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ANNUAL REVIEW

COMPUTER SCIENCE

VCU College of Engineering

COMPUTER SCIENCE

'GENCYBER' BOOTCAMP

AIMED AT BUILDING NEXT GENERATION OF CYBERSECURITY PROS

The VCU GenCyber Cybersecurity Summer Bootcamp is part of a nationwide initiative funded by the National Security Agency (NSA) with more than 70 locations across the U.S. It aims to provide summer cybersecurity camp experiences at the K-12 level, raising cybersecurity awareness, introducing cybersecurity career opportunities and increasing student diversity in cybersecurity colleges.

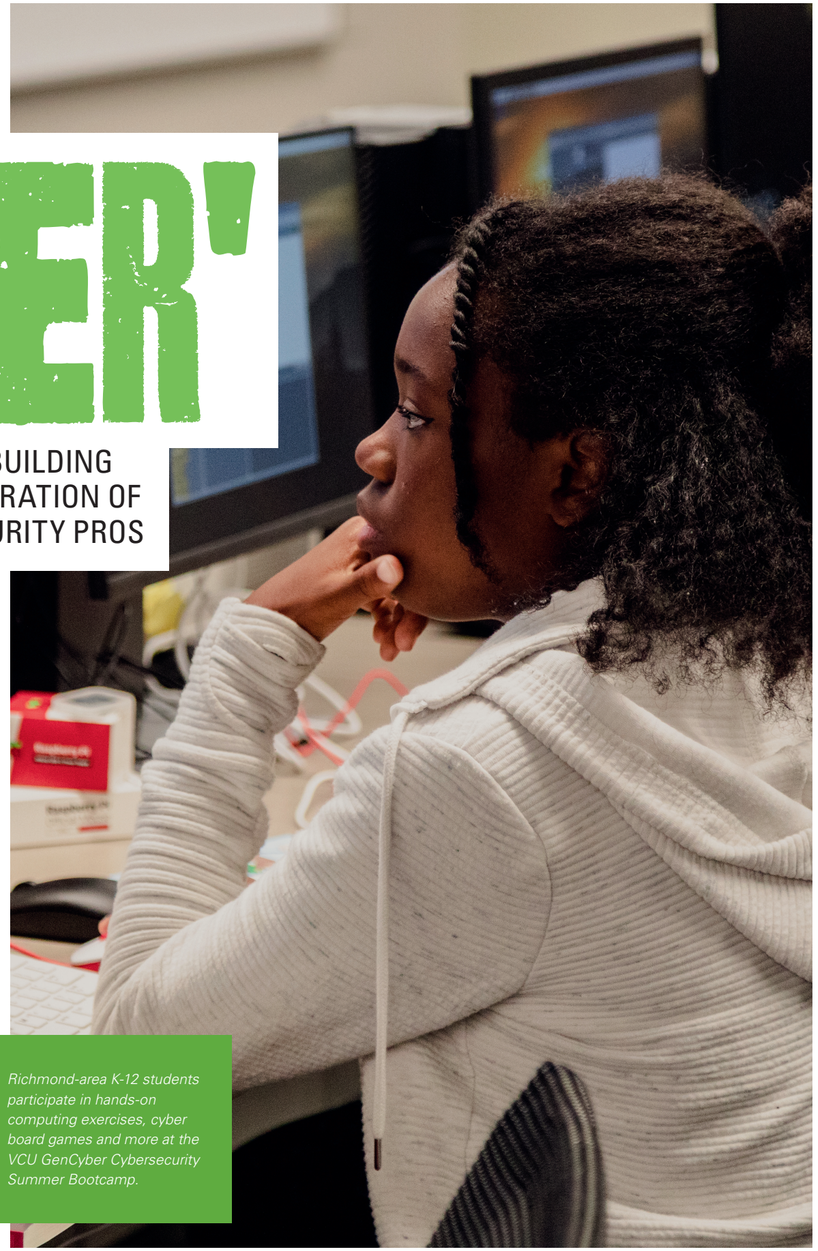
"The idea is to engage young students and introduce cybersecurity early in their life so that later, when it comes to choosing a profession, they know [cybersecurity] is an option to them," says **Irfan Ahmed, Ph.D.**, associate professor in the College of Engineering Department of Computer Science.

