ITHACA TIMES, JULY 28, 2010

CORNELL UNIVERSITY...

Walking robot logs 14.3 miles in 10-plus hours to edges Boston's BigDog for mileage record

After 10 years of cumulative research and multiple designs, with 65,285 steps taking 10 hours 40 minutes and 48 seconds, the new bipedal walking robot record has been set at 14.3 miles. Ranger, named after the famous TV show, "Walker, Texas Ranger," the four-legged biped robot, strutted around the Barton Hall track at 1.34 mph, or about half the speed of an average human walking pace.

"It's like walking with a small child," said Jason Cortell, one of the leading researchers on the team.

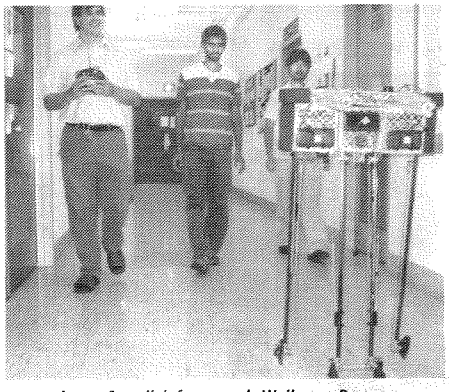
The goal of this design for the team was efficiency, using the least amount of energy to get the most amount of work done. Ranger has succeeded in setting some fairly high standards in efficiency using only 256 watt-hours during the almost 11-hour trek. The over half a marathon distance was covered with only a single charge of its batteries and the robot was never touched by a human during the journey. According to Professor Andy Ruina's Web site, and to put efficiency in another context, the "ranger took about 20,000 steps, over three miles, for each penny worth of electricity it used."

Monday July 5 at 2:08 p.m. the regular scheduled field test began with average hopes of success as the team has stood on the track before ready at any moment to note the errors about to arise and then return to the lab to adjust the "bot" necessarily. However, on this occasion the errors did not arise. The Ranger continued walking with no slip ups. The sensors functioned properly and responded to controller requests when asked to.

There isn't much control available within the robot as it only has three joints, the three joints include a hip joint and two ankle joints. There are no knees joints by design.

"Knees add an extra degree of complexity," Cortel said.

Knees are mostly used for walking up and down slopes or traversing stairs, which the Ranger is not being asked to do. The ankle joints propel it forward with spring-like action similar to an Achilles tendon. The hip joint simply allows the legs to move back and forth when moving like pendulum. There is one more pseudo joint which allows for a slight torque around the "hip" area which, when directed, helps the Ranger turn on wide angles.



Jason Cortell, left, controls Walker as Pranav Bhounsule, and Izping Yuan accompany the trip. (Photo by James Cosgrave)

The Ranger has a fairly long ancestry dating back to first human bipedalism and then to passive walking machines that use gravity as a power source to walk down hill. The initial development can be traced back to a simple child's toy created in 1938. "Wilson's walkie" uses two legs that counter balance each other as they swing back to front to propel the machine forward down a slope. This design inspired aeronautical engineer Tad McGeer from 1988-1992; McGeer went on to make a larger design using four legs to propel the machine more efficiently, allowing for very human like movement.

The concept in the Cornell lab was furthered to incorporate a more a few more joints and electrical power to substitute gravity power, making the machine no longer passive. The Ranger is the third working robot the Cornell team has developed. The Ranger itself has had three different "brains" with the current brain the most successful.

The first "brain" had one micro controller and limited sensors, the second "brain" had four micro controllers and an IMU, internal measurement unit, the third "brain" has eight micro controllers plus the IMU.

The sensors are basically the "nervous system" of the robot which tells it where it is in space to make the necessary adjustments in order to keep moving forward. The IMU provides the information of how fast the legs are moving in relation to each other to keep a steady pace and at what angle the legs are moving. The ranger can only move forward and cannot stand still by itself. The team has hopes for future robots to allow for back and forth movement t as well as more stability at the same time not needing more energy keeping the efficiency rate high.

Graduate student for the project Pranav Bhounsule is writing his PhD thesis on the question whether or not bipedal robots can be more efficient and have more working parts, or is there a trade-off at some point where one aspect must be compromised.

Competing team, Boston Dynamics, which held the record last year, according to the Cornell research team "is taking on the concept of bipedal robots from the other direction."

Their BigDog robot recently walked unassisted for 12.8 miles, but is gasoline powered and is more geared towards capability, what can be accomplished, while taking the concept of energy use out of the equation.

"We use mechanics ideas to study human and robotic motion — locomotion in particular," stated Ruina's Web site about the purpose of the National Science Foundation-funded research. "We hope that our work can help diagnosis and rehabilitation of people with movement disorders, robotic control, the understanding of coordination in general and, indirectly, engineering education."

For more information about the project, visit www.ruina.tam.cornell.edu. ■

— JAMES COSGRAVE