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We'll Take Manhattan

Berkeley Researchers' High Profile at the 15th annual ITS World Congress in NYC

Question: How do you transport a 40-foot research bus from Berkeley, California, to New York City to showcase technology that makes travel safe, efficient, and green?

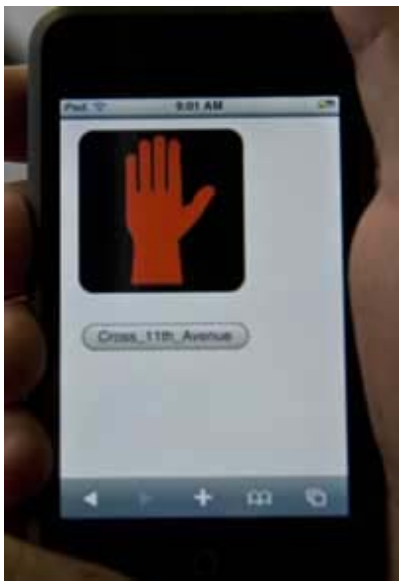
Answer: Don't move the bus. Just move the technology.

That challenge kept a team of researchers and engineers from the Institute of Transportation Studies' California Partners for Advanced Transit and Highways (PATH) working around the clock this November. The team had one week to rebuild the Networked Traveler, a complex set of mobility and safety applications delivered to travelers and vehicles through multiple wireless links.

The services were developed at PATH's Richmond Field Station facilities and reconstructed in a New York City transit bus for demonstration at the 15th Annual World Congress on Intelligent Transport Systems November 16 through 20.

Research from two other research centers at the institute—the California Center for Innovative Transportation (CCIT) and the Transportation Sustainability Research Center (TSRC)—was also featured prominently at the conference, held at the Jacob K. Javits Convention Center in Manhattan.

In addition to a daily schedule of bus demos, the PATH team presented two live safety demonstrations—vehicle-to-vehicle "situational awareness" and a pedestrian safety alert—as part of the conference's 11th Avenue Theater, which shut down the west-side artery for four hours every day for a live-action show of high-tech crash-prevention demos.



The Networked Traveler bus demo featured the technology's three main services:

"Tell me about my trip" assists trip planning with traffic information, transit connections, and driving choices for an eco-route and a fastest route."

"Tell me about my route" can provide travelers with real-time road-safety conditions, real-time traffic and parking conditions, schedule-driven transit information, real-time GPS-based transit status, and road signage.

"Watch out for me!" includes services such as the pedestrian-to-vehicle safety alert, the vehicle-to-pedestrian safety alert, road-to-vehicle road safety information, road hazard alerts, and work zone alerts.

"The concepts behind the Networked Traveler have their origins in our extensive dedicated short range communications (DSRC) work on our Vehicle Infrastructure Integration (VII) testbed, but the actual demonstrations for the World Congress were developed and delivered in less than six months," said Jim Misener, executive director of PATH and project manager for the Networked Traveler.

"We reconstructed real-time wireless communications links and 10 distinct demonstration applications on someone else's transit bus," said Misener, who added that the work included

ions in the complex transportation setting and cluttered wireless environment of midtown Manhattan. “Doing all this in a week was an audacious proposition, and a really a super-human feat by our PATH engineers,” Misener said. “Thanks to their diligence (and to nearby coffee vendors), the World Congress demos worked smoothly and to an appreciative audience.”

A speed zone alert appears on a cell phone.

SafeTrip-21

PATH’s Networked Traveler demonstration bus was the centerpiece of the U.S. Department of Transportation’s national unveiling of the first technologies it awarded a contract to under its SafeTrip-21 initiative, a federal program to support innovations that leverage current technology to make travel and transit safer and more efficient.

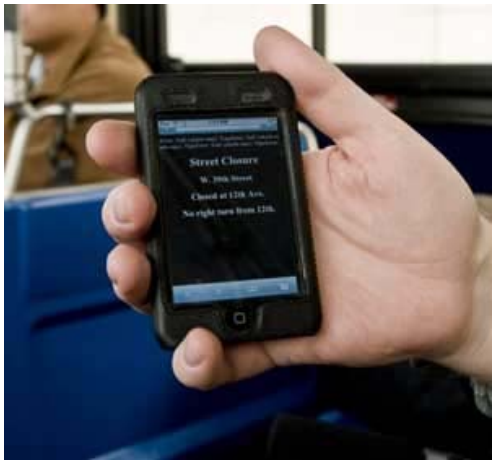
PATH's Jim Misener leads a SafeTrip-21 bus tour.

Submitted to SafeTrip-21 under a $13.4-million Caltrans-led public-private partnership, the PATH project was one of two ITS Berkeley research tracks to win federal support from the new initiative. CCIT’s Mobile Millennium was the other ITS Berkeley research project on that contract, and also ran a public demo at World Congress.

