# CS 664 – Cornell University
# Spring 2008

## Assignment 2: Final Project Proposal

When: Tuesday April 8, 2008
What: Writeup of technical approach to final project.
Who: project teams of 2 people, possibly 3 for a larger scope project.

Note: Final projects will be due on Thursday May 15, 2008

In this assignment you will develop the initial technical approach for your final project, and research or implement enough of the approach in order to evaluate its efficacy for the project. You are to hand in a write-up describing your approach and the initial evaluation, and highlighting the key questions or issues that will be addressed in the project itself, based on this initial investigation.

There are four possible projects to choose from, all of which will use data from the Cornell Urban Challenge vehicle. For all of the projects, you are to take an approach that uses the imagery from the wide field of view camera in order to solve the problem. We will also provide other sources of data, including where the vehicle is in world coordinates at each time frame (pose), targets identified by radar, and clusters of lidar points. For the radar and lidar data, location relative to the vehicle will be provided in terms of range and bearing. While you may use this data as ground truth for validation or for learning-based approaches, your final method should operate solely on image data except as described below or by other previous arrangement with the instructor.

1. Lane finding – locate the boundaries of the lane that the vehicle is currently in, from immediately in front of the vehicle to as far ahead as is feasible given image resolution. Preferably use a non-linear model of the lane boundaries to capture curving of the road.

2. Visual odometry – determine how the vehicle is moving with respect to the ground based on visual data such as optical flow. Recent work at SRI has demonstrated accurate visual odometry for small off-road robots, which should make a good starting point.

3. Safe following distance – determine whether the vehicle should limit its speed due to the presence of another vehicle in front. At a minimum this would require determining the distance to the nearest vehicle in front, but ideally would include an estimate of the relative velocities of the two vehicles so that a safe following distance can be computed.

4. Monocular depth estimation – estimate a depth or disparity map from the monocular camera imagery. Doing this purely from visual data will be

challenging because unlike stereo the “baseline” between images is in the direction of the camera axis, and the images are taken at different times so that motion of the vehicle and in the scene must be taken into account. For this project, the vehicle pose data may be used as input in addition to the image data.