O'PAVES

An open platform for autonomous vehicle tinkerers

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What is this project?

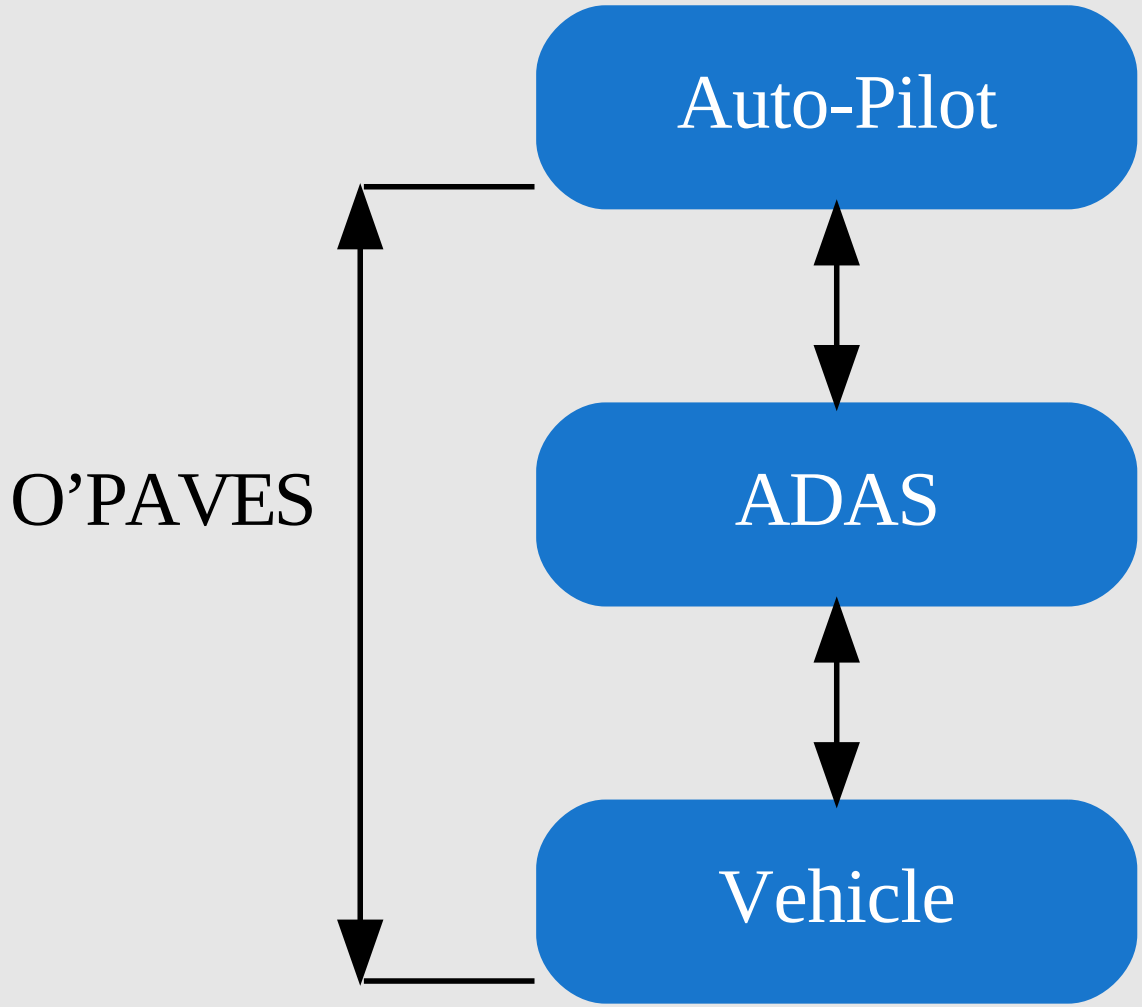
Open Platform for Autonomous VEhicleS (O'PAVES)

Video demo!

