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Cooperation: Adaptability of shared functions between Humans and Machines -Design and evaluation

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Sridath TULA

Human-Robot Cooperation: Agent's Cooperation Levels to Enhance Human-Robot Teaming

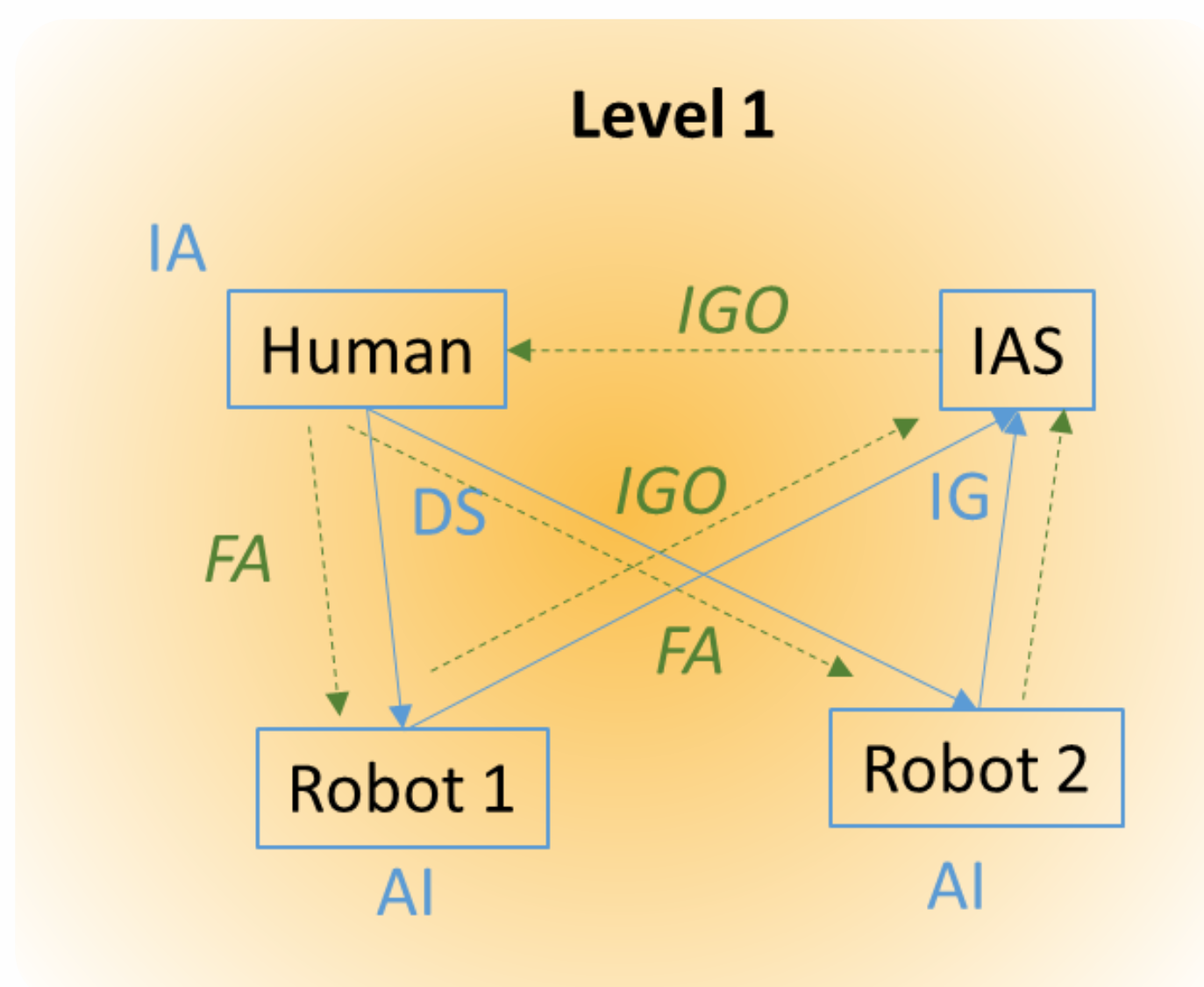
Supervisors: M-P. Pacaux-Lemoine, E. Grislin-Le Strugeon, P. E. Santos, A. Ma-Wyatt

Context:

- To Improve Human-Robot Cooperation in Crisis Management.

