Research at the forefront from the **UMKC School of Computing and Engineering**

VANGUARD

THE POWER OF SOLAR

One researcher's mission to take solar energy mainstream

/FROM THE DEAN

Dear alumni, supporters and friends,

It is my pleasure to bring you the latest issue of Vanguard, the UMKC School of Computing and Engineering's annual research publication. Our team began this magazine three years ago. We recognized the amazing discoveries and profound achievements happening within the walls of Flarsheim Hall – and wanted to tell those stories.

All of you have a vested interest in our school's future. I'm happy to report that these last several years we have been wildly successful in moving forward our mission for computing and engineering at UMKC. Our research funding doubled from 2017 to 2018, now reaching nearly $3.5 million a year. It's an upward trend we're confident we can maintain.

As I write this letter, I can look out the window and watch the new Robert W. Plaster Free Enterprise and Research Center (FERC) rise from the snow-covered ground. Since I came here eleven years ago our engineering has grown and now we're bursting at the seams. Not only do we need more space, but our research is advancing. We needed new, state-of-the-art equipment and a venue to match.

This facility will serve not only the dedicated faculty at SCE, but everyone on campus. The FERC will house the only clean room at UMKC. It will also feature research-grade 3D printing for which our health science partners are already planning projects to print biosensors and prosthetics.

It will be home to more than $3 million in augmented and virtual reality equipment where researchers can simulate outcomes, train graduate students and explore big data in new and exciting ways.

And these new opportunities are not just for the faculty we have now, but also for the faculty we hope to recruit. We hope the community will look to the FERC and see all the possibilities it can offer. Industry partners who want to experiment and explore in this space will be welcome. And students will, of course, come here to be inspired and to learn. We believe this new building will serve as a magnet for talent across the region and we're excited to open its doors.

But until then, there is still plenty to celebrate. Inside these pages, we have three stories for you about how our vanguard is leading the way for UMKC… and one article that helped me better grasp a new concept. From all of us at SCE, we hope you enjoy.

Sincerely,

KEVIN Z. TRUMAN, PH.D., F.ASCE
Vice Provost, UMKC
Dean, School of Computing and Engineering

VANGUARD

/'VAN,GÄRD/
A group of people leading the way in new developments or ideas

Research at the forefront from the UMKC SCHOOL OF COMPUTING AND ENGINEERING

PRODUCTION
UMKC Division of Strategic Marketing and Communications

MANAGING EDITORS
Lindsey Mayfield
Sara Vogt

ART DIRECTOR/DESIGNER
Sarah Richardson

CONTRIBUTING WRITERS
Stacy Downs, Kelsey Haynes, Lindsey Mayfield, Patricia O'Dell and Sara Vogt

PHOTOGRAPHERS
Brandon Parigo

SPECIAL THANKS TO
Mike Duah

Contact us
Flarsheim Hall, Room 534
5110 Rockhill Road
Kansas City, MO 64110
816-235-2399
sce@umkc.edu

sce.umkc.edu

Relay Missouri: 800-735-2966 (TTY)
SCE 18093269

UMKC
School of Computing and Engineering

/TABLE OF CONTENTS

/COVER STORY

/FEATURES

/NEWS AND EVENTS

On the cover: Sarvenaz Sobhansarbandi
Photo: Brandon Parigo
Photo illustration: Mike Duah

▼ Associate Professor Jerry Richardson stands on a bridge over a section of Brush Creek.

BRANDON PARIGO

DRAWN TO THE WATER

BY STACY DOWNS

Finding career inspiration in personal history.

JERRY RICHARDSON was destined to solve issues along Brush Creek and other waterways, and to teach others to fix them, too.

The proof is perched on his desktop in the form of a black-and-white photograph that's more than a half-century old. A man resembling Richardson wearing waders is traversing the Rio Grande River.

"I literally followed in my dad's footsteps," says Richardson, an associate professor of civil engineering at UMKC. His father, Rich, taught civil engineering at Colorado State University. "We were always going on adventures, taking pictures of rocks. He loved what he did and I love it, too."

LIKE FATHER, LIKE SON

Richardson laughs and looks out the window of his office in Flarsheim Hall. Snow is falling on the ground, and you can tell that it's literally freezing outside by the way students walking by are bundled up with hats and scarves.

"I remember it was a day like today, in the middle of winter, and my dad took me when I was in fourth or fifth grade out in the station wagon and we drove to a river," Richardson says.

They injected dye into the river and sampled it to understand how the river mixed it up. The dye container froze, and the only reason they built a fire was to unfreeze it. As soon as the dye tank thawed, they hopped back into the river to keep researching. Freezing. In a snow storm.

"For some reason, we kids — my brother and I — thought it was fun."

Before college, Richardson's father also exposed him to many other aspects of water resources engineering. At the end of his ninth grade year, his father was the primary investigator for a large multi-year water resources project in Venezuela. He and his brother spent months there working on the project. Richardson also helped with data collection and analysis.

"This is where I learned to drive a car," Richardson says. "In the traffic of Caracas without a license."

As a sophomore in high school, Richardson started working at the hydraulics lab at Colorado State University. He started by painting the ceiling of the lab with a small roller, but graduated to analyzing soil samples. During this time, he started working with some of his father's former students who started a small engineering firm.

"They taught me to draft, survey and work on construction projects," Richardson says. "By the time I graduated high school, there seemed to be no choice but to go to Colorado State University in civil engineering."

Richardson's dad was the director of the hydraulics lab at the time, and worked on a large project with the U.S. Agency for International Development in Egypt. To maintain separation, Richardson did not work much with his dad while at the university and building his career.

"It was important for me to work independently," Richardson says.

