

# SPARK

The open source ECU project



# Who We Are

Originally established as a spin-off of University of Bologna, Alma Automotive represents the synergy between knowledge acquired in academic research activities and years of experience in developing applied solutions. The company has now evolved to offer both ready-to-use products and technical consulting services supported by bespoke hardware and software solutions.

Our partnership with National Instruments and the strong relationship we have with major automotive and motorsport companies is testimonial to the high level of skill and quality of services offered to our customers.

Since 2010, Alma Automotive has been an official sponsor of UniBo Motorsport, Formula SAE Team of University of Bologna ([www.motorsport.unibo.it](http://www.motorsport.unibo.it)).



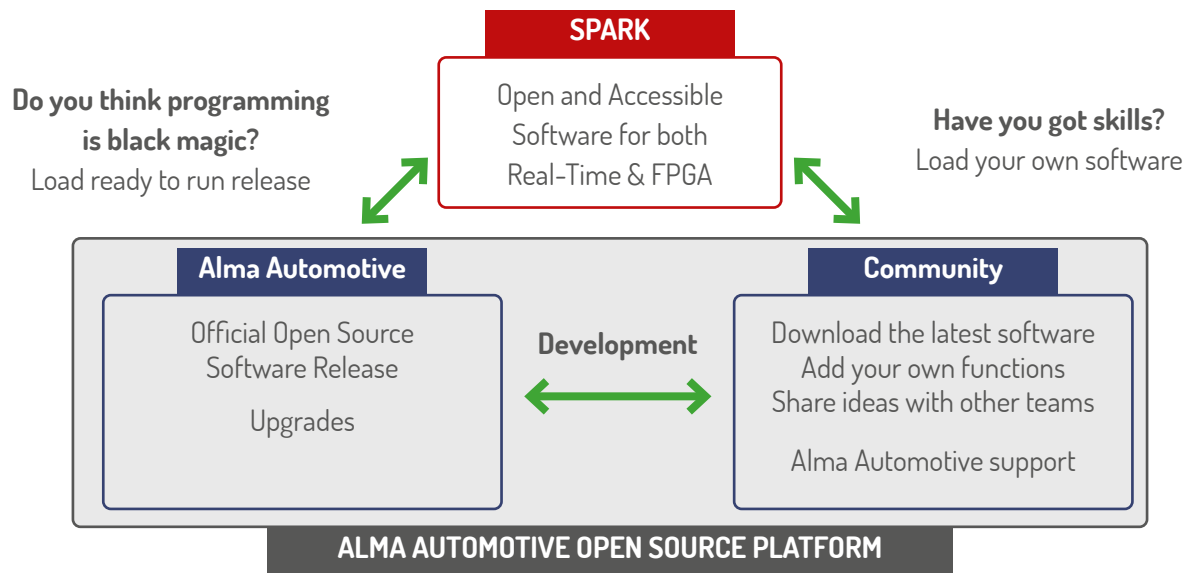
# The Open Source ECU project

Have you always wanted to design your own ECU but don't know where to start?

Do you know the basics of engine control systems but find too hard starting from scratch?

Do you want to implement your control functions but don't have a clue about C and VHDL?

**We have the solution for you! It's the open source ECU by Alma Automotive.**



The open source ECU is a fully programmable control prototyping system based on the latest National Instruments System On Module (SOM) sbRIO-9651. The Xilinx Zynq™, with its Dual Core ARM® Processor, Artix-7 FPGA on top and 512MB RAM, provides outstanding flexibility, efficiency and accuracy, enabling complex control algorithms and signal processing to

be performed. Such top-notch features provided by the National Instruments hardware are then expanded with our in-house designed hardware; the resulting product is an integrated engine and vehicle management system capable to meet the needs of any motorsport application.

