## FarmBot

**Industry:**
ROBOTICS
MACHINE DESIGN
AGRICULTURE

## The Challenge

Based in California, FarmBot is the developer of "humanity's first open-source CNC farming machine" for household use. The company's app-controlled Genesis robot plants seeds, waters them, detects and removes weeds, and uses sensors to monitor soil, weather and the environment. FarmBot's U.S. and Europe-based engineering team was looking to move its product development to the cloud to ensure that its more than 300 open-source contributors worldwide were all working from the same single source of truth.

## Results

- FarmBot credits Onshape's cloud-native collaboration tools for "a 50% to 100% increase in productivity."

- Onshape's accessibility across Windows, Mac and Linux operating systems enables FarmBot's core design team and 300+ open-source contributors to work on any device.

- Using the Simultaneous Editing feature allows FarmBot engineers split between the U.S. and Europe to work on the same CAD models concurrently without the delays or restrictions of checking files in and out of a PDM vault.

*"When we need to get parts to our manufacturers or need to make a prototype on the 3D printer, we do things a lot quicker in Onshape. For us, this has meant at least a 50% to 100% increase in productivity."*

– **Rory Aronson**, founder and CEO, FarmBot

DIGITAL TRANSFORMS PHYSICAL

# HANDS-OFF ROBOTIC GARDENING

*Startup FarmBot, creator of the first open-source CNC farming machine, credits Onshape for boosting productivity by more than 50%*



**21st Century Farming** – *The FarmBot uses precision CNC controls to determine the location of seeds, watering and weeding – eliminating physical labor on small plots of soil.*

If FarmBot founder Rory Aronson fulfills his vision, a robotic gardening machine will one day become a standard household appliance.

"Pretty much everyone in developed countries has a microwave oven and a refrigerator. And if they have the space, they probably have a washing machine and dryer at home, too," he says. "Every appliance has a specific function and you just plug them in, press some buttons and forget about it. These things add a lot of convenience to our lives and we see FarmBot headed in the same direction. It should make economic sense for everybody to be a participant in the food production process."

The FarmBot Genesis is "humanity's first open-source CNC farming machine." The automated machine plants seeds, waters them, detects and removes weeds and uses sensors to monitor the soil, weather and environment "to farm smarter over time." The farmer can tend crops without getting his or her hands dirty, controlling the FarmBot from any computer, phone or tablet (see a video here).

FarmBot's user interface is meant to make gardening fun, like you are playing a video game. In the initial session, "players" drag and drop their vegetable choices into a map with the seeds being automatically spaced by the software. "A lot of people say this reminds them of playing 'Farmville' on Facebook a few years ago," Aronson says. "It's really like a video game, except at the end you get a functional, tangible result – like salad, berries, or veggies to grill up over the weekend."
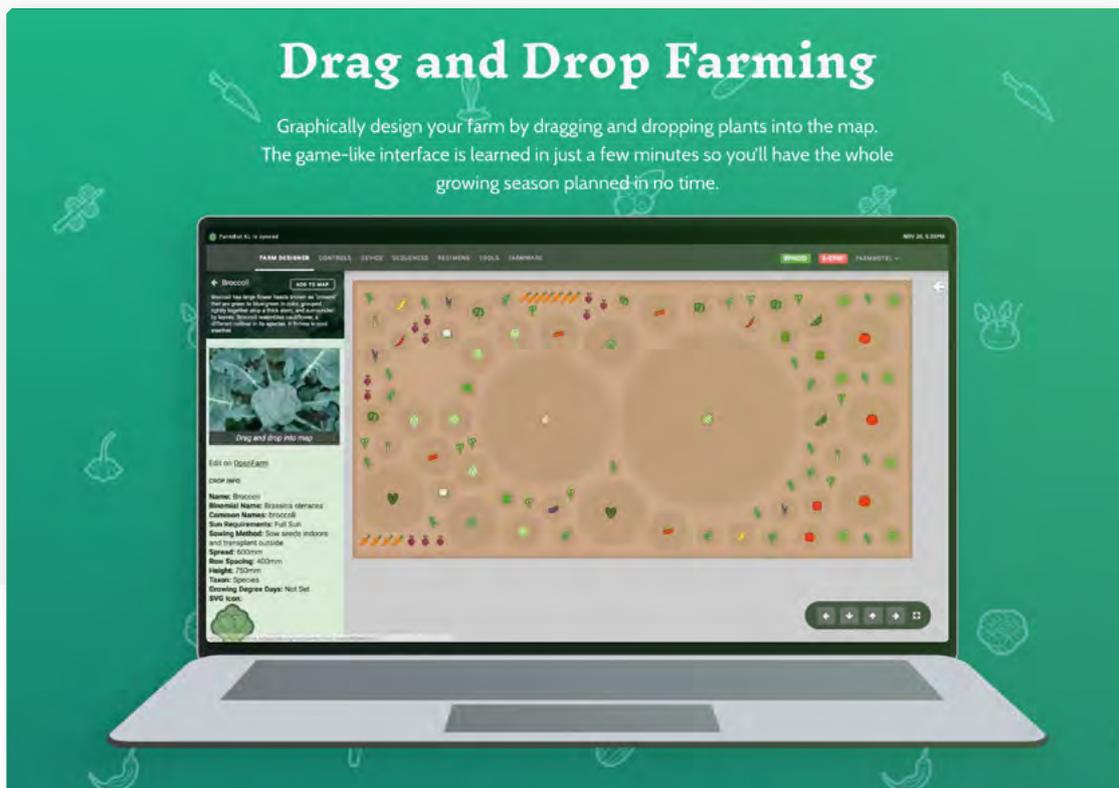


