



## **Senior Design Job Ticket**

**This is a joint project between ME and the Krenicki Arts and Engineering Institute**

**Sponsoring Company:** Off Center Farm, 48 Cener Rd. Woodridge, CT 06525

**Project Title:** Design of a Solar-powered Ventilation system for High Tunnels

**Prime Contacts:** Eli Kristyna Hulland, [offcenterfarmer@gmail.com](mailto:offcenterfarmer@gmail.com)

**Project Focus:** Design, concept development, concept prototyping

## **Senior Design Project Report: Ventilation System for High Tunnel**

### **Project Description**

This senior design project aims to address engineering and design challenges associated with creating an efficient, independent ventilation system for a High Tunnel, also known as a plastic tunnel in farming.

High Tunnels are widely used in agriculture to extend the growing season and protect crops from adverse weather conditions. However, during the hot days of summer, maintaining optimal temperatures and humidity levels inside these tunnels becomes a significant challenge.

The goal of this project is to design a ventilation system that can effectively extract hot air from one end of the High Tunnel to the other, ensuring a stable internal environment conducive to plant growth. The system will be powered by solar panels, making it independent from the electric grid. It will operate automatically based on adjustable temperature and humidity conditions, thus providing a sustainable and energy-efficient solution.

### **Engineering Challenge**

The primary engineering challenge in this project is to calculate and design a system capable of moving the necessary air volume to maintain optimal conditions inside the High Tunnel.

This involves determining the appropriate fan size, air flow rates, and the power requirements to ensure efficient operation. The system must be able to respond to varying temperature and humidity levels, turning on and off automatically as needed.

Additionally, the project requires designing motorized louvers for the two vent openings, each measuring 48" x 48". These louvers must be able to open and close automatically, allowing for precise control of air flow. The design must ensure that the system can

operate reliably in various environmental conditions, including high temperatures and humidity.

## **Design Challenge**

The design challenge involves creating a system that is easy to set up and dismantle, following human factors principles to ensure user-friendliness. The ventilation system must be robust yet portable, allowing for quick deployment and maintenance.

To achieve this, the solar panels will be mounted on a wheeled unit of our own design. This unit will be capable of folding the panels like a book during particularly harsh weather conditions, protecting them from damage.

The design must also consider the integration of all components, including the fans, louvers, sensors, and control systems, into a cohesive and efficient unit. Ensuring the system's durability and reliability under various operating conditions is paramount.

## **Deliverables**

**To successfully complete this project, the following deliverables will be required:**

1. **Project Plan and Timeline:** A detailed plan outlining the project phases, tasks, and milestones.
2. **Initial Prototypes:** Physical prototypes of the key components, including fans, motorized louvers, and wheeled solar panel unit.
3. **CAD Models:** Computer-aided design (CAD) models of the entire system, illustrating the integration of all components.
4. **Air Flow Studies:** Studies and simulations demonstrating the system's ability to move the necessary air volume and maintain optimal conditions inside the High Tunnel.
5. **Control System Design:** A fully functional control system that automatically operates based on temperature and humidity readings.
6. **Implementation Plan:** A step-by-step guide for setting up and dismantling the system, following human factors principles to ensure ease of use.
7. **Testing and Validation:** Testing and validation of the system under various environmental conditions to ensure reliability and performance.
8. **Final Report and Presentation:** A comprehensive report and presentation summarizing the project, design process, findings, and recommendations.

## **Conclusion**

This senior design project presents a unique opportunity for students to address real-world engineering and design challenges. By creating an efficient, sustainable, and user-friendly ventilation system for High Tunnels, students will gain valuable experience in areas such as renewable energy, automated control systems, and human-centered design.

The successful completion of this project will not only contribute to the field of agricultural engineering but also provide practical solutions for enhancing crop production and sustainability.

- Is there a specific software package required for the projects? Y \_\_\_ N X

Which package (name/version) \_\_\_\_\_

- U.S. Citizen/Person (green card) Required? Y \_\_\_ N X

- Will Export Controlled data be used in project (EAR/ITAR) Y \_\_\_ N X

- NDA/IP Agreements required? Y X N \_\_\_

- Other Considerations: