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Rhino search challenge

Kenyatta University, 21.01.2025

Background

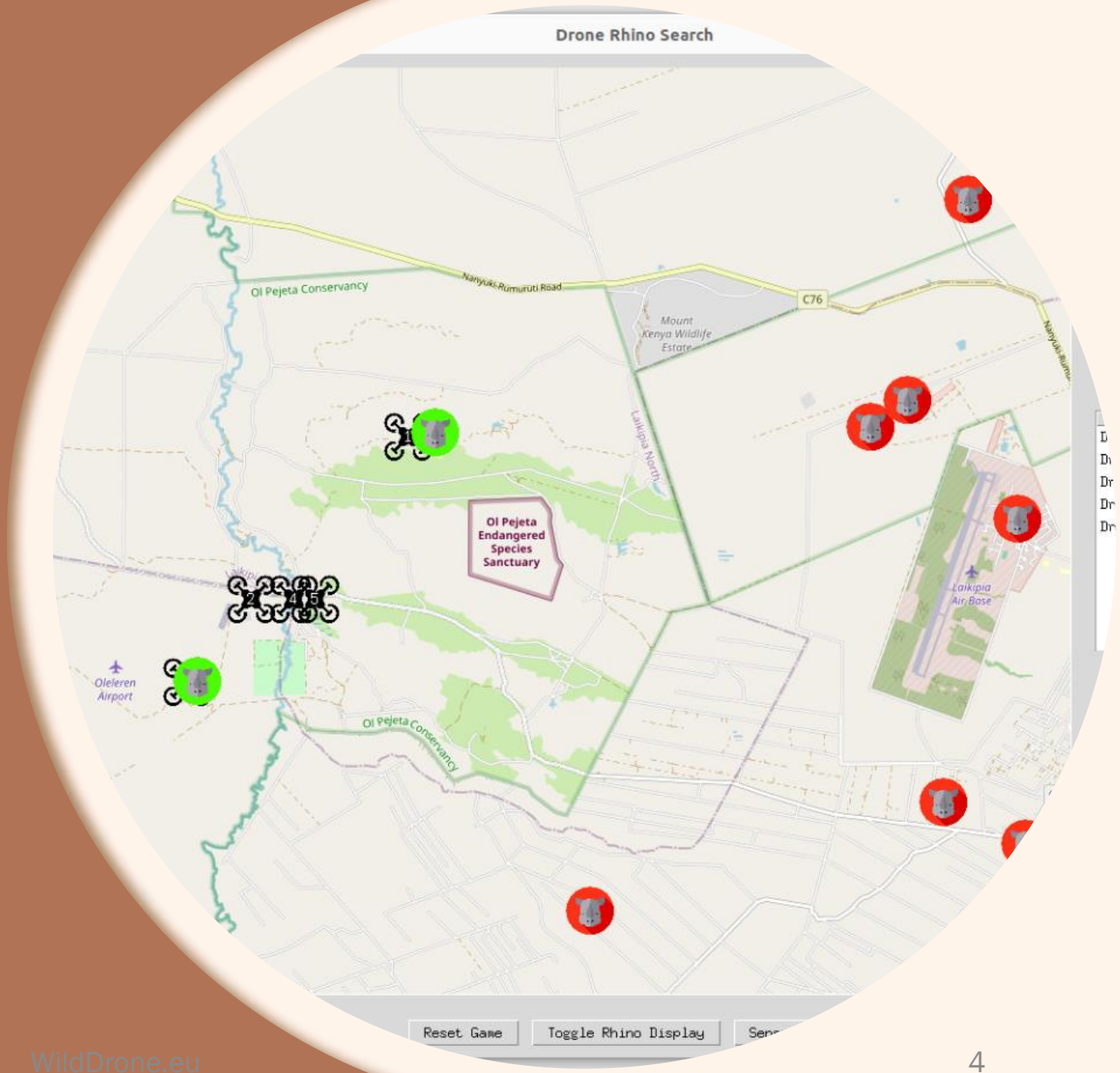
- Ol Pejeta is home to the last two remaining northern white rhinos, and a sanctuary for over 165 critically endangered black rhinos.
- The black rhinos need to be seen every 3 days.
- If that’s not the case, search parties are sent out in the parc until they find the missing rhino.
- Drones might be able to help this effort!

Rhino search challenge

- Each team gets to control a drone in Ol Pejeta
- The drone is equipped with a rhino range sensor and a downward-facing camera
  - The range sensor has a detection range of 200m.
  - The camera has a field of view of 50m on the ground.
- Your goal is to find a strategy to find and take a picture of all the rhinos in the park.

