

SUCCESS STORY



Photo credit: Thomas Meier

Driverless Car

The AMZ racing team from the ETH Zurich University decided to participate to the first «Formula Student Driverless» competition within Formula Student Germany. They chose the lightweight and small Ellipse2-N inertial navigation system for motion, equipment synchronization, and vehicle dynamic analysis.



CLIENT

AMZ racing (ETH Zurich University)

APPLICATION

Vehicle motion and trajectory

PRODUCT

Ellipse2-N Miniature Inertial Navigation System with GNSS

PROJECT

Motion, equipment synchronization, and vehicle dynamic analysis.

AMZ racing is a student organization based in Zürich which has been designing and building race cars since 2006. In 2010, AMZ decided to participate to the first formula student electric competition and take the challenge to switch from combustion to electric race cars. This year, and for the first time ever, Formula Student Germany introduced a driverless category, where race cars had to be adapted to drive without any human intervention.

AMZ decided to take the challenge again, and gathered a team and resources to make it happen. They prepared “flüela”, their car used for competition from 2015, to be driverless. They needed new sensors as well as a whole new software and computing system.

IMU AND GPS, CORE PARTS OF THE DRIVERLESS CAR

For the AMZ team, when designing a driverless vehicle, the IMU and the GPS are a core part of the sensor suite. As their car was already equipped with a standard IMU, they decided to upgrade it. The new IMU has to be as accurate as possible and it cannot fail since every single part depends on how accurate and reliable is that information. “We needed a rugged high-end Inertial Navigation System which would make the task of sensor fusion easier, with a LiDAR for example.” explains Miguel de la Iglesia Valls, team member. Lightweight and small, SBG Ellipse2-N is the most accurate of its category, and the easier to interface with, according to the AMZ

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Miguel De la Iglesia Valls, Member of the AMZ Racing team

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team. Indeed, the Ellipse2-N comes with a CAN BUS interface extensively documented, and a software to ease the integration.

ELLIPSE2-N, THE RUGGED MINIATURE INS/GNSS

The SBG Ellipse2-N offers a 0.1° Roll and Pitch, 0.5° GPS-based Heading and a meter-level GNSS position (GPS + GLONASS constellations in this case). “We were amazed by the quality of the gyroscopes. No one in our team neither in our university could believe the little drift we were experiencing” states Mr. De la Iglesia Valls. The team was also amazed by the quality of the output position data. The Ellipse2-N integrates a GNSS receiver and fuses inertial data and position information in real-time for a continuous trajectory even in case of GNSS outage. Additional algorithms have also been developed for land applications to improve even further the inertial sensor performance and robustness.

Robustness is one of those things that you only notice when it is not there. According to the AMZ team, it was a tough testing season with very hot days, extremely rainy days, a lot of vibrations, mounting, unmounting, plugging, unplugging. The sensor never failed. This reliability is also due to the extensive factory calibration. Every SBG inertial sensor is calibrated in dynamics and temperature; the Ellipse2-N gyroscopes, accelerometers and magnetometers bias are corrected and calibrated from -40° to 80°C for a constant behavior in every condition.

“We needed a rugged high-end Inertial Navigation System”

Mr. De la Iglesia Valls

AMZ RACING SUCCESS

For a bit more than half a year the AMZ racing team worked to be able to complete the three disciplines set for the driverless competition. These disciplines are acceleration, skidpad and trackdrive. The first one measures the ability of the car to accelerate fast, the second one to turn at steady state as fast as possible, and the last one consist in a race in an unknown track marked with cones which combines everything together.

AMZ racing managed to be first in skidpad and trackdrive, and second in acceleration. The overall event includes static disciplines in which the team also obtained good results: first in engineering design and cost, second in autonomous design and third in business plan presentation. The overall result was a clear victory in this first driverless competition.

■ AUTHORS

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AMZ reached the podium in each of the eight disciplines, and won five of them.

ELLIPSE2-N KEY FEATURES

- » Small & Lightweight (30 grams)
- » Embedded GNSS receiver
- » High Performance
- » IP68 Rugged Enclosure
- » CAN Connectivity



ABOUT AMZ RACING

Among other achievements, AMZ has been ranked first in the world formula student electric ranking in the years 2013, 2014, and 2015, and it looks like this year they may take the first position again. In June 2016, AMZ obtained the Guinness World Record for the fastest electric car to accelerate from 0-100 Km/h.

More Information:
<http://driverless.amzracing.ch/en/frontpage>