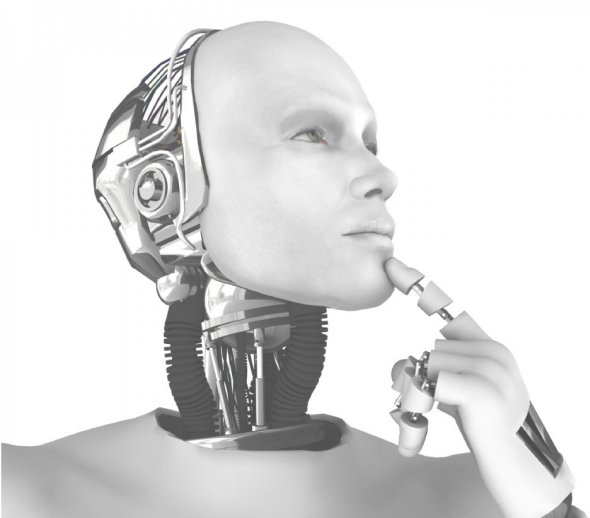


AIOLI - AI Open Lab Initiative

SciFi debunked - Slaughterbots

mail@tobias-weis.de

December 8, 2017

Agenda

Slaugherbots

Drone technology background

Drone- and weapon-related science and projects

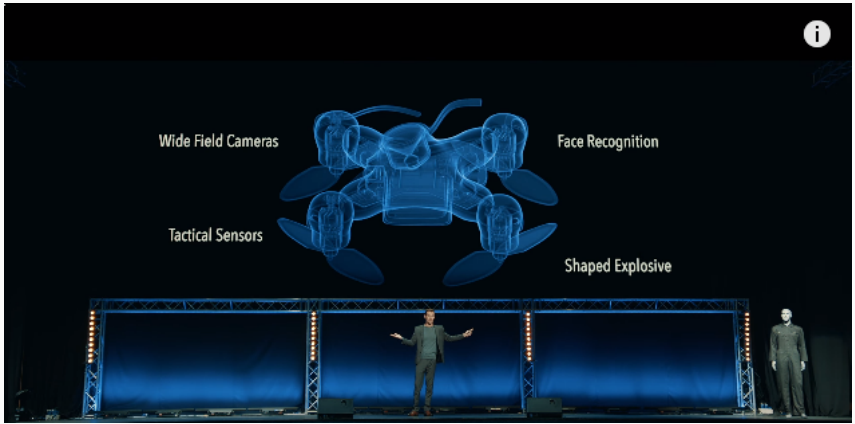
Live-demo

Assessment

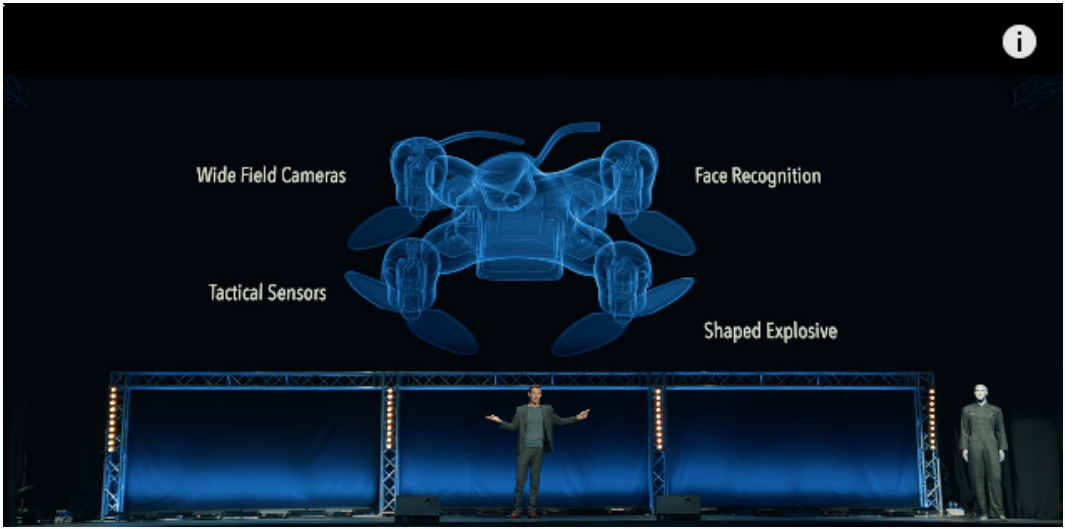
Slaugherbots

Video - Slaughterbots (7:47)

Video released by autonomousweapons.org, shall support the campaign(s) to pass laws against autonomous weapons (https://www.stopkillerrobots.org/) In the video: Prof. Stuart Russel (AI/CompSci, UC Berkeley)

