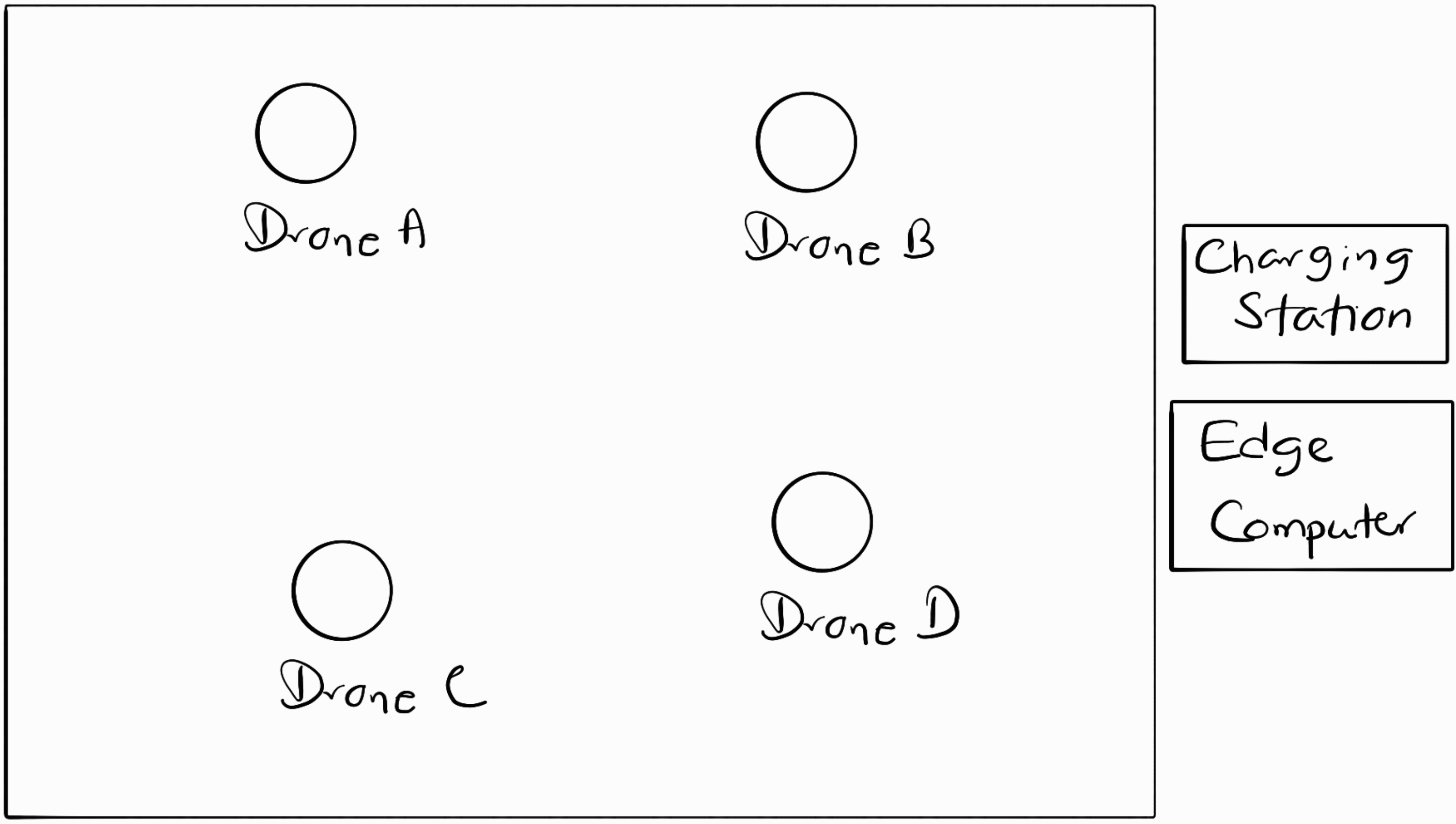
Date: 17.09.2025

Scenario: Drone is taking pictures of the crops. There are 4 Currently there are 4 drones in the field, covering the whole field.



Drone distribution methodology:

1) Amounts of drones needed will desided by the size of the field.
Example: A field of 100^2 can be covered with 1 drone, A field of 200^2 can be covered with 2 drones.

2) Allowed maximum and minimum distance between drones. To ensure reiable conection within drones.
Example: Minimum Distance: ~~50m
Maximum distance:~~ 150m

3) Replacing drones: If the battery level of the drone is >25% (or battery score*), then the drone should return to the nearest charging station.

