FedEx Institute of Technology
The University of Memphis

ANNUAL REPORT 2018

THE UofM: DRIVING INNOVATION to TRANSFORM OUR WORLD

NEAR THE NORTHERN EDGE of the University of Memphis campus is a small street with a big name: Innovation Drive. At its end gleams the FedEx Institute of Technology, a state-of-the-art center for the advancement of emerging technologies and the science of what's next: virtual reality, blockchain technologies, the Internet-of-Things, artificial intelligence, biologistics and much more.

Here, we understand that in a world that changes at the speed of light, innovation isn't a luxury. It's a necessity and an urgent one. Addressing growing needs in key areas such as transportation, cybersecurity, environmental stewardship, health care and urban living is necessary for survival and critical to the success of our communities, our industries and even national security.

It's not easy. It takes new ways of thinking and seeing. It takes the concerted effort of brilliant university researchers and students, visionary corporate partners and supportive community leadership. And it takes an organization to bring it all together, to fuel the world-class interdisciplinary research, promote promising technologies and foster unique collaborations. We are fortunate to have all of that here.

Welcome to the FedEx Institute of Technology at the University of Memphis, where the drive to innovate is strong and enduring, and the results have the power to bring positive change to people and communities around the world.

FedEx Institute of Technology
The University of Memphis

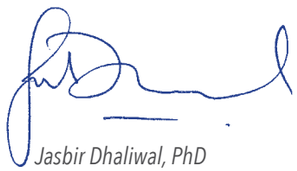
A LANDSCAPE OF COLLABORATION

I am proud to present to you the 2018 FedEx Institute of Technology Annual Report. In these pages, you will discover how the Institute is fulfilling its mission to be the defining feature in a landscape of collaboration, discovery and new opportunity here in Memphis and the Mid-South.

Among this year's triumphs:

- *The Institute has established an Additive Manufacturing Research cluster along with a new Metal Additive Manufacturing Research Lab in the Herff College of Engineering. These additions will help expand the possibilities for 3D printing, open new doors to research for our faculty and bring outstanding workforce development opportunities for our students.*
- *Strategic efforts in blockchain research are helping Memphis establish an early reputation as an innovator in the space.*
- *The MD2K NIH Center of Excellence has achieved new milestones as it moves to reshape healthcare – saving lives through sensor-based technologies.*
- *Our established interdisciplinary research clusters in Cybersecurity and Testing, Unmanned and Autonomous Systems, Smart Cities and Biologistics continue to reinvent the world around us, earning both grants and patents.*
- *The Federal Aviation Administration chose Memphis for its Integrated Pilot Program, which is examining how the use of drones can be integrated into our transportation network. This designation shows how the city is increasingly a part of the national conversation about emerging technologies.*

You will find more stories like these throughout this report. As diverse as they are, they carry one overarching theme: Our greatest successes come through our unique collaborations with technology-driven corporate and community partners across this great city. We look forward to reaping the rewards of these relationships in the coming year as we continue to support ground-breaking research.



Jasbir Dhaliwal, PhD
Executive Director
FedEx Institute of Technology

Community Partnerships | Common goals. Uncommon results.

The Institute has been fortunate to build some amazing partnerships with individuals, companies, nonprofits and technology groups over the past several years: FedEx, SAS, CodeCrew, Tech901, SweetBio, Agricenter International, AutoZone, International Paper and many more. Throughout this edition of our annual report, we've sprinkled quotes from some of these partners testifying to the unique and productive nature of these powerful relationships.

"The FedEx Institute team is great to work with; they are smart, results focused and outside-the-box thinkers. They really set up our company for growth and success."

TOM KADIEN
CEO, UMRF Ventures

"Our unique collaboration with FIT has been rewarding. Giving us the ability to bring together academic, research and enterprise perspectives is transformative and raises the bar for us all. My personal favorite engagement was supporting the first-ever all-female hackathon for Memphis. It was truly inspiring!"

MICHELLE EPPS
Senior Vice President IT & CIO, FedEx Freight

CHAIN REACTION

HOW MEMPHIS IS BECOMING A VITAL LINK IN BLOCKCHAIN DEVELOPMENT

No doubt, you are hearing the words "Bitcoin" and "blockchain" a lot these days. You might wonder why anybody would want a digital currency instead of good old American dollars and why so much attention is being paid to disrupting digital transactions as we know them. Well, you have come to the right place: Memphis and — more specifically — the FedEx Institute of Technology, where blockchain activity is creating a chain reaction of innovation that soon may be felt around the world.

Blockchain breakdown

Blockchain allows buyers and sellers to conduct transactions online without the need for a third party, such as a bank using a digital currency such as Bitcoin and Ethereum. Encrypted transaction data is accessed by everyone involved in the transaction via a computer network. Among these are thousands of independent volunteers whose computers work to unscramble the encrypted instructions of the transaction. Each transaction, which is represented as a "block" online, must be approved and validated by the nework in order to be executed and recorded. Once validated, ownership of the digital money transfers from the sender to the receiver and the block is added to a "chain" of previous transactions in what is often called a "digital ledger." This record is accessible and verifiable, providing security and transparency. And because this ledger is not stored in a single central location but, instead, exists – and is constantly reconciled – in millions of places, the opportunity for fraud and hacking is greatly reduced.

Although Blockchain was initially developed to enable the fast, secure exchange of digital currency, companies are spending billions of dollars studying ways to use it for other kinds of multi-step activities, from tracking and verifying the chain of custody of goods to the management of titles and deeds.

Hacker hotbed

In May, Memphis became blockchain central as the FedEx Institute of Technology hosted the ETHMemphis Hackathon, a three-day conference and contest that attracted people from around the world to explore blockchain solutions for supply chain, healthcare, travel, education and legal applications using the Ethereum blockchain platform.

Why Memphis? Memphis is primed to be a center of applied blockchain solutions that focus on bringing new business value through novel applications. The Institute explored how to best unite businesses with blockchain and saw Memphis as being the perfect destination for an Ethereum-based hackathon.

> ***"The FedEx Institute of Technology has been an important partner of Blockchain901 since the beginning. They provide a space to share ideas, network and learn. The Institute is a valuable resource and contributes to the growth and success of the Memphis Blockchain community."***
>
> **CHRISTINE FAHEY**
> **Executive Director, Blockchain901**

> ***"For dexFreight, Fedex Institute of Technology opens many doors and opportunities in blockchain and logistics space. For a startup like us with limited resources, FIT has provided us with invaluable connections and a platform to showcase our vision and product to not only the industry but also potential investors. On top of that, Memphis is a strategic hub for logistics, where many of our future customers reside. We will continue to collaborate and partner with FIT."***
>
> **RAJAT RAJBHANDARI**
> **CEO and Co-Founder, dexFreight**

The keynote speaker was Sean Healy, regional chief operating officer of FedEx Express, who spoke about how important it is for FedEx to harness the power of blockchain. He explained how information about a package is just as important as the package itself and how blockchain can make that information both accessible and secure. One example he gave was cross-border shipping, which involves brokers, customs authorities and government agencies who need access to the information about the packages being shipped. Blockchain, he said, could significantly reduce turnaround time and thus reduce operational costs.

Healy also explained the need for a common data language that can minimize discrepancies and disputes between transaction partners. As a founding member of BiTA, the Blockchain in Transport Alliance, FedEx is helping to develop standards and procedures for blockchain use in the transport industry.

