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'Pygmy shrew' robot navigates using tactile whisker sensors

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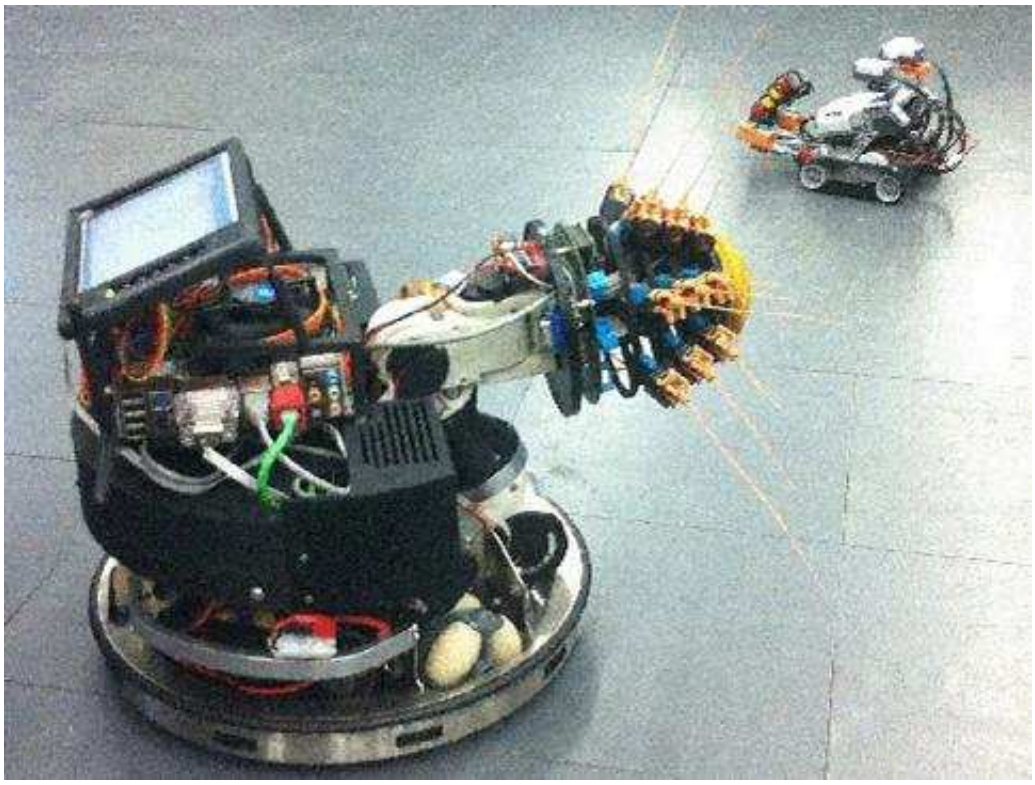

A new robotic system based on the Etruscan pygmy shrew can navigate by using tactile whisker sensors to build up a probabilistic map of its environment.

Shrewbot is the latest application of the tactile robotic sensing technology pioneered by engineers at the universities of Bristol, Sheffield and Sheffield Hallam.

Speaking to *The Engineer* at the TAROS robotics conference in Sheffield, project lead Prof Tony Prescott (University of Sheffield) explained the potential importance of tactile navigation.

'You can stare at a surface forever but you don't know whether it's safe to stand on. With something like a Mars lander, where you're relying on vision, you can't be sure that you're not going to stand on quicksand, whereas if you have a touch sensor you can at least say it's a solid surface,' he said.

Rats and shrews have two main types of whisker sensors: longer macrovibrissae and shorter, more densely arranged microvibrissae. Although both types are capable of detecting tactile features such as texture and shape, there appears to be some specialisation of function. Specifically, the longer macrovibrissae serve as a highly effective means of pinpointing interesting objects in space, whereas the microvibrissal array may be the most optimal device for the close examination of surface properties.

BIOTACT, a Seven Framework EU project, has been attempting to replicate aspects of this biological system for a number of years for use in various applications.

'At the base of the whisker there's a small metal tube that moves inside a magnet and you can measure the movement of the tip in three dimensions as it gets deflected,' Prescott said.

'From that information we can work out the texture and if we have several of these contacting at the same time we can extract the shape of things.'

Shrewbot then uses a number of software systems, including pattern integration and Bayesian frameworks, to aid further exploration and navigation.

'Basically, the whisker contacts are being integrated over time to get a map of the environment based on what experiences it's had already.'

The researchers also plan to replicate another aspect of Shrewbot's mammalian counterpart: the ability to track and catch fast-moving prey such as crickets using only its tactile system.

'The goal is to get Shrewbot to chase small Lego robots using just touch to follow them around a room — that's the next step of the project.'