In 1980, Richardson got a dream job working in water resources collecting and analyzing hundreds of river crossings for a large gas pipeline in Alaska. Then he went back to Colorado State for his master's. And then, another dream project for the U.S. Agency for International Development project in Indonesia.

"Basically Gallungung Volcano erupted and buried a couple of rivers in the Island of Java," Richadson says. "I was tasked to determine what to do about it."

And in 1985, he returned to Colorado State University to work on his Ph.D. Only after he completed that in 1989 did he start officially collaborating with his father.

"Working with my dad as a co-equal partner is one of the joys of my life," he says.

Their first project was a serious one. A bridge on the New York State Thruway over Schoharie Creek failed after a flood eroded the soils supporting its foundation. After this collapse, people died.

The case spurred the Federal Highway Administration to significantly ramp up how the United States maintains safe bridges resistant to floods.

"I worked with my father — one of the top experts in the field — writing papers, conducting research, developing Federal Highway procedures and policy. We traveled around the country teaching training courses to state highway departments. This is where I was most influenced by my father. We worked together for about 15 years until my dad's health failed."

In 1994, Richardson accepted a position for the UMKC School of Computing and Engineering, doing the same kind of work his father had done.

"It's been a joy to see how much the UMKC School of Computing and Engineering has grown and keeps growing," Richardson says. "The new building is going to be awesome."

MODEL PROFESSOR

Richardson's career has focused on research and teaching the fundamentals of river behavior. The field exists between civil engineering, geology and earth science. He is a leading expert in stream stability — river behavior, sediment transport, fluvial geomorphology and application of these specialties to civil infrastructure projects — like bridges —

//JERRY RICHARDSON, PH.D., P.E., D.WRE
Associate Professor, Department of Civil and Mechanical Engineering

RESEARCH INTERESTS
River engineering, sediment transport, open channel flow, engineering hydrology, scour at bridges, hydraulic structures

JOINED UMKC
1994

▼ Associate Professor Jerry Richardson works with his model of Brush Creek.

and anything else that needs to co-exist with the river.

Flooding always presents a hazard to structures like bridges, but the ever-present movement of water continuously picking up sediment, transporting it downstream and depositing it somewhere else results in lateral and vertical changes in the river than can endanger buildings and bridges.

As much as Richardson thrives on fieldwork, he also loves working in the lab and his enthusiasm is contagious.

His hydraulics lab is situated in basement space at Flarsheim. Taking up about half of the lab is a setup of terrain and small structures similar to a model train railroad — except this has running water. There's fake grass and a concrete-edged, rock-lined waterway meant to be Brush Creek in Mission Hills, Kansas.

"I much prefer real-world models to computer models," Richardson says. "Yes, they might take a bit more time on the front end in designing and building, but when you have a problem to solve, you can find a fix in a matter of moments rather than trying to solve a mathematical formula, which can take days or weeks."

Richardson turns on the water in the lab and demonstrates.

"See the flooding?" Using inches-large model sandbags, he talks through potential solutions.

Modern tools like numeric hydraulic models — using a computer — have always been important in his field of work. These tools have greatly improved over his career. Early computer models were slow, limited and difficult to use. Because of this, physical models were more commonly used to analyze complex flow. As technology advanced, physical models have been used less in favor of computer analysis.

Now there are so many numeric tools and models that many believe physical models aren't needed. And the number of people with the skillsets needed to conduct physical models is dwindling. But numeric models still have significant limitations.

"With few exceptions they only model the water, not how the water picks up, moves and deposits sediments," Richardson says.

Richardson returned to his roots and started conducting more physical models. These models are coupled with the numeric models to produce a superior analysis which greatly reduces uncertainty in the final analysis and design. The modeling he has been doing through the university has been a team effort with Water Resources Solutions in Prairie Village.

"We have collaborated to conduct more than six numerical and physical studies," Richardson says.

These include a sediment transport model for the Nebraska Department of Natural Resources, the Kansas Division of Fish and Wildlife and for the city of Mission Hills, Kansas.

Each model has been different, each has significantly reduced overall project costs, each has identified an unanticipated issue the numeric model could not identify.

These models have helped companies and cities save money and get better results, Richardson says.

The team is soon beginning a new model for Mission Hills, and is currently hoping to do a model for the city of Kansas City, Missouri. ●

/Q&A WITH JERRY RICHARDSON

YOU'RE RETIRING THIS YEAR. WHAT'S NEXT?

I am planning on retiring this year as a part of the voluntary severance offered by the University of Missouri System. However, this does not mean that I am planning on stopping what I am doing now. I hope to continue a close relationship with UMKC.

I would like to take the modeling work I am doing to the next level, and I am excited about the new engineering building (expected to open in 2020), where we can use advanced tools and equipment to build larger, more sophisticated models.

WHAT'S YOUR MOTTO?

A career is based on doing what you love to do. If you are happy doing what you love, your career will be successful.

WHAT'S BEEN YOUR PROUDEST CAREER ACHIEVEMENT?

My work with the Federal Highway Administration, working with them to design and maintain safe bridges. Since the inception of the program, bridge failures — and loss of life due to bridge failure due to floods — has plummeted. My work has led to international changes in how we design bridges to resist the ravages of floods and erosion.

WHAT'S YOUR FAVORITE PIECE OF ADVICE?

I am full of advice and tend to dole it out too frequently. However, when counseling young engineers on their career, I advise them to let up a little and let circumstances unfold for opportunity to present itself. If you are too inflexible with your career plan, you might miss an opportunity that will dramatically change your life — in a positive way. My career was filled with serendipity, and great career opportunities require being prepared, but also are serendipitous.

TELL US ABOUT THE MOST ELABORATE MODEL YOU'VE CREATED.

