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HARVESTING INSIGHTS

Indoor vertical farm uses data-driven insights from IoT deployment to increase yields, conserve resources and improve flavor

AeroFarms®

THE CUSTOMER

Company: AeroFarms
Industry: Agriculture
Headquarters: Newark, New Jersey

PLANNED SOLUTIONS AT A GLANCE

- Dell Latitude 12 Rugged Tablets
- Dell Edge Gateways 3001 and 3003
- Dell EMC IoT Advisory Service
- Dell EMC Ready Solutions
- Microsoft Azure

Transforming the world of agriculture

AeroFarms is the world leader for indoor vertical farming and sustainable agriculture. The New Jersey-based company is on a mission to transform agriculture, and show the world how to feed an ever-growing global population while conserving our limited natural resources.

Founded in 2004, AeroFarms grows high-quality, nutritious leafy greens and herbs without sunlight, soil or pesticides. The growing, harvesting and packaging are all done in a tightly controlled indoor environment. With its patented technology and data-driven insights, AeroFarms takes indoor vertical farming to a new level of precision and productivity with minimal environmental impact.

AeroFarms is an innovator on many fronts. It disrupts traditional supply chains by building farms on major distribution routes and near population centers. It defies traditional growing seasons by enabling local farming at commercial scale year-round. It sets a new standard for tracking by monitoring its leafy greens and herbs from seed to package. And, most impressively, AeroFarms achieves 390 times greater productivity annually than a commercial field farm while using 95 percent less water.

At its heart, AeroFarms is a technology company leveraging science and engineering to redefine agriculture and is constantly looking for best-practices and solutions to integrate into its proprietary growing systems. AeroFarms is equally vested in harvesting not just its plants but also its data to lead the way with understanding the symbiotic relationships among biology, environment and technology to drive better performance.

The roots of a growing company

While it is pioneering more sustainable approaches to food production, AeroFarms is pursuing a mission that is much bigger than that. At a higher level, the company is on a quest to help feed the world in a time of rising populations, disappearing farmland and increasing demands for water and other natural resources.

"For me, the journey started with an appreciation of some of the macro-challenges of the world, starting with water," says AeroFarms Co-Founder and CEO David Rosenberg. "Seventy percent of our fresh water goes to agriculture. Seventy percent of our fresh water contamination comes from agriculture. If one wants to solve our water problems, one really needs to start at agriculture, and move the needle in a more sustainable direction."

Yet that's just one of the issues that put Rosenberg on the path to AeroFarms. The other side of the equation is a pressing need to produce more food on less land.

"By U.N. estimates, we need to produce 50 percent more food by 2050, and we've lost 30 percent of our arable farm land in the last 40 years," Rosenberg says. "Looking at all those macro-issues, we need a new way to feed our planet."

A visit to a farm—in an inner-city

Every day, AeroFarms demonstrates a new way to feed our planet through the work it does at its indoor vertical farms, including its ninth farm built in an industrial building, a farm in the heart of Newark, New Jersey. At 70,000 square feet, this is one of the world's largest vertical farms.

At this site, plants grow in trays stacked layer upon layer in vertical columns that climb 36 feet into the air. Seeds are germinated on a patented cloth growing medium, and the plants are grown without soil, pesticides or wasted nutrients.

The crops get an ideal amount of moisture and nutrients misted directly onto their roots that dangle in a chamber below the growing cloth medium. They also get an ideal spectrum of LED lighting to match the plants' needs throughout a 12- to 16-day growing cycle. AeroFarms' precision growing algorithms allow just-in-time growing for its selling partners all year round.

Once the plants reach maturity, they are harvested and packaged onsite and then distributed to local grocery stores. The close proximity of the farming operation to its end consumers greatly reduces the transportation costs and spoilage associated with produce that is raised on distant farms and trucked across the country.

"Our supply chain is super short—just blocks or a couple of miles," Rosenberg says. "That means we have little to no spoilage of our product. We can track it from farm to fork very easily. And our supply chain has very little impact on the environment because very little fuel has to be burned to deliver our goods."