Students participated in hands-on exercises, cyber board games and a tour of VCU cybersecurity facilities. Instruction was led by **Ahmet Sonmez, Ph.D.**, associate professor in the College of Engineering Department of Computer Science. Colonel Carlton Day, Senior Army Instructor at Franklin Military Academy, served as the camp's middle and high school pedagogical expert.

A popular activity involved a Raspberry Pi: a low-cost, credit-card-sized computer that plugs into a monitor or TV and uses a standard keyboard and mouse. Each camp participant received their own Raspberry Pi to complete camp activities and to keep afterward.

Throughout the week, participants also heard from speakers in industry, government and academia, including an Algorithm Software Engineer at Oak Ridge National Laboratory, Director of Cybersecurity at Capital One, Tech Leader at Ferguson Enterprises and Cyber Warrior from the U.S. Army.

Participants walked away from VCU GenCyber with a deeper understanding of the cybersecurity profession. Ahmed and his team also organized a post-camp activity in the fall to keep students engaged. "Over 94% of our participants said they want to learn more about cybersecurity," says Ahmed. "We want to give them more opportunities to explore."



Richmond-area K-12 students participate in hands-on computing exercises, cyber board games and more at the VCU GenCyber Cybersecurity Summer Bootcamp.

VIRTUAL REALITY SURGICAL SIMULATOR WITH HAPTIC FEEDBACK HELPS SURGEONS HONE THEIR SKILLS

Drawing on the expertise of urogynecologist Lauren Siff, M.D., VCU Health adjunct assistant professor, VCU Engineering computer science professor **Milos Manic, Ph.D.**, and his students created a 3D virtual model of a patient's anatomic structures to train surgeons on how to implant a midurethral sling device. This device alleviates bladder control loss many women experience during physical stress like coughing or laughing. Implanting the sling is a widely-used procedure where doctors rely heavily on their sense of touch rather than seeing a patient's internal anatomy.

For the prototype training system the team combined virtual reality and "haptic" feedback, which mimics the resistance a surgeon feels when pushing into human tissue. Manic and his students got to work writing code and creating the virtual simulation using data from MRI and CT scans, artificial intelligence and feedback from Siff.

The "SlingVR" simulator creates a 3D representation of a patient's pelvis by piecing together two-dimensional images drawn from CT and MRI scans of unidentified patients. A trainee surgeon views that virtual environment on a screen or a VR headset.

Beyond looking real, the VCU sling training model is unique because it's also designed to feel real by providing the doctor touch feedback as they maneuver a device called a trocar through the virtual patient's anatomy.

If the trocar collides with the virtual pelvic bone, the instrument creates a rigid push-back response. It provides a more "pliable" feel when touching the bladder and an even slighter response while pressing on simulated blood vessels. The system also provides feedback on distance from critical anatomical structures and will provide "scoring" for levels of proficiency.

RESEARCH TEAM AIMS TO ENHANCE SECURITY OF MEDICAL DEVICES

Tamer Nadeem, Ph.D., the principal investigator (PI) of the VCU-based MedKnights project, and co-PI **Irfan Ahmed, Ph.D.**, both associate professors in the VCU College of Engineering Department of Computer Science, recently received an award from the NSF's Office of Advanced Cyberinfrastructure to put together a framework to improve security for the Internet of Medical Things (IoMT).

IoMT devices are used in a range of diagnostic, monitoring and therapeutic applications. IoMT includes patient monitors, ventilators and MRI machines. Ahmed cited the internet-connected insulin pump as a good example of an IoMT device. Internet connectivity allows for both monitoring and adjusting the dosage remotely — functions that require a high degree of security for patient privacy and safety.

Security is a considerable concern for the new generation of devices because the current IoMT devices have been hit hard by hackers, Nadeem said. Security is an issue that extends from the individual patient to the institution. The MedKnights team's preparation for taking on malicious IoMT attacks includes building a "test bed," an isolated hardware/software assembly that Nadeem says will mimic the internet-enabled hospital setting.

The test bed will incorporate IoMT datasets based on typical device behavior, traffic and known malicious attacks. Nadeem explained that MedKnights will explore vulnerabilities of various IoMT hardware and software by subjecting the elements of the IoMT test bed to a range of attacks.

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