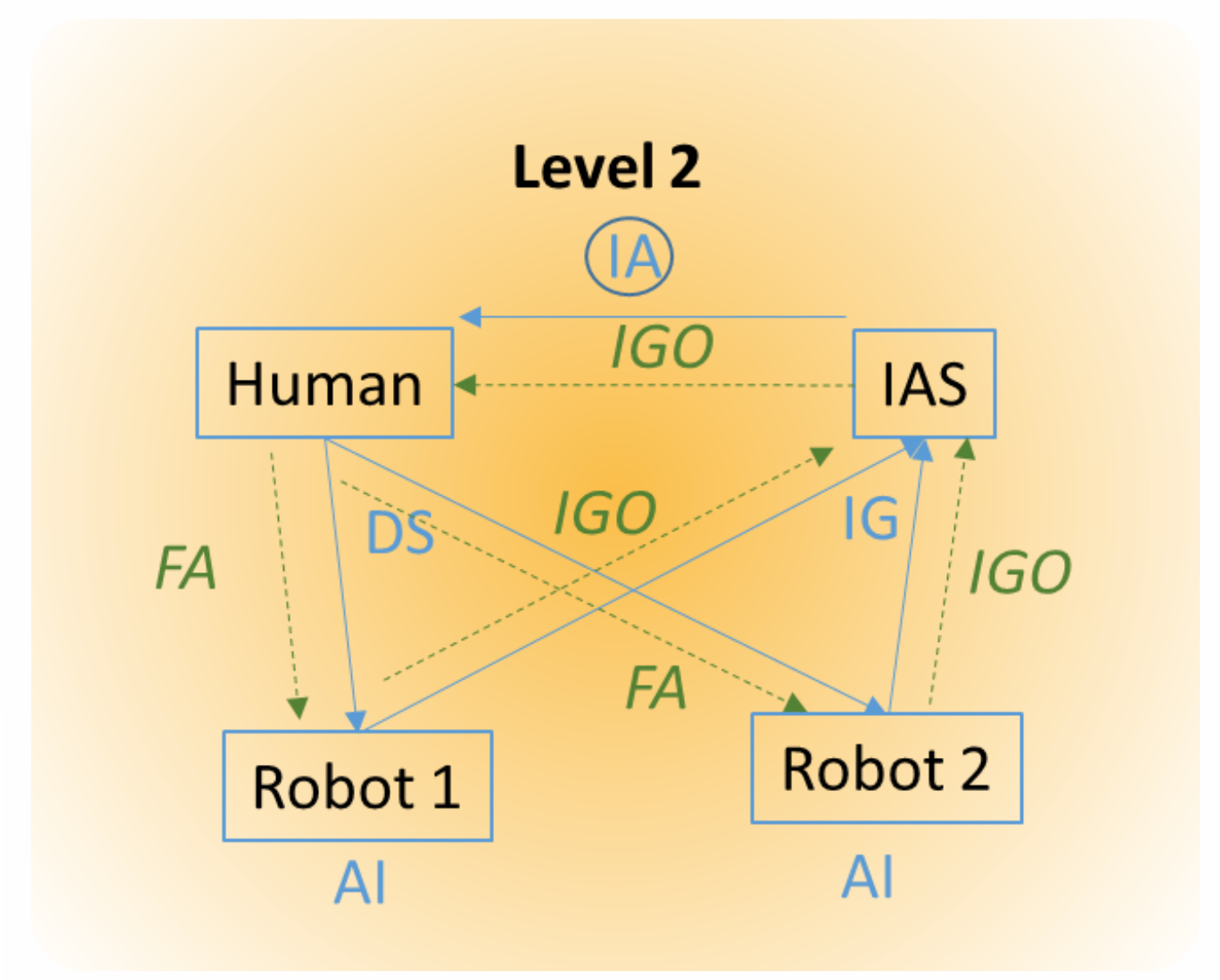
Objective:

- To make use of Human Machine cooperation model, Multi-Agent system approaches to define and adapt levels of cooperation to enhance Human-Robot Cooperation [2].



