16.810 **IAP 2007**
Engineering Design and Rapid Prototyping
January 10, 2007
Version 1.3, Deliverable A

Requirements and Interface Document
System: ___VDS AHPV____
Component or Subsystem: _____Hub Motor_____
Team Name: _____Web 2.0_____
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Team Member 2: ____Matt Peddie_____
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1. Component Description

VDS 2.0 needs a new hub motor designed. It's currently using a commercial motor from NGM that produces about 7 kW of power. They need one that meets similar high-efficiency standards but that produces a higher power. Building a hub motor that fits into the existing control and power infrastructure will make things easier for everyone, so we need to build a motor that still takes 3-phase DC power.

The hub motor should be powerful enough (i.e. provide enough torque) to drive the car on a road. It should be durable for long-term use and should contain any internal failures (electromagnetic or physical) in a way that is safe for the passenger and bystanders. It should also be reasonably cheap to manufacture, and it should be simple enough that we can construct it and test it (either ourselves or by getting external resources for manufacturing) by the end of the class. We need to essentially be able to simply replace the 7kW motor with this one without changing the design of the rest of the vehicle's subsystems (with the exception of the controller, which might need reprogramming based on layout differences).

2. Functional Requirements

1. The motor will deliver ten kilowatts of continuous power.
2. The motor will be more than ninety percent efficient at forty-five miles per hour.
3. The motor will sustain a driving speed greater than fifty miles per hour.
4. The motor will provide enough torque to accelerate a combined vehicle and load mass of one thousand pounds from zero to sixty miles per hour in at most fifteen seconds.
5. The motor will weigh less than thirty kilograms.

3. Constraints

1. The motor and enclosure must fit in between the wheel and the suspension arm and not interfere with the hole in the outer shell of the vehicle. The motor and its enclosure may not restrict the operation of the suspension arm.
2. The motor must not draw more power than the controller can supply.
3. The motor must not generate more torque than the suspension arm bolt hole can support.

4. Interface Definition

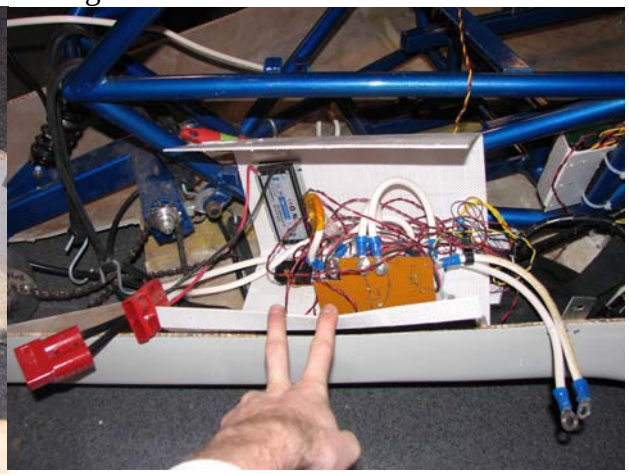
1. The hub motor must interface in a mechanically secure fashion with the wheel (Fig. 1) on one side, with a central axle hole and six evenly spaced holes arranged radially around it. Through the wheel it must interface with the suspension arm bolt hole and five radially spaced holes (Fig. 2). On the other side it must interface with the chain hub (Fig. 3) for the pedal drive via a 3.5" threaded column.
2. The hub motor must be controlled by the NGM EV-C200 motor controller (Fig. 4).
3. The hub motor must be powered by the solar/battery system.

Fig. 1: Wheel

Fig. 2: Suspension Arm

Fig. 3: Chain Hub

Fig. 4: Controller & Power Interface



5. Verification

1. The motor will be weighed.
2. The motor will be set up in a test stand and loaded and will have its power input and output measured (and its efficiency calculated).
3. The motor will be installed in the vehicle itself, the vehicle will be driven and the top speed and average acceleration will be measured (by speedometer and by stopwatch respectively).

Signatures ___Eric Conner_____
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