Impact

ICC Research Brief

institute of computing & cybersystems

Center for Human-Centered Computing (HCC)

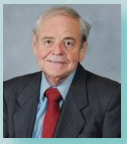
Appropriating Everyday Surfaces for Tap Interaction

Zachary Garavet and Siva Krishna Kakula.

The Researchers

Siva Krishna Kakula (PhD student, CS)
Zachary Garavet (Undergrad student, ECE)
Scott Kuhl (Associate Professor, CS)
Keith Vertanen (Assistant Professor, CS)

View a video about this research at **https://youtu.be/sF7aeXMfsIQ**, or use this QR code.



This research was funded by ECE alumnus Paul Williams '61. Paul was also the benefactor of the Paul and Susan Williams Center for Computer Systems Research, located on the fifth floor of the Electrical Energy Resources Center. The 10,000-square-foot, high-performance computing center—the home of the ICC—was established to foster close collaboration among researchers across multiple disciplines at Michigan Tech.

What if an everyday surface, like a table, could be transformed into a rich, interactive surface that can remotely operate things like computers, entertainment systems, and home appliances?

That's what ICC members Keith Vertanen and Scott Kuhl, along with two student researchers, set out to do with a $50K William Seed Grant.

The team's Research Goals were to:

- Create machine learning models that can precisely locate a user's taps on a surface using only an array of inexpensive surface microphones;
- Demonstrate the feasibility and precision of the models by developing a virtual keyboard interface on an ordinary wooden table; and
- Conduct user studies to validate the system's usability and performance.

Did they succeed? Yes! Outcomes include:

- A prototype virtual keyboard that supports typing at rates comparable to a touchscreen device;
- The first-ever acoustic sensing algorithm that infers a continuous two-dimensional tap location; and
- Novel statistical models that quickly adapt to individual users and varied input surfaces.

Further, the results, hardware, and data sets can be applied to future collaborative work, and were used in the researchers' $500K National Science Foundation proposal, "Text Interaction in Virtual and Augmented Environments," under review. The researchers are also working on a technical conference paper to present to their peers.

Extended research applications include:

- Enriched interactions in Virtual Reality (VR) and Augmented Reality (AR), compared to existing vision-only based sensing; and
- On-body interaction, like using your palm as an input surface.

What's next?

- Improved accuracy of tap location inference.
- Richer interactions like swiping or tapping with multiple fingers.
- Wireless sensor pods that can be quickly and easily deployed on any flat surface.
- Display of virtual visual content on surfaces via Augmented Reality smartglasses.