Electrical engineer working to improve monitoring systems

September 25 2009, Written by Marissa Doshi

(PhysOrg.com) -- An old man walks down the stairs in his home. Suddenly, he trips and falls. No one is home to help him. But soon he hears the reassuring clanging of approaching sirens. The surveillance system installed in his home worked: It alerted emergency services, and now, help is on the way.

Surveillance systems that monitor an environment can be quite useful and are becoming increasingly common. Arrays of strategically placed cameras and sensors can monitor an area and convey information to a node or “sink.” These systems, called distributed multimedia sensor networks (DMSNs), are being used in homes with older people, hospitals and geriatric facilities to monitor activities, spot gait irregularities, and signal that someone has collapsed.

These systems could also be useful in warzones. Once deployed, these networks could transmit important information about enemy location and activities, which could help military personnel strategize better.

But engineering complex surveillance systems that smarten up the environment is tricky. There are security, efficiency and privacy issues to consider. Tackling these issues is Dr. Deepa Kundur, an associate professor at Texas A&M’s Department of Electrical and Computer Engineering. She is analyzing lightweight algorithms that could help improve DMSNs.

Kundur said that directional communications using free space optics is

one technology currently being considered for advanced surveillance because of its high data capacity suitable for real-time video communications. One major problem facing directional communications for DMSNs is ensuring connectivity of such networks.

“The sensors use lasers to ‘talk’ with each other,” Kundur said. “To get the message across clearly, they need to be lined up correctly, which can be a housekeeping challenge. Think of a television remote. If you use it to change channels from the wrong angle, it doesn’t work.”

Another hurdle is keeping the network powered. The sensors handle large amounts of data, which can include visual and audio components. Communicating such complex data requires a lot of power, making it necessary to keep the sensors plugged in. This, in turn, leads to mounds of wires cluttering up the environment. The challenge lies in developing sensors that communicate wirelessly, without dropping messages and ensuring that the battery life is sufficiently long.

Ensuring privacy is another concern.

“We don’t want these systems to just gather data. We need them to gather it and then selectively transmit only the relevant parts. If someone falls down, emergency services do not need to know what the person was wearing when he or she fell. The angle of the fall and the person’s fallen position are more important,” Kundur said.

By transmitting only relevant information, the volume of data being communicated is reduced, thereby speeding up transmission.

Protecting DMSNs from attacks is another focus of her research. The lightweight algorithms she studies are also useful in this aspect of security. Kundur measures the probability with which these algorithms can detect attacks and distinguish them from false alarms.

Kundur said she hopes that understanding the limits and suitability of lightweight algorithms will help provide a framework for enhancing their performance with sensors.

“Security translates into safety, but efficiency is important too” Kundur said. “Achieving that crucial balance between security and efficiency is what will help improve DSMNs.”

Provided by Texas A&M University

Citation: Electrical engineer working to improve monitoring systems (2009, September 25) retrieved 3 May 2024 from https://phys.org/news/2009-09-electrical.html

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