Project in Summer Semester 2026 – Master's Program in Computer Science (Field of Study: Intelligent Systems)

Drones with Artificial Intelligence

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Participants in the project work in groups of up to four members. Each group is provided with a fully assembled (flight-ready) FPV drone as well as the required components. **The objective of the project is the independent development, implementation, and evaluation of a practical AI-based drone application for the automated delivery of objects**. In addition, both the technical challenges and the limitations of the employed systems are to be analyzed and documented in a comprehensible manner.

- **Task 1: Familiarize yourself with the drone and its hardware and software components.**
  - Understand the capabilities and limitations of the hardware components. These include: Frame, flight controller with motor control, video transmitter (VTX), ELRS receiver, motors, GPS receiver with compass, FPV camera, Li-ion batteries, remote controller, Raspberry Pi Zero 2 WH, Raspberry Pi AI camera module, FPV goggles, A/V video grabber, etc.
  - Understand the capabilities and limitations of the software components. These include: Flight controller firmware (Betaflight, INAV, ArduPilot), ground control station or mission planning (e.g. QGroundControl for ArduPilot, INAV Configurator for INAV), operating system (e.g. Raspberry Pi OS) for the single-board computer, as well as AI software (e.g. TensorFlow Lite, YOLO), etc.
- **Task 2: Extend the drone with the goal of enabling automated delivery of objects (including in indoor environments).**
  - This task consists of several subtasks (see Tasks 3–6)
- **Task 3: Integration of an autopilot function.**
  - Preferably using ArduPilot, alternatively INAV.
- **Task 4: Integration of Position Hold and Altitude Hold using range sensing (LiDAR) and optical flow (Optical Flow).**
  - Use of the MicroAir MTF-01P sensor.
- **Task 5: Research and integrate implementation options for Delivery-/payload systems.**
  - Develop and test a simple drop mechanism using a micro servo. 3D printing capabilities are available.
- **Task 6: Develop an improved frame or an extension of the existing frame to accommodate sensors for range measurement and optical flow as well as the Delivery-/payload mechanism.**
  - Use suitable software tools such as Tinkercad or UltiMaker Cura. 3D printing capabilities are available.
- **Task 7: Documentation and presentation of the results from Tasks 1–6.**
  - Create documentation and guides that enable students, researchers, and instructors to reproduce the AI drone scenarios and use them for their own modules and research projects.
  - **No slide presentations or traditional PDF project reports** will be created. Instead, each team develops a complete and comprehensible **online documentation** (e.g. via GitHub Pages) and presents the results in the form of a poster and a live demonstration.