We did a model of the spillway for Woodson County, Kansas. This is an old dam with an emergency spillway that has partially failed at least twice. A third failure would probably be catastrophic. We were able to simulate the most recent failure, and then using 3-D printing, test two solutions and refine and build the replacement structure. This project had a short timeline to build the model and design the solution.

▼ Associate Professor Jerry Richardson with his collection of antique instruments.

UNLOCKING THE MYSTERIES OF BLOCKCHAIN

BY SARA VOGT

The average Joe's guide to what it is and why everyone keeps talking about it

FOR THOSE OF YOU working day in and day out in emerging technologies — you probably don't need this article. But for those of you who find yourselves sporting a blank stare when blockchain comes into conversation, we've dedicated a couple of pages of this issue to tackle the concept.

If you read "blockchain" and immediately hoped for a simplification of this annoyingly complex yet outrageously popular topic, welcome. If you've ever been trapped at the proverbial water cooler with someone who rambles on about how blockchain is the biggest deal since the birth of the internet, we're here to help.

In this short conversation recap, we asked SCE faculty to explain blockchain to a self-described Luddite. We'll walk through what blockchain is, what it means for computing and, just as important, what it means for the everyday person.

WHAT IS BLOCKCHAIN?

Blockchain is a ledger. That's right, it's simply a record of transactions, much like the checkbook ledgers many of us maintained in the time before debit cards. Blockchain is a ledger system that can service an infinite number of transactions online. From the exchange of money for goods and services to banking, education, and healthcare records — the possibilities are endless. Blockchain can make all digital data more safe, secure and accurate.

What makes blockchain special is that it is centralized and unchangeable. Any data submitted to the chain immediately becomes part of the whole.

In blockchain there are only two functions: read and write. Because you can only review and add to the content, the data is significantly more secure than any previous method of digital collection. To alter or destroy data, a hacker would have to alter or destroy the chain everywhere. This is what is called distributed trust, the key component to the security of blockchain.

An anology by Sejun Song, Ph.D., helps us explore this concept.

Imagine a couple wants to let city hall know they got married. They have a marriage license and rings in hand, so city hall believes they are married. This is centralized trust. The account is recorded only in the minds of the married couple, and we have to rely on their account.

Now, imagine the couple plans a lavish wedding with hundreds of guests. The marriage of these two individuals is time stamped and recorded in the memory (or ledger) of hundreds of people's minds. This is distributed trust.

Just as a marriage record is more stable with distributed trust over centralized trust, so is blockchain and its data.

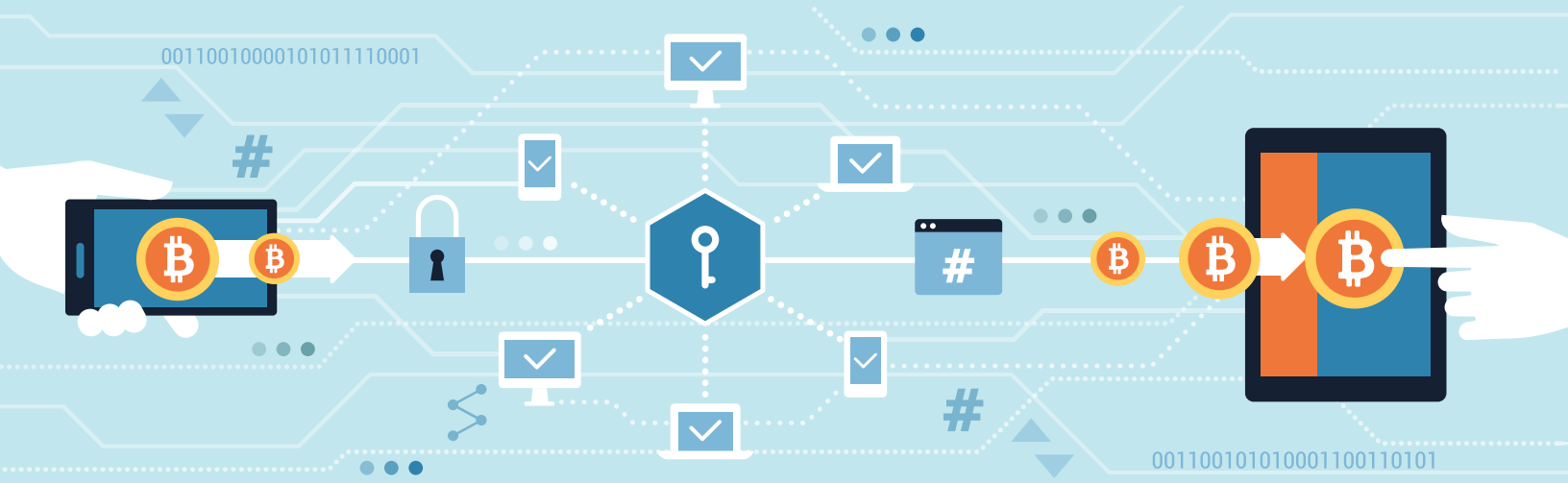
WHAT PREVENTS DATA BREACHES THROUGH EDITING OR DELETING THE BLOCKCHAIN?

As Praveen Rao, Ph.D., explains, it's all about cryptographic hashing.

Let's pause right there, because if you're still that average Joe reader, the term cryptographic hashing deserves a bit more explanation.

Cryptographic hashing occurs when a system takes an input and returns a hash value, which is essentially a unique string of letters and numbers. However, these hash values are extremely complex because the input and the return are not the result of a simple cipher.

For example, while the word "shoe" might have a hash value of "abcd 1234" the phrase "my shoe" would not be the hash value of "my" added to the hash value "abcd 1234." Rather, it would be completely unique. It could even look something like "0909 8765," not deriving any of its identity from the value of the word "shoe."



