

Mobile Temperature and Humidity Control Chamber

**SenSIP Algorithms
and Devices REU**

Brittany Hertneky, REU Student, Arizona State University
Graduate Mentors: Mark Bailly and Josh Eger, Faculty Advisor: Jennifer Blain-Christen
SenSIP Center, School of ECEE, Arizona State University



ABSTRACT

- Provide a controlled environment for reliable HPV point-of-care testing to be performed
- Mobile and inexpensive temperature and humidity control chamber with DC power supply
- Sensor and microcontroller communication to create optimal environment

MOTIVATION

Goals of Project

- Decrease HPV in low resource settings
- Permit individuals to seek medical attention if needed
- Prevent development of invasive cervical cancer

Point-of-Care Improvement

- Allow on-site detection
- Controlled, reliable results
- Minimize wait time

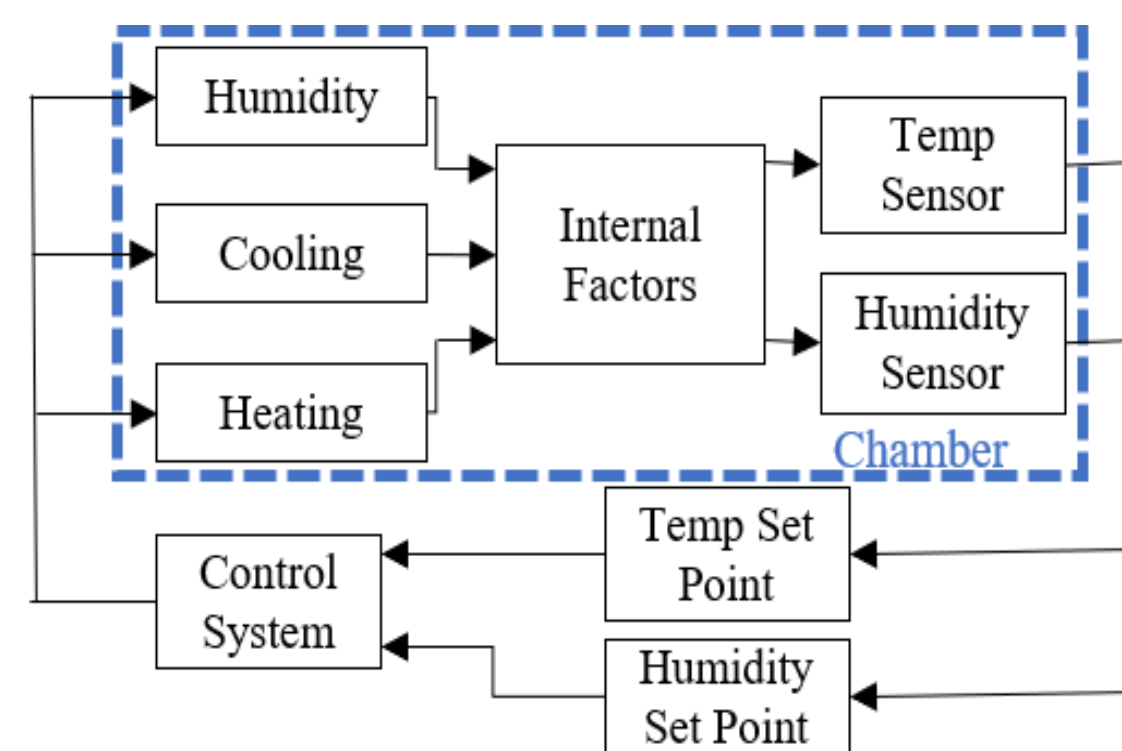


POC Testing Box

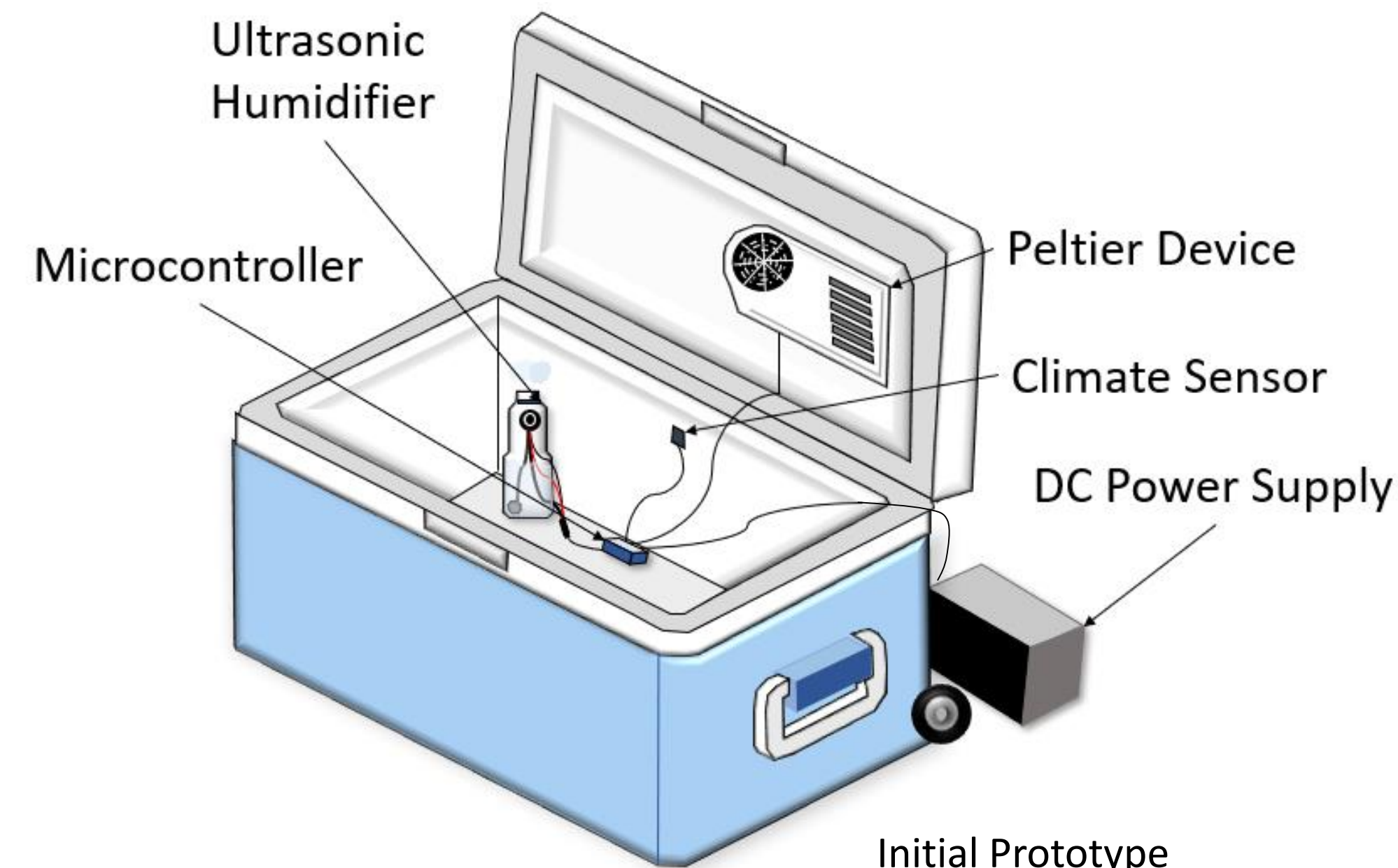
PROBLEM STATEMENT

Feedback Loop for Climate Control

- Current temp/humidity collected from internal sensor
- Microcontroller regulates climate modifying devices
- Maintain optimal environment for duration of testing