Practicals

- Remote simulated drones
- Try different search strategies
- Software with holes to fill



Download today's scripts

https://github.com/meierkilian/ArdupilotIntro

meierkilian / ArdupilotIntro

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SE-Reid Added Plane Param File

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

README

Local | Codespaces | Copilot

Clone

HTTPS | SSH | GitHub CLI

https://github.com/meierkilian/ArdupilotIntro.gi

Clone using the web URL.

Open with GitHub Desktop

Download ZIP

Extract it!

Installing python packages

- Packages
  - Open terminal (WIN+R, then type “cmd” and press Enter)
  - pip install numpy
  - pip install dronekit
  - pip install pymap3d
- Run helloworld.py
  - Change directory to the folder “Practicals/RhinoChallenge”
  - python helloworld.py
- Open “rhinoChallengeTasks.py” in your favourit text/code editor

TASK 1: is a waypoint reached?

- How can we check if a waypoint is reached?

TASK 2: wait until a waypoint reached?

- How can we send a drone to a waypoint and then wait until it reached it?

TASK 3: Connect to the drone

- Connect to local network
  - SSID: ANVLAN729
  - Password: ministrylevel369
- Fill in the system ID of your group
  - See the screen for your group IP address and port

TASK 4: run the manual search

- Can you find any rhino?
- Is it a convenient way of searching?

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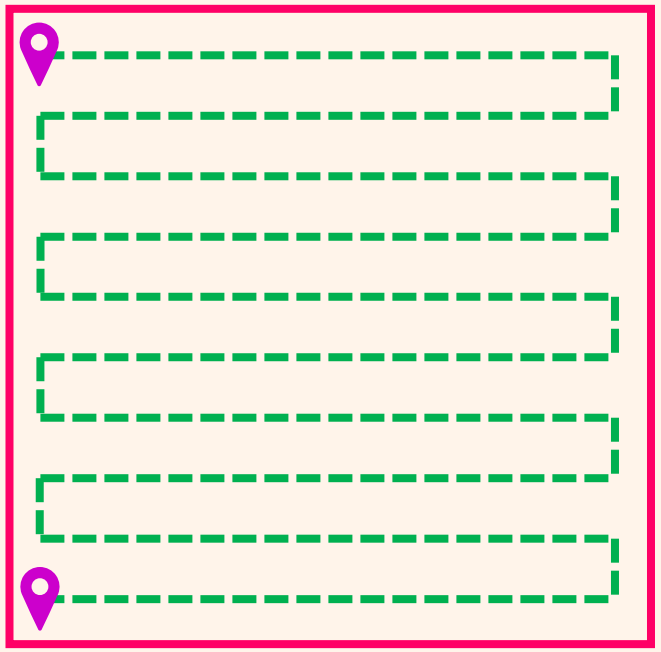
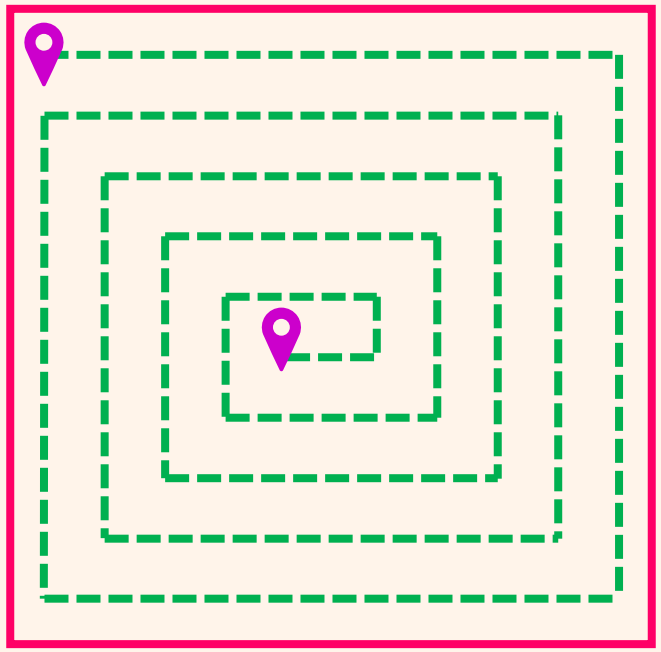
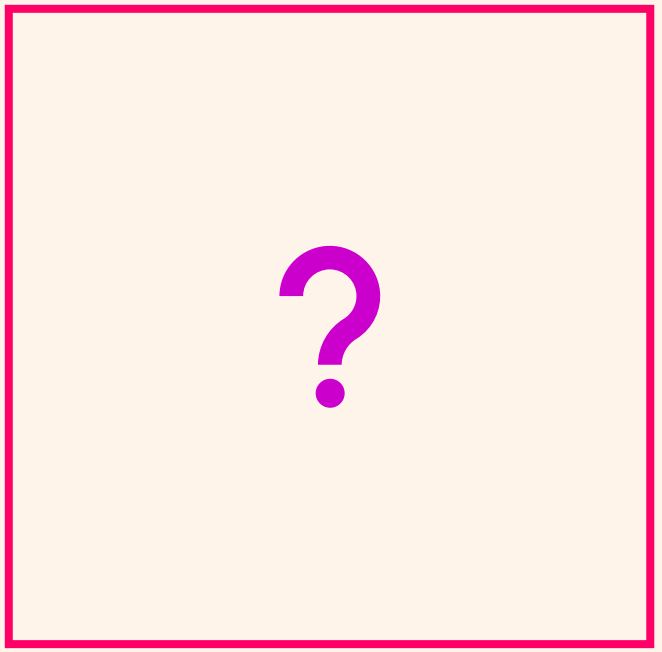
TASK 5: Search Patterns



