Smart Integration of Climatic Chamber Operation (SICCO)

Senior Design Team 508

DR 4

24-Jan-18

Team Introduction

Cassie Roby

Lead Engineer

Danny Carlos

Design Engineer and Web Designer

Daniel Lane

Lead Design Engineer

Kyle Barber

Project Manager

Sara Steele

Systems Engineer

Presented by: Sara Steele

Sponsor

Vinayak Hegde, Danfoss Turbocor Compressors Inc.

Background: Energy efficient technologies empower smart communities and industries to create healthier.

Advisor

Neda Yaghoobian, Ph.D.

Background: Computational fluid dynamics, urban microclimate, and energy efficiency.

Presented by: Sara Steele

Background

Danfoss climate chambers experience random power failures during testing and test engineers are unaware until visiting the test site. User must manually collect data with USB drive.

Objective

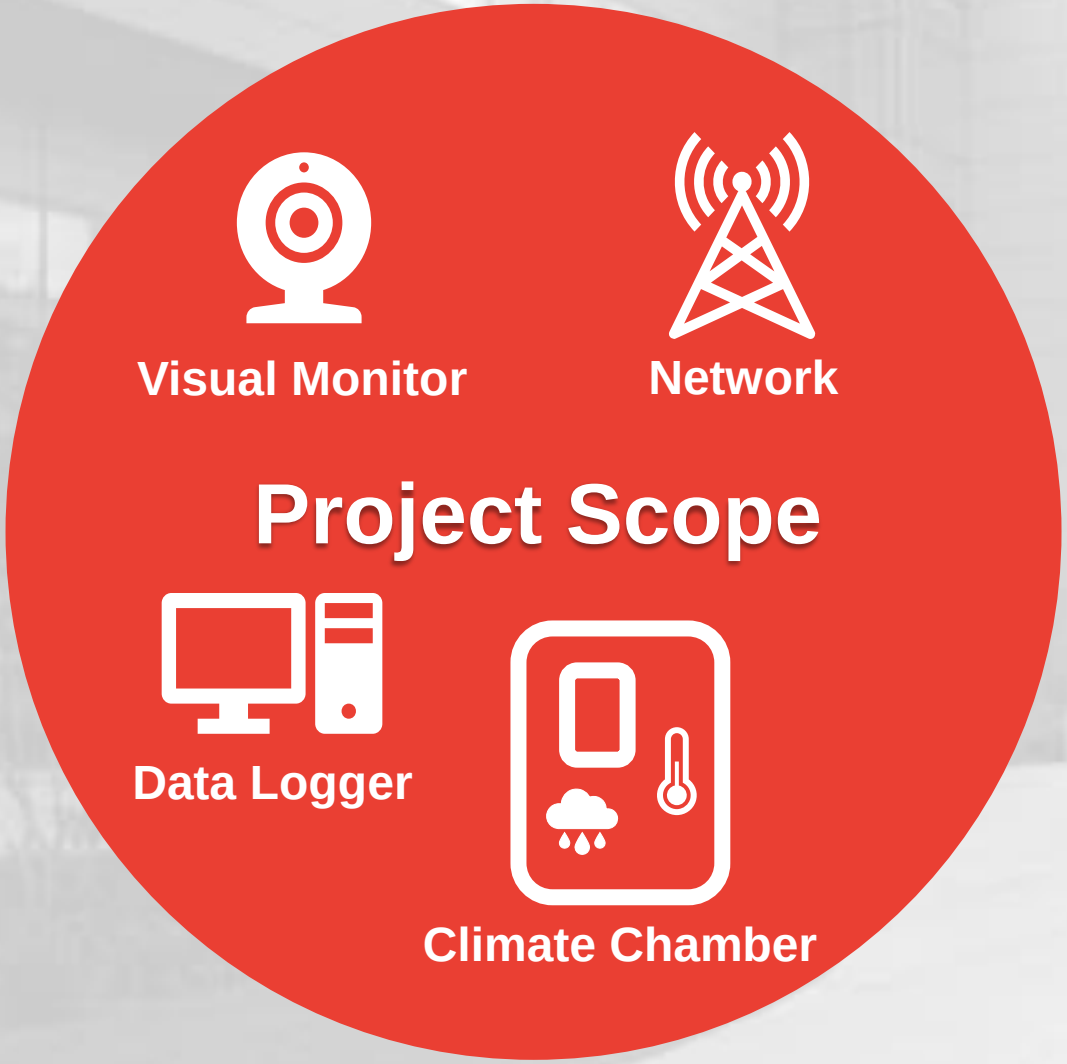
To design a smart integration network and an observation system with remote accessibility for climatic chamber tests.

