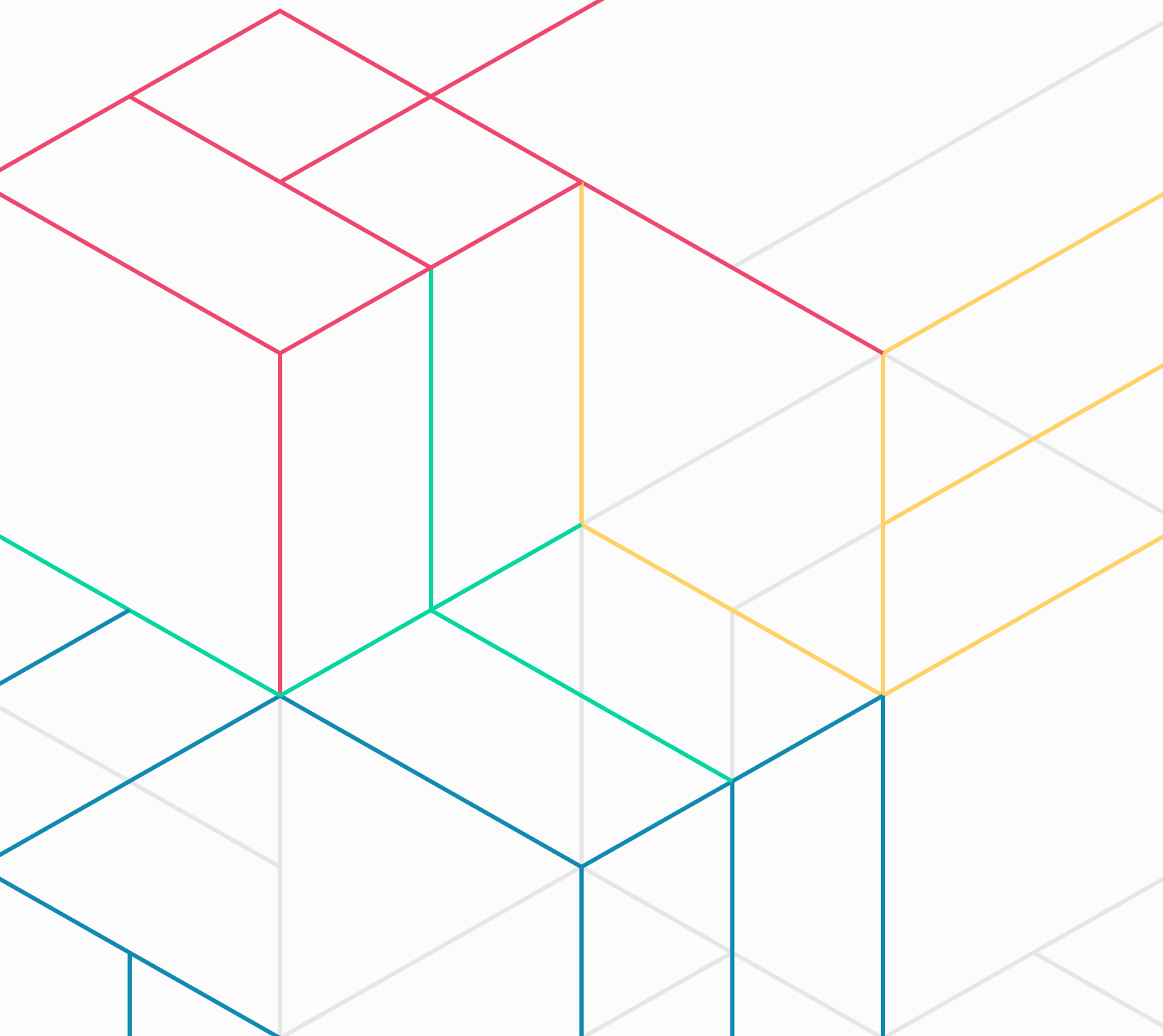


Engineers' Forum



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at Virginia Tech**
Emily Urda



