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Senior Design Day Spring 2024

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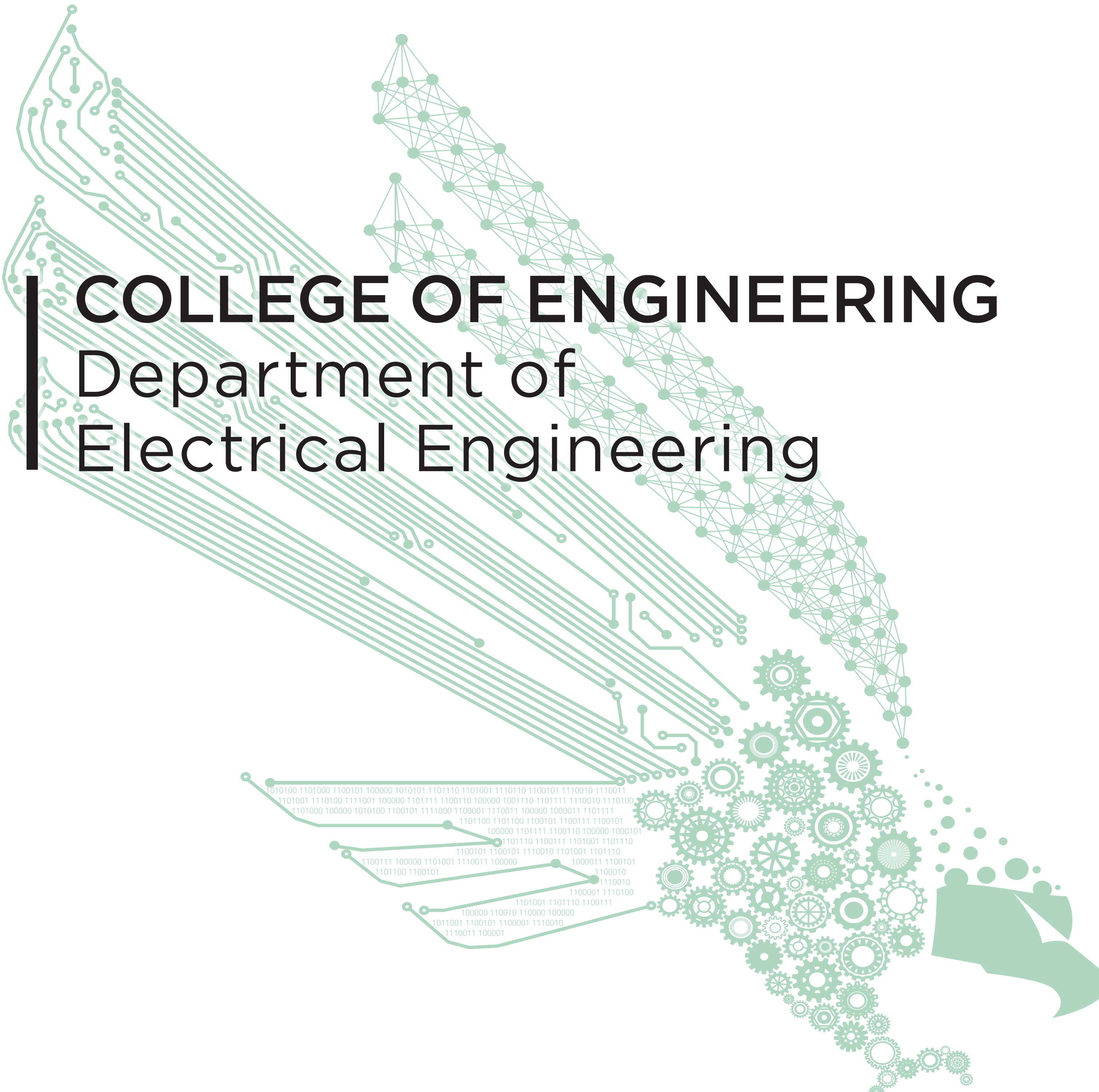

Senior Design Abstracts
Spring 2024

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Solar Powered ePaper Roadsign

