**2022 Intermountain Conference on Engineering, Technology, and Computing (IETC)**

**Welcome**

Welcome to the second annual Intermountain Conference on Engineering, Technology, and Computing. After an inaugural conference interrupted by the COVID pandemic, we are excited to meet in person for the first time. We have 58 papers in Engineering, 21 in Computing, and 10 papers in Technology We also welcome a new track, engineering, and technology education. It has 8 papers.

The theme of this year’s conference, “Innovations and Solutions for Today’s Challenges” expresses one of the two visions of this conference. While engineering, technology, and computing are different disciplines, they work together to create practical solutions. This conference embodies the synergy.

The second vision is to tap into the vibrancy of students, especially undergraduate students. This conference especially supports undergraduate students and gives them opportunities to share their innovative ideas. To this end, we also have over forty posters, mainly of undergraduate research and capstone projects.

We look forward to a stimulating conference, and hope you find it educational and enjoyable.

* Neil Harrison, General Chair

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**IETC Schedule**

Friday, May 13

**9:00 – 10:00 Opening Session, Room CS 404**

 **9:00 - 9:15 Opening remarks, Chairs**

**9:40 – 10:00 Keynote: Jake Barker, Rocky Mountain Power**

**Continual Reliability Improvement**



PacifiCorp has continually and steadily improved its service reliability to customers as measured by SAIDI and SAIFI. This presentation will detail the programs and practices put in place to achieve continual improvement, as well as discuss ideas for future improvement.

Jake Barker serves as director of distribution engineering and area transmission planning for PacifiCorp. He also has responsibility for customer generation engineering and power quality engineering. His responsibilities include ensuring PacifiCorp’s distribution and sub-transmission grid provides adequate capacity to serve customers reliably, customers’ power quality is within standards and customer generation installations comply with company interconnection policy. Previous to his current role, Barker worked in asset management developing the 10 year capital plan for major projects as well as managing customer engineering services and smart grid. Barker’s background at PacifiCorp includes service as a transmission planner, manager of distribution engineering and distribution engineer for downtown Salt Lake City, Utah. Prior to PacifiCorp, Barker worked for the Salt Lake Organizing Committee for the Olympic Winter Games of 2002 as a project engineer in timing and scoring. He received a master of business administration degree from the University of Utah, and an electrical engineering degree from Utah State University.

**10:00 – 10:20 Break**

 **Poster Session: Location: CS Building-Losee Center Breezeway**

**10:20 – 11:40 Session 1**

**Engineering 1 (Controls\Electrical Engineering 1) – Room CS 410**

Session Chair: Afsaneh Minaie

**Nonlinear Control Algorithm for Systems with Convex Polytope Bounded Nonlinearities**

Olli Jansson and Matt Harris

**Nonlinear, Low-Energy-Actuator-Prioritizing Control Allocation for Winged eVTOL UAVs**

Mason B. Peterson, Randal W. Beard, and Jacob B. Willis

**Temperature Uniformity Control in a Gas Heated Box Furnace**

Arthur Peck and Dakota Roberson

**Engineering 2 (Machine Learning/Artificial Intelligence 1) - Room CS 411**

Session Chair: Mohammad Shekaramiz

**Sparse Bayesian Learning via Variational Bayes Fused with Orthogonal Matching Pursuit**

 Mohammad Shekaramiz and Todd K. Moon

**Offline Signature Verification: A Study on Total Variation versus CNN**

 Kateryna Anatska and Mohammad Shekaramiz

**System Identification and Machine Learning Model Construction for Reinforcement Learning Control Strategies Applied to LENS System**

 Golam Gause Jaman, Asa Monson, Kaman Roy Chowdhury, Marco Schoen, and Thomas Walters

**Computing 1 (Systems) - Room CS 402**

Session Chair: Paul Bodily

**Exploring AV1 Encoder Potentials for Priority-Driven Wireless Multimedia Services**

 Evan Ballesteros, Krishna Murthy Kattiyan Ramamoorthy, and Wei Wang

**Human Cognition Aware QoE for NOMA Pricing: A Prospect-Theoretic Augmentation To Non-Orthogonal Wireless Multiple Access**