*Drag & Drop Farming –* *FarmBot's video game-like interface is meant to make gardening more fun and less labor-intensive.*

Based in California, the company has 8 full-time employees, including two hardware engineers, but also collaborates with more than 300 open-source contributors around the world. The company's mission is to publicly share all its design work, encouraging enthusiasts to modify and improve the 3D models to their own specifications. FarmBot kits for the various FarmBot models range in price from $1395 to $3,995 and include everything except the planter bed, garden hose and extension cord.

# Cloud-Native CAD and PDM Streamline Design Collaboration
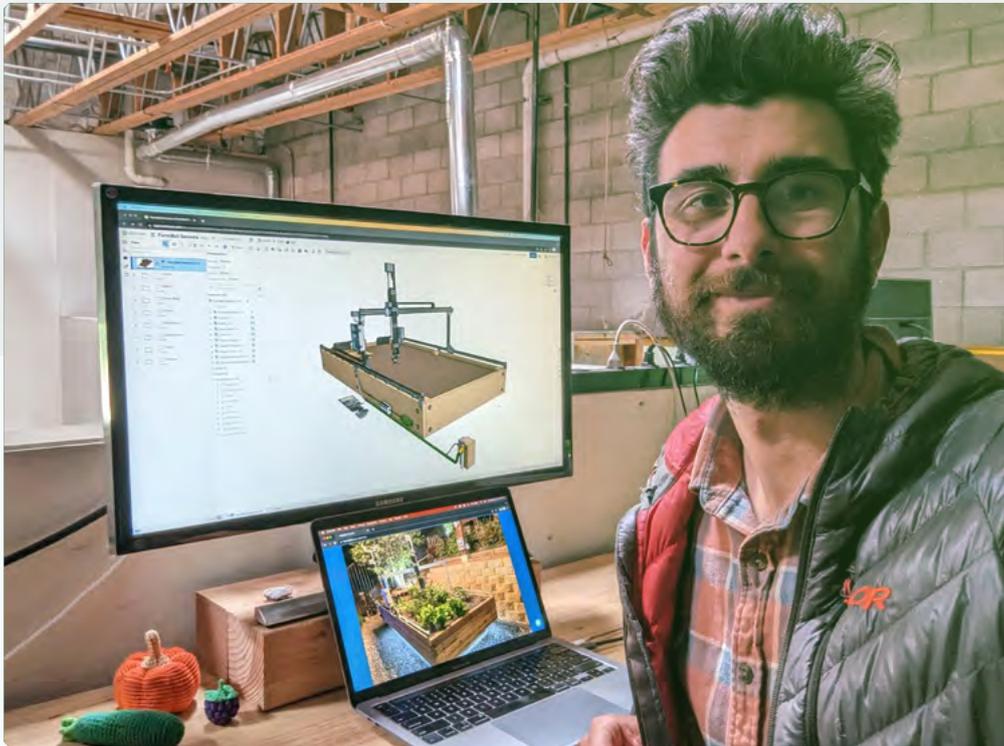


*FarmBot founder and CEO Rory Aronson values Onshape's instant accessibility on any computer, tablet or phone.*

To design the FarmBot Genesis, Aronson chose Onshape, a cloud-native CAD and PDM platform that accelerates product development and streamlines collaboration by ensuring every team member is working from the same single source of truth.

FarmBot's core development team works internally on new improvements before releasing them to the wider open-source community around the world. Onshape's simultaneous editing tools, allowing multiple people to collaborate on the same model at the same time, have been especially valuable as the core team is spread out between North America and Europe.

"Shifting to Onshape was very much like the shift from desktop word processing to Google Docs. All of a sudden, the power of collaboration was unlocked," Aronson says. "It's great to be in the same Document as another engineer and editing stuff simultaneously or being able to watch or provide feedback. When we're in the same workspace, I can update parts while someone else is updating the assembly and yet another person is updating the drawings."

"When we need to get parts to our manufacturers or need to make a prototype on the 3D printer, we do things a lot quicker in Onshape," he adds. "For us, this has meant at least a 50 to 100% increase in productivity as opposed to the old CAD workflow where only a single person can access a document at a time."

