Learning objectives

Knowledge

Value Sensitive Design concept and methodology applied to camera drones.

Architecture and principal components of multirotor drones and camera payloads.

Application of simple computer vision algorithms to RGB camera footage captured by a drone

Skills

Construction, calibration, and flight testing a basic multirotor drone.

Interfacing of simple camera payloads.

Development of simple computer vision algorithms.

Operation of a multirotor drone while adhering to operating procedures and safety protocols

Competences

Understand the principal requirements and design of drones and payloads for computer vision based applications.

Participate in finding technical applicable solutions to monitoring drones for environmental monitoring and sustainable precision farming

Requirements

First manual flight without camera

UAV must be a quad copter rotor construction	The drone has four propellers and is therefore a quad copter
UAV Camera must be controllable and time synced by the UAS, max capture rate is 1 Hz	Capture rate is 1hz by default and synced to capture at waypoints
UAV must fly at 15m Above ground	The drone was able to fly 15m above ground level
UAV must fly at a speed between 10-15 m/s	A max speed of 14.38 m/s was achieved while test flying, thus we know it is able to achieve the goal
The UAS must be able to perform a programmed monitored flight in a 100x100m area	Has been tested by flying a square with about 100 m^2
UAV must have autonomous takeoff and landing with a Weight of max 3 Kg	Current weight is: - 1190 with no battery - 1670 with battery (takeoff weight)
The UAV must be able to take-off and land autonomously	Yes
Operational procedures must be available and followed at all times: flight-planning, preflight, flight, contingency, emergency post-flight	For the first test flight after implementation the operational procedure/checklist was used to good results.
All project documents, source etc. must be available at a git repository either shared with the teachers or public. The repository must contain a license statement (BSD 3-clause is recommended).	Shared on github

The UAS design and construction should consider tech ethics and value sensitive design principles.
This is described on page 4. To summarize, our values are safety and privacy, with norm features such as high visibility LEDs and a stable structure is implemented for these values.

The UAS design, construction, production, operation, scrapping should aim to be sustainable in the sense of low resource consumption
The main construction material of the drone is wood, The wood sort is not known, but optimally it would be a highly sustainable and regrowable sort such as bamboo or ash. The centerpiece brace for our drone is currently printed in PETG, which is a “toxic” non-reusable plastic, so instead for further design iterations the material would be changed to PLA, which is recyclable. The weight of the drone is fairly high, resulting in a higher consumption of power during flight. This ensures safety since it is less prone to heavy winds and will remain more stable. Most of the extra weight is due to using heavy M5 bolts for the center assembly, which can easily be swapped out with something smaller or wood pegs.

Privacy concerns for a camera drone should be addressed.

The UAS should to the extent possible conduct the operation fully autonomously. For safety purposes a remote pilot must monitor and be able to intercept the flight following defined operational procedures.

The UAS post-processing of images must be able to perform robust color based segmentation of images: Classification of object shapes based on feature descriptors, Putting camera observations on a map using information about camera, UAV Position and orientation obtained from flight log.

flight, contingency, emergency post-flight

- Checklist is always followed

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The UAS design and construction should consider tech ethics and value sensitive design principles.
At the moment the camera is mounted at an angle. Optimally it would look straight down, ensuring that we only capture what is beneath our legal flight area. If it had been easier to power some LED's, these would have been used to increase the visibility of the drone, making it easier to detect. This would warn people that a drone is nearby. This would also increase safety, as it would increase awareness.

