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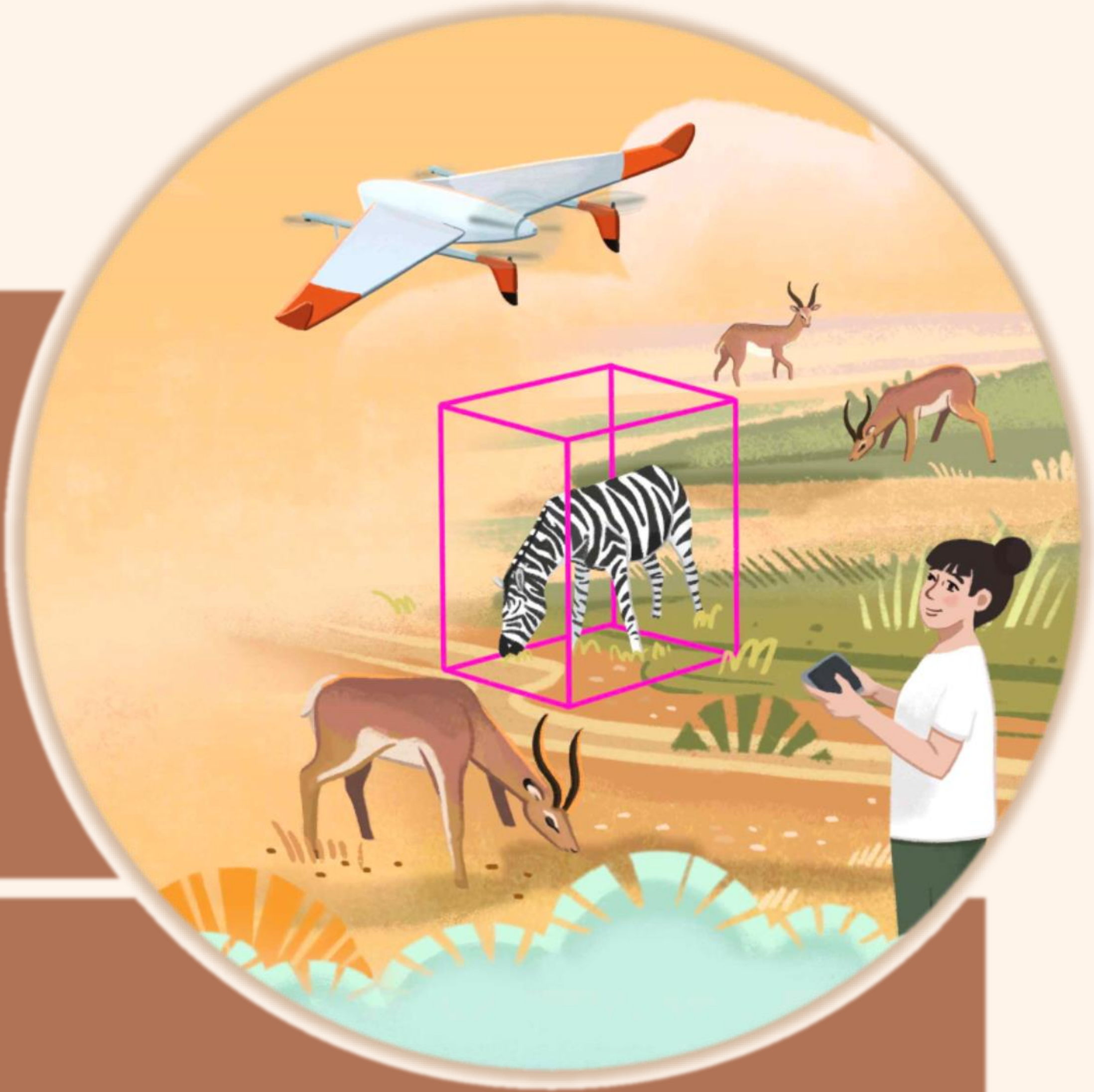
Mavlink

