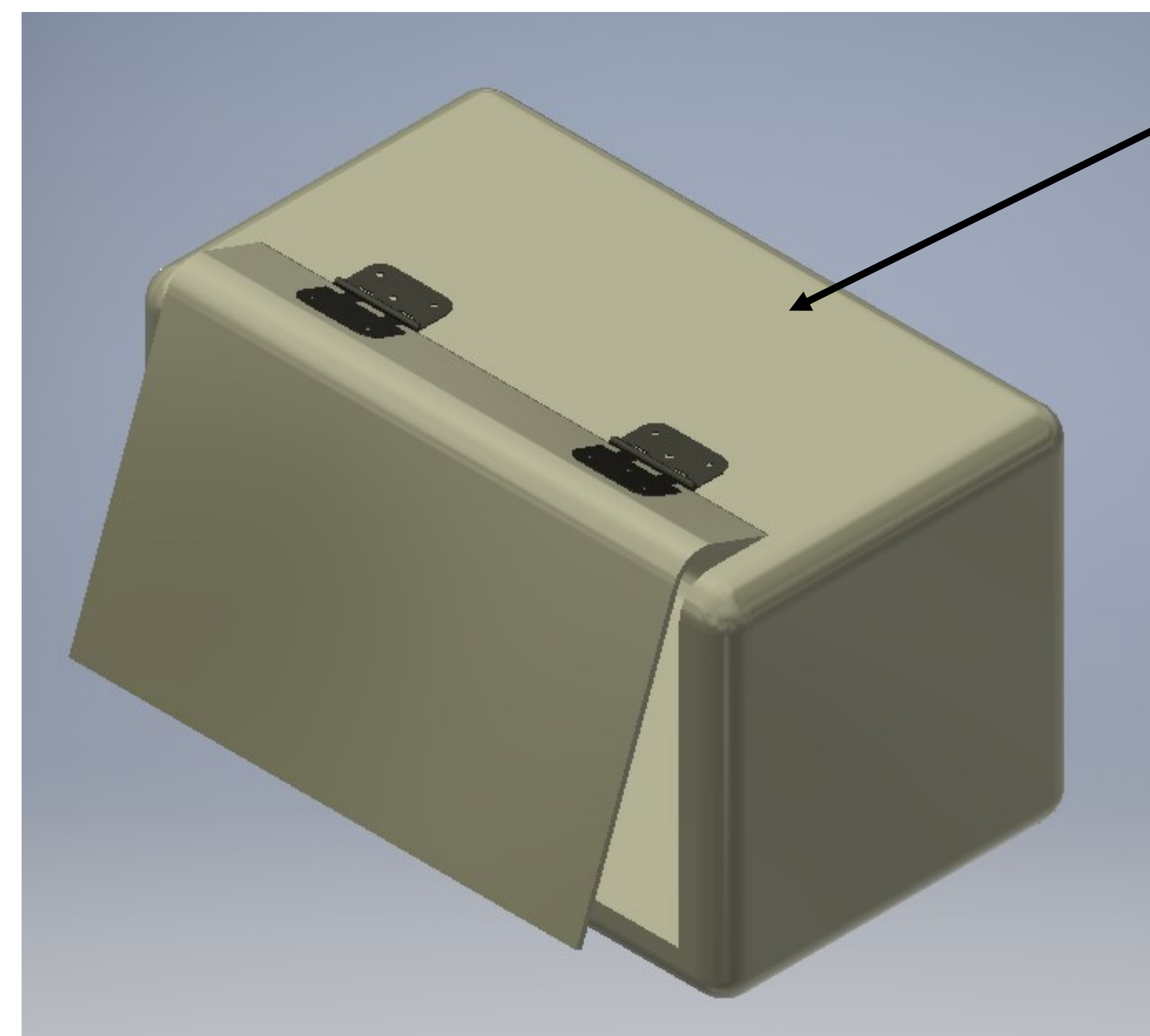


Design and Development of a Controlled Environment Chamber

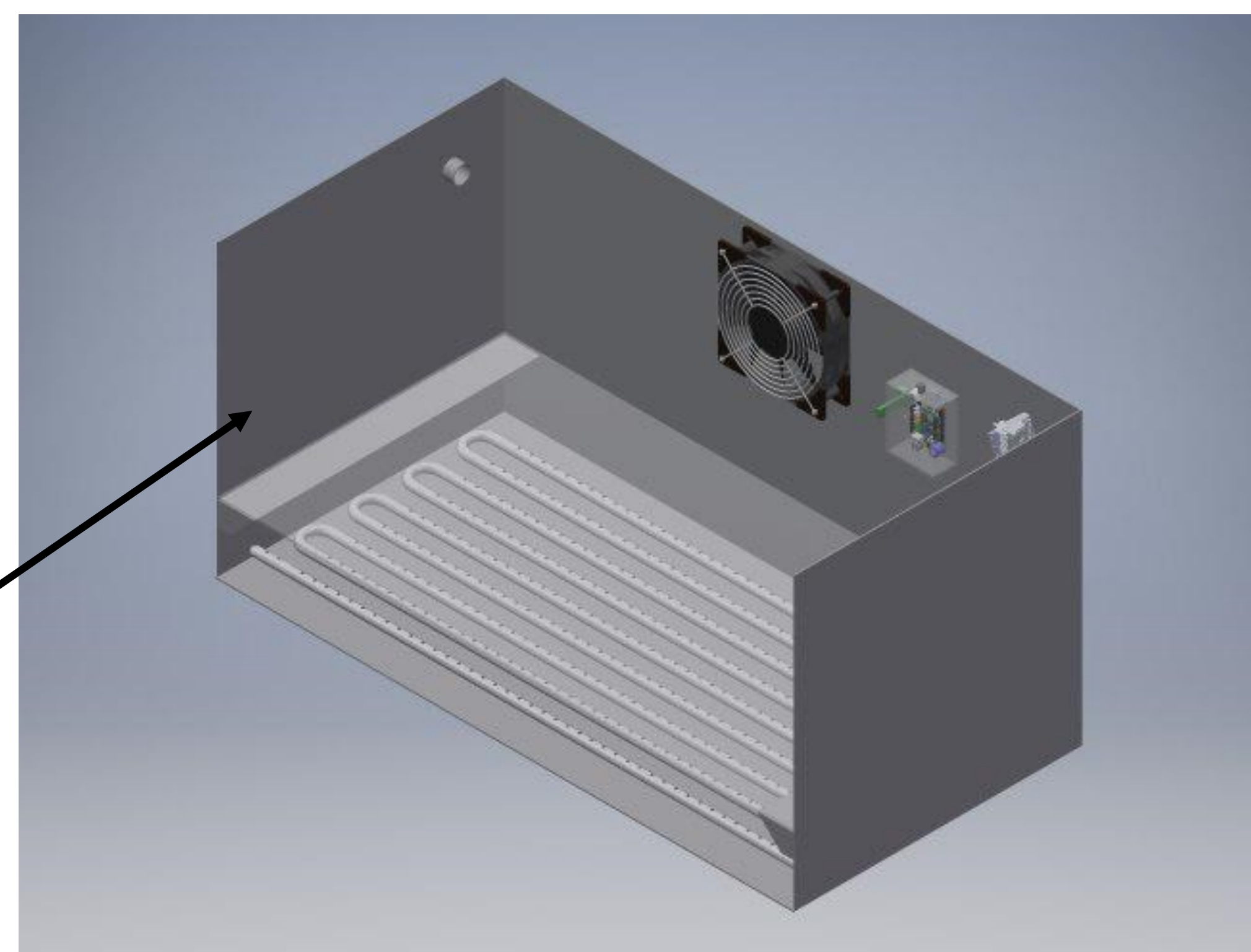
Faculty: Dr. Karen Gaines & Dr. Pedro Llanos
 Student Team Lead: Collin Topolski
 Student Team: Vijay Duraisamy, Kayla Hollis, Danayit Mekonnen,
 John Trzinski & Marcos Zamora
 Embry Riddle Aeronautical University
 600 S. Clyde Morris Blvd, Daytona Beach FL 32114-3900

Abstract

Our work is to build a versatile chamber that is capable of allowing experiments for any component needed in an advanced life support system while maintaining a much lower cost compared to a similar commercial product. We plan to use the chamber for conducting experiments on living plants and microbial life in a stable environment. These experiments will further research toward a bio-regenerative life support system capable of allowing humans explore beyond Earth. Our system is designed to control temperature, atmospheric composition, air flow, ambient pressure, water distribution, and light intensity. With these factors, the experiments can more closely mimic the environment of Mars, test the ability of an aeroponics growth system for plants, or even use a previously built-in-house clinostat to achieve hypogravity testing. Beyond our own research, the team will be working towards commercializing the device as it is needed for most experiments to ensure a consistent environment.



Current design showing the external view of the chamber. The vertically-opening door system is shown without overlapping material for gasket placements.



Previous design that emphasizing the anticipated interior for the chamber. Depicted is piping for aeroponics, a flat plate for experiments, a fan, the sensor suite, and an inlet for a vacuum pump.