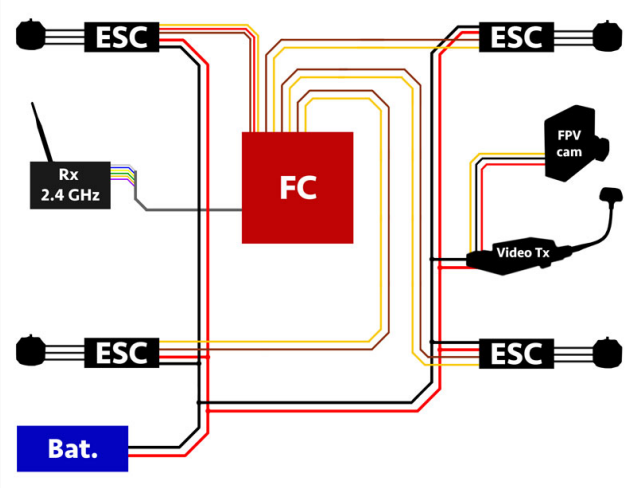


Video - Slaughterbots (7:47)



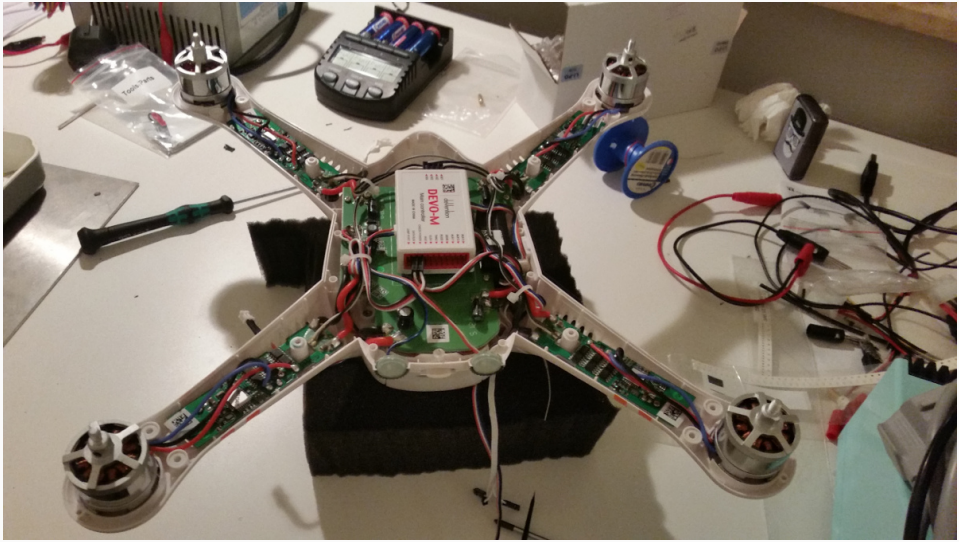
Drone technology background

Drone tech



http://fpvracing.ch/img/cms/infobereich/Bauanleitung/06-FPV-Overview_1.jpg

Drone tech - Hardware



Drone tech

Example: Walkera QR-X350 Pro

- Battery: 5Ah 30C Li-Po $\rightarrow$ 10-20 min. of flight w/ Cam + GPS
- Weight (incl. gimbal, camera, battery, transmitter): 1250g
- Topspeed: 71 km/h
- Cost: ca. 400 EUR

Remote-control

- Devo-7: 2.4Ghz, output: up to 20db (100mW) - up to 3km range

FPV - Camera stream transmission

- 5.8 Ghz transmitter, 600mw - up to 2km range, most often below 600m

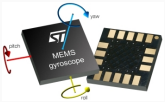
Telemetry - Serial data connection

- 433 Mhz - more than 1km range

Drone tech - Sensors

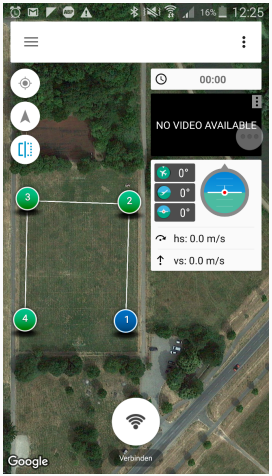
To maintain stability and navigate, the Flight Controller is usually connected to a lot of onboard sensors:

- Acceleration/Turnrate: Accelerometer + Gyroscope
- Height: Barometer
- Global orientation: Magnetometer (Compass)
- Global positioning: GPS
- Relative speed: Optical flow



Images from: http://www.dronetrest.com/t/beginners-guide-to-drone-autopilots-flight-controllers-and-how-they-work/1380