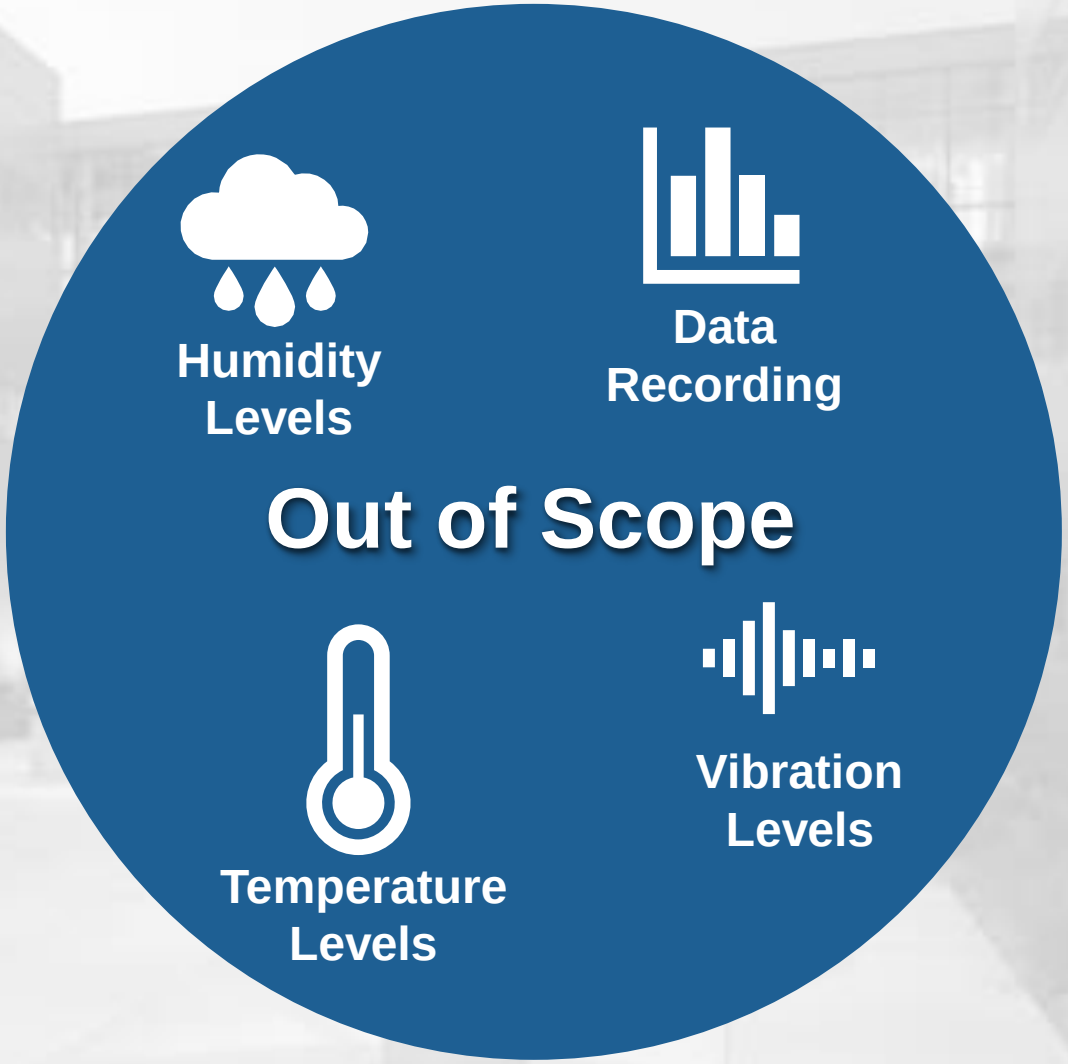
Presented by: Sara Steele

Project Summary

- To connect the Danfoss climate chambers and dataloggers to the accessible network
- To design and build a small scale prototype to demonstrate the software used to view the video footage of the climate chambers
- To research a camera that will withstand the environment in the chambers or design a possible installation system

