Science Blog

November 2003

From Binghamton University

Hearing aid research gets federal boost

A four-year, $6.5 million award from the National Institutes of Health to support the biomimetic acoustic sensor research of Professor Ron Miles is expected to lead to a revolution in hearing aid technology within the next four years.

President Lois B. DeFleur noted that the award builds on the University's momentum by bringing new support and attention to a critical area of research expertise.

"This major grant, as well as the recently announced $1.1 federal earmark and developing partnerships with industry, give us a solid foundation for the development of major research initiatives in small-scale systems," DeFleur said.

The University was notified last week of the award, which comes specifically from the National Institute on Deafness and Other Communication Disorders. The largest single research grant in the University's history, the award will support a project titled "Sensing and Processing for Directional Hearing Aids."

Miles' aim is to dramatically improve the ability of the hearing-impaired to understand speech in noisy environments. The work could help more than 28 million Americans who already suffer from or face imminent hearing loss. That significant demographic is likely to become even larger as aging Baby Boomers move into their senior years.

"Our focus is to improve the technology of acoustic sensing and signal processing so that we can minimize the influence of unwanted sounds," Miles said. "Research shows that hearing in noisy environments remains the number one unsolved problem faced by hearing aid wearers."

Miles is one of many Binghamton University faculty members pursuing small-scale systems research. His work, which is based on discoveries about the directional hearing capabilities of a small parasitoid fly, Ormia ochracea, holds promise in any number of civilian and military applications where microphones and acoustic sensing systems are or could be employed.

Miles, a mechanical engineer, has used a tiny structure found in the ear of the fly as a model to develop the world's smallest directional microphones.

"This important award is an indication of the level of research going on at Binghamton University," said Bahgat Sammakia, interim vice president for research. "Attracting funding at this level distinguishes Ron Miles as one of the top researchers in his field and underscores the important work being done in small-scale systems development across the disciplines here at Binghamton."

Improving the directionality of hearing aids, enhancing their ability to filter out unwanted noise and producing microphones that create less self-noise will mean major enhancements to speech intelligibility in noisy environments, Miles said.

Miles said these improvements would be accomplished by means of three interrelated areas of technology development: novel directional microphones, novel optical electronic sensors and novel signal processing.

As principal investigator for the project, Miles will partner with researcher Douglas Jones at the University of Illinois, an expert in signal processing algorithms, and Levent Degertekin at Georgia Institute of Technology, an expert in optical sensors. The optical sensors will replace and improve upon the variable capacitors in traditional hearing-aid technology.

By "reading out" sound waves hitting the microphone's diaphragm through signals created by changes in light rather than in electronic voltage, much thinner and more sensitive diaphragms can be used.

"This will remove some of the key design constraints that have limited the development of small microphones," Miles said. "It should permit a revolution in microphone designs and enable the achievement of much greater sensitivity and lower noise."

The signal processing algorithms will allow for the fine tuning and customization of hearing aid sensitivity and will reduce unwanted sounds beyond what is possible with existing hearing aid technology.

Ultimately, the signal processing could be tuned based on any of a number of criteria including directionality, frequency, or volume of sounds, Miles said. For starters, researchers will focus on directionality, since most hearing-aid users want to hear the speaker or sound source they are facing more than other ambient room noise.

Miles' laboratory will be in charge of designing and fabricating the microphones and incorporating the optical sensors and signal processing into a working prototype by the project's completion.

Three years ago, Miles' research attracted a $2.8 million grant from the Defense Advanced Research Project Agency. That award concludes this June. That project involved the development of acoustic sensing systems to detect troop and equipment movements and to help locate snipers.

Miles said he also hopes to adapt his acoustic sensors to predict the impact zone of incoming ordnance to keep soldiers safe in battlefield conditions.

Ultimately, Miles' work will be important in any application in which a miniaturized microphone and signal processing technology could improve the utility and performance of a product. Besides the manufacture of next-generation hearing aids, other envisioned civilian applications include security devices, cell phones and teleconferencing equipment.

Archives 2003 D