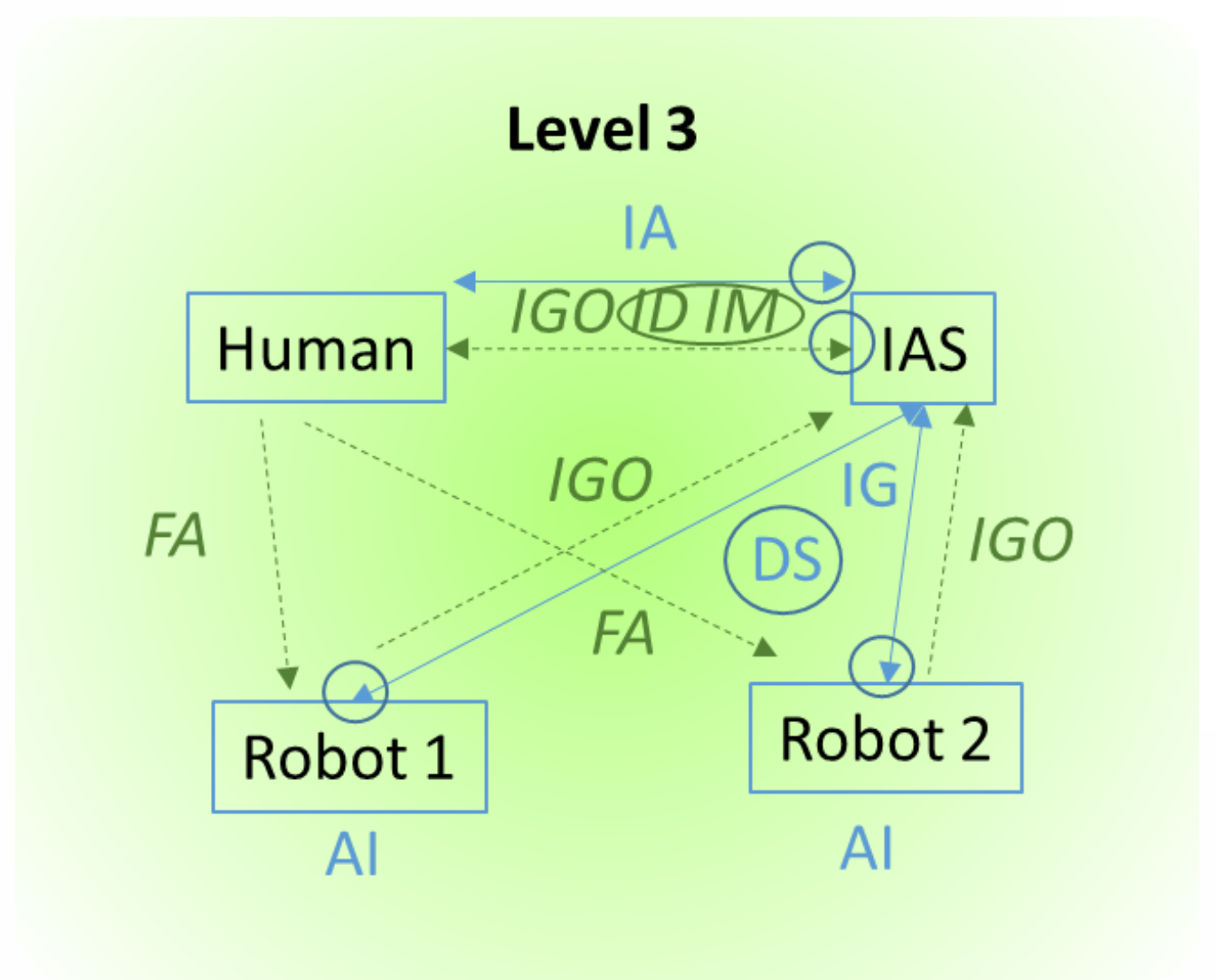
Level 1: Teleoperation

The Intelligent Assistance system (IAS) acts as an interface for teleoperation between the human and robots.