Materials and Methods

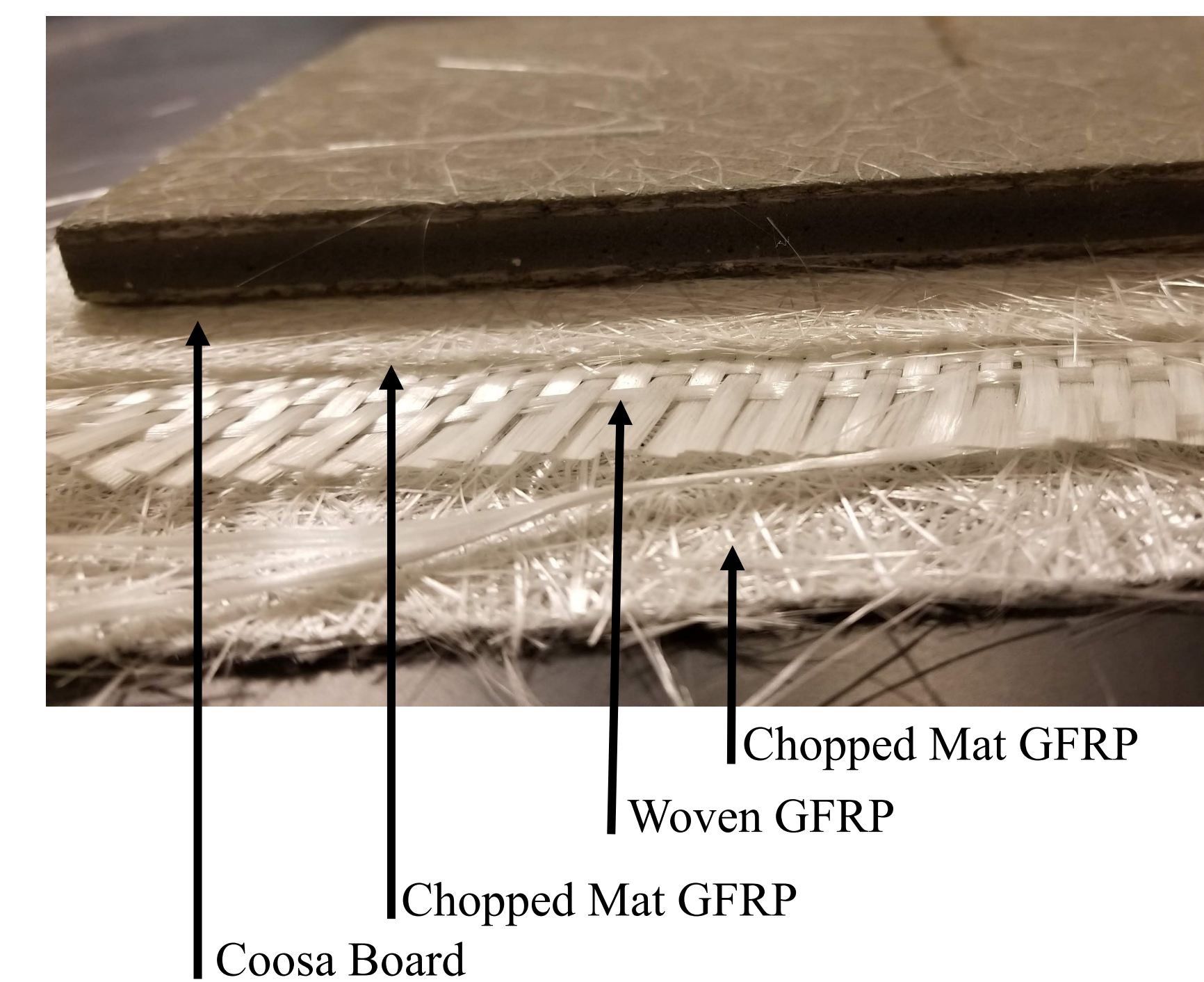
Structure

- Woven Fiberglass (GFRP)
- Chopped Mat GFRP
- Coosa Bluewater Board
- Polyester Resin / Hardener
- Hinges
- Gaskets
- Cutouts