The friendly contest part of the event pitted competitors from around the world who demonstrated how blockchain could be used in new and innovative ways. Winning ideas spanned the gamut from tracking criminal evidence used in trials to making hotel bookings simpler, cheaper and more secure.

Judges and speakers at the conference included representatives from Airbnb, Bounties Network, CryptoChicks, ConsenSys, Beagle Inc., Minute School, Amentum, SweetBio, DayaMed, Finnovate.io, Decentraland and Alluminate.io.

After the conference, the Institute's chief innovation officer, Dr. Jasbir Dhaliwal, reflected. "Academic research and business innovation are but two sides of the same coin," he said. "It was great to see so many participants from the Silicon Valley, Canada and other regions come together with our local participants to collaborate, conceptualize and create practical applications of blockchain technology."

Linking up

Memphis' blockchain allure is not just attracting conference attendees. In fact, in June, the University of Memphis announced that two new blockchain technology startups would soon join the FedEx Institute of Technology: Miami-based dexFreight and Halifax-based Peer Ledger.

dexFreight is an open source logistics platform built on blockchain technology and machine learning that helps improve supply chain collaboration and promote more efficient shipping. Peer Ledger creates and hosts blockchain applications in the automotive manufacturing and health care sectors.

When asked why Peer Ledger chose Memphis, co-founder and CEO Dawn Jutla said, "As blockchain and other exciting new technologies begin to permeate all industries, Peer Ledger wants to be in the middle of this rising city and the huge growth potential for our company in the U.S. market. The FedEx Institute of Technology and University of Memphis students are critical to our success, and we look forward to working with them to further realize the success of our company."

The FedEx Institute of Technology's ability to build research collaborations and workforce development solutions with emerging companies like Leer Ledger and dexFreight helps to further establish the University of Memphis as the heart of technology in our region and a national destination for applied innovation.

Additive Value

Test objects produced with metal additive manufacturing process

Transforming manufacturing through 3D printing

The technology of 3D printing, also called "additive manufacturing," is progressing rapidly. Recent advances in engineering and materials are now making it possible to use high-energy lasers to precisely deposit and fuse powder materials composed of metal, plastic and biocompatible materials layer by layer into all kinds of products, from auto parts to biomedical devices, directly from computer design files. Such capabilities could revitalize manufacturing in a wide variety of industries.

In the front lines of research in this area is the Additive Manufacturing Initiative and Research Cluster at the UofM, led by Ebrahim Asadi and Gary Bowlin. Supported by the FedEx Institute of Technology, this initiative is studying new practical applications of additive manufacturing. Because it eliminates many steps in traditional manufacturing and is extremely precise, additive manufacturing promises greater efficiency and cost savings. It can also enable cost-effective small-batch or as-needed manufacturing.

"It was unimaginable a decade ago," Asadi says, "but today, nearly any three-dimensional object can be fabricated using this technique."

Support

To support this work, the University of Memphis committed $2 million toward equipment and laboratory infrastructure for 2018. The new, state-of-the-art lab makes the UofM the first college in the Mid-South to have 3D metal printing capabilities and, with robust collaboration with local industry and a dedicated team of faculty researchers, puts the university on the cutting edge of a high-growth research arena. This, in turn, creates new in-demand educational opportunities for students. Already, FedEx, Medtronic, NASA, Naval Air Systems Command and others are partnering with the initiative to advance research and develop new solutions.

Collaboration

Across industries, additive manufacturing is making real impact. The establishment of the Additive Manufacturing cluster will open new projects and collaborations between the UofM and FedEx as 3D printing grows in prominence for the logistics industry.

The biomedical device industry is supported by the 2018 announcement of a collaboration between the Herff College of Engineering and Auburn University to explore research that will improve processes for the production of biomedical implants.

Long used for prototyping of biomedical devices, this emerging technology will soon be utilized to create and manufacture innovative, high-quality, finished products that can be used successfully in patients.

Grand opening of the Metal Additive Manufacturing Lab brings researchers and scholars together for new collaboration.

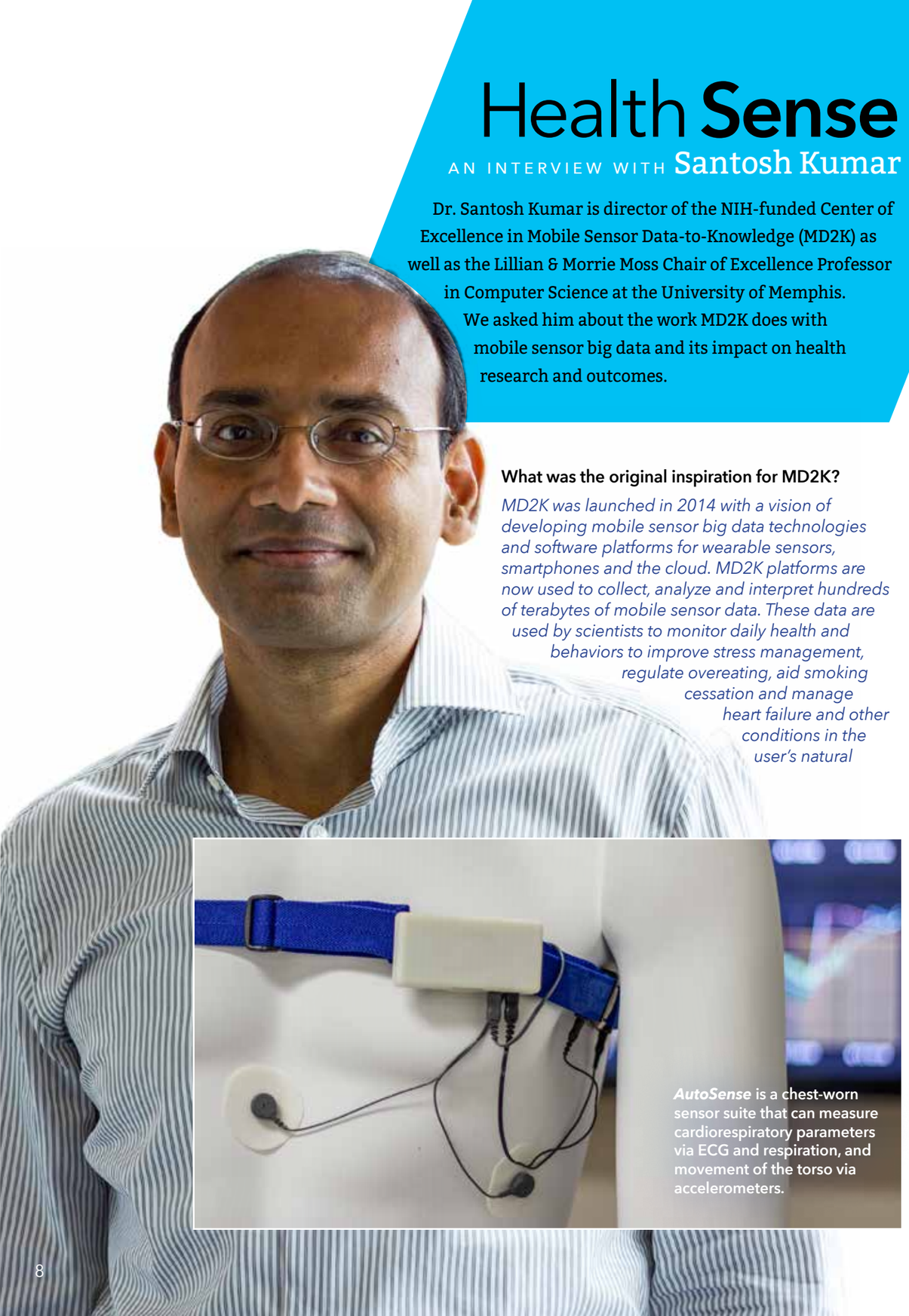
"A lot of people may not see how the FedEx Institute of Technology and Agricenter International are natural partners, but the agriculture industry is being impacted by advances in technology at a rate that is creating tons of new opportunities. This ever-changing landscape will provide for some amazing advancements for our region, and I am excited we have partners like the FedEx Institute of Technology helping us work on creative solutions for a better community."