Team Members

Christopher De Santiago
Shane Clark
Jared Fowler
Ramsanjeev Ramesh

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John Alexander

Internal Sponsors/Mentors

Colleen Bailey, PhD

Abstract

This project addresses the issue of high-power consumption of outdoor OLED displays by introducing a low-power e-paper display system powered by solar energy. Unlike traditional outdoor displays, this project commercializes e-paper technology for multiple displays in outdoor settings, specifically for digital road signs. The display will have remote updating capabilities that will allow for safe and convenient wireless communication. The result is an electric outdoor system that utilizes eco-friendly and energy-efficient technology with a focus on sustainability and functionality in remote outdoor locations, and the system's power consumption will be tested against traditional commercial outdoor OLED displays to ensure low power consumption is achieved.

Automating the Airspace

Team Members

Gavin Halford
Eliana Jaques
Zachary McCorkendale
Logan McCorkendale

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Internal Sponsors/Mentors

Dr. Kamesh Namuduri

Abstract

Large-scale autonomous drone operations have the potential to revolutionize the logistics and transportation sectors. This project focuses on improving independent drone navigation capabilities by integrating artificial intelligence and machine learning techniques and breaks down the problem into the three key areas: reactive, proactive, and data collection. Reactive refers to an on-drone collision detection and avoidance system characterized by a light weight, low power on drone sensor system. This system merges radar and camera capabilities and enables velocity data and computer vision fusion for accurate small object detection. A rapid vector-based avoidance algorithm will be used for efficient real-time obstacle navigation. Data collection will be handled through an onboard meteorological station designed to gather and transmit real-time atmospheric conditions, including wind speed, direction, and temperature. This information is to be forwarded to a base station, facilitating the creation of a detailed atmospheric model within the drone's operational airspace to inform flight constraints. Finally, central to the proactive navigation system is an overarching neural network that processes real-time environmental and operational data, and dynamically adjusts the drone's trajectory and flight plan to navigate the complexities of the air corridor. The development and testing phases will include the creation of prototype weather and object detection sensors for off-drone testing and validation. In flight drone avoidance and redirection testing will be handled through simulation software (MATLAB and Gazebo) environments. By addressing these key areas, the project aims to significantly advance the capabilities and autonomy of large-scale drone operations.

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Harvesting Wasted Heat Energy with Thermoelectric Generators

Team Members

Maanav Anumala
Blake Martin
Latrell Carter
Zachary Smith

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ASHRAE

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Dr. King Man Siu

Abstract

This project is an exploration into improving the energy efficiency of refrigeration systems by using wasted heat energy to power sub-systems or small electronic components. We aim to address the issue of energy waste in traditional refrigerators, which dissipate heat into the environment. We achieved this by recycling the wasted heat energy back into electrical energy through the use of thermoelectric generators (TEGs). This project aligns with contemporary environmental concerns, particularly the need for energy-efficient technologies amidst growing climate change concerns. It emphasizes the importance of aligning with ethical and professional standards in sustainable engineering, detailing the technical aspects and standards the design adheres to. The team's approach includes understanding the Seeback effect, optimizing the TEGs for maximum power generation, and integrating the generated electricity into electronic components.

FSAE EV Accumulator

Team Members

Petteri Pirhonen
Mena Sami

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Mean Green Racing
Dr. Tom Derryberry

Abstract

The purpose of this project is to develop a safe and affordable energy storage and delivery system for an electric race car. The project focuses on a method designed to safely handle the high currents and voltages required for racing applications. This is accomplished by using custom PCB's for power delivery and circuits which limit large inrush currents.

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TwAS Motor Control System

Team Members

Cristian Guerrero
Omar Madera
James Jenkins

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Advanced Robotic Manipulators (ARM) Lab in the Department of Biomedical Engineering, UNT.
Dr. Amir Jafari, PI of ARM.
Trevor Exley, M.S., PhD candidate in ARM.

