Practical Uses of the Internet of Things in Government Are Everywhere

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In the Internet of Things, the large, cutting-edge projects usually get the most attention. In the public sector, headlines are dominated by infrastructure projects like sensors in roads that help manage traffic or smart meters used by utilities to save energy.

Yet it's often the more prosaic use cases and smaller-scale projects that lead to real, long-lasting benefits. These projects are often at the local level. They fly under the radar and have modest goals. But this is where public servants are using the technology of IoT to better serve their constituents.

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The technology is in its infancy in the public sector, at both the federal and the local levels. "The Internet of Things is super-promising for local and state governments, but because it's an emerging technology, it can be expensive and it is relatively untested," New explained. "That creates a high level of perceived risk."

Laying the Groundwork

In Washington, the state's centralized IT department, Washington Technology Solutions (WaTech), is migrating to IPv6. IoT was just one of several factors that prompted the move, according to Daniel Mercer, WaTech chief technology officer. The prime reason was that the state needed to change how it governed Internet protocol (IP) addresses. Under IPv4, each state agency obtained and managed its own IP addresses, which in some cases led to problems. With IPv6, WaTech will manage all IP addresses. Also, the state needs to adopt IPv6 in order to be able to work with the federal government and commercial business partners in the future. IPv6 will enable state employees to move among networks and devices seamlessly, enabling a more efficient mobile workforce. In addition, the state is simply running out of IPv4 addresses.

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The same factors that the center identified in a recent report as holding back IoT projects at the federal level are likely to be even bigger barriers at the state and local levels. These include a lack of strategic leadership on how to use IoT; a lack of skills in using the data generated by IoT; insufficient funding to modernize IT infrastructure to enable IoT projects; procurement policies that make it difficult for governments to quickly and easily adopt the technology; and risk and uncertainty about privacy, security, interoperability and return on investment.

But strip away the label of "IoT" and you'll find dozens of interesting projects that use connected devices to increase efficiency, lower costs and even save lives. For example, the Lower Colorado River Authority (LCRA) started deploying sensors along the Colorado River in Texas decades ago to help track stream levels that could lead to floods. Back then "they didn't realize they were implementing an IoT system," said John Miri, chief administrative officer of LCRA. "They were just using the tools that were available."

The LCRA was created at the height of the Great Depression to help Texas better manage the flood plain along the lower Colorado River basin, as well as to produce and distribute hydroelectric power to the cities in the area. Over the past several decades, LCRA built a network of 275 connected river sensors — called Hydromet — to monitor and report stream flows and other data, including temperature, rainfall and humidity, on a public website in near real time.

This year, LCRA received a $650,000 contract from the U.S. Department of Homeland Security to investigate better sensor technologies and software needed to disseminate information and alerts during a flood. The sensors used in the system today are

expensive — costing anywhere from $25,000 to $50,000 each. One goal is to find or develop a next-generation flood sensor that would take advantage of advances in hardware and consumer sensor technologies yet still be rugged enough to last in harsh outdoor conditions.

Today, LCRA is evaluating sensors that cost $200 to $2,500, Miri said. The other goal is to build a better framework so that data can be used more practically. Rather than just post it on a website, LCRA might be able to help emergency responders geo-target the smartphones of citizens in specific areas where flooding is imminent. “If this works, then the cities and counties we serve could use this technology to send out better, more targeted warnings to keep their citizens safe,” Miri said.

Alerting residents to danger is the goal of a new project in Los Angeles as well. The city has lots of Internet-connected things, including 145,000 streetlights and 4,500 intersections. And yet IoT was not the goal. “Now we call them IoT devices. We’ve put a name, a label, a concept around it,” said Ted Ross, L.A.’s general manager and CIO. But “ three years ago, they were just devices.”

He calls what the city has done so far “Smart City 1.0.” The next step is to gather information from and send data to multiple sources — not just city-installed sensors, but the sensors that people carry around, such as smartphones and watches. Smart City 2.0 is about gathering “streams of data, then laying them atop of each other and getting situational awareness and location intelligence,” he explained.

For example, the city and the California Institute of Technology (Caltech) developed a project called “Quake Alert,” which uses sensors to detect the nearly constant tremors in the area. Today, that data is used to visually depict a quake in progress. To take it to the next level, the city is developing a system of sending alerts to citizens’ smartphones to give them 15 to 30 seconds to take cover. The application could save not only lives but also millions of dollars in damage if, for example, alerts went directly to manufacturing equipment, which could shut itself down to avoid ruining product, noted Ross. “That’s a classic IoT conversation, but under a very constrained timeline.”

