Case Study: Paloma Irrigation and Drainage District Reduces Downtime and Pump Repair Costs

groov devices provide flexibility and scalability for SCADA expansion

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CASE STUDY: PALOMA IRRIGATION AND DRAINAGE DISTRICT REDUCES DOWNTIME AND PUMP REPAIR COSTS

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The Paloma Irrigation and Drainage District (PIDD), spanning 30,000 acres in Gila Bend, Arizona, underpins the region's agricultural production. It supplies water to diverse crops, including alfalfa and cotton, and supports dairy operations, contributing to the area's varied agricultural output. Additionally, the district provides domestic water services to nearly 100 homes.

District Manager Robert VanHofwegen heads the water management network, ensuring effective delivery through a combined system utilizing Gila Bend Canal and groundwater sources. This approach fuels both agricultural growth and the prosperity of the local community.

More than just irrigation, the PIDD safeguards the environment and upholds the community's water rights. Their commitment to sustainable water practices aligns with Gila Bend's agricultural vision, ensuring long-term prosperity for both flourishing fields and surrounding homes. In this resource-scarce landscape, the district plays a crucial role in sustaining the thriving agricultural hub.

CHALLENGES

But in 2019, the PIDD faced several pressing challenges, culminating in the need for a strategic shift towards an

Gila Bend main canal at Gillespie Dam

Paloma Irrigation lift station

Industrial Internet of Things (IIoT) approach. Here's a closer look at the key issues:

Inefficient Manual Operations

- **Time-consuming & laborious:** Technicians relied on manual controls and frequent site visits for monitoring and adjustments, reducing efficiency and introducing delays.
- **High maintenance costs:** Frequent pump failures due to lack of continuous monitoring resulted in annual maintenance expenses of $300,000–$400,000, creating a financial burden for the district.
- **Reactive management:** The district's inability to proactively respond to changes in water demand or system failures hindered optimization and problem prevention.

Limited Visibility and Control

- **No real-time monitoring:** Absence of real-time data left the district unaware of issues that were impacting water delivery.
- **No remote control:** Inability to remotely control systems limited flexibility and timely responses to issues, potentially leading to supply interruptions.

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Gillespie Dam lift pumps

These challenges highlighted the critical need for a more modern, cost-effective, and data-driven approach to water management, paving the way for the district's exploration of IIoT solutions.

FIRST TRY: RASPBERRY PI

In a bid to address the challenges of outdated systems and modernize operations, PIDD District Manager VanHofwegen explored an unconventional solution: Raspberry Pi®. These low-cost, versatile devices offered a potential entry point into leveraging IIoT technology for improved water management. Their affordability allowed VanHofwegen to experiment with IIoT applications without significant upfront investment.

Raspberry Why?

Leveraging Raspberry Pi proved successful, laying the groundwork for the district's IIoT strategy. PIDD also adopted Node-RED®, a user-friendly flow-based programming tool, and FlowFuse™, a platform for remote device management, to more easily integrate hardware with online services. Node-Red's visual programming eliminated the need for extensive coding, enabling the development of sophisticated irrigation management solutions at a low price. Remote management capabilities improved, significantly reducing reliance on manual checks.

Raspberry Bye!

Despite initial success, Raspberry Pi solutions presented new challenges. While cost-effective and adaptable, they displayed limitations in reliability and durability. Sensitive to environmental fluctuations common in industrial settings, they also required substantial customization, delaying the expansion of digital transformation projects.

These vulnerabilities highlighted the inefficiencies in deploying consumer-grade technology in a demanding industrial context. PIDD needed a solution that was not only robust and reliable but also streamlined for quick deployment. Their experience led the district to seek an industrial-grade alternative better suited to their needs.

> **"Everything about [*groov* devices] seemed designed around ease of use and reliability, which was exactly what we needed."**
>
> **- Robert VanHofwegen, District Manager**

THE MOVE TO *groov*

Faced with limitations of Raspberry Pi, Paloma Irrigation and Drainage District sought a robust, industrial-grade IIoT platform. This search led VanHofwegen to a solution that transformed their operations: *groov* devices from industrial automation manufacturer Opto 22.

"I don't remember exactly how I found it, but what turned me on was that it was ready out of the box to be integrated with our existing Node-RED-based strategy. Beyond that, *groov* devices fit well into our future plans to migrate to Ignition® SCADA. Everything about it seemed designed around ease of use and reliability, which was exactly what we needed," VanHofwegen recalls.

groov EPIC and _groov_ RIO from Opto 22

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PIDD *groov* EPIC enclosure

THE *groov* LEARNING JOURNEY

In the initial exploratory phase, VanHofwegen actively engaged with Opto 22's online training resources, especially YouTube® tutorials and demonstrations. These materials comprehensively cover *groov* product functionalities and proved crucial for understanding MQTT integration, which was vital for the district's IIoT roadmap.