The FarmBot team also values Onshape's instant accessibility on any computer, tablet or phone. "I use both a Windows and a Mac computer, but I used to be tied to just Windows when I was using SOLIDWORKS," Aronson says. "Our other hardware engineer prefers Linux, so he can also be consulted in some software development. So it's really nice for him to be able to load up Onshape in the browser on his platform, and I can use it on my two platforms."

"We also like using it on our phones, whether it's at an informal lunch showing somebody a part to convey an idea, or in a car ride on the way to the manufacturer to update a part file or a drawing at the very last minute," he adds.

## Onshape is Perfect for Open-Source Projects
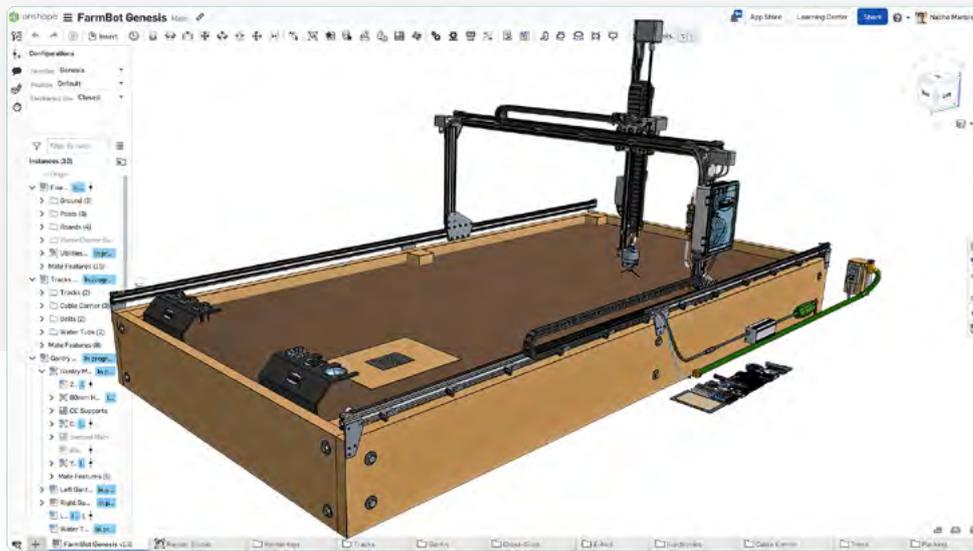


*FarmBot enthusiasts can copy the main Onshape design and make their own CAD modifications.*

As of July 2023, more than 4,000 people had copied the Onshape Public Document for version 1.7 of the FarmBot Genesis. Onshape is perfect for sharing open-source hardware projects because it not only gives contributors instant access to the CAD model, but also to the professional CAD tools needed to make custom modifications.

"Onshape gets rid of a lot of barriers for us. You don't need to download any software. All you need to do is create an account and it's free," Aronson says. "With any other system, you have to install software, be on the right computing platform or maybe export the files into other formats and import it into your system of choice. Sometimes you lose the design intention or it imports incorrectly."

"Onshape does away with all those problems because it is accessible to anybody – and that's what you ultimately want with open source. Often the open-source tools they give you aren't good enough for what you're trying to do. Onshape is very powerful, but equally important is that it's user-friendly and easy to learn for our contributors."

FarmBot's documentation is also open source, released under a common license developed by the Open Knowledge Foundation. For those who wish to go off-the-grid, there is a dedicated section in the FarmBot Forums discussing modifications for solar panels.

## Devil's Advocate: Will Robots Ruin Old-Fashioned Gardening?

The FarmBot enables a couch potato to grow potatoes from the comfort of his or her remote control. It does all the planting, watering, weeding and will even scare birds and other animals for you. It monitors the weather and adjusts plans accordingly. The only time you need to go outside is to pick your food. But what about traditional gardeners who enjoy getting their hands dirty – who appreciate feeling a deep physical connection to the land?

"Certainly, FarmBot is not for everyone," concedes Aronson. "We're not trying to replace somebody's hobby or take away therapeutic time in the garden. FarmBot is meant for people who otherwise wouldn't grow their own food and that's the vast majority of us. FarmBot customers like the concept of self-sufficiency. They like the idea of having a garden at home, but they don't have the time to get out there every single day."

*GROWING A MOVEMENT – FarmBot provides the software and hardware to support small-scale, hyperlocal, DIY food production. Backyard farmers can either purchase kits and build their FarmBots as suggested, or modify the design and share their version with the open-source community. (Photo courtesy of FarmBot)*

Outside of home consumer use, the FarmBot has proven itself as a useful educational tool and a platform for horticultural therapy, empowering disabled individuals who otherwise could not garden the ability to grow their own food. In 2017, the core FarmBot team was invited to present its technology at NASA's Kennedy Space Center for a forum on growing food in space.

"The FarmBot isn't a silver bullet for global food production, but we think it can be an important component in the future of agriculture," Aronson says. "There's only so much food you can grow in your backyard, but FarmBot empowers more people to utilize that previously unproductive space and engage in food production. Now we're going to have that many more people thinking about where their food comes from and potentially thinking about other ways to address world hunger."



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