Putting data to work—from edge to core to cloud

In its production facilities, AeroFarms is bringing new levels of precision and productivity to farming. And this is where a wide range of technology, largely Internet of Things (IoT) technology, comes into play—technology that extends from the edge to the core to the cloud.

To create its edge-to-core-to-cloud architecture, AeroFarms leveraged the support of the Dell EMC IoT Technology Advisory Services team. Through this program, Dell EMC Services experts work with organizations to develop IoT architecture and technology recommendations, to define use cases, and to build implementation roadmaps.

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"Dell Technologies is an ideal technology partner for AeroFarms. Dell offers a comprehensive infrastructure portfolio that spans our IT needs, from edge gateways and rugged tablets to machine learning systems and network gear. We are also benefiting from Dell's expert advisory services, such as the IoT vision workshop, which is helping us align our business and IT priorities and determine our highest-value analytics use cases."
— David Rosenberg, AeroFarms Co-Founder and CEO

Let's begin at the edge. Down on the indoor vertical farm, sensors and cameras in the aeroponic growing system gather data on everything from moisture and nutrients to light and oxygen. Their sensors capture data about the operating and growing environment and send it to Dell IoT Edge Gateways with powerful dual-core Intel® Atom™ processors. Information is then relayed over their farm network to Dell Latitude Rugged Tablets and a local server cluster, making it available for monitoring and analysis.

"We are excited to partner with Dell Technologies," Rosenberg says. "They have a unique approach leveraging all seven of their divisions to develop turnkey solution that meets our needs today and as we scale further in the future."

Looking ahead, AeroFarms is growing its machine learning capabilities with Dell EMC Ready Solutions for Machine Learning. The goal of deploying this core computing is to automate the analytics processes that help the company's scientists identify patterns in the images and data generated by the growing system. Deploying a solution of compute, networking and storage technologies in the core will enable a higher order of intelligence and more complex decision-making, such as real-time quality control that takes into account even more diverse types of data, including machine data, historical growing data, environmental data and quality data.

The core extends enterprise compute capabilities outward from the cloud to increase analytical capabilities at intermediate points. Each layer in the core is an aggregation point where additional data sources can be integrated to enable greater insights with lower latency. The core lessens the amount of data that needs to be transmitted through the network to the cloud and has sufficient intelligence to enable machines to take immediate action.

The company is also considering expanding its use of Microsoft Azure to conduct more data analytics in the cloud while leveraging geo-redundant data backup. With Azure support, AeroFarms can collect disparate data from its multiple farms and multiple data sources, including public clouds, as well as information interpreted in historical context, leveraging data previously collected and analyzed over time. A hybrid cloud model enables cost-effective large-scale processing and analytics, utilizing deep learning to glean valuable and actionable insights that drive analytical rules engines at the edge and augment machine learning in the core.

Two critical projects

Today, the Newark facility's edge-to-core-to-cloud architecture is helping AeroFarms complete two critical projects focused on improving operational efficiency through product tracking and enhancing product quality.

In one of these projects, AeroFarms is leveraging Dell Edge Gateways to improve its tracking from seed to package through each distinct stage of farming—seeding, germination, growing, harvesting and packaging. The Edge Gateway 3001 is deployed in the extreme condition of the indoor farm, and it wirelessly tracks key inputs for the growing environment. Product testing can then be associated with the entire history of the discrete locations within each of their farms, interactions with workers and sanitation records. Collectively, this information is helping AeroFarms optimize its processes to improve taste, texture, color, nutrition and yield.

The other project is focused on improving real-time quality control through multi-spectral imaging of grow trays. Special cameras with integrated structured light scanners send data to Dell Edge Gateways, which create 3D topological images of each grow tray. When an anomaly is detected, the gateway sends an alert to operators who carry Dell Latitude Rugged Tablets on the farm floor. Now they can stay connected all the time with a tablet designed to operate within the 70-degree indoor farm and the 36-degree packaging room, all while withstanding heavy use and the demanding conditions that are a part of everyday life on the farm.