HokieAI

VS

OpenAI

GUARDRAILS

Article / **Sawaira Summer ('28)**



bringing an exciting new advancement into the Fall 2026 semester. The **Large Language Model** (LLM)'s purpose is to provide accessible tools to all students, staff, and faculty. "The News Feed," which is a local online news page covering the New River Valley region, explains that HokieAI was developed to build an understanding for users about ethical usage and implementing security. In the artificial intelligence world, security defines the term guardrails. **What are guardrails, you might ask?** They act as security layers where instructional models check each input and output based on the policies developers add during the LLM pre-training process. The first process guardrails go through is called input checking, which effectively scans user prompts, ensuring no malicious content appears before the LLM provides a response. On the other hand, output checking scans the LLM's solution before revealing it to the user to avoid unwanted bias or hate speech. Despite HokieAI's six constructed models originating from OpenAI, the models were strictly developed to ensure stronger protections from dangerous prompts and to allow user interaction with artificial intelligence to be efficient for personal learning.

Instances at other universities display a harmful effect of when guardrails are not properly implemented. A specific reason may include developer error when fine tuning the model during the model's input and output checking. Vanderbilt University's model, Amplify, created by the Computer Science department demonstrated a struggle with the integration connection of the plagiarism tracker

software, Turnitin, which led to its permanent shutdown due to high false-positive error rates of assignment accuracy which contained various misinformation of differentiating between copy paste of external sources and student context of paraphrasing the original source. Vanderbilt University currently has Amplify available for faculty, staff, and students to establish personal learning of utilizing artificial intelligence however a disconnection of the model to a third party software differs from nationwide public concern where guardrails can extremely affect civilian lives or privacy.

HEY CHATGPT,

how does the media portray mass shooting?

what firearm should i use?

when should i get to campus?

47% of domestic civilians were concerned and raised questions about controversies that involve public concern of artificial intelligence advancements, mainly about user safety from harmful topics. The April 17, 2025 Florida State University mass shooting resulted in the deaths of two faculty and seven injured students. The suspect, Phoenix Ikner, utilized OpenAI during the day of the shooting, as revealed by the State of Florida Circuit Court. Ikner typed prompts such as "how the media portrays a mass shooting", "what firearm/ammunition to use", and "best time to arrive on campus". The model provided a sensitive response which seemed beneficial for the perpetrator with the number of national media coverage of mass shooting victims. This resulted with Florida being the first state to sue OpenAI's CEO Sam Altman, with reasons that it helped

JABIL

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the perpetrator with the shooting and its effect in harming children. OpenAI's response was brief, stating that ChatGPT was not responsible for the attack and that the model focuses on providing external sources from the Internet in providing solutions. OpenAI continues to be in demand, with half of the United States adult population reported utilizing ChatGPT for daily tasks. In multiple legal battles that involved OpenAI, **the basic reply from the company is to "implement stronger safeguards"**.

To establish a degree of independence from OpenAI models, Virginia Tech modified HokieAI's GPT submodels by avoiding rewriting the base model parameters and including an architectural security layer for data privacy/management. This allows "no model retention," which analyzes each prompt via output checking, ensuring all input and output are contained inside the university's cloud service: ECAP (Enterprise Cloud and AI Platforms).

WHAT MAKES

HokieAI

different?

No Model Retention

Disabled Chat Logs

Set Time Limit for High Intensity Workflow

No API Customization

Administrators or students are not allowed to check what users have typed previously, while the model logs are disabled and are only accessible to university legal auditors. HokieAI models have a set time limit for high-intensity workflow due to a continuous traffic from 70,000 Virginia Tech affiliates, with a circular usage tracker for model utilization (similar to a financial budget planner) that aids with the university's data demand, costs, and stability among all faculty, staff, and students. Another implementation of HokieAI guardrails is that it does not allow users to customize a model using an application programming interface (API), even after logging in with their Hokie PID. This allows more security from unwanted server addresses into the main interface.

