Report on the work for the application

Cloud-based Modelling and Optimization of the PHEV Controller Using Artificial Intelligence

(note: this version is reduced due to sensitive information not to be broadly distributed)

The proposal formulates a real time implementable energy management strategy (EMS) for plug-in hybrid electric vehicles (PHEV). Artificial intelligence (AI) techniques are employed for modelling and optimization of the PHEV control parameters to minimize vehicle energy consumption. Three different levels of system design will be considered: A primary physical model to generate the initial control rules, an upgrade of the rules using a hybrid rig and finally optimization of the control setting by communication between PHEVs and a central cloud. The control rules generated in the first step will be uploaded on a programable EMS. A wireless communication system is implemented between the EMS and a Cloud-based model. The system verification will be performed using a PHEV hardware-in-the-loop (HiL) system. Finally, in a real driving cycle the online calibration of a PHEV will be performed to validate the system for online optimization based on the cycle, traffic and driver pattern recognition. The proposal will cover Swedish automotive industry missions to bring traditional car manufacturing into a connected, sustainable and smart future.

Project objectives
1- To develop a full real-time model of the control system including PHEV model, EMS controller, providing communication ability between PHEVs and cloud-based model for remote optimization of control parameters (a hybrid system simulator).
2- To develop an on-board control system equipped with reinforcement learning to train in real-time and recognize the driver, cycle and environment behavior.
3- To develop a cloud-based optimization system involving dynamic multi-objective optimization.
4- To implement the initial control system on a HiL system, develop the vehicle connectivity with cloud-based model and finally demonstrate the EMS performance with different learning level in the real world.

Collaboration with Department of Computer Science and Engineering

Presentation at Volvo Cars Corporation (VCC):

Presentation at GTT:

Collaborations with Department of Electrical Engineering

WASP seminar

Upcoming updates

Attached to this email are the proposal draft based on FFI format and the presentation.