Presented by: Sara Steele





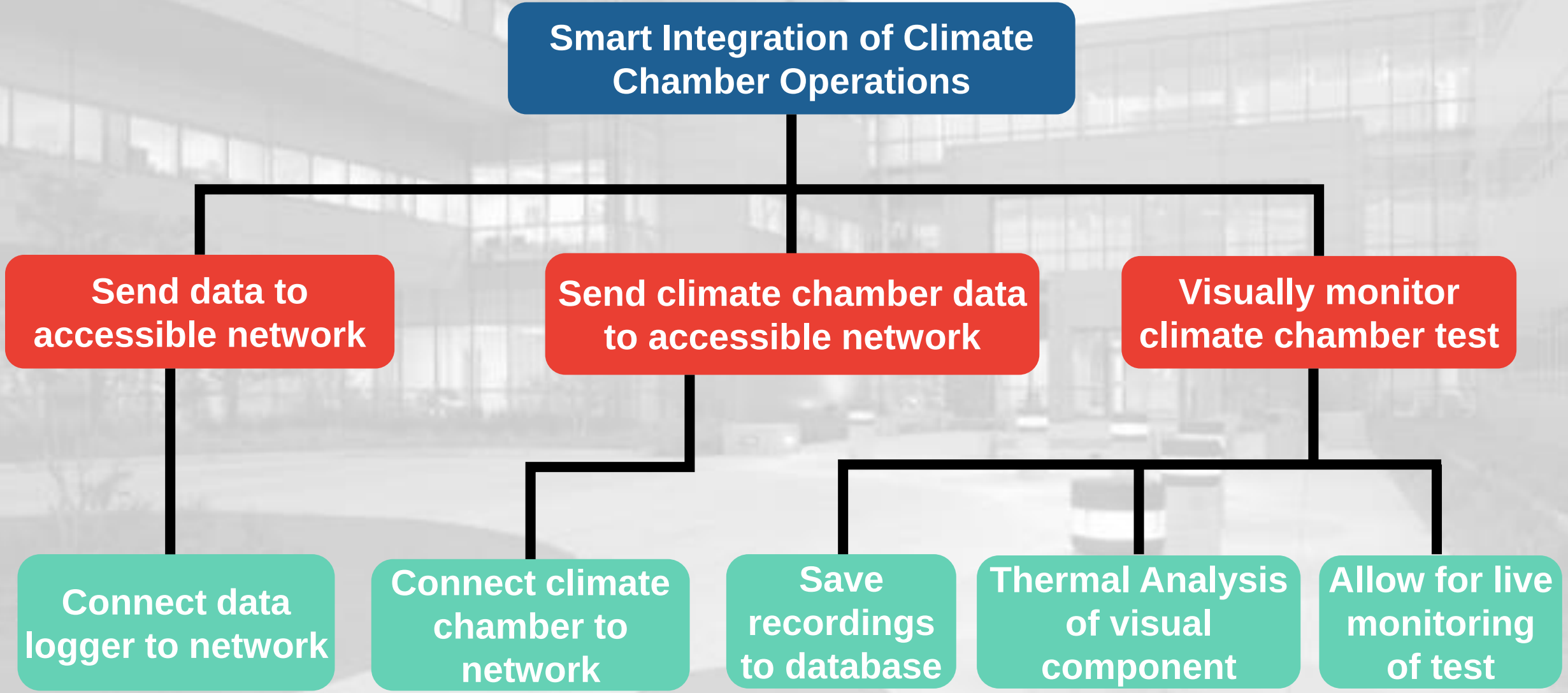
Presented by: Sara Steele

Customer Needs

- To remotely transport data from climate chamber to user computer
- Real time visual footage monitoring and recording the test
- Prototype of laboratory floor plan including microcomputer, camera, and tablet
- Prototype is not to exceed $4500