With the growth of artificial intelligence since its origins, HokieAI and its levels of guardrails implemented should be seen as a robust model for internal Virginia Tech use and other institutions to follow, which would ultimately provide accessible information about the usage and security of artificial intelligence models. **By introducing transparent AI tools, universities, including Virginia Tech, are creating an academic environment where students can safely explore emerging technologies without risk of privacy leakage or harm to university policies.** HokieAI and various AI tools in universities also increase digital literacy across majors, helping students understand how LLM systems operate, how guardrails protect users, and why secure design matters in real-life applications. With the emergence and high success rate of HokieAI, it displays innovation and safety can coexist, offering as a final prototype to institutions seeking to adopt artificial intelligence in a way that empowers learning while maintaining user trust.

INNOVATION

& SAFETY

can

coexist



Humanoid Bipedal Fabrication

Article / **Ethan Yueh ('28)**

Have you ever wondered

WHAT KINDS OF **TWO-LEGGED** CREATURES exist?

Humans come to mind first, followed by primates and birds with their jumps and waddles. Bipedal movement allows creatures to travel across varied terrain while their upper bodies perform other tasks. This makes bipedal robots potentially useful in environments built for humans. Recreating this locomotion in a machine, however, requires solving a difficult problem: balance. A bipedal robot must remain upright while moving across uneven ground.

VT Humanoid, a robotics club founded in spring 2026, is tackling this challenge through several specialized teams. The club also aims to make its design affordable and manufacturable for hobbyists, rather than limiting bipedal robotics to select research labs.



The actuators subteam develops the joints that move the robot. Because motors are typically the most expensive components, the team plans to use lower-torque alternatives supported by gearboxes. These gearboxes help keep the

robot lightweight and supplement the motors' lower torque to lift each link.

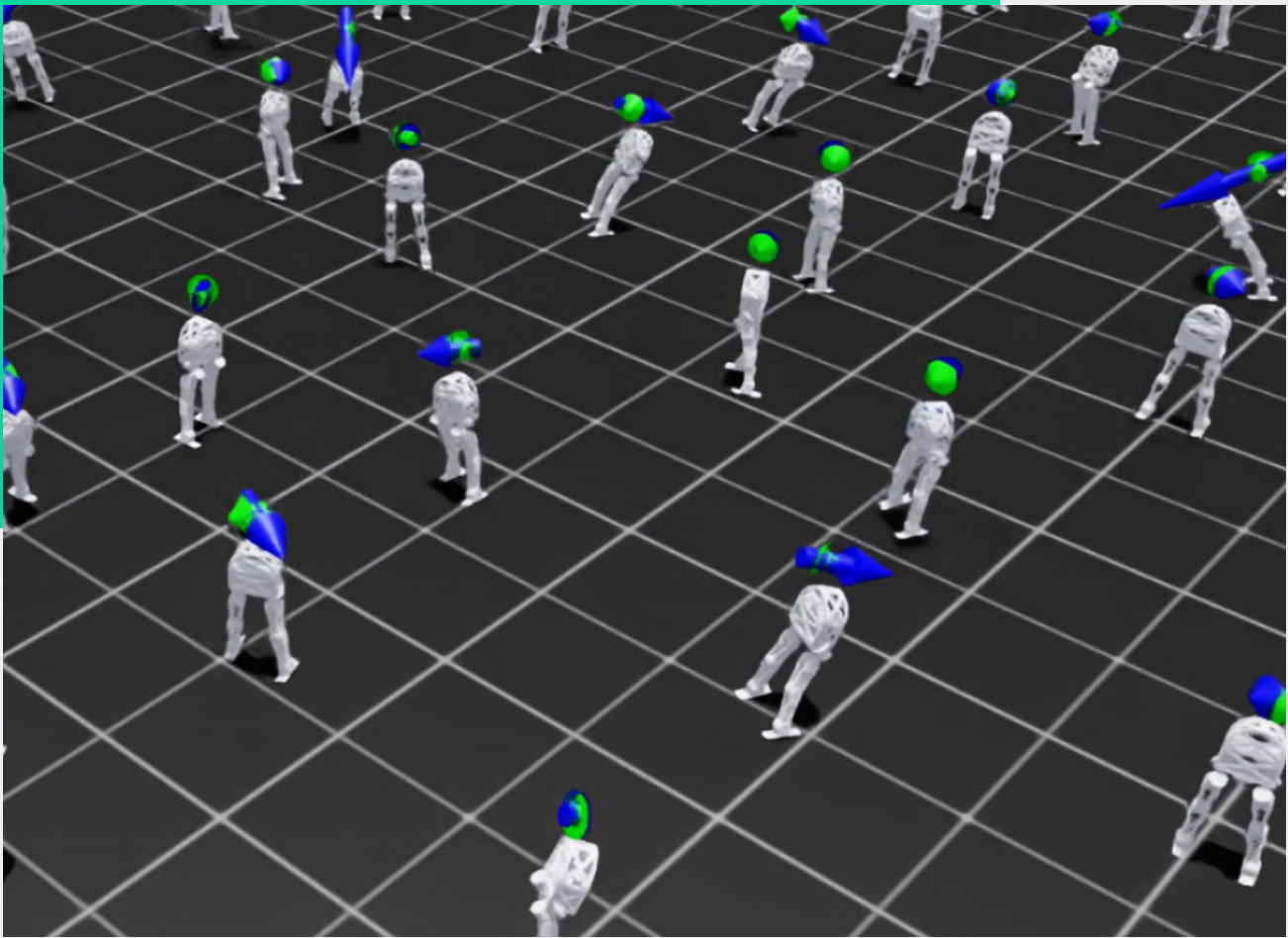
The structures team is building the robot's mechanical backbone. Its members must preserve structural integrity while minimizing the weight of each joint and leaving enough space for the electronics team to route wiring throughout the robot.