L.A. is working on a sensor-based system to alert smartphone users about an earthquake before the shaking starts. Photo courtesy of Shutterstock

Los Angeles is also using sensors to monitor environmental factors, including the health of trees. In its Internet of Trees project, the city is combining data from Google Street View with a machine-learning algorithm developed by Caltech to inventory its urban forest of some 700,000 trees scattered over 469 square miles. That has saved the city approximately $3 million, which is what it would have cost to deploy an army of people with clipboards to visually inspect each tree. Now, it is in the process of replacing 200,000 trees (removed when road repairs are made) with new ones that contain sensors to monitor moisture, air quality and the health of the tree itself.

The future value of such projects depends on the city's ability to innovate with the data, which is why it created a federation of 11 local universities where students will do projects with data from various use cases, Ross said. "We think an investment in data science and analysis will have multiple benefits."

Connected devices are also helping small cities save time, money and labor. Tamarac, Fla., population 65,000, uses IP-based controllers in many areas of city infrastructure, including controlling HVAC systems and monitoring data centers for humidity, temperature and flooding, said Levent Sucuoglu, the city's director of IT. Today, Tamarac requires that sensing and IP-based controls be considered in all new city construction. "We make that part of our construction documents, then as we go

through the design phase to ... determine how much [technology] will be included based on cost, functionality, availability and reliability," Sucuoglu said.

The city's new fire station, now under construction, will include IP-based building access control, security surveillance, HVAC and lighting control. It will have IP-based sensors to monitor the amount of gas in the facility's pumping station and report how much gas is distributed to each fire engine. A city-run golf clubhouse to be constructed next year will include energy-efficient, IP-based LED lights. Central control will also lower costs by turning the LEDs off when they're not needed. In addition, the city can add some whimsy: The lights can be programmed to change colors to match holidays or seasons — displaying red, white and blue on the Fourth of July, for example.

But network-connected sensors aren't always cost-effective, Sucuoglu noted. "There are a lot of practical applications, but the ones you read about in magazines — all those futuristic IoT devices — they aren't really widely available or affordable."

They also might not be very secure. Phil Bertolini, CIO of Oakland County, Mich., is extremely cautious when it comes to IoT. While central management and control of systems via the Internet can reduce costs and increase efficiency, it can also increase the danger that such systems can be hacked.

"I'm concerned about the Internet of Things from a security perspective," Bertolini said. "It scares the heck out of me that [we could rely on] some of these forward-facing IoT devices." What if a hacker shuts down the air conditioning in a data center, causing millions of dollars' worth of damage to computer equipment? Worse yet, a nefarious actor might take control of all those Internet-connected lights and plunge a city's entire downtown into darkness. "As government, we have to be extra careful," he noted.

Oakland County is installing a new building management system that will be centrally controlled, but the connection will usually be over a secure fiber-optic network connection, not riding over the open Internet, Bertolini said. There will be a way for IT managers to dial in remotely via the Internet, he added, but it will be through a secured "tunnel" connection requiring two-factor authentication.

At the state level, activity ranges from small, limited departmental projects to statewide initiatives that are laying the groundwork for possible IoT applications in a few years.

Florida's Fish and Wildlife Conservation Commission has been using sensors to track various kinds of wildlife for at least 15 years, said Chip Deutsch, associate research scientist. In one project, researchers attach GPS tags, along with temperature and depth sensors, to manatees to study their movements and habitats. The tags allow researchers to track the animals, documenting where and when the manatees travel in search of food, for example. With the latest sensors, Deutsch said, "we can get incredibly fine-scale on the locations and the time." The project has helped wildlife managers know where to put boating speed limits in order to protect the animals.

Photo courtesy of Shutterstock

Indeed, getting everything to work well together, even in limited pilot projects, can be challenging. If it finds lower-cost consumer sensors and hardware for its flood alert project, LCRA will have to find a way to use them in conjunction with its existing system, Miri noted. “These sensors won’t work exactly the same way, they won’t provide data exactly the same way,” he said. “So part of what we’re doing is changing the whole notification system, the whole business process around it. That’s what will help us get to a more cost-effective system.”

But this isn't IoT for IoT's sake. LCRA is quick to note that the exciting thing about its project is the intended outcome, not the technical architecture. “We are not doing this because we want to do an IoT project,” Miri said. “We’re doing this because we don’t want people to die or property to be destroyed in floods.”

Editor's note: Information about the LCRA's system was updated Jan. 4.

http://www.govtech.com/network/Practical-Uses-of-the-Internet-of-Things-in-Government-Are-Everywhere.html