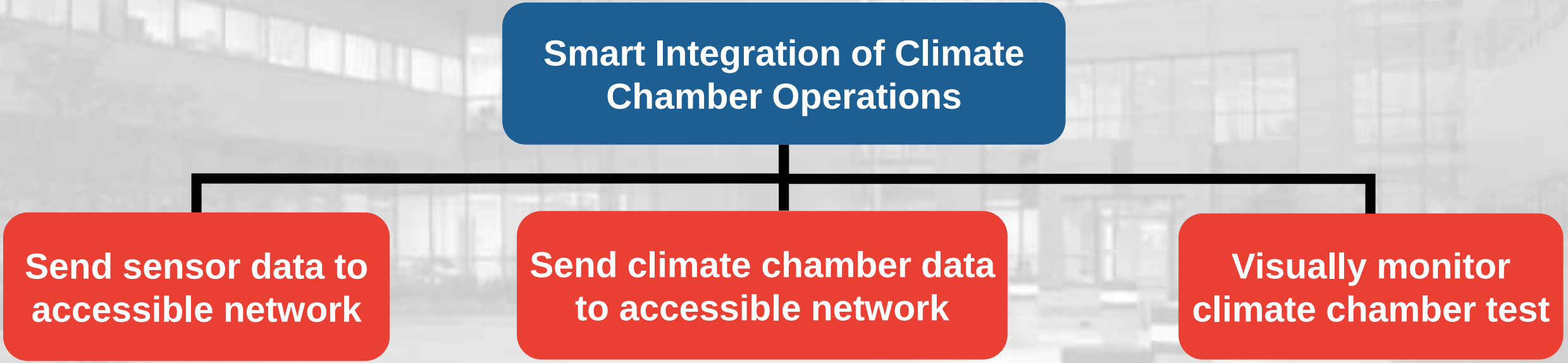
Presented by: Sara Steele

Functional Decomposition



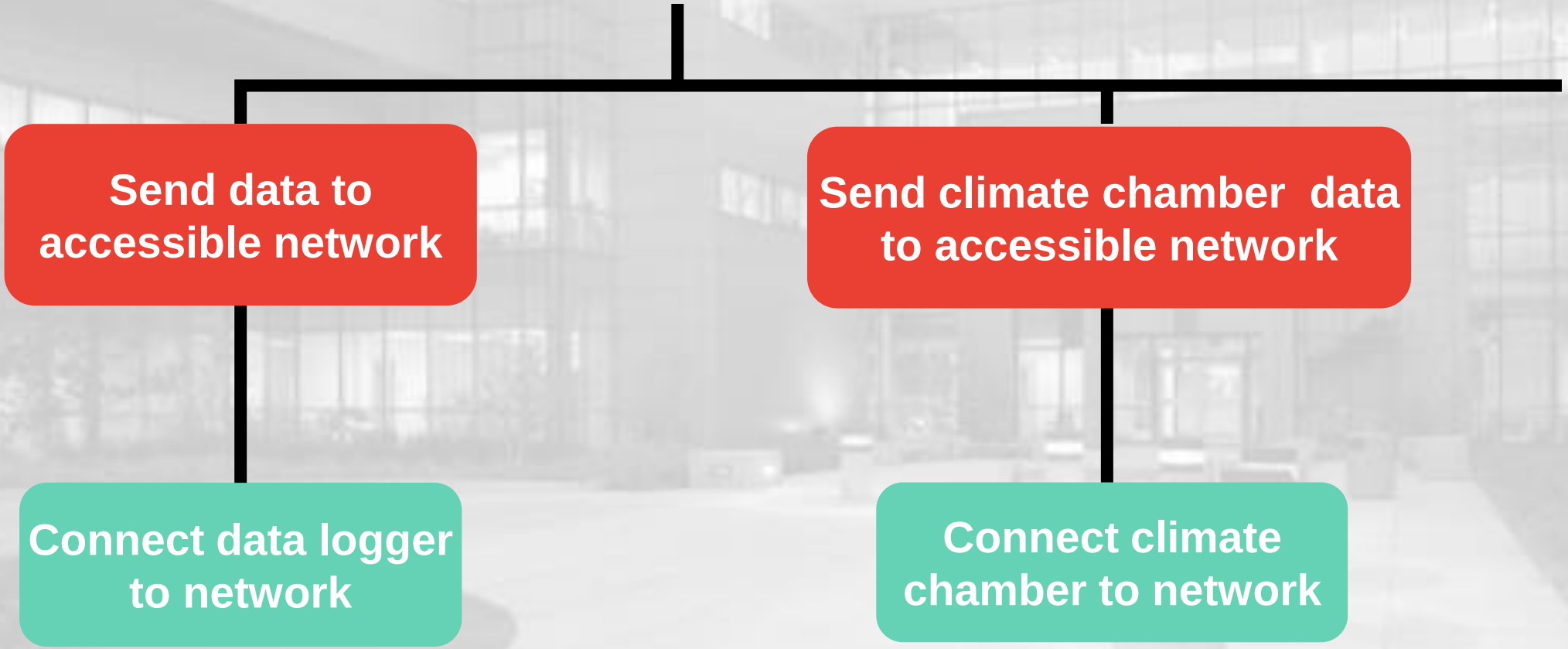
Presented by: Sara Steele

Functional Decomposition



Presented by: Danny Carlos

Functional Decomposition



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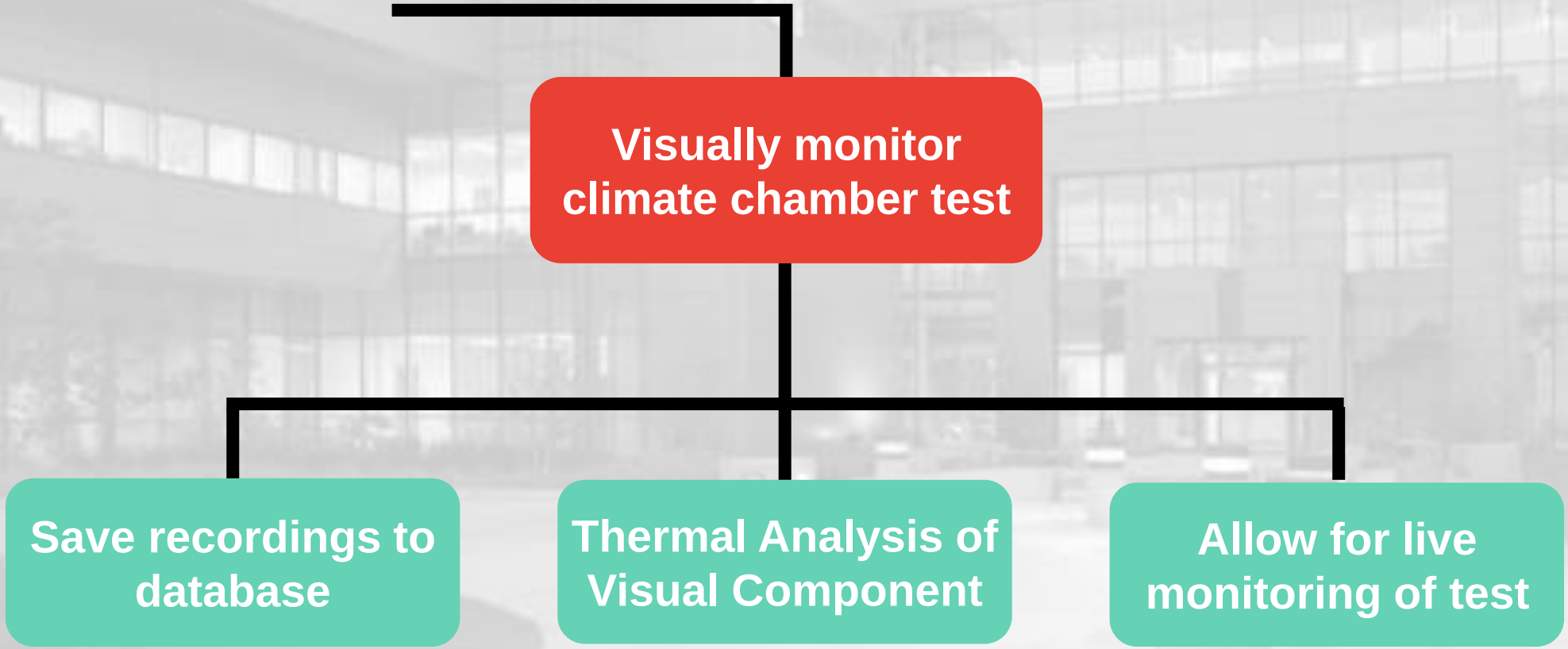
Functional Decomposition



Presented by: Danny Carlos

Previous Work

- Created spring project plan and Gantt chart
- Created Bill of Materials for Prototype
- Bill of Materials approved by sponsor
- CAD and 3D printed prototype parts
- Researched software to run cameras
- Researched how to connect climate chambers and data loggers to servers

