Team develops solar-powered laptop for Tanzanian students

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For a team of Penn State engineering students, the challenge wasn't getting laptops to Tanzanian students, but how to power those machines.

Tasked with developing a solar-based laptop system for the Nianjema Secondary School in Bagamoyo, Tanzania, the engineering team unveiled their prototype solution at last week's Learning Factory Showcase at the HUB. The event displayed student solutions to industry-sponsored projects.

The project, sponsored by the University's Center for Acoustics and Vibration (CAV), aims to develop the system for the school's new computer laboratory.

"Originally what they wanted was one (solar) panel per computer," explained Christopher Lute, an electrical engineering senior. "As we started looking into that, we didn't see that as most efficient."

The idea to create a solar-powered computer lab originated after a trip Gary Koopmann, professor of mechanical engineering and CAV director, and his wife, Barbara Bogue, associate professor of engineering science and mechanics and women in engineering, took to Tanzania.

Koopmann said the school lacked many of the educational basics students take for granted in industrialized nations, such as having textbooks available for each student. Laptops seemed to be an obvious solution to this problem.

"We want to leapfrog to a technology that is now common in U.S. high schools," he explained. Koopmann reasoned that supplying the school with laptops would not only make up for the shortage of books, but also help compensate for the lack of adequate chemistry, biology and physics labs.

He said the laptops also could access digital editions of books, along with teaching modules developed by the publisher. The computers also could serve as proxies for missing science labs.

"Under these circumstances, having simulated experiments (on the laptops) is the best we can do," Koopmann said.

But because much of Tanzania doesn't have access to a steady flow of electricity, the school's new computer lab would have to be powered from another source -- solar.

Charles Sloan, president of the Tanzanian Education Fund, which supports the school, said, "They have all this power from the sun, but they don't have the knowledge or technology to exploit it."

The Nianjema school board agreed to the idea and Koopmann gave the student team the task of turning it into reality.

Lute, along with electrical engineering seniors Emile Su, Matthew Keefer, George Reichard and Oladipod Ositelu, began working on the system as part of their senior capstone design project.

"It was a project to help people who need these things," Ositelu said. "And being from Africa, I wanted to make a contribution to society in general."

Lute said the original concept of building one solar panel per laptop

wasn't working as well as they had hoped, so the team changed gears.

"So we ended up going with a centralized array and a centralized battery bank," he stated.

The team developed a prototype system employing a solar panel, charge controller, battery, power adapter and laptop computer. Total cost for the Penn State system was $900, which included a commercially available Dell laptop.

"It's going to be a lot less expensive with a full system," Lute said, explaining that the cost per watt decreases with larger solar panels.

Sloan was impressed with what the Penn State team unveiled at the project showcase.

"We've got the brainpower here," he said of the students. "What you need for this project is a feeling of 'can do.' This is the best place we could have gone."

Team members said they didn't know much about solar power when they began the project, but learned a great deal along the way.

"There was a big debate as to do DC or AC distribution," Lute recalled of the power choices. He said DC was more efficient but more expensive, while AC was less expensive, but more lossy.

The team also wrestled with what type of computer to design the system for. Should it run on Microsoft Windows or on free, open source software? In the end the students chose a basic $400 Dell model equipped with Windows XP.

"Most of the publisher’s teaching modules are based on Windows,"

Koopmann said, though he added that the students' solar design will be adapted so that it can power any type of laptop computer.

Lute said the team's design will be scaled up to power approximately 30 laptops. "We hope to have it installed in six months."

After he graduates, Lute plans to travel to Tanzania to help set up the solar system and computer network.

Sloan said he looks forward to the new lab. "I don’t think they have anything like this in Tanzania."

Source: Penn State