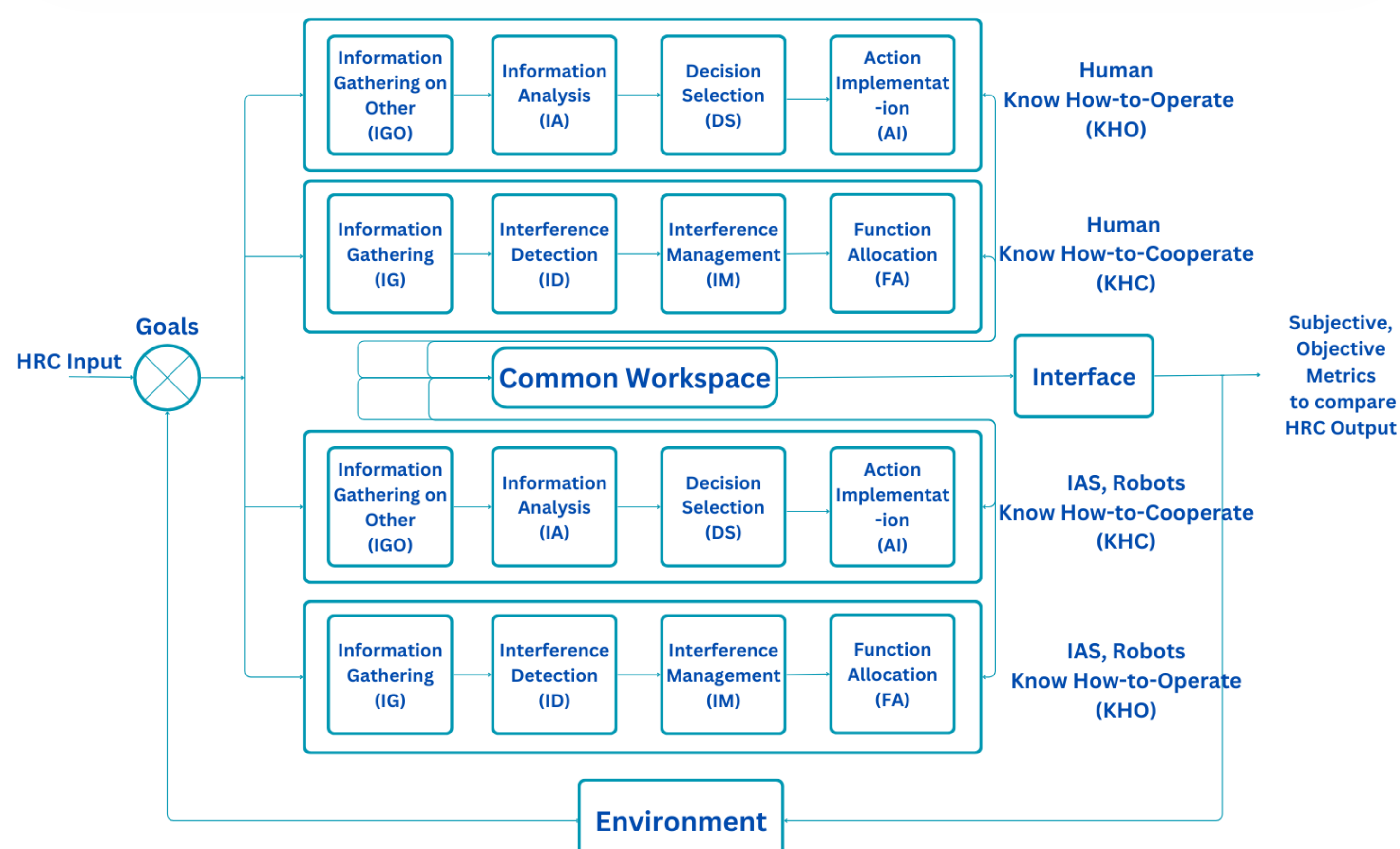
Level 2: Decision Support

IAS enhances the capabilities of the human operator by providing predefined strategies tailored to the task at hand.

