Case Study: Automated Concepts, Inc.

Rapid prototyping for simple (and delicious) connected control

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Do you love smoked meat but tire of babysitting the pit? So does David Counts's customer, a fan of competitive BBQ who had a hunch he could use technology to get even better results with his prized secret recipe.

For fun, he had built a custom carbon steel smoker using a reverse flow design to achieve a more uniform internal temperature. Its shape forces smoke to travel farther away from the firebox before passing through the cooking chamber, reducing hot spots and allowing him to pack the chamber more efficiently.

He thought he could take temperature control even further with automation and had produced a proof-of-concept using a special Arduino board with heat-tolerant components. For his next design, he turned to David Counts, hoping for something a little less DIY.

Dave works for Automated Concepts, Inc. (ACI), a Texas-based system integrator, and he proposed using Opto 22's *groov* RIO to build the next version of the prototype. Dave thought the multifunction I/O and simple Node-RED programming would give his customer a lot more flexibility to redesign.

THE JUICY DETAILS

groov RIO's main job in this system is to maintain pit temperature for the duration of the cookout. The firebox is still fed with wood, but Dave and his customer installed additional heater elements powered by a 30 A external generator to deliver more heat inside the cooking chamber. Dave wrote a program in Node-RED that allows *groov* RIO to cycle the heaters on and off based on low- and high-temperature limits until the preset cook time runs out.

It was also important to Dave's customer to be able to access the smoker controls on his phone, so he didn't have to drag a computer around. Dave connected a USB WiFi adapter to the *groov* RIO module, installed an industrial-grade access point in the trailer, and built a GUI in Node-RED.


Behind the custom barbeque, you can just spot the NEMA 4X enclosure that holds the *groov* RIO.

The GUI accepts temperature setpoint and deadband values, which Node-RED uses to calculate appropriate high- and low-temperature limits for each of the two heating zones in the chamber.

"Being able to run [the GUI] with a browser is huge because it gives you a lot of flexibility," says Dave. "You don't have to have someone's application software. Plus, it's cross-platform and works on anyone's device. That's pretty huge, especially on these small applications, because people don't want to have to spend a bunch of money on developing and licensing an HMI."

The GUI also allows the user to define a setpoint for smoke control that drives an actuator on the firebox outlet. The actuator can extend as much as 12", but for this application, Dave and his customer only needed a maximum 2.78" extension. Fortunately, since the rate of travel of a linear

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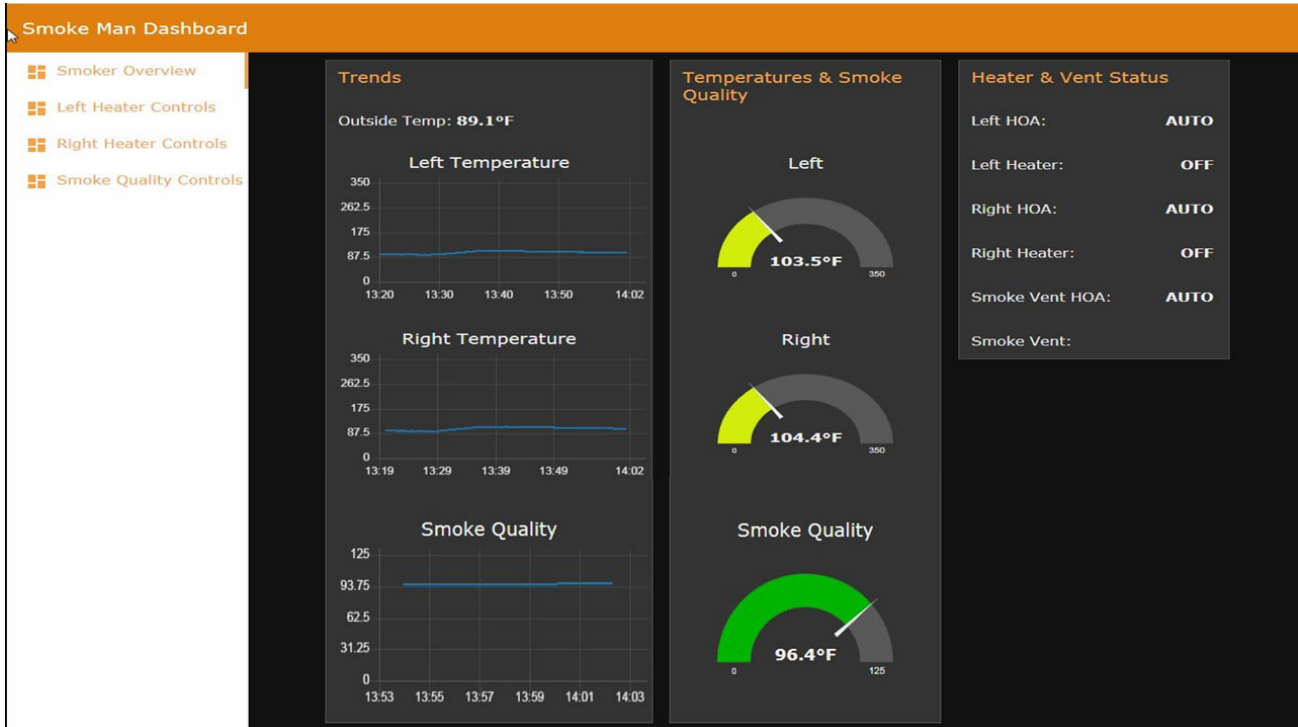
Mobile user interface built in Node-RED