Drone tech - GPS and positioning



Tower android app

- Mavlink-protocol to communicate with FlightController
- Get telemetry-data (current position, angles, height)
- Set targets, send control instructions

Drone tech - Computer vision

Off-Drone-Processing

- Re-use compute-hardware
- Latency
- Limited range

On-Drone-Processing

- No latency
- Requires additional hardware,
  - more weight
  - more power-usage
  - hardware evt. destroyed

Suitable hardware not existent *yet*

Drone- and weapon-related science and projects

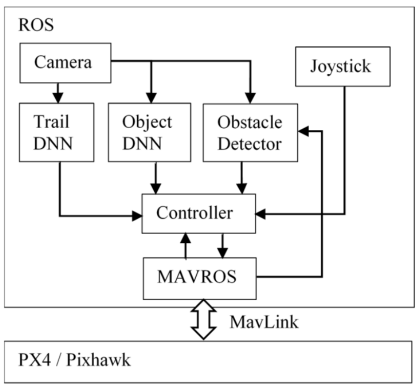
Drone- and weapon-related science and projects

- DoD: Perdix micro-drone-swarm
- No Info about localization found: ETH Zurich (D'Andrea): http://flyingmachinearena.org/research/, https://www.youtube.com/watch?v=RCXGpEmFbOw
- The pentagon wants you to develop drone swarms: https://thenextweb.com/insider/2017/10/23/the-pentagon-wants-you-to-develop-drone-swarms-for-the-military/

NVIDIA - Autonomous Drone video (3:10)

NVIDIA - Autonomous Drone video (3:10)

- NVIDIA Jetson TX1 onboard processing, trained on videos of eight miles of trails
- Resnet-18 architecture computes view orientation and lateral offset output
- YOLO DNN for object detection, Visual odometry



https://arxiv.org/pdf/1705.02550.pdf

NASA JPL autonomous drone race

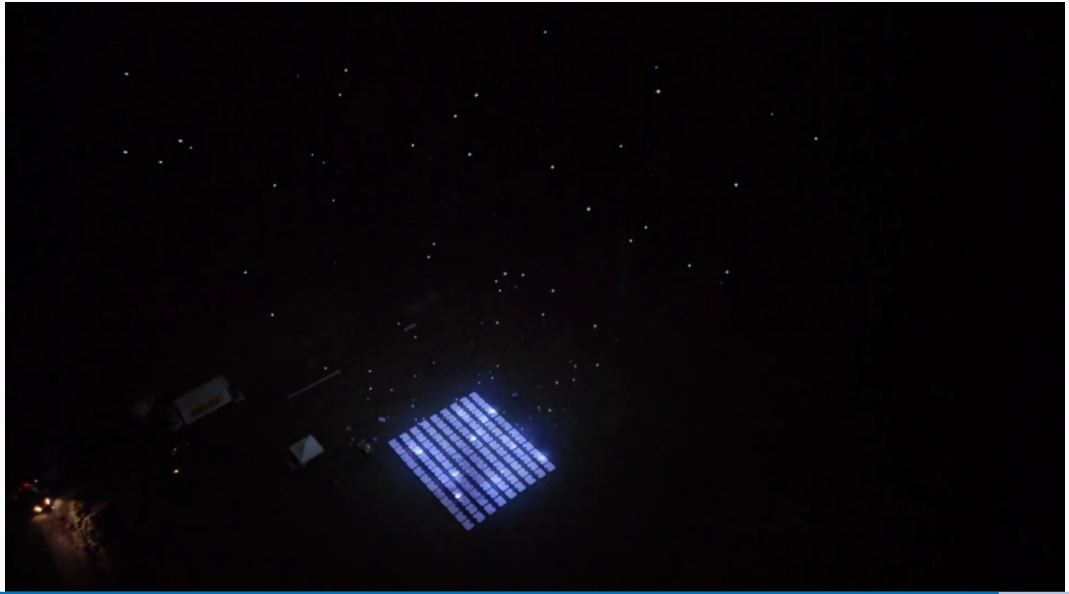
NASA JPL autonomous drone race

[...] processing is all done onboard. The team holds the drone and walks it through the course slowly ahead of the race to teach it the layout.[...]
(Andrew Good, JPL, 06.12.17)

- Localize by comparing current sensor-input to pre-built map
- Google Tango technology for VR - 3D mapping
- Qualcomm Snapdragon Flight board is used for real-time flight control
- 2 wide-field-of-view-cameras: forward + downward
- Depth-map from motion stereo

https://www.nasa.gov/feature/jpl/drone-race-human-versus-artificial-intelligence

Intel drone swarm



Live-demo

Livedemo

Assessment

Assessment