

Romanian Teen Wins IEEE Presidents' Scholarship

Student is developing artificial intelligence system for the blind

By JOHN R. PLATT 13 August 2012



Peter Staecker [left], 2012 IEEE president-elect, with Ionut Alexandru Budisteanu, recipient of the 2012 IEEE Presidents' Scholarship.
Photo: IEEE

Ionut Alexandru Budisteanu has a vision of using technology to give sight, of a sort, back to the blind. The 18-year-old high-school senior from Râmnicu Vâlcea, Romania, has spent the past year working on a project that combines a webcam, computer programming, and a series of small electrodes to help blind people recognize images by using their tongues.

Budisteanu's project, "Human Computer Interface: Using Artificial Intelligence to Help Blind People to See With Their Tongue," earned him the 2012 [IEEE Presidents' Scholarship](#). The honor, presented in May at the [Intel Science and Engineering Fair](#), in Pittsburgh, comes with a US \$10 000 scholarship to be paid out over the student's four years of undergraduate study.

[The IEEE Computer Society](#) also named Budisteanu its First Individual Award winner at the Intel fair, for which he received \$1000, a certificate, and a subscription to one of the society's magazines. The teenager has won more than 100 other awards in competitions in Romania and around the world. Some of his previous projects include writing software to identify natural disasters via satellite, and a method to recognize burglars from mug shots using facial recognition programs.

"I am very proud. This award motivates me to keep doing what I'm doing," Budisteanu says.

He says he first set out to make a human-computer interface, like a bionic arm, to help disabled people for the Intel fair, but he was inspired to take a different direction by his uncle, who has been blind for 26 years. "I decided to make a device to help blind people," he says.

Initially he thought of using 3-D radar to create information about a person's surroundings and transmit it as an audio file to the ears. But in his research he found that was more likely to create a two-dimensional, rather than a 3-D, image in the person's mind. Further research found three other possible parts on the human body that could be used as transducers for 3-D information: the fingertips, the armpits, and the tongue.

The tongue won out for two reasons. It is much more sensitive than fingertips, and the human brain uses some of the same neurons to process taste as it does for sight. This overlap of brain function enables blind people to learn "images" from the tongue faster than from their fingers.

MEMORY GAME

Budisteanu began experimenting by writing software that could translate webcam images to electrical pulses in real time. The pulses were then sent from the headphone port on his laptop to a sensor matrix placed on his uncle's tongue. The matrix, comprising an 8x8 grid of low-power electrodes measuring about 25 millimeters by 25 millimeters, delivered an electrical interpretation of the image to the tongue.

Since an 8x8 grid provides little detail, his uncle was unable to identify objects on his own. He required training. Accordingly, Budisteanu would use the webcam to transmit an image of either real objects, like cars or forks, or photographs of other objects such as a zebra, then tell his uncle what it was. "He was trying to memorize the electrical meaning on his tongue," Budisteanu says. After about 20 minutes of practice studying the way each object or image was represented on his tongue, his uncle could distinguish from among about 52 objects and recognize them without prompting.

The system also provided some spatial context for the images. "When I placed a black object on top of a white table, my uncle was able to recognize where it was on the table, whether it was left, right, front, back, or in the center," Budisteanu says.

His uncle also could recognize the shapes of letters. The letter B, for example, was represented by a larger amount of electricity in the middle of the matrix and more on the right side.

The teen has experimented with two cameras, allowing the system to provide a modicum of stereovision and depth. The software picks out the closest, most relevant objects to display on the tongue rather than any information in the distance.

Although he has been writing software since he was 10 years old, the webcam-matrix experiment was Budisteanu's first electrical engineering project. He bought the equipment—including a two-channel oscilloscope, a signal generator, and a soldering station—for about \$2500. It all came from winnings he collected from international contests he entered.

So far he has completed three prototypes of his tongue matrix, improving the design each time. He hopes to contract with a company to build a matrix with a 60x60 grid of electrodes, which is more than he could accomplish in his home laboratory.

“I am very proud to represent my community and Romania with this international award,” he says. He is also honored to represent his town, he says, because Râmnicu Vâlcea is home to so many hackers that it is often called “Hackerville.”

“I am proud not to be a phisher,” he adds, “and to represent computer science and artificial intelligence in this contest.”

Budisteanu still has one more year of high school remaining, after which he says he hopes to attend Carnegie Mellon University, in Pittsburgh, or Stanford University, and eventually become a professor.

“The people changing the world,” he says, “are the researchers and teachers.”