Kenyatta University, 17.01.2025

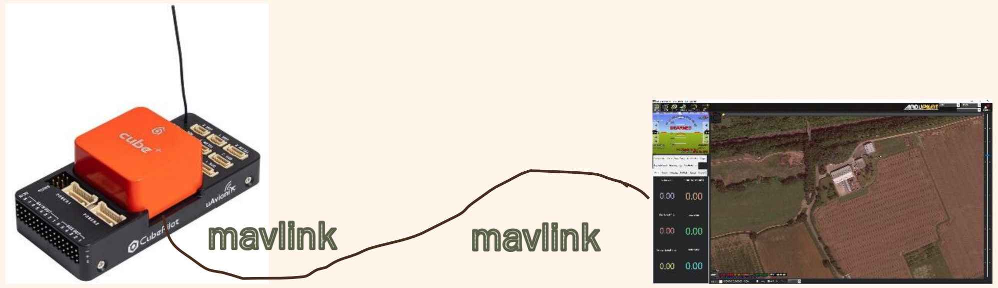
Communicating with your UAV

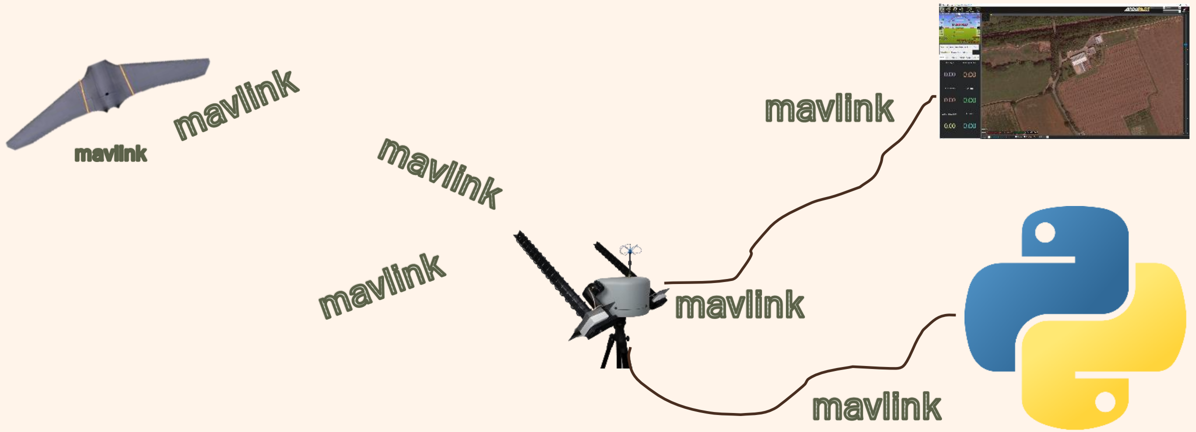


MAVLink

MAVLINK
MICRO AIR VEHICLE COMMUNICATION PROTOCOL

- Open-source messaging protocol for drones
- Use for telemetry and command
- Communication with ground control stations such as Mission Planner
- Wired or wireless connections
- Talk mavlink in Python using Pymavlink
- Pymavlink
  - Request and set parameters
  - Receive state information
  - Send servo control commands
  - Arm/disarm, change flight mode
  - Set waypoints
  - **Everything you can do with MP**

