Project Deliverable C: Design Criteria and Target Specifications

Client Needs:

- Light Weight => “with drones weight is everything”
- Accurate and constant communication / data exchange with flight operator
- Movement sensor (Make sure food isn’t violently shaken), don’t want spilt food/drinks
- Feedback 6 degrees of freedom, visual feedback to operator
- Temperature sensor : Relative humidity (50-55% humidity), temperature(room temperature) of the food container (food is still good for customer), needs to close to the hook
- Visual feedback/info that operator can easily interpret.
- Alert operator that drone has fallen + height vs anticipated height of drone, status of drone, alert nearby individuals to not touch and approach drone, operator will recover it
- Alert operator of stolen drone, deviated path, track it, don’t lose equipment
- Main thing : constant, reliable and accurate data being transmitted
- Ideally one module that can be plugged into the drone, show that some info (accurate data) is being relayed to some outbound
- Reliability
- “Any type of serial communication is the way to go”
- Consistent data - “If i see i consistent data im going to be very happy”
- “That information between the drone and the operator needs to be conveyed at all times. Constant communication. So whatever information information you can take from the drone and give it to the operator and vise versa is very essential”

Functional:

- Reliability of Data Exchange
- Lifespan/reliability of add-on system
- Consistent data of add-on system

Metric:

- Weight of add-on system (grams)
- Cost of add-on system (CAD)
- Dimensions of add-on system (cm)

Non-Functional:

- Not Specified (TBD)

Priority	Customer Statement	Interpreted Need
1	“If I see consistent data I’m going to be very happy”	Consistency of data collection
2	“That information between the drone and the operator needs to be conveyed at all times. Constant communication. So whatever information you can take from the drone and give it to the operator and vise versa is very essential”	Constant communication/data exchange between all parties
3	Visual feedback/info that operator can easily interpret.	Readable and understandable data
4	“As long as it is compact...So remember, drone weight is everything so make sure you are thinking about compactness”	Dimension and compactibility
5	“With drones, weight is everything”	Light weight

Problem Statement: Jamz needs an add-on system for a food delivery drone that provides consistent data and constant communication to the flight operator.

Interpreted needs	Design Criteria
Consistency of data collection	Sensor needs to accurately read temperature. Reliability. Temperature reading needs to be consistently collected
Constant communication/data exchange between all parties	Temperature readings are constantly being sent to drone operator (and any other sources)
Data is readable and understandable	Data from sensor is easily interpretable to the operator
Dimension and compactibility	Size (small) Depth and length correspond to aerodynamics
Light weight	Weight (minimal)

- Sensor (temperature probe) needs to accurately read temperature. Reliability.
- Temperature reading needs to be consistently collected
- Temperature readings are constantly being sent to drone operator (and any other sources)
- Data from sensor is easily interpretable to the operator
- Size (small)
- Depth and length correspond to aerodynamics
- Weight (minimal)
- Cost (minimal but flexible)
- Lifespan
- Durability
- Easily removable (from food box)

JAMZ Benchmarking

	UAV (Sensor)	**HTU21D (Sensor)**	**Bosch BME680 (Board w/ senor)**
Operating Temperature Range	-25 to +85 degrees C	-40 to 120 degrees C	-40 to 85 degrees C
Operating Humidity Range	10% ~ 90%RH	0~100%RH	0~100%RH
Temperature Accuracy	±1.0 degrees C	±0.3 degrees C	± 1.0 degrees C

Humidity Accuracy	±4% RH	~2-3%	± 3% RH
Temperature Response Time	5~30s	~2-5s	
Humidity Response Time	6-8s		~8s
Size		3 x 3 x 0.9 mm	Approx. size of quarter
Price		~$3.00/chip USD	$18.95 USD
Point total	12 points	**20 points**	16 points

Green: Good (3 points)
Yellow: Mediocre (2 points)
Red: Not good enough (1 point)

Metrics:

Metric	**Value**
Weight	<150 grams
Cost of Add-On System	<= $100
Dimensions of Add-On System (cm)	10x10x5
Reading Temperature range	-4°C to 35°C
Temperature reading accuracy	±0.5°C
Temperature Response Time	<15 seconds

Microcontrollers:

	Arduino Uno	Arduino Leonardo	Arduino Due	Teensy 4.0	Raspberry Pi 4
Price (CAD)	$29	$25.5	$51	$25	$44.6
Programming Language	C/C++	C++	C/C++	C++	Python
Size (cm)	6.86 x 5.34	6.86 x 5.33	10.2 x 5.33	3.56 x 1.78	8.56 x 5.65
Weight (g)	25	20	36	2.8	46

Input Voltage Limits	6-20v	6-20v	6-16v	3.3v	6v

Temperature Sensors:

	DHT11	DHT22	AM2302	BME280
Price (CAD)	$5.2	$8.6	$15.3	$5.15
Temperature Range	0-50°C	-40-80°C	-40-125°C	-40-85°C
Temperature Accuracy	± 1°C	± 0.5°C	± 0.2°C	± 1°C
Data Transfer	Serial Data	Serial Data	Serial Data	Serial Data
Response Time	6-15s	2s	2s	1s