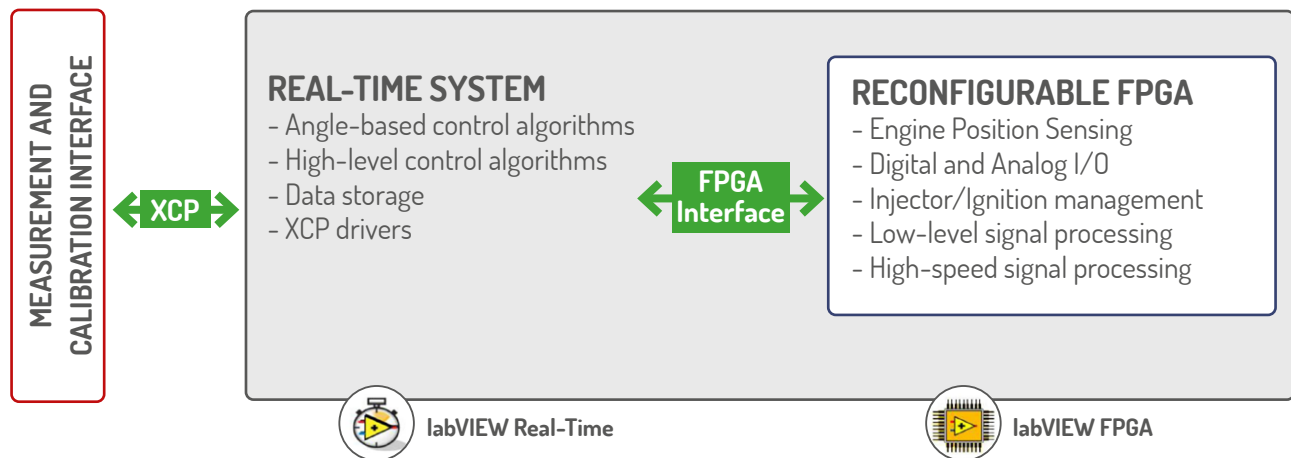
# Main features

A ready-to-use and fully accessible ECU will be provided, containing every single control strategy that has already been developed and successfully implemented both on the UniBo Formula SAE car or on other motorsport applications. The ECU software, both Real-Time and FPGA, will be **completely accessible and open**, so that you can read, edit or even replace everything you want.

Gasoline engines (both GDI or PFI) up to 8 cylinders can be controlled. Besides basic control functionalities,

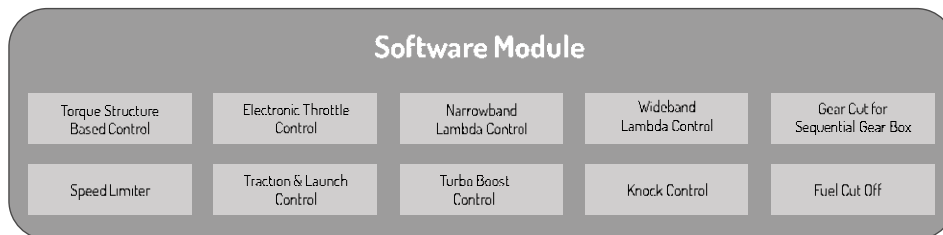
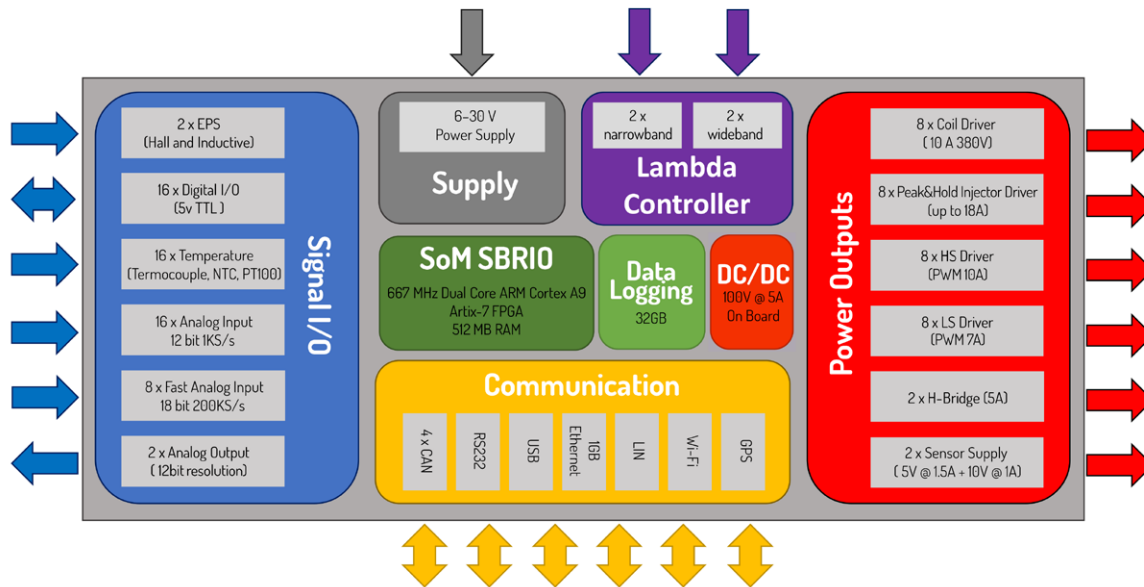
it features torque structure based control, electronic throttle control, lambda control, speed limiter, gear cut for sequential gear box, fuel cut off, traction control, launch control, turbo boost control, knock control.

Measurement and Calibration will be possible thanks to its compatibility with any commercial calibration tool (ETAS INCA®, Vector CANape®, ATI Vision®, etc.)\* via XCP on CAN and XCP on Ethernet.