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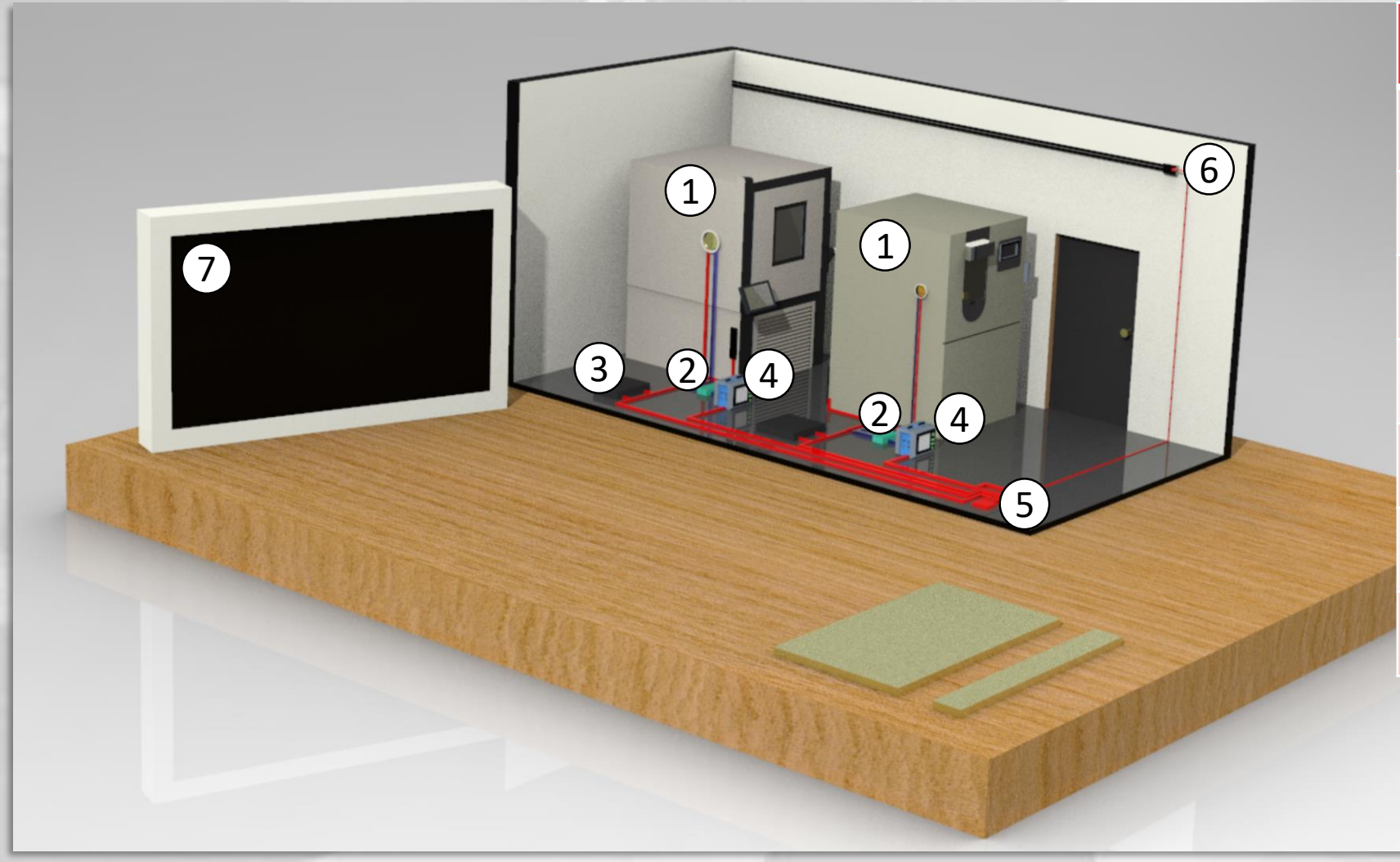
Prototype Design



#	Component
1	Climatic Chambers
2	Thermal Couples
3	Recording Device
4	Datalogger
5	Ethernet Splitter
6	Ethernet Connection
7	Table Display