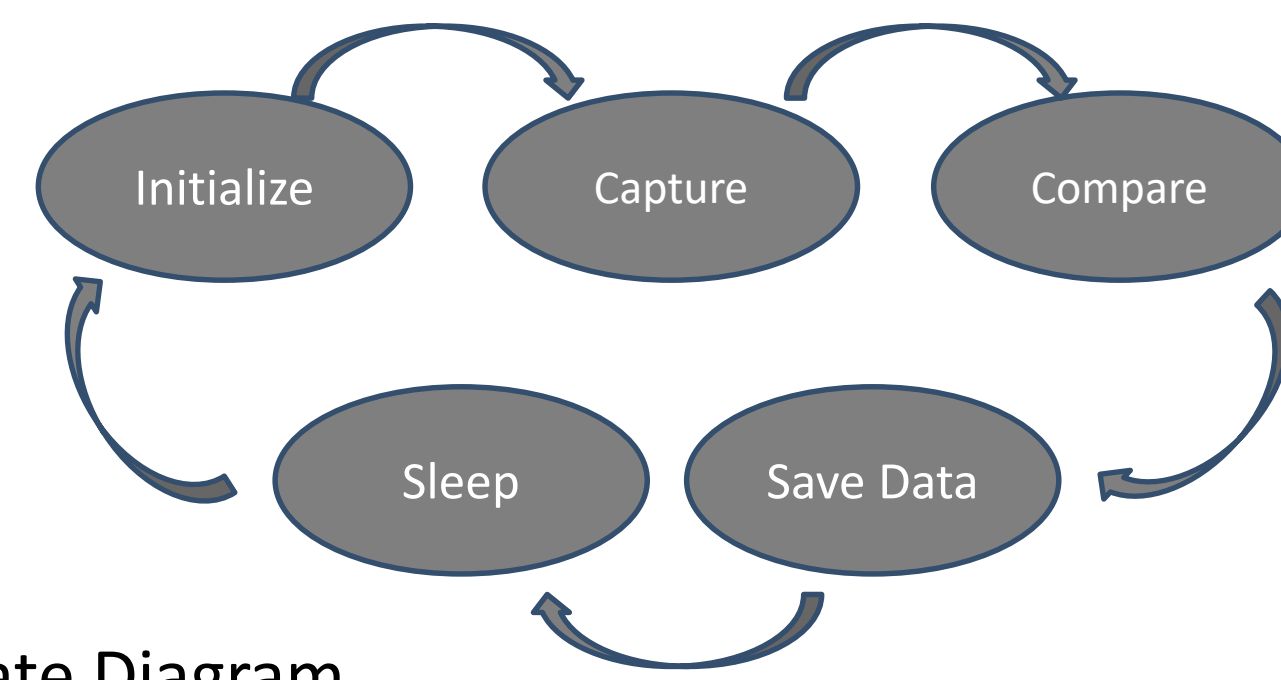


EXPERIMENTAL METHODS: SENSORS



Commercial cooler with sensor and microcontroller installed on inner walls

State Machine- permits microcontroller to go into sleep mode and conserve power



State Diagram

Built-in Peltier cooling device and homemade ultrasonic humidifier maintain desired climate for HPV testing box



