Cornell University's 2005 DARPA Grand Challenge Entry

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The 2005 DARPA Grand Challenge required teams to design and build autonomous off-road vehicles capable of handling harsh terrain at high speeds while following a loosely defined path. This paper discusses the critical subsystems of Cornell University's entry, an autonomous Spider Light Strike Vehicle. An attitude and position estimator is presented with modifications for specific problems associated with high-speed autonomous ground vehicles, including Global Positioning System signal loss and reacquisition. A novel terrain estimation algorithm is presented to combine attitude and position estimates with terrain sensors to generate a detailed elevation model. The elevation model is combined with a spline-based path planner in a sensing/action feedback loop to generate smooth, human-like paths that are consistent with vehicle dynamics. The performance of these subsystems is validated in a series of demonstrative experiments, along with an evaluation of the full system at the Grand Challenge. © 2006 Wiley Periodicals, Inc.

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