The Paparazzi Platform

Flexible, Open-Source, UAS Software and Hardware

esden, dotAero, misterj, cifo
Outline

- History, User Community, Competitions & Missions
- Software
- Hardware
- Example Vehicles
- Demos
Who are we?
Who is Paparazzi?

Micro unmanned aerial vehicle framework

http://paparazzi.enac.fr
Why do I care?

We're not going to preach the advantages of autonomous or RC vehicles - you know this already.

Paparazzi:
- Innovative
- Competitive
- Hugely flexible

"Many start Paparazzi as UAV hobbyists and leave as professionals!"
History

The journey started in 2003

Pascal Brisset & Antoine Drouin
History

Ecole Nationale de l’Aviation Civile

Toulouse, France
History

Over 60 developers contributing code several hundred users from 18 countries and counting
Involved Universities
Competitions

- JMD03, Toulouse, France: 1st place with the Twinstar
- EMAV04, Braunschweig, Germany: 1st place with the Microjet
- JMD04, Toulouse, France: 1st place with the Microjet
- MAV05, Garmisch, Germany: 4 Paparazzi teams at the first 4 places
- EMAV06, Braunschweig, Germany: all the teams were equipped with Paparazzi
- MAV06, Sandestin, Florida: 2nd and 3rd places
- MAV07, Toulouse, France: 1st place (tie), 3rd, 4th and 5th places
- OC09, Queensland, Australia: 1st place robot airborne delivery challenge
- IMAV2011, Harde, Netherlands: 2nd place outdoor challenge
- DARPA UAVForge 2011-12: 3rd place
Missions

2011 Antarctica Finnish Meteorological Institute
Missions

2012 Southern Madagascar multi university
Software - Overview

- Airborne and Ground Segments
- Reconfigurable multi-agent system, small programs perform simple tasks
Communications between the Paparazzi agents

**Aircraft**
- Sends telemetry messages
- Receives datalink messages

**Wireless link**
- Datalink
- Telemetry

**Link**
- Connects a hardware wireless device to the network

**GCS**
- Displays graphic data
- Controls the datalink

**Ground network**

**Messages (debug)**
- Display network messages

**Server**
- Logs raw messages
- Dispatches synthetic messages

Data is sent with messages divided into 3 classes:
- telemetry
- ground
- datalink
Software - Ground Segment

2D Map

Strips  Notebook  Console
Software - Ground Segment

Reconfigurable UI (XML)
Software - Airborne Segment

- Modules allow easy addition or replacement of functionality
- Supports a multitude of sensors and actuators
- XML-based automatic code generation allows quick code adaptation for different vehicle configurations
Software - Airborne Segment

- Complementary and Kalman filter-based estimators
- PID, PID with FF and adaptive controllers for attitude, altitude and position control
Software - Demo

- Flight in simulator
- Pray to Demo Gods
Hardware - Overview

Classix
ARM7

Tiny
ARM7

Umarim
ARM7

Booz
ARM7

Lisa/L
ARM Cortex-M3
ARM Cortex-A8

Lisa/M
ARM Cortex-M3
Hardware - Architectures

- **AVR** Atmega 8MHz (Dropped 2010)
- **ARM** 7 TDMI 60MHz (Stable)
- **ARM** Cortex M3 72MHz (Stable)
- **ARM** Cortex M4 168MHz+DSP (Upcoming)
Hardware - Sensors

Developed by the Paparazzi Community OSHW

IR Sensor
Booz IMU
Aspirin IMU

Sparkfun IMU
Polulu IMU
Cloudcap IMU
VectorNav IMU
XSens IMU

Third party hardware
Hardware - System Example
Hardware - License

GPL
Free Software
Free as in Freedom

cc
BY
SA
Hardware - Example Vehicles

Fixed Wing

Dragon Slayer
Miraterre
Flight Systems

UMARS
zhaw
Zürich Switzerland

Perching Airplane
BDML
Stanford CA US
Hardware - Example Vehicles

Multirotor/Rotorcraft

Quady
Transition Robotics

Variable-Pitch Quad
Eric Parsonage

Booz Hexa V
Antoine Drouin
Hardware - Example Vehicles

Transitioning Aircraft

Quadshot
Transition Robotics

Atmov
Atmos TU-Delft
Hardware - Demo

- Pray to Lithium-Polymer Gods
- In the front row?
  - Look for a helmet under your seat
  - Just kidding