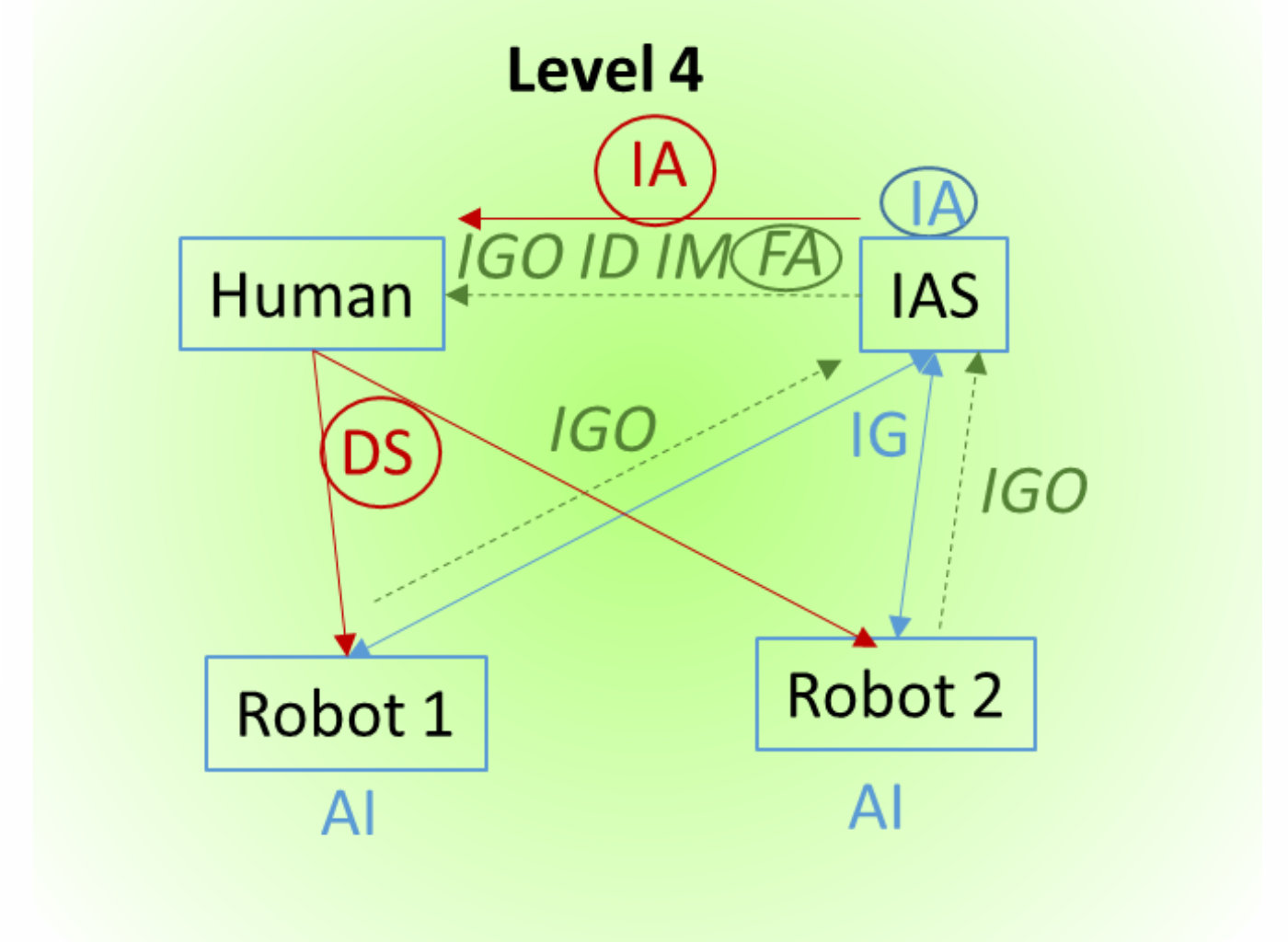