WHAT IS BITCOIN AND HOW IS IT DIFFERENT FROM BLOCKCHAIN?

- While the techies might find it annoying, this is a common misunderstanding we'd like to help dispel: **BITCOIN AND BLOCKCHAIN ARE NOT THE SAME THING.**
- Bitcoin is just like cash at online vendors who accept the currency. It's more secure than paying with your debit or credit card because it uses a blockchain ledger to record your transactions.
- Put simply by **YUGYUNG LEE, PH.D.**, bitcoin is a digital currency and the first successful blockchain product that can be used to buy, sell and invest. Put another way: Bitcoin is what is recorded; blockchain is where it is recorded.

Now back to Professor Rao.

He explains that, because of the complexity of the hash values, a hacker would need access to enormous computing power in order to fake or modify transactions. Any unauthorized changes would be detected due to principles of cryptography. This makes blockchain extremely secure.

WHY ISN'T THIS TECHNOLOGY MORE MAINSTREAM?

According to our faculty commentators, blockchain *is* mainstream. We just don't experience it much in our everyday lives.

For instance, bitcoin — a cryptocurrency delivered by blockchain — is available for trading and purchasing products online, but only a relatively small demographic of the public is using it.

Large enterprises such as finance, manufacturing and defense, however, which require a high degree of security, have already integrated blockchain into their operations or are exploring how it can transform their workflow to lower costs and increase data integrity. Just as many of us don't quite understand how typing a URL into our browsers delivers the content we're seeking, we may never fully understand blockchain, yet still be engaging with it on a daily basis.

HOW DO YOU SEE BLOCKCHAIN HAVING AN IMPACT ON YOUR RESEARCH?

Song: How we access and share big data, specifically medical data which requires a high degree of privacy, will be improved through blockchain.

Rao: I am currently working with the Air Force Research Laboratory to explore how blockchain can enable secure big data computations. Stay tuned!

Lee.: Blockchain will influence deep learning and artificial intelligence in areas such as robotics and the "internet of things." These technologies can be achieved in a scalable and distributed manner using the blockchain technologies for identification, verification and data transfer. ●

//YUGYUNG (YUGI) LEE, PH.D.
Associate professor, Department of Computer Science

RESEARCH INTERESTS
Artificial Intelligence, distributed computing and big data analytics, software engineering and semantic web

JOINED UMKC
1999

//SEJUN SONG, PH.D.
Associate professor, Department of Computer Science Electrical Engineering

RESEARCH INTERESTS
Software defined networks, cloud computing and data center networks

JOINED UMKC
2013

//PRAVEEN RAO, PH.D.
Associate professor, Department of Computer Science Electrical Engineering

RESEARCH INTERESTS
Cloud computing and information management, big data and analytics

JOINED UMKC
2007

THE POWER OF SOLAR

BY LINDSEY MAYFIELD

One researcher's mission to take solar energy mainstream

After a trip to California, most people would remember the beach, the landscapes, maybe an amusement park like Disneyland.

Sarvenaz Sobhansarbandi, Ph.D., remembers the solar panels.

"I was so happy to see panels on the roofs of villas and houses," she says. "Solar is such a green energy and so widely available. Why wouldn't you use it?"

Still, many people are not using solar energy technology in their homes and businesses. According to the U.S. Energy Information Administration, solar energy only accounted for 1.6% of energy generation in the United States in 2018.

So what's standing between solar energy and widespread public use? For starters, efficiency. Most commercially available solar panels only collect and convert 25 percent of the sun's rays.

That's where Sobhansarbandi comes in.

Her research is all about curiosity — taking current solar technologies and asking, "Why was it built this way? How can it be improved? What are we missing?"

Then, like any great researcher, she gets to work answering those questions. And so far, she's found some pretty compelling answers.

A SOLAR ENERGY CRASH COURSE

Sobhansarbandi works with a type of solar thermal collector called an evacuated tube solar collector, or ETC. A common use for ETCs, and the one she focuses on, is for solar water heating systems.

In the simplest terms, here is how ETC systems use solar power to heat water: A solar-selective coating absorbs the sun's energy and transfers it to a heat pipe located inside the tube. Then, water circulates through the manifold of the collector, heats up and returns to the storage tank, where it is available for a shower, dish washing or laundry.

The latest commercially available ETC system leaves 30 to 50 percent of the sun's rays unused. That's why Sobhansarbandi is re-examining each piece of this system, experimenting with ways to increase its energy absorption and storage, and therefore, its efficiency.

Her first order of business, however, was re-thinking how the system works altogether.

WHAT'S HAPPENING INSIDE

To understand ETCs, it's important to understand one of the components inside them: phase change materials.

When phase change materials melt, they begin storing energy from the sun's rays. When they cool, they release that energy, heating the water running through the system.

An ETC system can run constantly — 24 hours a day. So while the sun is heating the system, water is also running through, cooling it down. Keeping the system cool isn't necessarily a good thing, however, because phase change materials don't start storing energy until they reach their melting point.

Sobhansarbandi is testing another method, though, called stagnation or "on demand" operation, in which the system only runs after the sun has gone down.

"When it's on demand, we're just heating, heating and heating, without any cooling. So very easily, the material is fully melted," she says. "Then, when you start cooling down, there is a huge jump in energy, because the materials are releasing the maximum heat."

In short, the system is collecting the maximum amount of energy while the sun is up, then releasing the maximum amount once the sun goes down This seemingly simple change has the potential to increase ETC system efficiency by 66 percent compared to their commercially available counterparts.

Still, Sobhansarbandi wanted to go deeper.

