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A Prototype Bioreactor Incubation System Designed to Improve Cell Response Modeling in Microgravity

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Overview

The purpose of this project is to design and fabricate a novel prototype bioreactor that integrates a tumbler system into an incubator that can monitor and control temperature; humidity; and concentrations of oxygen, carbon dioxide, and nitrogen.

Explanation

- Cells grown in test tubes or Petri dishes have flat geometries unlike those existing in a living body, which can alter their characteristics and limit their ability to facilitate accurate models of their reactions to drugs and inoculations.
- A low-speed rotating tumbler system prevents the cells from settling in the medium and produces a culture that better mimics the three-dimensional geometry of cells found during *in vivo* testing.

Results

- The configuration ensures minimal error through simultaneous testing.
- The hardware is proving to sustain excellent custom atmospheric conditions.
- Initial software testing shows the system will respond appropriately to input test parameters once finalized.

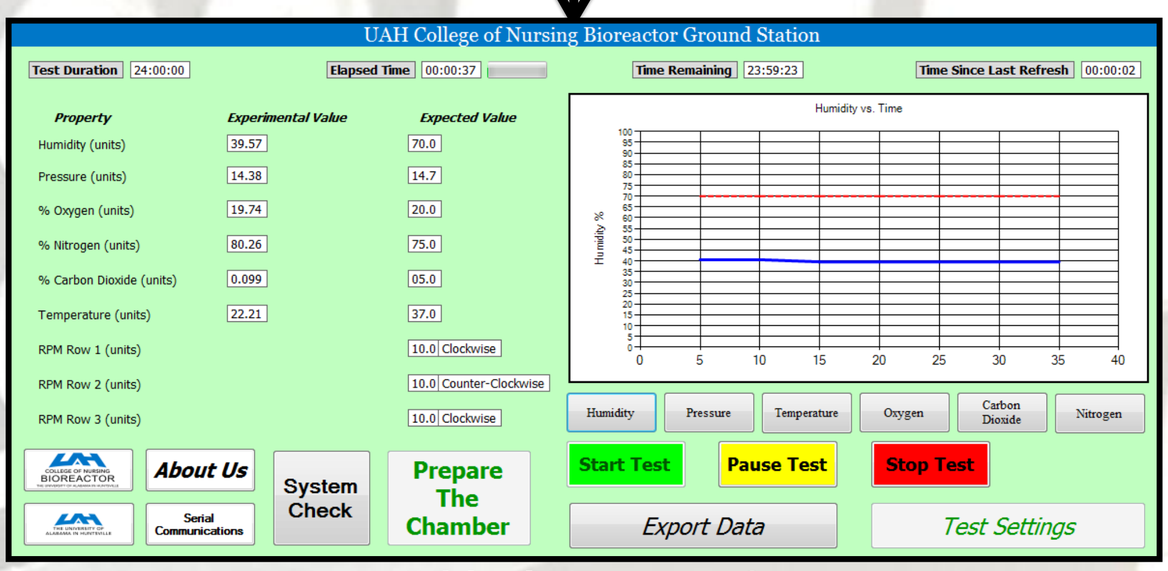
Impact

- The bioreactor is a cost effective alternative design with system integration and remote operation controls.
- The test platform is capable of handling various experimental conditions.
- A successful prototype will drive a future design that can withstand launch conditions and ultimately be delivered to the International Space Station where it will be exposed to a critical factor in realistic three-dimensional culture growth: microgravity.
- Further testing with three-dimensional culture growths in microgravity offers an unmatched potential for biomedical science breakthroughs.

Acknowledgements

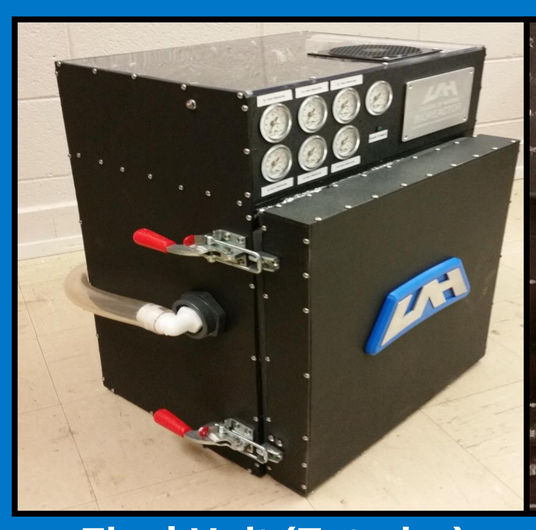
- Alumnus Team Members: Steven Doyle and John Helms
- Dr. Azita Amiri, UAH College of Nursing
- Office of the Vice President for Research and Economic Development
- UAH Mechanical and Aerospace Engineering Department

User Input



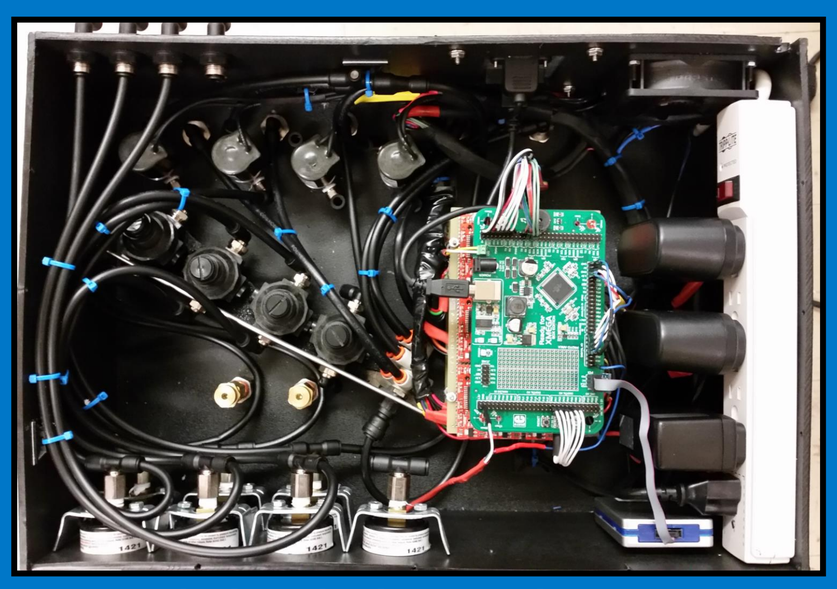
Graphical User Interface

Set Test Parameters



Final Unit (Exterior)

Final Unit (Interior)



Gas and Electrical Control Components

System Status Feedback to User

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