BIZCOMMUNITY

The internet of everything water

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Imagine a world where your spice cabinet reminds you to buy salt, or your cell phone sends a text message about the amount of water left in your water tank. These are the wonders of the internet of things (IoT).

An official checks data from an internet-based water monitoring device at a borehole in Basbedo, Burkina Faso. Photo: Panos/Andrew McConnell

It has been over a decade since Kevin Ashton, co–founder of the Massachusetts Institute of Technology's Auto-ID Center (now Auto-ID Labs), coined the term 'internet of things' to describe the network and communication of physical objects that have an IP address for the internet.

Since then the world has transitioned into a digital age, one in which IoT devices are being harnessed to improve quality of life on a global scale. African countries such as Ghana, Niger, Rwanda and South Africa, among others, have seen a steady rise in successful IoT implementation meant to improve key areas of sustainable development — water monitoring being one of the most popular sectors.

In order to get the full picture of how IoT technology works to improve water monitoring, Africa Renewal talked to Ilana Cohen, the senior market engagement manager of the Mobile for Development Utilities Programme at the Global System for Mobile Communications Association or GSMA — a trade body representing the interests of mobile operators worldwide.

GSM, the global system for mobile communications, refers to the internet of things as a broad concept, describing it as an open, digital cellular technology used for transmitting mobile voice and data services.

Machine-to-machine technology

Mobile technology enables IoT applications to function machine-to-machine (M2M), meaning machines use network resources to communicate with remote application infrastructure, like a water meter, for the purposes of metering and control.

For emerging utility models mostly operating in rural locations, GSM remains the most widely used machine-to-machine technology to transfer data over long distances. However, because GSM consumes a lot of power and relies on network coverage that is mostly unreliable in rural areas, utility companies are switching to NarrowBand (NB IoT) because it is cheaper and consumes significantly less power, which is ideal for utility applications that mostly require occasional connectivity with minimal throughput. The NB IoT standard is starting to emerge as the preferred mode by users.

Sensors and actuators (a component in a machine that is used to induce or control motion) used by water-related IoT devices can detect anything from changes in temperature and chemical composition to water quantity and soil humidity. They can even report a faulty water pump.

The good news is that the implementation of this technology in Africa is not a thing of the future; it is happening now with startups and institutions embarking on missions to conserve water, provide clean water, irrigate farms and monitor water usage, among other objectives.

Inaccuracies of traditional meters

Traditional water meters are notorious for inaccuracies in reporting water consumption; consumers sometimes pay for water not used, or find themselves unable to pay, where there is a dispute in payment, the accumulated cost of running water at home. The consequence of non-payment for services is that utility companies cannot sustainably provide safe drinking water to certain areas, and for customers it means possibly consuming unsafe water, or allocating more time and resources to finding clean water away from the comfort of their homes (e.g. from standpipes). In underserved communities in Niamey, Niger, where residents use CityTaps smart meters, consumers have gained access to running water at home, and spend 15 times less than they previously did.

In Niger, CityTaps, a social and tech company seeking to provide running water to every urban home, provides IoT tech solutions via smart meters to the national utility company, Société d'Exploitation des Eaux du Niger (SEEN), helping them provide drinking water to underserved communities in a sustainable manner.

In Rwanda, SweetSense — a tech company that provides low-cost remote monitoring for water, energy and environmental projects — uses sensor technology to monitor water pump performance.

In South Africa, EZ Farms, created by IBM Research, is an IoT remote water monitoring system that uses sensors on the field to tell small-scale farmers how to better manage water and agricultural aggregators (websites or a computer programme that sums up a specific type of information from multiple online sources) to enable farmers to identify the best prospects for business.

IoT water metering projects in Africa

Africa Renewal spoke with Patrick Thomson, the lead researcher on the water programme at Oxford University's Smith School of Enterprise and the Environment and CityTaps, which are funded partly by the GSMA, to learn more about their work with water metering and conservation in East and West Africa.

Africa has a plethora of ongoing IoT water metering projects, one of which was launched in 2013 by the University of Oxford, spearheaded by Thomson. The project started off with a 12-month smart hand pump trial in Kyuso town in Kitui County, Kenya, with the goal of resolving the problem of constant breakdown of water pumps.

According to a report on harnessing the internet of things for global development by the International Telecommunication Union, a United Nations agency whose purpose is to coordinate telecommunication operations and services throughout the world, “Water service reliability is closely correlated with extreme poverty and water insecurity in rural areas. Around one million hand pumps supply water to over 200 million rural water users across Africa, yet as many as one-third of all hand pumps are thought to be broken at any given time.”

Thomson described the impact of the water pump project on the community as money-saving and transformative. He mentioned a crucial thesis question posed by his colleague, Dr. Tim Foster: “Could we do things differently if the hand pump itself could tell you it was broken?” This thesis question has been answered by the success of the project. Thomson and his team found ways for a pump to literally tell you when it is defective, via a GSM network.

How does this technology work?

Thomson explained: “A device in the pump handle uses an accelerometer, just like the one in your smartphone that works out which way you are holding it, to sense the movement of the handle. From this movement we can tell if the pump is working and how much water is being produced by it. This information is then transmitted over the GSM network to a central server, where we process and present this information.” In a matter of 48 hours, as opposed to several weeks, the pump is repaired.

Moreover, since the success of the Kyuso project, Thomson said other new and exciting findings have emerged that could completely prevent any kind of water pump breakdown in the future.

In a new water pump project supported by UNICEF in Kwale County in southeast Kenya, new research is underway to determine how the data from the accelerometers can be used to determine the depth of the water beneath the pump in order to monitor the condition of the pump. This way an accurate breakdown prediction can be made before the pump actually stops working. The objective is to reduce pump downtime to zero, Thomson explained.

CityTaps founder Grégoire Landel explained to Africa Renewal how the company’s IoT tech solution works, saying that CityTaps provides utility companies with guaranteed pay for their water services via a prepaid meter system that uses mobile money. The utility company installs the smart pay-as-you-go water meters that help monitor the exact amount of water used. The company’s goal is to supply communities in need with clean running tap water.

Complexities and challenges

Implementing these technologies involves complexities and challenges. While recounting his experience in West Africa, Landel said he has witnessed water and energy utility companies perform ‘little miracles’ daily for the people they serve. Once people see the fundamental benefits of the product, they are usually willing to pay for what is generally a much better quality of life.

In the case of the Kyuso project, Thomson said that while there isn’t an excess of challenges, some communities and governments are more open to projects that meet their immediate needs. He and Landel believe it is important to watch, listen and develop solid relationships within the community in order to build technology that best serves it. It is, after all, the people that determine the success of the product and give meaning to the projects.

Can we benefit if the water pump itself can tell you it is broken? The answer is a simple and definitive yes. A broken hand pump that goes unfixed is expensive and dangerous to the community that depends on it. Water is life, and the internet of things is doing its part to provide sub-Saharan Africa with smart and affordable ways of monitoring, metering and conserving, and by so doing bettering the lives of urban and rural communities in the region.