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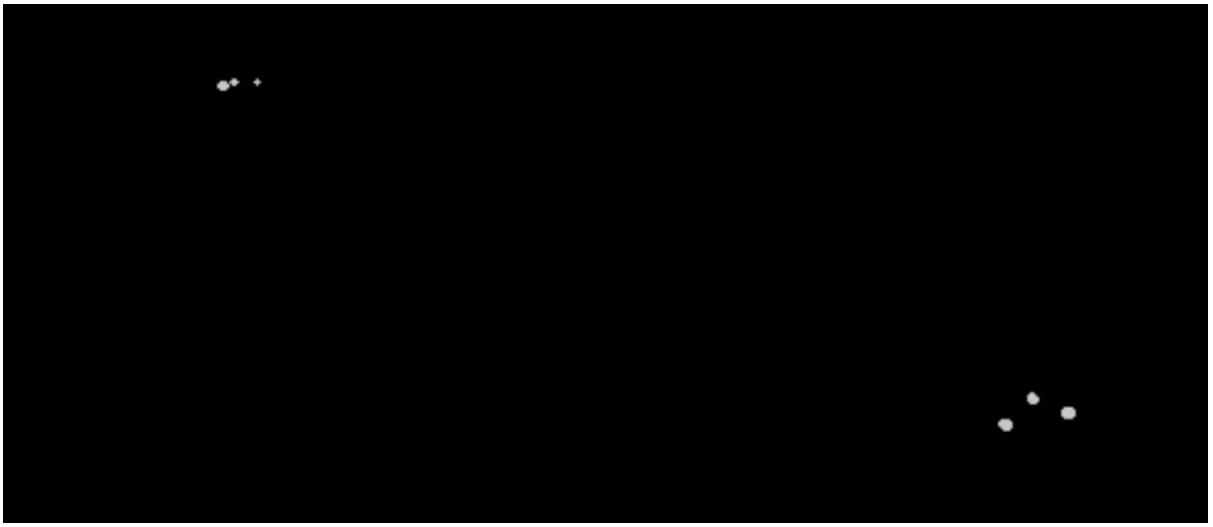
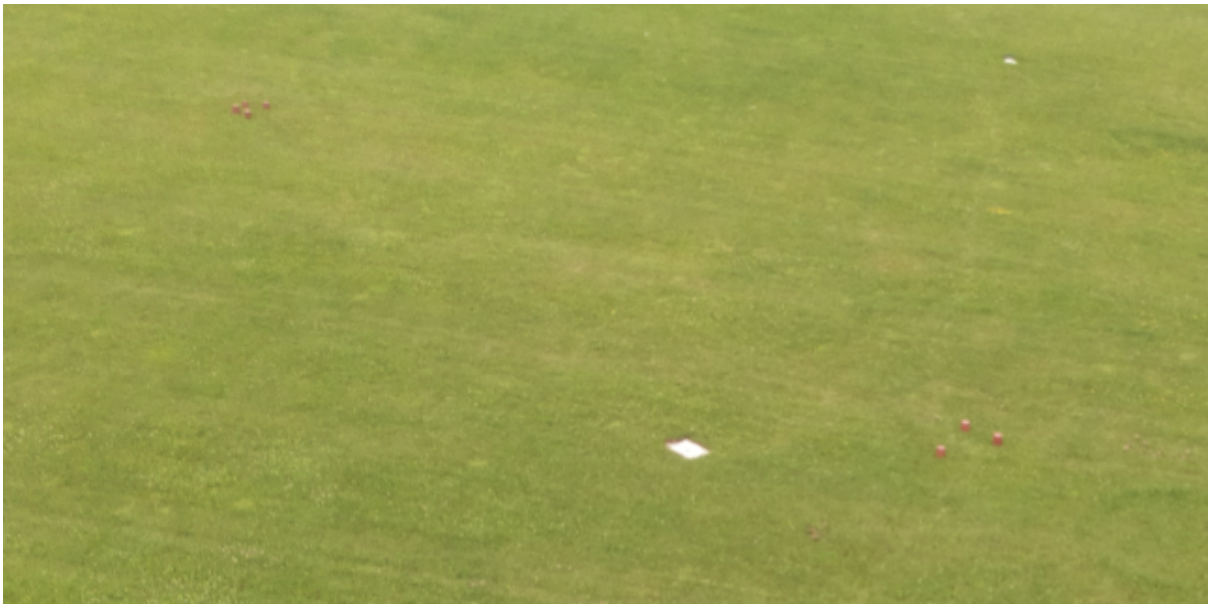
Privacy concerns for a camera drone should be addressed.
It is currently not perfect could turn camera downwards The UAS should to the extent possible conduct the operation fully autonomously. For safety
purposes a remote pilot must monitor and be able to intercept the flight following defined operational procedures. it can fly missions without any issues, but is always monitored

The UAS post-processing of images must be able to perform robust color based segmentation of images: Classification of object shapes based on feature descriptors, Putting camera observations on a map using information about camera, UAV Position andorientation obtained from flight log.
Currently we have a way of segmenting out the desired features, in this case being pots:





Value sensitive design

Values:

Safety, Privacy

Norms:

- Safety
    - High visibility
    - LED's for visibility in low light environments
    - Easy for animals such as birds to see and avoid
    - Stable drone, not too prone to high winds.
- Privacy
    - LED's alerting people to the presence of the drone.
    - Flight path will avoid residential areas as much as possible (if possible)
    - Photos with people detected in them will either be deleted or edited automatically (if that's possible)

Design requirements

- High visibility
    - Must be visible from 100 meters
- LED's
    - Blue LEDs
    - 5mm (30 mA)
    - Togglable from controller
- Easy animal visibility
    - 350x350mm drone frame
- Appropriate geo fence parameters

- Course specific specifications
    - UAV must be a quad copter rotor construction
    - UAV Camera must be controllable and time synced by the UAS, max capture rate is 1 Hz
    - The UAS must be able to perform a programmed monitored flight in a 100x100m area
    - UAV must fly at 15m Above ground at a speed between 10-15 m/s
    - UAV must have autonomous takeoff and landing with a Weight of max 3 Kg

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Design requirements

- High visibility
    - Must be visible from 100 meters
- LED's
    - 2 Blue, 4 green and 2 red LEDs
    - 5mm (30 mA)
- Easy animal visibility
    - 350x350mm drone frame
- Appropriate geo fence parameters

- Course specific specifications
    - UAV must be a quad copter rotor construction
    - UAV Camera must be controllable and time synced by the UAS, max capture rate is 1 Hz
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