

Diaphonics: Giving Biometrics A "Voice"

University of New Brunswick, Fredericton



Starting in the early 1990s, University of New Brunswick (UNB) Professor Kevin Englehart began designing state-of-the-art control systems for artificial limbs in his role as associate director of the university's Institute of Biomedical Engineering.

But when a company called Diaphonics approached him and UNB to develop a voice-authentication system about four years ago, he and his team smoothly switched gears. The project is an offshoot of biometrics, the science of identifying people by particular biological measurements. In this case, rather than a fingerprint or a retinal scan, it's the person's voice that is used as an identification marker.

“ *The technology, proponents say, has far-reaching implications in fighting organized crime, identity theft and terrorism.*

They also believe that speaker recognition technology is wellpositioned to capture a sizable share of the overall biometrics market, which is projected to grow to nearly \$6 billion by 2010, because it is the only type of biometrics technology that does not require a specialized scanner, just a telephone.

Englehart, who is located at UNB in Fredericton, New Brunswick, said he had already done some research in speaker recognition, though it was not his main focus.

“Though it might not seem obvious, the problem of controlling an artificial limb isn’t that much different than voice biometrics,” he says. “You still need to analyze incoming signals, do some intelligent processing and then decide what to do. If you draw big boxes around it, the mechanics of the problem for controlling a limb is not that much different than recognizing who said what.

“In the case of artificial limbs, it’s the electricity from muscles and basically smart, embedded computers that reside inside a limb that learn what the patterns look like, and then relaying these patterns to a robotic limb. “With speech it’s the distinctive patterns of a person’s voice. The kind of computing and signal processing technology behind both problems is surprisingly similar.”

A Collaborative Beginning

The collaboration between UNB and Diaphonics started in 2003 with a small grant from Canada’s National Research Council (NRC) for Englehart to lay out the design for building a voice identification system from the ground up for Diaphonics, a privately held firm backed by a number of venture capital firms.

“Everything looked good in the initial work,” says Englehart. “And about a year after that, they landed a large federal grant from the Atlantic Innovation Fund to build the system.

“We then entered into a threeyear collaborative research and development agreement to build the system that expanded to include another professor, a postdoc researcher, plus three engineers and a software architect to set up a development shop in Fredericton in the NRC building.”

Englehart says the system that has been developed is more sensitive than the human ear.

“Could you fake a voice and fool the system?” he asks rhetorically.

“It’s highly unlikely because the software is actually more capable of distinguishing voices than you or I could.”

In fact, most impersonation is based largely on mannerisms. Even just the tiniest little nuances of how a person articulates certain phonemes, one of the basics elements of speech, are picked up to build a template, he says.

By measuring pitch, frequency, intonation, and how long it takes a person to say certain words or phrases, the system creates a unique profile or template that is virtually impossible to duplicate, even for a talented impersonator.

“So the person with the closest template would be the individual identified as speaking, not the imposter,” Englehart explains. “You would have a very specific template and so would everyone else in the system.”

In addition to a person using his or her unique voice to gain, for example, access to a bank account, additional technology created by Englehart’s team can be used to discover a person’s identity through audio surveillance.

“There are applications in forensics where you might want to know if the voice clip you have really is Osama bin Laden,” says Englehart. “A voiceprint is like a fingerprint. If you are tracking someone, or monitoring a phone call, our software can be running in the background. It has obvious applications for intelligence work.”

Englehart calls the collaboration between UNB and Diaphonics “a fantastic two-way exchange of information and productivity.”

“The guys who formed Diaphonics came out of the telecom industry in Atlantic Canada and were very knowledgeable about the market, but realized they needed engineering help to build their system,” he says. “So they looked to us. And there are a lot of incentives and political reasons for industry to work with universities in Canada.”

Andy Osburn, CEO of Diaphonics, says his company and Englehart’s team were a good fit. Osburn — whose specialty was acoustics during a 20-year Canadian Navy stint — was Diaphonics’ chief technology officer when the arrangements were set up with UNB.

“We are the kind of company that needs to pursue leading-edge speech technologies,” he says. “We have a strong technology team at Diaphonics, but we are working at capacity. It is quite common for a firm like ours to seek an academic partner that has a lot of depth and breadth in a particular field, in parallel with what the company is doing.”

In addition to the appropriate research background, Osburn says the “human component” clicked with the UNB researchers, too.

“You have to land on a group that you think you can work with,” he says. “It is obviously a collaborative team arrangement. We got started four years ago with a bit of collaborative research that was sponsored by the NRC, and it took off from there.”

He says the three-year research and development project finished in the fall of 2007.

“But we will continue to work with and have ties to Kevin’s group,” he says. “There are always going to be new things to do as we move ahead.

He says he was pleased that the 36 months of collaboration identified technologies the company wanted to pursue.

“We also had time to see where the market was going as well,” notes Osburn. “As a result, we have been able to produce and commercialize several products.”

It is now in beta testing by existing customers, including banks, correctional institutions and the military.

David Foord, director of Intellectual Property at UNB, agrees that the partnership between Diaphonics and his university went well.

“We see all sorts of similar efforts in the research office here at the university. This is one that was excellent, in part because they took the right steps to make sure first there was chemistry and then moved into a larger project so they had a good statement of work and budget and vision for what was going to be done.

“The management team at Diaphonics is an impressive group who know what they want to do and know the market,” says Foord, who notes that the university will receive royalties for its work on the voice biometric products.

“We’re also pleased there will be ongoing research and development work,” he says. “That wasn’t something that we really planned for, it just happened because of the way we structured the legal agreement that allowed for this ongoing collaboration.”

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