 Wei Wang

**Communication without Connection**

 Jeffrey Johnson, Robert Foster Houghton, and Alex Jensen

**A Reference Architecture for Healthcare Systems with Coded Terminology Support**

 Renato F. Bulcao-Neto, Valdemar V. Graciano Neto, and Alessandra Alaniz Macedo

**Education 1 (Education and Technology) – Room CS 403**

Session Chair: Larry Zeng

**Curriculum Development for Teaching Cybersecurity of Industrial Control Systems & Critical-Infrastructure**

 Basil Hamdan and Rawan Al Nsour

**Online Engineering Education: Laboratories Factors and Barriers During the Pandemic** **- A Case Study**

Rawan Al-Nsour, Ruba Alkhasawneh, and Sura Alqudah

**Syntax Exercises and Their Effect on Computational Thinking**

Marina Johnson, Hillary Swanson, and John Edwards

**Examples of Machine Learning Models from Classic to Modern**

Gengsheng L. Zeng

**Technology 1 (Mixed Reality/ Technology Design) – Room CS 401**

Session Chair: Kodey Crandall

**Teaching & Learning in Virtual Reality: Metaverse Classroom Exploration**

 Emily Hedrick, Michael Harper, Eric Oliver, and Dan Hatch

**Theatrical and Spatial Modes of Presenting the Endowment Ritual in Latter-day Saint Temples**

 Brandon R. Ro

**Using Biometric Data to Assess the Interior Design of Transitional Housing**

 Derek Stevens

**Poster Judging Session 1: CS Building-Losee Center Breezeway**

**11:40 – 1:00 Lunch**

 **Poster Session: Location: CS Building-Losee Center Breezeway**

**1:00 – 2:20 Session 2**

**Engineering 3 (Transportation Engineering 2) – Room CS 410**

Session Chair: Khaled Shaaban

**Challenges and Lessons Learned from Building a New Road Drainage System in a Developing Country**

Khaled Shaaban

**COVID-19 Impact on Traffic Fatalities in Utah**

Khaled Shaaban and Mitch Mortimer

**Effect of Through Movement Flow Rate on Left-Turn Lane Utilization at Signalized Intersections**

Mohammad Shareef Ghanim and Khaled Shaaban

**Driver Compliance at All-Way Stop-Controlled Intersections**

Khaled Shaaban, Steven Taylor, Ryan Jackson, and Dustin Wall

**Engineering 4 (Machine Learning/Artificial Intelligence 2) - Room CS 411**

Session Chair: Mohammad Shekaramiz

**Automated Hearing Impairment Diagnosis Using Machine Learning**

 Kyra Taylor, Waseem Sheikh

**Identifying Patterns in Fault Recovery Techniques and Hardware Status of Radiation Tolerant Computers Using Principal Components Analysis**

Fereshteh Ramezani, Christopher Major, Colter Barney, Justin Williams, Brock J. LaMeres, and Bradley M. Whitaker

**Facial Password Data Augmentation**

 Shad Torrie, Andrew Sumsion, Zheng Sun, and Dah-Jye Lee

**Feature Analysis in Satellite Image Classification Using LC-KSVD and Frozen Dictionary Learning**

 Kaveen Liyanage and Bradley M. Whitaker

**Computing 2 (Machine Learning 1) – Room CS 402**

Session Chair: JP Tang

**Composition of Short Stories Using Book Recommendations**

 Delaney Moor, Aleksandar Petrovic, Caitlyn Bailey, and Paul Bodily

**Stock Market Feature Selection Using Orthogonal Array**

 Jingpeng Tang, Qianwen Bi, Ian Beal, Eric Stauffer, Yashwanth Kotha, and Smita Gupta

**Adaptive Encrypted Traffic Characterization via Deep Representation Learning**

Jonathan Wintrode and David DeTienne

**Education 2 (COVID-19 and Online Teaching) – Room CS 403**

Session Chair: Ghimire, Aashish

**Quantifying Student Struggles using Heatmaps and Keystroke Data**

 Gordon Fjeldsted and John Edwards

**Introspection with Data: Recommendation of Academic Majors Based on Personality Traits**

 Aashish Ghimire, Travis Dorsch, and John Edwards

**Remote Microelectronics Laboratory Education in the COVID-19 Pandemic**

 Chris J. Winstead

**Impact of the COVID-19 on Undergraduate Research for Engineering Students and Possible Strategies to Promote Research**

