

Case Study: Laser-Guided Sandwich Stacking

Application: Material Handling

Robot Model: Kawasaki RC005L general-purpose robot

Although simple automation can give some manufacturers the boost they need to increase production and product consistency, more complex applications require intelligent, flexible robotic solutions that can adapt to variable products and pick locations.

For this large-scale sandwich producer, the daily struggle of having to meet growing production demands amidst a major labor shortage motivated them to robotically automate their high-speed sandwich stacking application. TechBrew Robotics, a Kawasaki Preferred Integrator based in Salmon Arm, British Columbia, Canada, designed a custom solution using Kawasaki's industry-leading R series robots and F60 controller.



A view of the application running, from above. Kawasaki robot color changed per customer request.

CHALLENGES

- Complex application requires intelligence, fast processing speeds and precise tooling
- Inconsistent workers resulted in inconsistent production
- Food-safe robots and machinery needed to meet industry standards

The robots' task may seem simple: after the sandwiches are halved in the cutting machine, the robots need to pick up, and rotate to stack one half on top of the other, making them easier for human workers to package manually down the line. However, this application was tricky to automate for a few reasons.

The sandwich halves vary in their position as they come out of the cutting machine, so the robot would need some sort of vision intelligence to understand the halves' location on the conveyor. They also needed to be able to stack the sandwiches in practically the blink of an eye.

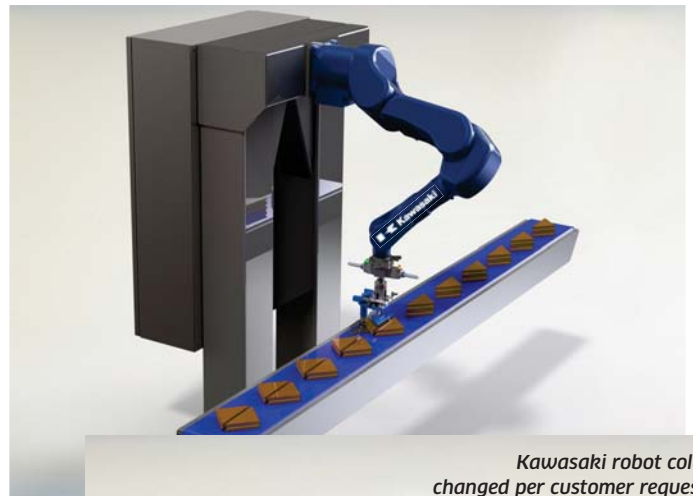
Fighting an Uphill Battle Against Labor Shortage

Like many other manufacturers, the customer struggled day in and day out to keep up with production goals due to absent workers. "The main driver for the end user for further robotics was the huge shortage of labor... Their production lines were understaffed, and they were always missing dozens of people from their optimum shift capacity," Findlater said. "Retention of staff was a huge problem."

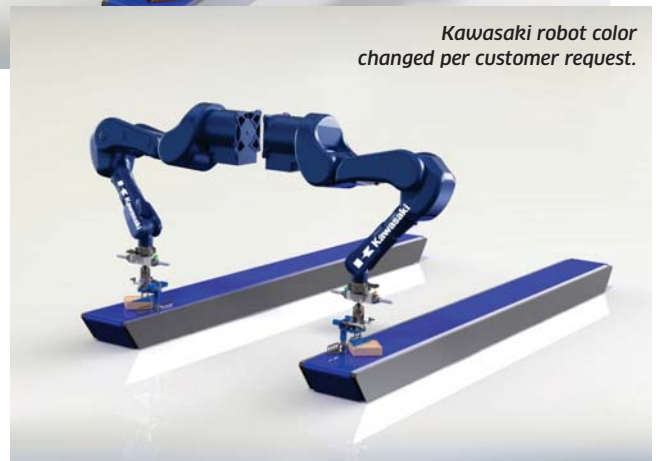
Food Safety First

TechBrew had to consider food safety regulations when designing this solution. The integrator used the cleanroom version of Kawasaki's 5 kg payload RS005L general purpose robot, which offers a pressurized cavity, ISO Class 5 cleanroom specification, and comes with an aluminum arm cover, rubber outer seals and a chemical resistant epoxy paint finish for easy wash down.

The patent-pending end effector's tool-less design makes it easy to disassemble for cleaning purposes, and it's constructed with stainless steel and food-grade plastic.



Kawasaki robot color changed per customer request.



SOLUTION

- Two wall-mounted Kawasaki RC005L robots equipped with custom end effectors pick up and stack sandwich halves on a conveyor
- Kawasaki F60 controller used for compact size and fast processing speed
- Conveyor tracking and laser range finding systems are used to detect the locations of sandwich halves
- Patent-pending, food-safe, pneumatic gripper handles product without losing excess ingredients

TechBrew needed to integrate their solution into the customer's existing production line, which meant getting creative with their use of space. The R series robots were inversely mounted on a cantilever beam attached to the cutting machine, so they could fit in the roughly 4.5-foot space. The F60 controllers' compact size (W300 mm x D320 mm x H130 mm), made it possible to stack them on top of the sandwich cutting machine, saving space.

To maximize throughput, the robots face outward, stacking sandwiches on two different conveyors running simultaneously. Because there were so many variables in this application, TechBrew used a laser range finding system and conveyor tracking to detect the shape and location of the sandwich halves as they emerge from the cutting machine.

Once the sandwich halves have been stacked, they travel down the conveyor where human workers are waiting to place the product into triangular cardboard boxes. Operators oversee operations earlier in the production line, smoothing sauces and adjusting ingredients as needed.

Custom Gripper

TechBrew designed a custom gripper specifically for this application. The pneumatic end effector is controlled directly by the F60 Controller, allowing for quick movements. A controllable pressure plate comes down to hold the product in place as two stainless steel paddles slide under the sandwich half to lift it. Once lifted, the actuator spins the sandwich half 180 degrees, and force dampers at the end of the rotation keep the sandwich and its ingredients intact.



Kawasaki RS080N robot, retrofitted

Dynamic Duo – The Kawasaki F60 Controller & AS Programming Language

The combination of Kawasaki's AS programming language and the industry-leading F60 controller easily handled the complexities of this application. Findlater was able to program this application directly on the robot, without a co-processor, which reduced costs and simplified the installation.

The Kawasaki F60 Controller's high processing speed handled real-time scanning and data analysis on the sandwich halves, and output the robot coordinates in under 200 milliseconds, while processing a queue of sandwiches at a rate of 60 per minute.

“[The F60 Controller's] processing speed was able to handle all this crazy stuff I was making it do without slowing down or having any issues.”

“The flexibility of Kawasaki's AS Language was really beneficial also... It's quite an advanced scripting language compared to some of the other robot manufacturers out there, who have very simple PLC-style programming or rudimentary commands available.”

-Kyran Findlater, Mechatronics Designer, TechBrew

RESULTS

- Fewer workers required; solution helps customer fight labor shortage
- Entire sandwich stacking process takes 800 milliseconds
- System can stack 60 sandwiches per minute, matching speed of human operators

It didn't take the line managers long to adjust to their new robotic co-workers. The new system is able to process the same amount of sandwiches as before, but throughput has increased as a result of the robot's consistency. Operators are only needed for the final packaging step and to oversee the process, intervening if needed. But, the end user no longer has to rely on a large staff of operators to meet production goals.

“A robot is a clear path to getting a more consistent reliable output and a more lean manufacturing process,” Findlater said. “If you're serious about your process and performance, and actually want to improve, robots are the key to that.”

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