***Interscatter* enables first implanted devices, contact lenses, credit cards to 'talk' WiFi**

University of Washington engineers have **introduced** a new way of communicating that allows devices such as brain **implants**, contact lenses, credit cards, and smaller **wearable** electronics to talk to everyday devices such as smartphones and watches. This new "interscatter communication" works by **converting** Bluetooth signals into Wi-Fi **transmissions** over the air. Using only reflections, an interscatter device such as a smart contact lens converts Bluetooth signals from a smartwatch, for example, into Wi-Fi transmissions that can be picked up by a smartphone. The new technique is described in a paper to be **presented** at the **annual** conference of the Association for Computing Machinery's Special Interest Group on Data Communication in Brazil. "Wireless connectivity for implanted devices can **transform** how we **manage** chronic diseases," said co-author Vikram Iyer, a UW electrical engineering doctoral student. "For example, a contact lens could monitor a diabetic's blood sugar level in their tears and send **notifications** to the phone when the blood sugar level goes down."

Due to their size and location within the body, these smart contact lenses are too **limited** by **power** demands to send data using **conventional** wireless transmissions. That means they so far have not been able to send data using Wi-Fi to smartphones and other mobile devices. However, the team of UW electrical engineers and computer scientists has **demonstrated** for the first time that these types of power-limited devices can "talk" to others using **standard** Wi-Fi communication. “Our technology **requires** no specialized equipment, would **exclusively rely on** mobile devices commonly carried by users, and **generate** Wi-Fi signals using 10,000 times less energy than conventional methods,” said co-author Vamsi Talla, a recent UW **doctoral graduate** in electrical engineering who is now a **research associate** in the Department of Computer Science & Engineering.

Because the new technique **enables** inter-technology communication by using Bluetooth signals to create Wi-Fi transmissions, the team calls it "interscattering." Interscatter communication uses the Bluetooth, Wi-Fi, or ZigBee radios **embedded** in common mobile devices like smartphones, watches, laptops, tablets, and headsets, to **serve as** both **sources** and **receivers** for these reflected signals. "Bluetooth devices **randomize** data transmissions using a process called scrambling," said lead faculty Shyam Gollakota, assistant professor of computer science and engineering. "We **figured out** a way to **reverse** this scrambling process to send out a single tone signal from Bluetooth-enabled devices such as smartphones and watches using a software app."

The researchers built three proof-of-concept **demonstrations** for previously infeasible applications, including a smart contact lens and an i**mplantable** neural recording device that can communicate directly with smartphones and watches. "**Preserving** battery life is very important in implanted medical devices, since replacing the battery in a pacemaker or brain stimulator **requires** surgery and puts patients at potential risk from complications," said co-author Joshua Smith, associate professor of electrical engineering and of computer science and engineering. "Interscatter can enable Wi-Fi for these implanted devices while **consuming** only tens of microwatts of power."

Beyond implanted devices; the researchers have also shown that their technology can a**pply** to other applications such as smart credit cards. The team built credit card prototypes that can communicate **directly** with each other by reflecting Bluetooth signals coming from a smartphone. This opens up possibilities for smart credit cards that can communicate directly with other cards and enable applications where users can **split** the bill by just tapping their credit cards together. "**Providing** the ability for these everyday objects like credit cards - in addition to implanted devices - to communicate with mobile devices can **unleash** the power of ubiquitous connectivity," Gollakota said.

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