The electronics team acts as the robot's nervous system, translating information about the changing environment into signals the software can use. Its members decode what the robot needs to know to remain standing and how its sensors should communicate that information by working with the software team.

The software team develops the control system that keeps the robot upright and coordinates its next movement. It determines what signals the computer should send to the motors and adapts to changes in the environment with sensor data. Using Isaac Sim, a robotics simulation software platform developed by NVIDIA, the team recreates scenarios thousands of times in parallel, developing models capable of responding to different conditions.

Although each subteam has a distinct responsibility, the club's success depends on collaboration. Club president Ashwin Pulla explains that "getting 40–50 people on the same wavelength is harder than designing and



building the robot.” Encouraging members to share discoveries and respond to ideas helps create an inclusive team environment, especially for members who may be less comfortable speaking up. **Even small actions, such as sharing an interesting breakthrough or responding thoughtfully to an idea, can help members become more engaged.**

This collaboration is essential because the robot’s systems are interdependent. A lighter frame may require different motors, while new sensors may require changes to the software. Constant testing and iteration give members experience with the integration challenges faced in professional engineering, where no subsystem operates independently, in a realistic team setting while developing communication skills.

“Work on something interesting and people will come.” By lowering the barrier to bipedal robotics, VT Humanoid hopes to expand innovation beyond a few research labs. **Accessible research could eventually help automate repetitive, mind-numbing tasks in environments designed for humans.** Virginia Tech Students interested in contributing in any capacity can join the operations team and help extend the project’s reach.

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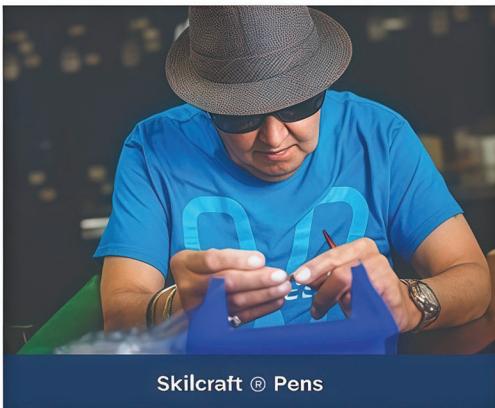
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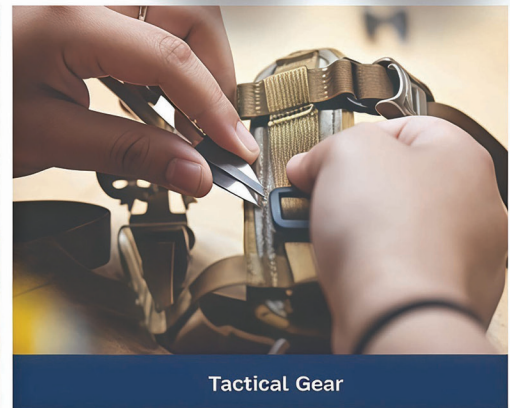
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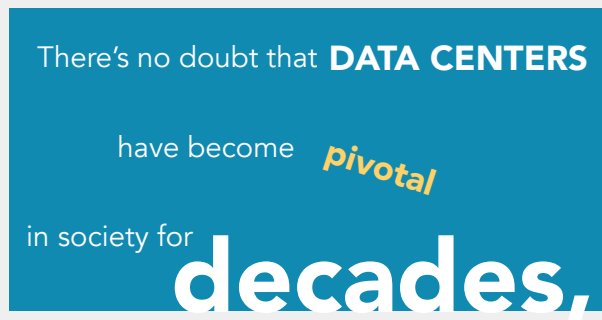


