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DARPA Challenge: Build Virtual Robots

Seven teams advance in robotics challenge, helping DARPA explore how virtual robots could improve disaster response.

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10 Breakthrough DARPA Technologies
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The Defense Advanced Research Project Agency (DARPA) is using its latest robotics challenge to test how virtual robots might respond to disasters and emergencies that would endanger human first responders.

The Virtual Robotics Challenge (VRC) represents another step forward in DARPA's efforts to develop new-generation technologies, and the first time the agency has focused on virtual robotics. This time, the aim is to find innovative software development teams adept at coding software that can direct a virtual robot through a series of qualifying tasks in a virtual environment that laid out obstacles in a simulated suburban setting.

"The robot must find a way to get into a utility vehicle and drive it, then how to locomote over muddy and uneven terrain, then how to pick up a firehose and attach it, then turn it on," said Dr. Gill Pratt, the program manager for the DRC, at a press briefing before the competition began. The teams ran each of the three scenarios five times, for 15 timed runs.

[DARPA shifts focus to keep up with budget constraints and new threats. Read more: DARPA: New Threats Demand New Technologies.]

To complicate the assignment -- but add a level of realism to the simulation since communications are often problematic at a disaster site -- the VRC set a round-trip latency on data communications between the teams and the virtual robot and played with the number of communications bits available per run, all the way from 900 megabits down to 60 megabits.

DARPA provided all teams access to the DRC Simulator, developed by the Open Source Robotics Foundation (OSRF). "This simulator runs in real time and does sophisticated tasks," Pratt said.

"This is the first time we're able to run a robot at tasks in a simulated environment," he said. The teams were required to develop software that would direct the virtual robot through the tasks. The performance characteristics of the virtual robot were based on the real-world performance capabilities of the Atlas robot, built by Boston Dynamics and modeled on its Petman humanoid robot platform.

Brian Gerkey, CEO of OSRF, said the simulation software platform aims to recreate as closely as possible the physics of the real world so that the software developed by the winning teams during the VRC can then be used in the next round of competition, when all the teams will be given a real robot to complete additional tasks.

"The software should transfer to a robot in the physical environment and translate into similar [performance]," Gerkey said. "So those who do well in the virtual challenge should be able to run their software almost unchanged on the physical robot."

The original plan was for the 26 qualifying teams in the VRC, drawn from eight countries, to compete for one of six slots in the next round of competition, where they would be provided their own Atlas robot and compete against other teams who are building their own robots.

Instead, nine teams were selected to move to the second round of competition, and ultimately seven will compete after some teams elected to join forces. The next round of trials is set for December and will involve physical execution of individual disaster response tasks.

The best-performing teams from the trials will receive funding to prepare for the DRC Finals in December 2014, when their robots will be faced with an "end-to-end" disaster scenario. The team that wins the final event will win a $2 million prize.

The nine finalists include:

1. Team IHMC, Institute for Human and Machine Cognition, Pensacola, Fla. (52 points)

2. WPI Robotics Engineering C Squad (WRECS), Worcester Polytechnic Institute, Worcester, Mass. (39 points)

3. MIT, Massachusetts Institute of Technology, Cambridge, Mass. (34 points)

4. Team TRACLabs, TRACLabs, Inc., Webster, Texas (30 points)

5. JPL/UCSB/Caltech, Jet Propulsion Laboratory, Pasadena, Calif. (29 points)

6. TORC, TORC/TU Darmstadt/Virginia Tech, Blacksburg, Va. (27 points)

7. Team K, Japan (25 points)

8. TROOPER, Lockheed Martin, Cherry Hill, N.J. (24 points)

9. Case Western University, Cleveland, Ohio (23 points)