

Group 16: Deliverable H

Objective:

For the third prototype of our bat box, specifically the circuit portion, our goal was to refine the ultrasonic sensor system that monitors the number of exits and entries of bats in our bat box. We aimed to improve the sensor's accuracy, resilience to external forces, and overall power efficiency.

- Test the ultrasonic sensor's ability to accurately detect both the entries and exits of the bat
- Verify that the battery/electronics system stays dry under simulated weather conditions.
- Ensure the Arduino code stores and tracks the time of entries and exits, and are able to be easily accessed.

Key Testing Areas:

- Enhanced ultrasonic sensor accuracy
- Environmental Durability

Components We Tested and the Results:

Ultrasonic sensor:

- Objective: Ensure that the sensor is able to detect entries and exits at the 30cm mark with an accuracy of 98%.
- Metric: No more than 1 false trigger in 50 entries/exits.
- Test:
 - Simulate bat movements using objects of similar size
 - Test with different speeds, angles, etc.
 - Test in varying conditions such as different light levels.

Results:

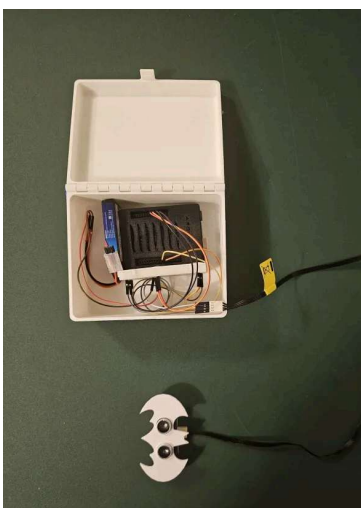
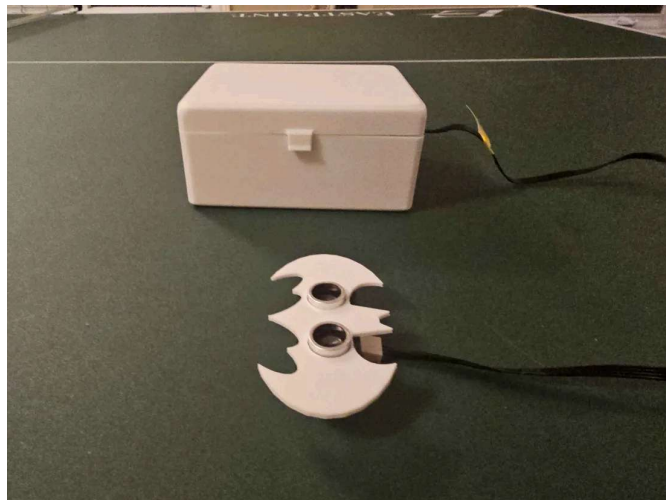
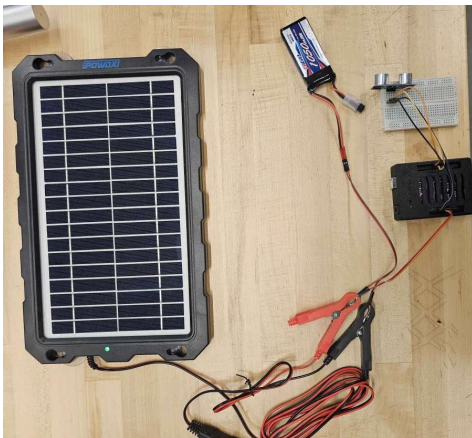
- The ultrasonic sensor met the performance metric with an accuracy rate of over 98%, though there is room to improve when it comes to high speed entries. All of the false triggers were a result of high speed tests, however, this is not a major issue as bat's generally do not enter bat boxes at high speeds.
- Total number of test cases: 300
- Number of false triggers: 5
- Accuracy: 98.3%

Environmental (Rain) Durability:

- Objective: Ensure that the electronics system is fully weatherproof and is able to withstand exposure to natural weather conditions such as rain. The electronics should remain functioning at all times.
- Metric: No water should be able to enter the electronics system to ensure there are no malfunctions.
- Test:
 - Simulated rainfall tests should be conducted on the electronics box alone, to ensure that if water were to enter the bat box, it would still not penetrate the electronics compartment.

Results:

- After our box was in moderate rain for 30+ minutes, our Bat Box passed the rain test.
- More importantly the compartment with the electronics stayed completely dry.
 - We observed that the electronics compartment stayed dry, but we have still created waterproof casing for our electronics, to make our design even more secure and reliable.
 - The casing will be included in our final product, we decided to include it even though our box passed our rain testing.



This is our electronics setup, including the solar panel, sensor, battery, and all of the respective casing.

This is our final circuit setup, and what we used in our testing.