Autonomous vehicle competitions 1/2

Autonomous vehicle competitions 2/2

Advanced Driver Assistance System



For whom?

- O'PAVES as a prototyping platform:
  - Students
  - Researchers
  - Hobbyists/Hackers/Makers
- OPAVES as an AdaCore tool demonstrator:
  - Customers and prospects
  - Trade shows visitor

Hardware

Hardware Requirements

- Capable of addressing the classical autonomous vehicle challenges
  - Lane following
  - Collision avoidance
  - Autonomous parking
- Affordable
- Easy to buy and/or build

Components

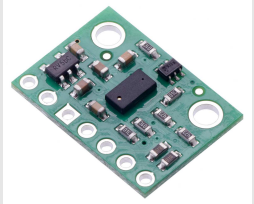
Bluetooth

MCU

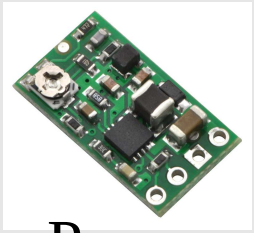
Steering

IMU

Motor(s)



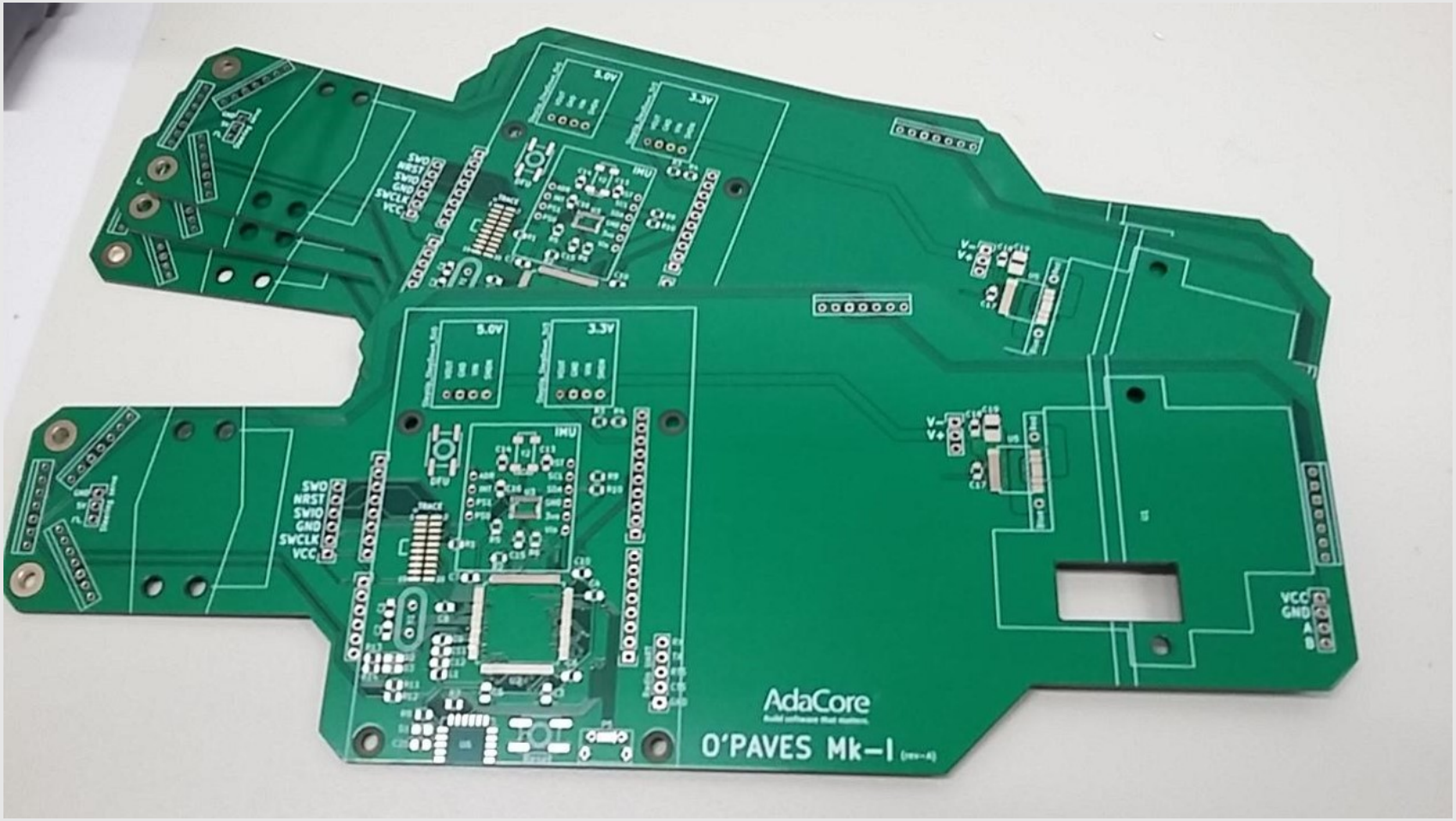
Range (x5)



