Hagen E. Fritz

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EDUCATION

University of Texas at Austin | Cockrell School of Engineering **June 2018 – Present**
Ph.D. Civil Engineering – Building Energy and Environments

University of Texas at Austin | Cockrell School of Engineering **Aug 2016 – May 2018**
M.S. Environmental and Water Resources Engineering – Indoor Air Quality
Thesis: Effects of Scented Personal Care Products on Ozone Reactivity with Human Building Occupants

University of Texas at Austin | Cockrell School of Engineering **Aug 2012 – May 2016**
B.S. Civil Engineering

AWARDS AND RECOGNITION

Scholarships, Fellowships, and Grans

Walter L. and Reta Mae Moore Graduate Fellowship	2016
University of Texas Legacy Scholar Scholarship	2016
Green Fund Grant	2021

Awards and Recognition

UT CAEE, Outstanding Teaching Assistant	2018
UT CAEE Sustainable Doghouse Challenge, People's Choice Award	2017
People's Choice Award, UT CAEE Graduate Student Symposium	2021

RESEARCH EXPERIENCE

Building Energy and Environments, Graduate Research Assistant **June 2018 – Present**
PI: Dr. Zoltan Nagy and Kerry Kinney, Civil, Architectural and Environmental Engineering | UT Austin

- Creating and testing a low-cost environmental module of sensors built using Raspberry Pi microcomputers that is capable of characterizing the indoor air quality and thermal conditions in one's bedroom
- Testing the efficacy of wearable fitness trackers to detect sleep quality through tests conducted at the UT Sleep Lab, comparing results from the fitness trackers to more conventional sleep quality tests like polysomnography
- Deploying wearable fitness trackers alongside environmental module to students in dorms on UT's campus to see if key indoor air pollutants have an appreciable effect on an occupant's sleep quality
- Created low-cost sensor network on UT's campus to measure temperature, relative humidity, and particulate matter – see map.
- Developing calibration factors for various low-cost sensors using a variety of machine learning algorithms to improve the accuracy of these devices.

Whole Communities, Whole Health, Graduate Research Assistant **Nov 2018 – Present**
University of Texas at Austin Bridging Barriers Program | UT Austin

- Multi-disciplinary group of researchers whose goal is to make sure that advances in behavioral and health sciences reach under-represented groups in the Texas community
- Gathering initial data from UT student community using low-cost environmental sensors created in-house using Raspberry Pi microcomputers, wearable fitness trackers, phone sensors, and electronic surveys
- Analyzing data from over 1600 participants in Python-based Jupyter Notebooks to determine how thermal conditions and indoor air quality might affect sleep quality
- Deploying more robust sensor technologies to low-income communities in the Austin area to ascertain what effects their environments produce on their health and mental well-being

Building Energy and Environments, Graduate Research Assistant **Aug 2017 – Aug 2018**
PI: Dr. Zoltan Nagy and June Young Park, Civil, Architectural and Environmental Engineering | UT Austin

- Helped program Raspberry Pi computers to gather occupancy data via Bluetooth and light levels in university offices

- Developed algorithm in Python3 for a smart lighting control system for single office spaces using a Markhov Decision Process
- Deployed hardware with smart lighting control system to 5 offices over a period of 3 weeks and analyzed the resulting data to validate machine learning model

Indoor Air Quality, Graduate Research Assistant **Aug 2016 – May 2018**

PI: Dr. Richard Corsi and Dr. Atila Novoselac, Civil, Architectural and Environmental Engineering | UT Austin

- Healthy High School PRIDE (Partnership in Research on InDoor Environments): A field campaign funded by the US EPA to sample and analyze indoor air quality of central Texas high schools. Determined ozone decay rates to occupants and classroom surfaces using carbon dioxide and ozone data gathered during the field campaign and additional experiments performed in unoccupied classrooms during the summer.
- Effects of Scented Personal Care Products on Ozone Reactivity with Human Building Occupants: Determined ozone decay rates to humans without and with a scented body spray applied by ozonating human subjects in a controlled environmental chamber.

Ocean Engineering Group, Undergraduate Research Assistant **Dec 2015 – Aug 2016**

PI: Dr. Spyros Kinnas and Allen Du, Civil, Architectural and Environmental Engineering | UT Austin

- Selected to assist graduate research students with optimizing the design of ducted propellers and turbines.
- Simulated the design of the propellers and turbines in ANSYS Fluent and analyzed the results using a linked program developed in Fortran 90.