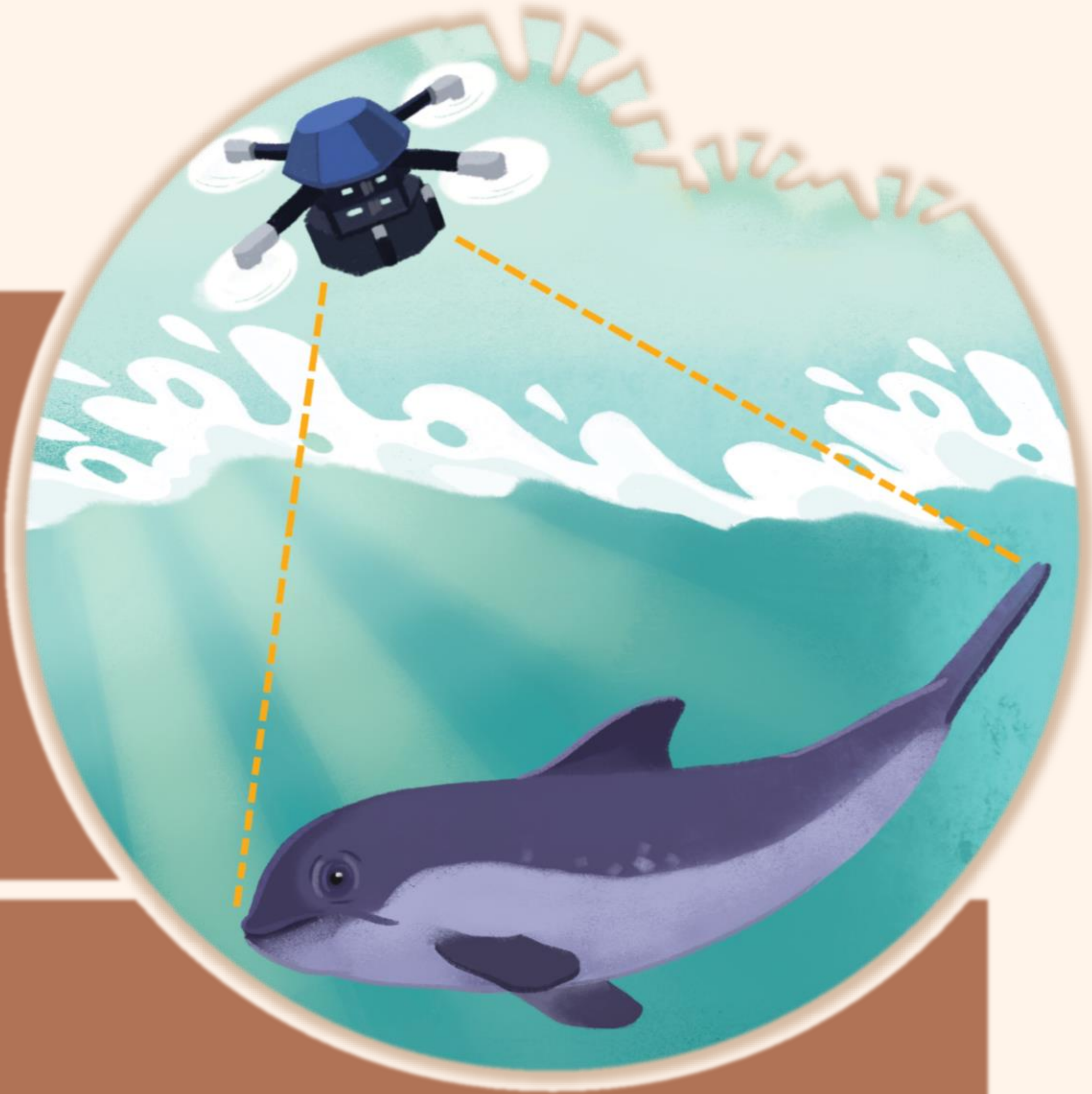




Mavlink Ressources

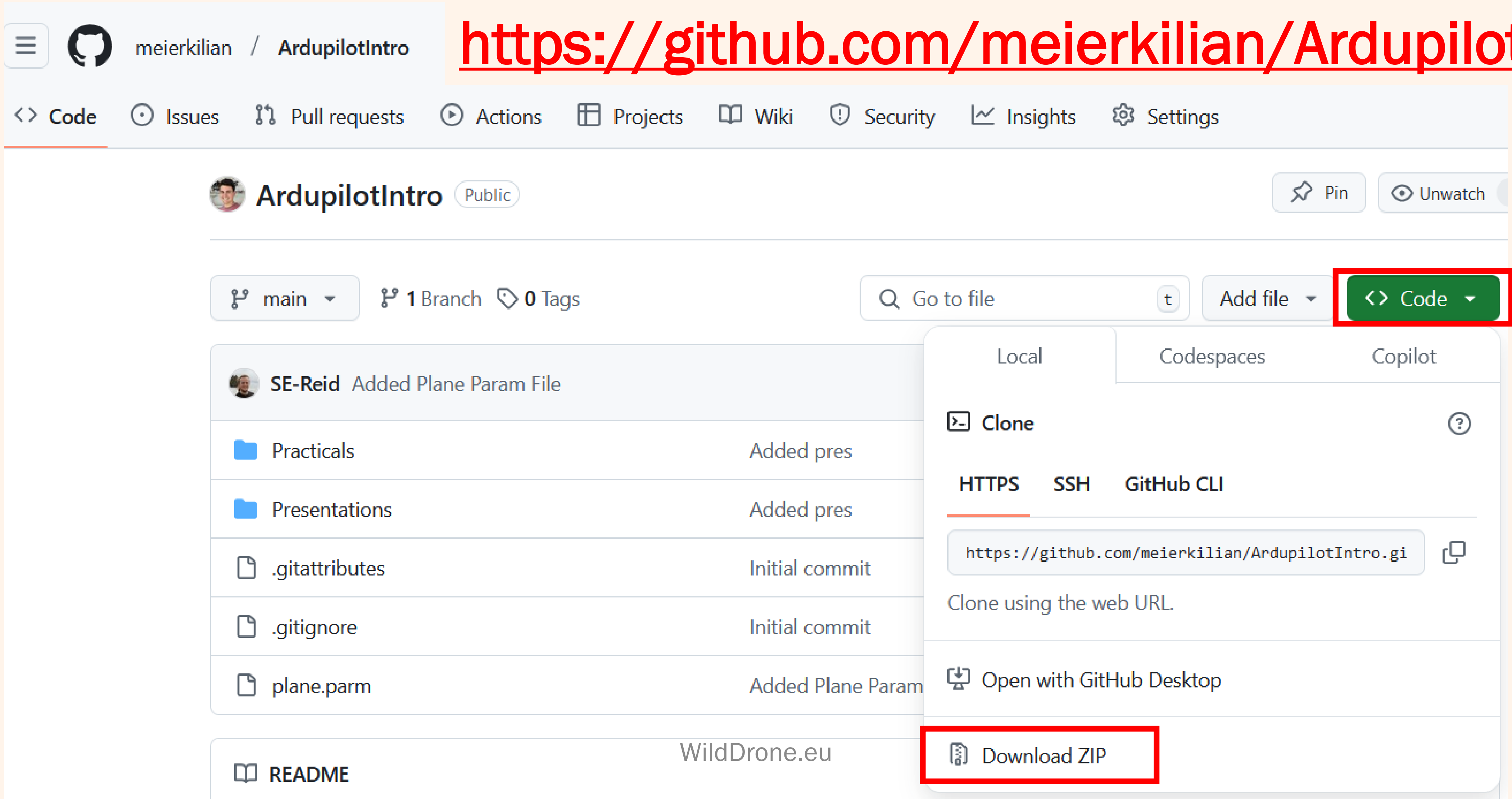
- PyMavlink examples and documentation
  - ArduSub book! ardusub.com/developers/pymavlink.html
- Mavlink Documentation
  - https://mavlink.io/en/messages/common.html
- Today’s presentation and scripts
  - https://github.com/meierkilian/ArdupilotIntro

Practicals



Download today’s scripts

https://github.com/meierkilian/ArdupilotIntro

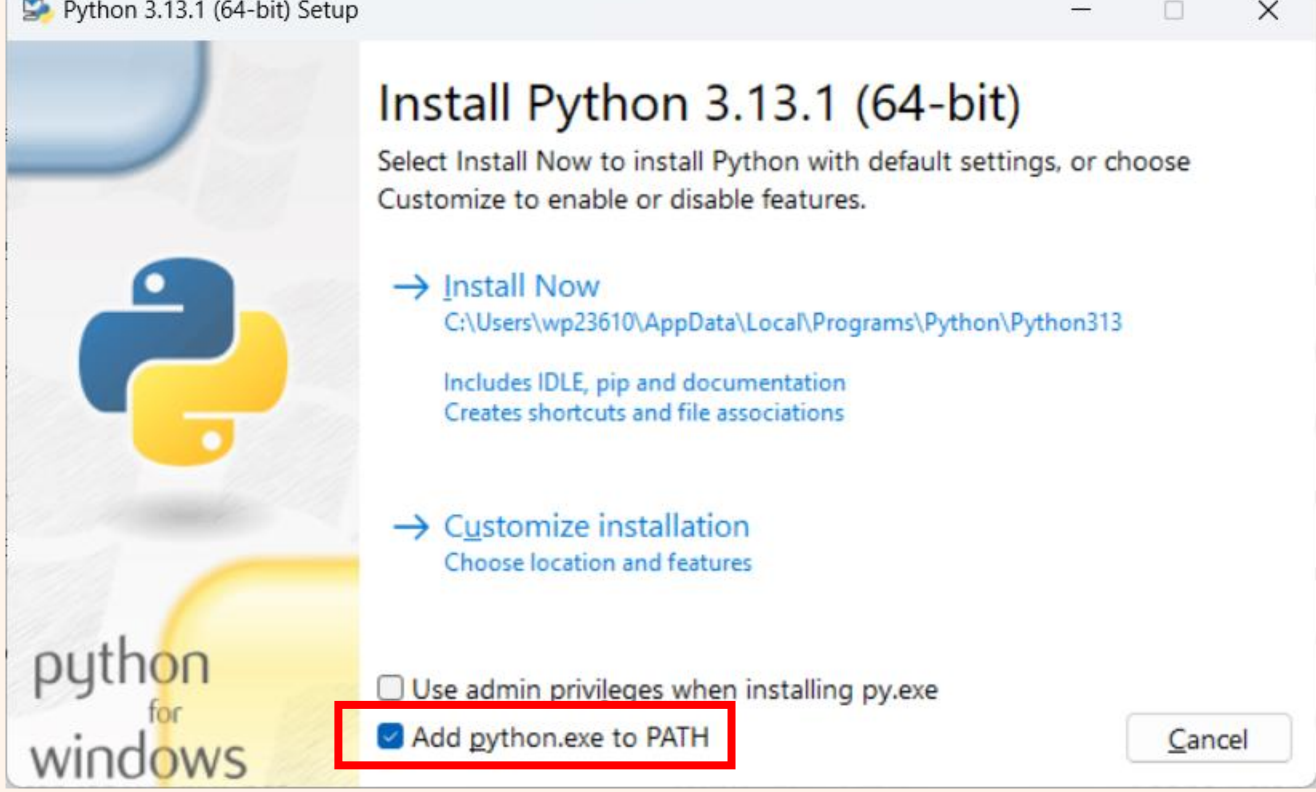


SE-Reid Added Plane Param File

Practicals	Added pres
Presentations	Added pres
.gitattributes	Initial commit
.gitignore	Initial commit
plane.parm	Added Plane Param

