Robotics

Recycling Workers Vie for Bonuses by Getting Robots to Do the Dirty Work

A software project has humans collaborating with robots to sort trash.

by Rachel Kremen May 3, 2016

Sorting waste isn't fun. Trash can be sticky, stinky, and sharp. The entrepreneurs at Jodone want to turn this mundane task into a human-robot collaborative game to improve efficiency and accuracy.

For Jodone's new pilot project at the Pope/Douglas waste-to-energy facility in Alexandria, Minnesota, human operators will use its software to monitor waste as it travels along a conveyor belt. Using a touch screen, workers will swipe any recyclables they spot and then select the appropriate category: paper, plastic, tin, etc. Those instructions will be sent wirelessly to robotic arms that will grab the recyclables and drop them in the correct bin. Workers who salvage above-average amounts of recycling will receive additional income.

"People like solving puzzles, they like being mentally challenged," says Cole Parker, cofounder and CEO of Jodone. By presenting the job as a puzzle and offering bonuses, Parker believes, he can make the job more interesting for workers, which should, in turn, make the operation profitable.

A software interface allows humans to swipe with a finger on one hand to identify trash and classify it with the other hand.

Jodone estimates that its system—which combines the company's software with standard industrial robots—will generate $24 million in additional revenue for waste facilities. Under lab conditions, Parker says, they have achieved pick rates of 2,500 per hour—eight times higher than a human being alone—with 95 percent accuracy. The pilot project will be the first time the software has been tested outside of the lab.

"We know that robots are great at manual labor—at doing the same thing a million times in a row. But humans are great at problem solving, classification, identification, and dealing with diversity," explains Parker.

One aspect of the touch-screen software was inspired by the game Fruit Ninja—a user swipes a finger over the recyclable item with the right hand and then classifies it with the left hand. The developers are also working on a system that will learn from past swipes, so that the

software can highlight items it believes should be recycled and wait for human approval.

Michael Rivera, cofounder and chief operating officer at Jodone, estimates that the system will cost $150 per ton of recyclables retrieved. The key is reaching a price that's lower than the cost to landfill the waste, says Harri Holopainen, head of technology at ZenRobotics. The firm, based in Helsinki, Finland, was an early leader in robotic recycling systems and now sells its systems to waste facilities worldwide. But the ZenRobotics technology is different from Jodone's in two ways: ZenRobotics relies entirely on software and sensors to identify recyclables, and the company focuses on construction waste. Holopainen says it's easier to turn a profit in that sector because construction waste tends to be heavier.

Holopainen says he's a firm believer in gamification and has worked in that field in the past. But he's not sure Jodone's system will be cheap enough for broad adoption if it continues to rely partly on human labor and involves municipal waste.

Moreover, Holopainen says, modern sensors and software can do as good a job as humans. "There's been a huge investment into techniques that can very rapidly identify contents of images," he says.

Scott Cassel, CEO and founder of the Product Stewardship Institute, says Jodone's technology could be helpful, but he's skeptical that it can be cost-effective. Moreover, he's not sure the public would support such a system for municipal waste. He points to a decision earlier this year

that halted construction on a mixed-waste materials recovery facility for municipal waste in Indianapolis. Cassel says the decision was made in part because people thought the money earmarked for the facility should be spent on education programs to encourage people to recycle at home.

Robotics

A Treasure-Hunting Ocean Robot

A submersible robot used to explore a 17th-century shipwreck shows how humans and machines might collaborate in other settings.

