MedicalXpress

Engineering students: Headset muffles loud, unnerving MRI noises

April 22 2008

Having an MRI exam, an experience many people describe as stressful and uncomfortable, could soon become a bit more pleasant, thanks to the work of a team of University of Florida engineering students.

The students have designed a headset that shows promise of reducing the extremely loud, repetitive, industrial-like noises that accompany magnetic resonance image examinations. The noises, which range from beeping to whirring to grinding and can often be as loud as a jet engine, stem from the workings of the powerful magnets at the heart of the machines' ability to produce sharply defined internal images of the body or body parts.

The headset would not only make the experience less off-putting, it might also reduce the number of needed exams, freeing up the machine for access by more patients, said Stephen Forguson, a senior majoring in electrical engineering.

"The sound often makes patients move or wriggle a bit," he said. "Unfortunately, that can blur the image, which means the operators have to redo the exam."

Forguson and Chad Dailey, Paul Norris and Christopher Ruesga, all also engineering seniors, designed the headset as part of the College of Engineering's Integrated Product and Process Design Program. The program pairs student teams with corporate or government sponsors for yearlong design projects of products or processes intended to be useful

to the sponsor. The sponsor of the headset project was Invivo, a Gainesville manufacturer of magnetic coils, monitors and other MRI accessories.

With battery-operated headphones that cancel internal airplane noise or other loud noises already commercially available, muffling the noise a patient hears when inserted into the cylinder-like MRI machines might seem a small challenge.

But the problem is that no electronics are permitted within the MRI chamber because the electronics can distort or disrupt the images scanned by the machines' magnets. So the difficulty for the UF students was figuring out how to reduce noise without the use of any wires, switches or other electronics with the patient in the chamber.

"Passive" systems that use foam or other sound-deadening materials are insufficient to combat the noise. So the team attempted to solve the problem using existing "air phones," or headphones attached to small tubes, connected via the tubes to specially crafted electronics and software located outside the MRI machine.

The air phones, which are similar to the headphones once distributed on commercial airplanes, pipe the sound via two tubes to tiny microphones connected to an amplifier and a signal processor several feet away.

That processor taps an algorithm, or set of computer instructions, to produce a sound signal that is the opposite of the signal just received. That opposite signal then gets piped back through a third tube to each of the patient's ears.

Because the MRI sounds are repetitive and the piped-in sounds are timed to occur on top of the repetitions, the result is that the patient hears the same sound as he or she would have without any intervention — but at a

lower volume.

Trials of the system using a loud beeping sound similar to some MRI noises showed it could reduce the noise by as much as 15 decibels. Ambient noise is about 60 decibels, with jet engines and other extremely loud noises reaching 120 decibels. The students were only able to reduce actual MRI sounds by about four decibels, but they said further tweaks of the system and algorithm are likely to improve that result.

The team's results are "significant and make a difference," said Gijs Bosman, a professor of electrical and computer engineering and the team's faculty adviser. "Based on experiments and further testing of the prototype, the team has come up with several recommendations for further improvements."

Sam Coons, a project manager with Invivo and the company engineer who worked with the UF team, said reducing the MRI noises is also challenging in part because as clinicians develop new scans, new noises emerge. But he said that improving the algorithm at the heart of the headset project should make it more effective against the variety of noises.

The noise-muffling technology is "a big piece" of Invivo's entertainment system, he said. "We hopefully at some point will incorporate this into all of our systems because noise is such a problem," he said. "If we can achieve our goals, we will ship this to everyone."

Source: University of Florida