Lawnmower

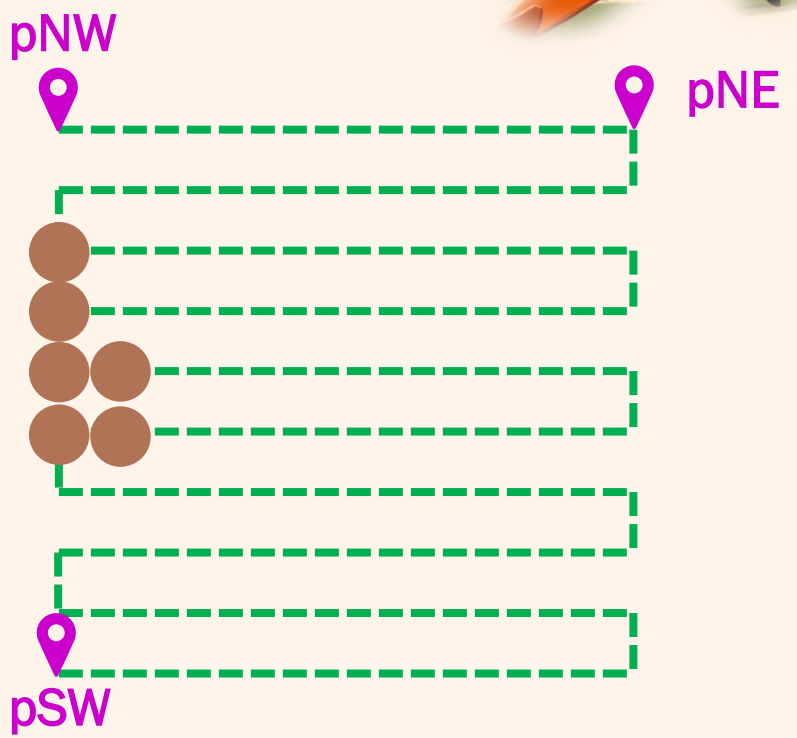


Spiral



TASK 5: lawnmower pattern

- Explain what those 4 lines do.
  - What are pNW, pNE and PSW?
  - Why divided by sensorRange?
  - What about 2**0.5?
  - Why +1?
  - What does the linspace() function do?



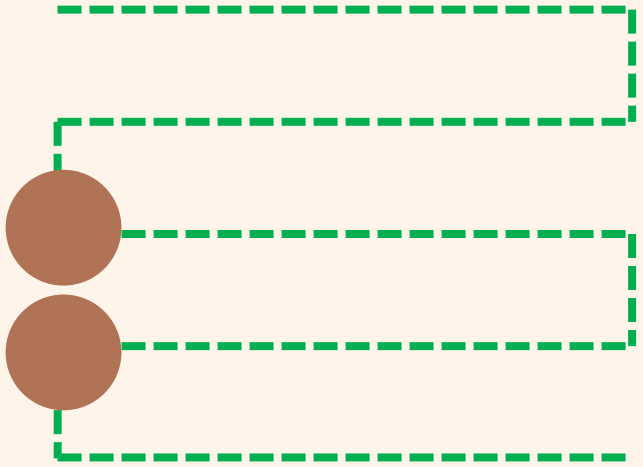

```
# @@@ TASK 5 @@@: Explain what the next 4 lines do.
latStepNbr = int(pNW.distTo(pNE) // (PARAM.foundThreshold / 2**0.5) + 1)
lonStepNbr = int(pNW.distTo(pSW) // (PARAM.foundThreshold / 2**0.5) + 1)
lat_points = np.linspace(PARAM.limit_south, PARAM.limit_north, latStepNbr).tolist()
lon_points = np.linspace(PARAM.limit_west, PARAM.limit_east, lonStepNbr).tolist()
```