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# Hardware description\*



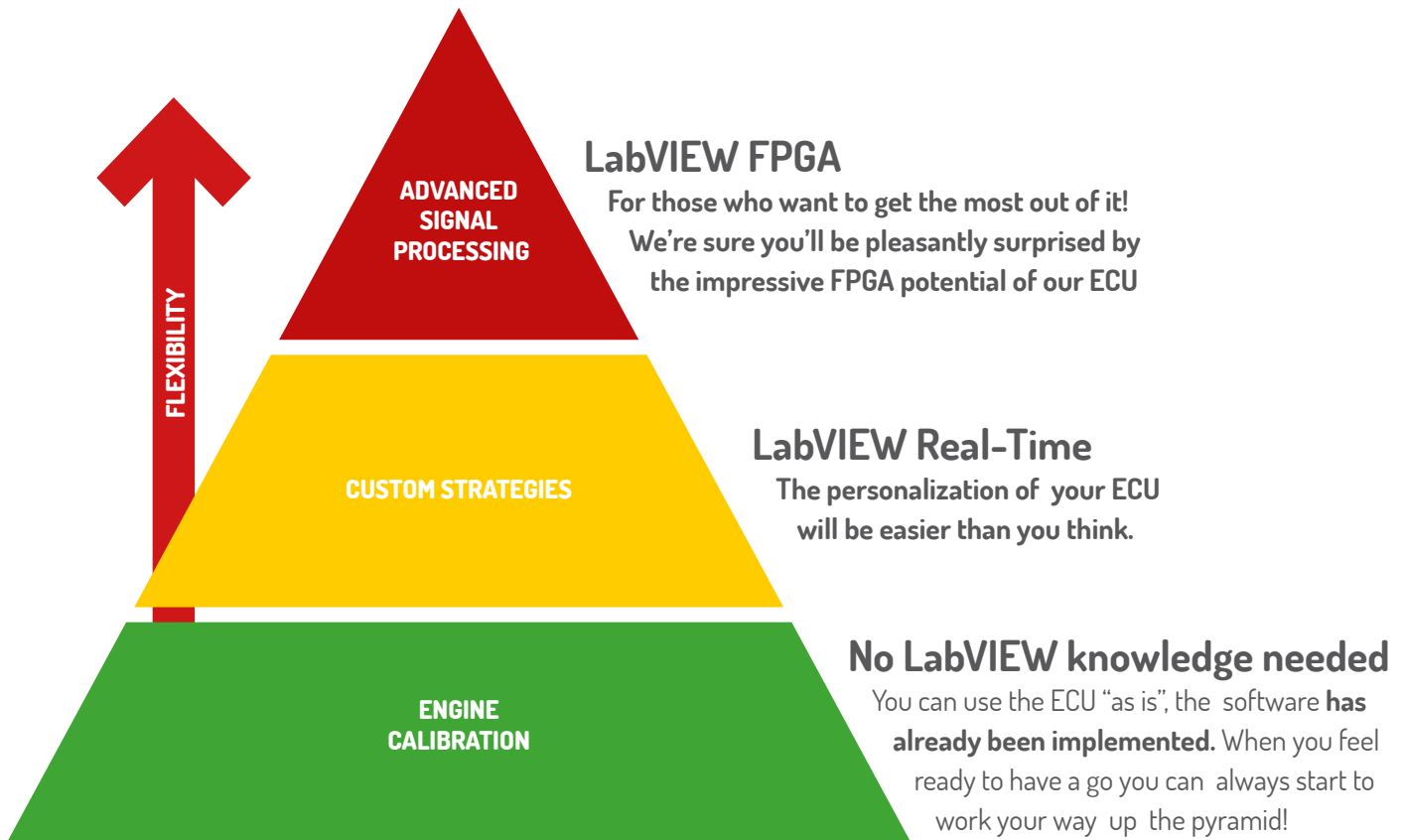
\*All specifications are subject to change without notice

SOM sbRIO



# Where do you see yourself in the “User Pyramid”?

It doesn't matter what category are you in, **as everyone will get the same ECU as well as the same software...** what use **you** make of it is up to you!



Specific training regarding LabVIEW, engine control, as well as support for engine calibration will be offered by Alma Automotive as a service.

# Alma Automotive & UniBo Motorsport

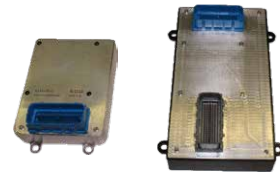
Alma Automotive and UniBo Motorsport have been proactively collaborating for 7 years now. It all started in 2010, when UniBo Motorsport took its first step in the Formula SAE series, with something that no Team had ever done before: an engine control software designed from scratch and implemented on a NI Compact RIO! From 2011 on UniBo Motorsport has developed its ECU year after year, until 2014, when the team developed a new ECU based on 2 NI Single-Board RIO, a reliable product with excellent

performance. Thanks to this new ECU, impressive results in the most challenging Formula SAE competitions have been achieved and remarkable feedback from technical judges from all over the world have been received. UniBo Motorsport will be the first team to test our Open Source ECU, which will finally debut in the 2017 Formula Student Season. The experience gained in these years led in 2017 to a new milestone: a new Spark is glittering!



**2010**

Team's debut and first Engine Control on Compact RIO



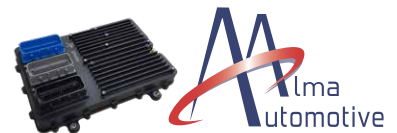
**2014**

Upgrade from Compact RIO to 2 Single-Board RIO



**2011**

Unibo Motorsport wins the NI award "**Most innovative use of an embedded system in the car**" at Formula Student UK in Silverstone.



**SPARK Project**

**2017**



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