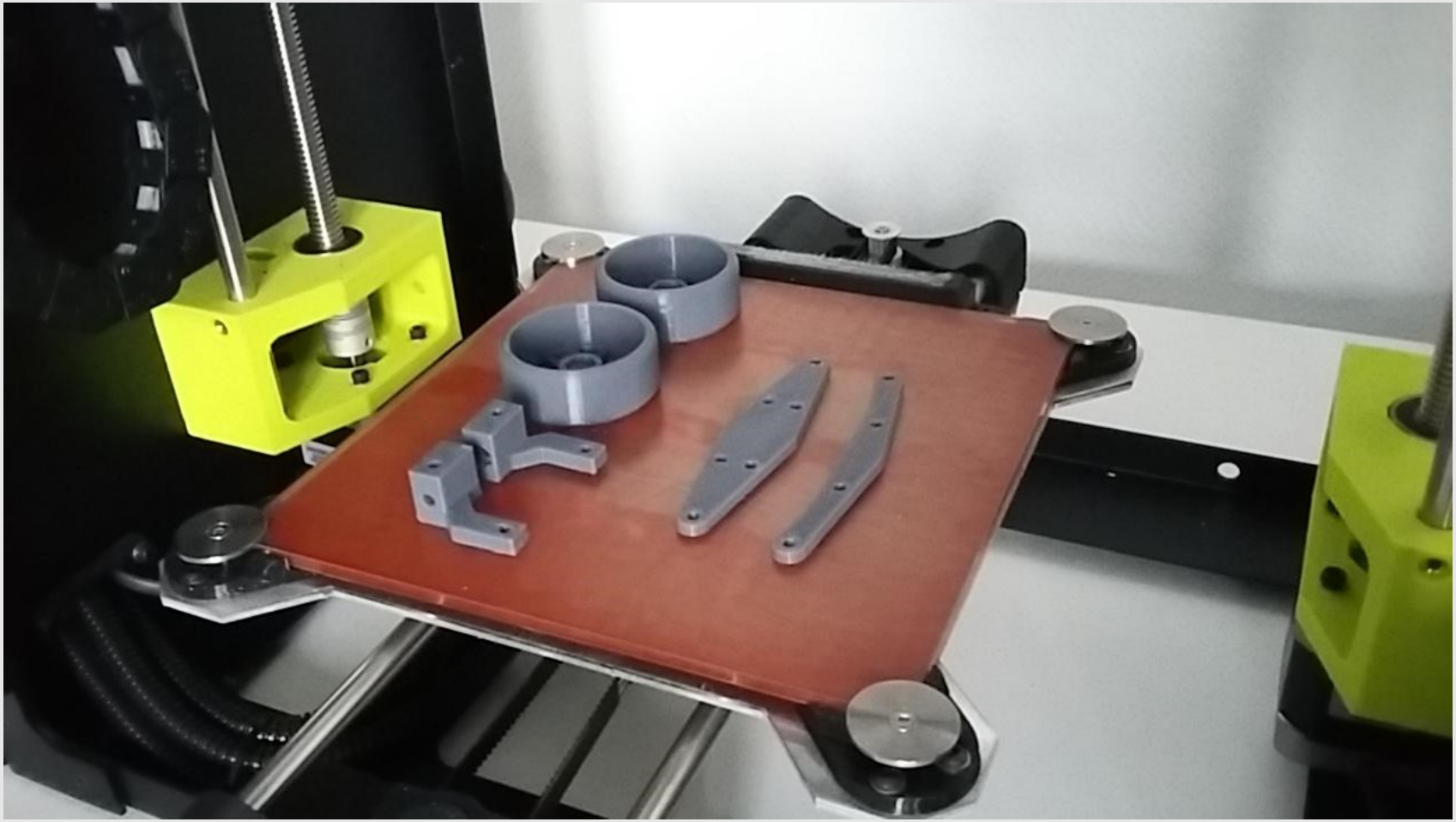
Power

Battery

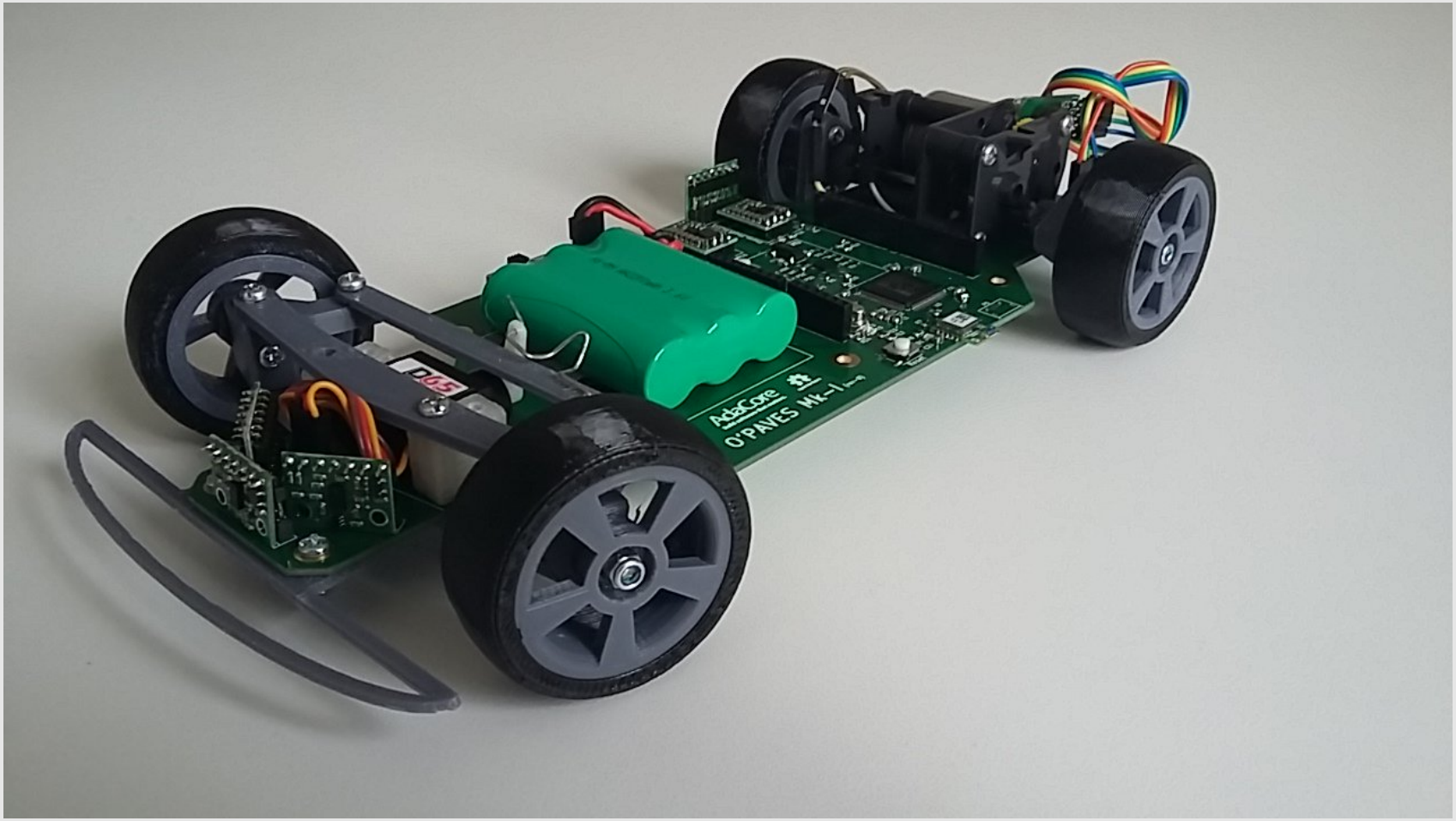
PCB Frame


5.0V
3.3V
IMU
SWO
NRST
SWIO
GND
SWCLK
VCC
DFU