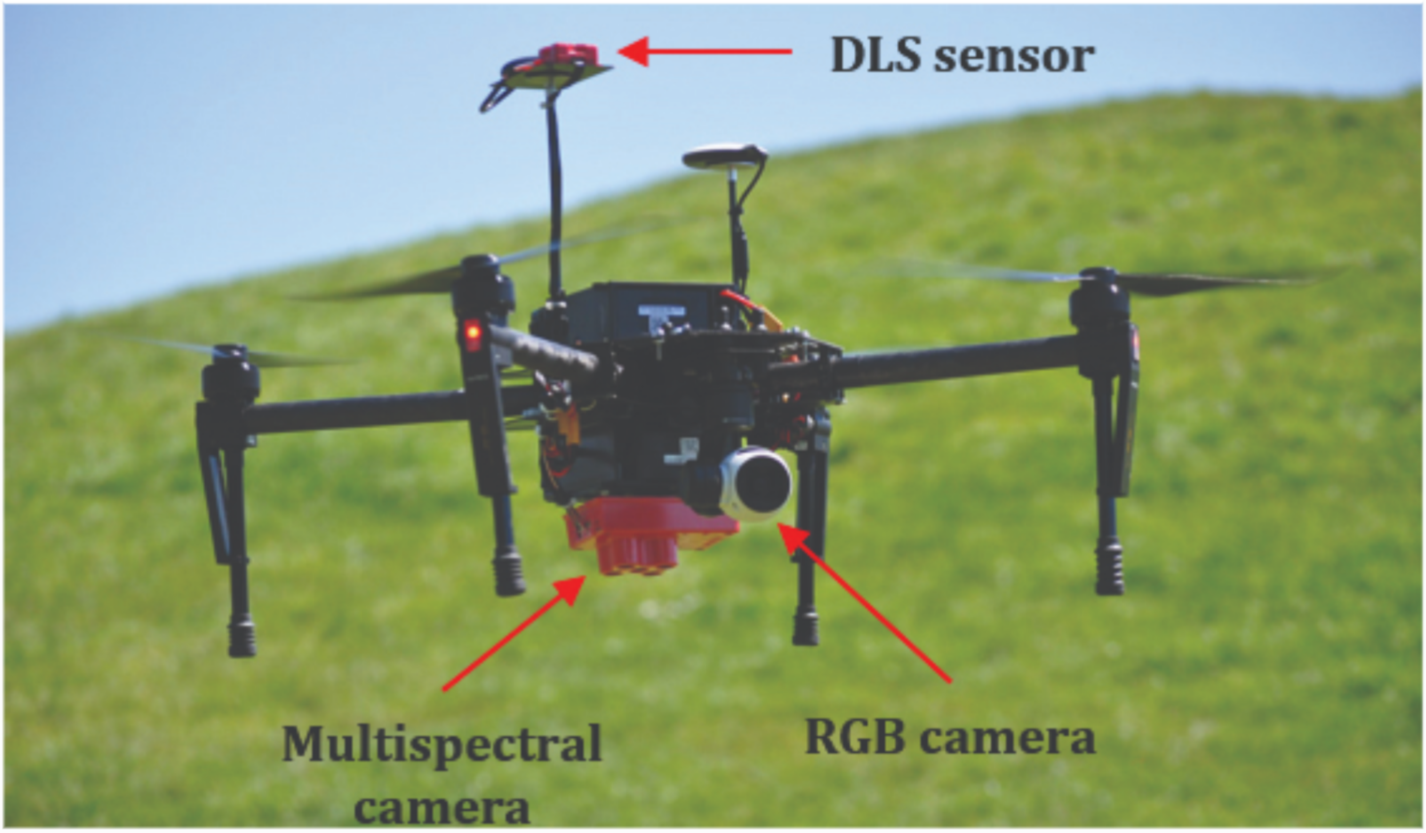
Amount of drones: active drones: x
charging drones: y

SEQUENCE DIAGRAGRAM COMES HERE.....

Drone A is executing field operations when its battery level drops to 25%. This status is transmitted to the edge computer, which evaluates the fleet and selects the most suitable replacement. The selection criterion is the drone with the highest remaining charge above 85%, which in this case is Drone E. Once identified, Drone E is tasked to continue the mission in place of Drone A.

The system considers operational parameters: the average speed of Drone A (), the average speed of Drone E (), and the distance between Drone E and the charging station (). The edge computer schedules Drone E's departure so that it reaches Drone A's last operational point at , coinciding with Drone A's withdrawal. The travel time is calculated as . During this interval, workload data is transferred from Drone A to Drone E. At , Drone E arrives with the tasks synchronized and is fully ready to continue operations, while Drone A proceeds to the charging station.

Possible Sensors in the Drone



1) RGB camera : spotting visible issues like discoloration or pest damage

2)Near-Infared & Multispectral Cameras : Healthy vegetation reflects strongly in near-infrared, whereas stressed plants reflect less

3)Therman infared camera: measuring surface temperature. thermal camera can pinpoint water stress and irrigation issues that might not be obvious in RGB(extensionpubs.unl.edu). Thermal imaging can also reveal temperature differences from soil moisture (cooler moist areas vs. warmer dry soil) and even detect warm-blooded animals hidden in crops at night.

