



A team of researchers studied data from INL bus sensors and GPS systems to identify efficient driving behaviors. They constructed a Virtual Bus simulator that uses computational intelligence techniques to mine the decision-making process of drivers and suggest optimal actions.

Virtual Bus simulator uses real-time driving data to boost fuel efficiency

By Kortny Rolston, *INL Communications & Governmental Affairs*

Same bus. Same route. Same fuel.

So why does one Idaho National Laboratory bus driver get up to 30 percent better gas mileage than another? That's what a [Center for Advanced Energy Studies](#) research team is studying in an effort to improve the fuel efficiency of INL's bus fleet.

"We want to understand what these drivers are doing to get such good gas mileage and use that information to build a tool that will help all drivers improve efficiency," said David Gertman, an INL researcher helping to lead the CAES team.

To do that, the team, which is comprised of researchers from INL, [University of Idaho](#) and [5D Robotics](#), is interviewing drivers and studying data generated by sensors located on INL's buses. The sensors gather real-time data — every second or so — and store it on a laptop, which mechanics are able to access and send to the CAES research team.

With that information plus data from the bus GPS systems, researchers are able to analyze entire routes, determine which is getting the best mileage and understand what that driver is doing at different points to be fuel efficient.

"It's really about driver behavior," said Milos Manic, a University of Idaho professor and CAES researcher. "What we know is that all drivers are good at different parts of the route. We want to understand what they are doing at a particular section to be so efficient and replicate that. How fast are they going when they climb a hill? How fast are they going when they approach a turn?"



Bus sensor and GPS info helped researchers analyze routes, find those getting the best mileage and understand how driver actions impact fuel use.



The Virtual Bus simulator is based on INL bus specs and mimics the controls, pedals and road conditions.

Manic and his graduate students have constructed a Virtual Bus simulator based on INL bus specs that mimics the controls, pedals and road conditions to help understand behavior of data. The Virtual Bus simulator is using various computational intelligence techniques to mine the decision-making process of drivers and suggest the optimal set of actions.

The ultimate goal is to create an Intelligent Driver System, a tool that gives drivers real-time feedback about what they could do to improve mileage.

"Instead of telling drivers how they did after they finish a route, this tool would let them know what is coming up, whether they should slow down or speed up and what else they can do to improve efficiency," he said.

Researchers believe that what sets the CAES-funded project apart is that they are focused on drivers and helping them get the best mileage along specified routes.

"The INL bus system is a really good test bed for us," Gertman said. "They take the same routes several times a day so we can study it in detail. We think we can eventually use this model to help trucking companies, government agencies and others that are in similar situations."

Scott Wold, who oversees INL's bus fleet, said improving efficiency is one of the lab's major goals, which is why his department agreed to participate in the project.

INL has undertaken several measures to reduce the amount of gas its buses consume on the dozens of trips they make each day to and from the Idaho desert, where many of the lab's research facilities

Did You Know?

INL's bus fleet is consistently recognized

are located.

Among the measures is introducing a park-and-ride system to reduce the number of stops and the amount of bus engine idling time.

But if the lab is to save even more, Wold said, it must look at driver behavior or other factors.

"We already know that some of our drivers get up to two or three miles per gallon better mileage than others," he said. "If we can help everyone, even our most efficient drivers, improve it would save us a lot of money."

The INL bus fleet consumes 500,000 to 600,000 gallons of fuel per year, so improving efficiency by even 10 percent has the potential to save hundreds of thousands of dollars each year.

"It would be a substantial savings for us," Wold said.

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for its efforts to improve efficiency. The lab's Integrated Transportation Department has undertaken measures to reduce bus idling time and has streamlined routes to maximize fuel efficiency.