 Khaled Shaaban and Alaa Alsarhan

**Technology 2 (Technology Management)– Room CS 401**

Session Chair: Rawan Al-Nsour

**Developing & Implementing a System of Rubrics for Assessing Interaction Design**

 Dan Hatch and Eric Oliver

**What Twitter is Saying About Women in Technology**

 Kelsey Stephens and Kodey Stephen Crandall

**Examining the Role of Art in Healthcare Architecture through Pre-Attentive Visual Processing Software and Surveys**

 Ian Hargrave

**Digital Twins in Control Cabinet Construction**

 Dusko Lukac, Sergio Montiel, Jeffrey Kilburn, Sean Mulherrin, Todd Telles, and Ahmad Omari

**Poster Judging Session 2: CS Building-Losee Center Breezeway**

**2:20 – 2:40 Break**

 **Poster Session: Location: CS Building-Losee Center Breezeway**

**2:40 – 3:40 Session 3**

**Engineering 5 (Transportation Engineering 3) – Room CS 410**

Session Chair: Khaled Shaaban

**Operational Performance of Signalized Intersections: HCM and Microsimulation Comparison**

 Mohammad Shareef Ghanim, Khaled Shaaban, and Suhaib Allawi

**Analysis of Pedestrian Crashes in Utah**

 Khaled Shaaban and Austin Pinter

**Engineering 6 (Wind Turbine Inspection: Machine Learning/Drone Path Planning) – Room CS 411**

Session Chair: Mohammad Shekaramiz

**Drone Path Planning and Object Detection via QR Codes; A Surrogate Case Study for Wind Turbine Inspection**

 Branden Pinney, Shayne Duncan, Mohammad Shekaramiz, and Mohammad A.S. Masoum

**Locating and Extracting Wind Turbine Blade Cracks Using Haar-like Features and Clustering**

 Cherif Seibi, Zachary Ward, Mohammad A.S. Masoum, and Mohammad Shekaramiz

**Residual and Wavelet based Neural Network for the Fault Detection of Wind Turbine Blades**

 Lalle M. N’diaye, Austin Phillips, Mohammad A.S. Masoum, and Mohammad Shekaramiz

**Wind Turbine Fault Classification Using Support Vector Machines with Fuzzy Logic**

Colton Seegmiller, Blake Chamberlain, Jordan Miller, Mohammed A.S. Masoum, Mohammad Shekaramiz

**Computing 3 (Image processing) - Room CS 402**

Session Chair: Bob Houghton

**Handwritten Multi-Digit Recognition with Machine Learning**

 Soha Boroojerdi and George Rudolph

**Learn Dynamic Facial Motion Representations Using Transformer Encoder**

 Zheng Sun, Andrew Sumsion, Shad Torrie, and Dah-Jye Lee

**Engineering 7 (Communications Engineering 1) – Room CS 403**

Session Chair: Todd Moon

**Soft Linear Algebra over Noisy GF(2) matrices**

 Todd K. Moon and Jacob H. Gunther

**Scheme of Secure Satellite Intercommunications Based at Solar Photons**

 Huber Nieto -Chaupis

**Outdoor Surveillance and Mitigation of Infected Zones Through Engineered Electrical Fields**

 Huber Nieto-Chaupis

**Using Dual Approximation for Best Linear Unbiased Estimators in Continuous Time, with Application to Continuous-Time Phase Estimation**

Todd K. Moon, Randy Christensen, and Jacob H. Gunther

**Technology 3 (Automotive/ Industrial Automation) – Room CS 401**

Session Chair: David Frame

**Using Gasoline Engines to Power Electric Cars**

 Edward Durney and Brian Durney

**Lightweight Foldable Robotic Arm for Drones**

 Wesley Thomas, Parker Wegrowski, Jacob Lemirick, and Taher Deemyad

**Make Cars Modular Again**

 Edward Durney and Brian Durney

**Poster Judging Session 3: CS Building-Losee Center Breezeway**

**3:45 – 4:45 Session 4**

**Engineering 8 (Mechanical and Civil Engineering 1) – Room CS 410**

Session Chair: Masood Amin

**Design and Development of a Single-Stage Axial Compressor Testbench**

 Shishir Khanal, Cooper Dastrup, Andrew Anderson, Anish Sebastian, and Marco P. Schoen