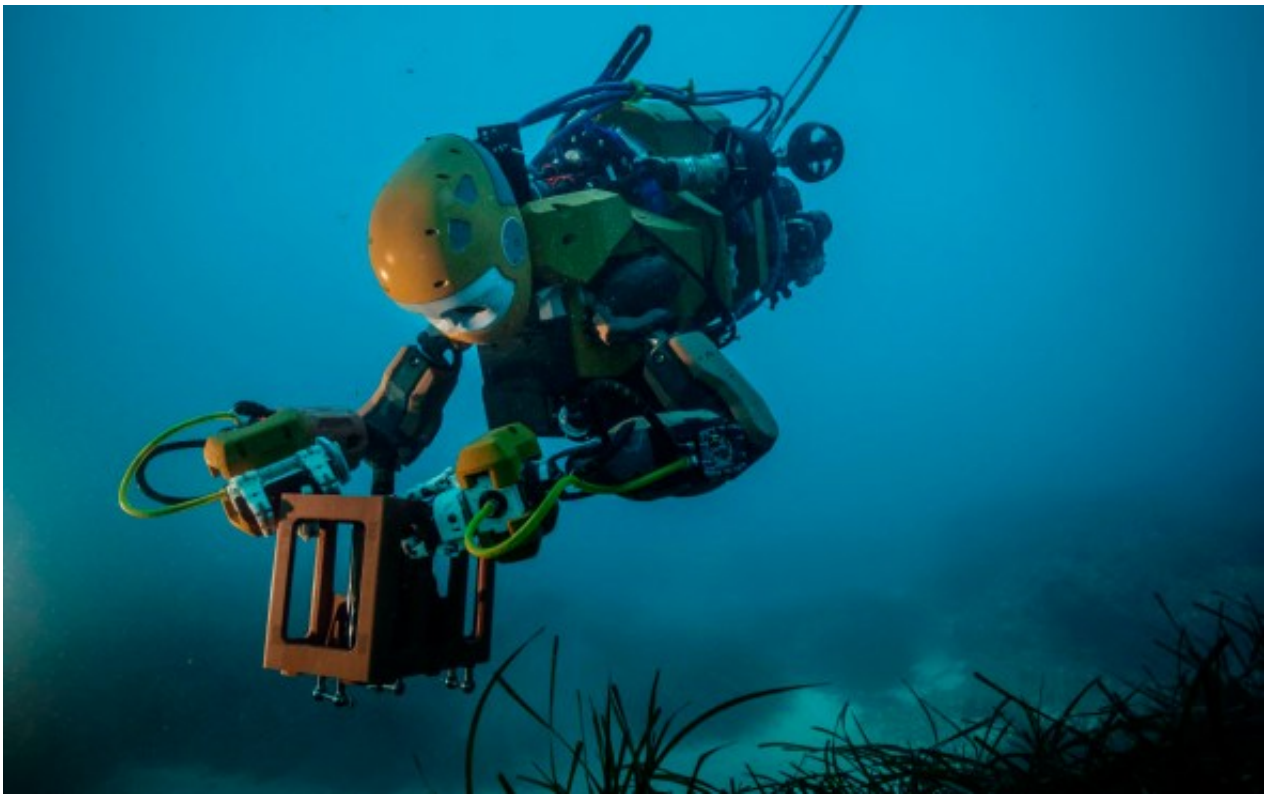
by Will Knight May 3, 2016

This "robotic mermaid" could be more than just a clever way to retrieve sunken treasure (and disappoint amorous sailors). It hints at how humans and robots may someday work together in all sorts of difficult environments.

The submersible humanoid robot, called OceanOne, was developed at Stanford University. It recently retrieved priceless artifacts from King Louis XIV's *La Lune*, a 350-year-old galleon wrecked off Toulon in southern France in 1664.

OceanOne has two arms, a head, and a tail-like appendage fitted with motorized propellers. It was developed in the lab of Oussama Khatib, a professor at Stanford University, who used a set of computer joysticks to control the robot on its first dive to *La Lune* from aboard a ship floating above. The robot returned video footage from stereoscopic cameras and

provided haptic feedback, allowing Khatib to feel (in a crude sense) what it was grasping.



"The intent here is to have a diver diving virtually," Khatib explains in a video about the robot (see below). "It's almost like you are there—you create a new dimension of perception."

Importantly, OceanOne is also partly automated. It's possible for the operator to take full manual control, but usually the robot will keep itself positioned correctly by sensing current and turbulence and activating its propellers accordingly. It will also avoid obstacles automatically.

Human-robot collaboration could be important in situations such as repairing a stricken nuclear reactor. But a contest set up by DARPA last year to simulate that scenario showed how difficult it can be to operate complex machinery remotely in an unstructured environment, especially if the communication link is patchy. The underwater setting is

similarly challenging.

OceanOne can withstand far greater pressures than a human diver, potentially enabling it to take on many more deep-sea tasks that are too dangerous to be done by hand. The robot may, for example, end up repairing oil rigs or maintaining underwater communication lines.

More significantly, the robot could inspire a new generation of remote-controlled robots that work with their operators in a more intelligent way.

Stanford's humanoid robot explores an abandoned shipwreck

(Read more: Stanford News, "Why Robots and Humans Struggled with DARPA's Challenge")