Presented by: Danny Carlos

Prototype Bill of Materials

Item	Description	Quantity	Supplier	Specifications	Total Cost	Maturity
Ply wood	Base	1	Home Depot	2 x 4 ft	$7.53	0.0%
Wood screw	Pack of 50	1	McMaster-Carr	No. 6 1.5 in	$11.70	0.0%
PLA filament	3D printer	1	Innovation Hub	N/A	$0.00	0.0%
Jumper cable & bread board	40 male to male, male to female, and female to female	1	ALLEU	8.27 in, 2.13 x 0.39 x 3.27 in	$10.99	0.0%
Raspberry PI 3	To power camera	1	Raspberry Pi	3.34 x 2.2 x 0.76 in	$34.99	0.0%
Wood glue	For Prototype	1	Gorilla Glue	7 x 5 x 5 in.	$3.97	0.0%
SD card	To run Raspberry PI 3	1	Amazon	32GB	$8.99	0.0%
Camera	ABS caseing, comes with cable, USB2.0 HD	2	EBAY	30MB, 4x1.5x3 cm	$5.47	0.0%
Power cable	1.5m 5V 2.5A For Raspberry PI 3	1	Enokay	1.5m	$7.99	0.0%
LED lights	For light in model chamber	1	Chanzon	5mm, 3V	$6.50	0.0%
Button	To simulate a chamber or component failure	1	Digikey	4x4 mm	$5.85	0.0%

Presented by: Danny Carlos

Current Work

- Continue 3D printing components
- Sand and paint 3D printed components
- Receive ordered materials from Danfoss

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Moving Forward

- Code microcomputer to run visuals on prototype
- Download and configure software on the microcomputer running the monitoring system
- Build base for prototype
- Connect climate chambers and dataloggers to Danfoss' network

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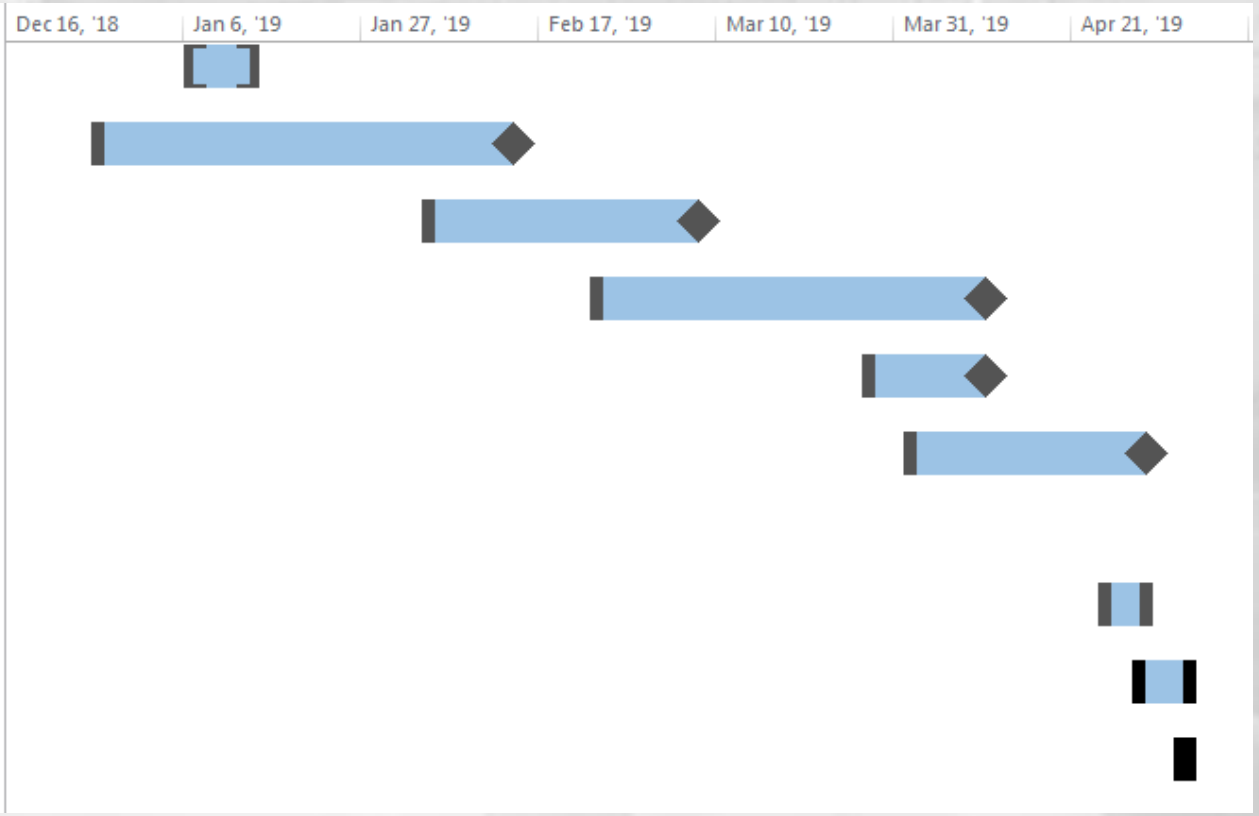
Moving Forward

