Post-Doc. Proposal 2009-2010

Integrated Video/position/Force Feedback Tele-operation

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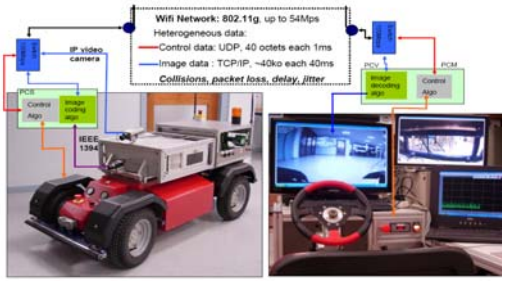
Scholarship/salary: 2250 (Brut) Euros (CARNOT), **Start:** Any time 2009, **Duration:** 10 months

Context. NeCS is a joint CNRS (GIPSA-lab)-INRIA team. The team is a bi-located at INRIA (Montbonnot) and at the GIPSA-lab (at the Grenoble campus).The team goal is to develop a new control framework for assessing problems raised by the consideration of communication and computation constraints in some applications like the tele-operation of vehicles considered here. NeCSCar is an electrical vehicle (scale 1/3) to be used as an experimental platform to study improvement of new control architectures. The vehicle is designed to be remotely tele-operated from our active steering wheel platform, ant it is equipped of a 3D vision system to provide the operator with stereo vision capabilities. Bilateral teleoperation are already in place, and are implemented using wheel contact torque measurements, feededback for force deflexion. Wireless connection allows us to test coding algorithms, resource sharing, and robustness against transmission delays.



Topic description. The objective of the proposal is to propose an integrated control approached for tele-operation including classical signals (like position, velocity and force), but also the video quality resulting from a particular image coding, and their impact in the driver acutance. In particular we wish to consider the following points:

1. **Image coding.** Select among some existing image coding algorithms some of the parameters that affect the quality of the image (quantization, optimal flow, deepness, etc.), and a suitable quality metric to be used in the particular context of the bilateral tele-operation. New notions of visual "transparency" need to be developed here including the subjective impact to the driver.
2. **Mathematic models of the Drivers.** Simple model as time-delays are some-time used to model the driver. Here we aim at devising new mathematic model that capture the relation between received image quality and driver action (i.e. optimal reactions, etc.)
3. **Adaptive coding and resource distribution.** The goal is to design new control scheme to share the resource allocation between images and position/force signals, but also to adaptively modify the vision coding parameters (defined in point 1) to ensure closed-loop stability and "visual/force" transparency.

Requested Work. The work will focus on the development of new control items described in points 1-3, and to implement/validate the control algorithms in our test bed NeCSCar. For the implementation, the candidate will receive technical support from our technical team.

Candidate profile. Applicants should have an Engineering degree with a specialization in Control Theory,. Knowledge on tele-operation will be welcomed. Application should be send electronically with a CV.