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Clemson Visualization uses cutting-edge technology, virtual reality to give researchers insight into data

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Rapid technological advances have given researchers access to more data than ever before, and Clemson University's Advanced Visualization group wants to give those researchers better insight into their data using cutting-edge equipment and high-performance visualization.

"Visualization is the ability to be able to see your data, to actually see what's happening within your data," said Dr. Oyewole (Wole) Oyekoya, Director of the Advanced Visualization group. "You have to be able to visualize that data and see information that you otherwise would not be able to see when you run your data analysis. What our department tries to do is provide those resources."

Oyekoya and a team of students operate in the newly-renovated Visualization lab in Barre Hall, a space packed with the newest in virtual and augmented reality technology. The Viz Wall, featuring six 46" tiled displays, looms over a multitouch table, whiteboards and computer workstations connected to head-mounted Oculus Rift, HTC Vive, Samsung Gear VR and Microsoft HoloLens devices.

Nuyun Zhang tests out a Microsoft HoloLens while senior Joseph James offers assistance.

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Image Credit: Clemson University

The department puts technology, including Clemson's robust Palmetto Cluster's GPU (Graphical Processing Units) resource, to use in adding another dimension to data. Recently, Dr. Oyekoya's team helped a graduate student learn the Paraview visualization software and set him up on the Palmetto Cluster to harness the school's computing power and give him a different look at his data.

Students work on their own research projects when not helping others around campus, including

creating a virtual tour of Clemson's new Littlejohn Coliseum and building a 3D projection system for the multitouch table so users can combine the touch functionality while seeing their hands in virtual reality.

"Right now I'm working on a driving simulator," said senior Joseph James. "Just imagine putting on the headset and being immersed into a vehicle so you put your hands up and you're actually able to control the vehicle with your hands. It seems like actually driving a real car."

Students recently used the multitouch table in an effort to engage younger children with science. Using the hands-on technology, students could create and manipulate molecular structures to better understand the building blocks of chemistry.

Education and inspiration guides much of the department's outreach. The rapid rise in VR technology for the mass market—from major technology companies like Microsoft, Samsung and Google—has helped Dr. Oyekoya get closer to that goal by traditional barriers to entry, like cost and space. In March, Dr. Oyekoya and Clemson researchers showcased their work at the Institute of Electrical and Electronics Engineers (IEEE) Virtual Reality conference in Greenville.

"Now with the virtual reality headsets coming in at just a couple of hundred dollars, it means that we're able to showcase the uniqueness, the 'wow factor' that this research has," he said. "Most importantly—and this is something I'm just talking about from a personal perspective—it really allowed us to reach out to potential groups, like underrepresented groups, to get them very interested in STEM [science, technology, engineering and mathematics] programs. Which, in the long run, is actually an area that the US and most countries are concentrating on to get more people interested in STEM. Visualization is one way to do that."

In addition to science outreach and building their own programs, Dr. Oyekoya's group wants to push visualization to the next level—the cloud. Oyekoya points to the growth of supercomputing and more robust cloud resources working in harmony with VR headsets and smartphones. He envisions a not-too-distant feature where the GPU computations happen in the cloud and devices handle the visual component.

The Advanced Visualization Department is also working with Adobe on VR in digital marketing (leading to the Littlejohn Coliseum tour) and body scanning, where full-body images become three-dimensional animated avatars.

"This is a very useful technology and facility for our researchers," said Oyekoya. "They will be able to scan anybody and construct various scenarios. There could be a social science scenario where maybe you were trying to do research into violence in a typical area that you would not otherwise be able to do in real life, but you can do it in a virtual scenario."

Student Barry Tucker works on a simulation aimed at testing how best to demonstrate anti-bullying strategies.

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Image Credit: Clemson University

James came to the visualization world two years ago with no programming experience. Since then, he's worked in half a dozen programming languages, something he says has made him more versatile and marketable. For those new to virtual and augmented reality, James has a simple and reassuring message.

"Don't be afraid, it's very easy," he said. "To me, it's taking over the future. It can take over the world."

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