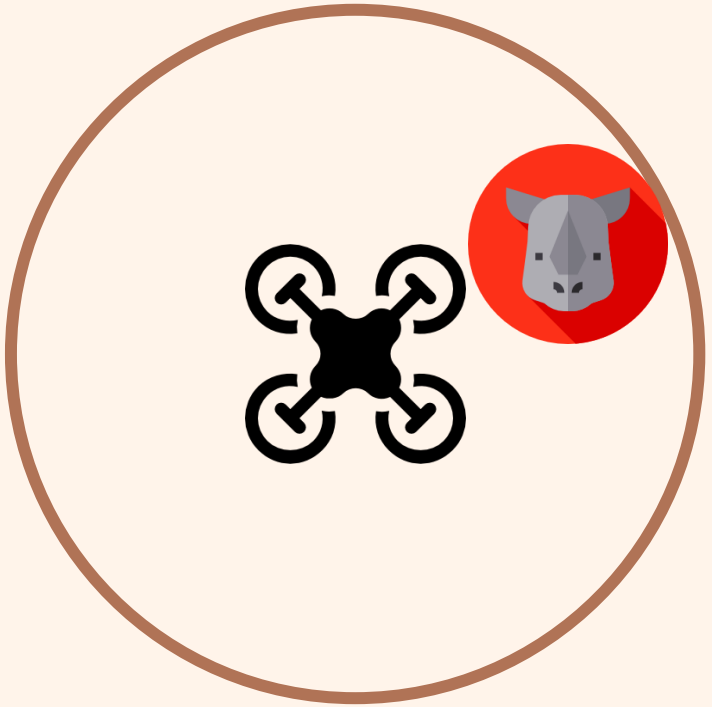
TASK 6: run the lawnmower search

- Can you find any rhino?
- Is it more efficient than manual search?
- What is the drawback of this search?

TASK 7: triangulation

- How should we use the range finder?





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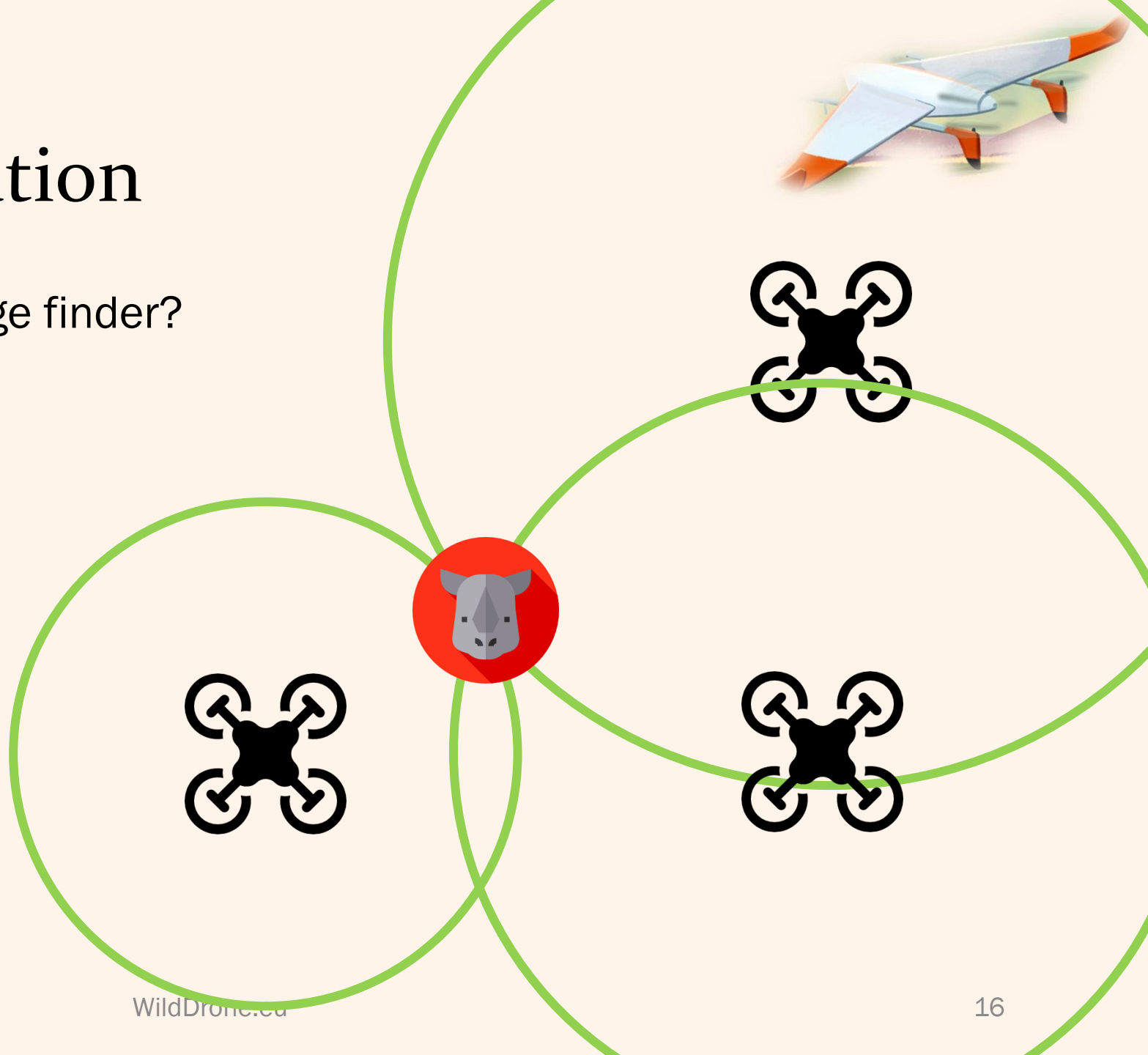