A DEEPER DIVE

The term "phase change material" may conjure an image of test tubes and chemicals, but the materials Sobhansarbandi is working with are actually quite common. In fact, you probably have them in your home.

The first, erythritol, is a sugar sweetener, not unlike the one used in coffee or tea. The second, paraffin wax, is often used to make candles.

Another way Sobhansarbandi is rewriting the rules: using her phase change-combination in an entirely new part of the ETC system.

Currently, manufacturers are only using phase change materials in the water storage tank. Sobhansarbandi is using them deep inside the solar collector, where they can have maximum effect.

"We know phase change materials are good," she says. "But I am looking for much stronger and more economic uses for them, as well."

WHY SOLAR?

Hearing Sobhansarbandi speak so passionately about tubes, wax and tanks, it's reasonable to ask how she became interested in the subject. Her introduction to solar energy, she says, started 6,000 miles away from UMKC, in the small island country of Cyprus, where she got her master's degree.

"It's a sunny island, so the sun was nearly 100 percent available, 365 days a year," she says. "It was the best research project, both because of the maximum radiation from the sun and the high price of electricity in Cyprus."

What really got her hooked on solar, however, was the hands-on experimentation it allowed.

"For me, doing real field testing was so interesting and challenging," she says. "I wanted to do hands-on work in addition to my simulation analysis. I fell in love with solar."

The university where Sobhansarbandi went on to earn her Ph.D., as luck would have it, was also extremely conducive to solar research. She was headed to warm, sunny Texas.

FROM SIMULATION TO EXPERIMENTATION

At the University of Texas at Dallas, Sobhansarbandi began working with full-size ETC models, testing their effectiveness under the hot Texas sun, and began to see some of her theories come to life.

One of her research group's theories, for instance, was to add an absorption layer to the innermost tube of an ETC. Instead of using aluminum nitride — a traditional absorption material — the group used carbon nanotube sheets with high thermal conductivity.

Essentially, they created their own unique version of an ETC. So far, this twist has shown promising results. Current versions of these tubes have a maximum absorption rate of 80 percent. Preliminary experiments of the unique absorption layer, though, show potential to increase that absorption rate to 98 percent.

Her work in Dallas wasn't without its ups and downs, however. One summer, Sobhansarbandi and her campus partners were all working on other projects, so the ETC equipment sat idle for three months in the Texas heat. When everyone returned in the fall, the equipment was, let's just say, not in good shape.

"We didn't expect it to be *that* terrible," she says. "Just think of when a candle melts — if you pour it somewhere, it will solidify into a new shape. And it's hard to clean up and get back into its original version."

The ruined equipment, however, was an experiment in and of itself. It taught Sobhansarbandi how important regular maintenance is to the ETC system — just another hurdle to jump in her goal to make solar energy more mainstream.

59%

Solar energy growth over the past decade

– U.S. ENERGY INFORMATION ASSOCIATION, SOLAR ENERGIES INDUSTRY ASSOCIATION

NEW HORIZONS AT UMKC

In Fall 2018, Sobhansarbandi was well into her second year at UMKC. Her laboratory in Flarsheim Hall was complete, outfitted with advanced thermal analysis devices, data acquisition systems, simulation software and infrared cameras.

Then she heard about the new building going up next door.

The Robert W. Plaster Free Enterprise and Research Center, set to open in 2020, will provide high-tech research and development opportunities for both SCE and the Kansas City community. With 57,800 square feet of new space being built just steps from her office, Sobharsarbandi had to ask, "Are you using the roof?"

Now, included in the plans for the Free Enterprise and Research Center is a Renewable Energy Deck and Renewable Energy Research Laboratory. The roof space will open with several full-scale ETCs, with additional solar panels and even wind turbines to be added later.

The timing of the building, she says, is perfect. For the next year, she will use simulation and smaller-scale models to test various absorption materials. Then, when the Free Enterprise and Research Center opens in 2020, she'll be ready to move from trial-and-error to much more targeted experiments on the full-size models.

BACK TO BASICS

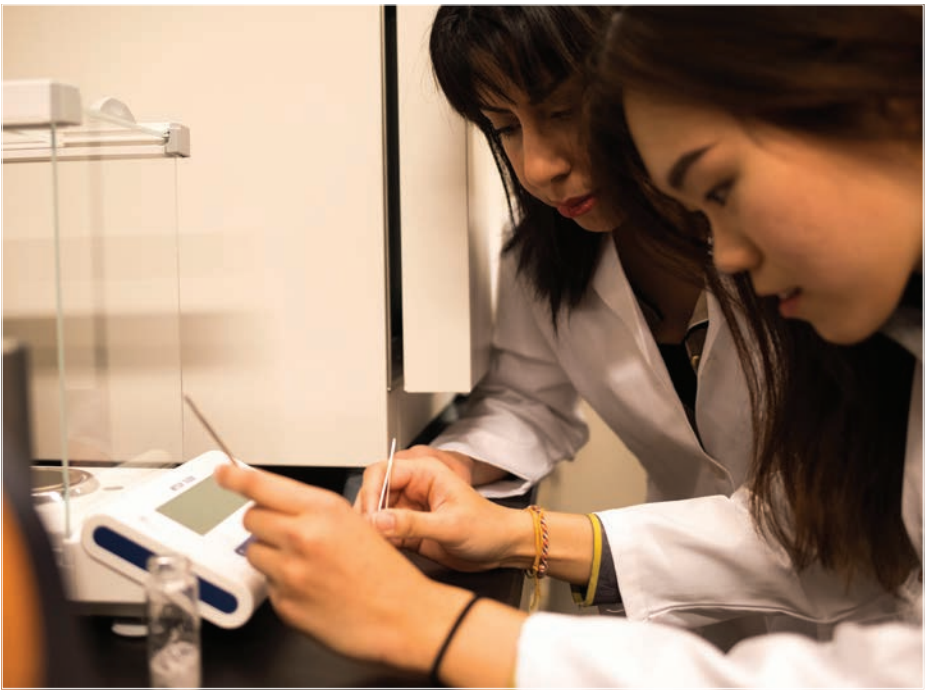
When she spotted those solar panels on her trip to California, Sobhansarbandi was reminded of one of the key reasons she does this work: to make a positive impact on people's lives and the environment.