Transportation Engineering Department, Undergraduate Research Assistant **Dec 2014 – July 2016**

PI: Dr. Stephen Boyles and Michael Levin, Civil, Architectural and Environmental Engineering | UT Austin

- Selected to assist graduate research students in the areas of intersection management of autonomous vehicles and presented findings at a posted competition on campus
- Assisted the Autonomous Vehicle group by compiling the group's research and findings into technical reports provided to the Texas Department of Transportation

Technologies for Renewable Energy Generation and Management NSF REU, Undergraduate Research Assistant **June 2015 – Aug 2015**

PI: Dr. Joel Burken, Civil and Environmental Engineering | Missouri S&T

- Selected to design and implement experiments to test the water retention and release properties of a typical green roof soil mixed with various additives
- Attended workshops to embellish presentation and scientific writing skills and presented findings in a poster competition on campus.

TEACHING EXPERIENCE

UT CAEE Department, Graduate Teaching Assistant **Fall 2020**

Professor: Dr. Zoltan Nagy, Civil, Architectural and Environmental Engineering | UT Austin
Course(s): HVAC Design

- Provided introductory lessons on Python and Jupyter Notebook in addition to a few lectures covering psychrometrics and heat exchangers
- Held office hours each week and graded all assignments including homeworks, quizzes, exams, and final projects

UT CAEE Department, Graduate Teaching Assistant **Fall 2018**

Professor: Dr. Atila Novoselac, Civil, Architectural and Environmental Engineering | UT Austin
Course(s): ARE 301 Introduction to Architectural Engineering

- Helping students to understand and construct wood-frame models for residential construction and evaluating and grading student groups' model
- Teaching students the basics of energy analysis through the use of a simplified case study that builds off a wood-frame model developed in the first part of the course

UT CAEE Department, Graduate Teaching Assistant **Fall 2016 – Spring 2018**

Professor: Dr. Howard Liljestrand, Civil, Architectural and Environmental Engineering | UT Austin
Course(s): CE 311K Introduction to Computer Methods, CE311S Probability and Statistics for Civil Engineers, CE 319F Elementary Mechanics of Fluids

- Designed and gave lectures to students in laboratory sections in addition to grading assignments and holding office hours for extra instruction. Have assisted in the following undergraduate courses:
- CE 311K Introduction to Computer Methods (Fall 2016, 17, and Spring 2017): Organization and programming of civil engineering problems for computer solutions
- CE 319F Elementary Mechanics of Fluids (Summer 2018): Fluid properties, hydrostatics, elements of fluid dynamics, energy and momentum, boundary layers, similitude, pipe flow, metering instruments, drag forces
- CE 311S Probability and Statistics for Civil Engineers, Teaching Assistant (Spring 2018): Basic theory of probability and statistics with practical applications to civil engineering problems, including statistical inference and sampling

Austin Learning Center, Math and Science Tutor **Fall 2016 – Fall 2021**

- Tutoring middle and high school students in the topics of algebra I, geometry, algebra II, pre-calculus, chemistry, physics, and computer science
- Responsible for staying up-to-date with current topics in each of these subjects and with regular students' homework and exam schedules

UT Physical Education Department, Assistant Coach **Spring 2018 – Fall 2021**

Head Coach: Geoff Rich, Department of Kinesiology and Health Education | UT Austin
Courses: Beginning, Intermediate, and Advanced Volleyball

- Helped with each level of the course throughout many semesters, helping with typically two courses during each semester
- Assisted the head coach by leading drills, further developing student's techniques, officiating in-class games, managing equipment, and providing feedback during games and drills.

PUBLICATIONS

Journals

- Levin, M. W., Fritz, H., & Boyles, S. D. (2017). On Optimizing Reservation-Based Intersection Controls. *IEEE Transactions on Intelligent Transportation Systems*, 18(3), 505-515.
- Park, J. Y., Dougherty, T., Fritz, H., & Nagy, Z. (2018). LightLearn: An adaptive and occupant centered controller for lighting based on reinforcement learning. *Building and Environment*.
- Ganesh, H. S., Fritz, H. E., Edgar, T. F., Novoselac, A., & Baldea, M. (2019). A model-based dynamic optimization strategy for control of indoor air pollutants. *Energy and Buildings*, *195*, 168-179**.**
- Ganesh, H. S., Seo, K., Fritz, H. E., Edgar, T. F., Novoselac, A., & Baldea, M. Indoor air quality and energy management in buildings using combined moving horizon estimation and model predictive control. *Journal of Building Engineering*, *33*, 101552.
- Wu, C., Fritz, H., Nagy, Z., Maestre, J. P., Thomaz, E., Julien, C., ... & Schnyer, D. M. (2020). Multi-Modal Data Collection for Measuring Health, Behavior, and Living Environment of Large-Scale Participant Cohorts: Conceptual Framework and Findings from Deployments. *arXiv preprint arXiv:2010.08457*.

