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**Science News**

**Researchers Focus on Robot that Can Manipulate Objects**

**Humans and Robots Working Together**

Researchers at the University of Munich are working to develop ways for humans and robots to work together, using language and gestures to reach a common goal.

“This is not a project that produces a marketable product,” says Mary Ellen Foster, a postdoctoral student there at the university. “We’re looking at more industrial settings. If you’ve got humans and robots working together [now], they are segregated.”

The research team working on the Joint Action Science and Technology (JAST) project wants to help humans and robots work interactively, such as on a production line. The robot the team is using consists of a Phillips iCat head mounted to a large pair of shoulders and arms.

“One thing that emerged as interesting, if you have an agent [robot] and human working on a plan together and they have to discuss what a plan is, and discuss who’s going to do what, they’ve got to be able to do that. Jointly executing a plan has a whole lot of interesting features to it,” she tells Unmanned Science.

Communication is somewhat easier if the robot and human are focusing on a common task rather than just chatting.

The user and the robot work jointly to assemble a wooden construction toy on a common work area, coordinating their actions through speech, gestures and facial displays. Joint action can take several forms: for example, the robot may ask the user to provide assistance by holding one part of a larger assembly or by assembling or disassembling components,” says a paper presented at the Third International Conference on Human-Robot Interaction in Amsterdam last week.

In the future, the researchers plan to run a full-scale user evaluation of JAST, “using metrics such as user satisfaction, task success, and dialogue efficiency to compare the quality of the system under a range of different configurations.”

**How Quickly Should a Robot Respond?**

**It Can Stall for Time**

Humans want communications robots to respond within two seconds, although it doesn’t bother them if a robot says “uh,” or “well” to stall for more time, researchers at Japan’s Advanced Telecommunications Research Institute and Keio University found.

“We wanted to think about the limitation, how long should we wait for a robot’s response,” said Toshiyuki Shiwa, who presented a paper at the Third International Conference on Human-Robot Interaction in Amsterdam.

In a task where a user asked a robot to move a trash can to another room, a one-second delay was found to be fine. Two seconds was about the limit, he said, in line with the “two second rule” which says people want a speedy response from other electronics, including TVs and telephones.

Robots often cannot react in two seconds. For example, when a robot tries to react to a person's speech, the speech recognition process often takes more than a few seconds but it can quickly recognize that a person is speaking to it,” a paper presented at the conference says.

The researchers measured users’ impressions of the response time. Robots got high scores only if they responded within one second, and the scores dropped after that, declining precipitously after two seconds.

However, humans are used to “conversational fillers,” such as “uh” or “well” or, in the case of Japanese, “etto,” which means roughly “ah, well.” If the robot said “etto” to indicate it was thinking, users gave it a high score even if it delayed as long as nine seconds.

Shiwa summarized the results by saying robots ideally should respond within one second, should at least start within two seconds--but if they can't do either they should stall for time.

**Improving the Tracking of Robot Dogs**

**Robot Dogs Can Help Care for the Elderly**

A Sony Aibo robot dog was shown to improve its people-tracking skills when several tracking algorithms were combined rather than being used separately, according to researchers at the University of Amsterdam.

Fixed-camera systems can also be used to monitor the elderly but they are not flexible and can be considered intrusive. Using a robot dog is easier because it can move and "people regard it just as a dog and it's easy for them to have it around the house," said the university's Martijn Liem.

The robot can use one of two "state of the art" algorithms for tracking, he said: Background subtraction and color-histogram tracking. However, each has drawbacks. Background subtraction, which seeks to "carve out" the human from its environment, can be thrown off by shapes behind the subject, and color-histogram tracking, which follows colors, can get thrown off by colors in the background.

Using them together helped improve Aibo's performance, according to a paper Liem presented.

"The real strength of the fusion algorithm becomes clear when movement is introduced. The tracker is able to stay focused on the person for a much longer period of time, can handle erratic and swift object movements, and prevents unlimited kernel growth by combining the strength of both basic algorithms."

Aibo can use the algorithms to stay within two meters of its subject. If it loses tracking, it can quickly regain it, even if the subject is moving. In fact, it's better if the subject is moving.

"The more movement is introduced in to the sequence, the more stable the algorithm becomes," Liem said.

**A Point and Click Interface for Controlling Robots**

**A Laser Pointer Can do the Trick**

Robots can be controlled by something as simple as a laser pointer, according to researchers from the Georgia Institute of Technology.

In collaboration with the Emory School of Medicine, the researchers found that robots can fetch and return objects when directed by a simple laser pointer, similar to the ones used to guide "helper monkeys" for the disabled.

The human points at a location of interest and illuminates it ("clicks it") with an unaltered, off-the-shelf, green laser pointer. The robot detects the resulting laser spot with an omnidirectional, catadioptric camera with a narrow-band green filter. After detection, the robot moves its stereo pan/tilt camera to look at this location and estimates the location's 3D position with respect to the robot's frame of reference," says a paper presented at the Third International Conference on Human-Robot Interaction by Georgia Tech's Charles Kemp.

Kemp said, for instance, that a user could click on a drink bottle and the robot would fetch it. The user could then aim the laser at his or her body, prompting the robot to bring the bottle to them. If the user pointed the laser at someone else, the robot would deliver the drink to them. In tests, the researchers found that the laser-guided robot was able to find an object and estimate its location 99.4 percent of the time.

"In the long-term, we expect this style of interface to support a diverse array of applications for personal robots, much as point-and-click interfaces support diverse personal computer applications today," the paper says. "By selecting objects, a user should be able to command a robot to perform a variety of tasks."

**Who Buys Robots?**

**And Will They Buy More?**

People who buy and like iRobot's Roomba floor-vacuuming robot tend to also buy other robots, suggesting a growth trend for domestic robot systems, according to researchers from the Georgia Institute of Technology and Siemens Medical Solutions.

In a survey of 379 Roomba users, the researchers found that most are young with high levels of education and technical backgrounds, though they are equally likely to be men or women. The users tended to clean more frequently using Roomba.

"Households with children expressed greater satisfaction with Roomba's performance," says a paper presented at the Third International Conference on Human-Robot Interaction in Amsterdam.

Roomba owners also tended to own other robots, including iRobot's floor-mopping Scooba, Friendly Robotics' Robomow lawn mower and humanoid robot toys such as Robosapien.

"Positive experiences reported by Roomba users, accompanied by encouraging projections from industry organizations, collectively suggest that there is a market for domestic robots, and that it will continue to grow," the paper says.

Most of the respondents had bought a Roomba less than a year before and, "given that Roomba has only been manufactured and sold since 2002, our data suggests that more users are buying them each year, [suggesting] a growth curve," it says.

**Technical Papers**

**ARL Robotics Research Program**

A look at research efforts at the U.S. Army Research Laboratory.
Bornstein.pdf (1944Kb)

**Unmanned Systems Research and Development at SPAWAR Systems Center Pacific**

A look at robotics work at the U.S. Navy's Space and Naval Warfare System Command's (SPAWAR) Systems Center Pacific.
Hudson.pdf (3438Kb)

**Networked Autonomous Systems**

A look at research into netted, autonomous sensor systems.
Johnson.pdf (2681Kb)

**NASA Perspective and Plans for Unmanned Systems**

A look at NASA's Airborne Science Program.
Roberts.pdf (3344Kb)

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