Twirre
Architecture for autonomous mini-UAVs using interchangeable commodity components

J. van de Loosdrecht, K. Dijkstra, J.H. Postma, W. Keuning and D. Bruin
NHL University of Applied Sciences, Centre of Expertise Computer Vision (www.nhlcomputervision.nl)

Objectives
- All sensors and processing on-board
- Low-cost components
- Upgradable and extendable
- Useful in multiple applications
- Instantly and reliably switch between manual and autonomous control

Architecture

Cascade control system
- High level: simulation of human stick inputs
- Low level: exchangeable flight controller

Autonomy switch
- In hardware only, no software involved

Software
- Mission and high level control system
- Portable C(++)

Conclusions
- Twirre architecture has been derived from objectives
- Low-cost multi-copters are implemented
- Successfully tested in GPS-deprived environment
- Autonomy switch is safe and reliable

Example implementation
- Processor board
  - Core i7, USB 3.0
- Microcontroller
  - Arduino, USB, PWM outputs
- Flight Controller
  - Naza-M v2
- Autonomy switch
  - Dual receiver controller
- Platform
  - DJI 550
- Camera + Gimbal
  - IDS uEye
  - Custom gimbal
- Sensors
  - Gyro, accelerometer, magnetometer, barometer, ultrasonic sensor, GPS
- Transmitter and Receiver
  - Graupner

Result of experiments
State machine
- Hovering & Searching
- Approaching Point of Interest
- Facing Point of Interest

Example graphs
- Graphs showing performance metrics

Future work
- Extract reusable software components
- Add extra sensors for increased robustness
- Extend state machine
- Release system software to public domain

International Micro Air Vehicle Conference and Competition (IMAV 2014)