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 2/2
Advanced Driver Assistance System

O’PAVES

Auto-Pilot

ADAS

Vehicle
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
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
New Version
Open-Source Hardware

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

[Diagram showing the relationships between different components of a software architecture, including Pilot, Communication, Shared values and parameters database, ADAS, Collision Prediction, SLAM, Sensors Acquisition, Steering, Motors, and Sensors.]
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

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB (by 10)</td>
<td>~$50</td>
</tr>
<tr>
<td>Misc Components</td>
<td>~$110</td>
</tr>
<tr>
<td>Crazyflie 2.0</td>
<td>$180</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>~$380¹</td>
</tr>
</tbody>
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¹That’s less than a Tesla
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 development 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