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Professor Wants To Put Your Toaster On The Internet

The past 100 years has been The Age of Electricity, says Professor Fei-Yue Wang. During that time, our homes have become increasingly complex and home appliances now have sophisticated internal microprocessors and CPUs. This includes VCRs, TVs, DVD players, telephones, microwaves, dishwashers, CD players and many other devices.

As we enter the Age of the Internet, it's time to rethink how we control our homes and appliances, says Wang, a professor Systems and Industrial Engineering at The University of Arizona.

"We now have high-end appliances that have powerful computers and are high priced," he said. "Upgrading is costly. But now that we are living in a connected world, we can have a connected lifestyle and much cheaper, more energy-efficient devices."

Reconfigurable "Dumb" Appliances

Wang's idea is to connect inexpensive, reconfigurable, "dumb" appliances to a central operation center that provides “smart control agents” (autonomous software algorithms). Each appliance has just enough memory space and processing power to host one or two control agents for specific functions.

Take a VCR, for instance. If you want it to record, it will send a request to the central computer asking for the control agent that does the recording at the speed you specify. When it's done recording, the VCR deletes the control agent for recording and asks for a control agent that will rewind and play the tape.

By parsing the functions, the VCR needs much less computing power and can be upgraded with software. The only time you need to buy a new one is when there is a major hardware upgrade and the new VCR will be less expensive because it won't contain a huge amount of computing muscle.

Wang’s project was initiated in 1999 through an international research agreement between the University of Arizona, Chinese Academy of Sciences (CAS), and Kelon Electronics Holding Group, which is based in Hong Kong. The project was funded with more than $10 million from Kelon and $500,000 from CAS through China’s Overseas Outstanding Talent Project. UA’s portion of the grant was $750,000 through the Sino-US Kelon Joint R&D Center for Intelligent Control Systems, Wang was the general director of the center. During its five-year operation, the center graduated more than 20 Ph.D. and 30 MS students at both UA and CAS.

Two Central Controllers

In a connected world and for a connect lifestyle, Wang envisions two central controllers — one in the house and another at the appliance company headquarters.

"The company headquarters will have a super operation center that will learn the habits from each individual house by various data mining techniques," he said. "Like when you get up, when you come home, how you

cook, when you turn on the lights, and how you use each appliance. So you will have an individualized control system just for your house. It will know, for instance, what times of day you use your refrigerator and how often you open the door and how long you leave it open. That will help in managing the energy efficiency. This will increase performance and lower the cost."

"Now appliances are made with one-size-fits-all control algorithms," he added. "This is not right. It's inefficient. You use only some of the functions and those functions are designed for the average user, not for you."

Wang envisions control agents that are specifically configured for your needs. The company that produced the appliance or a third-party company could take the data from your household, design custom control agents and retrain your appliances via the Internet while you sleep.

Three Levels of Control Agent

There would be three levels of control agent, Wang says. A default agent at the device level would have very basic functions and would control the appliance when the network is down. A second agent would operate on the local network at the household level, and a third would be the latest custom-designed agent from the manufacturer, featuring sophisticated learning and optimization capabilities. The customized agent would be periodically downloaded to become the new local network agent.

Getting manufacturers involved would be easy, Wang said. The computers they would need to do this would be fairly inexpensive and, in return, the manufacturers would get valuable data from individual users.

"Now, appliance makers just sell their devices to Walmart, for instance, and they get lost," Wang said. "This would help them develop much more sophisticated, highly targeted market strategies because they could track the units and find out how they're being used."

He recognizes that this could raise concerns about privacy. But individual privacy could be protected by encrypting the data, Wang said. The manufacturer wouldn't know the customer's identity or exactly where they live, only a general area of the city, for instance.

System Has Five Aspects

Wang says there are five aspects to the system, which he has been working on for about ten years:

1. ABC — Agent Based Control instead of a single control algorithm within the device.
2. LSRC — Local Simple, Remote Complex. That is, the appliances are simple and the complexity is in the remote controllers and agents.
3. ASOS — Application Specific Operating Systems. The agent is designed for the specific use. Most owners use only about 40 percent of an appliance's capabilities. Wang would like to see this raised to 70 or 80 percent.
4. RCPD — Remote Configurable and Programmable Devices. These would be the "dumb" appliances without networking and “smart” appliances when connected to the network.
5. OSGi — Open Service Gateway Initiative. A standardized specification for net appliance control that makes all appliance software and hardware compatible.

Extending the Idea to Traffic Control Wang also is expanding his ideas about the Age of the Internet control to traffic control systems and automobiles.

He envisions traffic lights that would gather data about traffic volume and movements each day. The lights would then be reconfigured from a central controller each night. Smart vehicles would be customized

specifically for each driver as the computer learned more about the driver's habits and how the vehicle is used.

Wang is the president elect of the Intelligent Transportation Systems Society of IEEE (Institute of Electrical & Electronics Engineers). The society sponsored an intelligent vehicle conference this May in Las Vegas and sponsored an intelligent transportation conference in Vienna this month.

"I'm trying to put this idea to the whole professional community," Wang said. "I'm hoping others will follow this idea of remote intelligence instead of designing complex, dedicated intersection controllers at each intersection, for instance."

Wang admits that he doesn't know exactly how these appliance, traffic control and automotive systems will evolve or ultimately be used.

"Actually, I don't know all the potential yet for any of these systems," Wang noted. "It's like the Internet and personal computer. When they were first being developed, people didn't realize everything they would do or where they would go. In fact, you don't need to know. This is an opportunity for third parties to develop ideas."

Editor's Note: The original news release can be found here.

This story has been adapted from a news release issued by University Of Arizona.