

Data Science in every drop

Ensuring efficient and reliable water sources around the world



Call for change

One in ten are without clean water

Water is essential to life. But 785 million people, or 1 in 10 in the world are without clean water, according to the US Centers for Disease Control and Prevention (CDC). Since 2006, the non-profit charity: water has provided clean, safe drinking water to more than 11 million people in 29 countries.

The organization builds sustainable, community-owned water projects, including small, community-managed water points in remote areas. When a water pump fails, many people in rural communities must walk several miles to a neighboring water system just to access clean drinking water. What's

more, repairing these systems can be complicated and inefficient, as there is no visibility when the pumps break down.

With a Global Impact Award grant from Google and support from other technology partners, charity: water created and developed a remote cloud-connected sensor device to monitor the performance and functionality of clean water projects located in rural areas in developing regions around the world. Specifically, 3,000 first-generation Internet of Things (IoT) sensors were retrofitted on water points to track the operational functionality of systems installed in northern Ethiopia. The sensors

transmit hourly real-time water flow data to the cloud-based tracking system.

Over the course of four years, the organization captured more than 32 million data points, however, it did not have the tools or expertise to analyze and unlock the potential value buried in this data. In addition, the organization struggled to filter out the “noise” in the data.

charity: water knew that accurately collecting and harnessing this data could significantly improve the sustainability, scalability and reliability of its services.





When tech meets human ingenuity

Innovation where its needed most

charity: water partnered with Accenture's Tech4Good program, which applies cutting-edge technology to address critical challenges facing society. Its aim is to bring innovation where it's needed most, helping to build a more sustainable and inclusive world.

"We started a conversation with Accenture about how to collaborate on a project where Accenture could use their best and brightest resources to help us do the data analysis to understand what we were seeing, to understand trends and events in all of this data and ultimately help us develop the building blocks for a predictive algorithm that will tell us when wells are going to break down before they even break down," explains Christoph Gorder, charity: water's Chief Global Water Officer.

The team built a two-part anomaly-detection system using data science, machine learning and advanced probabilistic models. The team applied the system to charity: water's supply network data to provide deeper, more accurate insights from cloud-connected pump sensors throughout northern Ethiopia.

First, the system models normal water usage behavior and consumption patterns at a specific water pump. This helps the team learn how behavior changes throughout the week and months. For example, charity: water can understand precisely when the least amount of water is consumed in some areas, including the wettest months of the year, when communities may have different water sources.

Second, the system analyzes the data and "scores" it to flag anomalies. This helps detect malfunctioning water flow sensors. And if a pump breaks down, charity: water can subsequently alert network operators who dispatch mechanics to repair it as quickly as possible.

This anomaly-detection system has set the stage for a second phase of the partnership. Accenture is next working on delivering a predictive maintenance solution to help charity: water notify an operator or technician before a pump breaks. The team hopes to one day deploy this solution for thousands of cloud-connected water systems.

A valuable difference

Better visibility to help more communities

Through in-depth collaboration and working sessions, the team first clearly identified the data challenges that charity: water faced. After dissecting the massive data set, they created a water consumption model that provides better visibility into how, when and how often communities are using water points to ensure reliable access.

The team's new anomaly-detection system has set the stage for a predictive maintenance solution in which charity: water can accurately predict and prevent failures in its water systems.

In addition, this accurate data can help charity: water plan the location of future pump installations. The team is using external data—such as how many people could have access to a water system and which areas optimize cell network coverage—so systems can connect to the cloud.

The team at charity: water is also working on a second-generation prototype for a more accurate and more robust sensing technology through firmware and hardware updates. And there are possibilities for other innovation, including a sensor that measures each time a pump is stroked.

With improved technology like this, charity: water can proactively obtain better visibility into its water systems and malfunctions, instead of reactively deploying limited resources. Communities benefit from less pump downtime and charity: water can concentrate on using its resources to help more communities.

A valuable difference

In addition, the team published their work in a peer-reviewed journal, Sustainability – doing so shares the team’s methodology and findings with others in the field who are trying to solve the water crisis. This will free up resources for other teams and organizations to focus on raising money and installing more water projects worldwide.

As the size of charity: water’s network expands, monitoring and maintaining it will become a bigger challenge. The team will continue to innovate to decrease the maintenance costs and downtime of water systems. Through lower financial and social costs, more communities will have efficient, reliable access to clean, safe drinking water at scale. And with its commitment to transparency and accountability, charity: water is reinventing charity on its way to ending the water crisis.

“charity: water’s main focus is installing these pumps and giving more people access to clean water. We are proud that Accenture Labs can provide the statistical modeling and data science technologies to help advance this important work.”

Zaid Tashman
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