The Networked Traveler

For the past four years, PATH has conducted extensive research using DSRC for vehicle-to vehicle and vehicle-to-roadside communications to increase safety and efficiency for travelers by providing information and situational awareness—a few key seconds of road, signage, or vehicle awareness that increase a driver’s time window to react.

Spurred by SafeTrip-21, the researchers transformed their futuristic safety applications into a new, near-term vision for open-platform wireless applications—a single travel-information network.



Dubbed “The Networked Traveler,” it incorporates existing technologies, including cell phones, 3G networks, and a DSRC gateway, and is accessible via any GPS- and wifi-enabled mobile phone or device with an Internet browser. The goal is to provide travelers with a menu of real-time transit and traffic information services —wherever they are in their journeys.

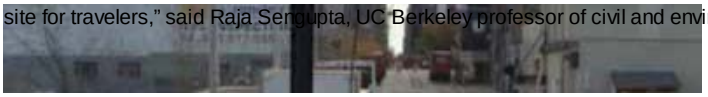
A cell phone alert announces an upcoming street closure.

Under the SafeTrip-21 banner, PATH’s World Congress demos featured a sampling of the services they are developing: Pedestrian alerts allowed slow-moving pedestrians to signal drivers to watch out; a work zone alert signaled phones on the demo bus to slow down for its approach to the cone area; centralized, real-time transit information helped virtual commuters meet their trains and buses on time; and smart parking simplified a modal switch by helping drivers find and reserve available parking in real-time.

Other items in the demo included updated travel time estimates, next-stop alerts, a hydrocarbon-savings calculator for transit riders, and speed zone and signal priority alerts for drivers.

The Networked Traveler's alert is projected on the 11th Avenue Theater video screen.

“It works like a social networking



site for travelers," said Raja Sengupta, UC Berkeley professor of civil and environmental engineering and principal investigator on the project. "You put in only the information you wish to share, such as your position. You take out only what interests you."

Sengupta said typical commuters might use the smart parking feature to find a parking spot at the train station, the transit planner feature to see when their trains will arrive, and a next-stop alert to signal them as they approach their stop. People who exclusively drive or take transit would select from the services that suit their habits. "The key factor is that you personalize it for your own travel needs," Sengupta said.

Shahram Rezaei, senior researcher at PATH, and Sengupta are the lead authors of the paper presented at the conference, "Adaptive Communication Scheme for Cooperative Active Safety System."

Hundreds of conference attendees rode the demo bus over four days, including a congressional delegation and transportation officials from across the country, including Paul Brubaker, administrator of the U.S. DOT's Research Innovative Technology Administration.

In addition to California and federal DOTs and PATH, Networked Traveler partners include map giant Navteq, the Metropolitan Transit Commission (MTC), the Santa Clara Valley Transit Authority, and car maker Nissan. During the World Congress, Caltrans announced a new partner, Parking Carma.

Mobile Millennium at the World Congress

On the morning of November 18, a fleet of 20 cars traveling along a 10-mile loop in Manhattan gathered and broadcast real-time traffic information on side streets (arterials). "Traffic Pilot," the freely downloadable cell-phone software developed by the research team, and Nokia N95 "smart phones," were the drivers' only tools. The data was visualized on screens in the Navteq and U.S. DOT booths in the Javits Center.

CCIT's Mobile Millennium project, an ambitious pilot traffic-information system that uses measurements from mobile phones to glean real-time traffic conditions, also received SafeTrip-21 support under the $13.4 million Caltrans partnership. The system launched in the Bay Area on Nov. 10 with the availability of free cell-phone software for the public. The CCIT team traveled to the World Congress to deliver a first-of-its-kind live demo of arterial traffic information collection and dissemination using only data from cell phone probes.

"What started as a simple concept between J.D. Margulici and Alexandre Bayen has grown—in less than a year—to become one of the most watched ITS development efforts in the nation," said CCIT director Thomas West. Margulici is CCIT's associate director; Bayen is an assistant professor of civil and environmental engineering and the principal investigator on the project.

"Such an aggressive program has required incredible hard work and sacrifice," West said, acknowledging the team that includes half a dozen Ph.D. candidates, several master's degree and undergraduate students, two post-doctoral researchers and several staffers from CCIT and the Institute of Transportation Studies.

How does it work?

CCIT's February 8, 2008 Mobile Century experiment, a UC Berkeley-Nokia research partnership supported by Caltrans, the National Science Foundation, the Center for Information Technology Research in the Interest of Society (CITRIS), and Tekes, a Finnish research institute, demonstrated that a small percentage of mobile phone-equipped vehicles traveling on highways provide enough data to reconstruct highway traffic very accurately.

