

# Drones with Artificial Intelligence

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Drones are helpful in many scenarios but are cost-intensive and technically complex. This situation is unfortunate from a university perspective, as the combination of drones and artificial intelligence opens up exciting scenarios for research and teaching.

**Students in the project will develop, investigate, and document cost-effective AI-capable drones that are suitable for teaching and research.**

- Task 1: Develop and build a low-cost FPV drone (ideally <250g).
- Task 2: Integrate an AI application (e.g., object recognition).
- Task 3: Research and possibly integrate an autopilot feature.
- Task 4: Research and possibly integrate a delivery/payload feature.
- Task 5: Document and demonstrate the results of tasks 1-4.

Groups of a maximum of 4 people each develop and build a drone. Individual steps include:

- Research the legal framework conditions.
- Collect functional requirements for the hardware and software.
- Select hardware components.
  - Frame, flight controller (FC), electronic speed controller (ESC), FPV transmitter (for video), ELRS or TBS Crossfire receiver, motors, possibly GPS receiver, camera, batteries, remote control, single-board computer (e.g. Raspberry Pi Zero), AI accelerator (e.g. Google Coral USB Accelerator), possibly FPV goggles, etc.
    - \* Selection criteria: Acquisition costs, range of functions, availability.
    - \* The university or students can purchase the hardware.
- Select software components.
  - Flight stack software (e.g., Betaflight, PX4 autopilot, ArduPilot), ground control station (e.g., QGroundControl), operating system (e.g., Raspbian, Ubuntu) for the single-board computer, software to implement the AI functionality (e.g., YOLO), etc.
    - \* Selection criteria: License, features, level of activity of the OpenSource project.
- Assembly of the drone, integration of hardware and software components, flight tests
  - Understanding of hardware and system software is mandatory. Basic knowledge of (electrical) soldering and handling electronic components is helpful
- Documentation and demonstration.
  - Each team develops a complete and easy-to-understand documentation online (e.g. via GitHub pages) and a presentation consisting of a poster and a demonstration. There will be no conventional presentations with slides or project reports.
    - \* The students in the project will develop documentation and instructions to enable students, researchers, and teachers to build AI-capable drones at low cost and use them for their modules and research projects.