

# Can San Diego's Brain Corp. become the Microsoft of self-driving robots?

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Ten years ago computational neuroscientist Dr. Eugene Izhikevich walked away from a successful career in academia to co-found Brain Corp. with the ambitious goal of building artificial brains for robots.

These days when the Russian-born Izhikevich lands late at San Diego International Airport, he sometimes sees the fruits of that decision rolling along the airport halls.

The squat, half-ton [robot](#) powered by Brain Corp.'s technology isn't sexy. It scrubs floors at a leisurely pace.

But under the hood, it does things that many robots can't—navigate safely in unpredictable, public places with no driver.

"Anything with wheels can be turned into a fully autonomous, self-driving robot using the BrainOS operating system, provided that the speeds are slow and stopping is never a safety concern, which means we are staying away from driving on public roads," said Izhikevich, Brain Corp.'s chief

executive.

Self-driving cars get a lot of hype. But the technology and infrastructure needed for widespread adoption of autonomous cars is likely years away. The market is not a priority for Brain Corp. for now.

But a few under-the-radar industries are ripe to automate with self-driving robots, including large venue floor cleaning, retail restocking and health care equipment delivery.

Industrial/commercial robots have been around for years to help build cars or fetch merchandise at warehouses. But these machines are not well-suited to operate around people. They're often caged off from workers. The robots find their way by following wires in the floor on pre-programmed routes.

In the last five years, a new type of robot has emerged in commercial markets. These robots aren't tethered to specific routes. They can operate safely alongside people.

"If the robot encounters something and it doesn't know what to do, it can stop and wait for people to walk away or the situation to clear up," said Izhikevich.

Brain Corp. is a leader in this space. It doesn't build robots itself. It partners with firms that make manually operated machines and helps them convert the equipment into self-driving robots.

Its proprietary BrainOS operating system integrates off-the-shelf cameras and sensors with a cloud-connected software stack to provide a "[brain](#)" that enables robots to understand their surroundings.

Though small compared with the overall robotics market today, the market for these autonomous mobile robots is forecast to grow fast—notching a

compound annual growth rate topping 50% over the next decade, according to ABI Research, a technology market research firm.

In April, Walmart ordered 1,860 self-driving cleaners for its stores powered by the BrainOS operating system.

This summer, Brain Corp. teamed up with Softbank Robotics to deploy autonomous Whiz vacuum cleaners, which are the size of an office trash can. Whiz robots target smaller retail and workplace spaces, with the initial roll out in Japan.

"We deploy 150 robots per month to Walmart, and Walmart is not our biggest customer," said Izhikevich. "We have thousands of robots deployed out there."

Mobile robotics today looks like the personal computer industry before Microsoft Windows, said Izhikevich. Every robot maker is trying to develop their own hardware, operating system, navigation, cloud infrastructure and other features themselves.

"That is why robots today are expensive and kind of clumsy," said Izhikevich. "I realized that a Microsoft of robotics is going to appear and unite everybody on this single platform. Robots will become cheaper, much more capable and ubiquitous. Brain Corp. has to become this Microsoft of robotics."

The jury is still out on that. Several robotics rivals want to do the same thing, including BlueBotics, Balyo, Seegrid and Kollmorgen.

In addition, [big companies](#) such as Amazon and Google remain threats to enter the autonomous mobile robot market either through their current robotics operations—Amazon uses thousands of guided robots in its warehouses—or by pivoting their self-driving car initiatives toward other robotics markets.

"The desire of Brain, and many other companies, is to develop the common base platform that all robotics manufacturers will defer to when building a new mobile robot," said Rian Whitton, an analyst with ABI Research. "Competition is increasingly fierce in this space."

Whitton added that it's not clear whether robotics manufacturers will flock to a common operating system when they can use existing, open source middleware to heavily tailor their own software.

Still, Brain Corp. has something to offer. The company "is amongst the most well-established, has the most comprehensive technology stack and is aiming to develop solutions across the widest range of verticals," said Whitton.

Founded in 2009, Brain Corp. spent its first five years embedded inside Qualcomm, working on creating neuromorphic artificial intelligence silicon based on the wiring of the human brain. Known for his contributions to the theory of spiking neural networks, Izhikevich has authored two textbooks on computational neuroscience. He came to the region as a senior fellow in theoretical neurobiology at the San Diego-based Neurosciences Institute.

In 2014, Brain Corp. spun out on its own. It has raised \$125 million to date from Softbank Vision Fund and Qualcomm Ventures. The company employs about 320 people globally—mostly in San Diego—but also in satellite locations in Japan and Europe.

"I want to see robots everywhere—in our homes, in the office, doing landscaping and agriculture and cleaning and deliveries, basically taking care of us," said Izhikevich. "There is no way a single company can create all those robots. The only way for me to realize my vision is to build the software and then partner with other companies, each one focusing on their own type of robot, but each one will use our software."

In commercial floor cleaning, Brain Corp. has signed on with four large manual equipment manufacturers—Tennant, ICE, Minuteman and Nilfisk.

Tennant, a 150-year-old Minnesota company, got its first Brain Corp. enabled robotic floor cleaner to market in less than a year. Its customers are driven to automate not only to lower costs but also by labor shortages and safety concerns around operating hulking scrubbers deep into the night shift, said David Strohsack, vice president of

product management and marketing for Tennant.

But autonomous floor scrubbers introduce complex technology into a non-technical work environment, said Strohsack. For now, it remains unclear whether they will have staying power among Tennant customers.

"We monitor a number of factors to see if this a sustainable disruption or a blip," he said. "I would say in certain industry segments—retail being one—the evidence is mounting that this is absolutely a sustainable disruption to the industry."

In addition to Walmart and the San Diego International Airport, Brain Corp. provides its operating system to machines operating in Mall of America, Mitsubishi Property Group and the Seattle-Tacoma International Airport, among others.

"Running an auto scrubber is a really mundane task," said John Beach, senior housekeeping manager at Mall of America in Bloomington, Minn. "Believe me you can fall asleep if you're not careful. We wanted to reallocate our team to more high value tasks."

It hasn't all smooth sailing with the robotic scrubbers. The mall has glass railings on some upper floors. At first, sensors picked up the scrubber's reflection in the glass and stopped, thinking it was an obstacle.

But that problem has been fixed, said Beach. The mall is planning to buy more autonomous machines next year. While they usually run on the overnight shift, Beach will bring them out occasionally during regular mall hours when weather is bad to clean snow and salt near entrances.

"The cool thing is parents and children, they love looking at these machines," he said. "The machine looks like a normal scrubber. It has a steering wheel. It doesn't look like a robot. It is just driving itself with nobody on it. People get a kick out of that."

This spring, Brain Corp. introduced a new self-driving system targeting auto-delivery robots that haul merchandise from the back of big box stores

or loading docks at malls to retail shelves for restocking.

Next year, the company plans to release software development kit tools so it's easier for any robotics company do adopt the BrainOS operating system.

The company also is building out new services to deliver analytics data to retailers that robots collect while cleaning.

The data could include spotting when the price of a product is incorrect, when a product is misplaced on the shelf or if the merchandise layout doesn't match the retailer's overall plan.

"While our robots clean floors in retail environments, they also have 3-D sensors and cameras for navigation," said Izhikevich. "We have video of every product on every shelf of big box retailers, so we can use this to provide additional services to retailers in terms of merchandise analytics."

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