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AI DATA CENTERS & COOLING TECHNOLOGIES

Article / **Minami Furukawa ('30)**



storing data for people to watch shows, use tap-to-pay, or for businesses to run databases. However, as AI development and use have grown, demand for new data centers has surged. Nowadays, AI data centers are sliding into existence, from rural Utah locations to just outside of our backyards in Northern Virginia.

Why Should We Care?

Data centers are reliant on significant electricity and water consumption for cooling purposes. This energy usage is predicted to consume up to 17% of all U.S. electricity by 2030, and water usage can go up to 5 million gallons per day, equivalent to the water usage of 50,000 people. Furthermore, the water is not reused. **Roughly 80% of consumed water, mostly fresh water, evaporates in the cooling process.**

The evaporation of water is a primary concern, since cooling through evaporation leaves behind salts and other sediments, lowering the surrounding water's quality. It also poses a concern for the environment and nearby community, since used water isn't entering back into the community water stream.

Not only that, data center companies withdraw local water. Google, for example, reported that 31% of its freshwater usage came from medium or high water scarcity. **By taking freshwater from local communities, including those that already have water scarcity, data centers are only harming them further by contributing to water usage.**

Where Does Engineering Come Into Play?

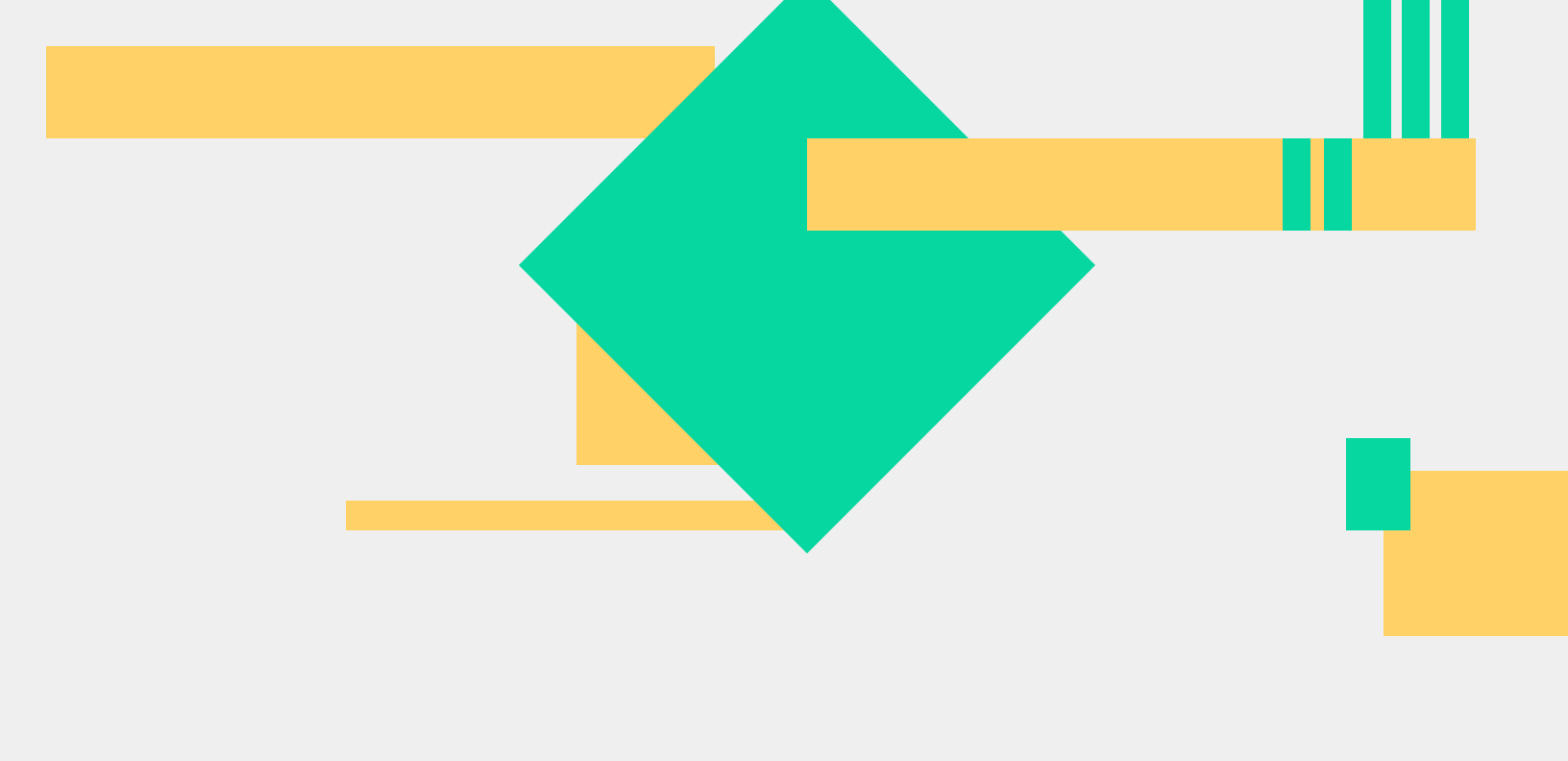
Several engineering companies and researchers are in the process of optimizing cooling technologies for data centers, which would result in less water and electricity usage.

Ferveret, a start-up started by Massachusetts Institute of Technology (MIT) researchers, is developing a specialized liquid that's adapted from "subcooled boiling," or using a liquid that has a low boiling point. This liquid, dubbed "Ferveret's Adaptive Phase Cooling," produces smaller bubbles in comparison to other liquid cooling methods. These bubbles then more frequently travel to recondense, accelerating the cooling process and preventing complications that would come up in traditional liquid cooling.