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The detailed walk-throughs and use-case scenarios in Opto 22's videos offered practical insights into the real-world capabilities of *groov* products, confirming their alignment with the district's needs. This, combined with the district's existing MQTT expertise and HiveMQ® broker usage, underscored the potential for seamless integration and robust data communication, ultimately solidifying their decision.

Reasons for Choosing Opto 22 Products

- **Industrial durability & reliability:** With a proven track record in harsh environments—unlike the more sensitive Raspberry Pi—*groov* products reduce maintenance and ensure operational stability.
- **Affordability:** *groov* RIO units at roughly $1,000 each are significantly cheaper than existing industrial-grade pump monitoring/control solutions, making them a more cost-effective option.
- **Modular design:** *groov* EPIC's modular design allows for customization of I/O per pumping station, with the flexibility to expand as needed.
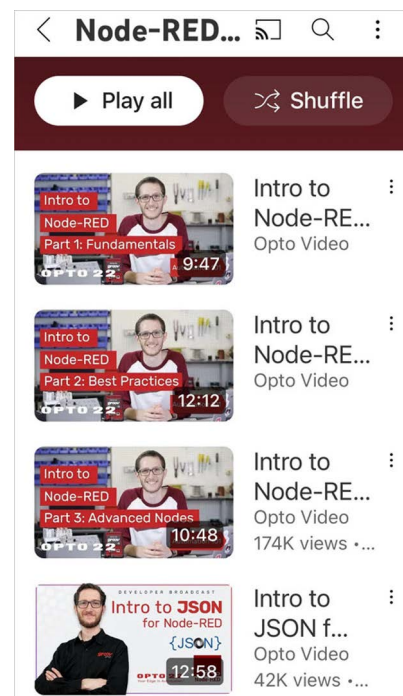
In selecting *groov* products, PIDD embarked on a new phase of its modernization journey, now armed with technology that aligned with their goals for efficiency, reliability, and future scalability. They were poised to transform their water management practices and set a potential new standard for precision and control.

Opto 22 YouTube channel

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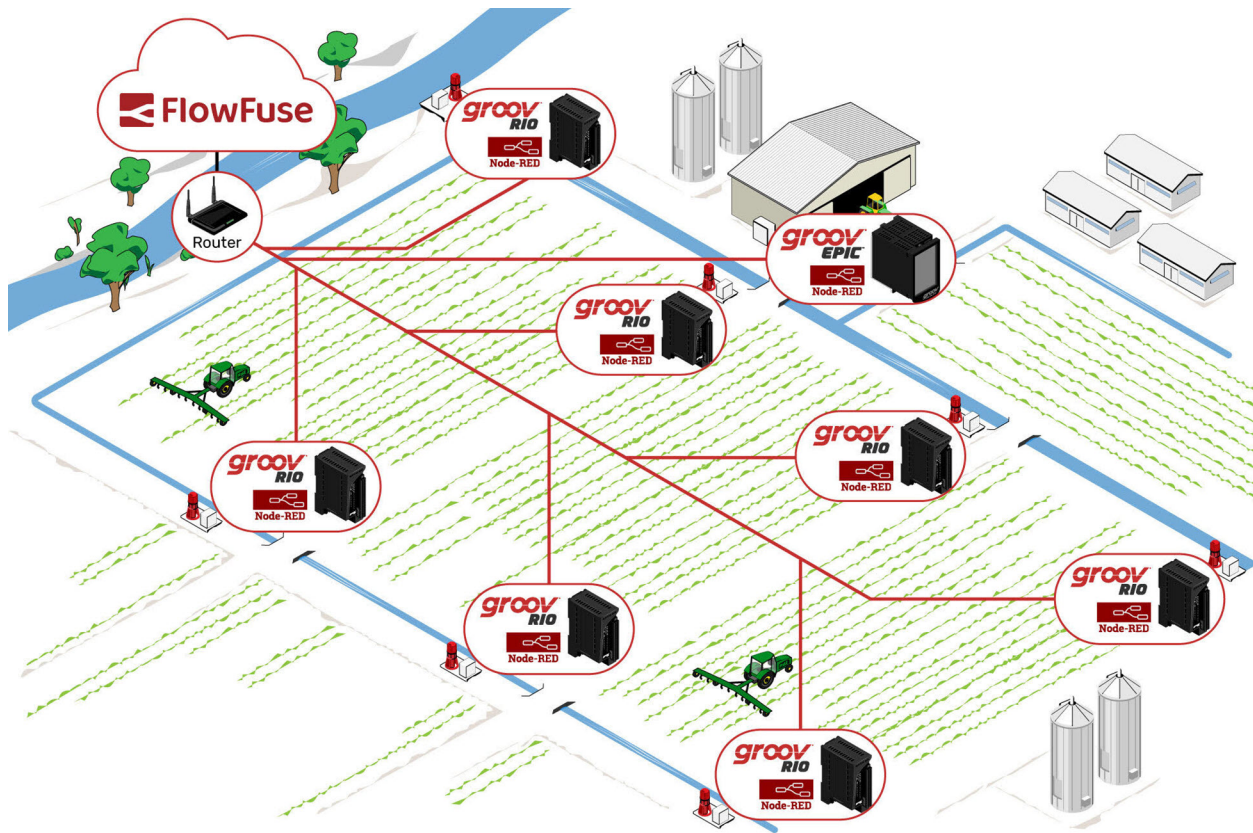# Case Study: PIDD Reduces Downtime and Pump Repair Costs with SCADA

