Design Projects for EE4OI4

September 2005

1. Telemetry System

Race Strategists are able to optimise the energy consumption and achieve maximum overall speed using information such as power usage/generation as well as immediate road speed and driver activities. In addition detailed real-time data could assist in locating a problem that needs attention. The telemetry system should transmit the information to the chase vehicle (minimum range of 50). This includes development of the receiving-end of the system (i.e. Radio receiver and a graphing/data-logging software running on a laptop)

2. Driver Interface System(DIS)

Displaying all the information the driver needs to know to operate the car efficiently. It has traditionally included Speed, battery voltage, motor current and solar panel output current. Ideally it should also display basic diagnostic messages from the motor controller.

3. Video Overlay Module

The vehicle uses an LCD display and a camera as its "rear-view mirror" system. It is ideal to overlay all the information from the Driver Interface System on the LCD display. The module should receive the information from the DIS and display them on top of the signal from the camera. (e.g. analog line from the camera and serial link from the DIS)

4. Battery Protection System(BPS)

The vehicle's battery pack is the combination of approximately 30 lithium-ion battery cells in series. This type of battery chemistry is sensitive to any over-range conditions and operating a battery cell beyond its limits is an immediate fire hazard. By the Regulations the car needs to have a Battery Protection System capable of monitoring each individual cell's voltage and current and only allow operation of the vehicle if the values are within the factory specified range. The system must by design fail in off-state and should be fault tolerant. (check the NASC Regulations at www.northamericansolarchallenge.org for more details about the system requirements)

5. Solar Panel Peak Power Point Tracker(PPT)

To efficiently interface the solar panels (with a possibly wide voltage range) to the battery pack. The circuit should maximise the power received from the solar cells by matching the impedance of the source, solar cells, and the load, the batteries. (e.g. connecting a 30V solar panel to a 100V system)

6. Motor Air-gap Adjustment System

Creating an electromechanical drive circuit to adjust the motor air gap. The air gap controls the motor torque vs. maximum RPM and it changes the efficiency at any given speed. It could be compared to the transmission in a normal car. The unit should reliably interface with the motor and adjust its air gap screw. If the air gap is closed too quickly at higher speeds, the back EMF of the motor would cause damage to the motor controller, as such a safety mechanism is desirable.

7. IV Tracer

The solar car uses about 480 solar cells. By ensuring that the cells of the same characteristics are grouped together the IV curve of each cell is needed. An IV Tracer finds the voltage versus current graph of a device and the fill factor of each cell. For solar cells a Tracer capable of maximum1V and 8Amp maximum is required. For solar car purposes having approximately 10 points on the graph would suffice.

8. Battery Energy Capacity Measuring Tool

Batteries of exact same type exhibit slightly different electrical characteristics. This difference is gravely aggravated with use. Matching the batteries according to their energy capacity would ensure a more "matched" battery pack and better energy storage capacity for the overall system. The tester should be able to drain a fully charged battery and integrate the output to find the total storage.

More information:

General information about the car:	www.solarcar.mcmaster.ca
Team email:	solarcar at mcmaster dot ca
More information about the design topics:	ahmada2 at mcmaster dot ca
The Races:	www.formulasun.org www.americansolarchallenge.org