TRACE
V−
V+
VCC
GND
A
B
AdaCore
O'PAVES Mk−I

3D Printed Parts



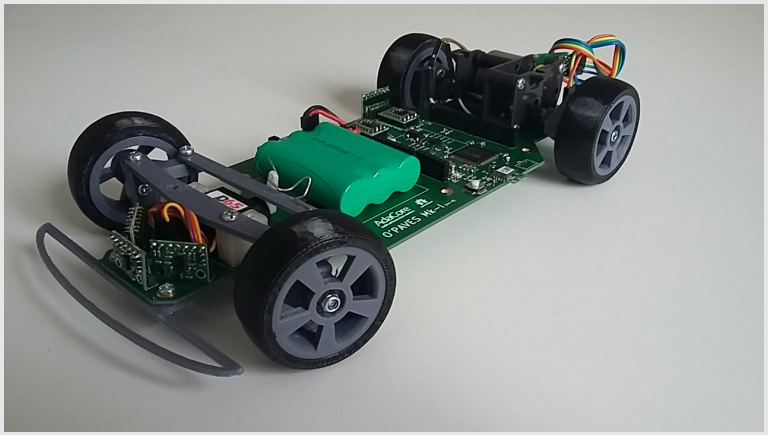
First Prototype



First prototype vs requirements

