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The University of Dayton Department of Computer Science opened a new set of virtual reality (VR) and mixed reality (MR) labs during the spring 2018 semester to expand its capability in researching and developing applications for virtual and augmented reality systems. The new facility in the former Music and Theatre Building expands the department's access to VR technology to three fully functioning labs with a variety of systems.

"The first thing for a student, is to have an environment that they don't get tired in," said Mehdi Zargham, professor and Department of Computer Science chair. "The students love to work here as much as they can. Second, it gives us enough space to experience different equipment and new ideas. If we had a smaller space we couldn't set up all of this equipment. Now we can go beyond what we were doing because of the expansion of the space."

The new labs are equipped with the HTC Vive virtual reality system, the Oculus Rift virtual reality system and the Microsoft Hololens augmented reality system. The department equipped one of the labs with an interactive chair rigged to respond to a virtual environment, such as a computer-generated roller coaster.

"When you go from this two-dimensional screen, to a three-dimensional environment, you immerse with that environment much more," Zargham said. "The physical space will not be an issue anymore. You can go and meet someone, or go and sit in a virtual classroom. Just think, in your virtual environment you can go to your doctor and ask a question.

"Virtual reality even has potential for promoting human rights and social justice. For example, a movie maker took a 360-degree camera to a Palestinian house and recorded how the family interacted with each other. He brought it to the United Nations, and they put the VR headsets on and saw that environment. That changed the world."

Virtual reality technology refers to technology that places the user into another location entirely, either in a computer-generated environment or one captured through the use of 360-degree cameras. Applications of VR include gaming, education, virtual doctors visits, addressing human rights issues and more.

Mixed reality technology refers to technology that overlays digital content onto an otherwise visible world. Mixed reality research at the University includes real-time face tracking using Microsoft's Hololens augmented reality system.

"We are using C-Sharp and an eye-wear device from Microsoft called the Hololens," said Asma Almalki, a graduate researcher in the Vision and Mixed Reality Lab led by Tam Nguyen, assistant professor of computer science. "The goal is to do the face detection, extract the useful features from the face, and then offer a piece of information like names or any other piece of information."

This is but one of the many innovative uses for mixed reality being developed at the University.

In the adjacent lab, Zargham and fellow researchers have created a program that helps young students learn to write computer code in a virtual reality environment. Students in middle school can design a virtual environment, including a virtual roller coaster, as a means of teaching the skills of coding through an exciting and immersive experience.

"The new labs have helped a great deal," said graduate researcher Chandra Kishore Danduri. "Before these labs and the VR equipment, we were using a single laptop. Now we can expand our efforts. We are using my lab to develop software to educate kids on coding and more using VR."

The third new VR lab is dedicated to researching human language and how it can be integrated into automated chat bots, particularly in a virtual environment.

"We are dealing with question and answer processes, with automated systems, and with chat bots," said Saeedeh Shekarpour, assistant professor of computer science. "We want to understand what people say in language, and interpret that in a smart way in order to better interact with people. This new lab is dedicated to knowledge, semantics and text analytics."

The uses for VR and MR technology are only limited by the ingenuity of researchers and developers. Through advancements in the technology, creative thinking and smart collaboration about how the technology can be used, the Department of Computer Science hopes to enable more accessible education, healthcare, social justice and more.

"So how do you apply it to all of this?" Zargham asked. "Once the technology is there, once the tools are there, I think it will change the way we live."

- Aaron Alford, graduate communication assistant, College of Arts and Sciences