Peltier Cooling Device



Ultrasonic Humidifier



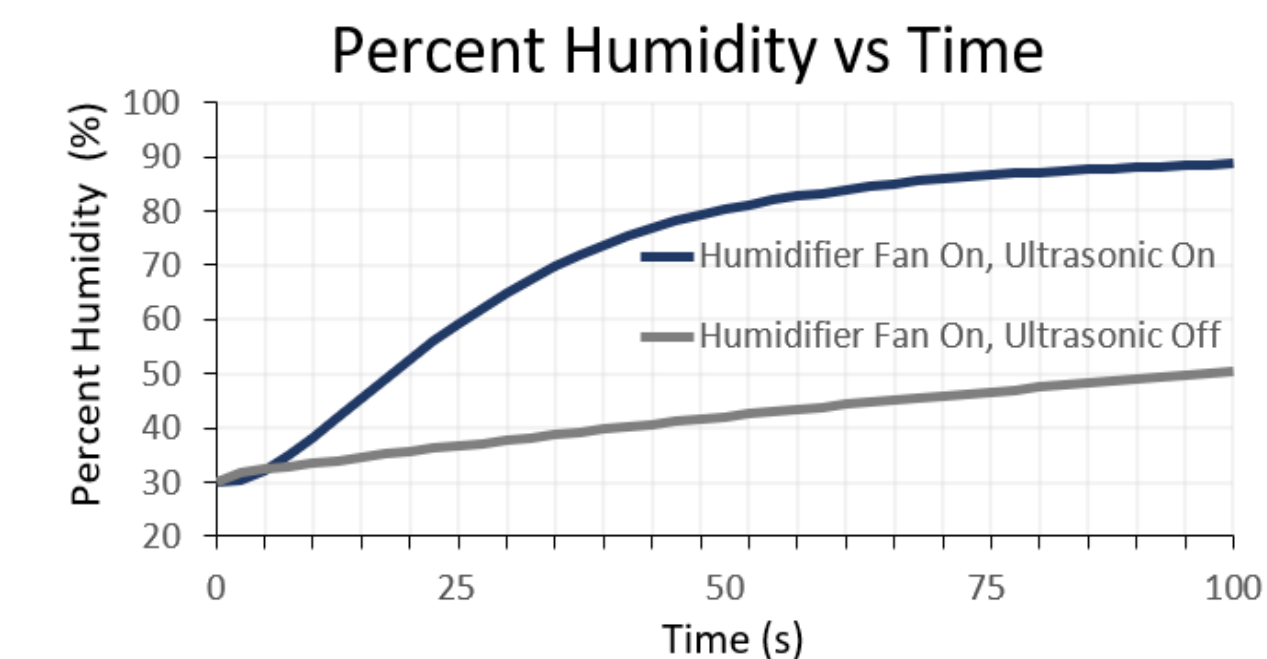
Testing Set Up

PRELIMINARY RESULTS

Ambient Humidity: 30.1%

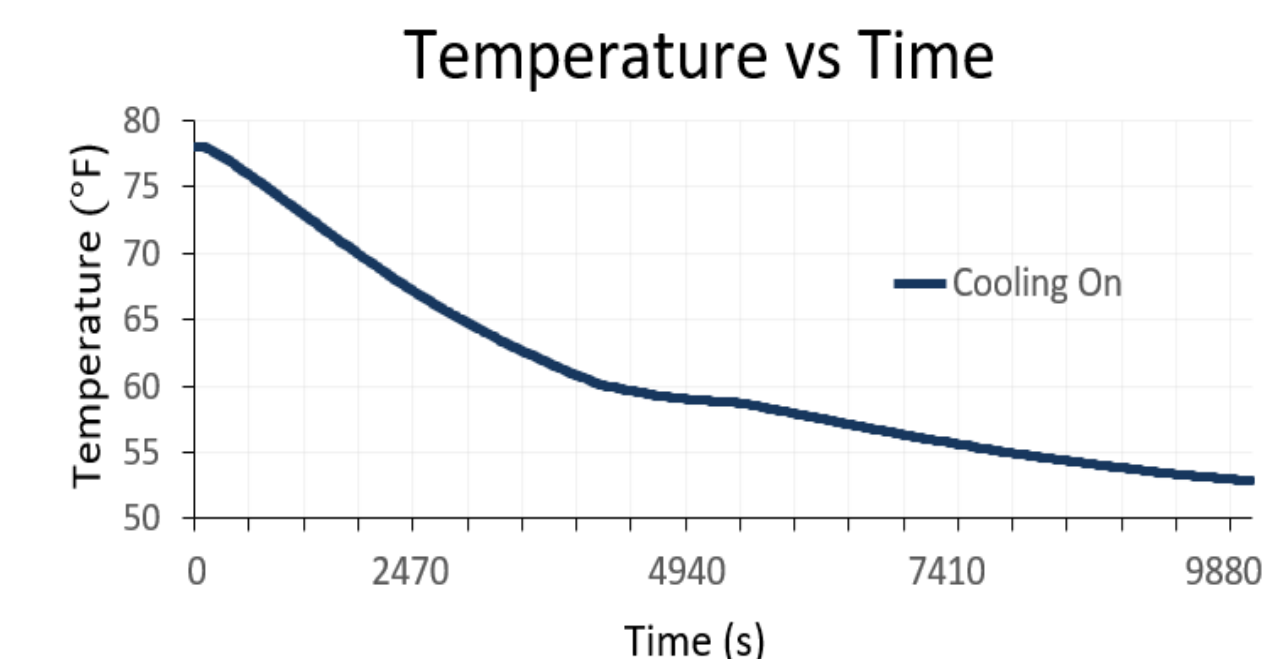
Ambient Temperature: 77.8°F

Ultrasonic Humidifier Data



- Polynomial Fit: $y = -0.05x^2 + 3.7x + 23.5$
- Coefficient of determination (R^2) = 0.839
- Saturation fan on, ultrasonic on = 94%
- Saturation fan on, ultrasonic off = 84%
- Humidifier has no measurable effect on temperature

Peltier Cooling Data



- Polynomial Fit: $y = 0.003x^2 - 0.005x + 77.5$
- Coefficient of determination (R^2) = 0.985
- Saturation cooling on = 50°F
- 30°F change in temperature attainable
- Peltier cooling device causes relative humidity to increase

REFERENCES

1. Gubala, Vladimir, Harris, Leanne F. Ricco, Antonio J., Tan, Ming X., and Williams, David E. "Point of Care Diagnostics: Status and Future." *Analytical Chemistry* 84 (2012): 487-515.
2. Ewaisha, R., I. Meshay, J. Resnik, B. A. Katchman and K. S. Anderson, "Programmable protein arrays for immunoprofiling hpv associated cancers", *PROTEOMICS* 8 (2016).

ACKNOWLEDGEMENT

- This project was funded in part by the National Science Foundation award number 1540040 and IIS-1521904 SCH: INT and the National Cancer Institute award number CA211415