Conference Proceedings

- Park, J. Y., Dougherty, T., Fritz, H., & Nagy, Z (2018). Reinforcement Learning for Occupant Centered Building Control System. *2018 CHI Conference,* Montreal, Canada, April, 2018
- Park, J.Y. Park, Dougherty, T., Fritz, H. and Nagy, Z. LightLearn: Occupant centered building controller using reinforcement learning to adapt systems to humans. *7th International Building Physics Conference IBPC2018*, Syracuse NY, September, 2018

Miscellaneous

- Kockelman, K. M., Boyles, S. D., Avery, P., Claudel, C., Bansal, P., Loftus-Otway, L., Wagner, W., Stewart, D., Sharon, G., Albert, M., Fritz, H., & Clements, L. (2016). Bringing smart transport to Texans: ensuring the

benefits of a connected and autonomous transport system in Texas--final report (No. FHWA/TX-16/0-6838-2). Texas. Dept. of Transportation. Research and Technology Implementation Office.

- Kockelman, K., Boyles, S., Stone, P., Fagnant, D., Patel, R., Levin, M. W., Sharon G., Simoni, M., Albert, M., Fritz, H., & Hutchinson, R. (2017). An assessment of autonomous vehicles: traffic impacts and infrastructure needs (No. FHWA/TX-17/0-6847-1). University of Texas at Austin. Center for Transportation Research.

CONFERENCE PRESENTATIONS

- R. Corsi*, L. Lesnick, **H. Fritz,** and A. Novoselac. Ozone Deposition in Portable Classrooms in Central Texas. International Society of Indoor Air Quality & Climate (ISIAQ): *Indoor Air 2018*, Philadelphia, PA. July 2018. (oral, accepted)
- **J.Y. Park**, T. Dougherty, H. Fritz, and Z. Nagy, LightLearn: An Adaptive and Occupant Centered Controller for Lighting based on Reinforcement Learning. *OB-18: The International Symposium on Occupant Behaviour, Ottawa Canada*, October, 2018 (oral, accepted)
- **H. Fritz**, W. Waites, S. Bastami, K. Kinney, Z. Nagy, BEVO Beacon: A Low-Cost Sensor Platform to Monitor Indoor Environmental Quality. *AAAR 2019*, Portland, OR. November 2019 (poster, accepted)
- **H. Fritz,** S. Bastami, K. Kinney, S. Schnyer, Z. Nagy, Exploring the relationship between multiple indoor air pollutants and sleep quality in university students, *Indoor Air 2020,* Seoul, South Korea, November 2020 (poster, accepted)
- **H. Fritz,** K. Kinney, Z. Nagy, Ecologically Valid, Multimodal Data Collection, *BuildSys 2020,* Yokohama, Japan, November 2019 (poster, accepted)
- **H. Fritz,** L. Calvin, K. Kinney, Z. Nagy, Validity of a Dense, Low-Cost Particulate Matter Sensor Network, *BuildSys 2020,* Yokohama, Japan, November 2019 (poster, accepted)
- **H. Fritz**, K. Kinney, A. Novoselac, Z. Nagy, Ventilation and Indoor Air Quality in Residential Bedrooms, *ASHRAE Annual Conference 2021,* Phoenix, AZ, June 2021 (oral, accepted)

PROFESSIONAL MEMBERSHIPS

ASHRAE, student member — Current
International Society of Indoor Air Quality and Climate (ISIAQ), member — Current

LEADERSHIP AND COMMUNITY INVOLVEMENT

ASHRAE UT Student Chapter, Co-President — **May 2018 – Fall 2021**

- Helping to recruit members, organize meetings, communicate with the ASHRAE local branch, and organize events for student members.
- Helped organize sustainability panel held on campus to discuss what "green" buildings are, how they come about, and what the future holds
- Organized a panel discussion for UT's Energy Week titled "Future of Building Energy Efficiency: Smart Buildings or Building Smarter?"
- Organizing UT's Civil, Architectural, and Environmental Engineering department's 3rd and 4th annual Sustainable Dog House Challenge

