Deliverable C: **Design Criteria and Target Specifications**

Introduction

The choice of design criteria has a significant impact on the success of a project. Picking what will be the most important features of a product is an important task. However, great engineers will not pick but rather interpret what is most important to their product, by empathizing with their client. In determining design criteria, this group empathized with the client, JAMZ Delivery.

The most important way of empathizing with a client is listening to what they have to say. During their meeting team members from JAMZ mentioned that the most important feature in any Climate Sensor was the ability to measure the temperature and humidity of their payload. Other criteria that they said were important were constant visibility of the inside of their package, and that the Climate Sensor is connected to their main computer.

Design: Design criteria

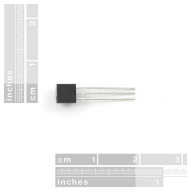
Converting Needs to Design Criteria		
Need Description	Priority /5	Design Criteria
Safety	5	Waterproofing and cable management
A consistent and high volume of data	5	Frequency of data collection (Hz) Consistent sensors
Measure humidity	5	Temperature measurement range (degrees Celsius)
Measure temperature	5	Humidity measurement range (humidity percentage)
Send data to the central computer	5	Correct wire type
Accurate data	4	Accuracy of data collection (percentage error)
A retractable sensor that can get close to the food/inside container but remain attached to the drone	4	Length of retracting piece (cm) Be able to retract back to the drone
Attach to frame/hook	4	Be able to attach to the frame of the hook on the drone

Low weight	3	Weight (kg)
Low volume	3	Volume (LxWxH cm)
Low cost	3	Cost ($)
Provide visual feedback	2	Be able to transmit images of cargo
Aesthetic	2	Type of material used Clean module (no loose ends, cable management, attention to detail)

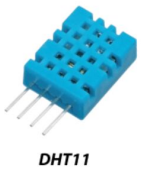
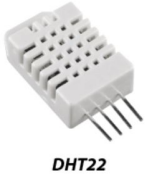
Design Specifications	Relation (=, <, >,between)	Value	Units	Verification Method
Functional Requirements				
Transmit images of cargo	=	True	N/A	Test
Measure a temperature range	between	0 - 20	℃	Test sensor
Measure a humidity range	between	50 – 55	% (Relative humidity)	Test sensor
Stability of module	=	True	N/A	Test completed module
Accuracy of data	<	5	% (Error)	Test sensor
Non-Functional Requirements				
Aesthetics	=	True	N/A	Test if possible Client Perception
Corrosion protection	=	True	N/A	Test
Water resistance	=	True	N/A	Test
Constraints				
Weight	<	2	Kg	Analysis of sum of parts
Cost	<=	50	$	Analysis of sum of costs
Power	<=	5 Volts	V	From client meeting
Number of cables available	=	4	RXD, TXD, 5V, GnD	From client PDF

Benchmarking

Benchmarking - Temperature Sensor

Specifications	Product 1	Product 2	Product 3	Product 4
Company	DS18B20	LM35	TMP36	MAX31820
Image				
Cost	$3.95 USD	$2.93USD	$1.50 USD	$1.95USD
Temperature Range	-55-125	0-100	-40 - 125	-55 - 125
Temperature Accuracy	0.5	1.5	To 1 degree at 25+, otherwise to 2 degrees	To 0.5 degrees between 10-45,otherwise 2 degrees
Communication Protocol (Digital/Analog)	Digital	Analog	Analog	Digital
User Benchmarking (Reviews)	4.3 out of 5, 41 Reviews	3 Reviews, 4.66/5	4.3 out of 5, 16 reviews	1 Review, 5/5

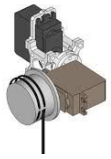
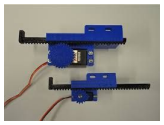
Benchmarking - Humidity Sensor

Specifications	Product 1	Product 2	Product 3	Product 4
Company	DHT11	DHT22/AM2302	LM35DZ	HDC1080
Image of Sensor				
Cost	$1.9 USD	$6.5 USD	$1.9 USD	$11.99 USD
Humidity Range	20-80% RH	0-100% RH	0-100% RH	0-100% RH
Humidity Accuracy	± 5% RH	± 2-5% RH	± 2-5% RH	± 2% RH

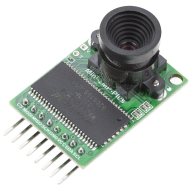
Operating volt	3-5 V	3-5 V	4-20V	2.7-5.5 V
Communication Protocol (Digital/Analog)	Digital	Digital	Analog	Digital
User Benchmarking (Reviews)	4.5 / 5, 112 reviews.	4.5/ 5 , 318 reviews	4.1 / 5, 5 reviews	3.7 / 5, 5 reviews

Benchmarking - Retracting Mechanism Type

- Currently no product for sale that fulfills our needs. Any mechanism would have to be repurposed or made from scratch. Since products don't exist, exact prices and specifications can't be found.

Specifications	Winch	Ratcheted spring reel	Linear servo
Image of Mechanism			
Parts required	Motor, power supply, spool, motor controller	Spool, spring, ratchet	Stepper motor, linear gear, circular gear, power supply, motor controller
Versatility	High, cable length can be adjusted and sensors can be placed anywhere.	High, cable length can be adjusted and sensors can be placed anywhere.	Low, actuator length is restricted and sensors can only be placed where actuator is oriented
Simplicity	High	Medium, ratcheting may be difficult	Low
Weight	26g (Low)	Low	56g (High)
Price	$2.6 (Low) motor only	Low	$70 (High) servo only
Volume	3 cm x 3 cm x 3 cm (Low)	Low	1.2 cm x 1.2 cm x 5.2 cm (Medium)
Power Supply	1-3 V	N/A	2.7 V
Automation	Low, sensors still need to be manually placed in correct location	Low, sensors still need to be manually placed in correct location	High, sensors could be inserted and retracted automatically
Customer Reviews	4.2/5	N/A	4.1/5

Benchmarking - Camera

Specifications	OV5642	Pixy 2 CMUcam5	OV9655	OV2640 2
Company	Arducam	Charmed Labs	Waveshare	Arducam
Image				
Cost (CAD)	$39.99-$52.66	$80.05	$11.99	$33.99
Resolution Support	5MP, 1080p, 720p, VGA, QVGA	Aptina MT9M114, 1296×976 resolution with integrated image flow processor	SXGA (1280x1024) max res.	Still picture resolution: 2592 x 1944 Max video resolution: 1080p
Weight (g)	20g	10g	6g	23g
Dimensions (mm)	34x24mm	38.1x41.91x 15.24mm	35.7x23.9mm	36x36mm
Data output(s)	RAW, YUV, RGB, JPEG	UART serial, SPI, I2C, USB, digital, analog	YUV/YCbCr Serial Raw RGB Data	SPI, CSI bus
User Benchmarking (Reviews)(From amazon.ca)	3.5 Stars	5 stars	3.9 stars	4 stars

Conclusion

When coming up with design criteria, what is important is to focus not only on what JAMZ said, but to take into account constraints in accommodating certain needs. This means that interpreting their needs may not necessarily be done straightforwardly. After interpreting the needs of a client, benchmarking must be done to determine the standard of what you must create.

References:

General Arduino
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https://randomnerdtutorials.com/9-arduino-compatible-temperature-sensors-for-your-electronics-projects/

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https://github.com/milesburton/Arduino-Temperature-Control-Library/blob/master/README.md

Retracting mechanism
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Wrike Screenshots