**Sarrus Linkage Aerial Drone Arm**

 Jacob Lemirick, Wesley Thomas, Parker Wegrowski, and Taher Deemyad

**Jet Engine Modeling Using T-MATS with Experimental Verification**

 Kellie Wilson, Marco P. Schoen, and Ji-Chao Li

**Engineering 9 (Communications Engineering 2) – Room CS 411**

Session Chair: Todd Moon

**Soft Solution of Noisy Linear GF(2) Equations**

 Todd K. Moon, Jared O. Jensen, and Jacob H. Gunther

**Doppler Shift and Envelope Distribution of V2V Channels at 5.9 GHz in Suburban Environments**

 Carlos A. Gutierrez, Willie Harrison, Michael Rice, Bryan Redd, and Autumn Twitchell

**Fabrication of Metallic Far-Infrared Filters**

Jared E. Payne, Joseph Eddy, Hunter R.J. Stevenson, Brad Ferguson, Ryan T. Beazer, Gregory N. Nielson, and Stephen M. Schultz

**Computing 4 (Machine Learning 2) - Room CS 402**

Session Chair: Larry Zeng

**Sketch-a-Map (SAM): Creative Route Art Generation**

 Marcus Goeckner, Kirill Brainard, Austin Lyman, and Paul Bodily

**Authorship Verification via Linear Correlation Methods of n-gram and Syntax Metrics**

 Jared Ray Nelson and Mohammad Shekaramiz

**Using Neural Networks to Model the Spread of COVID-19**

 Isaac Boyd, David Hedges, Benjamin T. Carter, and Bradley M. Whitaker

**Technology 4 (Technical Sessions) – Room CS 403**

Session Chair: Tyler Bird

**IT/OT Cyber Security**

 Rockwell Automation / Codale - MATTSON Jacob

**Siemens Motor Management and Data Usages**

 Siemens Industry / Mark Berger

**Post-Pandemic IoT Electronics/ Accelerated Change**

 Engineering Technology / David W. Frame

Saturday, May 14

**9:00 – 9:30 Plenary, CS 404**

**Keynote: Tulinda Larsen**, **Utah Advanced Materials Manufacturing**

**Initiative: New Technologies in Manufacturing**



Dr. Tulinda Larsen is Executive Director, Utah Advanced Materials and Manufacturing Initiative (UAMMI), a public-private partnership to elevate the advanced materials and advanced manufacturing industry in Utah. She serves as the key spokesperson for UAMMI at industry events and before government agencies.

She began her career in Washington, D.C. as an economist at the US Department of Transportation, where she gained experience in the air transport industry. For more than 40 years, she has been a practicing economist studying various aspects of the aerospace industry.

Dr. Larsen is also an Adjunct Professor in the School of Business, Embry Riddle Aeronautical University, Worldwide Campus. She holds a Doctorate of Management from University of Maryland Global Campus, BA and MA in economics from The George Washington University.

**9:40 – 10:40 Session 5**

**Engineering 10 (Communications Engineering 3) – Room CS 410**

Session Chair: Todd K. Moon

**Audio Event Recognition in Noisy Environments using Power Spectral Density and Dimensionality Reduction**

 Siddat Bin Nesar and Bradley M. Whitaker

**Open-Source Antenna Pattern Measurement System: Development and Applications**

 Christian Hearn

**Engineering 11 (Transportation Engineering 1) - Room CS 411**

Session Chair: Khaled Shaaban

**A Time-Series Analysis of Traffic Crashes in New York City**

 Khaled Shaaban and Mohamed Ibrahim

**Review of Factors Affecting Public Transportation Ridership**

 Khaled Shaaban and Abdalla Siam

**COVID-19 and Public Transportation Usage in Utah**

 Khaled Shaaban and Luke Maeser

**Design Challenges for Hyperloop Transport Systems**

 Khaled Shaaban and Essam Radwan

**Computing 5 (Applications) - Room CS 402**

Session Chair: Sayeed Sajal

**The Quality Attributes and Architectural Tactics of Amazon Web Services (AWS)**

 Neil Harrison and Hind Milhem

**KAMI: Leveraging the power of crowd-sourcing to solve complex, real-world problems**

 Kaden Marchetti and Paul Bodily

**Engineering 12 (Civil/Environmental Engineering 1) - Room CS 403**

Session Chair: Ben Willardson

**Evaluation of Cleaning Methods for Restoring Water Drainage Through Pervious Concrete Pavement**

 Leah C. Guthrie and W. Spencer Guthrie

**Investigation of High-Frequency Ground-Penetrating Radar for Detecting Debonding of Asphalt Overlays on City Streets**

 Ammon K. Hymas, Maia A. Nelsen, Adam Z. Guthrie, Robert J. Stevens, and W. Spencer Guthrie

**Incorporating Waste Plastic in Cement-Lime Mortar Mixtures**

 Alex P. Guthrie, Nathan J. Weaver, W. Spencer Guthrie, and Aaron N. Weaver

**Technology 5 (Technology Design) - Room CS 401**

Session Chair: Dan Hatch

**Using Modular Model Cars to Drive Innovation and Learning**

 Brian Durney and Edward Durney

**Mobile Remote Assistance with Augmented Reality Applied in a Power Distribution Utility: A Qualitative Study**

Paula Zenni Lodetti, Aguinaldo B. dos Santos, Leandro Takeshi Hattori, Edgar Gerevini Carvalho, and Marcos A. Izumida Marins

**10:40 – 11:00 Break**

**11:00 – 12:00 Session 6**

**Engineering 13 (Controls\Electrical Engineering 2) – Room CS 410**

Session Chair: Afsaneh Minaie

**Design and Implementation of a Quadcopter Drone Control System for Photography Applications**

 Blake Chamberlain and Waseem Sheikh

**Design, Analysis, and Manufacturing of a Novel Electrically-Assisted Human Powered Vehicle**

 Tyler Orr, Nathan Robertson, Jonathan Hill, Kevin McAllister, Chandler Hoopes, and Israd Jaafar

**Design of a Multi-Effects Guitar Pedal Controlled via Bluetooth App**

 Nick Robillard, Charles Farrell, Miles Pearson, and Hua Tang

**Engineering 14 (Power Systems\Electronics 1) - Room CS 411**

Session Chair: Ehsan Rohani

**Business Models for Charter Electric Bus Fleets**

Lucas Silveira dos Santos, Cesare Quinteiro Pica, Rodolfo Sabino de Moura, Pamela Rugoni Belin, Marcos Aurelio Izumida Martins, Jessica Ceolin de Bona, and Luiz Henrique Cruz

**Evolution of Electric Mobility in Brazil and Study of Charging Infrastructure to Meet the Expected Demand**

Flavio de Faveri, Daniel Gomes Makohin, Pamela Rugoni Belin, Cesare Quinteiro Pica, Leonardo Gasparini Duarte, Marcos Aurelio Izumida Martins, Marco Aurelio Gianesini, and Thiago Jeremias

**Long Range Sensor Network for Disaster Relief**

Elliot Elison, Ehsan Rohani

**Computing 6 (Education and Communication) – Room CS 402**

Session Chair: Abraham Teng

**Temporal Abstract Syntax Trees for Understanding Student Coding Thought Process**

 Delaney Moore, John Edwards, Hamid Karimi, Rajiv Khadka, and Paul Bodily

**Automated Unit Testing and Test-Driven Development Approach to Teaching C++**

 Kyra Taylor and Waseem Sheikh

**BabelFish: A Seamless Solution to Communicate with Multi-Lingual Individuals**

 Clay Keisel and Sayeed Sajal

**Engineering 15 (Civil/Environmental Engineering 2) – Room CS 403**

Session Chair: Ben Willardson

**Factors that Influence a Student’s Decision to Pursue a Bachelor’s Degree in Civil Engineering**

Gina Young, Alexis Post, and W. Spencer Guthrie

**Utah Lake Nutrient Cycling Studies: Limnocorral Usage and Experiments**

Rachel Ann Valek, Emily Sara Walmer, Cristian Alun Dorrett, Kaylee Brook Tanner, Anna Catherine Cardall, Gustavious Williams, and Woodruff Miller

