Rice team talks the walk

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The team of Rice University seniors Jon Stanley, Ashley Hill and Laura Leim developed the Trek Tracker, a high-tech video camera on a trolley that automates the process of videotaping a patient's gait, from the perfect angle, while the patient walks. Credit: Jeff Fitlow/Rice University

Walk this way and a camera-carrying robot will follow. That sounds simple until you get into the details.

Fortunately, Steven Irby, an engineer in the Motion Analysis Lab at Shriners Hospital for Children in Houston, knew just where to look for someone who could handle those details.

Irby turned to engineering students at Rice University who routinely tackle such challenges for their senior design projects. In this case, they're also supporting the noble goal, outlined in Rice's Vision for the Second Century, to contribute to the community beyond the Houston campus.

The team of Rice seniors Jon Stanley, Ashley Hill and Laura Leim delivered the Trek Tracker, a high-tech video camera on a trolley that automates the process of videotaping a patient's gait, from the perfect angle, while the patient walks.

Stanley, an electrical engineering major, described the system as a 24-foot-long printer mechanism with a camera. The computer-controlled Trek Tracker is smart enough to follow a moving patient step-by-step by keying in on one saturated color.

The team demonstrated the device, developed over the past nine months at Rice's Oshman Engineering Design Kitchen, at the Brown School of Engineering Design Showcase at Rice Memorial Center's Grand Hall a few weeks ago. When Hill donned a bright red jacket and started strolling, the camera, mounted 7 feet high and about 10 feet away on a track parallel to her path, rolled right along with her as it downloaded video to the computer controller.

It was a compelling demonstration that won the team the $5,000 grand prize (aka the Kellogg Brown & Root Design Excellence Award), and the $500 Faculty and Staff Choice Award. (A complete list of winners is available here.)

"This will give our clinicians better video documentation for analyzing the gait of our kids," said Irby, who had been thinking about a video trolley for gait analysis to replace a hand-operated, tripod-based system that doesn't approach the Trek Tracker's accuracy.

"The analysis we do breaks down human motion into three basic planes," Irby said: coronal (straight-on), sagittal (side) and transverse (top-down). The sagittal plane is "where the big motions occur when you're walking. Your legs swing forward and back in that plane. That's what we spend most of our time looking at, because that's where most of the action is."

He had enough confidence in the students that three weeks into the design process he invited them to present their ideas to his board of directors with a demonstration system they built out of borrowed components and Lego blocks. "They were hooked right away," he said of his superiors.

Hill, a mechanical engineering major, said the project appealed to her immediately when she and her teammates were presented with a list of possibilities last fall. "It seemed kind of cool, and it had a purpose behind it," she said.

"It had a mixture of electrical and mechanical engineering," said Stanley, who also designed the control software. "I like robots and things, and this gave me an opportunity to do everything, instead of being limited to one specific field."

The camera rests on a trolley that, like the print head on a standard ink-jet printer, rides along a platform hooked to an embedded motor-driven cable. Rollerblade wheels keep it quiet.

That was one goal. Hill said the first of several prototypes was very noisy. "A lot of metal on metal," she said. "Things we wanted to roll weren't rolling. They were sliding."

Key to the system's success was the decision to use image saturation as the target. Stanley can be seen on the team's YouTube videos holding an orange Nerf football for the camera to lock onto. "It prefers to track bold colors, like cherry red, bold blue, orange - things like that," he said. "We could have tracked other parameters, like layers or hue, but we found that tracking saturation level took the least amount of time. That was important, because we only had 33 milliseconds per frame to process all the information in real time."

Irby said his lab typically looks at children with cerebral palsy, and the Trek Tracker will be invaluable. "Video in general is used for three purposes," he said. "The first is simple documentation. The second is education of the residents and families. A doctor can show the recordings from two years ago and from a recent visit and say, 'Okay, this is what Joey looked like then, and this is what he looks like today.'

"The third use for video is as a quality-assurance tool," he said. "Video is the gold standard for confirming patient ID and basic gait characteristics."

Gary Woods, a Rice professor in the practice in computer technology and electrical and computer engineering and faculty adviser to the team, said Team Trek Tracker executed well from the outset. "Expectations were set high back in October when the team presented its original prototype to the Shriners board," he said. "The team has justified our high level of confidence. It's a rare senior project that succeeds well enough to be installed in a hospital."

Provided by Rice University

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