Bat-bot boosts sonar research

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A robotic bat head that can emit and detect ultrasound in the band of frequencies used by the world's bats will give echolocation research a huge boost. The Bat-Bot, developed by IST project CIRCE, can also wriggle its ears, a technique often used by bats to modulate the characteristics of the echo.

CIRCE developed the Bat-Bot to closely mimic the amazing echolocation skills of bats and to act as a tool for further research in echolocation.

"Sonar in water is a mature field, but sonar in air is far less advanced," says Dr Herbert Peremans, who is head of the Active Perception Lab the University of Antwerp and CIRCE coordinator.

"Whenever a robot team wants to build an autonomous robot they look at sonar first, but they quickly run into problems due to the simple nature of commercial sonar systems, and switch to vision or laser-ranging. We hope that the research we can now do with the robotic bat will lead to more sophisticated sonar systems being used for robot navigation and other applications," he says.

One of those potential applications could be identifying plants using echolocation. During development of the Bat-Bot CIRCE research validated that different plants give off unique echo signatures.

"We tested several plant species and they could all be reliably identified by echolocation, proving that in principle the technique could work for

plant identification. But further research into the technique is needed," says Peremans.

While building the robotic head was the primary aim of CIRCE, the group generated many useful results along the way. One project partner developed a broadband transducer that could both convert acoustical energy to electrical energy and electrical to acoustical across the 20 to 200 kHz spectrum.

"There are about 700 echolocating bat species, and they use a wide range of frequencies. We needed a single device that could handle that entire range. The transducer developed by one of the partners can do that and has some additional advantages making it a promising technology for further commercialisation," he says.

The project also completed CT scans on about 20 bat species, demonstrating that the ear shape of bats varies enormously, and heavily influences their performance. This knowledge could also be used to enhance the performance of existing sonar systems.

"We're the first to build a high resolution computer model of bat ears, which act as antennae. It's a result we're very proud of and so we've manufactured a series of simplified nylon ears (rapid prototyping tool) which we can now begin to characterise by investigating how their shape influences their sound reception," says Peremans.

The Bat-Bot will now feature in a number of new research projects, such as the EU project CILIA, due to start in September, which will examine how sets of tiny hairs on insects, fish and in the cochlea of mammals like bats and humans can be used to extract information on the organism's environment.

"We're interested in further exploring active sonar sensing with the

device, and we hope that other researchers and teams will get in touch with us to collaborate on new projects," says Peremans.

It's impossible to guess at what potential results the Bat-Bot might generate, but CIRCE's work with plants and bat ear design demonstrate that sonar in air has potentially many applications, not least in the development of functional sonar navigation for robots.

Source: IST Results istresults.cordis.lu/

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