JOHN BUTLER
President, Agricenter International

Health **Sense**

AN INTERVIEW WITH **Santosh Kumar**

Dr. Santosh Kumar is director of the NIH-funded Center of Excellence in Mobile Sensor Data-to-Knowledge (MD2K) as well as the Lillian & Morrie Moss Chair of Excellence Professor in Computer Science at the University of Memphis. We asked him about the work MD2K does with mobile sensor big data and its impact on health research and outcomes.



AutoSense **is a chest-worn sensor suite that can measure cardiorespiratory parameters via ECG and respiration, and movement of the torso via accelerometers.**

What was the original inspiration for MD2K?

MD2K was launched in 2014 with a vision of developing mobile sensor big data technologies and software platforms for wearable sensors, smartphones and the cloud. MD2K platforms are now used to collect, analyze and interpret hundreds of terabytes of mobile sensor data. These data are used by scientists to monitor daily health and behaviors to improve stress management, regulate overeating, aid smoking cessation and manage heart failure and other conditions in the user's natural environment. Mobile sensor big data collected by MD2K platforms are uploaded and archived in a digital biobank. A biobank allows researchers to go back to the data collected and reapply it in new ways to pursue scientific discoveries not possible at the time of data collection. MD2K technologies are currently used in 10 field studies supported by 13 federal grants from NIH, NSF, and IARPA, involving 20 universities. Its headquarters are right here at the University of Memphis.

Tell us about digital biomarkers.

A digital biomarker is a measurable indicator of a biological state or risk factor. We use biomarkers in our data to identify the presence of, or potential for, a disease, to identify significant changes in health or personal habit, or to even detect changes in risk factors in a person's environment.

MD2K has developed wearable sensors (that are optimized for research usage), a suite of smartphone apps we call mCerebrum and cloud software we call Cerebral Cortex. Together, they enable us to receive, store and analyze hundreds of gigabytes of mobile sensor data per day from hundreds of participants across the nation. From this, we derive 10s of digital biomarkers that can help us assess and understand the role of daily behaviors in health outcomes of participants.

What are some health issues you are currently investigating?

Right now, mobile sensor data collected by MD2K platforms are being used to study congestive heart failure (Ohio State); smoking cessation (Rice, Utah, Vermont); stress and smoking (Moffitt Cancer Center); smoking and overeating (Northwestern); oral health (UofM, UCLA); cocaine use detection (Johns Hopkins); behavior change (Dartmouth); and workplace performance (UofM, Minnesota).

Workplace performance?

Yes, we're excited to be working on that here in Memphis. The center led a six-university team to objectively assess everyday job performance using passively collected sensor-based markers of task performance, personality, cognitive ability, workplace behaviors and context. We call the project mPerf.

How is the mPerf project progressing?

In the past year, we completed a large field study (led by Dr. Deniz Ones at University of Minnesota), where we collected 2.7 trillion data points from 380 employees, working in 100+ different organizations in three states. These participants wore the sensors for 10 weeks during all awake hours to capture their daily work and off-work behaviors.

With the addition of work performance monitoring, the MD2K mobile sensors and big data software can now be used to investigate the impact of workplace behaviors on health and wellness and vice versa.

How can this study eventually benefit workers and employers?

Current workforce evaluation tools include interviews, cognitive assessments and questionnaires, which are helpful in assessing job performance but do not always accurately reflect how a person is performing on a day-to-day basis. Most people spend a substantial part of their lives at work, which provides meaning and extrinsic rewards and drives human progress. By better understanding work performance, we can help individuals maximize their impact and also help organizations reduce bias in performance appraisals.

Since you are dealing with personal health data on a large scale, does cybersecurity become an issue? If so, what are the concerns and safeguards?

Privacy and the use of smartphones and mobile sensors are equally important when building mobile health research platforms. That is why MD2K has made privacy an ongoing aspect of its research from Day 1 and developed mSieve, a privacy framework for sharing physiological sensor data. The mSieve framework is a new behavioral privacy network that uses a novel data substitution mechanism to protect behavioral privacy expressed in terms of a whitelist and a blacklist of inferences.

Also, the mCerebrum software platform developed by MD2K implements privacy controls that allow study participants to stop data collection temporarily and that use secure encryption.

Tell us about some of the mobile sensors you use.

Some are common sensors we all use, such as wristbands and chestbands that track heart rate and exercise. But our investigator, Dr. Emre Ertin at Ohio State, developed custom sensors that are optimized for collecting high-rate sensor data, so as to allow creation of a digital biobank as well as to facilitate development and validation of new computational models. An example is a wrist sensor called MotionSenseHRV*, which measures gestures via accelerometers and gyroscopes and interbeat intervals via optical sensor for computing heart rate variability indices. Another sensor called* AutoSense*, worn on the chest, can measure cardiorespiratory*

(CONTINUED)

parameters and movement of the torso. Other more sophisticated ones include the **EasySense** *sensor, which can detect heart and lung motion and assess change in the lung fluid level. Another investigator (Dr. Deepak Ganesan at UMass Amherst) developed computational eyeglasses, called* **iShadow** *that can monitor the wearer's eyes for markers of saccades (rapid eye movement), fatigue, pupil dilation, etc., as well as the effects of visual cues on the participant, like exposure to alcohol advertisements.*

MD2K is also working on something called Just-in-Time Adaptive Intervention. Can you explain that for us?

Just-in-Time Adaptive Interventions (JITAIs) are mHealth technologies that seek to deliver the right intervention components at the right times and locations to best support individuals' health behaviors.

These interventions are adapted to a person's emotional, social, physical and contextual state, so negative outcomes are avoided, and the JITAI promotes the adoption and maintenance of healthy behaviors.

MD2K researchers are working to determine the best timing of a JITAI to maximize its effectiveness and limit the interruption of the user's daily life. This is especially important in management of stress, which can contribute to many other health issues.

We understand that MD2K is expanding its influence by enabling "citizen scientists" to use its technology.

Yes. MD2K has released a personal edition of its software platform that allows individuals – citizen scientists – to install and use MD2K's software to collect and process their own high-frequency mobile sensor data on an Android® smartphone and analyze it on a personal computer.

Individuals who download this latest version of mCerebrum and Cerebral Cortex to their smartphones and personal computers will be able to collect data about themselves and run single-patient experiments on that data. The personal version of mCerebrum and Cerebral Cortex comes with the same features and digital biomarkers as the full-scale version of the software. Individual users will be able to run the same types of analysis on their personal computers and retain their privacy because the data never leaves their devices.

