

# **Smart Integration of Climatic Chamber Operation (SICCO)**

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**Senior Design Team 508**

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**VDR 2**

**12-Nov-18**

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# Team Introduction



**Cassie  
Roby**

Team Leader



**Daniel  
Lane**

Lead Design  
Engineer



**Sara Steele**

Communication and  
Documentation  
Manager



**Danny  
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Web Designer and  
Design Engineer



**Kyle Barber**

Financial Planner  
and Project  
Manager

Presented by: Cassie Roby



# 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: Cassie Roby

# Objective

The objective of this project is to design a smart integration network and an observation system with remote accessibility for climatic chamber tests.

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Visual Monitor



Data Logger

## Project Scope



Network



Climatic Chamber



Humidity Levels



Data Recording

## Out of Scope



Temperature Levels



Vibration Levels

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Functions	Metric	Target
Connect Data Logger to Network	Internet Speed Uploaded, Megabits (Mbps)	30 Mbps
Live Stream Visual Monitoring	Frames per Second (FPS)	60FPS
	Internet Speed Uploaded, Megabits (Mbps)	30 Mbps
	Useable Space	6 X 6 X 6 in
	Weight	20lbs
Save Recordings to database	Internet Speed Downloaded, Megabits (Mbps)	20 Mbps
Thermal Analysis of Visual Monitor	Temperature	-73°C - 180°C
	Relative Humidity (RH)	98% RH

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# Concept Generation needs pictures

## Concept 1

- One corner mounted camera
- Full size prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HILOGGER LR8400 Series data logger
- Internet connection through Ethernet cable

## Concept 2

- One outside mounted camera (side)
- Full size prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HILOGGER LR8400 Series data logger
- Internet connection through Ethernet cable and Https access point

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# Concept Generation needs pictures

## Concept 3

- One outside mounted camera (front)
- Three-fourths scaled prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Ethernet cable with Website

## Concept 4

- One camera mounted in corner on vertical rail
- Three-fourths scaled prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Ethernet cable

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# Concept Generation needs pictures

## Concept 5

- One camera mounted in corner on chamber ceiling
- Full size prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Ethernet cable

## Concept 6

- One camera mounted in front right corner with stand
- Three-fourths scaled prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Ethernet cable and website

Presented by: Kyle Barber

# Concept Generation needs pictures

## Concept 7

- One outside mounted camera (front)
- Three-fourths scaled prototype with window
- Live stream and recording be a security system recording device
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Ethernet cable

## Concept 8

- One thermal camera mounted in corner
- Three-fourths scaled prototype
- Live stream and recording be a security system recording device
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Ethernet cable

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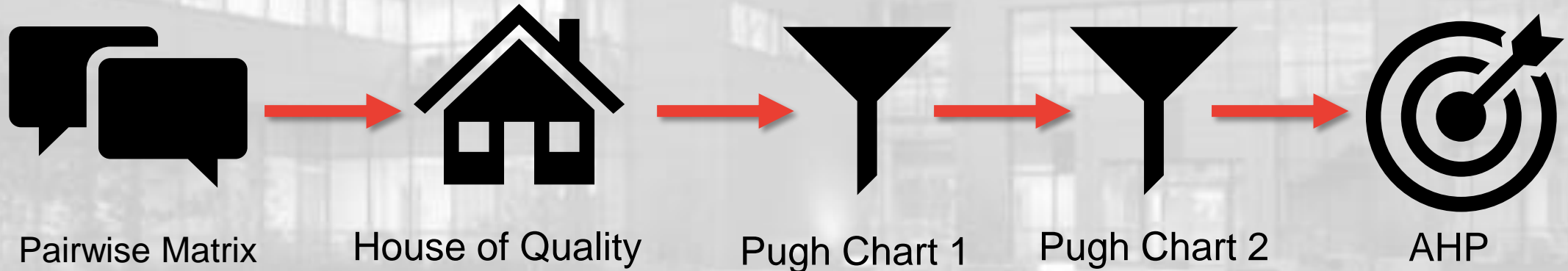
# Concept Generation needs pictures

## Concept 9

- One camera mounted in corner with adhesive glue
- Full size prototype
- Camera records data and transfers it to a microcomputer
- Existing MEMORY HiLOGGER LR8400 Series data logger
- Internet connection through Https server

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# Concept Selection



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# Pairwise Matrix

	Remote Transport	Real Time Visual System	Risk Assessment	User Interface	Budget	Total
Remote Transport	X	0	1	1	0	2
Real Time Visual System	1	X	1	1	1	4
Risk Assessment	0	0	X	0	1	1
User Interface	0	0	1	X	1	2
Budget	1	0	0	0	X	1
Total	2	0	3	2	3	10