4)LiDAR(optional): LiDAR units add significant weight and drain power https://extensionpubs.unl.edu/publication/g2296/na/htmlview#:~:text=A%20RGB%20camera%20,and%20useful%20for%20field%20scouting

Potential tasks that drones could process

1. Plant health anomaly detection (nutrient deficiencies & diseases)
2. Pest infestation detection
3. Crop water stress & drought zone identification:
4. Soil condition assessment
5. Weed detection and mapping
6. Crop growth and population monitoring
7. Yield estimation and crop yield prediction
8. Wildlife and livestock monitoring (animal/bird tracking)

https://www.mdpi.com/2072-4292/13/20/4141#:~:text=This%20study%20proposes%20monitoring%20methods,ambient%20temperature%20and%20the%20body

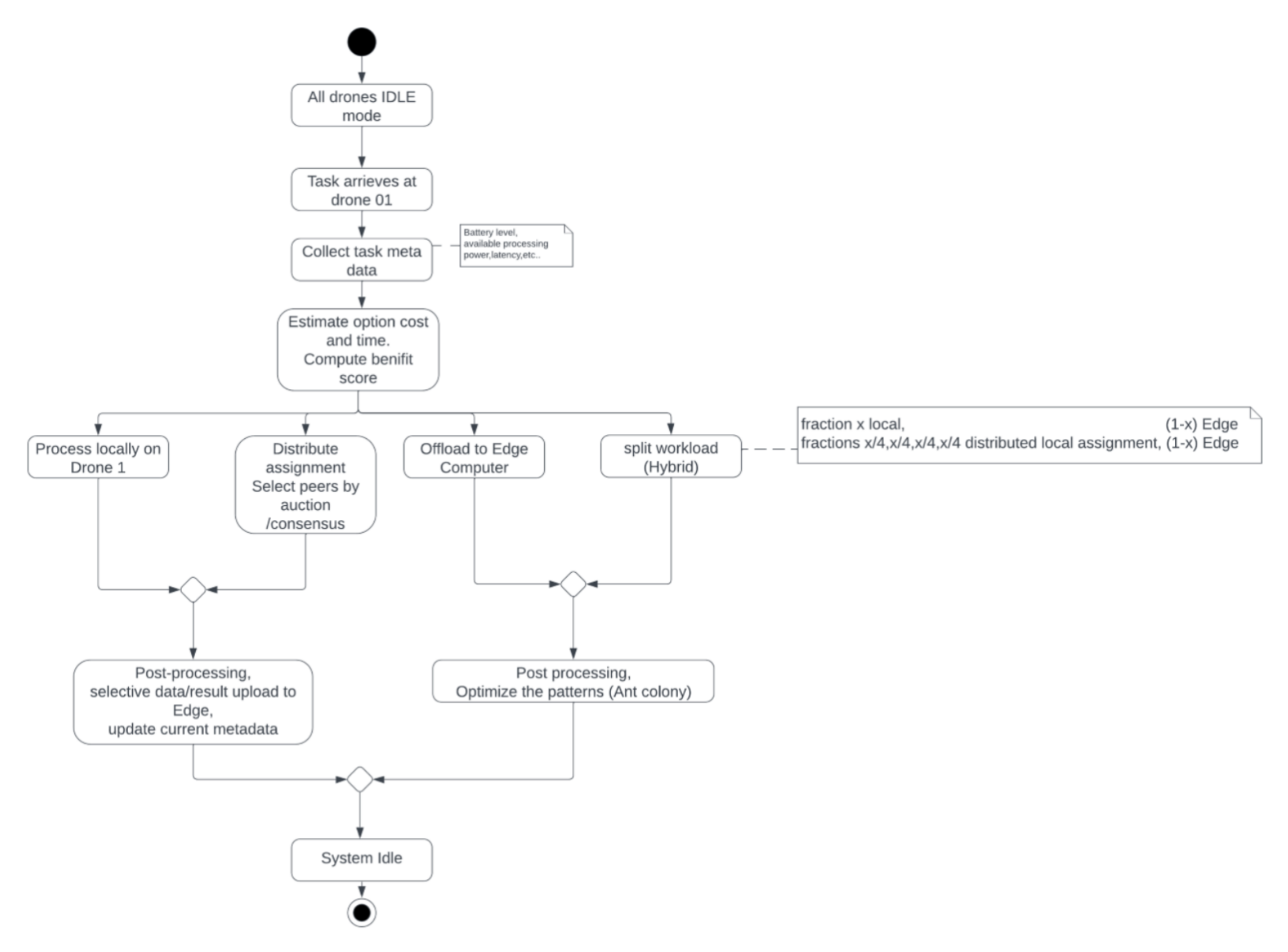
Tasks related to autonomous flying of the drones

1. Automated path planning for field coverage
2. Real-time obstacle detection and avoidance
3. Adaptive rerouting and mission re-planning
4. Return-to-base (RTB) and fail-safe logic

https://www.xa.com/en/p150#:~:text=Intelligent%20Route%20Planning

Task placement decisions for Drones

- 1 drone 1 process



- **1 drone multiple process**
- **multiple drones multiple process (avoid conflits)**

Possible simulation Methords

- iFogSim: An extension of CloudSim designed for Fog and Edge computing. It allows simulation of IoT/edge environments and evaluation of task scheduling policies across edge and cloud resources.

- EdgeCloudSim: Built on CloudSim for edge computing experiments. It adds network and mobility models (e.g. moving devices/drones) and realistic load generation, which is useful for simulating task distribution in mobile scenarios.

- Matworks simulink