The images are also sent on to the local server cluster in the core, where they can be further analyzed using machine learning to continue to update the anomaly detection algorithm running on the gateways. Ultimately, this project gives AeroFarms the potential to increase yields and further improve its ability to optimize the nutritional content of its produce.

The bigger picture

These two projects are just the beginning for the AeroFarms team. They have another 10 on their list already that they are scoping.

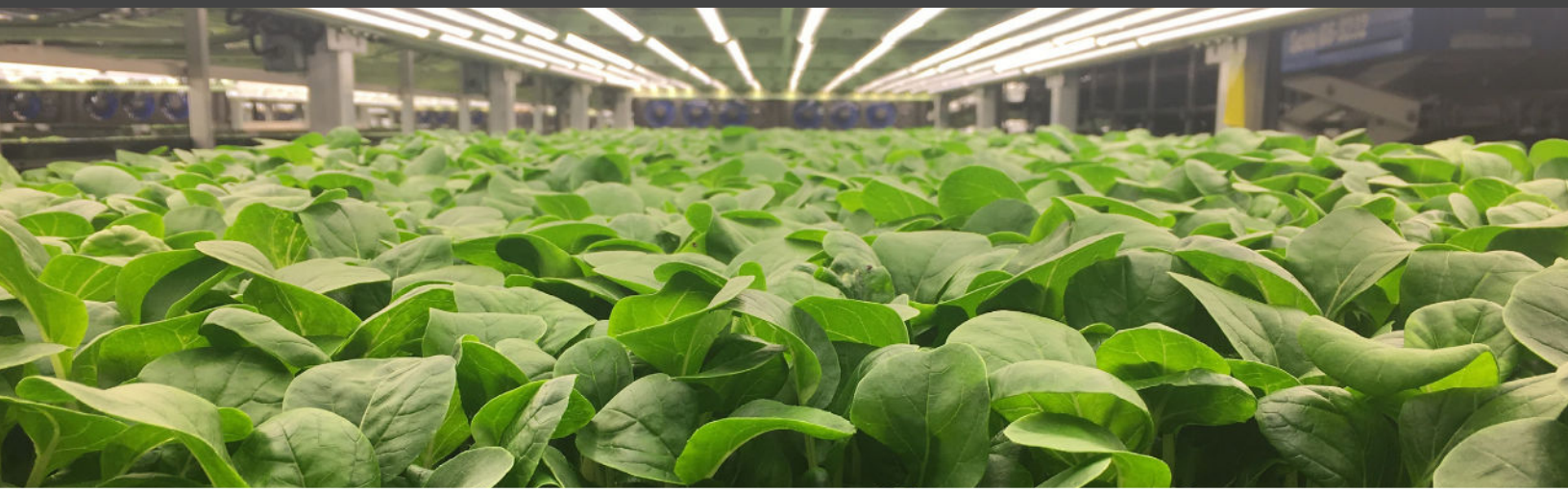
Now that they have the right distributed architecture in the farm, they can scale much faster. In addition, they have made a concerted effort to deploy headroom so they do not have to install additional computing infrastructure with every new use case, but rather just push additional applications out as they see fit.

One exciting project they are looking at as one of the next expansion areas is plant listening. They can actually listen to all the important ways plants communicate, and interrogate that data using statistical techniques, including machine learning. That's just one of the many projects that uses technology to get AeroFarms closer to its mission.

Rosenberg adds, "We are as much a capabilities company as we are farmers, utilizing science and technology to achieve our vision of totally-controlled agriculture. We have worked closely with Dell Technologies to develop the tools to wirelessly track and monitor our product throughout the growing process from seed to package. Dell Technologies understands our IoT infrastructure and integration needs, and we see the opportunity to collaborate on additional solutions as we build our indoor vertical farms in major cities around the world."

A LEGACY OF GOOD

AeroFarms' mission, passion and focus closely mirrors that of the Dell 2020 Legacy of Good Plan. This plan is focused on driving human progress by putting Dell technology and expertise to work where it can do the greatest good for people and the planet. Learn more about Legacy of Good.



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