

## **Team Ate**

Deliverable C - Design Criteria

GNG1103 C – Introduction to Engineering Design

Lab Section CO2 – Group 8

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**Abstract**

To aid the development of the solution by defining the list of prioritized design criteria, doing technical benchmarking, and determining target specifications.

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### **List of Prioritized Design Criteria**

Bat boxes need a device that can monitor bat entry and exits to track their effectiveness in Canada. The bat box and device will be easy to maintain, weatherproof, suitable for one of the bat species in Ontario to roost in and cost effective.

The needs of the client have been analyzed and design criteria meant to meet these needs have been found. Then organized into functional, and non-functional requirements and constraints.

Need	Design Criteria
Tracker for the entry and/or exits in bat box.	Acoustic, Video, Radio telemetry sensors
Storage/access to data	Uploads data automatically or data storage for later download (MB)
usable for one species of bats in Ontario (big brown bats or little brown bats)	Capacity (in <sup>3</sup> ) Chamber sizes(in <sup>3</sup> )
Usable for both species	Multiple Chambers Different chamber sizes (in <sup>3</sup> )
Protect bats from predators	attachable to structures above ground (ft) via hooks or nails Small entrance length (in) Small entrance width (in) Reinforced entrance
Maintain comfortable temperature	Thick insulating wood material (min 1/2inch) Multiple Chambers vents (in <sup>2</sup> ) [to stop overheating] Small entrance length (in) Small entrance width (in)
Weatherproof bat house (stay dry)	Sealant applied Chaulk applied Acrylic waterproof paint
Require minimal maintenance/easy to install	Reliable materials Easy to clean Tracker non-wired for power (Battery/solar)
Low cost	Cost (<=150\$)

#### **Functional Requirements:**

-Track bats using Acoustic, Video, Radio telemetry sensors

-Multiple chambers

- Usability by bats: Proper dimensions (in) for little brown bats/big brown bats
- Usability by bats: prevents over heating (°C)
- Usability by bats: Thickness of wood (inch)
- Entrance: small entrance to protect against predators (in)
- data storage and access (MB)

#### Nonfunctional Requirements:

- Long product life (years)
- reliable materials for ease of maintenance
- easy to clean
- data is uploaded live

#### Constraints:

- cost ( $\leq 150$ \$)
- Maintain ideal internal temperature range (°C)
- Weatherproof with sealant, caulking and paint
- Non -wired power for Tracker
- mounting apparatus to attach to trees, poles etc...

### Technical Benchmarking

Functionality	Bat Boxes				
	Canadian Bat Houses (Nursery)	Canadian Bat Houses (Motel)	Canadian Bat Houses (Hotel)	Eco Kent Bat Box	Wildlife World Conservation Bat Box
Capacity	300 bats	600 bats	900 bats	-	2.52kg
Dimensions	47cm x 104.1cm x 8.9cm	47cm x 104.1cm x 14cm	47cm x 104.1cm x 17.8cm	W23cm x D16cm x H52cm	444mm x 250mm x 145mm
Price	\$300CAD	\$400CAD	\$500CAD	\$97.81CAD	\$229.30CAD
Chambers	2	4	6	-	2
Maintenance-free	Yes	Yes	Yes	Yes	Yes
Tracking device	No	No	No	No	No
Weatherproof	Yes	Yes	Yes	Yes	Yes
Material	Plywood	Plywood	Plywood	Spruce	Timber
Multispecies usage	-	-	-	Yes	Yes
Fit for ideal temperature	Yes	Yes	Yes	-	-
Safe from predators	-	-	-	-	-
Total	19	21	23	18	21

Functionality	Trail Camera iG200	Driveway Sensor	Bat Detector SM4BAT	BatRack	Laser Detector Alarm Beam
Company	iZEEKER	HTZSAFE	Wildlife Acoustics	GitHub – Contributors:	Dahszhi

				J. Höchst, P. Lampe, T. Nauss.	
Weatherproof	Yes	Yes	Yes	Yes	Yes
Cost	\$49.99CAD	\$39.99CAD	\$1619.91CAD	\$1174.93CAD	\$89.38CAD
Type of Detection	Motion, Camera	Motion	Acoustic	Acoustic, Video, Radio telemetry sensors	Infrared Laser
Power Source	Battery	Battery	Battery	Solar	Wire
Live Access to Data	No	No	Yes	Yes	No
Dimensions	14.5cm x 10.5cm x 6.8cm	10cm x 7.5cm x 9.5cm	21.8cm x 15.2cm x 7.1cm	-	7.9cm x 7.9cm x 17cm
Total	13	13	15	13	10

