College of Engineering

R&D Expo

University of North Texas

SENIOR DESIGN

Spring 2025

UNT

COLLEGE OF ENGINEERING
Department of Mechanical Engineering

Mechanical Engineering Technology
Senior Design Abstracts
Spring 2025

The Composters - Design and Build of a Compost Testing Device

Team Members

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External Sponsors/Mentors

Project Sponsor- Z&S Tech
Sponsor- Dr. Sheldon Shi

Internal Sponsors/Mentors

Professor- Dr. Rattaya Yalamanchili
Mentor- Xuan Wang

Abstract

This project aimed to design and build a composting device to measure the biodegradability of polymer-based materials. The system was developed in accordance with the ASTM standard for determining the aerobic biodegradation of plastics under controlled composting conditions. Using a range of sensors to monitor carbon dioxide production, oxygen consumption, temperature, and humidity, the system automates data recording through an internal computing module. The rate of biodegradation is evaluated by analyzing the extent of carbon-to-carbon dioxide conversion in the material. In addition, the aim was to have the design follow a steady-state condition, creating predictable measurements that allow for better analysis and diagnostic measures. Unlike other biodegradability testing devices, our system integrates all components into a single containment unit, fully complying with ASTM standards. With the increased use of different polymer-based materials, the importance of testing and understanding decomposition becomes more critical than ever. This innovative design provides a more streamlined and automated approach to measuring biodegradation, offering potential benefits for environmental testing and material research.

Mean Green Chargers

Team Members

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External Sponsors/Mentors

Milan Patel - Charger Supply

Internal Sponsors/Mentors

R. C. “Chow” Yalamanchili, PhD, PE - Professor
Bobby Grimes - Faculty Member
FSAE - Project Provider
UNT Surplus - Component Supply

Abstract

The objective of this senior design project is to develop a custom charging cart for the SAE (EV FSAE) vehicle designed by our collegiate racing team. The cart serves a dual purpose: safely transporting the high-voltage accumulator and enabling efficient, controlled charging while complying with stringent SAE and electrical safety standards.

Key design considerations included structural analysis using 1" Chromoly steel tubing with 1/8" wall thickness to ensure frame integrity under load, ergonomic handling for pit crew operation, and the inclusion of ventilation and thermal protection systems to prevent overheating during charging. The team employed a comprehensive systems engineering approach, including detailed CAD modeling, static analysis of individual beam members, and iterative validation. Project management was executed using Primavera P6, which helped allocate resources efficiently across milestones such as the Conceptual Design Review (CDR), Procurement, Manufacturing, and Testing.

COST EFFECTIVE AUTOMATED PARKING MANAGEMENT SYSTEM

Team Members

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External Sponsors/Mentors

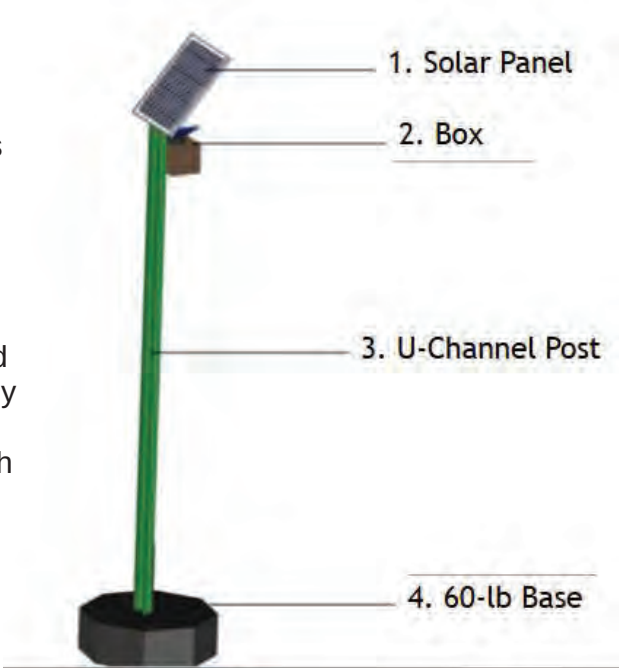
UNT Department of Parking and Transportation
Christopher Hawke

Internal Sponsors/Mentors

Dr. Rattaya Yalamanchili
Robin Pottathuparambil
UNT EMF
Austin Killam
Parker Throneberry

Abstract

Parking inefficiency has been a problem at the University of North Texas (UNT) that causes traffic congestion, long searching time, and frustration. Commercial solutions are too expensive, complex, or dependent on infrastructure, making them unsuitable for campus use. The Cost Effective Automated Parking Management System solves these challenges with a smart, scalable, and affordable solution to improve parking at UNT. The design employs Infrared Sensors to automatically count vehicles as they enter and exit and displays real-time parking availability with over 90% accuracy and under 5 seconds data latency. Our system promises long-term sustainability and dependability as components are powered by solar energy and protected by weather-resistant 3D printed ASA box casings. Developed prototype shows great efficacy in both detection and data transfer using Arduino-based microcontrollers and confirmed by technical simulations. By aligning with safety and environmental standards, our design offers a cost-effective solution to enhance parking operations and experience at UNT.