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# House of Quality

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	Units	lbs	in <sup>3</sup>	lbs Camera	C	Mbps Internet Speed	FPS	%RH	Dollars	Degrees
	Weight	Weight	Max Size	lbs Camera	Temperature	Internet Speed	Frames per Second	Relative Humidity	Cost	Area View
Remote Transport	2	X	1		X		X	X	X	X
Real Time Visual System	3	3	3		9	X	3	3	9	9
Risk Assessment	1	1	1		3	X	1	1	X	1
User Interface	2	X	X	X	X	1	9	X	1	3
Budget	1	X	X	X	X	X	X	X	9	X
	Raw Score (213)	13	15	5	39	4	31	13	50	43
	Relative Weight (%)	6.10	7.04	2.35	18.31	1.88	14.55	6.10	23.47	20.19
	Rank	<b>T6</b>	<b>5</b>	<b>7</b>	<b>3</b>	<b>8</b>	<b>4</b>	<b>T6</b>	<b>1</b>	<b>2</b>

# Pugh Chart 1

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	Security Camera	Concepts									
	Datum	1	2	3	4	5	6	7	8	9	
Cost	Datum	↑	↑	↑	↑	↑	↑	S	-	-	
Area View									-	-	S
Temperature									S	S	+
Frames per Second									-	-	S
Max Size									S	-	-
Weight									S	-	-
Relative Humidity									S	-	S
		Pluses							0	0	1
	Minuses	0	3	4	3	3	7	2	6	3	
	Net	1	-2	-2	-2	-1	-1	-2	-6	-2	

# Pugh Chart 2

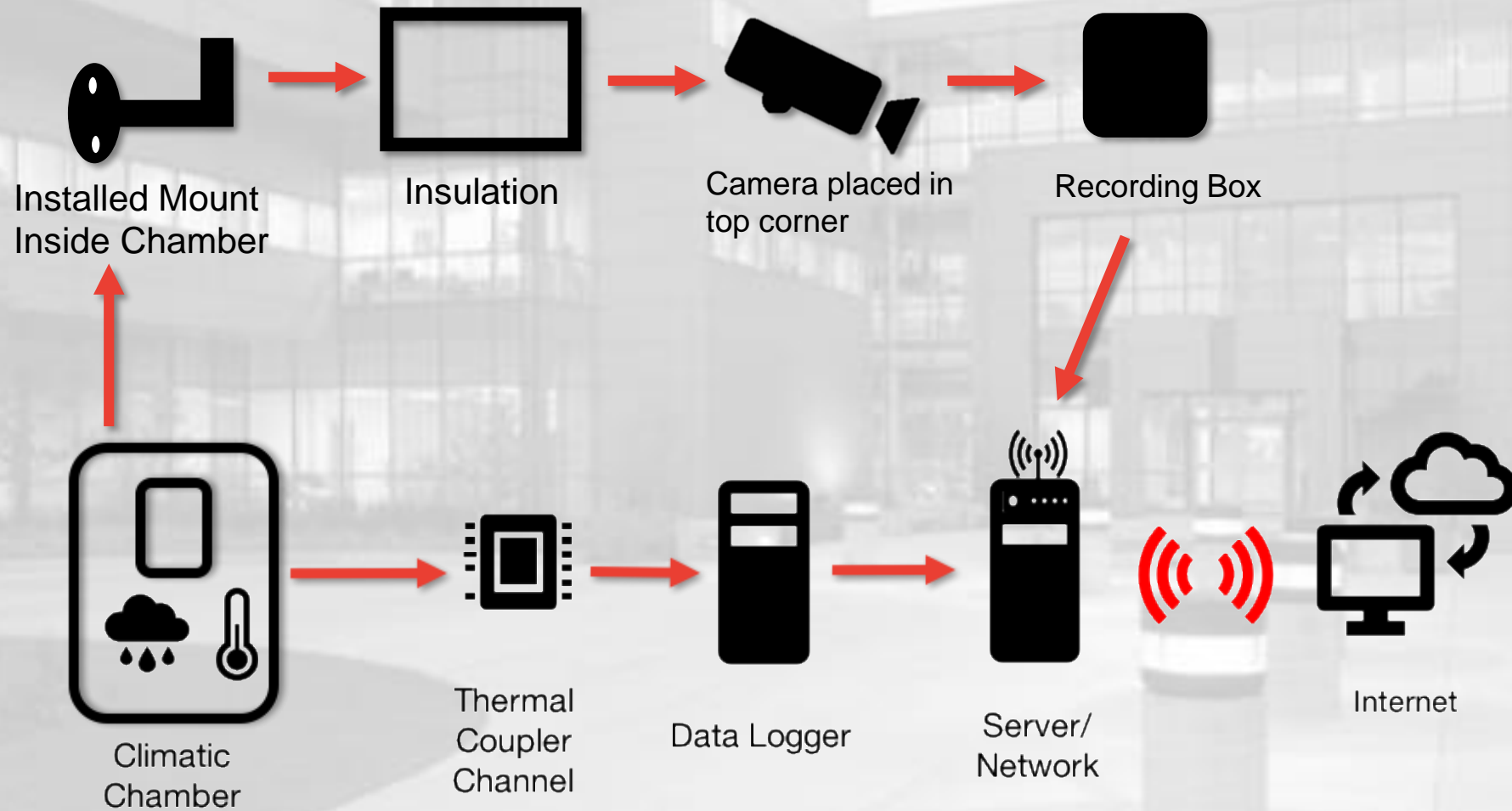
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		Concepts				
	5	1	2	3	4	6
Cost	Datum			-	S	
Area View				+	-	
Temperature				+	S	
Frames per Second				S	S	
Max Size				+	S	
Weight				-	S	
Relative Humidity				S	S	
		Pluses	3	3	3	0
	Minuses	1	1	2	1	1
	Net	2	0	1	-1	2



