Low cost navigation system for unmanned aerial systems

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An EU-funded initiative has developed a low-cost positioning and navigation system for unmanned aerial systems (UASs). Utilising

multiple-antenna, the device is based on off-the-shelf components and advanced data fusion algorithms.

UASs have attracted growing interest for use in agriculture, public safety, smart cities, sustainable resource management, and many other areas. There is now a significant demand for an affordable, reliable system that can provide estimations of attitude and position for these devices.

The EU-funded Horizon 2020 GLAD-2 project addressed this need, developing a low-cost attitude determination and navigation system. This system computes low-level data received via a multi-antenna global navigation satellite system (GNSS).

The work involved in-depth analysis of algorithms, hardware and software re-design, exhaustive refinement and repeated in-field testing. "We created a low-cost platform that can be adapted to different user needs through careful selection and evaluation of commercial off-the-shelf components and implementation of advanced data fusion algorithms," says project coordinator Esther López of Spanish tech company ACORDE.

More is better

Researchers used the low-cost GNSS receivers, together with advanced data fusion with an inertial measurement unit, and barometer data to enhance the attitude and position of UASs in harsh GNSS environments. The system also avoided the use of magnetometers, making it immune to magnetic fields, and removing the need for system calibration when the magnetic environment is modified.

Engineers selected different GNSS antennas and measured their performance according to technical and economic criteria. A multi-

antenna approach enabled UASs to take accurate headings without suffering the usual problems inherent to magnetometers. "The use of multiple antennae will help to improve positioning, while the inclusion of a barometer will decrease recovery time in the event of GNSS signal outages," López explains.

Commercialisation of the system was conducted in parallel with the harmonisation of regulations in Europe thus fostering this niche market, particularly in magnetic interference sensitive applications. Regulation, market analysis and feedback from third parties helped to define requirements concerning electrical and mechanical constraints, interface definitions and software.

Cheap, accurate and reliable

The successful fusion of GNSS and inertial data enabled accurate and reliable navigation. According to López: "The inertial sensors provide an excellent dynamic response at very high data rates, while GNSS serves as an absolute reference to prevent drift. In addition, differential GNSS carrier phase measurements can be used to obtain great accuracy in orientation by using the multi-antenna configuration."

GLAD-2 successfully achieved the commercialisation of a low-cost navigation system based on sensor fusion and a multi-antenna platform. This culminated in the European Conformity (CE) certification mark following the corresponding certification process. The CE mark indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic area.

The final result is a highly competitive product aimed at the low-cost sector of the navigation systems market. "Due to its flexibility the system fulfils the needs of a wide range of users, not only in UASs, but also in terrestrial and maritime environments applications," López points

out.

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