Task Name
Return from Break
Order materials through Danfoss
Receive all parts
Complete prototype build
Prototype testing complete
Prototype documentation, connection proposal, and operation manual
Engineering Design Day
Finals Week
Graduation



Presented by: Danny Carlos

References

Cincinnati Sub-Zero.Enviromental.(2017).Environmental Chamber Controller: User Manual. Sharonville, OH.GENTHERM

Thermotron.(2009).Environmental Chamber: Instruction Manual.Holland,MI.Thermotron

Multi-channel Data Logger LR8400, LR8401, LR8402. (n.d.). Retrieved from https://www.hioki.com/en/products/detail/?product_key=5613

Coley, P. (n.d.). Old V-Model Diagram. Retrieved October 03, 2018, from https://www.coleyconsulting.co.uk/old-v-model.htm

Questions?

Task Name	Duration	Start	Finish
Update BOM	4 days	Thu 1/10/19	Tue 1/15/19
Reading Review 1	2 days	Thu 1/31/19	Fri 2/1/19
Advisor meeting 1	2 days	Thu 1/31/19	Fri 2/1/19
Attend STEM Day	2 days	Tue 1/15/19	Wed 1/16/19
Receive all parts	**24 days**	**Mon 2/4/19**	**Thu 3/7/19**
Begin Spring Presentation 2	6 days	Thu 2/21/19	Thu 2/28/19
Cut base for prototype and 3D print components	9 days	Sun 2/10/19	Wed 2/20/19
Program microcomputers for prototype	13 days	Mon 2/4/19	Wed 2/20/19
Assemble prototype	11 days	Thu 2/21/19	Thu 3/7/19
Reading review 2	2 days	Thu 2/28/19	Fri 3/1/19
Advisor meeting 2	2 days	Thu 2/28/19	Fri 3/1/19
Complete prototype build	**33 days**	**Sun 2/24/19**	**Wed 4/10/19**
Test and modify	27 days	Sun 2/24/19	Sun 3/31/19
Create design report	26 days	Wed 3/6/19	Wed 4/10/19
Create Operation manual and connection proposal	26 days	Wed 3/6/19	Wed 4/10/19
create mini poster	5 days	Mon 3/25/19	Fri 3/29/19
Reading Review 3	2 days	Thu 3/28/19	Fri 3/29/19
Advisor Meeting 3	2 days	Thu 3/28/19	Fri 3/29/19
Prototype testing complete	**10 days**	**Thu 3/28/19**	**Wed 4/10/19**
Create final project poster and presentation	10 days	Thu 3/28/19	Wed 4/10/19
Edit prototype documentation	10 days	Thu 3/28/19	Wed 4/10/19
Edit connection proposal and operation manual	10 days	Thu 3/28/19	Wed 4/10/19
Prototype documentation, connection proposal, and operation manual complete	**20 days**	**Tue 4/2/19**	**Mon 4/29/19**
Prepare for final presentation	3 days	Tue 4/16/19	Thu 4/18/19
Begin studying for finals	20 days	Tue 4/2/19	Mon 4/29/19
Engineering Design Day	**3 days**	**Thu 4/25/19**	**Mon 4/29/19**
Study for finals	3 days	Thu 4/25/19	Mon 4/29/19
Reading Review 4	2 days	Thu 4/25/19	Fri 4/26/19
Advising Meeting with Dr. McConomy	1 day	Fri 4/26/19	Fri 4/26/19
Finals Week	**6 days**	**Mon 4/29/19**	**Sat 5/4/19**
Graduation	1 day	Sat 5/4/19	Sat 5/4/19