**The electrical panel Dave designed
with *groov* RIO (circled)**

screw actuator is very consistent, Node-RED was able to control it very precisely with simple timing control.
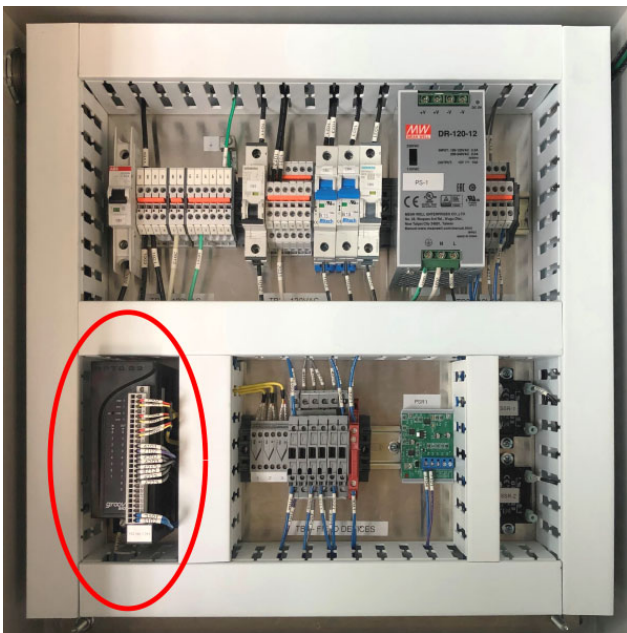
With his *groov* RIO-based prototype, Dave's customer can monitor the smoke process from the comfort of his living room using trend charts and warning indicators on the GUI. He can also switch into other control modes if he needs to get more hands-on. When the preset smoke time has run out, he gets a text message from Node-RED telling him it's grub time!

DIG INTO *groov* RIO

This was David Counts's first project using *groov* RIO, and with his customer now considering a potential franchise opportunity, Dave is feeling pretty good about the outcome:

"What we normally use for smaller jobs is a Siemens micro PLC, but if you want to have an operator interface on top of that then you've gone way over the cost of *groov* RIO, whereas RIO has the I/O, control, and user interface all in one."

And for prototype development like this, Dave adds, "It's a big advantage to be able to modify the I/O without having to modify the board or even buy another module."

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Now, he's looking to use *groov* RIO for a potential geotechnical monitoring project and another one designing an electronic pressure relief for an oil field control system.

What's Dave's very next project, though? Adding mobile control (and maybe Alexa notifications down the line) to his hot tub with *groov* RIO and Node-RED!

ABOUT OPTO 22

Opto 22 was started in 1974 by a co-inventor of the solid-state relay (SSR), who discovered a way to make SSRs more reliable.

Opto 22 has consistently built products on open standards rather than on proprietary technologies. The company developed the red-white-yellow-black color-coding system for input/output (I/O) modules and the open Optomux® protocol, and pioneered Ethernet-based I/O.

In early 2013 Opto 22 introduced *groov* View, an easy-to-use IoT tool for developing and viewing mobile operator interfaces—mobile apps to securely monitor and control virtually any automation system or equipment.

Famous worldwide for its reliable industrial I/O, the company in 2018 introduced *groov* EPIC® (edge programmable industrial controller). EPIC has an open-source Linux® OS and provides connectivity to PLCs, software, and online services, plus data handling and visualization, in addition to real-time control.

All Opto 22 products are manufactured and supported in the U.S.A. Most solid-state SSRs and I/O modules are guaranteed for life.

The company is especially trusted for its continuing policy of providing free product support, free online training, and free pre-sales engineering assistance.

For more information, visit opto22.com or contact **Opto 22 Pre-Sales Engineering**:

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