

The Ranger Robot

Within a crowd of students and faculty walking an “ultra” marathon in Barton Hall on Cornell’s main campus is a stick figure a little over three feet tall – a robot. After 307 laps, the crowd on the indoor track has dwindled to a handful of enthusiasts -- and the “Cornell Ranger.” Finally, voltage seeps away and Ranger’s walk comes to a triumphant end. The robot has just walked some 186,000 steps non-stop, covering a distance of about 40 miles, setting a new robot walking record.

For the past five years, 60 Cornell undergraduate and graduate students and post-docs, as well as visiting students from Delft University in the Netherlands, have been developing and improving Cornell Ranger under the direction of Prof. Andy Ruina of the Sibley School of Mechanical and Aerospace Engineering (MAE).

Other robots typically are either energy efficient but fall down, or robust but energy greedy. The challenge is to achieve robustness and reliability without sacrificing energy efficiency. Hence the Cornell team’s delight with Ranger’s performance in the May 2011 marathon: it is a triumph of robustness – the robot did not fall down; reliability – the robot went the distance; and energy efficiency – the robot used only 5 cents worth of electricity.

A key player on the Ranger robot team is MAE Ph.D. student Pranav A. Bhounsule who has been developing, testing, and debugging walking algorithms. Says Pranav, “Ranger is at least an order of magnitude; more energy-efficient than present walking robots. Unlike other walking robots that control every joint at every instance of time, Ranger uses its momentum to walk. Every once in a while,

the Ranger’s computer brains tell the motors to push the legs here and there rather than trying to force them to move in un-natural ways.”

Pranav is a graduate of the Indian Institute of Technology and started his Ph.D. program in the Theoretical and Applied Mechanics Field at Cornell five years ago. He chose Cornell over other graduate programs not only because it offered him a fellowship but because of the opportunity to switch fields from solid mechanics to dynamics and controls.

Pranav says of his time at Cornell, “It’s been very challenging.” He has been funded in part by a fellowship, a research assistantship, and various teaching assistantships. He says teaching preparation often competes with research time. And the research project itself has been very demanding.

Pranav emphasizes that it has been a team project, singling out lab manager Jason Cortell (ME ‘97) who oversaw project management, designed the mechanical and electrical hardware, and wrote substantial micro-controller codes.

Pranav will complete his Ph.D. program in a few months and has started a job hunt in industry. His work on the Ranger project should make him particularly marketable

because of its contribution to the understanding of how humans walk. Among the practical applications of his work could include better prosthetics thanks to improved ability to control devices.

With a stellar educational foundation from India and his Cornell Ph.D., Pranav is also considering a career in academia, which may well mean his next step is a research post doc.

