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Introduction: DARPA Urban Grand Challenge

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THE Urban Challenge is the third in a series of robotic grand challenges put on by the Defense Advanced Research Agency (DARPA). The grand challenges have the goal of developing robotic technologies that will reduce the number of warfighters operating in hazardous conditions and is in support of the government mandate that one-third of the military's vehicles be autonomous by 2015.

The first Grand Challenge was in March 2004 and was over a 142 mile course in the desert between Barstow, CA and Primm, NV. Fifteen vehicles made the final round, but none finished. The second Grand Challenge was in October 2005 and was over a similar 132 mile course. In this race four vehicles successfully completed the course with "Stanley" from Stanford University coming in first and winning the $2 million prize.

The Urban Challenge will test the ability of robots to operate safely and effectively in populated, busy areas. It will feature autonomous ground vehicles maneuvering in a mock city environment, simulating military supply missions and must negotiate the course along with approximately 50 human-driven vehicles. The robotic vehicles will have to complete a 60-mile course in less than six hours and must obey California traffic laws while merging into moving traffic, navigating traffic circles, negotiating busy intersections and avoiding obstacles.

The final event will take place on November 3, 2007 at the urban military training facility located on the former George Air Force Base in Victorville, Calif. The location has a network of urban roads and simulates the type of environment the military operates in when deployed overseas. The awards will be for $2 million, $1 million and $500,000 and will go to the top three finishers that complete the course within the six hour time limit. More information about the event is available at the DARPA web site at www.darpa.mil/grandchallenge.

This special issue has nine papers from entrants to the urban challenge. The first paper by Wooden et al. describes the Sting Racing Team's modular control architecture based on nested hybrid automata. The second paper by Crane et al. describe Team Gator Nation's solution to the challenge to the determination of pose, appropriate behavior mode, and the smooth transition of vehicle control between behavior modes. The third paper by Upcroft et al. of the Sydney-Berkeley Driving Team discusses their solution to denied GPS and their use of vision for localization. The fourth paper by Effertz describes the Team CarOLO approach for multi-target, multi-sensor data fusion based on an extended Kalman filter algorithm. The fifth paper by Yang et al. of TeamUCF discusses their real-time trajectory planning for their vehicle. The sixth paper by Herpin et al. discusses the steering controller of their CajunBot II. The seventh paper from Henrie and Wilde describe their approach to generating clothoid-based trajectories using constructive polylines. The eighth paper from Basarke et al. discusses their system and software engineering process for developing the intelligent autonomous software for Team CarOLO. The ninth paper from Johnson discusses the TeamNOVA approach for navigating in GPS denied areas using modified orienteering techniques.

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