Mini robots to undertake major tasks?

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From cell manipulation to micro assembly, micro robots devised by an international team of researchers offer a glimpse of the future.

The MICRON project team, led by the Institute for Process Control and Robotics (IPR), Karlsruhe, Germany, brought together eight international partners. Funded under the European Commission's FET (Future and Emerging Technologies) initiative of the IST programme, MICRON set out to build a total of five to ten micro robots, just cubic centimetres in size.

"Each one would measure about 1.5cm by 3 cm," says IPR´s Joerg Seyfried. "They were designed to be complete robots, with different kinds of actuators for gripping, cell manipulation, and so on. Each one would be wireless, with lots of electronics on board, and an infrared control system – rather like a TV remote, but two-way in this case. They

would be able to cooperate together on a range of tasks."

Building the robots involved developing many custom applications, he adds. "One of these was the wireless powering system, the 'power floor', which allows the robot to get energy from its surroundings," he says. "It uses a coil system to transmit the electricity through the air."

The robots were designed as part of a networked system: "The individual robots are not that intelligent," explains Seyfried. "They don't, for example, know where they are, although they know which direction they are moving in. We developed a special positioning system, so that we know where each robot is. It views them from 40 to 50 cm above. They are controlled by a central robot control system, with several networked computers for planning and commands – this could theoretically control many robots."

The hardest part of the project was "getting the hardware integrated and running – our goal was to have five robots operational, but this couldn't be done in our three-year timeframe owing to the extreme complexity of the task," he says.

Nevertheless, the one fully functional robot that the project did achieve could be tested in three different scenarios. "The first was a medical or biological application, in which the robot was handling biological cells, injecting liquid into them," Seyfried explains. "The second scenario was micro-assembly, in which the robot soldered tiny parts. The final scenario looked at atomic force, with the robot mounting atomic force and doing experiments on it."

The results were encouraging. "Our experiments showed that the cell injection is entirely feasible, as is the micro soldering," says Seyfried. Although the MICRON robots are clearly not a mass market product, commercialisation – though still far off – would be perfectly possible, he

believes: “Robots with this sort of capability, and mobility, would be perfectly suited to lab work, such as the micro assembly of prototypes. Tasks such as cell injection could be performed on a mass scale.”

With MICRON now having run its course, the project team is currently working on the project reports and evaluation. “What’s missing is the integration work, and this is what we will try to do next within the [also FET-funded] I-Swarm project,” says Seyfried. “This will build on MICRON to produce robots with a ‘swarm’ intelligence – that is, with limited capabilities, but able to communicate with each other.”

The tiny robots of science fiction tales might be smarter, but, as Seyfried points out, “We’re working on the smallest size range currently being worked on by a few other groups worldwide – like MIT. On a European level, MICRON is unique.”

Source: IST Results