UT Men's Club Volleyball, Webmaster — **Nov 2019 – Aug 2020**

- Manage the team's website by updating with rosters, events, and results from tournaments held in the greater Texas area
- Help manage general club activities like promoting fundraisers and volunteer work amongst the members of the team

UT Sports Club Council, Member — **Aug 2015 – May 2017**

- Helped organize events for UT sports clubs including a canned food drive, organization fair, community service project involving feeding the homeless, and a field day for all sport club members
- Allocated the RecSports budget to the different sports club based on need and merit
- Personally re-organized and rewrote the sport club application

UT Men's Ultimate Frisbee, President, Vice-President, and Treasurer — **Aug 2013 – May 2016**

- Treasurer (2013 – 2014): Made purchases for the team including tournament fees, rental cars, and airfare for out-of-state tournaments. Managed the expenses for each player including dues, gas reimbursements, and jersey/equipment purchases.
- Vice-President (2014 – 2015): Assisted the President and other executive board members by coordinating tournaments, making miscellaneous purchases, and organizing the UT-hosted tournament.
- President (2015 – 2016): Conducted presentations to the club regarding safety and the budget. Coordinated with Texas A&M University to host a tournament on their campus and organized the South Texas D1 Sectionals tournament in Kyle, TX.

Aerospace Engineering Department, First-Year Interest Group Mentor **Aug 2014 – May 2015**

- Attended a one-semester course regarding how to be a successful First-Year Interest Group (FIG) mentor
- Coordinated with the Aerospace Engineering department's undergraduate advisor to create a series of lectures regarding topics vital to a university freshmen's success.
- Gave weekly 45-minute presentations to a group of 15 aerospace engineering freshmen

Aerospace Engineering Department, Undergraduate Peer Advisor **Aug 2013 – May 2014**

- Held open office hours each week for students to ask questions regarding the aerospace engineering curriculum, courses, and career paths within the major.

UT New Student Services, Freshmen Orientation Advisor **Jan 2013 – July 2013**

- Attend a one-semester course regarding how to be a successful freshmen orientation advisor (OA)
- Supervised and lead incoming freshmen and transfer students during multiple university orientation sessions during the 2013 summer semester
- Wrote and performed in programs to educate freshman regarding campus issues and university information
- Created and conducted campus tours

SKILLS

Hard: Microsoft Office Suite, Wordpress, SketchUp, OpenStudio, ANSYS Fluent/AirPack, Soldering, Laser Cutting
Programming: Fortran 90, MATLAB, Python, LaTex, familiarity with Bash/Linux, HTML, Swift, Java
Soft: Strong organization and multitasking skills, willingness to help others/team player, and effective communication abilities

ACTIVITIES

UT CAEE Graduate Student Assembly Board, member	May 2020 – Present
UT ASHRAE Student Chapter, member	Aug 2017 – May 2018
UT Architectural Engineering Institute, member	Aug 2016 – May 2017
UT Men's Ultimate Frisbee, member	Aug 2012 – May 2016
Longhorn Energy Club, member	Sep 2018 – Aug 2019
UT Men's Club Volleyball, member	Sep 2018 – Aug 2020

REFERENCES

- Zoltan Nagy, Ph.D., Professor Civil, Architectural, and Environmental Engineering, University of Texas at Austin, nagy@utexas.edu
- Kerry Kinney, Ph.D., Professor Civil, Architectural, and Environmental Engineering, University of Texas at Austin, kakinney@utexas.edu
- Richard L. Corsi, Ph.D., Dean Maseeh College of Engineering and Computer Science, Portland State University, corsi@mail.utexas.edu
- Howard Liljestrand, Ph.D., Professor Civil, Architectural, and Environmental Engineering, University of Texas at Austin, liljestrand@mail.utexas.edu
- Atila Novoselac, Ph.D., Professor Civil, Architectural, and Environmental Engineering, University of Texas at Austin, atila@mail.utexas.edu

- Joel Burken. Ph.D., Professor Civil and Environmental Engineering, Missouri University of Science and Technology, burken@mst.edu
- Becky Fliss, MA, Founder and CEO, Austin Learning Center, becky@austinlearningcenter.com
- Geoff Rich, MA, Specialist, University of Texas at Austin, geoff@austin.utexas.edu