

Twistthink and charity: water design IoT devices that use AWS to keep water flowing for millions of people

Case Study

Executive Summary

[charity: water](#) is a non-profit that provides clean water to rural communities in developing countries. They needed a way to predict when hand pumps were going to break, so they could keep the water flowing for millions of people. By developing an IoT device that runs on AWS IoT and AWS IoT Analytics, charity: water can more efficiently and cost-effectively monitor the health of 7,300 water pumps in remote locations and dispatch service before the water source stops working.

[Twistthink](#) developed a solution which includes an IoT device and platform. The device embeds in the hand pump and transmits data to AWS via wireless carriers, while custom algorithms on AWS IoT Analytics review the pump data for signs of disrepair. By building on AWS, charity: water can easily deploy devices and access insights about the pumps from anywhere in the world.

Rural communities lose their one water source if pumps break

charity: water funds water programs in 28 countries across Africa, Asia, Central and South America. Their main service is providing rural communities access to clean water through hand pumps. Traveling to these communities is logistically challenging which makes water transport unrealistic and wells expensive for inhabitants.

To install the pumps, charity: water contracts with local partners that go into the remote community. Once the pump is operational, the contractor leaves, and it is time consuming and expensive to check on the health of the pump for the remote villagers. In an attempt to maximize a well's longevity, charity: water tightly controls the material and blueprint specifications used by their partners. Even so, wells still break, which can leave communities without a water source for months until someone comes around to check on them.

About Twistthink

Twistthink transforms companies by bringing new digital and connected offerings to life that their customers desire. By leveraging the proven process of human-centered design (HCD), Twistthink creates new user experiences and business models through digital connectivity that involves sensing, algorithm development, connectivity, IoT and cloud architecture, and UI / UX design. Having connected more than 100 million devices to cloud, Twistthink is at the forefront in designing, validating, and building digital solutions that grow businesses and improve human experiences.

"Moving our systems onto AWS significantly reduced our costs and gives us access to unlimited scalability with a variety of new tools that AWS is constantly updating."

— Christoph Gorder, Chief Global Water Officer, charity: water

Twistthink designed a cost-effective IoT pump sensor using AWS

Through a grant, charity: water developed a proof of concept (PoC) that used IoT sensors to remotely monitor their pumps' health. The PoC ran on a bespoke server developed by in-house developers out of a datacenter in Manhattan. While the team was able to prove the idea was viable, they struggled with how to best utilize the pump data and deploy the solution at scale.

charity: water engaged Twistthink to help them expand the PoC and design an end-to-end, cost-effective solution for remote pump monitoring that would mitigate downtime. The team designed a sensor that did not require any modification to the original pump and used AWS IoT Core and AWS IoT Analytics to run machine learning algorithms. As a result, the cost per sensor, including 10 years of data, is roughly \$250 (USD), or about 2 percent of the cost of a hand pump.

The digital sensor pilot program deployed over seven thousand sensors, impacting millions of people. Using the sensors and platform on AWS, it's now possible for charity: water to monitor water flow remotely from anywhere in the world, analyze the data and alert teams of water flow and pump issues, schedule proactive and predictive maintenance for water pumps, and deploy teams to quickly restore water flow.

AWS provides scalability, security, and infrastructure management

Twistthink tested different cloud providers and chose AWS for the performance, stability, and cost effectiveness it would enable for charity: water. According to Twistthink, "The AWS platform provides an ideal mix of services for charity: water's analytics pipeline. From AWS IoT Core to Amazon Kinesis and Amazon Redshift, AWS IoT offerings are the most complete on the market. With FreeRTOS and IoT Core, we knew our development team would be able to rapidly build and deploy the best solution."

Furthermore, AWS handles infrastructure maintenance and security updates themselves, so charity: water doesn't have to—meaning they can spin up data replicas around the world with clicks while proactively meeting local data residency laws.

APN partner solution provides vital connectivity component

The AWS Partner Network (APN) provided Twistthink access to a broad range of IoT partner solutions that they used to build the end-to-end technology stack for charity: water. To start, Twistthink needed a microprocessor that could read sensor data at the pump, process it, and send small batches to the cloud. Doing it this way would reduce the volume and frequency of transferred data and optimize battery life. ST provides an edge computer that performs this task well and can withstand the rugged environments where pumps live.

Next, Twistthink needed to solve for connectivity issues. Given the remote locations of the communities, connecting to the internet wasn't an option. According to Kurt Dykema, Director of IoT Solutions at Twistthink, "the networks we could connect to were a lot of small 2G and 3G networks. We found a cellular

"We're using AWS to improve access to clean water for rural communities in Africa and Asia. If we didn't have this cost-effective platform, there's no way we could scale in the way we want to."

— Christoph Gorder, Chief Global Water Officer, charity: water

aggregator, Aeris, that could combine over 200 cellular carriers into one network." Then they used a solution by AWS partner u-blox to bring the data to the cloud. "With one u-blox SIM card in the device, we could achieve global coverage from everywhere the pumps are located," Kurt explained. By selecting to use hardware built on AWS by an APN partner, Twistthink could integrate it seamlessly into the platform which saved them valuable time getting to market as well as extensive development money compared to needing to build it themselves.

IoT pump monitoring opens up new possibilities for service

Having a clear line of sight into the health of a water pump is a game changer for the communities served by charity: water, its partners, and supporters. Partners can now be compensated for the water they deliver, not just installing pumps. This removes the need for charity: water to impose strict build requirements and empowers partners to get innovative. Instead of funding trips to check on pumps that may be fine, charity: water's supporters' donations go toward deploying service teams to fix pumps that show signs of wear or have broken.

Working with charity: water has made Twistthink thirst for new ways to support and extend the nonprofit's mission of collaborating across teams, companies, and continents to bring clean water to people in need. They are currently exploring starting a non-profit, IoT alliance that develops and shares the opensource IoT code developed for water pump sensors to help serve more communities.

Why AWS?

Twistthink and charity: water chose AWS as the platform because it provides a mix of performance, stability, innovation, and cost effectiveness. According to Twistthink, "AWS's IoT offering is the most complete on the market. From FreeRTOS to IoT Core, these products enable our development team to rapidly build and deploy the most cutting-edge technology needed, while giving us confidence that we're getting a platform with a solid long-term roadmap." By choosing AWS, Twistthink was also able to leverage the talent of the AWS Partner Network (APN) ecosystem to enhance their design and bring it to market faster.