Installing python

- Installing python
  - Download Python from: www.python.org/downloads/
  - Add python.exe to PATH
  - Run and click “Install now”
- Installing Pymavlink
  - Open terminal (WIN+R, then type “cmd” and press Enter)
  - Run “pip install pymavlink”
  - Run “pip install requests”
- Hello world script
  - Create a script “helloworld.py”
  - Run “python helloworld.py”


Python 3.13.1 (64-bit) Setup

Install Python 3.13.1 (64-bit)

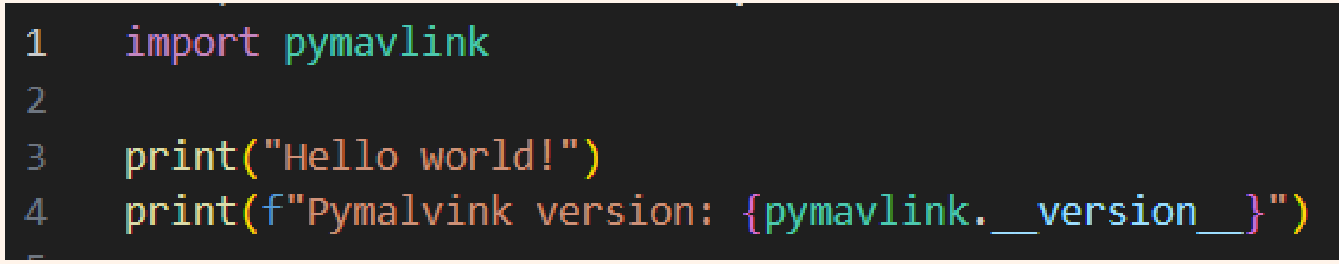
Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

→ Install Now
C:\Users\wp23610\AppData\Local\Programs\Python\Python313

Includes IDLE, pip and documentation
Creates shortcuts and file associations

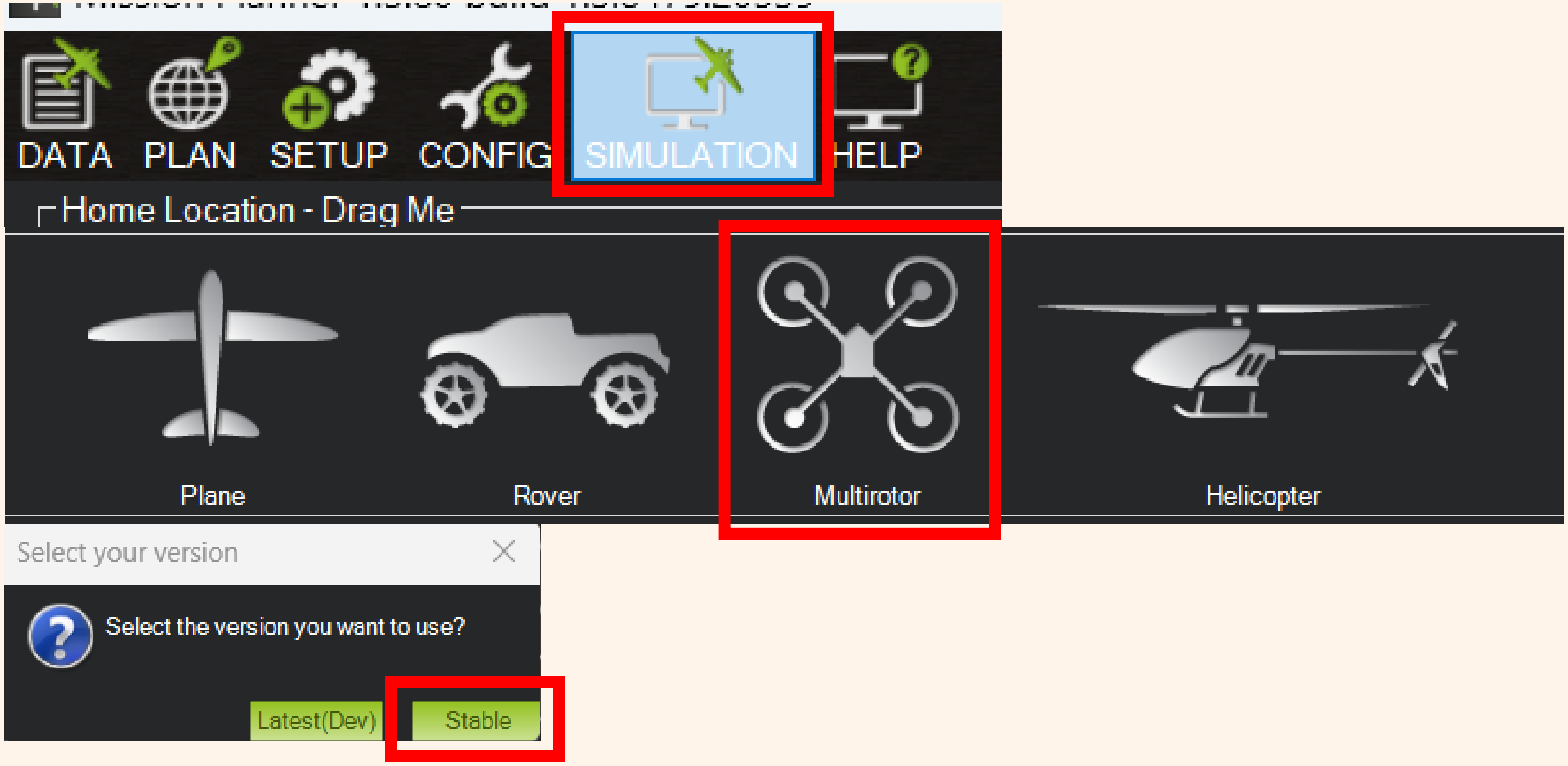
→ Customize installation
Choose location and features