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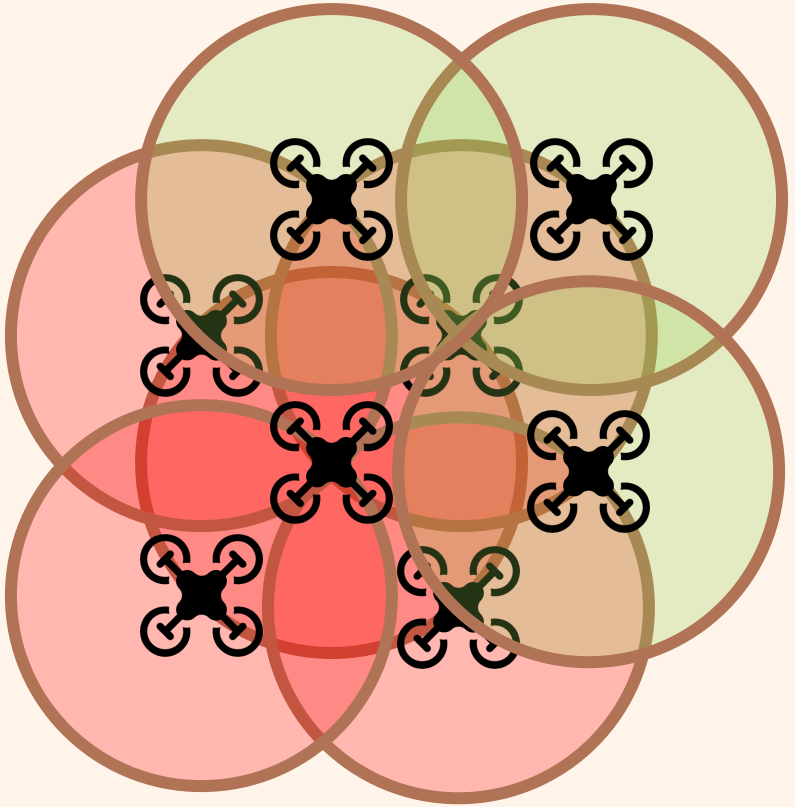

TASK 8: run the triangulation search

- Can you find any rhino?
- Is it more efficient than the lawnmower search?
- Do you think a rhino ranger finder is something we can build?

Conclusion

Give an overview of how to design and conduct a safe semi-autonomous drone (quadcopter) operation in the context of wildlife conservation.

- Autopilot software and simulation (Ardupilot)
- Ground Control Station software (Mission planner)
- Communication protocol (Mavlink)
- Safe operation (SORA)
- Practical work

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