

# Smart robots

By Maayan Hoffman

**IN ISRAEL** and the United States, there is a controversy over what sound a rooster makes: cock-a-doodle-doo as in the US or *kukuriku* as in Israel. But what about a rooster that says “whirr” like the rattling of a helicopter?

Meet Rooster, one of the latest autonomous robots invented by Beersheba-based RoboTiCan. The 30 cm by 40 cm in diameter robot looks not too dissimilar from a plastic, geometric expandable ball for children, with a robot caged inside. But Rooster is not a toy. It is a powerful communications device that can help search and rescue teams reach injured victims of natural disasters or terror attacks, where it is not safe to send human rescue workers.

Rooster is unique and unlike other search and rescue robots, RoboTiCan COO Ofir Bustan tells *The Jerusalem Report*, because like a rooster, it both walks and flies. Further, it runs off a sophisticated communications platform. When Roosters are deployed as a team by a single operator they can talk to each other and the operator over hundreds of meters.

“The Roosters set up their own wireless mesh communications network,” not dependent on a cellular connection, which may not be available in times of disaster, explains Bustan. The operator can send out one rooster. When it reaches as far into the disaster zone as its communications will carry, the operator can send a second rooster and then a third, and so on. The signals are relayed from one Rooster to the next and then back to the operator piggyback style.

“Roosters have a powerful camera and everything Roosters see is transmitted back and can be seen on screen by the search and rescue team operator,” Bustan says. The Rooster also has heat sensors, and its metal case allows the robot to take some hard hits, yet it is lightweight enough so that it can work inside or outside.

Bustan says the Israeli Home Front Command is currently testing Rooster and that Israel’s disaster relief team brought a set of the robots to Mexico in 2017 to assist after a powerful earthquake rocked the southern city of Oaxaca. Clients in the United Kingdom and Mexico have already pre-ordered it.

Rooster is not RoboTiCan’s only electronic

creation. The company, which was started in 2011 by three Ben-Gurion University students who wanted to work with the open-source programming language Robot Operating System (ROS) but could not afford to buy the robot on which to run the code, is most known for Lizi, the robot they built on their own to solve their problem. The founders then sold Lizi as a developer kit to other research units at BGU and then to research units abroad, which likewise were investigating autonomous robots.

The money RoboTiCan makes off Lizi (about \$60,000 for each kit) gives the team of now 17 people the ability to develop more robots. For instance, the company has developed Komodo, a multipurpose unmanned ground vehicle (UGV) robot; ARMadillo, a one-armed autonomous assistive robot; and KREMBOT – shaped like the chocolate-coated marshmallow treats eaten by Israeli children – an intelligent swarm robot.

However, only Lizi is actively sold, and Rooster is in the evaluation phase.

Part of the hold up, said RoboTiCan CEO Hagai Balashi is that there is still a gap between what is being developed and what companies and individuals feel comfortable deploying, whether it be in security, agriculture or industry.

Uri Dubin, CEO and co-founder of C-Robotics, respectfully disagrees. He says that within a year or a year and a half, his new robot, a modified version of RoboTiCan’s Komodo, will be on the market and probably in use. The robot, still unnamed, is meant to help people do one of what he considers the most unpleasant tasks: cleaning public bathrooms.

“Facilities management companies have a huge headache and spend a lot of money trying to find people willing to do this job who can keep bathrooms clean,” Dubin tells *The Report*. “But a public bathroom is a nice environment for a robot.”

The washroom, explains Dubin, is a consistent environment where nothing much moves around. At most, a robot would need to open stall doors to get the job done. The cleaning is routine and does not require precision.

“A good robot for that could be made affordable,” Dubin believes. He sees his robot being

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used by facility managers, rented by airports, schools and health care facilities, which could leverage robots to fight germs.

Dubin says that Israel’s contribution to the world of robotics will be the robotic brain, an industry that is moving very fast.

“Look at small babies,” explains Dubin, who is currently pursuing a PhD in neuroscience from the Technion – Israel Institute of Technology. “Babies are born with all their muscles, everything is connected physically, but the brain must be molded. In robots, it is hardware versus software.”

Dubin says it is the sophisticated combination of artificial intelligence, machine learning, computer vision, navigation and head control coming together and functioning on top of the hardware that makes a robot smart.

“Israel’s contribution to the robotic revolution won’t be manufacturing robots, because Japan or China, are better suited,” he said. “But the brain – the most complex part of the machine – that will be Israeli. Israel will contribute to making robots smart.”

And making people smart about using robots.

A team of BGU researchers are looking at preferences in human-robot interactions and the need to personalize those encounters to fit both the human’s preferences and the designated task.

Dr. Shelly Levy-Tzedek, head of the Cognition, Aging and Rehabilitation Lab in the Department of Physical Therapy in the Faculty of Health Sciences and a member of the



President Reuven Rivlin with 'Pepper'

Zlotowski Center for Neuroscience, has been focusing her research on robots for rehabilitation patients who need to practice at home due to rehabilitation therapist shortages. She is designing robot companions to encourage patients to practice and to track their progress.

