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NETWORKING

Street Smarts: In Chattanooga, Tenn., Connectivity Paves the Way for Safety Improvements

University of Tennessee research aims to identify driver and pedestrian risks, plus other safety advancements.

by Erin Brereton

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Editor's Note: This is the fourth article in "Street Smarts," an ongoing StateTech *series that highlights local stories of smart city projects, from development to execution. Check out the first article in the series on Montgomery, Ala., the second on Colorado Springs, Colo, the third article on Racine, Wis., and the fourth article on Columbus, Ohio.*

In spring 2019, the University of Tennessee at Chattanooga's Center for Urban Informatics and Progress (CUIP) began using cameras and lidar, radar and other sensors, along with various networking capabilities, to **test pedestrian safety conditions, traffic flow and air quality elements along a 1.2-mile portion of the city's Martin Luther King Boulevard**.

Thanks to the resources provided by utilities supplier EPB, city government and other members of the Chattanooga Smart Community Collaborative, **setting up the smart technology-enabled test bed only took a few months**, according to Mina Sartipi, CUIP director and a professor in the UTC Department of Computer Science and Engineering.

Nine hundred miles of fiber, laid between 2008 and 2010 to help create an advanced smart grid to distribute electricity, serves as a backbone to support the project's physical infrastructure.

While CUIP added some cameras used to detect roadway elements — models such as the Axis P1448-LE and M2025-LE — on 11 poles along the highway, researchers have also been able to **tap into cameras the city previously installed**.

"The fact that we were able to have the test bed up and running so quickly and relatively inexpensively is because of the collaboration," Sartipi says. "We were able to take advantage of some of the previous efforts; it helped us do this much faster and more efficiently."

Connected Vehicles and Other Tech Could Increase Safety

The smart corridor is being used to study various scenarios, such as being able to **sense the location, velocity and direction** of pedestrians, bicyclists and cars within the roadway. That data will enable the city to **develop applications that can alert motorists and pedestrians of a potential collision**.

"One of the things we've been analyzing recently is **trying to be able to understand near-misses**," says Eric Asboe, Chattanooga Department of Transportation's deputy administrator. "Is it at certain times of day, or all day? What are the factors we'd be able to control? We are getting a pretty good understanding of those intersections and other locations that have particular challenges we can start to address."

The CDOT Traffic Signal technical staff worked with CUIP to design, build and install the technologies deployed on the testbed. These technologies utilized existing eight traffic signalized intersections along the corridor. Photography by Andrew Rodgers/CUIP.

To protect privacy, no camera data is recorded; **instead software conducts a real-time analysis of each video frame to detect buses, bicycles and other objects that are present**.

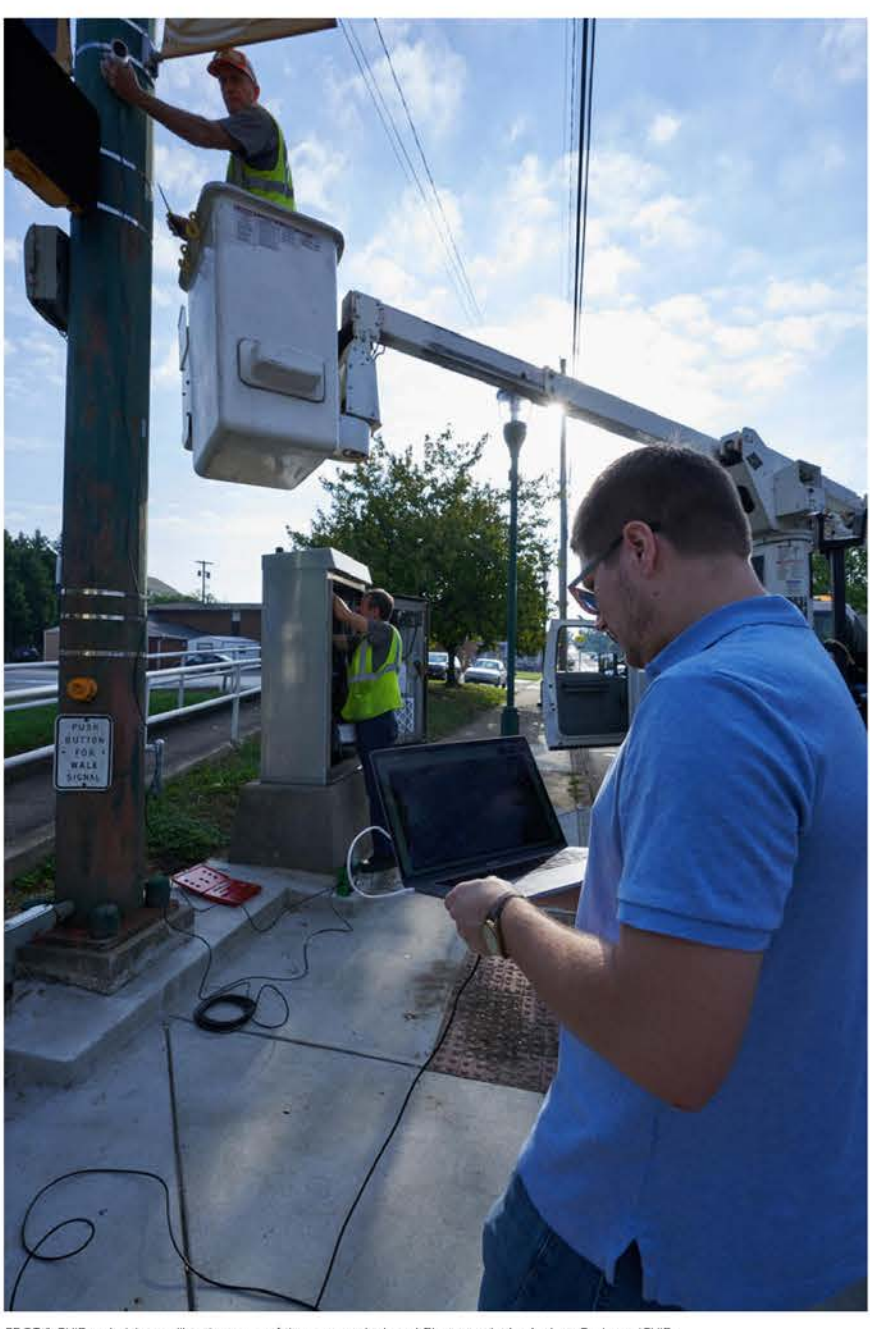
Edge computing capabilities provided by devices, including the NVIDIA Jetson TX2 and Raspberry Pi, allow researchers to process data at each pole or to CUIP with almost no latency — which, according Sartipi, would be necessary for the information to then be transmitted to both parties in time to avoid a collision.

