

ArduPilot and Gazebo Setup Instructions

1. Clone ArduPilot

Open a terminal and run the following commands to clone the ArduPilot repository:

```
cd ~  
sudo apt install git  
git clone https://github.com/ArduPilot/ardupilot.git  
cd ardupilot
```

2. Install Dependencies

Navigate to the ardupilot directory:

```
cd ardupilot
```

Run the script to install prerequisites:

```
Tools/environment_install/install-prereqs-ubuntu.sh -y
```

Reload the profile:

```
. ~/.profile
```

3. Install Gazebo (Ubuntu 20.04)

3.1 Add OSRF Repository

```
sudo sh -c 'echo "deb http://packages.osrfoundation.org/gazebo/ubuntu-stable `lsb_release -cs`  
main" > /etc/apt/sources.list.d/gazebo-stable.list'
```

3.2 Setup Keys

```
wget http://packages.osrfoundation.org/gazebo.key -O - | sudo apt-key add -
```

3.3 Update Software List

```
sudo apt update
```

3.4 Install Gazebo

```
sudo apt-get install gazebo11 libgazebo11-dev
```

4. Install Gazebo Plugin for APM (ArduPilot Master)

Clone the plugin repository:

```
cd ~  
git clone https://github.com/khancyr/ardupilot_gazebo.git  
cd ardupilot_gazebo
```

Build and install the plugin:

```
mkdir build
cd build
cmake ..
make -j4
sudo make install
```

Set up environment variables:

```
echo 'source /usr/share/gazebo/setup.sh' >> ~/.bashrc
```

Set paths for models:

```
echo 'export GAZEBO_MODEL_PATH=~/.ardupilot_gazebo/models' >> ~/.bashrc
. ~/.bashrc
```

5. Install ROS

Perform a Desktop-Full Installation of ROS Noetic by following the instructions up to Step 1.7 here:
[ROS Noetic Installation Guide](#)

6. Build and Set Up the Workspace

Unzip the catkin_ws folder.

Build the workspace:

```
cd catkin_ws/src/
catkin build
```

7. Launch Gazebo World

Run the following command to launch the Gazebo simulation:

```
roslaunch iq_sim runway.launch
```

8. Run SITL Simulation

Open a new terminal tab and run:

```
cd
./startsitl.sh
```

Wait for the following messages to appear in the console:

```
AP: EKF2 IMU0 is using GPS
AP: EKF2 IMU1 is using GPS
```

9. Launch APM

Open another terminal tab and run:

```
cd catkin_ws/src/iq_gnc/launch/  
roslaunch apm.launch
```

10. Object Detection Using 2D LiDAR

Open another terminal tab and run the following script for object detection:

```
cd catkin_ws/src/3D/Code/  
python3 ./Detection_Pipeline.py
```

Note: The /braking topic outputs:

True: No object within 1m range.

False: Object detected within 1m range.

11. Moving the Drone

Open another terminal tab and run:

```
cd catkin_ws/src/  
roslaunch iq_gnc square
```

When prompted, set the drone to GUIDED mode:

Go back to the terminal where ./startsitl.sh is running.

Press ENTER and type:

```
mode GUIDED
```

This setup allows you to run the simulation, perform object detection, and move the drone based on waypoints in GUIDED mode. Let me know if further clarification is needed!