Included in Cerebral Cortex Personal Edition are hundreds of markers for activity, posture, mobility behavior, location, smoking, app usage, ambient light, phone calls, SMS messaging and stress. The collected and computed data can be visualized on a personal computer. Information on the personal version of mCerebrum/Cerebral Cortex, plus a link to download it, can be found at ***md2k.org/personal****.*

Is this program popular?

The software, documentation, videos of lectures and other educational materials posted on the MD2K website and its mHealthHUB are now attracting 10s of thousands of viewers from 149 countries. ⬢

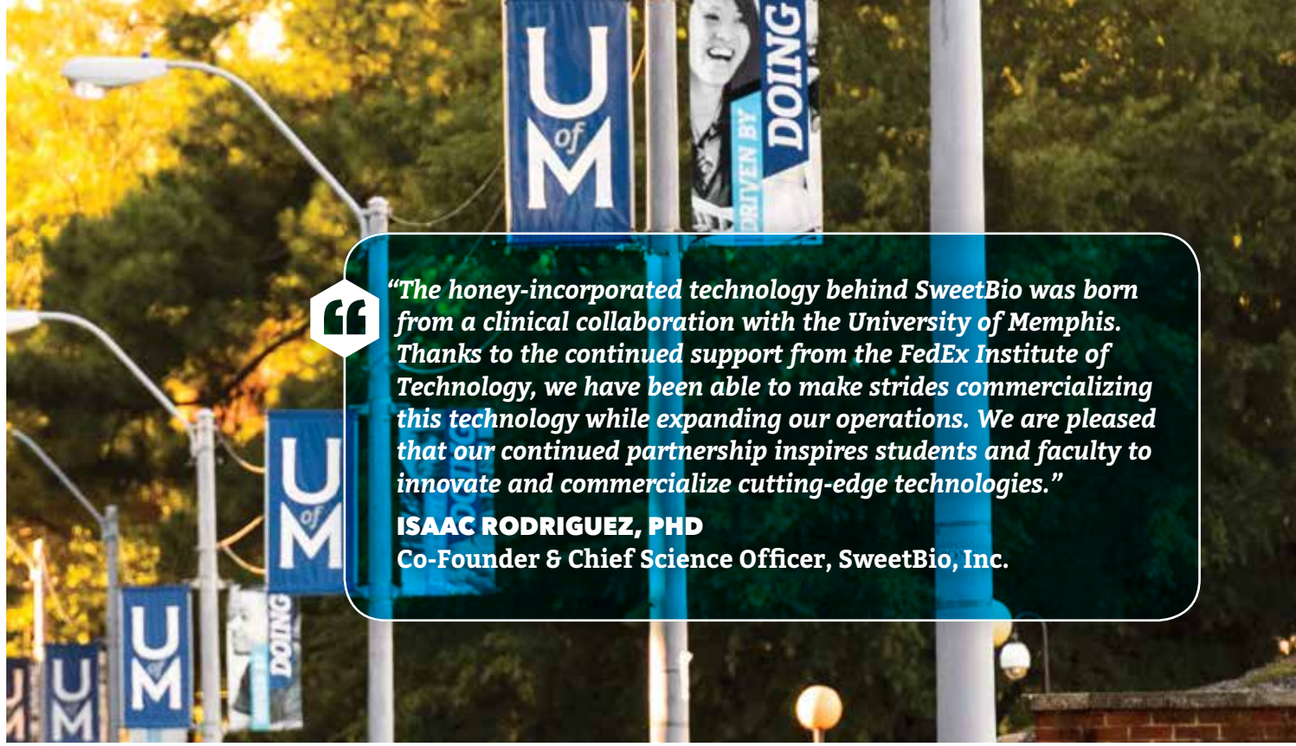
HIGHLIGHTS *From* UPCOMING RESEARCH

Crash-Test Pottery
Dr. Firouzeh Sabri is using cutting-edge physics research to explore new properties of an ancient material – ceramics. Recent advances in ceramics engineering have allowed Dr. Sabri and the ENrG company to explore using flexible ceramics for impact reduction in drone flight. For a complete list of the DRONES Research Cluster projects, see page 22.

Breaking Bluetooth
BLE (Bluetooth Low Energy) technology is all around us. It wirelessly connects our cars, our homes and our lives. But what happens when we reach a saturation point? Dr. Kevin Berisso is exploring this emerging crisis in wireless communication by probing the limits of this wireless communication technology, which will be critical to sensor-based logistics. See the complete list of Biologistics Research Cluster projects on page 22.

The End of Public Key Encryption As We Know It
Drs. Yang and Wang of Computer Science have pioneered new work that turns the traditional way we think of cybersecurity on its head. Using blockchain technology, they have created a decentralized public key management system that requires us to rethink Secure Sockets Layer (SSL) certificates. A complete list of the Cluster for Advancement in cyber Security & Testing (CAST) projects is available on page 23.

Spray-On Future
Dr. Gopalakrishnan is creating a spray-on future using aerosol spray-based manufacturing. His innovative techniques are being applied to solar cell applications as well as biomedical implant surface treatment and production of low-cost metal oxide sensors for chemical and biological applications. Research funding by the FedEx Institute of Technology will enable an investment in a variety of coatings and address additive manufacturing challenges while supporting interdisciplinary collaboration.



> ***"The honey-incorporated technology behind SweetBio was born from a clinical collaboration with the University of Memphis. Thanks to the continued support from the FedEx Institute of Technology, we have been able to make strides commercializing this technology while expanding our operations. We are pleased that our continued partnership inspires students and faculty to innovate and commercialize cutting-edge technologies."***
>
> **ISAAC RODRIGUEZ, PHD**
> **Co-Founder & Chief Science Officer, SweetBio, Inc.**

Spotlight: VR Lab

Virtual reality. Real breakthroughs.

New realities are taking hold at the FedEx Institute of Technology thanks to advanced Virtual Reality (VR) research. VR enables us to engage with the world in unique ways by creating very real interactive experiences within computer-generated simulated environments. A key part of this work is the newly established VR Lab. Here, a nexus of community organizations, researchers and students are working to position Memphis as a VR leader.

Led by lab director Ernest McCracken, University of Memphis faculty are using the lab to explore the field of robotic vision and human-computer interaction. The lab has pioneered the pairing of VR with LiDAR, a 3D mapping and surveying method that uses pulsed laser light, to map public facilities and interact and explore those facilities virtually. The team has also engaged an interdisciplinary faculty from across campus, including the University of Memphis' Netlab, led by Dr. Lan Wang, chair of the Department of Computer Science, to develop location and context-aware augmented reality using an emerging, alternative internet architecture called Named Data Networking.

Research is one aspect of the VR Lab's work. Collaboration is another. Through a partnership with Memphis Game Developers, the VR Lab has hosted VR Game Jams, weekend events where community members and developers come together to design games in VR environments. In addition, it participates in hackathons and other community events held at the FedEx Institute of Technology, contributes to the University of Memphis student chapter of the Association of Computing Machinery, and often plays host to students who visit the lab looking to learn more about this exciting technology.

