

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : DTIS-2026-68
(à rappeler dans toute correspondance)

Lieu : Toulouse

Département/Dir./Serv. : DTIS/SEAS/EDO

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DESCRIPTION DU STAGE

Thématique(s) : Robotique et Autonomie

Type de stage : Fin d'études bac+5 Master 2 Bac+2 à bac+4 Autres

Intitulé : Robustness of Multi-Robot Task Allocation Algorithms

Sujet :

Distributed coordination in Multi-Robot Systems is a key challenge when such systems are deployed in uncontrolled environments, for instance in search and rescue missions or long-term autonomous operations. In these contexts, multiple tasks must be efficiently allocated to robots, and frequently reallocated as the mission evolves or when unexpected hazards occur.

In order to tackle multi-robot task allocation, ONERA/DTIS researchers experiment methods based on Consensus-Based Bundle Algorithm (CBBA), a distributed task allocation method with both theoretical guarantees and good performances. In particular, the team in which the internship will take place has developed a variant based on the use of organizational models [1] which provides a representation of roles, groups, and responsibilities within the robot organization, and improved CBBA so that agents can represent groups when participating to the task allocation [2].

During this internship, the first objective will be to evaluate this variant, called Org-CBBA, and compare its benefits with other multi-robot task allocation methods. A particular focus will be made in considering real-world uncertainties, such as:

- robot failures or resource loss,
- communication disturbances in distributed networks,
- execution delays or planning errors,
- dynamic evolution of objectives (appearance, modification, or removal of tasks).

Following the results obtained in this evaluation, the second objective will be to propose variants of the Org-CBBA method to account for these uncertainties.

The intern will have to:

- Review the state of the art, and identify relevant benchmarks and evaluation metrics.
- Evaluate Org-CBBA through carefully designed test scenarios.
- Propose algorithmic extensions to improve fault tolerance and dynamic adaptation.
- Implement these contributions as Python/ROS modules, and evaluate them through simulations.

The student will be integrated within the SEAS (Safe, Embedded, and Autonomous Systems) team at ONERA/DTIS, alongside researchers and PhD students working on coordination, robotics, and autonomous systems. Depending on the results achieved during the internship, this work could lead to a publication in a robotics or multi-agent systems conference.

[1] Hübner, Jomi Fred, Jaime Simão Sichman and Olivier Boissier. "MOISE+: towards a structural, functional, and deontic model for MAS organization." *Adaptive Agents and Multi-Agent Systems* (2002).

[2] Guillet, Victor. "Extending Consensus-based Task Allocation Algorithms with Bid Intercession to Foster Mixed-Initiative." *Adaptive Agents and Multi-Agent Systems* (2025).

Est-il possible d'envisager un travail en binôme ? Non

Méthodes à mettre en oeuvre :

- | | |
|---------------------------------------------------------|----------------------------------------------------------|
| <input checked="" type="checkbox"/> Recherche théorique | <input type="checkbox"/> Travail de synthèse |
| <input checked="" type="checkbox"/> Recherche appliquée | <input type="checkbox"/> Travail de documentation |
| <input type="checkbox"/> Recherche expérimentale | <input type="checkbox"/> Participation à une réalisation |

Possibilité de prolongation en thèse : Oui

Durée du stage : Minimum : 5 mois Maximum : 5 mois

Période souhaitée :

PROFIL DU STAGIAIRE

Connaissances et niveau requis :

Algorithmique
Systèmes multi-agents
Robotique
Programmation

Ecoles ou établissements souhaités :

M2 ou écoles d'ingénieurs