Best Option - 3

Worst Option - 1

Middle Option - 2

### Target Specifications

#### Functional Requirements

	Design specifications	relation	Value	Units	Verification Method
1	Tracker	=	Acoustic, Video, Radio telemetry sensors	n/a	Test
2	Capacity	>	900	bats	Analysis and test
3	Track bats entry/exit	=	yes	N/A	Test
4	Dimensions	>	47x 104.1 x 17.8	cm	Analysis
5	Multiple chambers	=	2-6	number	check
6	Multiple species usage	=	yes	n/a	Analysis and test

7	Material	=	timber	n/a	analysis
8	Mounting Apparatus	=	yes	n/a	test

### Non-Functional Requirements

	Design specifications	relation	Value	Units	Verificatin Method
1	Reliable Material	=	yes	N/A	Test
2	Product Life	>	5	years	Test
3	Easy to clean	=	yes	N/A	Test
4	Transmits Data	=	yes	N/A	Test
5	Maintenance free	=	Yes	n/a	Analysis and test
6	Data storage	>	5	MB	Analysis and test

### Constraints

	Design specifications	relation	Value	Units	Verificatin Method
1	Cost	<=	150	\$CAD	Estimate/Final Check
2	Internal Temperature in cool and hot weather	=	10-37	°C	Test/Measure
3	Non-wired tracker power source	=	yes	N/A	Check

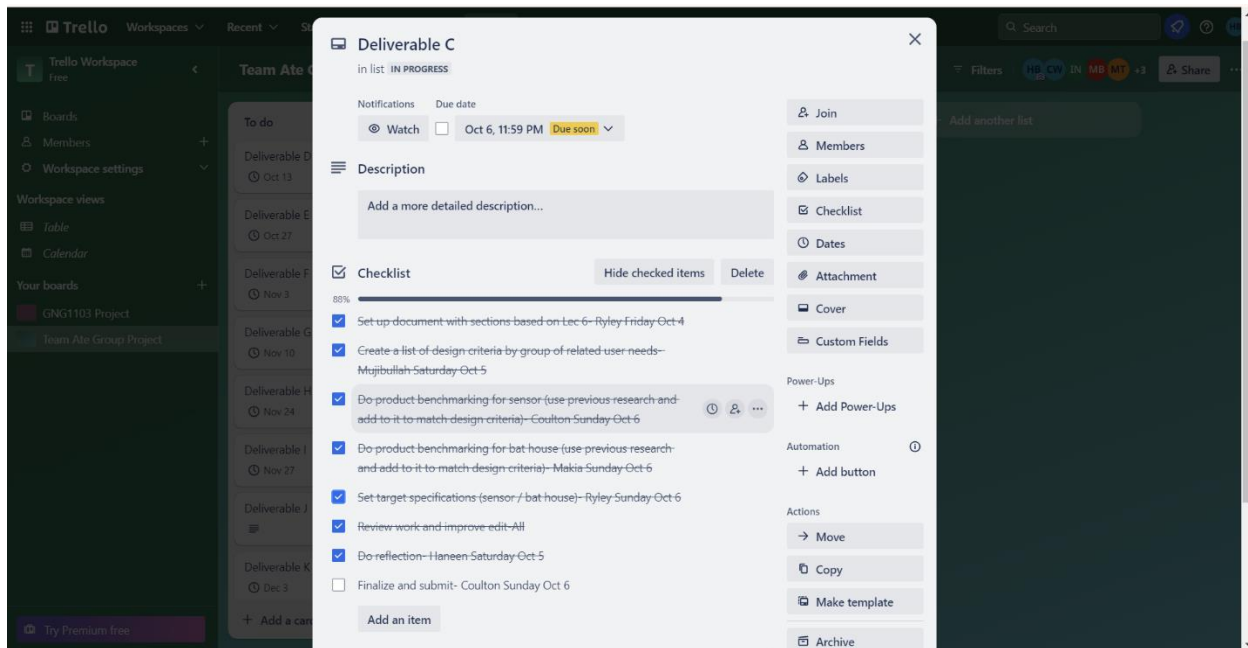
### Reflection

Our design requirements map the user requirements we discussed with the client either directly or indirectly. Many of our functional requirements are a direct result of the needs expressed by the client for suitability of the bat house (such as size, protection) while others are indirect, for example ease of use led to identifying that the sensor needs to be non-wired. Our design criteria needed to be benchmarked against two types of products which are bat boxes and sensor because none of the bat boxes we researched had sensors. The customer needs were descriptive and to convert them into design criteria we had to translate them into quantitative and qualitative criteria. A user need often resulted into multiple design criteria, for example the need to monitor bat usage of the house resulted in design criteria around the type of sensor, the power source for the sensor and the constraint around data storage of the sensor. There are no



major changes to the requirements, the user requirements remain the same however the design requirements led us to think through additional details. We have now more details on the type of sensor and design details on achieving the livability and temperature through material choices and maintainability.

## Trello Updates



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