The World Congress demo showed for the first time the technology's effectiveness on arterials.

As vehicles pass through the system's virtual trip lines—geographical markers defined by GPS coordinates—the phones send anonymous speed and location readings to servers at Berkeley and Nokia. The data is then integrated into traffic models that produce an estimate of traffic flow.

Those estimates are relayed back to the mobile phones, where they are visualized on maps as green, yellow, red, and black dots, respectively indicating fast, slow, congested, and stopped traffic, to guide users in their choices for navigating roads, or changing to transit.

Bayen says the first phase of the pilot system will focus on traffic data on Bay Area highways, with more highways coming online as more users sign up. By the end of the study researchers expect to have enough users to provide information on some arterial routes in the Bay Area and in Sacramento.

"The New York City demo was a public preview of the arterial traffic information we hope to provide to the early adopters who have downloaded our free software," said Bayen. "Our field testing so far has shown that we need only a very small percentage of users within a given set of coordinates to be able to predict traffic patterns with a very high degree of accuracy."

Just over a month into the launch, the software has been downloaded more than 3,000 times. Researchers will continue to make the free software available to the public through the spring of 2009, after which the team will evaluate the results and determine their next research priorities.

Juan-Carlos Herrera, a Ph.D. student in Berkeley's transportation engineering program, presented a paper at the World Congress on Mobile Century that briefly summarizes the main results of the Mobile Century experiment, in terms of data accuracy and system feasibility. A more thorough version of the paper is under review for publication in the journal *Transportation Research.*

Other related CCIT papers at the conference were presented by Margulici, and Ali Mortavi and Xuegang (Jeff) Ban.

Mobile Millennium is a joint project between CCIT, the Nokia Research Center in Palo Alto, and Navteq, a Nokia-owned corporation based in Chicago, with support from the U.S. DOT's SafeTrip-21 initiative and Caltrans. CITRIS provided seed money for the research and lent key support to the launch.

Sustainability and Intelligent Transport Systems

The institute's **Transportation Sustainability Research Center (TSRC)** also had a significant presence at the November conference. The TSRC team—co-directors Timothy Lipman and Susan Shaheen and senior researcher Caroline Rodier—collectively moderated four podium sessions and gave eight talks over three days.

Lipman moderated discussions about and spoke on electric drive vehicles, exploring the potential linkage among intelligent transportation systems (ITS), vehicles, and alternative fuels. The session examined how ITS may be used in future "smart grids" to link vehicles and electricity infrastructure for storing and selling energy.

Rodier presented her work on streamlining the parking process to meet the growing demand for parking at transit stations in urban areas. Her research investigated the potential of a smart-parking system to be deployed and tested in San Diego in the near future.

Shaheen spoke on eco-driving and CO2 emissions, carsharing, and ITS for an aging America.

By some calculations, there will be more than 30 million "baby boomers" over age 65 in the United States, many of whom will require public transit and alternative mobility options. As the population ages, their transportation needs will shift. Shaheen's talk on transportation for an aging population focused on the key role ITS can play in extending safe driving years and providing specialized and innovative transport services.

Shaheen moderated and spoke on the growing popularity—and questionable accuracy—of carbon footprinting services. Traveler information services in Europe, America, and Asia-Pacific are increasingly expressing trip options in terms of their carbon contribution. Her session and talk addressed new laws and regulation, increased public awareness, and potential policy implications.

Shaheen also spoke on carsharing and CO2 emission reduction. "My current research shows nearly 320,00 North Americans, living primarily in urban areas, have made the switch to carsharing," says Shaheen. "When you calculate how many personal vehicles carsharing takes off the road—between six to 10 private vehicles per carsharing vehicle—and reductions in vehicle miles traveled due to this alternative, it is possible to achieve notable emission reductions," said Shaheen.

As sustainability issues continue to be on top of our national and global agendas, Shaheen says TSRC's work to understand and improve the transportation sector's role will continue to grow. "That will involve maximizing our understanding of ITS, alternative fuel vehicles, human behavior, and the interaction among them," said Shaheen.

More papers, more awards

In addition to the research featured here, faculty, research staff, and students from the institute led or coauthored more than 30 papers presented at the conference.

The institute also came up more than once during the Best of ITS America Awards ceremony.

Mobile Century, the precursor to the Mobile Millennium project, was named Best New Innovative Practice.

CCIT, Caltrans, and Sensys Systems were recognized as participating agencies in the award of the Best New Innovative Product or Service for the development of the Sensys Wireless Vehicle Detection System.

ITS California, chaired by PATH's Jim Misener, won the Best Chapter Outreach and Education honors. "It was great for California and the institute that our leadership in intelligent transportation systems was so prominent at this major conference," Misener said.

—Ann Brody Guy

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