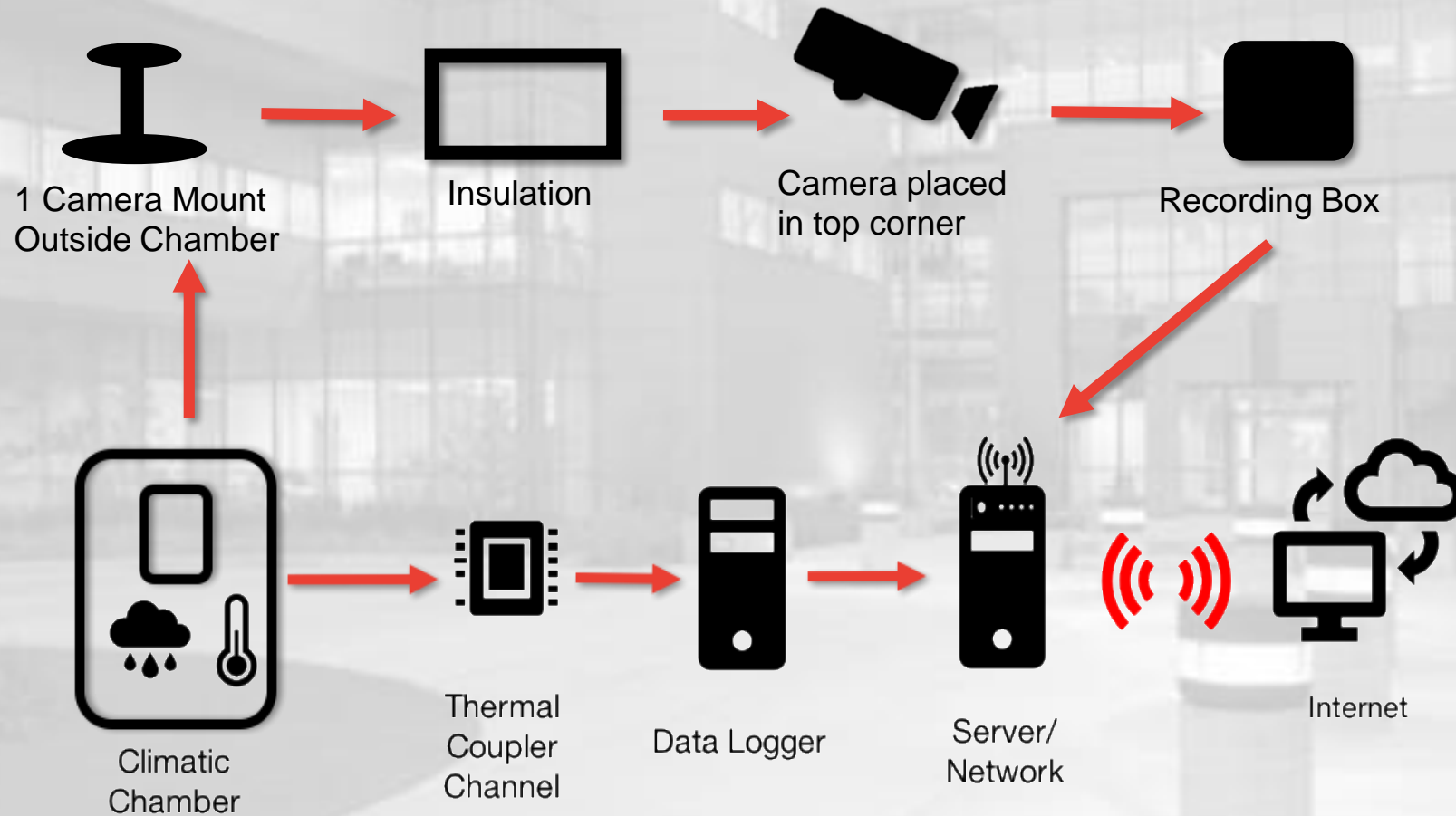


# Network Diagram – Concept 1



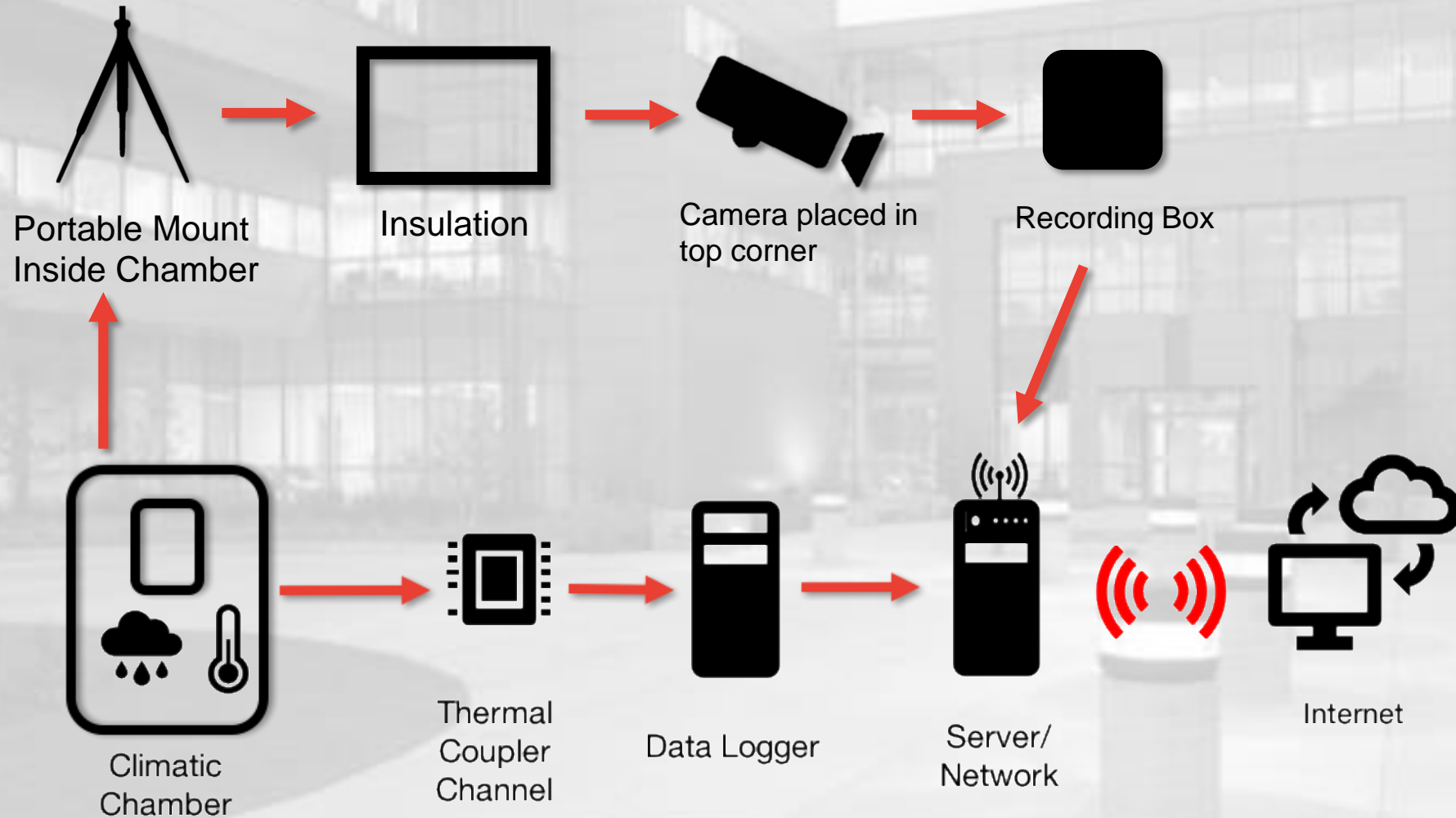
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# Network Diagram – Concept 2



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# Network Diagram – Concept 6



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# AHP



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# Moving Forward



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# References

Cincinnati Sub-Zero.Environmental.(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](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>

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# Questions?

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