Data Collection from a Plug-in Hybrid Electric Vehicle
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Why Monitor the PHEV?
- Determine the effect the PHEV will have on the electrical grid for when there are many PHEVs actively running in the community
- Gather statistical data on the driving habits of the PHEV drivers, such as:
  - Where PHEVs are plugged in throughout the day (home, work, shopping malls, etc.)
  - Average distances driven, acceleration habits, etc.
- Determine fuel efficiency of PHEVs compared to regular motor vehicles in day-to-day driving
- Verify results from PHEV models, such as the Renewable Energy Vehicle Simulation (REVS)

How it Works:
- The stock battery of a 1995 Toyota Prius keeps a state of charge of about 60%
- Hymotion installed a Lithium-ion battery in the wheel well of the Prius; the Hymotion battery can be charged to 100% via an outlet installed in the back of the car and uses a regular 110V outlet

Devices Installed
There are three data logging devices currently installed in the Prius:

**Otto Driving Companion**
- Logs data from the CAN bus
- Time Stamp from an external atomic clock

**KVaser Memorator**
- Logs data from the CAN bus
- Time Stamp from an internal clock

**OttoLink**
- Logs data from the CAN bus
- Time Stamp from an external atomic clock

Some of the data from the CAN bus that can currently be interpreted includes:
- Hymotion Battery Current and Voltage
- State-of-charge (SOC) of the Prius battery
- SOC of the Hymotion battery
- Car Velocity
- Engine RPM
- Fuel intake
- Brake Position
- Battery Temperature
- Electric Motor Current and Voltage
- Throttle Position
- Individual front wheel rotation

GPS location data collected can be used to plot trips with Google Maps

Continuing Research
- System will be put in place to monitor power and power quality from the grid coming and going through the car using the OttoLink
- Deciphering more signals logged from the CAN bus
- Verifying results of REVS simulations which are run using duty cycle information collected from PHEV
- Design and optimize new configurations for PHEV, including modifications to the power flow through the batteries and frequency of engine use

Summary of Results
- The PERSENTECH Otto devices allow for convenient data set matching because of a common accurate time stamp
- Data from the CAN bus shows the Hymotion battery keeping the Prius stock battery at 60% charge

Optimized Results
- Experimental Duty Cycle Data
- Velocity
- SOC
- Engine Power
- Regenerative Braking