SafeFry Solutions - Garri Producer

Team Members

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Steven Ohakwe

External Sponsors/Mentors

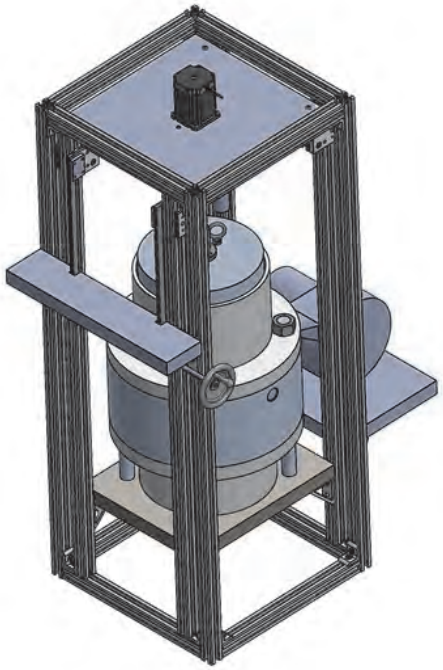
Project Sponsor- Helena Ranch LLC.
Sponsor Contact- Dr. Yalamanchili

Internal Sponsors/Mentors

Professor- Dr. Rattaya Yalamanchili
Faculty Advisor- Dr. Seifoullah Nazrasdani
Assistance and Materials- UNT EMF

Abstract

Our project focuses on the design and fabrication of a semi-automated processing machine for a popular food in west Africa called 'garri', which is made from cassava roots, to improve on the safety and ergonomics of how it is being processed currently. The scope of our design required from our sponsor includes the processes after the fermentation of the crushed cassava: de-watering, sieveing and drying, as well as making it conform to a typical household device as our target customer is for household or small-scale production. Our machine integrates a pressing mechanism to de-water the cassava mash after fermentation, an automated stirring and sieving process and drying the mash by convection using a hot-air blower. Through detailed manufacturing planning, material analysis, and cost estimation, this project demonstrates an effective balance of engineering design, ethical decision-making, and practical application for agricultural processing in resource-limited settings.



Shadeotech Unishades Machine

Team Members

Bailey Butler
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External Sponsors/Mentors

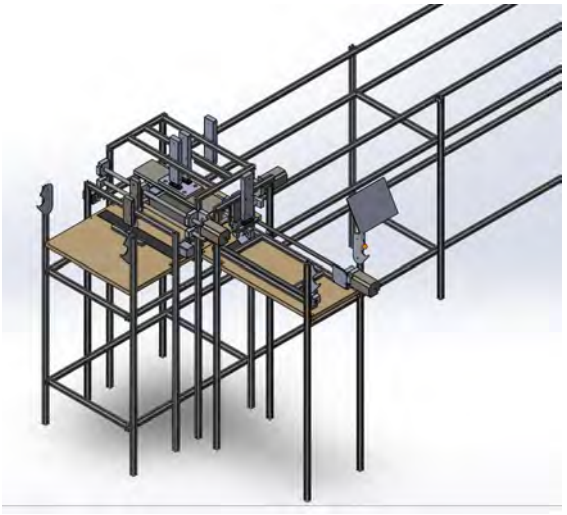
Project Sponsor - Shadeotech Window Fashions
Sponsor Contact - Moe Nilli

Internal Sponsors/Mentors

Professor - Dr. Rattaya Yalamanchili
Faculty Advisor - Dr. Hector Siller
Assistance and Materials - UNT EMF Lab
Shop Mentor - Austin Killam

Abstract

This project focuses on optimizing the manufacturing process for one of the products from Shadeotech Window Fashions. This product, the Unishades, is produced in three separate steps: measuring and cutting the fabric panels, heat-pressing a nylon header, and attaching carriers. This project streamlines production by combining the measuring, cutting, and header cutting and application into a single automated machine. The machine features an interactive tablet interface, allowing operators to select curtain lengths and quantity along with being able to adjust different operation settings. Once this is completed, the machine automatically produces the curtains with headers attached, depositing the finished panels into a basin for final assembly. By reducing manual effort and production time by 50%, automation enhances efficiency, minimizes labor intensity, and improves overall manufacturing consistency.



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