



URCAD
UNIVERSITY RESEARCH AND
CREATIVE ACHIEVEMENT DAY

Oral Presentations – Afternoon Session 2

Location: AIH 207

Time: 12:00 PM – 2:00 PM

Lower Allston landing underground Train Station

Orion Inkel

Construction Management

Advisor: Dr. Cindy DeSellier and Dr. Talat Salama

Student from the B.S. Construction Management Program competed for the first time in the fourth annual Northeast Student competition.



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Team BEEZ KNEEZ: Robotic Assistant for the Disabled

Jahmal Bynum, Central Connecticut State University
Dang Ly, University of Connecticut
Alissa Pace, Central Connecticut State University
Justin Tran, Central Connecticut State University

Mechanical & Manufacturing Engineering Technologies (MET2) Program
Advisor:

Eric Flynn, Professor CT State Community College Gateway

This project is to develop a robotic assistant that can serve food to the disabled. 3D modeling and printing the external components of this robot are utilized to develop an ESP32 microcontroller along with a variety of sensors, including, but not limited to: infrared, inertial measurement unit (IMU), and ultrasonic sensors. These components will be programmed to allow the robot to act autonomously. The project is composed of two main parts: a modified mini fridge and a mobile robot. The modified mini fridge responds to the input for a selected meal and releases the meal container for the mobile robot to retrieve. The mobile robot retrieves the food from the mini fridge delivers the meal first to the microwave, which is located on top of the mini fridge, and then to the table.

This is a research project from the Mechanical & Manufacturing Engineering Technologies (MET2) Program, which is supported by the National Center for Next Generation Manufacturing through National Science Foundation Advanced Technological Education Program funding. The MET2 Program implements industry-driven team research projects that incorporate manufacturing engineering technologies. MET2 recruits students from community colleges and universities for the purpose of learning professional and technical skills that complement their classroom curriculum and address advanced manufacturing workforce needs.



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Team Maker Motion: 3D Scanning & Cobot Mobile Pedestal

Hanif Barrett, CT State Community College Middlesex
Anders Maxilus, CT State Community College Gateway
Latosha Murray, CT State Community College Gateway
Jeannie Tran, CT State Community College Gateway
Mechanical & Manufacturing Engineering Technologies (MET²) Program

Advisors:

Eric Flynn, Professor CT State Community College Gateway
Steve Longpre, Director of Technology & Programming, Northwest Connecticut Housing and Innovation Center

The Maker Motion project aims to design and develop a mobile cobot pedestal system for the Revopoint Vbot 3D scanning platform. The system will be used for demonstration, training, and practical applications. The project involves integrating a commercially available 80/20 pedestal structure with a custom-designed mounting interface to securely support the scanner while maintaining stability, mobility, and ease of use. The team is responsible for assessing structural requirements, creating CAD models, selecting materials, and producing a functional mounting solution that meets both technical and practical needs. This project provides hands-on, application-driven engineering experience that emphasizes real-world system integration over theoretical design.

This project enhanced engineering judgment by requiring consideration of fabrication, assembly, and system integration constraints throughout the design process. Decisions were assessed not just for theoretical performance, but also for constructability and real-world implementation. Additionally, the project emphasized the importance of clear communication, thorough documentation, and iterative development when collaborating with a team and a project sponsor.

This is a research project sponsored by the Northwest Connecticut Housing and Innovation Center (NCHIC) for the Mechanical & Manufacturing Engineering Technologies (MET²)

Program. MET² is supported by the National Center for Next Generation Manufacturing through National Science Foundation Advanced Technological Education Program funding. The MET² Program implements industry-driven team research projects that incorporate manufacturing engineering technologies. MET² recruits students from community colleges and universities for the purpose of learning professional and technical skills that complement their classroom curriculum and address advanced manufacturing workforce needs.



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Team MEK Additive Manufacturing: Part Optimization using Simulations and Additive Manufacturing

Emma Dargenio, University of Hartford

Kenyce Johnson, University of Bridgeport

Matthew Lynch, University of Hartford

Mechanical & Manufacturing Engineering Technologies (MET²) Program

Advisors:

Eric Flynn, Professor CT State Community College Gateway

Sean Belleau, Client Executive, TRIMECH

The objective of this project is to optimize a part using simulation and additive manufacturing technologies. To achieve this, a 3D scan of the part, a physical pipe, was completed. From the scan, a 3D model of the pipe was created using computer-aided design (CAD) software. Finite element analysis (FEA) analysis and a flow simulation of the 3D model were completed. With the results of the FEA and the flow simulation, the team designed a more organic model of the pipe for 3D printing to find potential efficiencies that can be made in both the pipe design and manufacturing process. By combining digital analysis with additive manufacturing, the team illustrates a modern engineering workflow that integrates design, simulation, and advanced manufacturing technologies.