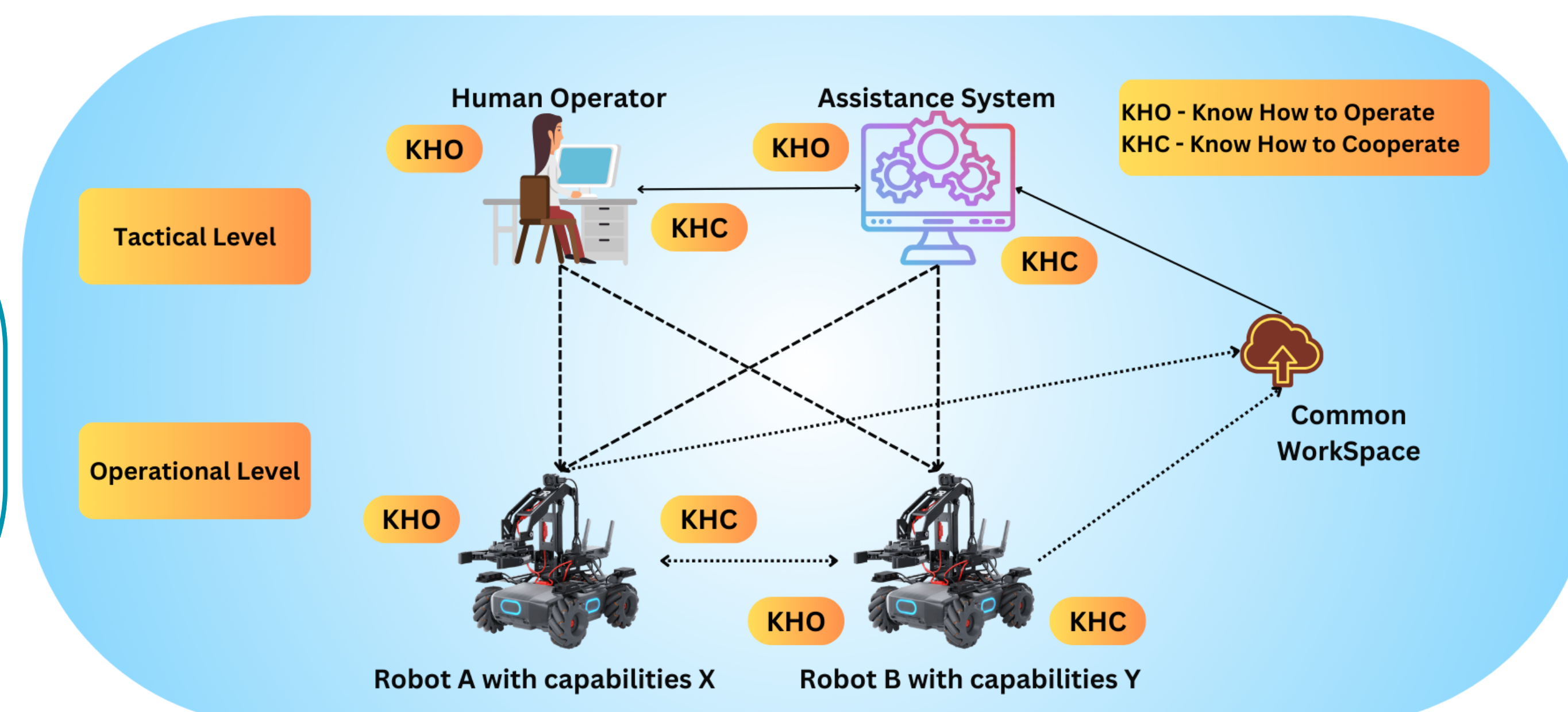