As more companies begin to explore how VR can make possible new lines of business and reshape the reality of customer engagement, the VR lab, as well as VR workshops and other events at the Institute, will continue blazing new trails and new opportunities for Memphis. ⬢

Patents and Tech Grants

UofM Researchers Building on Success

The Institute houses the Office of Technology Transfer (OTT) which works with faculty to invest in research with the potential for promising breakthroughs and inventions. Last October, the OTT held an Inventor's Celebration honoring and recognizing the awarding of a record 10 U.S. patents and eight research development grants to UofM researchers. This year, we celebrate the addition of seven new patents received in 2018, a testament to the impact the UofM FedEx Institute of Technology continues to have on innovation in the Mid-South.

The Patents

PATENT NO. 9,733,351

Surveillance and Tracking System and Method
Robert Kozma, Orges Furxhi, Khan Iftekharuddin, Lan Wang, Ross Deming, Serji Consul-Pacareu

PATENT NO. 9,786,195

System and Method for Evaluating Reading Fluency Using Underlining
Max M. Louwerse

PATENT NO. 9,912,657

Adaptive Multi-Factor Authentication System
Dipankar Dasgupta, Abhijit Kumar Nag, Arunava Roy

PATENT NO. 9,952,209

Iron Oxide-Gold Core-Shell Nanoparticles and Uses Thereof
Huang Xiaohua, Bhana Saheel

PATENT NO. 9,962,468

Cell Growth Apparatus and Use of Aerogels for Directed Cell Growth
Firouzeh Sabri

PATENT NO. 9,983,162

Method and Device for Detection of Bioavailable Drug Concentration
Edward Chaum, Erno Linder, Jidong Guo

PATENT NO. 10,052,388

Compositions and Methods for Delivering an Agent to a Wound
Warren Haggard, Scott Noel, Joel Bumgardner

The development grants awarded by the Institute totaled $160,000 and were awarded to the most commercially promising technologies. The Institute's goal is to support and propel these innovations so that they join the University's ever-expanding profile of commercialization and patent achievements.

The Grants

Making sensors "Band Aid-like"
Typical monitors used on patients to capture physiological signals are heavy and uncomfortable for long-term use. Dr. Bashir Morshed's grant-funded technological research will combat these issues by developing an ECG and Sp02 Monitoring system for smartphones using low-cost, disposable inkjet-printed sensors worn on the body.

Generating stability for wind power
After a major disturbance, a power system must be able to regain its synchronization and stability quickly. This is called transient stability. Dr. Mohd Hasan Ali has received a grant to build the hardware for a nonlinear capacitor controller that can cost-effectively improve transient stability of wind generator systems through a hardware-in-the-loop system.

Getting the lead out
Dr. Gary Emmert has received a grant to fund research and development of a fully automated, on-site system to monitor in real time lead concentrations in drinking water – in both the distributed supply and in homes – and provide early warnings that can facilitate a rapid response.

Getting drones to do the dirty work
Dr. William Alexander has received a grant to further his work developing modular amphibious drones for environmental sampling and analysis. Helpful in conducting tests in dangerous or difficult-to-access areas, these unmanned aerial systems will be tested with the assistance of the Tennessee Department of Environment and Conservation and will include real-time feedback and display of water quality sensor outputs.

Babying the newborn
Dr. Randal Buddington has received a grant for a Fetal Transport System that can successfully transport premature infants born at less than 26 weeks to an advanced NICU in order to receive proper treatment and care. Part of the research involves determining what nutrients the placenta provides to the fetus in order to mimic those womb conditions within the transport system. The goal is greater survival outcomes for these vulnerable newborns.

Shedding new light
Dr. Chrysanthe Preza is using her grant to design and evaluate a "multi-focal-light sheet structure" illumination system and software for florescence microscopy in order to obtain 3D super-resolved images with improved optical sectioning.

Controlling virtual emotions
Dr. Mohammad Yeasin is using his grant to collect more natural emotion data and incorporate it into new techniques for generating virtual examples for training purposes. A primary objective of this work is to customize feedback to suit the needs of specific users.

Standardizing cancer detection
Liquid biopsy is a method of detecting and identifying cancer biomarkers using the body's fluids as samples. Dr. Xiaohua Huang's continuing research is focused on the standardization of the testing used for cancer-detecting liquid biopsies, focusing on sensitivity, specificity and reproducibility. Further research will include in-vitro validation.

Training Ground

Over the past year, The FedEx Institute of Technology continued to fulfill its role as a vital resource for cutting-edge corporate training as well as student education. Milestones included an innovation bootcamp, the opening of a new training center, a multi-course Agile training program and a unique student-operated IT systems analytics command center.

Memphis Innovation Bootcamp

The Memphis Innovation Bootcamp (MIB) is a three-day design thinking course with real impact. Working with community organizations, professionals and stake-holders from around Memphis, the MIB teaches design thinking skills with context. Each class takes participants out of their comfort zone, immersing them in a challenge that pushes the limits of what we think we know. Classes comprise a diverse cross section of community leaders, all of whom use the principles of design thinking to reconsider the way they interact with the world around them. Participants receive a toolkit that they can apply to their daily lives, building empathy and creating new perspectives on how we work together.

To give you an idea of how the workshops operate, check out the last three bootcamps we ran and the challenges they dealt with:

Healthcare Solutions and Challenges for Migrant Communities

Partnering with a team of medical professionals from St. Jude Children's Research Hospital including international guests from St. Jude's facilities in Mexico, the MIB class visited Church Health Center, Crosstown and Refugee and Immigration Services to explore the healthcare challenges of the migrant community in Memphis.

Reimagining Libraries in the Memphis Community

Working with the University of Memphis Library faculty and staff, the MIB guided a class of professionals on a journey that reimagined the role of the library in our community. With a visit to Cloud901; the Memphis public library's innovation space; and MidSouth Makers, a makerspace in East Memphis, this class explored how libraries of the future serve as a toolkit to unlock innovation across all disciplines.

Taking Out the Trash

In partnership with the National Civil Rights Museum and in alignment with the MLK50 celebrations, our MIB class explored the challenges associated with solid waste management in downtown Memphis. This multifaceted problem brought a cross section of city officials and community members together to consider the labor, logistics and legal challenges of solid waste management, all with the backdrop of the sanitation worker strikes of the 1960s. The best proposals were presented to Phillip Davis, Deputy Director of Solid Waste, and City Council Chairman Berlin Boyd.

Through collaboration, innovation and design thinking techniques, we are building a brighter Memphis.

Certifiable Progress

New SAS training center is creating a talent pipeline

SAS, a global leader in big data analytics based in North Carolina, opened its first university-based training center in the FedEx Institute of Technology in 2018. Course offerings at the center include SAS programming and advanced analytics leading to certifications, including SAS Certified Base Programmer, SAS Certified Advanced Programmer and SAS Certified Predictive Modeler Using SAS Enterprise Miner. UofM faculty are supporting experts from SAS to provide the training, and trainees are able to apply for tuition reimbursements from their organizations to help cover training costs.

The new center is just one more way the UofM and the Institute are helping to increase the size and technical sophistication of the Mid-South technology workforce.

Sean O'Brien, vice president of SAS Education, put it this way: "The SAS training center at the FedEx Institute of Technology will not only help meet the analytics talent needs of Memphis-area organizations but provide rewarding career opportunities for students and adult learners."

