

University of Pennsylvania
Department of Electrical and Systems Engineering

ESE SENIOR DESIGN PROJECT - ADVISOR PROJECT SUBMISSION FORM

1. Project Title: **AutoPlug: Open Automotive Architecture for Plug-n-Play Services**

2. Proposer's Name: **Prof. Rahul Mangharam** **E-mail:** **rahulm@seas.upenn.edu**

Are you willing and able to serve as advisor for this project? Yes; No

3. Brief Project Description:

AutoPlug connects your car's on-board computer to 3rd party software modules and devices such as iPhones, gPhones, new sensors and actuators. We believe that the automobile of the future is a programmable vehicle with plug-n-play facilities for 3rd party devices and software modules. Vehicles will be extensible in both software functionality and pluggable hardware prosthetics. Plug-in services which communicate to and from the vehicle will allow new classes of services and customization such as on-line vehicle diagnostics, warranty management, networked infotainment, integration of mashable applications, and personalized insurance services.

For more details see <http://autoplug.org>

4. Project Design Objectives:

The current lifecycle of an automobile averages 8 years until the next major design overhaul. Vehicle electronics are subject to this technology adoption lag and therefore are dated, offer limited capabilities, and allow for very limited differentiation between vehicle models. The electronics included with each vehicle are therefore tightly integrated with the automotive unit and are not extensible over the lifetime of the vehicle. Thus in the common case of modern automobiles, the electronics and software services are 'frozen' for approximately 12 years (average of 6 years until major 'All But Platform' model re-design plus average of 6 years of vehicle usage).

Our vision is to facilitate Plug-n-Play services for both 3rd party hardware devices and software modules to make vehicles extensible, customizable and more integrated with evolving technology over the vehicle's lifetime. Owners will be able to enhance the current capabilities (e.g. engine performance, infotainment), add-on new functionality (e.g. new safety sensors, on-road diagnostics) and personalize their vehicle via an 'Auto AppStore' (a la Apple iTunes AppStore).

The AutoPlug platform will be developed during the semester in three steps. First, the hardware architecture and overlying software API will be constructed using the Gumstix Computer-On-Module and the XMPP instant-messaging protocol. The platform will interface with the car using a CAN Bus controller. Next, a software application for the iPhone will be created to interface with the AutoPlug platform. This application will be a vehicle diagnostics program and will show information about the car, vehicle warranty management, and insurance risk-reward analysis. Finally, the platform will be connected to and demonstrated on the Toyota Prius (from PhillyCarShare) vehicle.

5. Project Prerequisites:

What specific knowledge (e.g. courses or topics) and skills (e.g. programming languages or software packages) will this project require? Please rank order the knowledge and skills you have identified, with the most important at the top of the list.

The ideal candidates would have a strong willingness to learn, try new and unconventional approaches and cross the boundary between Electrical Engineering and Computer Science. A good grasp of C, no fear of programming and hardware design would be essential. You do not need to know everything mentioned above because then it will not be research © Knowledge of web protocols and programming (XMPP, MySQL, PHP, Python) will be a plus.