Cooperative system could wipe out car alarm noise

June 24 2008

The persistent, annoying blare of an ignored car alarm may become a sound of the past if a cooperative, mutable and silent network of monitors proposed by Penn State researchers is deployed in automobiles and parking lots.

"The basis of this system is trust," says Sencun Zhu, assistant professor of computer science and engineering. "You need to trust the entity that distributes the system's sensors, so you can rely on all the monitored cars having the goal of protecting your car and others from theft."

Working with Guohong Cao, associate professor of computer science and engineering, and Hui Song, recent Penn State graduate and now an assistant professor at Frostburg State University, Zhu developed a monitoring system that relies on a network formed by the cars parked in a parking lot. When a car enters a lot and parks, the sensor is alerted – probably when the car door locks -- and it sends out a signal that in essence says, "hello, I am here." Sensors in nearby cars acknowledge the signal and incorporate the new car into their network. Periodically, each car sends out a signal indicating that it is still there. When the driver unlocks the car, the sensor sends out a "goodbye" message and the network removes that car, and it drives away.

If, however, a car leaves the network without issuing a goodbye message, the other cars will notice the absence or the "still here" message. Once the system has confirmed that the car is gone, checking that other cars have not received the "still here" message, the monitoring sensor sends a

signal identifying the car to the base unit in the parking lot, which will phone the owner to indicate the car is missing. The owner can then check it out.

"Our thought is that the apartment complex owner could provide the sensors with the parking stickers as an additional free perk," says Zhu, also assistant professor of information sciences and technology at Penn State. "All they need is the base unit, the car owner's phone number and the sensors in the car for the car should be safe in the lot."

If a car is stolen from the lot, it is preferable that the theft be noticed and reported before the car leaves the lot, but if it is not, the Sensor network-based Vehicle Anti-Theft system, SVATS, has another layer of protection.

Although the main or master sensor needs to be connected to the car's power system and so is fairly easily disabled by thieves, other slave sensors would be distributed in the car. These sensors might be activated when the master sensor no longer operates and begin to send out an identification signal. The researchers hope to be able to use existing wireless devices that are at intersections and roadsides, to track the sensors in the stolen car. While these wireless nodes are not on every street, in areas where they are used to sense traffic patterns, stop light timing and other things, they can be used to track stolen cars. Because the slave sensors are very small, they would be very difficult to locate and destroy, while conventional location equipment, such as various G.P.S. systems, can be identified and neutralized.

"Right now the sensors we are testing are about the size of a dollar coin with leads coming off," says Zhu. "We will eventually make them only about a cubic millimeter, small enough to embed in a parking sticker and very inexpensive to manufacture." A cubic millimeter is about the size of an ice cream sprinkle.

The researchers presented information on their system at the Institute of Electrical and Electronic Engineer's Infocom 2008 Conference in Phoenix. Experimental evaluation of the SVATS system used a laptop as a base station and one sensor per vehicle in a Penn State parking lot. The base station transmitted once per second while the vehicle sensors sent live messages every 200 milliseconds. Each sensor could monitor up to seven other nodes but should be monitored by at least three other nodes.

The researchers tested two different detection methods. The signature-based method took four to nine seconds to detect the absence of the stolen vehicle. This method requires that at least three nodes recognize that the stolen car has moved before sending an alert. Because of this requirement, there are no false positives and consequently, no false alarms. The system works in a parking lot and can track stolen vehicles.

According to Zhu, street parking is more difficult to deal with than parking lots, however, he believes that if apartment buildings along the street band together to provide sensors and base stations it might work as well. Because of the trust problem, he does not see the sensors being incorporated into cars from the factory, because identifying who owns which car and sensor would be difficult. Rather, Zhu thinks that perhaps eventually, some government office like a state's department of transportation could provide the sensors and keep track of the vehicles.

While the plan now is to have the base station contact the car owner by phone, eventually the option of having the call go to a protective service or the police for a fee is possible.

Source: Penn State