"These are cases where we want data to be collected, processed and **the results sent back instantaneously, basically**," she says. "Even one second is already too late."

To provide the communication capabilities that would work best for various components at any given time, the poles offer a number of options, including software-defined radio, dedicated short-range communications, Aruba and other brands of Wi-Fi access points, and long-range MultiTech MultiConnect Conduit LoRa gateway networking technology.

"We don't want to force everything to use Wi-Fi," Sartipi says. "For example, **we have a LoRa gateway that is low-energy** that we're using to communicate for radio-frequency identification devices — they have less battery life. That can be used as a backup for another item's connectivity, if needed."

Using a mobile device dashboard, researchers get a holistic view of potential collision elements in the corridor and can see how many lights are getting close to changing from red to green. According to Asboe, traffic signals could be controlled to direct emergency vehicles where they need to go faster using the technology.



CDOT & CUIP technicians calibrating some of the sensors deployed. Photography by Andrew Rodgers/CUIP.

"We're thinking about how we can help first responders know the best route to and from hospitals, or the best route for firefighters to take from fire stations to locations where they need to go — utilizing real-time information, routing for incidents that may have happened on roadways or closures," he says.

Pole-mounted sensors are also helping CUIP test air quality throughout the day and during different seasons. Researchers hope to better **understand how air quality may correlate with traffic, temperature and humidity**, which could lead to changes that would improve public health, according to Sartipi.

"We measure different particulate matter," she says. "There are a lot of hypothetical research questions to answer — such as, if you were thinking of going running and have asthma, this is probably a day it's going to be healthier to be inactive."

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Connectivity Enhances Customer Information Distribution and Service

In addition to the technologies CUIP is using in its research, Chattanooga has incorporated other smart tech capabilities in recent years.

EPB became the first U.S. utility to **offer 1-gigabit internet speed service to its entire community in 2010** — rolling it out first to the most socioeconomically challenged neighborhoods to help bridge the digital divide, according to Vice President of Marketing J. Ed. Marston.

"We know that internet is an economic development tool, improves people's quality of life and improves learning access and opportunities," Marston says. "Before, some businesses or select neighborhoods might have been able to get fiber service; this made it accessible to every home and business — because it's very important it be a community asset that's useful to everybody, not a rarified service."

Approximately 1,200 smart switches layered on top of the city's fiber-optic network have allowed EPB to create an automated local electricity distribution system that alerts the provider when a tree falls on a power line, causing an outage. The system can potentially automatically switch that area to a new distribution source.

Customers can also view real-time personal energy use data through smart meters that conduct readings every 15 minutes. If a home with a heat pump begins using an abnormally large amount of electricity, the atypical consumption is identified by the same open source code algorithm Twitter uses to detect an increase in feed activity, Marston says — which EPB applies to electrical data such as voltage and frequency — and the company is alerted through automated reporting.

"When heat pumps are not operating properly, they will go to auxiliary power, using a lot more energy than they typically would and doing a poorer job of maintaining climate control," Marston says. "In the past, customers might only discover that from a very high bill. Now we're able to proactively contact them and let them know they need to have their system checked."

While EPB is city-owned, Chattanooga's work with external organizations like CUIP isn't necessarily an unusual move in today's smart technology landscape.

A number of cities are, in fact, **partnering with universities, private enterprises and other organizations** to test and adopt smart technology, according to Neil Kleiman, research director for the Mayors Leadership Institute on Smart Cities and a professor at New York University's Robert F. Wagner Graduate School of Public Service.

Small to midsized municipalities, in particular, may benefit from such relationships. They might not have the same array of companies looking to experiment in the space as large cities, or as many consulting firms offering to help them strategize. However, with fewer factions involved, **smaller cities may find that introducing smart technology can be a fairly collaborative and straightforward process**, Kleiman says.

"A lot of times, it's much easier to implement," he says. "Communication and strategy are so much easier to do in smaller places. You know each other and can get on the same page."

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