☐ Use admin privileges when installing py.exe
☑ Add python.exe to PATH


```python
import pymavlink

print("Hello world!")
print(f"Pymalvink version: {pymavlink.__version__}")
```

Start SITL

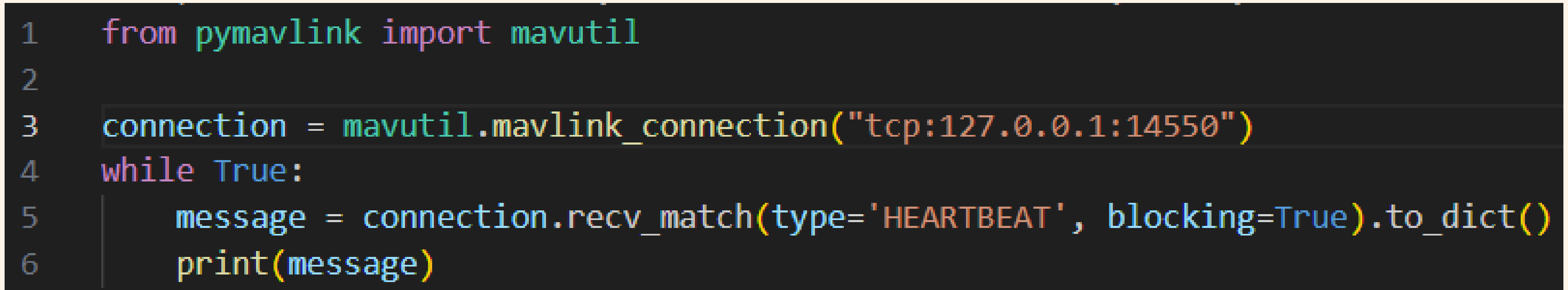


Select your version

Select the version you want to use?

Task 1: connection and heartbeat

- Start SITL
  - Create a quad copter
  - Ctrl + F, Mavlink, TCP Host, Write access, Connect
- Connection
  - Depends on the scenario
  - connection = mavutil.mavlink_connection(‘tcp:127.0.0.1:14550’)
- Heartbeat
  - message = connection.recv_match(type='HEARTBEAT', blocking=True).to_dict()
  - Waits for a message of type HEARTBEAT

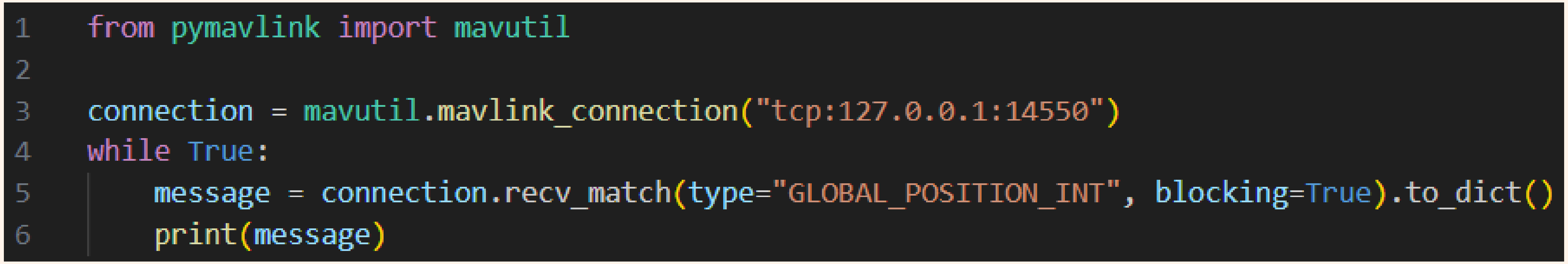


```
from pymavlink import mavutil

connection = mavutil.mavlink_connection("tcp:127.0.0.1:14550")
while True:
    message = connection.recv_match(type='HEARTBEAT', blocking=True).to_dict()
    print(message)
```

Task 2: get telemetry (or any message)

- Have a look at common mavlink message and find a message that will give you the global position of the drone.
  - https://mavlink.io/en/messages/common.html