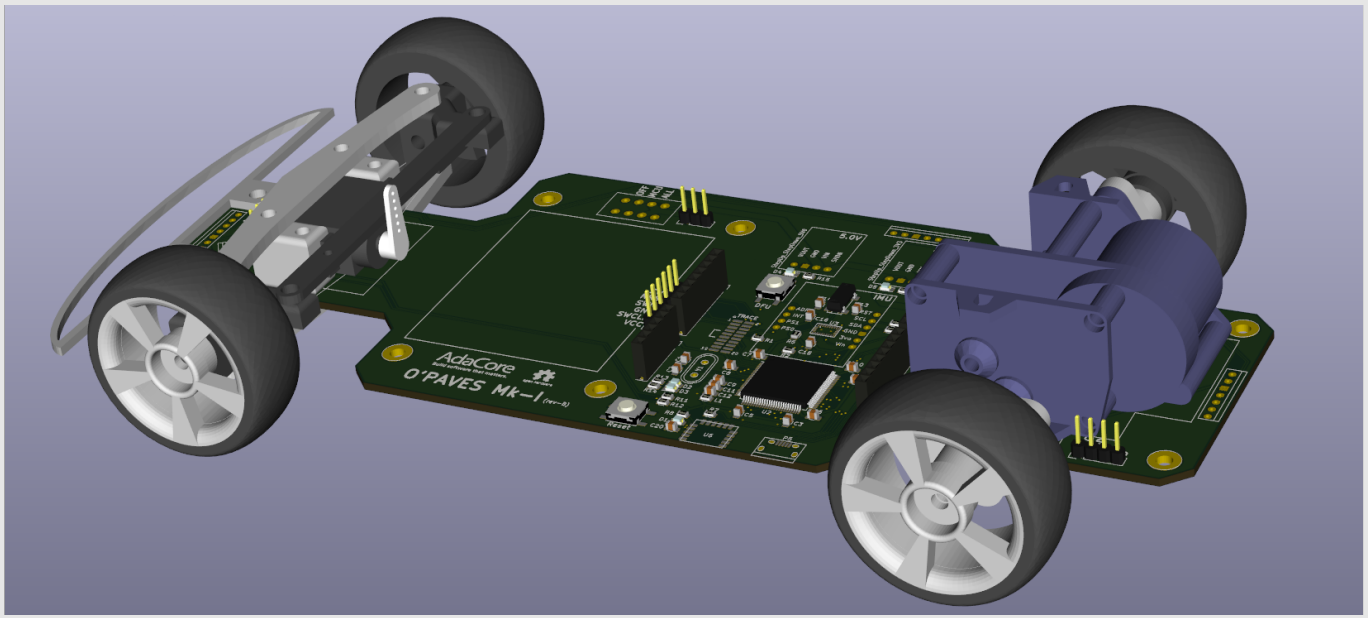
- Capable of addressing the challenges - YES
- Affordable - YES
- Easy to buy and/or build - Not really...