Level 3: Autonomous decision making

The IAS gains authority to make decisions autonomously among the predefined strategies.



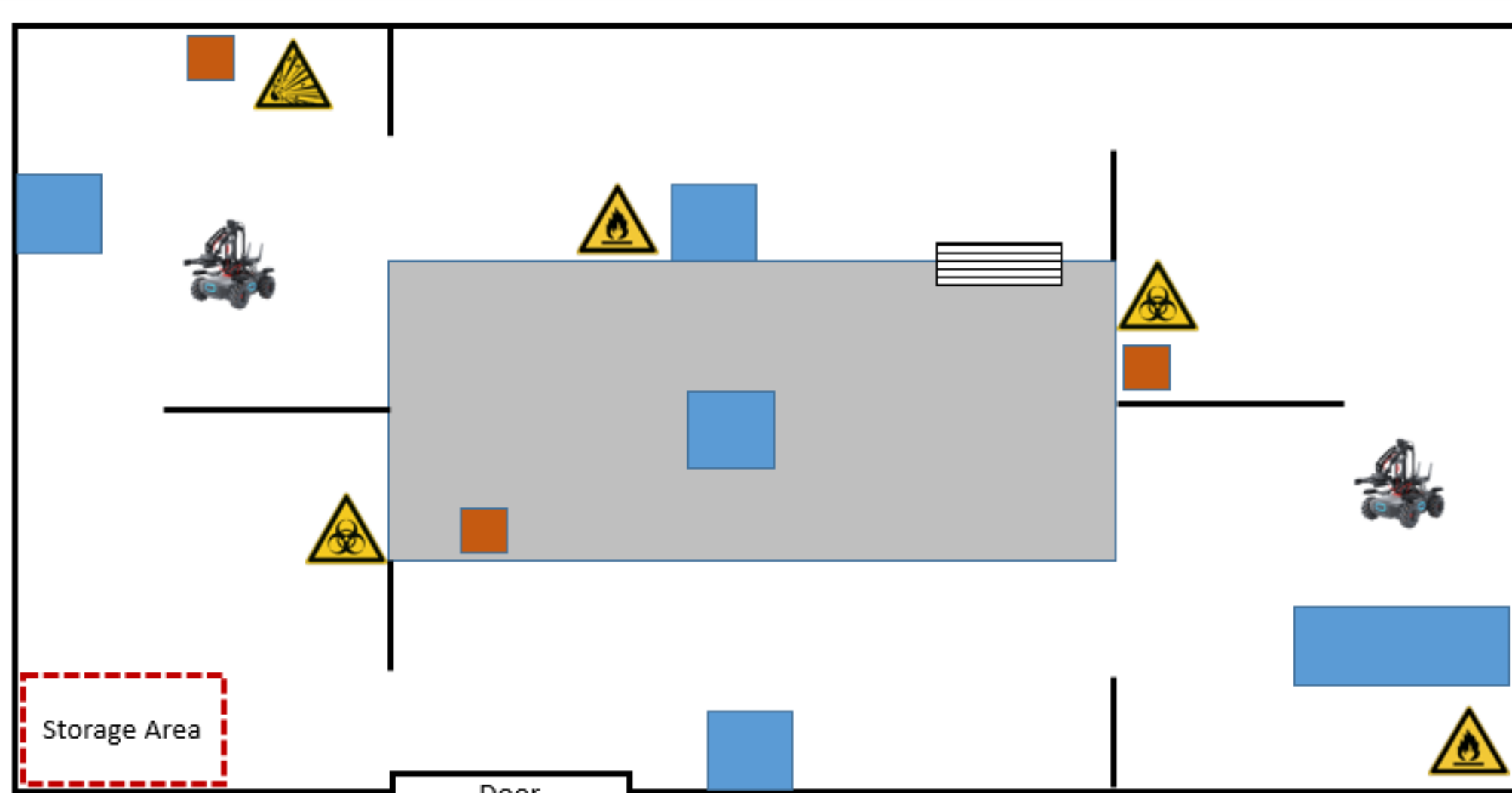
Organization of cooperation model [1]