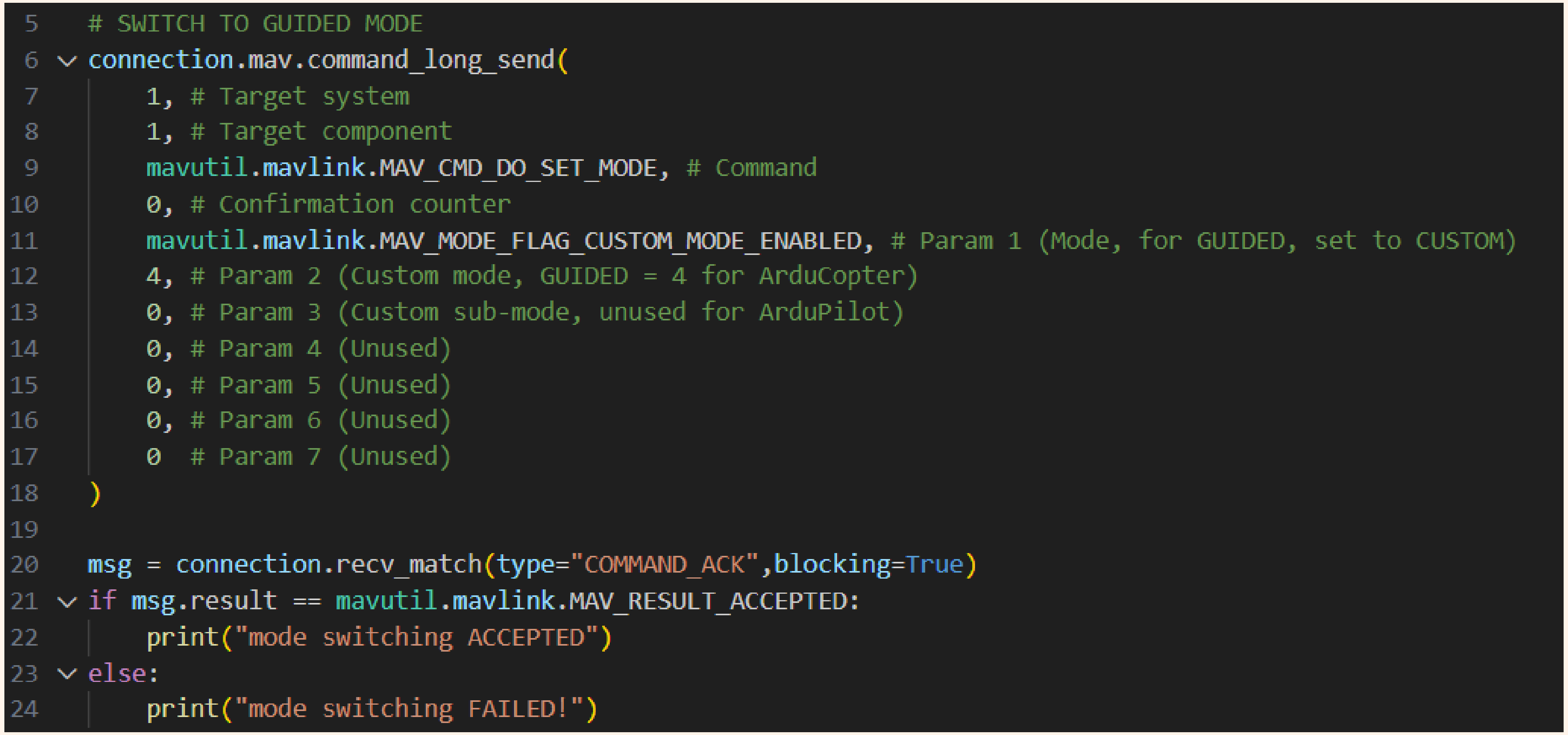
```
from pymavlink import mavutil

connection = mavutil.mavlink_connection("tcp:127.0.0.1:14550")
while True:
    message = connection.recv_match(type="GLOBAL_POSITION_INT", blocking=True).to_dict()
    print(message)
```

Task 3: taking-off

- Taking-off includes three steps
  - Change the aircraft to the GUIDED mode
  - ARM the aircraft
  - Take-off
- So three commands have to be sent!

Task 3: taking-off: mode change

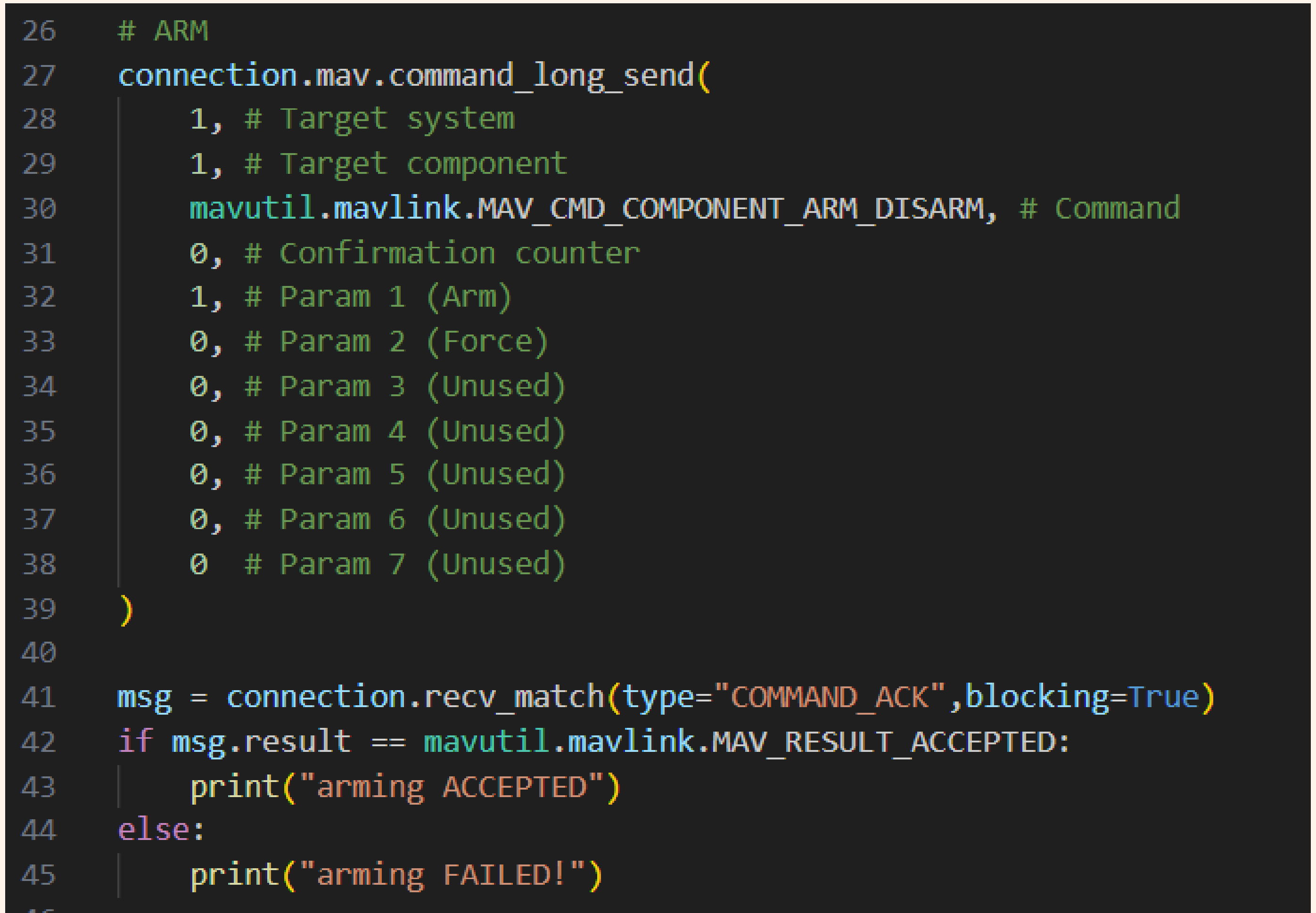


```python
# SWITCH TO GUIDED MODE
connection.mav.command_long_send(
    1, # Target system
    1, # Target component
    mavutil.mavlink.MAV_CMD_DO_SET_MODE, # Command
    0, # Confirmation counter
    mavutil.mavlink.MAV_MODE_FLAG_CUSTOM_MODE_ENABLED, # Param 1 (Mode, for GUIDED, set to CUSTOM)
    4, # Param 2 (Custom mode, GUIDED = 4 for ArduCopter)
    0, # Param 3 (Custom sub-mode, unused for ArduPilot)
    0, # Param 4 (Unused)
    0, # Param 5 (Unused)
    0, # Param 6 (Unused)
    0  # Param 7 (Unused)
)

msg = connection.recv_match(type="COMMAND_ACK",blocking=True)
if msg.result == mavutil.mavlink.MAV_RESULT_ACCEPTED:
    print("mode switching ACCEPTED")
else:
    print("mode switching FAILED!")
```

