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Smartphone interference tackled by Kansas startup

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Future smartphones could gain numerous benefits from algorithms to fight interference, developed by a little-known startup in Lawrence, Kansas, that last week drew closer to implementing the technology in devices.

The algorithms are intended to more efficiently cancel out interference among different radios built into the same phone, potentially giving users longer battery life or fewer dropped calls. The same technology might also be used to counter other types of interference, including military jamming and power-transmission signals that hurt powerline networks.

The source of these signal-filtering algorithms isn't a wireless-industry giant but Avatekh, a 2-year-old research company that's working with Kansas State University's Electronics Design Laboratory. They announced last week they have received a National Science Foundation grant to implement and test the technology in hardware.

Radio-frequency interference can hold back network performance, and one

source of it is the multiple radios found in many devices. Most smartphones are equipped with Wi-Fi, Bluetooth, GPS and other radio technologies, all of which may be transmitting or receiving signals at the same time in close proximity. Even if they use different bands, the radios in a device may interfere with each other if they're very close together, according to Alexei Nikitin, Avatekh's founder and chief science officer.

Overcoming this interference requires detecting and cancelling out the offending signals. This is often done through digital processing after the signals have been captured and digitized, Nikitin said.

Radio waves traveling through the air or within a device are analog until they're converted into digital signals. Instead of trying to fix the interference after that conversion, Avatekh's algorithms deal with the analog signals directly. This allows them to reduce some forms of interference that can't be corrected at all in the digital realm, and it also eases the computing and energy load on the device. Though there are analog filters in phones already, the new algorithms can outdo them in solving some types of interference that come from other radios, Nikitin said.

A key advantage of Avatekh's algorithms is that they can analyze and mitigate the internal interference in real time, said Tim Sobering, an electrical engineer at Kansas State who is helping to bring the technology onto hardware boards for testing and development. In the digital realm, this kind of work has been limited to a non-real-time process because it requires a huge amount of processing power and energy, Sobering said.

The higher efficiency of the analog algorithms could mean longer battery life. In addition, clearing up interference can raise the signal-to-noise ratio, making networking easier in multiple ways, Nikitin said: Depending on the situation, less noise may make a phone's useful range wider, let a mobile operator get more service out of the same spectrum, and give subscribers a higher data rate than they would otherwise get.

Beyond the wireless world, better interference mitigation could be a boon to powerline broadband, which has to share wires with electric current. The electricity running through powerlines can interfere with the data signals being sent through them, so the network can't run as fast as it might. The Avatekh algorithms could help to mitigate interference from that current, Nikitin said.

In a similar way, they could help to combat interference on copper wires used for DSL (digital subscriber line), clearing the way for faster DSL speeds, he said. Because they combat interference, the algorithms might also be useful for overcoming intentional jamming. Avatekh is starting to talk with some defense companies about this, Nikitin said.

Avatekh has patented the algorithms but is just beginning to test them out in hardware through the project with Kansas State, Nikitin said. It may be three to five years before they're implemented in commercially available devices, he said.

"It's pretty wet around the ears as far as actually putting it on a chip," he said.

Nikitin came to Kansas from the Soviet Union and earned a doctorate in physics from the University of Kansas in Lawrence. Avatekh was founded in 2011. Nikitin has been working on the signal-filtering idea for about 15 years but only recently got to the stage of implementing the algorithms in hardware. For help, he turned to Sobering, whom he already knew, even though Kansas State is a rival to Nikitin's alma mater.

Launching his company so far from the traditional centers of the tech industry was a brave move.

"I had some pressure to go to the Valley, but for various reasons, I kind of decided to undertake the insane task of trying to start a high-tech startup in Lawrence, Kansas," Nikitin said.