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Dr. King Man Siu

Abstract

The ARM lab has a biomedical treadmill used for studying gait rehabilitation and the biomechanics of walking on surfaces of varying stiffness. It is called the Treadmill with Adjustable Stiffness (TwAS) and is currently inoperable because it lacks an electrical control system. Our team is employed to give them a control system. The TwAS has a track for each leg for bilateral speed (2 motors) and surface stiffness control (2 motors). To ensure patient safety, a harness attached to a LiteGait actuator (1 motor) is worn by the patient. The critical components of the system are the LiteGait actuator and two NEMA 34 stepper motors which control bilateral surface stiffness. Our team's comprehensive motor control system is rated approximately 700W and aims to achieve a dynamic less than or equal to 0.5 seconds, a maximum stepper motor speed as high as 3,657 RPM, and a track displacement as precise as 0.025mm. Experimental bench test results involving the DM860T stepper driver, external DC power supply, and oscilloscope show good agreement with theoretical knowledge.

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Plant Monitoring Network

Team Members

Steve Hernandez
Collin Hogan
Ryan Taylor

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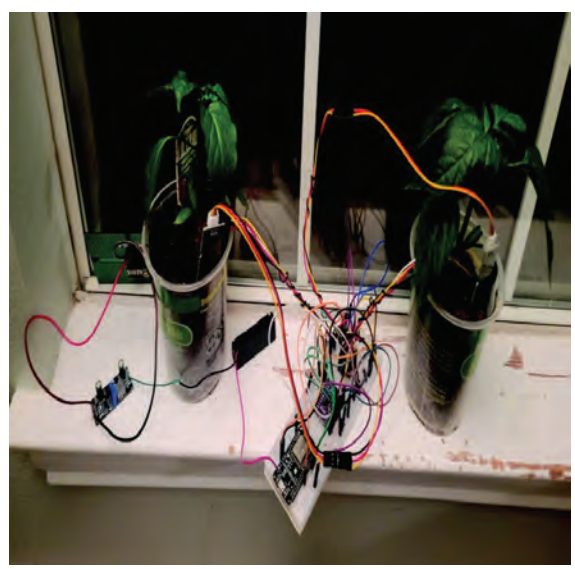
Dr. Miguel Acevedo

Abstract

As the demand for efficient and sustainable agricultural practices increases, there is a need for real-time monitoring of plant health. However, the traditional method of manual observation is time-consuming and imprecise. To address this, we created a wireless plant monitoring system that can provide automated monitoring and data collection.

The system works by monitoring moisture levels in the soil and the plant itself. This is achieved through the use of probes equipped with a infrared and moisture sensor, which are placed in each plant pot, organized in clusters, and connected to a single MCU node to process and transmit the data. The data is collected by the Raspberry Pi W Zero, which compiles the information into a CSV file that can be accessed on any device connected to the network.The system will provide early warnings to avoid potential crop losses and eliminate the need for manual monitoring and lengthy cables.



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Low Power Wrist Wearable Heart Rate and Spo2 Monitor

Team Members

Dylan Shaft
David Perez

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Dr. Gayatri Mehta

Abstract

Description: Low-power, Wrist-wearable Heart rate and SpO2 Monitor.

Motivation: To design a device that provides accurate health measurements so people can monitor and improve their health.

Design: The sensor and Processing board are 4-layer custom built PCB boards.

Testing: Design and testing have been done using OrCad design software.

Conclusion: The team members will present our heart rate and spo2 monitor on Senior design day.

Autonomous Search and Rescue Drone Network

Team Members

Mathias Kidane
Nathan Smith
David Martinez
Jean Arbulu

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Internal Sponsors/Mentors

Dr. Kamesh Namuduri

Abstract

Every year, people go missing in national parks and remote areas. The standard protocol in such an event is to mount a search and rescue operation to comb through a search area. This requires manpower and time that isn't always available and will not guarantee a successful mission. To combat this issue, a new protocol was developed, which is an autonomous drone network that utlilizes vehicle-to-vehicle communication (V2V) and object detection systems. These systems will allow a drone network to comb a search area more efficiently and find a missing person. The V2V system implemented is intended to aid in the developent of the IEEE1920.2 standard for V2V Communcation, and the designed object detection system is tailored to be compatable with different types of onboard computers. The system is designed to be modular, easy to use and accessable to allow for more time efficent search and rescue opporations that will save lives and reunite loved ones.

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