The Renewal Technical Tenet Academy

A global training initiative

Today more than ever, technology is defining how the world does business. For companies that were "born digital" like Facebook, Netflix and others, the seamless integration of technology across the organization is effortless. For others, the disruption of technology innovation means creating solutions that help transform corporate culture and prepare the company for a dynamic and engaging future.

The FedEx Institute of Technology helps with this transformation process by bringing research and innovation together to create scalable training solutions built around the customized needs of companies in critical areas like agile, DevOps and testing automation. In collaboration with FedEx Services, we have developed the Renewal Technical Tenet Academy, a training solution that provides professional development opportunities in critical areas associated with transformation.

The pilot courses were developed in partnership with the FedEx Center for Agile Transformation and key collaborators across the company over a period of 18 months. The courses leveraged faculty experts from institutions around the world, creating a community of practitioners familiar with best practices on every continent – from brain science to design thinking and all points in between.

Our team of faculty researchers from 10 universities, along with FedEx colleagues, are reshaping the future of transformation for global companies and helping to reimagine the workforce for the next 100 years.

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"Innovate Memphis and our priority projects for the City of Memphis have benefitted from the Memphis Innovation Bootcamps. The bootcamps have greatly accelerated our work. It's been a huge help to have a collaborative group of professionals working through the design-thinking process to understand civic challenges and come up with new ideas. It's meaningful to have professionals from the private sector get deeper awareness and insight into public sector challenges they may have never considered. It's been a valuable experience for our organization."

JUSTIN ENTZMINGER
Executive Director, Innovate Memphis

STEM at Work

Unique centers offer new opportunities for students and employers

Last fall, the University of Memphis Research Foundation and its wholly owned subsidiary, UMRF Ventures Inc., opened a unique, student-operated call center as part of an economic development initiative designed to provide real and transferable opportunities to students in the Memphis community.

It's first customer? FedEx. Student employees at the support center handle technical support calls from FedEx team members, including "first-level" technical support, such as phone configuration and basic application and computing device troubleshooting. The center employs UofM students as call center agents from 7 a.m. to 8 p.m., seven days a week, 365 days a year.

In June, the FedEx IT Systems Analytics Command Center opened at the Institute, providing technical support for the FedEx IT Command Center housed at the FedEx World Technology Center. The center employs approximately 45 UofM graduate students from 7 a.m. to 8 p.m., seven days a week, 365 days a year.

"This is the first of many steps on a journey toward creating opportunities for more students to earn good wages in a professional environment and to become the most competitive candidates they can be in any job market," says Tom Kadien, CEO of UMRF Ventures. "Corporations like FedEx that invest in the future workforce with innovative programs like this know that they are contributing to the long-term success of their companies."

Memphis Chosen for National Drones Testing Program

In May, the Memphis-Shelby County Airport Authority, in partnership with FedEx, the DRONES Research Cluster at the FedEx Institute of Technology and other entities, successfully brought a high-profile drones testing project to the city. Memphis was one of only 10 locations nationwide to be included in the UAS Integration Pilot Program, designed to accelerate the successful integration of unmanned aircraft into the National Airspace System. The MSCAA was the only airport authority among the applicants selected.

During the program, drones will be used at the airport for delivering aircraft parts and at Shelby Farms Park to deliver medical supplies. The goal is to test and further develop a reliable, safe system for integrating manned and unmanned aircraft in real-world applications.

According to Eddie Jacobs, Director of DRONES, the ability to offer a variety of environments – farm, city, and major industry – in a single county was a key to winning the honor.

"It was a compelling part of our bid," he says.

> ***"FedEx Institute of Technology is a restless innovator always looking for ways to make Memphis more competitive. The facility is world-class, and the faculty and staff show the kind of energetic commitment to learning and teaching that makes any idea we explore possible. We are grateful to partner with them to meet the local industry's need for analytical support."***
>
> **SEAN O'BRIEN**
> **Vice-President of Education, SAS**

Function Junction

Whether developing corporate training, providing technology workforce development or bringing emerging technology experiences to new audiences, the FedEx Institute of Technology is committed to leading by providing cutting-edge training and bringing people together in the broader community to engage, grow and explore emerging technologies and innovations.

TRAINING PROGRAMS & WORKSHOPS

Academic Innovation Training Session
Amazon Web Services Learning Day
Automated, Cloud-Based and Real-Time Software Reliability Growth Modeling
CAST Foundations Cyber Security Certifications Program
Critical Conversations: DACA
Critical Conversations: Title IX in Practice
Critical Skills: Business Intelligence/Data Analysis
Critical Skills: Data Management Association
Critical Skills: DRONES Racing
Critical Skills: HTML/CSS
Critical Skills: Introduction to Agile
Critical Skills: Level Design Using ProBuilder
Critical Skills: Mini Workshops in PC Systems
Critical Skills: PHP
Critical Skills: Programming with Tech901
Critical Skills: Python
Critical Skills: Ruby
Critical Skills: Social Media Data Collection
Critical Skills: Unity
Cyber Security Talks
DXtera Academy
Emerging Innovation Series: ALSAC
Emerging Innovations Series: Tennessine Talk
FedEx ITTC Technology Training
FedEx Leading SAFe
FedEx Leading SAFe 4.5 Class
FedEx Renewal Technical Tenet Academy (RTTA): Cloud Native
FedEx RTTA: DevSecOps
FedEx RTTA: Executive Leadership
FedEx RTTA: Finance
FedEx RTTA: Project Management
FedEx RTTA: Release Management
FedEx RTTA: User eXperience (UX)
FedEx SaFe Agile Release Train Engineer Certification
FedEx Services: FedEx Agile Training
FedEx Services: FedEx/USO Charitable Giving
FedEx Services: ICCC Executive Training Seminar
FedEx: Training From Back of the Room
Grizzlies Foundation Volunteer Training
Hack Night Projects: What's Next?
Hospital Wing Training Session
ICCC Executive Training Seminar
Intensive VR/Unity Workshop
International Paper Information Workshop
Memphis Innovation Bootcamp (MIB) Design Thinking Workshop
Memphis Light Gas & Water (MLGW) Training
Memphis Technology Foundation Tech Camp
Mental Health America of Middle Tennessee Behavioral Health and Aging Seminar
Network Theory Workshop
New Leaders Inc. Resident Training
NSBE: Corporate Networking Workshop
PFM Asset Management Internal Training
PHP for Professionals
Public Health Summer Institute
Python 4 Analytics
Quantum Computing Workshop
R Immersion for Data Science Workshop
Retirement Advisor University
Ruby Workshop
SACS Accreditation Meeting
SAS: Creating Reports and Graphs with SAS Enterprise Guide
SAS Enterprise Guide 1: Querying and Reporting
SAS Macro Language 1: Essentials
SAS: Proactive Modeling Using Logistic Regression
SAS Programming 1: Essentials
SAS Programming 2: Data Manipulation Techniques
SAS Programming 3: Advanced Techniques and Efficiencies
SAS SQL 1: Essentials
SAS: Statistics 1: Introduction to ANOVA, Regression and Logistic Regression
SAS: The Introduction to Applied Econometrics
Shoemaker Financial/Financial Literacy: Retirement Planning Today
Shoemaker Financial/Financial Literacy Training
Software Testing Excellence Program (STEP) Certification
ThyssenKrupp Elevator Americas Greenbelt Six Sigma Certification/Whitebelt Champion Tournament
ThyssenKrupp Elevator Americas Six Sigma Training
TPSU Program
Triumph Bank Business Symposium
UMRF Ventures / FedEx ITTC Technology Training
What's Next Series: DNA Data Storage
What's Next Series: Metallic Additive Manufacturing
What's Next Series: Practical Transition to Autonomous Vehicles
What's Next Series: Semantic Representation Analysis
What's Next Series: Turning Citizens Into Mobile Sensor Big Data Scientists