At the University of California San Diego, researchers have developed a "cold plate," which consists of a new fiber membrane with pores that draw cooling liquid across it through capillary action. The pores are key to effective evaporation since pores that are too small clog, and pores that are too large end up boiling in the process of evaporating. Housed directly on a CPU or GPU chip, this cold plate would mitigate heat from electronics through evaporation as the liquid travels. Although this uses liquid cooling, the fiber membrane development allows for increased evaporation efficiency, harnessing the ability to cut energy use.

Although the exact methods of cooling improvement in data centers are still unknown, innovations will undoubtedly occur as research progresses. New ideas, such as closed loop liquid cooling, are already being implemented at a Microsoft AI data center, already significantly reducing water waste. **With projects such as the above continuing, the future seems bright for engineering solutions for the future.**





FAILURE & SUCCESS

Article / **Riya Kumar ('30)**

Many people have heard the phrase

**"THOSE WHO CANNOT
REMEMBER
THE PAST
ARE DOOMED TO
REPEAT IT,"**

however, it is easier said than done to learn from mistakes and failure. One of the most important parts of being an engineer isn't intelligence, skill, or even personality; it's perseverance and determination. Here is a story of resilience, hard work, and persistence from our very own Professor Juno at Virginia Tech.

Professor Juno is currently teaching Computer Science and working towards their PhD. They studied computer science education as an undergraduate and continued to pursue a PhD while teaching Computer Science.

To them, **success can be defined as anything you want to put your mind to.** Success looks different for everyone; for some, it can simply be pursuing their degrees, while for others it might be learning and successfully understanding all

BOTH THE
**STUDENT &
EDUCATOR**
NEED TO
**WORK
TOGETHER**
FOR A
SUCCESSFUL OUTCOME

the material. Juno defines failure as something that can stem from not trying or even trying all alone.