Task 3: taking-off: arming

- Command name: MAV_CMD_COMPONENT_ARM_DISARM

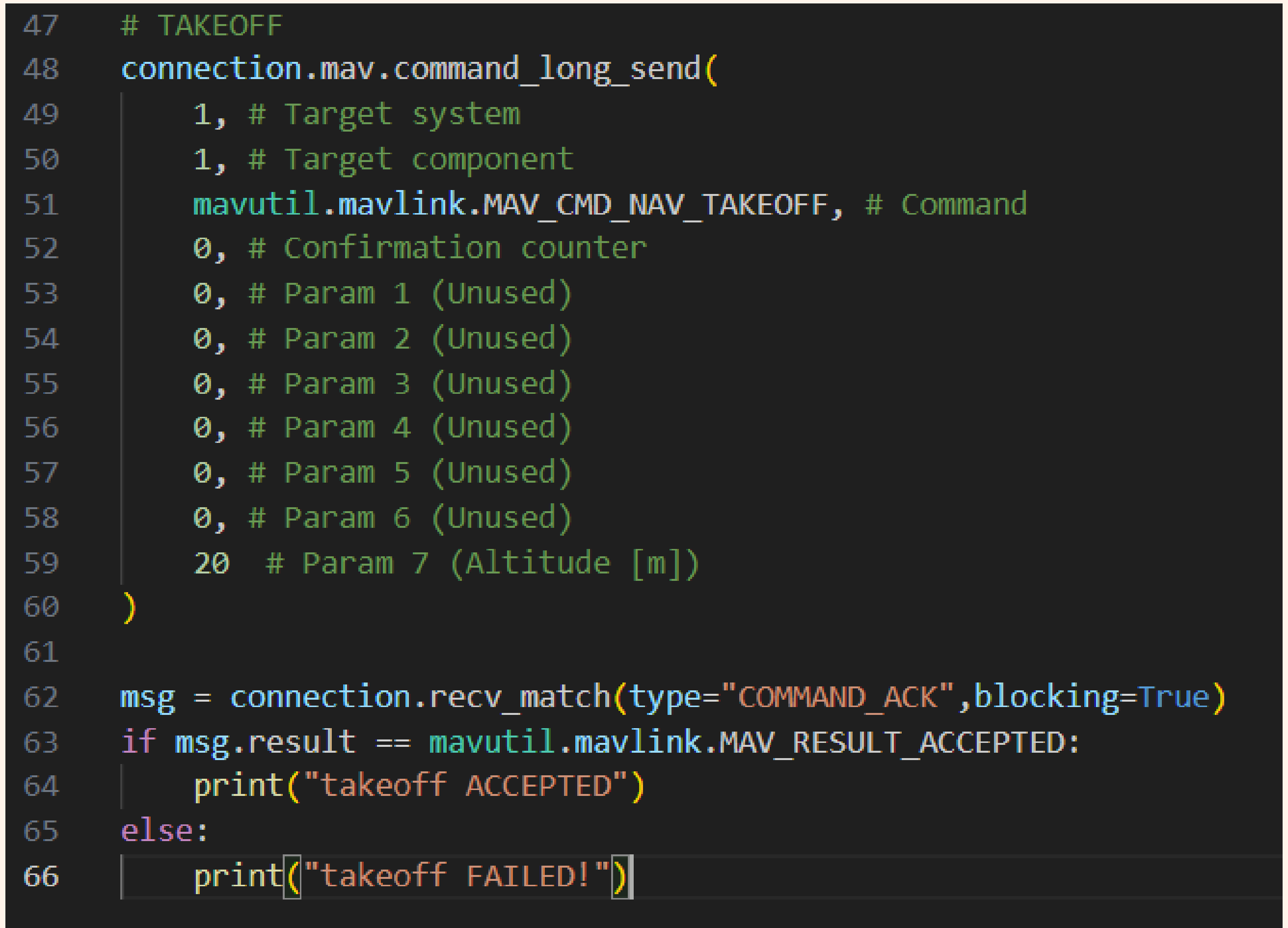


```python
# ARM
connection.mav.command_long_send(
    1, # Target system
    1, # Target component
    mavutil.mavlink.MAV_CMD_COMPONENT_ARM_DISARM, # Command
    0, # Confirmation counter
    1, # Param 1 (Arm)
    0, # Param 2 (Force)
    0, # Param 3 (Unused)
    0, # Param 4 (Unused)
    0, # Param 5 (Unused)
    0, # Param 6 (Unused)
    0  # Param 7 (Unused)
)

msg = connection.recv_match(type="COMMAND_ACK",blocking=True)
if msg.result == mavutil.mavlink.MAV_RESULT_ACCEPTED:
    print("arming ACCEPTED")
else:
    print("arming FAILED!")
```