"It's so good to see the direct effect of your technology to the real world," she says. "If we start right now, we can see the real change right away — we don't need to wait a long time."

It's no surprise Sobhansarbandi spotted solar panels in California. It is the far-and-away leader in the U.S. solar industry, generating nearly five times more solar energy than even the next leading state. Missouri, on the other hand, ranks 29th in solar energy producers. Just 0.3 percent of the state's energy is generated through solar power.

But when Sobhansarbandi sees those numbers, she doesn't see the challenges ahead — just the massive opportunity for growth.

"At the end of the day, it's not all about the money. It's about being part of a green world," she says. "In my lab, I have it written: 'Today, it's our turn to make the world sustainable.' It's our turn, not the generation after us. So we have to start at some point."



▼ Assistant Professor Sarvenaz Sobhansarbandi, Ph.D., works with students performing thermal analysis on energy absorption materials.

BRANDON PARIGO

MENTORING THE NEXT GENERATION

While earning her doctorate at the University of Texas at Dallas, Sobhansarbandi began working with high school and undergraduate students as a teacher and mentor — a role that gives her as much satisfaction as it does the students.

"Whenever I mentor a student — high school or undergrad — and they see how something works in the real world, not just theoretically, they are so shocked," she says. "I like the feeling of watching their excited faces and seeing them learn."

The high school and college students had an important task: protect and maintain the equipment, rain or shine. When hail was in the forecast, for instance, the students helped her remove the delicate tubes from the system and put them in a safe place.

To Sobhansarbandi, it's important that her younger students get the full experience of working with the equipment. She treats them just as she would her master's or doctoral students – trusting them to use the often-expensive equipment with care.

"It's not an easy thing. We're asking these high schoolers and undergraduates to handle a real system when usually engineers are doing that," she says. "But I tell them all the time, 'don't be scared to work with this stuff.' I love to let them do whatever they can, and they do great work, in my opinion."

If Sobhansarbandi's mentoring program had a catchy slogan, it might be "Seeing is believing." The excitement she felt when taking her theories from a computer screen to the real world — she wants her students to feel it too.

"I was also a student until two years ago, so I'm not that far from where they are now," she says. "I can talk with them in a way that makes them feel confident. They know the topics, they just need to get some experience, and I'm sharing my own experience with them, every day."

//SARVENAZ SOBHANSARBANDI, PH.D.
Assistant Professor, Department of Civil and Mechanical Engineering, and Director of UMKC Renewable Energy Laboratory

RESEARCH INTERESTS
Renewable energy, solar energy, computational fluid dynamics and fuel cell technology

JOINED UMKC
2017

BIG PROGRESS FOR BIG LEARNING

BY PATRICIA O'DELL

Center for Big Learning gains new funding and partnerships

In March 2018, five UMKC researchers accepted $750,000 from the National Science Foundation to create the Center for Big Learning**.** The announcement launched the faculty members from their offices in Flarsheim Hall to the forefront of UMKC news.

The question was, what were they going to do with it?

Just one year later, the Center for Big Learning has done quite a lot, in fact. The group has raised an additional $750,000 in funding from industry partners, and is on track to raise even more in 2019.

The Center is led by principal investigator Zhu Li, Ph.D., along with UMKC faculty members Reza Derakhshani, Ph.D.; Yugyung Lee, Ph.D.; Praveen Rao, Ph.D.; and Sejun Song, Ph.D.

Their task? Advance research into artificial intelligence (AI) and deep learning. Their partners? The University of Florida, the University of Oregon and Carnegie Mellon University, along with industry collaborators from around the world.

IMPROVING LIVES THROUGH MEDICAL INNOVATION

One of the Center's newest university collaborators is Northwestern University in Chicago. In May, representatives from Northwestern will join UMKC researchers in Kansas City.

As Li explains, the potential for collaboration between the two universities is great.

"They are pursuing artificial intelligence-enabled medicine, which aligns with the Center's expanded focus into medicine this year," he says. "We will utilize the technology we have in imaging and deep learning to further medical innovation."

School of Medicine professor Peter Koulen, Ph.D., is working alongside SCE researchers to help further their medical research. Koulen says he is excited by the opportunities available through the Center for Big Learning and sees AI and deep learning as critical components to medical advancement. He is — as always — looking forward to new discoveries.

"What we currently consider 'state-of-the-art' in diagnostics of complex or chronic diseases will become obsolete in a few years and will be replaced with faster, more reproducible and — very likely — less invasive AI-based methods," he says. "In addition, AI will enable us to translate insights from basic science and clinical research to true personalized and precision medicine."

Industry partners like CloudMinds are also assisting the Center with innovations in medical technology. Their vision is to use a 5G network — the next generation of wireless communications that will allow increased capacity and faster browser speeds — to enable a variety of robotics applications.

"The possibilities are very broad — from self-driving cars to crime fighting to senior assisted living," Li says.

With the advent of 5G cloud-based technology, Li envisions a time in the near future when older people and people with disabilities have more freedom and independence through technology.

"Right now there is no smart wheelchair, but even if there were a smart wheelchair, it would need a 5G cloud-based service to navigate," he says. "There's the possibility that information could be stored in a cloud so it could beam information about location or resources to goggles or glasses for people who are visually impaired."

