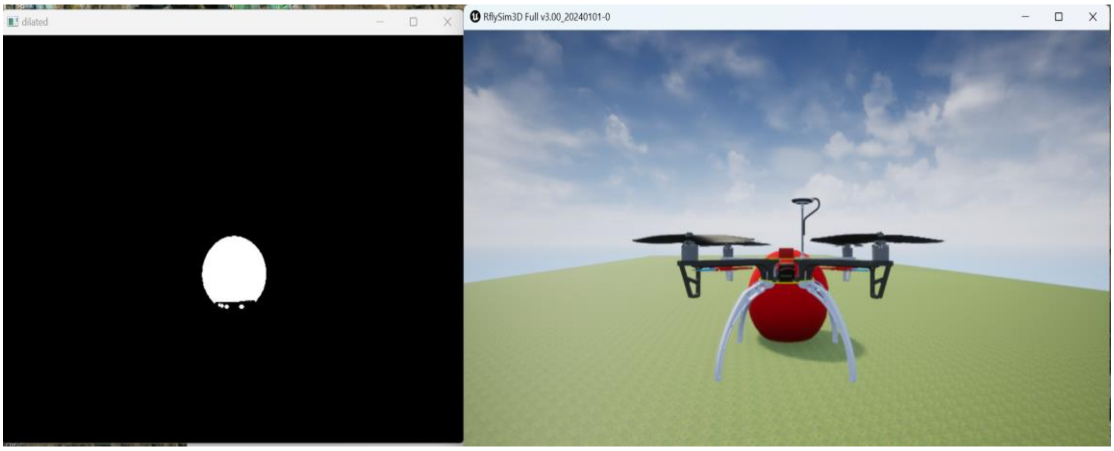
Obstacle avoidance decision-making flight based on RflySim

RflySim based obstacle avoidance decision-making flight involves obstacle detection, decision-making and obstacle avoidance in a simulation environment using an aircraft. The performance of the UAV obstacle avoidance system can be effectively tested and verified without actual flight. It is helpful to find potential problems in advance and improve the algorithm.



Support visual servo control

Image-based visual servoing control means that the UAV compares the image features collected by the camera with the image features of the target position, and constructs the image Jacobian matrix according to the image feature error for feedback control. The UA V can control the position and attitude of the UAV according to the change of the image, and realize the precise positioning and tracking control of the robot to the target object. Through the computer vision technology, the image information is converted into the robot motion control command, so as to realize the control of the robot. The method has the a dvantages of simplicity, quickness, strong real-time performance and the like, and is widel y applied to the fields of robot precise positioning, assembly, photographing and the like.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RflySim3D Full v3.00_20240101-0