MEETINGS

American Statistical Association Presentation & Mixer
Apprenticeship Accelerator Luncheon for Engineers
AutoZone Agile Meeting
AUVSI Chapter Meeting
Business Information Technology Advisory Council / Mentoring Event
Center for Applied Earth Science Research Meeting
City and Regional Planning
CodeCrew Hackathon
Complete Tennessee
Computer Science Camp Awards Ceremony
Daya Medicals, Inc: DayaMed Demo Day
DRONES/Agriculture Meeting
FedEx Brand Creative Offsite Meeting
FedEx Brand Creative Planning Session
FedEx Corp. Legal Regulatory Affairs Meeting
FedEx Corporate Meeting
FedEx Express Air Traffic Operations FAA Spring CDM Planning Session
FedEx Express Air Operations
FedEx Express Air Operations Meeting
FedEx Freight Marketing
FedEx Freight Team Meeting
FedEx SAS Luncheon
FedEx Services Endpoint Offsite Knowledge Share
FedEx Services International Marketing
FedEx Services IT VP Session
FedEx Services LPSP Core Manager Team Meeting
FedEx Services Offsite Team Meeting
FedEx Services Shipment CORE Session
FedEx Services VP Vendor Strategy Meeting
FedEx Technical Tenets Meeting
FedEx / UMRF Ventures Internal ITCC Visit
FedEx / USO Charitable Giving
First Lego League – Practice
Girls Experiencing Engineering
Governor's School Model UN
IAB Meeting
Information Technology Services Training Session
Institute of Intelligent Systems (IIS) – CSAL
Institute of Intelligent Systems (IIS) – Hu's Research Lab
Institute of Intelligent Systems (IIS) – ONR Options E and F
Institute of Intelligent Systems (IIS) – NSF AutoMentor
Institute of Intelligent Systems (IIS) – Optimal Learning
Institute of Intelligent Systems (IIS) – USC/Memphis (ONR)
International Paper Strategy Planning
Launch TN Resources for Entrepreneurial Researchers
Leadership Memphis
LENA Research Foundation
Memphis in May – Czech Academy of Sciences Meeting
Memphis Technology Foundation User Groups (memtech) Planning Session
Memphis Women in Tech (MWiT) Luncheon
MemTech Planning Session
Mid-South Healthcare Executives CEO Roundtable
MRC Meeting
Office of Technology Transfer Inventor's Celebration
Office of Tech Transfer (OTT) – IP Committee Meeting
Open Data Initiative Kickoff
Open Data Planning Meeting
Open Data Researcher Meetup
Ops360 Meeting
Panasonic Corporation of North America Presentation
Power Connection
Radian Partners Medical Presentation
Raymond James Campus Visit
SAS Partnership Signing Ceremony
SAS Planning Meeting
Shelby County Education Foundation Race for Education 5K
Teach for America (TFA) 2018 Summer Institute
Tech Jobs Tour
Thriving Cities Group Planning Session
TN Section Institute of Transportation Engineers Meeting
Topco America, LLC Point Blank Interviews
University of Memphis Foundation (UMRF) Board Meeting
UMRF Ventures / FedEx Strategic Planning Session
UMRF Ventures IT Command Center Analytics Systems Kickoff with FedEx
UMRF Ventures Kickoff / Media Event
Vibrant Memphis & Epicenter: Angel Resource Institute Seminar
West TN Structural Engineers Winter Meeting
XMC Sales Meeting

CONFERENCES

3MT Competition
ACSA International Cotton Institute 2018
Aspire Public Schools Staff Retreat
Associate Director of Admissions Campus Presentations
ATHENAtechne All Women's 3-Day Hackathon
BIOLOGISTICS Research Cluster Symposium
Biomaterials Day
CBIZ Annual Conference
City of Memphis MPLOY Roundtable Discussion
City of Memphis MPLOY Youth Business Partner Orientation
Cluster to Advance cyber Security & Testing (CAST) Research Cluster Summit
Code Crew Drone Programming Weekend
Congressman Cohen's Small Business Procurement Fair
Enactivism: Theory and Performance
ETHMemphis 3-Day Hackathon
FedEx Express Air Traffic Operations AA Spring CDM
GiveCamp
Greater Memphis Chamber Presentation
HackMemphis Hackathon
ICOMAS International Conference on Mathematics & Statistics
Ingram Memorial Orthopedic Lecture
Intermodal Freight Transportation Institute (IFTI): Choosing Transportation Summit
IFTI: State of Freight Annual Conference
International Symposium on Software Reliability Engineering
Junior League of Memphis: 2018 Women's Summit
Materials Day Symposium
Medical Anesthesia Group (MAG) 2018 SH Meeting
Memphis Bioworks Foundation: Musculoskeletal New Ventures Conference
Memphis Light Gas & Water (MLGW) Cyber Security Summit
Memphis Research Consortium
Methodist Healthcare Primary Care Conference
Mobile Sensor Data-to-Knowledge (MD2K) Annual Meeting, featuring Dr. Leroy Hood
nexAir Conference
Science Teacher Share-A-Thon
Software Engineering Final Projects
SQLSaturday Hackathon
Tennessee Community Foundation Transactional Practice 2017
Tennessee Department of Education West TN TSA Regional
T-STEM Academy
West Tennessee STEM Hub Conference

MEETUPS

BIOLOGISTICS Research Cluster Monthly Meetup
Blockchain901: Blockchain Technology – Back to the Basics
Blockchain901: Creating a Cryptocurrency: The TurtleCoin Team
Blockchain901: Hack Night
Blockchain901: Solidity Intro + Tools
Capabilities of Smart Cities: Lessons from Asia
CAST Conversations Research Cluster Meeting
CAST Research Cluster: Featuring - Admiral Paul Sohl
Creating a Cryptocurrency: The TurtleCoin Team
Cryptocurrency and Taxes
DAMA Monthly Meeting
DRONES Research Cluster Monthly Meetup
Emerging Innovations Series: Blockchain in Action
Emerging Innovations Series: Smart Dust Industry Applications
MemDevOps Meetup
Memphis Technology Foundation User Groups (memtech): Machine Learning/Data Sciences
Memphis Women in Technology (MWiT) Monthly Meeting
memtech User Group: MEMPass / PowerBI Meetup
memtech User Group: Memphis Agile Practitioners Meetup
memtech User Group: Memphis Animation Meetup
memtech User Group: Memphis Game Developers Meetup
memtech User Group: Memphis Linux/Unix Meetup
memtech User Group: Memphis Python Users Group Meetup
memtech User Group: Memphis Ruby Users Group Meetup
memtech User Group: Memphis Web Workers Meetup
memtech User Group: WordPress Meetup
PIVX Cryptocurrency with Douglas Broughton
SMART CITIES Research Cluster Monthly Meetup
Women in Data Science Meetup

"Moving research into practice can be difficult. The FedEx Institute of Technology reached out to me in Sydney, Australia, and brought me to Memphis to workshop new Agile Release Management Techniques with FedEx teams who were at the right point in their Agile Transformation training to be able to apply the concepts. The result was a win-win for all concerned, with the opportunity to extend the relationship into leading-edge research that can result in the adoption of scalable agile frameworks."

