Students produce energy from movement of leg brace

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The energy-harvesting device invented by Rice University students amplifies the motion of a knee as it bends. Credit: Jeff Fitlow

Rice University engineering students have created an energy-generating knee brace that they hope may someday help power artificial hearts.

The device is a modified medical brace that generates power with every bend of the knee. The electricity produced by a motor attached to the

joint of the brace is funneled into a battery, but someday may go straight back into one's body.

The brace produces 4 watts of energy as the wearer walks and feeds it to a lithium-ion battery pack.

That's not quite enough power for the artificial heart being developed by the students' sponsors, Omar Kabir and John Bartos of Houston company Cameron International, which brought the energy-harvesting project to Rice. But the team collectively known as Farmers, the third to take on the multiyear project that started with a shoe-based generator, has pushed the technology significantly forward.

"We added a power conversion and storage system that was not present in the device at the beginning of this year," said Hutson Chilton, a bioengineering major who also studies sustainability issues. "So we're getting about the same power output, but we're also able to convert it to direct current and store that into something useful."

She was joined by an electrical engineering major, Taylor Vaughn, and three mechanical engineering majors, Adrian Bizzaro, Sean LaBaw and Chase Gensheimer. LaBaw is a junior; the others are seniors.

The brace is comfortable enough to wear for long periods, said Gensheimer, who has done most of the road testing, including stretches on a treadmill. "We had a previous design to build on, but we tried to make it lighter and easier to wear and move in."

"We went through a very long process to get where we are today," Vaughn added.

LaBaw said it was a challenge to reduce the mechanism and its casing to reasonable proportions while also reducing friction from the moving

parts. "We didn't want somebody walking with a motor 6 inches off the knee and running into tables," he said.

Rice University engineering student Chase Gensheimer takes a walk with a power-generating knee brace. The invention by Rice students charges a battery pack but they hope it will lead to a device that will charge artificial hearts. Credit: Jeff Fitlow

The team expects a future version to supply energy wirelessly to medical devices.

The team's adviser is Steven Rickman, an adjunct professor of mechanical engineering, with assistance from course professors Gary Woods, a Rice professor in the practice of computer technology and electrical and computer engineering; Fathi Ghorbel, professor of mechanical engineering and bioengineering; and Eric Richardson, a lecturer in the Department of Bioengineering.

Provided by Rice University