

Prioritised Design Criteria

1. Safe and Suitable Environment for Bats (Highest Priority):

- Functional Requirement: The bat box must provide a safe habitat, with proper roosting space and temperature regulation.
- Non-functional Requirement: It should operate quietly to avoid disturbing the bats.
- Constraints: Temperature inside the box must remain below 40°C.
- Metrics:
 - Internal temperature monitoring (below 40°C)
 - Quiet operation (below a defined decibel level)
 - Roosting space ($\frac{3}{4}$ inch spacing between slats)

2. Consistent Data Collection (High Priority):

- Functional Requirement: The system must track all bat entries and exits accurately, with the possibility of adding timestamps.
- Non-functional Requirement: The data collection system should be reliable throughout the bat season (April to October).
- Constraints: Sensors must function continuously and without interference from bats or environmental factors.
- Metrics:
 - Accuracy of entry/exit counting (95% or above)
 - Sensor lifespan (minimum 6 months of reliable operation)

3. Environmental Impact (Moderate Priority):

- Functional Requirement: The bat box should be made from eco-friendly materials to minimise environmental damage.
- Non-functional Requirement: Solar panels or other eco-friendly power sources should be integrated to reduce energy consumption.
- Constraints: All materials must be weather-resistant, durable, and sourced sustainably.
- Metrics:
 - Use of ethically sourced materials (compliance with environmental standards)
 - Energy efficiency (use of solar panels)

4. Ease of Installation and Maintenance (Moderate Priority):

- Functional Requirement: The bat box must be simple to install and maintain, with a maintenance time of less than 30 minutes.
- Non-functional Requirement: The design should allow easy access to sensors and monitoring equipment.
- Constraints: Maintenance must not disturb the bats or interfere with their habitat.
- Metrics:
 - Installation time (under 1 hour)
 - Maintenance time (under 30 minutes)

5. Prototype Budget (Lower Priority):

- Constraint: The prototype must cost between \$50 and \$150.
- Metrics:

- Total cost of materials and construction (\$50-\$150)

6. Temperature Monitoring (Lower Priority):

- Functional Requirement: The system must monitor temperature inside the bat box to ensure a suitable environment for the bats.
- Non-functional Requirement: The temperature data should be collected consistently to track environmental conditions.
- Constraints: The temperature must remain below 40°C.
- Metrics:
 - Accuracy of temperature readings (within $\pm 1^\circ\text{C}$)
 - Frequency of data collection (e.g., every 5 minutes)

Technical Benchmarking

1. Existing Products:

- Some existing bat boxes focus on eco-friendliness by using sustainable materials, but they lack the integration of data-collection sensors.
- Current wildlife monitoring systems use motion or heat sensors to track entry and exit, which is viable for bat tracking.
- Ultrasonic Sensors could also be used to count entries and exits, ex.
<https://github.com/Abdelrahman1810/People-Counter-Arduino-UltrasonicSensors>

2. User Benchmarking:

- Users appreciate durable and low-maintenance boxes but note difficulties in installing systems with multiple components (sensors, solar panels).
- Reliability in data collection is highly valued, especially in wildlife research, where gaps in data can skew results.

Target Specifications

- Material Durability: Minimum lifespan of 5 years in outdoor conditions.
- Temperature Range: Internal temperature must not exceed 40°C.
- Sensor Accuracy: 95% accuracy in tracking bat movements.
- Cost: Between \$50 and \$150.
- Installation Time: Under 1 hour.
- Maintenance Time: Less than 30 minutes every 6 months.
- Weight: Variable, as long as it can be supported on a tree
- Dimensions (Minimum): 2 ft tall, 20 inch chambers, 14 inches Wide, Landing area 3-6 inches below entrance

Reflection on Client Meeting

Feedback from the client emphasised the importance of sustainability and minimising environmental disruption. As a result, the team increased the priority of eco-friendly materials and energy efficiency (solar power). The client also highlighted the need for accurate data collection, pushing the team to focus more on reliable sensors. Furthermore, the client emphasised the importance of minimal maintenance on the bat box/the tracking system. As a result, the team increased priority on creating a tracking system that requires little maintenance, using high quality components and being powered by the aforementioned solar.

Task Plan Update

- Add more detailed sub-tasks for sensor testing, eco-material sourcing, and solar panel integration.
- Verify task completion deadlines and balance the workload considering team members' availability and deadlines from other courses.
- Ensure that tasks related to testing and reporting are divided among team members to meet the deliverable deadline.

This structure ensures that all client needs are systematically addressed and that the project meets both technical and environmental goals. Let me know if you'd like help with specific sections!