As an educator, Professor Juno has seen instances when a student may be struggling and either feels scared to reach out or simply doesn't have the time. This is where failure occurs, in part due to not only a lack of accountability for their own learning, but also due to the educator not necessarily cultivating an environment in which students have no reservations about seeking help. Here, both the student and educator would need to work together for a successful outcome, at least in education.

According to Juno, they have experienced rejection throughout their academic career. Their work in broadening participation spaces and DEI accessibility, which is often undervalued in the current community of engineering and computer science, has in part led to rejection. Additionally, with the rise in AI, it is increasingly competitive to gain funding for research projects without ceding to artificially including it in their work. For Juno, a difficult aspect of this failure was hearing from conferences that state that they value diversity and accessibility, yet aren't satisfied with how their research would benefit the general public rather than the minority they state they want to value.

Instead of giving up, Juno received advice from their peers and advisors.

"Do you know how every PhD person finds their niche and area of expertise? When they give you comments on something from their area of expertise, you take those comments and think about them. And when they give you feedback outside that niche, you take it with many grains of salt."

Sometimes when we receive negative feedback or response, it's important to recognize who or why they believed those things. **Sometimes failure can result because the audience doesn't recognize or prioritize what you are working towards.**

The peers also stated that, when rejected, you have to just keep putting in effort. When they were in undergrad, they were very committed to an issue that became their first real paper that was eventually published at Respect 2025, a Computer Science conference focused on accessibility and equitability. However, before it was finally published, the paper had been rejected five times. It was originally a 200-page senior thesis that they had started in the Fall 2023. The paper consisted of a survey of minoritized students across the computer science field and their recommendations. While Professor Juno stated that they were told it was "the most comprehensive senior thesis this department has seen in the last 10+ years", the manuscript was unfortunately not uniformly praised. That did not stop them, though; they continued to go to conferences and stuck to their convictions. As a PhD student, they told me, "Don't let anyone tell you that your research is not worthy of students, and by extension, the community that you work with is not worth your time because they absolutely are. I work with neurodivergent students now, and I think that is really, really important." **Though failure is part of the growing and learning experience, never let anyone invalidate the ideas, motivations, and opinions you have.**

Professor Juno also left some final pieces of advice to aspiring computer scientists. Firstly,

don't stop reaching out to people. If someone says no, keep trying until you find someone who says yes. Not only that, reach out to your peers and professors in other departments. Take classes in different departments that could help you in your own endeavors. **Communication, collaboration, and leadership are just as important as any other skill you could learn in college.** And numbers don't define success at all; focusing on what you like and talking to more people is what can be defined as success.

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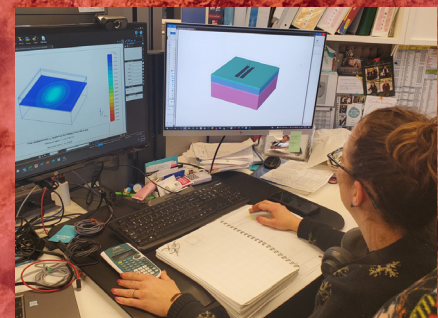
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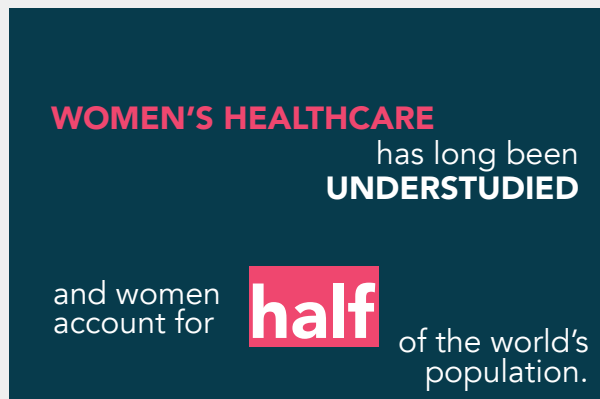
WHY SETTLE?