Task 3: taking-off: take-off

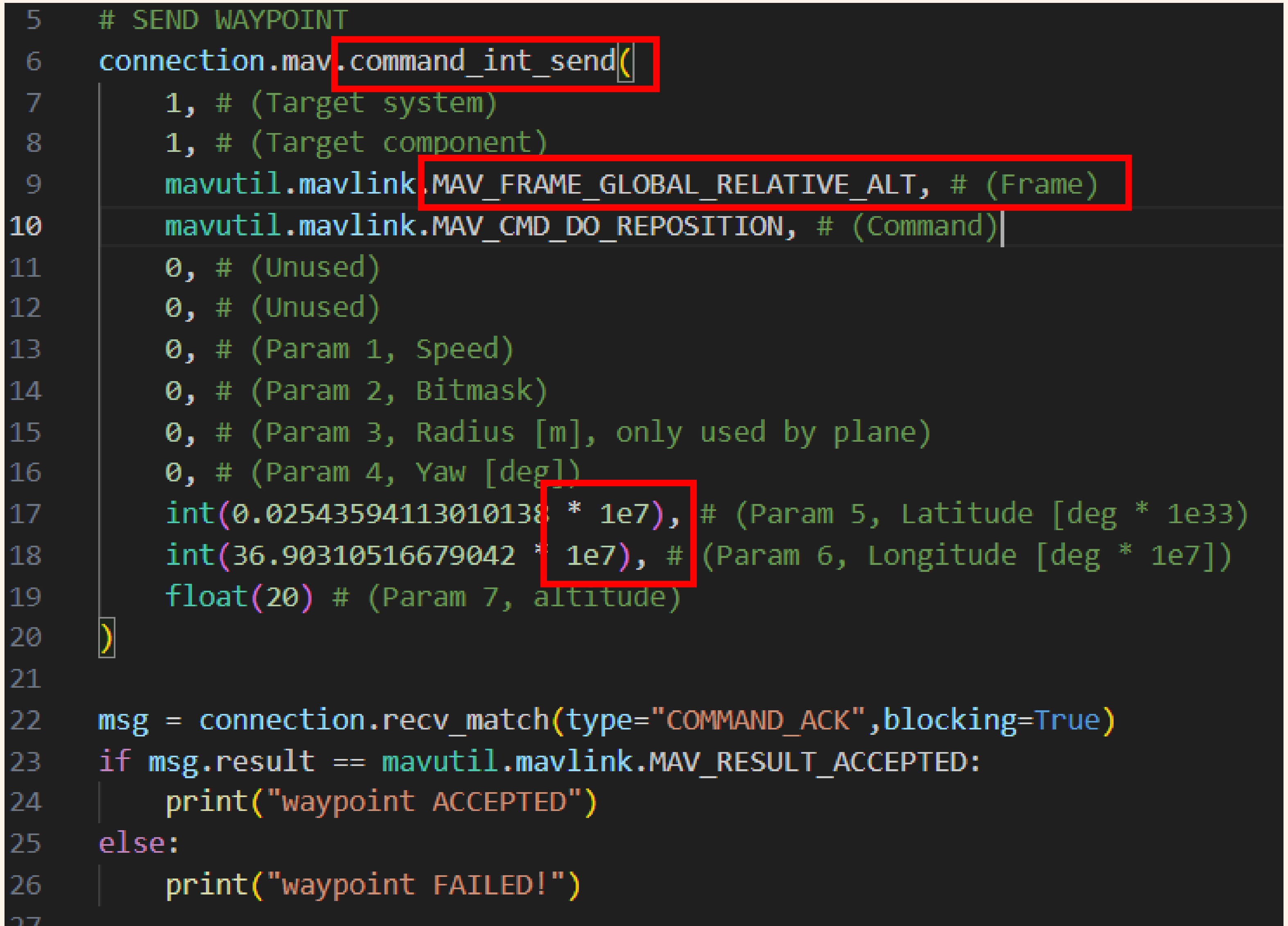
- Command name: MAV_CMD_NAV_TAKEOFF



```python
# TAKEOFF
connection.mav.command_long_send(
    1, # Target system
    1, # Target component
    mavutil.mavlink.MAV_CMD_NAV_TAKEOFF, # Command
    0, # Confirmation counter
    0, # Param 1 (Unused)
    0, # Param 2 (Unused)
    0, # Param 3 (Unused)
    0, # Param 4 (Unused)
    0, # Param 5 (Unused)
    0, # Param 6 (Unused)
    20  # Param 7 (Altitude [m])
)

msg = connection.recv_match(type="COMMAND_ACK",blocking=True)
if msg.result == mavutil.mavlink.MAV_RESULT_ACCEPTED:
    print("takeoff ACCEPTED")
else:
    print("takeoff FAILED!")
```

Task 4: send a waypoint command



```
# SEND WAYPOINT
connection.mav.command_int_send(
    1, # (Target system)
    1, # (Target component)
    mavutil.mavlink.MAV_FRAME_GLOBAL_RELATIVE_ALT, # (Frame)
    mavutil.mavlink.MAV_CMD_DO_REPOSITION, # (Command)
    0, # (Unused)
    0, # (Unused)
    0, # (Param 1, Speed)
    0, # (Param 2, Bitmask)
    0, # (Param 3, Radius [m], only used by plane)
    0, # (Param 4, Yaw [deg])
    int(0.02543594113010138 * 1e7), # (Param 5, Latitude [deg * 1e33)
    int(36.90310516679042 * 1e7), # (Param 6, Longitude [deg * 1e7])
    float(20) # (Param 7, altitude)
)

msg = connection.recv_match(type="COMMAND_ACK",blocking=True)
if msg.result == mavutil.mavlink.MAV_RESULT_ACCEPTED:
    print("waypoint ACCEPTED")
else:
    print("waypoint FAILED!")
```

Task 5: send a WP to remote SITL

- Connect to local network
  - SSID: ANVLAN729
  - Password: ministrylevel369
- Change connection to your groupe IP
- Change the “target system” to your group ID

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