Illustration of PIDD site technology

THE TECHNICAL DEEP DIVE: OT AND IT COME TOGETHER

Paloma Irrigation and Drainage District worked to bridge the gap between operational technology (OT) and information technology (IT) for seamless data flow and efficient management.

Automating Key Functions

Leveraging his existing Node-Red expertise, VanHofwegen automated key functions like pump and oiler control, tank level control, environmental monitoring, and data transfers at pump stations. Automation reduced the need for frequent onsite visits and manual checks.

Innovation with AI

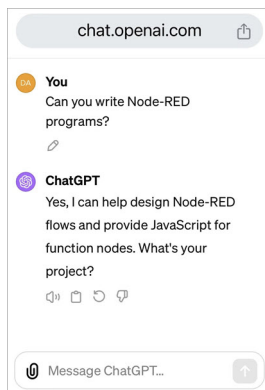PIDD used ChatGPT® to simplify Node-RED flow development with JSON code.

Design Node-RED flows with ChatGPT

Automating code creation empowered team members with varied skill sets and also boosted system flexibility.

Secure, Real-Time Data Communications

The team adopted MQTT communications for efficient and secure transmission of operational technology (OT) data across the network. This publish/subscribe communication methodology enabled remote monitoring of water levels, pump statuses, and informed decision-making. Security was prioritized through a centralized internet connection, minimizing cyber threats.

Actionable Insights from Raw Data

FlowFuse, already integrated within their IIoT strategy, offered a robust platform for transforming raw data into user-friendly dashboards, providing actionable insights accessible to all technicians. Additionally,

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FlowFuse complemented Node-Red's data flow capabilities by offering a secure environment for application deployment and monitoring.

RESULTS AND IMPACT

While the PIDD's digital transformation is still in its infancy, VanHofwegen and his team have already ushered in a new era with the following clear benefits:

- **Reduced downtime & maintenance costs:** Automation, especially pump lubrication, minimized component wear and tear, leading to significantly fewer breakdowns and an estimated $300,000 annual cost reduction. "This is easily going to pay for itself!" exclaimed VanHofwegen.

- **Enhanced remote monitoring & control:** MQTT and FlowFuse enable real-time oversight of water levels, pump statuses, and other critical parameters, which resulted in fewer water shortages (reduced from monthly to yearly occurrences) and improved service reliability. As VanHofwegen notes, "Most times we are able to address and resolve issues before customers find out we are nearly out of water."

- **Positive impact on personnel:** Operators appreciate the user-friendly technology and reduced need for manual checks, allowing for more efficient deployment and productivity. PIDD was able to maintain its existing staff but deploy them more effectively—a win-win.

FUTURE PROSPECTS AND FINAL THOUGHTS

Paloma Irrigation and Drainage District's initial IIoT journey offers valuable insights for organizations considering similar endeavors.

PIDD solar-powered, automated control gates

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Here are some key takeaways:

- **Demonstrating value and building upon success:** Early ROI validation through small-scale IIoT projects using consumer-grade solutions can pave the way for more robust industrial deployments. Additionally, leveraging open-source tools and standard protocols makes it easier to transfer knowledge and scale up your system, supporting future expansion and efficiency improvements.

> **"This is easily going to pay for itself!"**
>
> **- Robert VanHofwegen, District Manager**

- **Positioned for further growth:** PIDD has now established an IIoT foundation that positions them well for future enhancements. The scalable *groov* products and exploration of advanced solutions like Ignition SCADA integration hold promise for further water management efficiency and sustainability gains.

ABOUT PALOMA IRRIGATION AND DRAINAGE DISTRICT

Paloma Irrigation and Drainage District, which has operated for over 100 years, was established to serve the local farming community in Gila Bend, AZ. With a commitment to sustainability and efficient water management, PIDD provides essential irrigation and drainage services to support the diverse needs of the agricultural sector. Through reliable water delivery and effective flood control measures, using advanced irrigation techniques and infrastructure, the district plays a crucial role in enhancing crop production and ensuring prosperity of the region's farmlands.

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.

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.

groov RIO Ethernet-based edge I/O modules, introduced in 2020, include I/O and IIoT software in a compact industrial package that goes anywhere.

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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