Drones with Artificial Intelligence

Prof. Dr. Christian Baun – `christianbaun@fra-uas.de` – `www.christianbaun.de`

Participants of the project will form groups of up to four people. **Each group will receive an AI-capable FPV drone and the necessary components. The tasks include the development, implementation, investigation, and evaluation of exciting and comprehensible drone AI applications.**

- **Task 1: Familiarize yourself with the FPV drone and the additional hardware components (single-board computer, camera, A/V video grabber, AI accelerator, etc.).**
  - Learn about the capabilities and limitations of the hardware components, including:
    * Frame, flight controller and electronic speed controller, FPV transmitter (for video), ELRS receiver, Motors, GPS receiver, camera(s), batteries, remote control, single-board computer (e.g., Raspberry Pi Zero 2 WH), AI accelerator (e.g., Google Coral USB Accelerator), FPV goggles, A/V video grabber, etc.
  - Learn about the capabilities and limitations of the software components, including:
    * Flight controller firmware (Betaflight, INAV, ArduPilot), Ground Control Station (e.g., QGroundControl for ArduPilot), operating system (e.g., Raspberry Pi OS, Ubuntu) for the single-board computer, AI software (e.g., TensorFlow Lite, YOLO)
  - The focus of the project is on **AI applications (see Task 2)!** Building a new drone is not required and not the goal of the project. Modifications of the existing drones are possible if desired.

- **Task 2: Develop, integrate, and test AI application(s). Application areas may include:**
  - **Computer Science:** Object recognition (e.g., Detection of persons and animals)
  - **Logistics:** Automated object delivery and pick-up
  - **Geography:** Biodiversity research or detection of weather-related damage
  - **Engineering:** Structural inspections
  - **Agricultural Science:** Monitoring of plants and pest infestation
  - **Archaeology:** Aerial photography
  - **Atmospheric Research:** Smog measurements

- **Task 3: Research and integrate autopilot options.**
  - For example, with INAV or ArduPilot.

- **Task 4: Research and integrate delivery/payload options.**
  - Develop and test a simple drop mechanism (e.g., with a servo).

- **Task 5: Documentation and presentation of the results of Tasks 1–4.**
  - Create documentation and guidelines that enable students, researchers, and instructors to replicate the AI drone scenarios and use them for their own modules and research projects.
  - There will be **no slide presentations and no PDF project reports**! Each team will develop a complete and well-structured **online documentation** (e.g., via GitHub Pages) and present their results with **a poster and a live demonstration**.