M2 internship proposal

C. Lesire & J. Guiochet

- Title : Dependable task-level behaviors for autonomous systems
- Keywords : Task planning, autonomous system, drone, failure analysis, dependability
- Technologies : Skill-based planner, drone simulation, programming, python, ROS2, Gazebo
- Location : ONERA / LAAS-CNRS, Toulouse, France
- Level : M2
- Duration/Dates : 4-6 months, between January-October 2021.
- Student profile : Computer Science, Embedded systems (Robotics or dependability is a plus)
- Supervisors : Charles Lesire (ONERA), Jérémie Guiochet (LAAS-CNRS)
- Salary : env. 500€/month
- Application : please send cv + motivation + transcript (marks) of the last 2 university years, to charles.lesire@onera.fr, jeremie.guiochet@laas.fr
- Internship description :

  The development of decisional autonomous systems, like drones or mobile robots, now makes it possible to perform tasks without human supervision for extremely varied environments. However, the failures of these systems can have unacceptable consequences for the mission. These failures may appear at low functional level of the architecture of the system (e.g., sensors), but also at higher levels where decision are taken (e.g., task planner).

  When developing these systems, a major challenge is to define and carry out reaction strategies, to mitigate failures that may occur. This work is particularly complex, when some reaction strategies may be activated at different levels in the architecture. For instance, a reaction could be to switch to a degraded mode, which has an impact both on the functionalities and the decisions of the system. It is then complex to specify all required reactions, and provide guarantees about their consistencies.

  For this internship, we will focus on a two-layers architecture: a functional layer in ROS (managing all sensors, actuators, and basic control), and a decisional layer that uses a formal description of robot skills to program high-level behaviors. The objective of the internship is to analyse failure modes of both layers, their consequences, and possible reaction strategies, and identify how these two analyses can be related to make them consistent. The main outcome would be a method that can guarantee that chosen reaction strategies will be deployed on the architecture in a consistent way.

  This approach will be applied on a case study, consisting of a drone performing the mapping of a rescue area, in which several failures may occur (e.g., GPS failure, loss of communication with the pilot, or sensor failures). The complete software architecture (incl. ROS nodes, Skills models, high-level behaviors) can be deployed and tested on a simulator environment based on ROS2/Gazebo.