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

GNG 1103 – Engineering Design

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Introduction:

As a part of their development process, JAMZ Delivery, a newly-developed drone food delivery company asked students from the Faculty of Engineering at the University of Ottawa to help them develop a safe, consistent and an all-in-one anti-theft module. This module is expected to be able to detect if the delivery drone has deviated from its designated course and notify the piloter quickly and accurately. Furthermore, if the drone is downed, the module will be able to alert the piloter such that assistance can be dispatched. It should also, through both audio and visual queues, notify citizens to stay clear of the downed drone until an operator arrives. Based on a client meeting that had taken place on January 27, 2021, JAMZ identified a clear list of needs which they expected would be met through the development of the module.

In this document, the engineering students have created and formalized a list of the design criteria that were present within the client meeting. These criteria are directly based on the identified client priorities. Additionally, in order to keep up with market standards, comparisons were made between JAMZ and the products created by other competing companies located elsewhere in the world. Finally, in order to set up concrete parameters, target specifications are also provided. This report aims to create a solid design base that will be used for the development of the module.

Design Criteria

#	Client need	Design Criteria
1	Should be safe for passersby and not easily stolen	Safety
2	Should occupy as little space as possible without risking performance.	Compactness
3	The total mass should not exceed 25kg with the package.	Weight
4	The attachment should notify the operator when one of the sensors is disturbed.	Consistent
5	The drone itself should be efficient to delivery packages to its customers	Efficient
6	Products must not be violently shaken around.	Stability
7	There should be flexibility in the locations the module can be attached.	Easily attachable
8	Should abide by all the applicable air traffic laws.	Legal
9	Should accurately exchange data with the operator.	Accurate

Tabulated List

Functional Requirements	Non-Functional Requirements	Constraints
• Good aerodynamics • Sensors must communicate with operator • Drone needs to follow the correct coordinates • Climate sensor needs to know what the relative humidity is inside the container	• User friendly • Environmentally friendly • Low sound pollution • Create a map to follow a path with the least civilians • Aesthetics of the drone	• Time to complete • Weight of food • Altitude the drone can fly to • Cost of manufacturing

Benchmarking

Specifications	Flirtey	Matternet	Fly Zipline	Amazon Prime air
Safety	Aviation grade technology, parachutes	No parachute. Package set down by wire	Parachute, redundancy system	Sense and avoid technology
Compactness	Storage: 115.6 × 41.9 ×27.9cm	Size of a home printer	Wingspan 3.7m	N/A
Weight	2.5kg payload	Up to 2.268kg (5lbs) payload	1.75kg payload	2.26kg payload
Easily attachable	Sensors built in	Sensors built in	Sensors built in	Sensors built in
Consistency	10 minute delivery	3 minute delivery	45 minute delivery	30 minute delivery
Efficiency	130km/h	80km/h	100km/h	80.5km/h
Stability	Package is tethered down while drone is hovering	Package stored in drone and tethered down	Releases package with a parachute	Drone sets down to deliver package
Legal	Regulatory permission (US, Australia), FAA approval	Authorized by the FAA	Partnership of national civil aviation authorities	Authorized by the FAA
Accuracy	Can operate in 95% of all weather conditions	N/A	Can operate in hot and rainy climate	N/A

Numerical Comparison

Specifications	Priority Rating	Flirtey	Matternet	Fly Zipline	Amazon Air
Safety	5	3	1	3	2
Compactness	2	3	2	1	-
Weight	4	3	2	1	2
Easily attachable	3	3	3	3	3

Consistency	5	3	3	1	2
Efficiency	1	3	1	2	1
Stability	2	2	2	1	3
Legal	5	3	3	3	3
Accuracy	4	3	-	2	-

**Priority rating: 5 is most important and 1 is least important.*

	Flirtey	Matternet	Fly Zipline	Amazon Air
TOTAL SCORE	91	61	62	64

Target Specifications/Metrics

List	Design Specification	Relation	Value	Units	Marginal Value	Ideal Values	Verification Method
Functional Requirements							
1	Good Aerodynamics	=	yes	N/A	Slows down the drone by 5km/h	Minimal air resistance	Test
2	Sensors must communicate with operator	<	1	Time (second)	<1	100ms	Test
3	Must weigh less than 25kg with the payload	<	25	Weight (kg)	15-25kg	20kg without sacrificing performance	Mean weight
4	Drone needs to follow the correct coordinates	=	N/A	N/A	In the near vicinity of the drone	Directly on top of coordinates	Test
5	Climate sensor needs to know what the relative humidity is inside the container	=	yes	N/A	Near the exact temperature and humidity	The exact temperature and humidity	Sensor/thermometer
Non-Functional Requirements							
6	User friendly	=	yes	N/A	N/A	N/A	Operator Feedback
7	Environmentally friendly	=	yes	N/A	Close to 0 carbon emission	0 carbon emission	Test
8	Low sound pollution	=	yes	dB	0-70dB	Below 70dB	Survey
10	Aesthetics of the drone	=	yes	N/A	Simple colors	Modern, sleek design	Customer Feedback

Constraints							
11	Time to complete	<	**10**	**weeks**	**>10**	**<10**	**Estimate, Final Check**
12	Weight of food	<	**10**	**Kg**	**<10**	**<10**	**Legal limit**
13	Altitude the drone can fly to	<	**200**	**ft**	**<200**	**=200**	**Test**

Conclusion

After the successful client meeting with JAMZ Drone Delivery, a lot of very specific and useful information was obtained. Throughout the interview process, one of the top priorities from JAMZ is drone safety, as it is very important, as well as the consistency for the drone.

Additionally, thorough research/benchmarking was performed by the group of engineering students in order to have a strong and comprehensive understanding of the potential JAMZ competitors. The group of students took into account all of the specifications from Flirtey, Matternet, Fly Zipline, and Amazon Prime Air and compared the companies from the best to the worst specifications. It was concluded that Flirtey will be the top competitor for JAMZ Drone Delivery with an outstanding benchmarking score of 91. To put it all together, this document should serve as a phenomenal body for design specifications which will be valuable for the upcoming parts of this project final.

References

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