About embedded sensors on robotic platforms, technical features

Stephane Normand, Karim Boudergui, Frédérick Carrel, Romain Coulon, Vladimir Kondrasovs, Jean-Michel Bourbotte, Romuald Woo, Guillaume Sannié and Gwenolé Corre

CEA, LIST, Laboratoire Capteurs et Architectures Electroniques, F-91191 Gif-sur-Yvette, France

Embedded intelligence on robotic platform is meanly induced by the use of many sensors that can produce information to the central command unit of the robot. Therefore, the larger the number of sensors is the clever the robot is. Both sensors and computation capabilities on board are the key for an optimum operational platform.

Using sensors on a mobile platform is not so easy to do. In fact, sensors should be hardened to take into account meanly vibrational or more generally environmental conditions (temperature, etc.). They should also be smart and low power consumption. These constraints lead to have in general large sensor which is non-sense for embedded system.

In the recent past, CEA LIST was involved in several robotic project for terrestrial robot (CSOSG ANR SRIP project) or underwater robot (FP7 UNCOSS project). For the first project, the mean goal was to develop a radiameter able to work even in the harsh environment of a mobile platform. The challenge was to deal with an embedded signal processing able to take into account signal induce on a standard sensor by the vibration environment. Here was only software approach because the sensor is a classical commercially available one. The FP7 UNCOSS project was focused on the mine searching in the Adriatic Sea. Therefore an active measurement system was developed meanly based on neutron interrogation system. The goal is here to generate neutron that could imping the potential mine, then we measure on line the gamma spectrum emitted by the system and then between time correlation and gamma spectrum analysis it is possible to distinguish bumb system from innocent system. CEA LIST designed a new acquisition setup able to be smart enough to be embedded on the robot and that can deal with the environmental condition of underwater system (especially heat exhaust, water, etc.). Which is fundamental in active measurement is the timing and here we will show that it was possible to manage down to 1.4 ns of time resolution, which is at the state of the art. More recently, CEA LIST is involved in the FUI SUISPEO which deals with an enhancement of radioactive material detection, especially using CdZnTe semiconductor detector for gamma spectrometry.

We proposed in this paper to show how the hardness approaches were conducted for the radiation detection sensors, both on the design of electronic and sensor and also based on signal processing that can be designed to deal with the environmental conditions.