REAL-WORLD EXPERIENCE FOR STUDENTS

As the Center for Big Learning looks to far-ahead technologies, it also benefits current UMKC students, giving them hands-on experience.

Last summer, UMKC students received internships at Tencent, one of the world's largest social media companies, exploring HDTV compression; Future Wei, a wireless telecommunications company focusing on point cloud compression; and HERE, a company expanding 3D map technology.

Anique Akhtar, a Ph.D. student in the Department of Computer Science Electrical Engineering, interned at HERE Technologies in Berkley, California, where he focused on 3D maps using LiDAR (Light Detection and Ranging) technology.

The results, he says, could have a big impact on autonomous driving, where detecting objects and making intelligent decision is crucial

"This artificial intelligence can detect and classify objects on its own in a completely new environment," he says. "Basically, we are building machines that can learn on their own without explicit programming and are able to adapt to newer environments."

MEASURING SUCCESS

Considering both the Center's financial support and the potential real-world applications of its research, Li says he feels confident he and his team are carrying out the vision the National Science Foundation laid out for them.

"In under a year, we are up and running, with new results and new possibilities," Li says. "It's a great project for UMKC."

//ZHU LI, PH.D ,
Associate professor, Department of Computer Science Electrical Engineering

//SEJUN SONG, PH.D.
Associate professor, Department of Computer Science Electrical Engineering

//PRAVEEN RAO, PH.D.
Associate professor, Department of Computer Science Electrical Engineering

//REZA DERAKHSHANI, PH.D.
Associate professor, Department of Computer Science Electrical Engineering

//YUGYUNG |YUGI| LEE, PH.D.
Professor, Department of Computer Science Electrical Engineering

//PETER KOULEN, PH.D.
Professor, Departments of Ophthalmology and Biomedical Sciences, School of Medicine (Not pictured)

▼ (Left to right) Sejun Song, Zhu Li, Reza Derakhshani, Praveen Rao and Yugyung (Yugi) Lee have received more than $750,000 from the National Science Foundation to perform cutting-edge research on big data and big learning.

BRANDON PARIGO

VANGUARD AWARDS 2019

2019 VANGUARD AWARD WINNERS

Congratulations to our 2019 Vanguard Award winners, who have shown outstanding commitment and dedication to the School of Computing and Engineering at UMKC. Please join us in thanking them for their service.

Thomas Cliett

YOUNG ALUMNI AWARD

Thomas Cliett is currently working at Google as a Strategic Cloud Engineer. Through both professional and volunteer activities, Thomas advocates for bringing more women and underrepresented minorities into STEM careers. Thomas graduated in 2010, but upholds a strong bond with UMKC by generously supporting SCE scholarships.

Steve Dunn

SUPPORTER AWARD

Steve Dunn is a retired chairman of JE Dunn Construction Company. He has supported SCE by serving on the Dean's Executive Advisory Council. Additionally, Steve's company JE Dunn has provided major support through donations, scholarships and sponsorship of events, including a gift of $100,000 to SCE's new building and an annual $2,500 scholarship.

Robin Stubenhofer

STEM OUTREACH PARTNER OF THE YEAR

Robin Stubenhofer is currently the Vice President, Engineering at the NNSA National Security Campus at Honeywell FM&T. She is an avid supporter of STEM education at both the K-12 and college levels, and is also a strong advocate for women in STEM careers. She has served SCE on the Dean's Executive Advisory Council and as a commencement speaker.

Burns & McDonnell

COMPANY OF THE YEAR

Burns & McDonnell is a well-respected Kansas City company and one of SCE's most engaged supporters. The company has pledged more than $500,000 for SCE's new building, funds a $14,000 endowed yearly scholarship and supports students through student organizations and hiring.

AR/VR SUMMER SESSION

VIRTUAL AND AUGMENTED REALITY: Applications, business implementation, and content creation

DATES: June 3–28. 2019
SCHEDULE: Monday through Thursday, from 9 a.m. to noon
LOCATION: Flarsheim Hall, Room 463, 5110 Rockhill Road
COURSE CAPACITY: 20
CREDIT HOURS: 3

PREREQUISITES:

- No academic requirements
- Basic coding or software development skills are desirable
- Highly encouraged for students and faculty of the UMKC School of Computing and Engineering, as well as members of the community and industry
- Other undergraduate students by permission only

TOPICS:

Week 1: Introduction to AVR and development workflows
Week 2: Development and 3D AVR-enabled assets
Week 3: Programming interactive applications
Week 4: AVR Immersive Systems

3-CREDIT INTRODUCTORY SESSIONS SUMMER 2019

To enroll or get more information, contact SANDRA MARIN at MARINRUIZS@UMKC.EDU

BRANDON PARIGO

/MAJOR GRANTS AND AWARDS AT SCE

CONGRATULATIONS

to our many faculty members who received financial support for their work in 2018 through grants and other major awards.

ANTHONY CARUSO, PH.D. was awarded an additional $6.7 million by the Office of Naval Research for his project titled Short Pulse Research, Evaluation and non-SWaP Demonstration for C-sUAV Study.

ZHIQIANG CHEN, PH.D. was awarded $99,986 by Aware Vehicles, Inc. for his projects titled Situational Awareness in Autonomous Agriculture and High-Spatial and Hyperspectral Resolution for Imaging. He also was awarded a $150,000 Inspection (of which UMKC will be a subcontractor and receive $46,993) by the U.S. Department of Transportation/Volpe National Transportation Systems Center for his project titled SBIR Phase I: High-Spatial and Hyperspectral-Resolution Imaging for Bridge Inspection. **AJITA RATTANI, PH.D.** is the PI for Aware Vehicles (formerly Sr. Research Associate to Reza Derakhshani, Ph.D.); ZhiQiang Chen is the PI for UMKC.

