BPS - Bat Preservation Society

Deliverable C: Design Criteria

Team C03-17

Engineering Design GNG1103

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1. Introduction

In the previous deliverable, deliverable B, the purpose of the project was introduced, and the client needs were outlined. The device that will be designed for the client, Tiree, will be used to track the number of bats that are using bat boxes around Canada. The data that is collected by the device will be stored for future analysis.

The purpose of deliverable C is to define the design criteria and target specifications that are needed to begin the design of the BPS prototype device. The design criteria are based on the client's needs that were identified in the last deliverable. Technical benchmarking of similar devices is also done to compare products and determine the pros and cons of devices that are currently in the public market. Target specifications are then done on design criteria that has been organized into lists of functional criteria and non-functional criteria, which is then followed by constraints.

Table 1. Ranking of Client Needs by Importance Revision

Client Needs	**Importance**
Ability to track the population of bats using bat boxes	5
Data is collectable and accessible to the client	5
Low cost	3
Easily constructable	2
Minimal maintenance	2
Weatherproof and durable	4

2. Design Criteria

Need	**Design Criteria**	**Importance**
Ability to tell how many bats enter and collect data	Tracking	5
	Storable and Collectable data	5
$150 or less	Cost ($)	3
Can withstand weathering of the seasons	Weatherproof	4
	Durable	4
Box must be warm enough for the bat between April and October	Colour	3
The sensor and box should be easy to install	Quick setup (min)	2
The bat house must only require 1 Maintenance visit per month	Low Maintenance	4
	Battery Life (weeks)	5

Client needs the sensor to be applicable with existing bat boxes	Sensor works with existing boxes	3
Can't let light in the box or else bats won't roost	Opaque	5

Functional Criteria	Non-Functional Criteria	Constraints
Tracking and storable data Opaque Sensors work with existing boxes	Low maintenance Weatherproof Colour Quick setup Durable	Cost Does not disturb bats Month long battery life

3. Benchmarking

The three products that we researched were the Cavity Peeper, Digital Borescope, and the Apodemus Bat Counter. The Cavity peeper is a small camera that can slip into crevices easily. The Digital Borescope is a double-sided camera on the end of a cable that is used for the observation of bat roosts or boxes. The Apodemus Bat Counter is a metal rectangle that reads the number of animals or objects that may fly through it. Our research is categorized below, in tables 3.1 and 3.2.

3.1 Analyzing similar products and competition based on Design Criteria:

Product Name:	Cavity Peeper	Digital Borescope	Apodemus Bat Counter
Tracking	No, only has observation	No, only has observation	Yes
Tracks Entrances vs. Exits	No, only has observation	No, only has observation	No, only total passages
Data Storage	Yes, USB or SD card	Yes, wireless to mobile device	Yes, SD card or email
Automatically Uploads Data	Yes, if connected or just SD card	No, must be connected within 50 feet	Yes
Low Cost	No, $749	Yes, $149	No not at all, $2,849
Weatherproof	No, meant for short term observation	Kind of, is more durable but also meant for short term	Yes, metal frame is coated with a durable treatment
Low Maintenance	Yes, very easy to use	No, must stay close and be wary of transmitter position	Yes, data collection is simple

Easy to Assemble	Yes	Yes	No, must be plugged into battery and set up

3.2 Benchmarking System based on Design Criteria

Product Name:	Importance	Cavity Peeper	Digital Borescope	Apodemus Bat Counter
Tracking	5	1	1	3
Tracks Entrances vs. Exits	4	1	1	2
Data Storage	5	3	3	3
Automatically Uploads Data	4	2	1	3
Low Cost	5	2	3	1
Weatherproof	3	1	2	3
Low Maintenance	3	3	1	3
Easy to Assemble	2	3	3	1
Total		60	58	75

After researching, we have found 3 different products that involve the tracking of bats. After performing technical benchmarking, we have concluded that we will be referencing Apodemus Bat Counter when designing our device.

4. Target Specifications

4.1 Functional Criteria

	Design Specifications	Relation (=, <, or >)	Value	Units	Verification Method
1	Tracking	=	Yes	N/A	Testing
2	Tracks Entrances vs. Exits	=	Yes	N/A	Testing
3	Data Storage	=	Yes	N/A	Testing
4	Automatically Uploads Data	=	Yes	N/A	Testing

4.2 Non-functional Criteria

	Design Specifications	Relation (=, <, or >)	Value	Units	Verification Method

1	Low Cost	<	100	Dollars	Estimate, Final Check
2	Weatherproof	=	Yes	N/A	Testing
3	Low Maintenance	<	1	Month	Testing, Analysis
4	Easy to Assemble	=	Yes	N/A	Analysis

4.3 Constraints

	Design Specifications	**Relation (=, <, or >)**	**Value**	**Units**	**Verification Method**
1	Cost	<	150	Dollars	Estimate, Final Check.
2	Bat Entrance is Unobstructed	=	Yes	N/A	Analysis
3	Does not Disturb Bats	=	Yes	N/A	Analysis

5. Conclusion

This deliverable outlined design criteria and target specifications needed to design the BPS device prototype. Criteria that were identified from the client's needs was divided into functional and non-functional criteria, as well as important constraints. Benchmarking was used to compare 3 similar products that follow these criteria: Cavity Peeper, Digital Borescope, and Apodemus Bat Counter. To conclude, Apodemus Bat Counter best met the criteria and will be used as a reference when designing our device.

6. References

Cavity Peeper Camera - Wireless. (2024). Bat Conservation and Management, Inc. https://batmanagement.com/collections/digital-inspection-cameras/products/cavity-peeper-camera-wireless

Digital Borescope - Dual lens, 1080P resolution. (2024). Bat Conservation and Management, Inc. https://batmanagement.com/collections/digital-inspection-cameras/products/digital-borescope

Apodemus Bat Counter. (2024). Bat Conservation and Management, Inc. https://batmanagement.com/products/apodemus-bat-counter