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A Robot With Finger-Tip Sensitivity

Two arms, three cameras, finger-tip sensitivity and a variety of facial expressions -- these are the distinguishing features of the pi4-workerbot. Similar in size to a human being, it can be employed at any modern workstation in an industrial manufacturing environment. Its purpose is to help keep European production competitive.

Picture the following: With great care, a robot picks up a gear wheel in one hand, a housing in the other, and places the two together. When they don't immediately engage, it breaks off its movement. Slowly, it twists the gear wheel round a little and tries again. This time the wheel slots easily into its mounting. The robot smiles, and places the correctly assembled part on the conveyor belt. The pi4-workerbot is capable of making many more movements than a normal robot and is the jewel in the crown of the EU-funded PISA research project, which aims to introduce greater flexibility into industrial mass production by using robots in assembly processes. All manufacturers operating in Germany need technology that can be adapted for and cope with a variety of product versions and fluctuating volumes. And because workforce requirements also change in line with orders on company books, the idea is that manufacturers should even be able to lease these robots as and when necessary.

Dr.-Ing. Dragoljub Surdilovic, Head of the working group at the Fraunhofer Institute for Production Systems and Design Technology IPK in Berlin, says: "We developed the workerbot to be roughly the same size as a human being." Which means it can be employed at any modern standing or sitting workstation in an industrial manufacturing environment.

The robot is equipped with three cameras. A state-of-the-art 3D camera in its forehead captures its general surroundings, while the two others are used for inspection purposes. The workerbot can perform a wide range of tasks. Matthias Krinke, Managing Director of pi4-Robotics, the company that is bringing the workerbot onto the market, explains: "It can measure objects or inspect a variety of surfaces." To give an example, the robot can identify whether or not the chromium coating on a workpiece has been perfectly applied by studying how light

reflects off the material. Krinke adds: "If you use two different cameras, it can inspect one aspect with its left eye, and another with its right." Moreover, the workerbot is also capable of inspecting components over a continuous 24-hour period -- an important advantage when precision is of the utmost importance, such as in the field of medical technology, where a defective part can, in the worst case scenario, endanger human life.

Another distinctive feature of the pi4-workerbot is that it has two arms. "This allows it to carry out new kinds of operations," says Surdilovic. "These robots can transfer a workpiece from one hand to the other." Useful, for instance, for observing complex components from all angles. The Fraunhofer researcher continues: "Conventional robotic arms generally only have one swivel joint at the shoulder; all their other joints are articulated. In other words, they have six degrees of freedom, not seven like a human arm." However, as well as the swivel joint at its shoulder, the workerbot has an additional rotation facility which corresponds to the wrist on a human body. Surdilovic's working group developed the control system for the workerbot. He recalls: "Programming the two arms to work together -- for example, to inspect a workpiece or assemble two components -- was a real challenge. It requires additional sensor systems."

The researchers also endowed the robot with finger-tip sensitivity. "If you set the strength of the grip correctly, it will take hold of an egg without cracking it," says Surdilovic. And it even has a variety of facial expressions. If its work is going smoothly, it will smile happily. If it looks bored, it's waiting for work, and the production manager knows the production process can be speeded up.

Story Source: The above story is reprinted from materials provided by Fraunhofer-Gesellschaft.