During the last ten years, the Institute of Systems Optimization evolved into a center of excellence for multi-sensor guidance, navigation and control systems. The analysis and development of advanced methods concerning multi-sensor guidance, navigation and control systems are performed in close cooperation with partners of the industry, mainly from the aerospace sector. This includes the development of the algorithms, software implementation, hardware design as well as simulation and hardware system test.
**AirQuad: VTOL MAV for airborne surveillance**

### Mission

**Numerous application areas:**
- Civil tasks
- Security applications
- Rescue missions in disaster areas
- Surveillance and reconnaissance

### Capabilities

**Self-stabilization and position hold**
- Assistance and support of operator
- Compensation of wind disturbances

**Autonomous flight**
- Flexible mission planning
- Planning of waypoint flight
  - with PC and georeferenced maps
  - programming by Teach-In during flight
- Numerous additional functions like
  - Hover points with defined duration and yaw-angle
  - Control of payload like camera trigger, zoom and panning
  - Point of interest: Arbitrary choice of point at which the camera is pointed during flight

### Specifications

- Maximum velocity 50 km/h
- Maximum length 92 cm
- Payload 200 g
- Take-off weight 1000 g
- Flight time ~25 min
- Operating range ~5 km
- Altitude up to 500 m above ground level

### Guidance, Navigation & Control

**Hardware**
- Microprocessor
- 3 MEMS gyroscopes
- 3 MEMS accelerometers
- GPS Receiver
- Magnetometer
- Baro-Altimeter

**Additional Equipment**
- Onboard logging of flight data
- Radio Up-/Downlink to ground station
- Payload like digital camera or infrared camera

### Image processing algorithms** for support of the operator
- Image stabilization
- Detection and tracking of moving objects

- Geolocation of objects as well as visualization of positions with georeferenced maps

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**IndoorGuide: Personal Navigation & Guidance System for Indoor Environments**

**Mission**

Numerous user groups of personal navigation & guidance systems:
- Fire fighters and first responders
- Security and other field personnel
- Visually impaired and blind people
- Private users / Location-based services

**Capabilities**

Precise indoor navigation & guidance
- Localization in unprepared environments with completely self-contained sensors (maps, infrastructure or GPS not required)
- Real-time onboard 2D-map generation with rotating laser scanner

**System Setup**

**Multisensory Concept**
- Inertial Torso Unit: IMU/MAG/BARO
- Inertial Foot Unit: IMU
- 2D Laser ranger
- GPS
- Camera

- Data fusion: Dual IMU Concept

**Future System**

- Miniaturized sensors
- Vision-based mapping, navigation & guidance

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