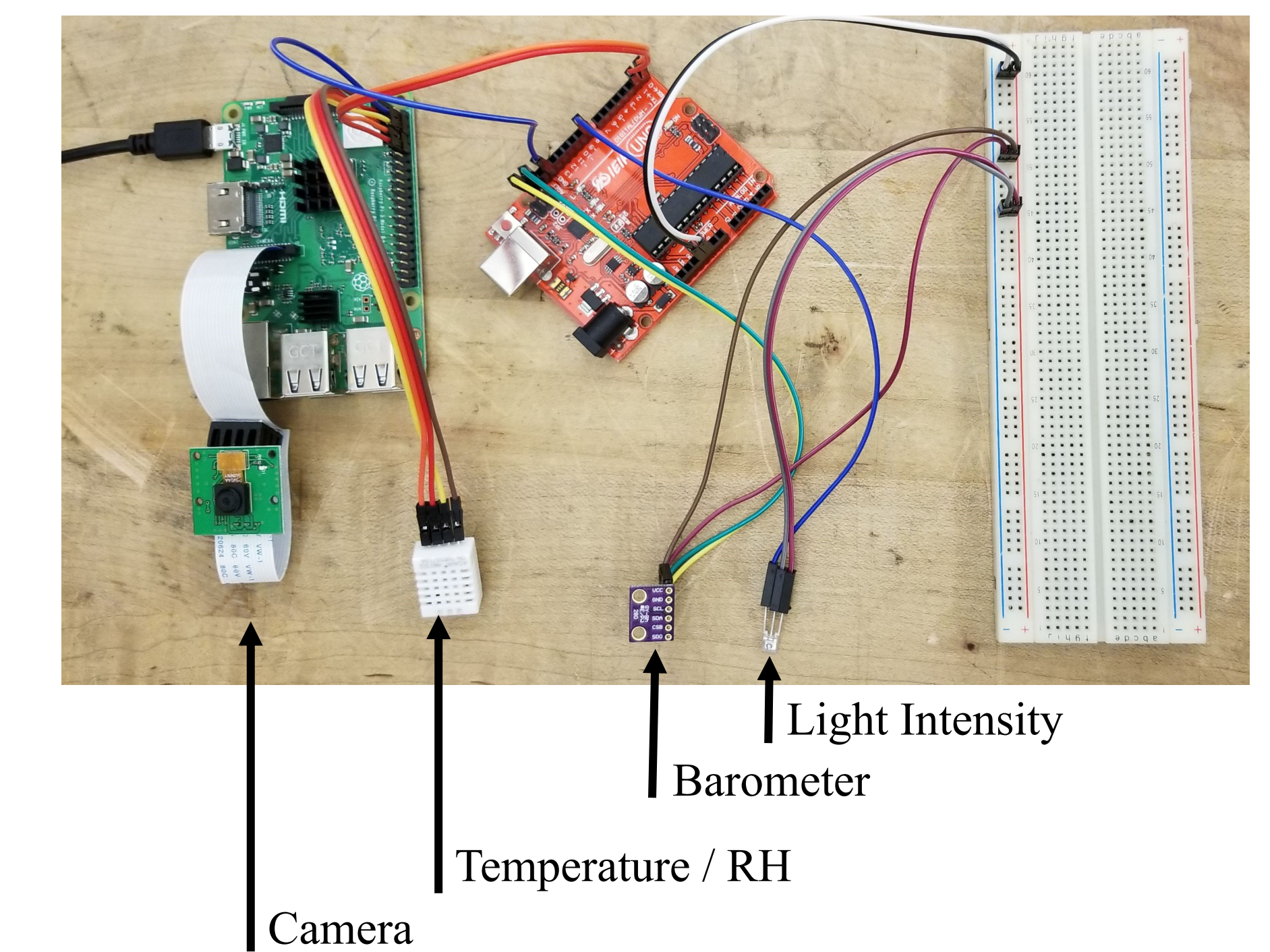
Hardware / Software

- Electronics (below)
- Vacuum Pump
- Fan
- Peltier Heater / Cooler
- Water pump / Piping
- Raspberry Pi
- Arduino

The structure will consist of four layers of chopped mat, two layers of woven fabric, and a 1/2" Coosa board. The board can be used as the mold for the fabrics. Materials are currently being purchased for pressurization testing.



The controller will process the data locally upload to a server. Once there, the data can be viewed online and the chamber parameters can also be adjusted without being with the chamber.



Future Work

Following the construction of the walls, hardware will be integrated with systems capable of conducting hydroponic or aeroponic research. Beyond this integration, the chamber will be outfitted with a custom sensor suite, a vacuum pump, and additional materials to ensure controlled environmental conditions. Experiments will consist of plant growth in altered environments, cyanobacteria growth, and efficiency testing for power. Behind our own testing, other academics could potential use this device for innumerable amounts of research.

Acknowledgments

Dr. Jeff Brown — College of Engineering
 Dr. Hugo Castillo — College of Arts and Science
 Americraft Enterprises Inc.