**Mineral Precipitation in Utah Lake and its Effluent Mixing Zones**

 Jacob Taggart, Theron Miller, Alexis Navarre-Sitchler, and Gregory Carling

**12:00 – 1:00 Lunch**

**1:00 – 2:20 Session 7**

**Engineering 16 (Power Systems\Electronics 2) - Room CS 410**

Session Chair: Ehsan Rohani

**Laser Assisted Cleaving for Waveguide Facets on Silicon**

 McKay Formica, Noah Boehme, Tyler Adams, Gracie Richens, Aaron Hawkins

**Charge Detection Mass Spectrometry of Micron-Sized Particles Using a Differential Amplifier**

 Parker Allred, JuHang Kim, Yixin Song, Shiuh-hua Wood Chiang, and Aaron R. Hawkins

**Particle Concentration using Electroactuated Nanopumps**

 Hollis Belnap, Samuel Lahti, and Aaron Hawkins

**Accelerated Protection Methodology for Broken Conductor Protection - An Implementation Case**

 Diogo Vinicius Joao, Hamilton G. B. Souza, Marcos A. Izumida Martins, and Kennedy A. Martins

**Engineering 17 (Mechanical and Civil Engineering 2) – Room CS 411**

Session Chair: Masood Amin

**Advanced Folding Robotic Arm for Quadcopters**

 Parker Wegrowski, Wesley Thomas, Jacob Lemrick, and Taher Deemyad

**Object Detection and Navigation Strategy for Obstacle Avoidance Applied to Autonomous Wheelchair Driving**

 Nusrat Farheen, Golam Gause Jaman, and Marco P. Schoen

**Development of a Transparent Cryogenic Probe Card Based on Silicon Carbide**

Ryan Beazer, Jared Payne, Gregory N. Nielson, Rebecca Anderson, Madeline Thompson, Topher Johnson, Brad Ferguson, and Stephen Schultz

**Machining of Silicon Carbide Wafers**

 Madeline Thompson, Bradley Ferguson, Gregory N. Neilson, and Stephen Schultz

**Computing 7 (Security and Theory) - Room CS 402**

Session Chair: John Edwards

**A Comprehensive Survey: Cybersecurity Challenges and Futures of Autonomous Drones**

 Nyles Durfey and Sayeed Sajal

**Utilizing a Blockchain for Managing Sensor Metadata in Exposure Health Studies**

Aaruchi Sarbhai, Ramkiran Gouripeddi, Philip Lundrigan, Pavithra Chidamdaram, Aakanksha Saha, Randy Madsen, Julio Facelli, Katherine Sward, and Sneha Kumar Kasera

**Visualizing the 3SAT to CLIQUE Reduction Process**

 Kaden Marchetti and Paul Bodily

**John the Ripper: An Examination and Analysis of the Popular Hash Cracking Algorithm**

 Paul Bodily

**Engineering 18 (Mechanical and Civil Engineering 3) - Room CS 403**

Session Chair: Ben Willardson

**Unbalanced Civil Engineering Education on Sustainability**

Irma Wang
**Analysis of Long-Term Chlorophyll Trends in Utah Lake using Landsat Data and Lake Regions**

 Kaylee Brook Tanner, Anna Catherine Cardall, and Gustavious Paul Williams

 **A Thermoacoustically-Driven Vocal Tract Model**

Veronica Gunyan, Benjamin Miera, Abolfazl Amin, Bonnie Andersen

 **Rebalancing Civil Engineering Education to Address Social Aspects of Sustainability**

Xiaomei Wang, Andrew J. South, W. Spencer Guthrie, Clifton Farnsworth

**2:30 – 3:00 Closing session, Room CS 404**

 Closing remarks, student awards