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Team Motion Forms: Servo Motor Power Transmission for Robotic Arm

Diego Angeles, CT State Community College

Jacob McCann, Central Connecticut State University

Thomas Roberts, University of Connecticut

Mechanical & Manufacturing Engineering Technologies (MET²) Program

Advisor:

Dr. Haoyu Wang, Professor, Central Connecticut State University

The project focuses on designing and assembling a reliable system to consistently transmit power from a servo motor to an abrasive polishing disk for a research initiative in the Central Connecticut State University Robotics Lab. The primary goal was to engineer and optimize a servo-driven power transmission system that minimizes vibration from external sources, ensuring smoother operation and improved precision. This work supports the broader objective of developing a fully autonomous robotic arm capable of manufacturing aircraft turbine blades, for which consistency and accuracy which are critical to reducing the number of defective or scrapped parts that helps reduce cost and time spent machining.

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Team UpTime: Using Artificial Intelligence and Machine Learning for Predictive Maintenance

Michael Miranda, University of New Haven

Victor Paez, CT State Community College Gateway

Ibraheem Rana, CT State Community College Manchester

Alexander Valdivia, CT State Community College Gateway

Mechanical & Manufacturing Engineering Technologies (MET²) Program

Advisor:

Eric Flynn, Professor CT State Community College Gateway

Team UpTime set out to create a machine learning algorithm to classify and predict the remaining lifespans of bits used in computer numerical control (CNC) machines. The purpose of this research project is to allow for accurate predictions of needed maintenance before the problem occurs, removing maintenance downtime. Artificial intelligence and machine learning programs were used to digest the data collected and give precise and accurate estimates on the parts to tell how certain processes or materials could further degrade or extend lifespan. Team UpTime developed a variety of programs to achieve this, going through several algorithms and iterations to increase machine “Uptime.”

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Mineral Effects on Nonenzymatic Adenosine Monophosphate Polymerization Under Variable Hydration Conditions

Allison Gonzalez Fernandez
Chemistry
Advisor: Dr. Sarah Maurer

Various minerals have been studied for their potential role in the origins of life. Montmorillonite, specifically, has been shown to catalyze nucleotide polymerization under simulated prebiotic conditions. However, the influence of other minerals on abiogenesis remains poorly understood.

This study quantifies the extent of adenosine monophosphate (AMP) polymerization in the presence of varying minerals, acids, salts, and lipids under variable hydration conditions. The yields were determined using liquid chromatography–mass spectrometry (LC-MS). The results contribute to our understanding of how mineral chemistry and environmental factors affect nonenzymatic polymerization processes.



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From Radio Waves to Stellar Properties: Using Circumstellar Carbon Monoxide to Understand Nearby Pre-Main Sequence Stars

Caroline Kilian

Physics

Advisor: Dr. Kristine Larsen

To infer the masses of stars, astronomers typically rely on measurements of luminosity and temperature, interpreted through stellar evolution models. However, with the unprecedented accuracy and precision of distance measurements provided by the Gaia mission, combined with the angular resolution of the Atacama Large Millimeter/submillimeter Array (ALMA), a radio telescope located in Chile, it is now possible to make dynamical (i.e. direct) mass measurements of stars that host circumstellar gas disks. These dynamical mass measurements use Kepler's third law of planetary motion to derive the stellar mass based on the measured orbital velocity of gas as a function of distance from the host star. The dynamical mass can then be compared with the output of stellar evolution models to test if the models can reproduce our measurements. This serves as an important benchmark for the success of these stellar evolution models, especially as the fifteen star sample in this project represents both early main-sequence and pre-main sequence (i.e. young) stars where the astrophysical processes in this epoch are the least understood. This project uses carbon monoxide emission in gas-bearing debris disks (disks of dust and rock circling stars, analogous to the Kuiper Belt of our solar system) to measure stellar mass and identify possible non-Keplerian features of the disks. Our results show that stellar evolution models consistently overpredict the stellar masses of the stars in our sample.



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Anatomical Analysis of Hamamelis virginiana Leaf Venation in Relation to Spatial Distribution of Hormaphis hamamelidis Galls

Jessica Rustico

Biology

Advisor: Dr. Alicia Bray

Insect herbivory is a form of predation in which insects feed on a variety of plant tissues. In the case of galling insects, the interaction goes beyond the insect just feeding on plant tissue. Galling insects are specialized parasites that chemically manipulate plant tissue to form gall structures, which provide the insect with food and shelter. The process begins with the insect secreting a “cecidogen” during feeding that alters cell division in the plant, resulting in gall growth. For aphid species *Hormaphis hamamelidis*, the cecidogen enters plant cells during aphid feeding when a first instar fundatrix inserts a stylet into plant tissue. The location of feeding for this insect is typically near a plant vein, since aphids feed on nutrients in the phloem of plant vascular tissue. This would explain why gall structures are all located very close to veins of the insect's host plant, *Hamamelis virginiana*. However, this does not answer the question as to why significantly more galls were located specifically on secondary leaf veins as opposed to midrib veins or tertiary veins. This study aims to identify anatomical differences between different vein types and between galled and non-galled veins by measuring the distance of the phloem to the surface of each vein. To do this, veins will be cross-sectioned and analyzed under a compound microscope. It is predicted that phloem in galled veins and secondary veins will be closer to the surface, making access easier for aphids.