The Robins

Deliverable B - Needs Identification and Problem Statement

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Client: Frederick Conn

Overview:

The purpose of a bat box is to attract bats to locations where they are endangered or hardly seen. Its purpose is to protect bats from predators during their rest periods throughout the day after night foraging. The goal of this project is to build a sensor that can measure the number of bats entering and exiting the bat box while withstanding heat waves, extremely low temperatures, and overall weather conditions. In addition, to ensure that the bats are not scared off and are comfortable. Our task is to design a sensor small enough to fit within a standard bat box without taking up too much room, allowing the bats to continue feeling at ease and getting as much rest as they require without any disturbances. Additionally, we are required to put together a prototype bat box for the bats and install the sensor inside.

Organizing Needs:

Number	Needs	Importance
1	Adding a net/ platform for the bats to grip onto while climbing into the box	5
2	Fits all species of bats in Canada	4
3	Device to record the amount of bats using the bat box	5
4	Compact and can fit anywhere	3
5	Easy to clean from the inside	4
6	Easy to install by a non-engineer	5
7	Lightweight	2
8	Ventilation	4
9	Mimics trees to attract bats	3
10	Box has to be insulated, but at the same time it can't get too hot or too cold	5
11	Can protect the bats from all types of predators	4
12	The counting device must be easily added to preexisting bat boxes	5

Legend:

Very Important: 5 Somewhat Important: 4 Not Really Important: 3 Somewhat Not Important: 2 Not Important: 1

Problem Statement:

A bat box with a device to count the number of bats using the box is needed so the effectiveness of bat boxes can be more accurately studied to ensure the safety and preservation of bat species in Canada. The counting device must be easily applied to existing bat boxes across Canada, effectively record the number of bats using the bat box, relay this information to the appropriate source, and the bat boxes must be easily installed and accessible for all bat species in Canada.

Customers & Users:

Lead client is Tiree Company, with Frederick Conn as a representative. The product will be deployed by his company, and will be marketed to other companies as well. End users will deploy and maintain this product to act as an offsetting measure when demolishing/displacing current bat habitats. The most important users in this case would be bats.

Gathering and Interpreting Raw Data:

Since the users in this case are bats, raw data is impossible to collect, instead, we have used peer-reviewed academic journals.

- Bats, specifically male unidentified Myotis, and long-eared species had "Roost sites [that] were evenly distributed among four main stand types: old-growth white pine, mature white pine, old aspen, and mature boreal mixedwoods" (Jung, Thompson, Titman 329)
- The same study says that the bats preferred dying trees in high altitudes for roosting
    - Preference was towards tree snags. Snags are pieces of bark that have partially detached from the tree, thus creating a small space for bats to roost in.
- The study found that the snags in which the bats roosted were closer to bodies of water, which implies that moisture is a factor to account for. (Jung, Thompson, Titman 331)
- It would be best to create bat boxes that can heat up faster in the morning and retain the heat without overheating throughout the day, as "southfacing side of snags, with dark bark, might become too warm for bats" (Jung, Thompson, Titman 333)
- The bat boxes should be able to withstand some sun exposure, as bats are more likely to choose roosting sites with lots of canopy gaps (an area in a forest that does not have trees creating shade) (Fabianek, Simard, Racine, Desrochers 544)
    - This gives the impression that warmth is ideal
- Female maternal bats roost together in colonies reaching thousands, while non-reproducing female and male bats roost in smaller colonies (Langlois Habit and Habitats)
    - The large colonies have warm roosts, while the smaller ones prefer cooler
    - Need to clarify with the client on which colonies we're expecting
- For big brown bats, "They prefer cool temperatures" (Berry)
    - This seems to be the same for smaller colonies
- Would like to gather weather data on the specific parks bats will be placed in
- Screens would be the worst implementation as a grip as "it may be shredded over time. At worst, bats may be getting trapped under parts of the screen. " (Chenger Shredded screen)
    - The same website brings up checking to see if the bat box is airtight by shining a light. We should be making sure that the materials used keep it airtight over longer periods.
    - Keep an open bottom to make sure cleaning droppings aren't a chore

Overall, the bat boxes should prioritize the comfort of the bats through insulated material and dark, snug space. It might be effective to use the same materials that were preferred by the bats in the study by Jung and Thomas. Bats need warmth after cool night expeditions. However, these boxes should not be overheating. This can be done by instructing that the boxes are placed facing east to gain heat in the morning and then rely on insulation for the rest of the day. Considering that these boxes should be able to withstand Ontarian weather, it would be best to look up the weather patterns of the specific conservation parks and build based on that. This information could also let us research the insects within the area that might want to build nests in the bat boxes.

References:

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List of Needs:

The most important needs that the product must meet are as follows:

- Must be accessible to all species of bats in Canada. This includes an effective landing zone for the bats, proper insulated spaces for roosting, air vents for fresh air intake, and it must be large enough to fit all species in the deployed area.
- The bat box and counting device must be easily installed by a non-engineer.
- Includes a counting device to accurately measure the amount of bats using the bat box.
- The counting device must be easily applied to existing bat boxes across Canada.
- The bat box must protect the bats from predators.
- Must have a conservative cost to produce.
- The bat box and counter must need, at most, maintenance once per month. Reducing the frequency of maintenance is a large bonus.

Some features that could be included in the design but do not take precedence over the most important needs are as follows:

- Compact design to fit in small spaces and not impose on preexisting structures.
- Easily cleaned to reduce maintenance.
- Lightweight to make installation and transport easier.
- The design mimics trees to encourage the use of the box by bats.
- Able to transmit counting data remotely to remove the need to physically collect data.

Further Questions We Can Ask During Our Next Client Meeting:

- Is there a preference for the number of bats the box should accommodate?
    - We’re assuming that these bat boxes are for smaller colonies (non-reproducing ones that don’t reach insanely large numbers). Double-check that
- Can safety measures be incorporated to protect humans from potential diseases bats transmit?
- Is there a specific type of wood that would be preferred for the design?
- Are there ongoing bat research projects to compare the collected data?
- What is the expected lifespan of the bat box?
- Are there any weather conditions that may affect the bat box (rain, snow, humidity) and are there any ways you would prefer we design the box to accommodate these weather conditions?
- Are there any concerns about disturbing the bats during the counting process, and how should that be minimized?
- Are there specific parks these boxes will be placed in?