"In the future, human beings may increasingly rely on robotic assistance for daily tasks, and our research shows that the type of motion that the robot makes when interacting with humans makes a difference in how satisfied the person is with the interaction," Dr. Levy-Tzedek says.

Studies so far have led to three conclusions. First, robotic movement primes the human movement, meaning that the person tends to imitate the movements of the robot. Second, people generally don't care whether they lead the robot or vice versa. Third, patients prefer smooth, familiar movements, which resemble human movements over sharp "robotic" or unfamiliar movements.

In her clinic, Levy-Tzedek is using a social robot named Pepper, a child-sized robot (about 1-meter tall), with a human face that can talk and move in ways similar to a human. With Pepper, she is testing interactions with robots over time to see if these interactions really improve functions like opening jars, slicing bread and picking up cups of water.

"We want to see if the patients improve because of interacting with robots," she says. "If working with robots proves to be more beneficial than self-practice, then the first step would be 'employing' robots full-time in clinics.

Maybe a patient would come in three days to work with a physical therapist and then work the other two days with a robot.

"We have to first show that these robots lead to real improvement rather than just being a fun toy. That is what we are working on now."

If it works, then Pepper and other similar robots could save the health care system money and be used not only for rehabilitation but prevention, Levy-Tzedek says.

"I see a future not far from now where you will be able to rent a robot, just like you can rent crutches or other medical equipment from Yad Sarah. Why shouldn't you be able to rent a robot?" she asks.

Right now, robots like Pepper cost thousands, if not tens of thousands of dollars. But moving forward, Levy-Tzedek says the price of these robots will be reduced, making them first widespread in clinics and then owned.

Levy-Tzedek has worked with all kinds of robots in her labs. She has found that when patients were asked to work with a robotic arm that didn't look human, the comments from users were negative. They wanted to see a face or hear it talk and have some more human-like interaction.

But she cautions that a robot cannot be "too human."

"If the robot becomes too much like a human, then you enter what is called uncanny valley, where people feel less good about the robot," she says. "If it gets too human, people find it creepy."

Levy-Tzedek believes robots must balance mechanical and human features for robots to become mainstream. She also believes that personalized robotic medicine is "crucial" to integrating robots into the medical arena.

In the rehabilitation space, for instance, robots often play games with the patients to help them achieve their rehabilitative goals.

"We get them to exercise through games," says Levy-Tzedek. "But in games, some people like to win all the time, some people like a challenge, some people want short-term feedback. Some people want to be told, 'You did well,' or hear jokes along the way. Personalization is important to success."

On the commercial side, Levy-Tzedek says the use of robots can move much faster. Though less in Israel, she says robots are in commercial use in other places around the world. She cited a hotel in Japan where the entire service team is robotic.

For industry, a separate team of BGU researchers recently developed a robotic arm that could be useful in orchards. Called

MASR, which stands for minimally actuated serial robot, this minimalist robot can travel along a structure and rotate the joint it needs to flex.

Dr. David Zarrouk, a lecturer in BGU's Department of Mechanical Engineering and head of the Bio-Inspired and Medical Robotics Lab, says he could see MASR being used imminently in agriculture or other related industries. MASR, he says, could also be used for picking fruit.

Levy-Tzedek says people are always concerned that robots will take their jobs. If hotels are being manned by robots and farmers no longer need to pick their own produce, how will humans be employed?

"This was also true at the time of the industrial revolution, but jobs were not lost, they were changed," says Levy-Tzedek. "Machines took over dull, dirty and dangerous jobs. The same will be true with the robotics revolution. There will be many new job opportunities opening for those people who can manage in the world of robots."

The bigger hold up, she says, should be centered on ethics. Currently, members of Levy-Tzedek's BGU team are collaborating with German researchers to tackle questions about the appropriate role of robots in rehabilitation and home care, especially because in this field robots are interacting with a vulnerable population that is often frail or elderly. Levy-Tzedek says these researchers are examining if it is OK to create a situation where people in rehabilitation get attached to an inanimate object.

"When something looks and talks like a human but cannot give you all you are hoping for from a person as a companion, then people might experience disappointment or deceit," Levy-Tzedek explains.

She says people must ponder what the nature of the human-robot interaction will be, as robots become more frequent companions, not just in industry, but in everyday life.

For humans, there are issues of privacy and personal security. Robots are often equipped with cameras and other detection devices, so they could easily be photographing you, stealing from you or even carrying bombs or other dangerous devices, she says.

For robots, there might be issues of personal rights, like should robots get rest time, or should laws be put in place to prevent robots from being vandalized or harmed.

"It will be interesting to see where this robot thing is going," says Levy-Tzedek. "I think the future is here." ■