DR. LOUIS TABORDA
School of Civil Engineering,
University of Sydney

Our Research Innovation Clusters

Made up of leading researchers from departments across the campus, the interdisciplinary innovation research clusters supported by the FedEx Institute of Technology are committed to addressing a wide range of technological issues that are critical to the success of our community and corporate partners — everything from preventing cyber theft to advancing sustainable living. Cluster members work together to apply for research funding, seek external research partners, and create training and certification programs for the community. All the while, our clusters find ways to encourage junior and senior faculty, students and community organizations to contribute their ideas and be a vital part of the conversation.

Drones, RObotics and Navigation Enabled Systems (DRONES)

The DRONES Research Cluster is committed to establishing and providing proactive leadership in the fast-emerging field of unmanned systems, including autonomous vehicles, robots and drones. Its goal is to bring new, practical applications of these technologies to commercial markets.

DRONES 2018–2019 Fellows:

Dr. Lan Wang, Department of Computer Science. **"Real-time Interactions and Navigation of Autonomous Vehicles for Optimized Unmanned Package Delivery"**

Dr. Ranganathan Gopalakrishnan, Department of Mechanical Engineering & Dr. Jingbiao Cui, Department of Physics. **"Spray-Coated Perovskite Solar Cells – Phase 2"**

Dr, Ranganathan Gopalakrishnan, Department of Mechanical Engineering & Dr. Sanjay Mishra, Department of Physics. **"Hybrid Energy System for Ultra-Lightweight Vehicles"**

Dr. Firouzeh Sabri, Department of Physics. **"Flexible Ceramics for Crash-Proof Drones"**

Dr. William Alexander, Department of Chemistry. **"Smart Unmanned Amphibious Vehicle Sensing and Sampling for Surface Water Quality"**

Dr. Esra Ozdenerol, Department of Earth Sciences. **"GIS Mapping With Drones"**

Biologistics

The Biologistics Research Cluster collaborates with the Memphis Intermodal Freight Transport Institute to research and develop better ways to safely transport and store high-value, temperature-sensitive and time-critical biological materials, including tissue and blood samples, vaccines and pharmaceuticals.

BIOLOGISTICS 2018–2019 Fellows:

Dr. Sanjay Mishra & Dr. Thang Hoang, Department of Physics & Materials Science. **"Development of Next-Generation Energy Storage Device for the Biologistics Applications: Nanostructured Energy Storage Device"**

Dr. Omar Skalli, Dr. Judith Cole & Dr. Amy Abell, Department of Biological Sciences. **"Developing Evidence-Based Best Practices for Shipping Cell Cultures"**

Dr. Firouzeh Sabri, Department of Physics & Materials Science. **"Detection, Evaluation and Prediction of Radiation-Based Damage in Flexible Peel & Stick Temperature Sensors for Logistics and Tracking"**

Dr. Charles Camp & Dr. Shahram Pezeshk, Department of Civil Engineering. **"Post-Disaster Management of Freight Transportation Networks"**

Dr. Jeffrey Marchetta, Mechanical Engineering. **"Simulation and Optimization of Advanced Solution for Cold-Chain Biologistics"**

Dr. Kevin Berisso, Department of Engineering Technology. **"Smart Sensor Communications Congestion Testing"**

Dr. Mohamed Laradji & Dr. Thang Hoang, Department of Physics & Materials Science. **"Plasmon-Enhanced Temperature and Humidity Sensing for Biological and Pharmaceutical Shipments"**

Dr. Pratik Banerjee, School of Public Health. **"Novel 3D Encapsulation Method and Device for Storage and Transportation of Living Cells for Improved Biologistics Solutions"**

Cluster for Advancement in cyber Security & Testing (CAST)

CAST is made up of interdisciplinary researchers from colleges and academic departments across campus working together to address one of the biggest challenges of our day: keeping online data secure from cyber theft. With threats growing more sophisticated, CAST is stepping up research, working on the front lines of the cyber war to provide new solutions and software testing expertise that will help protect corporations, Tennessee government agencies and the Department of Defense.

CAST 2018–2019 Fellows:

Dr. Nirmalee Raddatz, School of Accountancy. **"Exploration of the Impact of Malware Warning Messages"**

Dr. Mohd Hasan Ali & Dr. Dipankar Dasgupta, Department of Electrical & Computer Engineering and Department of Computer Science. **"Exploring Cyber Security Issues and Solutions for Photovoltaic (PV) System Connected to DC Microgrid"**

Dr. Mohd Hasan Ali & Dr. Dipankar Dasgupta, Department of Electrical & Computer Engineering and Department of Computer Science. **"Exploring Cyber Security Issue and Solution for Energy Storage at Smart Microgrid System"**

Dr. Kan Yang & Dr. Lan Wang, Department of Computer Science. **"Decentralized Public-Key Management System Based on Blockchain Technology"**

Dr. Lih-Yuan Deng & Dale Bowman, Department of Mathematical Sciences. **"Design of Secure Random Number Generators for Cyber Security Applications"**

Dr. George Deitz, Department of Marketing & Supply Chain Management. **"Moral Intuition and Consumer Response to Privacy Norm Violations: An N400 ERP Study"**

Dr. Sajjan Shiva, Dr. Deepak Venugopal & Dr. Naveen Kumar, Department of Computer Science & Business Information Technology. **"Machine Learning Approaches to Secure Virtual Machine Migration in the Cloud"**

Dr. Soumitra Bhuyan, School of Public Health. **"Case Studies on Health Information Security and Privacy Breach in the United States"**

Dr. Deepak Venugopal & Dr. Naveen Kumar. Department of Computer Science & Business Information Technology. **"Content-Based Detection of Fake Reviews Using Deep Learning"**

Smart Cities

A partnership between the University of Memphis and the City of Memphis, the Smart Cities Research Cluster addresses the needs of Memphis citizens utilizing emerging technologies and innovations arising from research at the UofM.

Mobile Sensor Data-to-Knowledge (MD2K)

MD2K is one of 11 national Big Data Centers of Excellence awarded by the National Institutes of Health (NIH) as part of its Big Data-to-Knowledge initiative. It continues its research and development of innovative tools that make it easier to gather, analyze and interpret health data generated by mobile and wearable sensors. The goal is to reliably quantify physical, biological, behavioral, social and environmental factors that contribute to health and disease risk. *See the in-depth interview on page 8.*

Institute for Intelligent Systems (IIS)

The IIS is dedicated to advancing the state of knowledge and capabilities of intelligent systems, including psychological, biological and artificial systems. It is using an interdisciplinary approach that brings together researchers from many different research areas in the cognitive sciences, including biology, communication sciences & disorders, computer science, education, engineering, linguistics, philosophy, physics and psychology.

We're in this together.

Expanding our mission of innovation depends on an active, engaged and supportive citizenry. That's why the FedEx Institute of Technology is always looking for new alliances in both the academic and business communities. Whether you want to support us, need help with a new research project or a new product, or simply want more information about all of the work we do, we encourage you to visit us online or give us a call. Together, we can make exciting new discoveries and drive innovation toward a bright and opportunity-filled future.

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