New Version



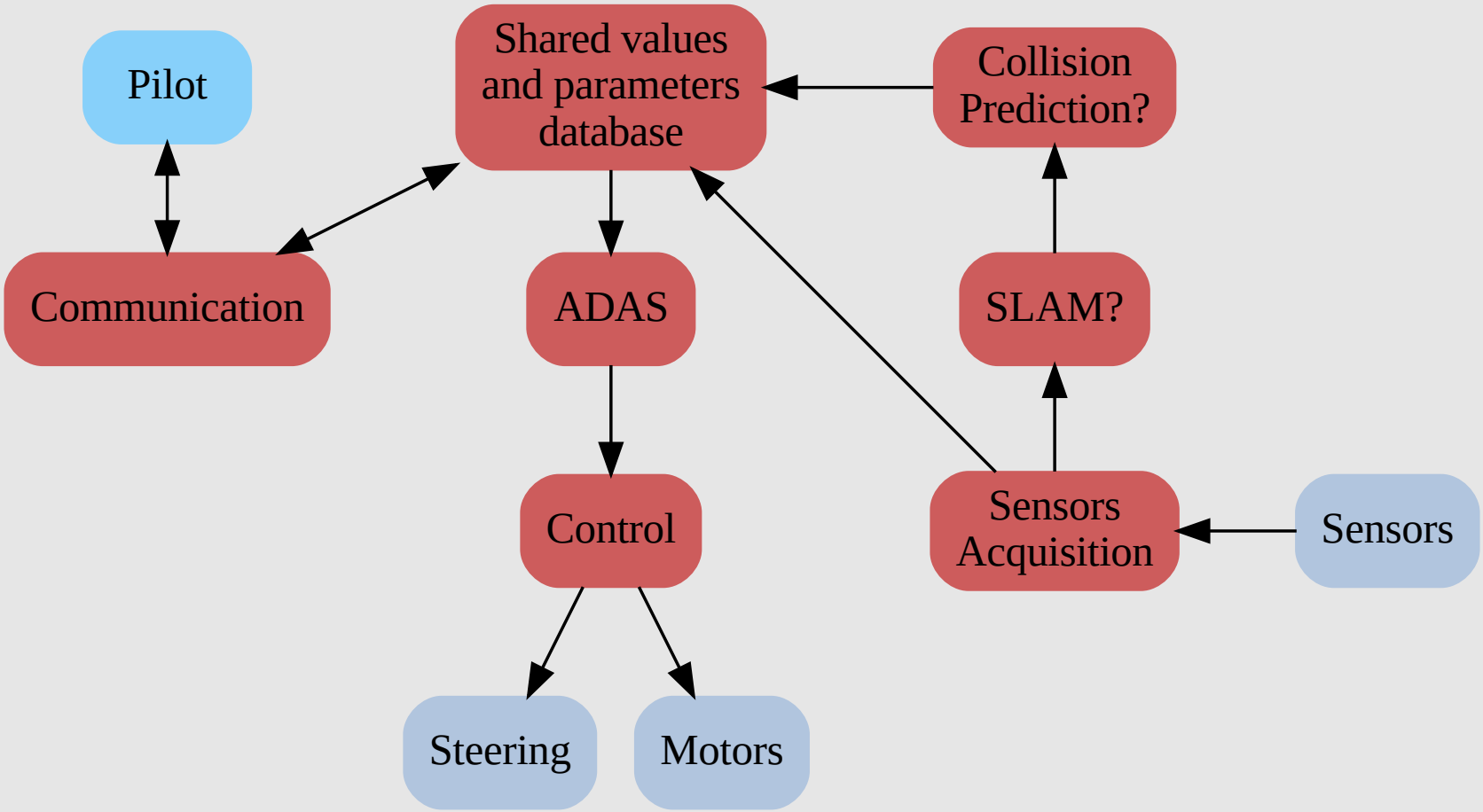
Open-Source Hardware

- Released under the CERN Open Hardware License
- Designed with open-source software:
  - KiCad
  - FreeCAD
- Public repo: https://github.com/AdaCore/OPAVES

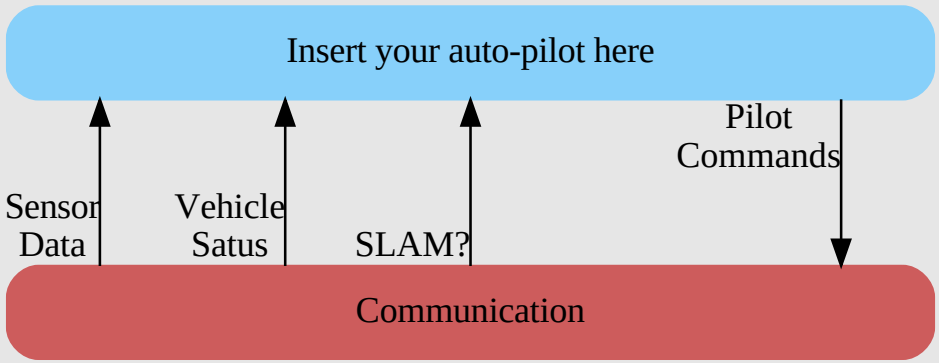


Software

Software Architecture



Auto-pilot interface



Tools and libraries

- Ada and SPARK: programming languages
- Ada_Drivers_Library: Drivers for micro-controllers
- Certyflie: Flight controller written in Ada and SPARK
- GNATprove: Formal proof of the the SPARK code
- GNATcoverage: Source coverage analysis (up to MCDC)

Costs

PCB (by 10)	~$50
Misc Components	~$110
Crazyflie 2.0	$180
Total	~$380[1]

[1] That's less than a Tesla

Fork it, Build it, Use it, Improve it

Build it and make your own autonomous car!

Potential improvements:

- Hardware
  - Encoders on the motors
  - Change the PCB to make it compatible with your favorite dev board
- Software
  - Active differential
  - Actually use the sensors available

Follow the project on:

- GitHub: github.com/AdaCore/OPAVES
- Hackaday: hackaday.io/project/17555-opaves
- Twitter: @OpenPAVES