FEMTECH:

**A NEW RESEARCH
INSTITUTE AT
VIRGINIA TECH**

Article / **Emily Urda ('29)**



Historically, women's reproductive system research has had less attention and funding. This has contributed to inadequate devices, dated procedures, and period products. **Many women suffer from unknown chronic conditions related to their reproductive system, due to our current gap in knowledge.** FEMTECH, Forging Expertise in Modern Technology and Engineering, aims to close the gap in women's healthcare while simultaneously supporting women engineers. FEMTECH is a new research institute at Virginia Tech started by Dr. Raffaella De Vita.

Since the women's movement in the 1970s, women's healthcare has become an important priority. Only in 1993 was it made law that women were explicitly required to be included in clinical trials. In fact, if women and minorities were to be excluded from the trial to receive funding, a valid reason had to be provided. Before this, women were excluded from HIV trials and were often "protected" from facing the harm that might ensue during the clinical trial process. Ultimately, it was decided that women should be able to choose whether

FEMTECH
FEMTECH
FEMTECH

they'd like to participate in beneficial research. In this short period of time, only recently has the female reproductive system had breakthroughs. In 2026, the nerve endings of the clitoris were completely mapped, thirty years after the penis. Other breakthroughs have been improvements in UTI care, improving the current standard medicine's efficacy by 14%. This new drug is called Contepo.

SOCIAL MEDIA has allowed women

to discuss things they
may feel need to be

UPDATED

On social media, women have found community and have begun sharing their experiences when receiving Pap smears. A major topic was the pain caused by the speculum and how the metal it is usually made of can be cold and uncomfortable. Social media has allowed women to discuss things they may feel need to be updated, and considering women's health has only been a topic for the past thirty years.

With the powerful tools in mechanical engineering, the instrumentation and medical devices in gynecology have been revamped and continue to be. The original speculum is made out of metal, and the process of opening up the vaginal canal is not smooth or analogous to the movement of the vaginal canal. A new device called the Nella Speculum aims to combat the issues with the current speculum, in which it only opens the vaginal canal laterally when in reality, it should open the vaginal canal evenly. Another powerful tool being used is the MRI to measure the pelvic floor muscles, accompanied by a pressure sensor (to quantify contraction)

that can map the whole reproductive system as it is interconnected. MRI use has become more popular in recent years and can be used to evaluate whether a patient has fibroids, cysts, or lesions in their reproductive system.

De Vita studies the vaginal canal. The vaginal canal is constructed with ligaments, fascia, and suspending structures. This structure stretches and expands as the vaginal canal is a muscle. These tissues experience forces, deformation, and mechanical loading, so they can be studied through mechanical systems. In De Vita's lab, there are a variety of different machines that perform pinpointed stress on anything from a cell to a ligament, to even mouse pups. These experiments model the vagina and could be used to predict and calculate points of stress during different diseases such as endometriosis, genitopelvic pain, Polyendocrine Metabolic Ovarian Syndrome (PMOS), and high-risk pregnancies. Understanding how the vaginal canal functions in a mechanical system allows for innovation in period products to gynecological devices. De Vita studies the vaginal canal during puberty, perimenopause, and aging, as the vaginal canal goes through a series of physiological changes and important differences.

De Vita envisions a center here at Virginia Tech for female reproductive research. Her hope is to create classes in biomedical engineering that are geared towards teaching students about specific anatomy and physiology, cell function, and female reproductive system function all pertaining to the female reproductive system. **She hopes that her classes provide students with a direct path into the field of women's health and female reproductive system research.** Her hopes for the project currently are to recruit students of all disciplines, whether they have an innovative idea or just want to learn. She hopes to have multiple students contributing through design teams and research.



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FEMTECH has been backed by the College of Engineering, and FEMTECH has received a large grant of millions of dollars within the last month. A study published in the Women's Journal of Health stated that about 75% of funding is allocated toward male-dominated diseases; this number has remained static over a three-year period. Through FEMTECH, De Vita hopes Virginia Tech will become a leader in propelling female reproductive health forward.

75% of funding

is allocated toward

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dominated
diseases**



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