HUBO ready for DARPA's Robotics Challenge trials (w/ Video)

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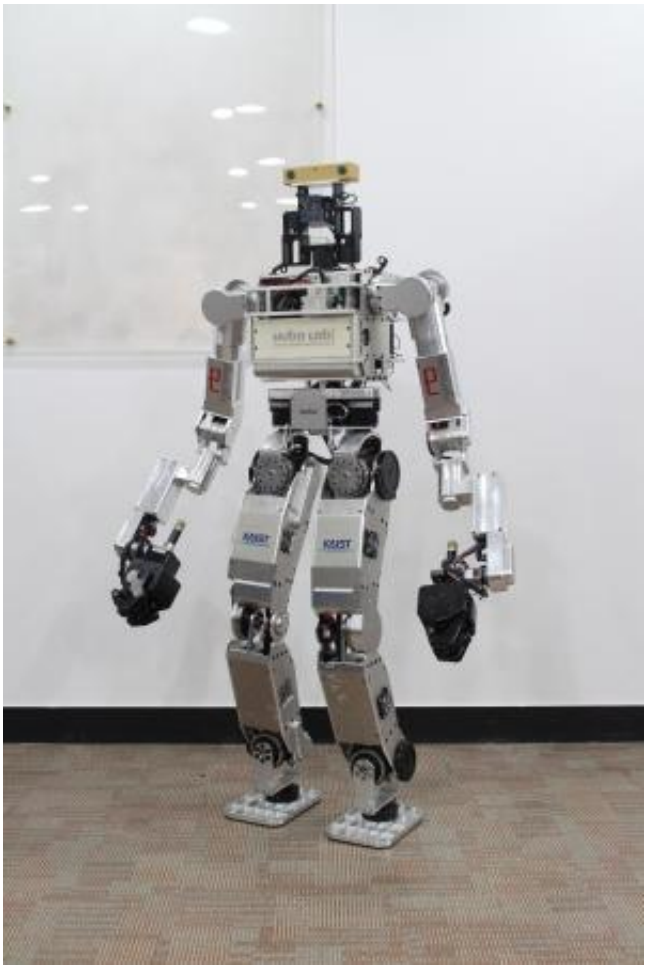

DRC-HUBO will compete at the DARPA's Robotics Challenge Trials to be held in December 2013. Credit: KAIST HUBO Lab & Rainbow Co.

The Humanoid Robot Research Center (HUBO Lab) at the Korea

Advanced Institute of Science and Technology (KAIST) and Rainbow Co., a spin-off venture company of the university, unveiled a new model of HUBO that will be entered in an international robotics competition scheduled later this year.

The competition is hosted and sponsored by the US Defense Advanced Research Projects Agency (DARPA), which is called the DARPA Robotics Challenge (DRC). Kicked off in October 2012, the DRC's goal is to spur the development of advanced robots that can assist humans in mitigating and recovering from future natural and man-made disasters.

KAIST's humanoid robot, HUBO, was originally created by Jun-Ho Oh, a distinguished professor of the Department of Mechanical Engineering, in 2004. Since then, the robot has gone through technological advancements, with the latest version of HUBO II released in 2012. So far, 12 HUBOs have been exported for further studies in robotics to universities, research institutes, and private companies in the US, China, and Singapore.

In tandem with Rainbow Co., Professor Oh and his research team recently developed DRC-HUBO, which will compete as Team DRC-HUBO led by Drexel University at the DRC trials to be held in December 2013. Team DRC-HUBO is consisted of KAIST and nine US institutions.

DRC-HUBO can switch from bipedal to quadrupedal walking, which provides the robot with greater stability to walk on uneven terrain or to climb up a hill. Credit: KAIST HUBO Lab & Rainbow Co.

DRC-HUBO is designed to perform difficult but essential activities required when responding to disaster scenes. The robot will have to fulfill eight tasks assigned by the DRC at the upcoming event such as driving a utility vehicle, walking across rough terrain, climbing a ladder, and using hand tools.

Unlike the previous models of HUBO, DRC-HUBO boasts several distinctive, enhanced features. Chief among them is the way the robot

interacts with the external environment. Without complex sensors installed throughout the body, DRC-HUBO can control each joint of the arms and legs in compliance with the dynamics dictated by the external environment.

For example, when DRC-HUBO is faced with a rock falling from above while climbing up a ladder, the robot's arms and legs naturally give in to the force of external changes. Accordingly, as the robot dodges the rock, its body and joints smoothly sway to absorb shock so that the fingers can keep a tight grip on the ladder, and the feet are planted firmly on the rail of the ladder, not losing balance.

In addition, DRC-HUBO can switch from bipedal to quadrupedal walking and vice versa. This provides the robot with greater stability to walk on uneven terrain or to climb up a hill. The robot's arms and legs are elongated to better meet the challenges demanded by the DRC competition. DRC-HUBO's two arms swing back and forth to form legs when necessary, thereby walking freely backwards and forwards.

The robot has gotten stronger grip as well. The right hand has four fingers (with one triggering finger that operates independently from the other three fingers), and the left hand has three fingers. All three fingers on both hands are actuated synchronously for gripping. The fingers are sophisticated enough to steer the wheel of a vehicle or grab a ladder to climb up, and strong enough to hold 15 lbs in one hand.

"With a full 34 degrees of freedom (DOF), DRC-HUBO stands 4.7 ft tall and weighs 120 lbs. All in all, the robot has been improved and extensively refurbished from the past models of HUBOs to compete at the DRC Trials. It has better vision and coordination. The legs and arms have become stronger," said Professor Oh.

"Although the robot is still a prototype, it has important capabilities that

can be utilized in advancing humanoid robots in general. One example is the way its arms can be used as extra legs to support the robot's body, offering more flexibility in providing aid to humans."

Provided by The Korea Advanced Institute of Science and Technology (KAIST)

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