Level 4: Supervised Autonomy

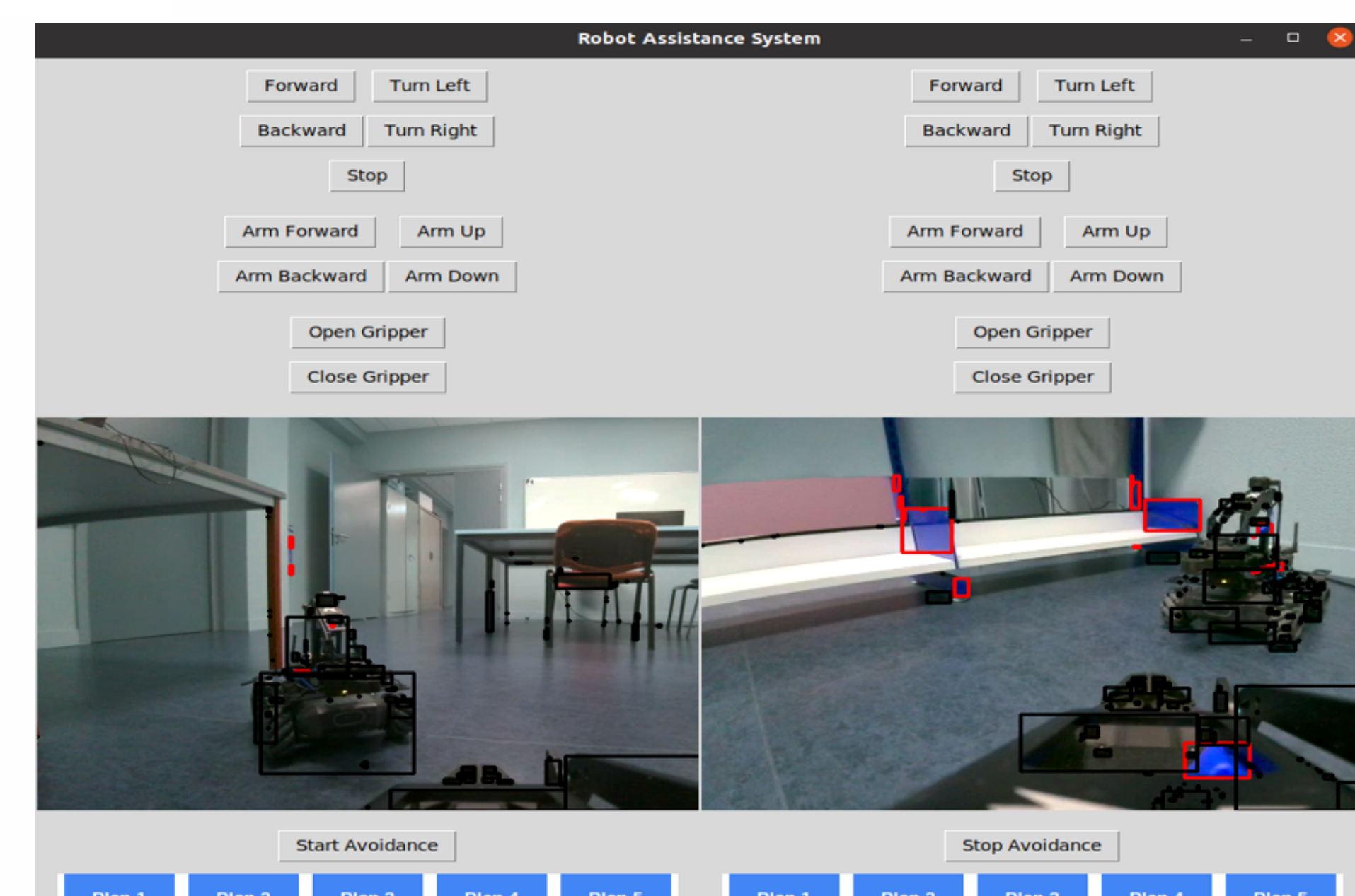
The IAS has the highest level of autonomy, assuming full control over the robots.

Experimental Setup:



Environment setup inside a room

- A fire accident situation in a controlled setting.
- The experimental setup aims to validate and evaluate the proposed cooperation levels.
- Among the cooperative tasks are pick-and-place tasks between two robots.



Human-Robot Interface

References:

- [1] Pacaux-Lemoine MP, Flemisch F. Layers of shared and cooperative control, assistance, and automation. *Cognition, Technology & Work*. 2019 Nov;21(4):579-91.
- [2] Pacaux-Lemoine MP, Vanderhaegen F. Towards levels of cooperation. In: *2013 IEEE International Conference on Systems, Man, and Cybernetics 2013* Oct 13 (pp. 291-296). IEEE.
- [3] Pacaux-Lemoine M.-P. (2020). Human-Machine Cooperation: Adaptability of shared functions between Humans and Machines - Design and evaluation aspects, Habilitation à Diriger des Recherches, Université Polytechnique Hauts-de-France, Valenciennes, France, August.

