

## End-to-end strategy for autonomous vehicle

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### Background information

**Profile:** Master student  
**Period:** 6 months  
**Salary:** 4,35 euros par hour  
**Place:** ENSISA, UHA, Mulhouse  
**Deadline:** Thanks to postulate before 10/01/2026

### Context

One of the principal research themes of the IRIMAS MIAM team concerns the development of advanced control strategies for autonomous vehicles operating in shared and dynamic environments. Within this context, decision-making constitutes a core component of autonomous driving. By integrating perception data—such as localization, object detection, and motion prediction—obtained from onboard sensors or inter-vehicle communication, the decision-making module is required to determine an appropriate maneuver for the current driving situation. This maneuver subsequently guides the generation of a feasible and safe trajectory, with final control instructions transmitted to the steering, acceleration, and braking actuators (see Figure 1). In conventional system architectures, these functionalities are organized in a sequential, pipeline-based structure. However, with the emergence of artificial intelligence methods, unified end-to-end architectures are increasingly being explored, wherein control commands are derived directly from raw sensor data [1].

Traditionally, two main learning paradigms have been employed for this purpose : imitation learning, based on demonstrations of human driving behavior [2], and reinforcement learning, which relies on trial-and-error optimization guided by reward functions [3,4]. The training process may utilize datasets derived from real-world driving scenarios or from high-fidelity simulators. Once trained, the resulting inference models must be validated within real-time system architectures. To support such requirements, heterogeneous computing platforms—encompassing CPUs, GPUs, and FPGAs—are increasingly adopted. However, these architectures introduce additional challenges related to reliability and fault tolerance [5].

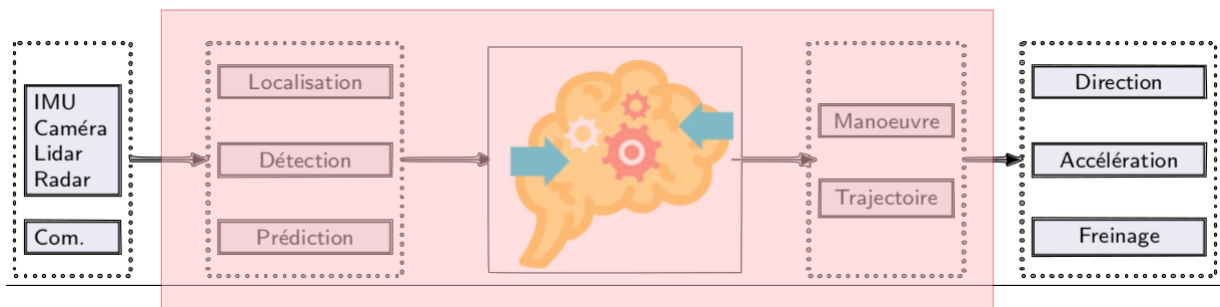


FIGURE 1 – End-to-end architecture

### Objectives

This internship is conducted within the framework of a national and international collaborative project dedicated to the development of a novel end-to-end autonomous driving architecture that can be adapted to the specific mission of the vehicle. The main objectives are as follows : (1) to analyze, through a comprehensive literature review, the advantages and limitations of existing end-to-end approaches ;

(2) to implement a selected method by interfacing it with the Carla simulation environment and the ROS2/Autoware middleware ; (3) to design a simulation framework enabling the training of all networks using data from the nuScenes database ; and (4) to test and validate the proposed method within the simulator. Ultimately, integration into a heterogeneous embedded system, followed by deployment on an experimental platform (see Figure 2), may be envisaged as a final stage of this work.

Trips to partner laboratories (France/Compiègne, Luxembourg/Luxembourg City, Canada/Waterloo) may be considered in order to benefit from technical expertise on the test platforms.



FIGURE 2 – IRIMAS Laboratory Test Platforms

**Keywords :** Autonomous vehicle, Artificial Intelligence, Neural Network, ROS

**Applicants are invited to submit their curriculum vitae, statement of purpose, and academic transcript(s) to the following contacts :**

## Contacts

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## References

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- [2] : S. Luo, H. Kasaei, and L. Schomaker, “Self-imitation learning by planning,” in Proc. IEEE Int. Conf. Robot. Automat., 2021, pp. 4823–4829.
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