BAEK-YOUNG CHOI, PH.D. was awarded $49,964 by the National Science Foundation Division of Computer and Network Systems for her work on Smart and Connected Communities.

TRAVIS FIELDS, PH.D. was awarded $130,993 by the U.S. Army Engineer Research and Development Center for his project titled Advancing Steerable Low-Cost Precision Aerial Delivery Systems. He was also awarded $9,900 by the NASA Goddard Space Flight Center for Steerable Parachute Wind Tunnel testing at NASA Langley.

ZHU LI, PH. D. was awarded $8,000 by Snap, Inc. for XZY, and $105,329 by the University of Maryland for his project titled Dynamic, Data-Driven Design Methodologies for IoT. Additionally, he was awarded $299,992 by the National Science Foundation Division of Computer and Network Systems for his project titled Phase I IUCRC University of Missouri-Kansas City.

CEKI HALMEN, PH.D. was awarded $57,500 by the American Concrete Institute for a collaborative project between universities and consultant companies to develop a standard critical chloride threshold test.

MEGAN HART, PH.D. was awarded $17,500 by Boise State University for ongoing engineering research on wildfires, wildfire prevention and remediation.

GREG KING, PH.D., ANTONIS STYLIANOU, PH.D. (UMKC School of Computing and Engineering) and **GARY SUTKIN, PH.D.** (UMKC School of Medicine) received $609,695 from the National Institute of Health for their project titled Virtual Pelvic Surgery Simulator for the Prevention of Surgical Errors.

DEEPANKAR MEDHI, PH.D. was named program director for the Computer and Network Systems Division of the National Science Foundation, a prestigious position that takes Medhi to the CNS headquarters in Washington D.C. for two years.

MOSTAFIZUR RAHMAN, PH.D. was awarded $50,000 by the National Science Foundation Division of Engineering Education and Centers for his project titled Seeking Commercialization Potentials of a New Interconnect based Nanoscale Computing Technology for Future Digital Integrated Circuits.

PRAVEEN RAO, PH.D. was awarded $25,000 by Planit Impact, LLC for his project titled A Bayesian Approach for Accurate Prediction of Energy, and $50,000 by the National Science Foundation Division of Engineering Education and Centers for his project titled Scalable Storage of Whole Slide Images and Fast Retrieval. Additionally, he was awarded $13,500 by the UMKC Funding for Excellence program.

JERRY RICHARDSON, PH.D. was awarded $20,937 by Water Resources, LLC for his work in Brush Creek from 66th Street to Hiawassee Park.

AJITA RITTANI, PH.D. was awarded $38,671 by EyeVerify, LLC for Multimodal and Multispectral Biometric Data Collection.

SARVENAZ SOBHANSARBANDI, PH.D. was awarded $13,500 by the UMKC Funding for Excellence program.

SEJUN SONG, PH.D. was awarded $50,000 by the National Science Foundation Directorate for Computer and Information Science and Engineering for his project titled LESQ: LED based Smart Cue.

GANESH THIAGARAJAN, PH.D. was awarded $8,000 for his project titled REU Supplement: Micro-Macro Scale Investigations to Study. Additionally, he was awarded $9,600 by the University of Missouri South Africa Exchange Program to "Determine Fracture Resistance of Endodontically Treated Upper Premolars Restored with Horizontal Glass Fiber Post using Finite Element Analysis," in collaboration with UMKC School of Dentistry and University of Western Cape faculty.

/PROFESSIONAL LICENSURE PREP

A team of expert faculty teaches these face-to-face courses, segmenting the exam into digestible components and delivering the key points likely to be covered.

ELECTRICAL AND COMPUTER – POWER PE REVIEW COURSE

DATES: June 3–August 5, 2019
TIME: Mondays and Thursdays from 6–9 p.m.
LOCATION: Black & Veatch, Room IP1, 11401 Lamar Ave., Overland Park, KS 66211
FEE: $849
DEADLINE: Sign up by Friday, May 31
Register at sce.umkc.edu/power-pe

CIVIL PE REVIEW COURSE

DATES: August 20–October 1, with practice exam on Saturday, October 5
TIME: Tuesdays and Thursdays from 6–9 p.m.
LOCATION: Flarsheim Hall, Room 531 (Toyota Executive Education Center), 5110 Rockhill Road
FEE: $895
DEADLINE: Sign up by Friday, August 16
Register at sce.umkc.edu/civil-pe

/PROJECT MANAGEMENT PROFESSIONAL (PMP) PREP

Gain an understanding of the project management concepts, terms, processes and scenarios that are required content for the PMP Certification Exam in this 35-hour course.

DATES: September 12, 13, 16, 17 and 18
TIME: Thursday–Friday; and Monday–Wednesday from 9 a.m.–5 p.m. (no classes over the weekend)
LOCATION: Flarsheim Hall, Room 531 (Toyota Executive Education Center), 5110 Rockhill Road
FEE: $995
DEADLINE: Sign up by Wednesday, September 4
Register at sce.umkc.edu/pmp-prep

UNIVERSITY OF MISSOURI-KANSAS CITY
School of Computing and Engineering
5100 Rockhill Road
Kansas City, MO 64110

Nonprofit Org.
U.S. Postage
PAID
Kansas City, Mo.
Permit #6113

COMING FALL 2020

The Robert W. Plaster Free Enterprise and Research Center is under construction in the heart of the UMKC Volker campus. Set to open in Fall 2020, the 7,800-square-foot building will provide leading-edge, high-tech research and development capabilities for both the campus and the Kansas City community at large. **Learn more at sce.umkc.edu/research-center.**