BPS - Bat Preservation Society

Deliverable H: Prototype III and Customer Feedback

Team C03-14

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Abstract

In the previous deliverable, Prototype II was generated based on feedback received from the client and others. After additional feedback was generated from Prototype II, modifications were done to produce Prototype III. This deliverable highlights our entire experience when designing Prototype III, including modifications and issues that arose during the process.

1. Introduction

In the previous deliverable, Prototype II was developed based on feedback that was generated from Prototype I. Prototype II underwent testing and analysis which provided additional feedback so modifications can be done to improve our design. The purpose of this deliverable is to present our final prototype, Prototype III, along with an analysis of its functionality and performance. This deliverable then discusses feedback that was generated from our final prototype and our final project updates.

2. Prototype III

2.1. Bat Box

For the final prototype, we have constructed our bat box that will be used on Design Day to demonstrate the functionality of our sensor. The box was made from 1/8 inch thick MDF that was cut with a laser in the MakerLab. The dimensions of the box are as follows: two 9”x9” panels used for the front and back, two 2”x9” panels used to mount the camera, four 9”x4” panels used for our landing pad and side panels, one 9”x4 ¼” panel for the roof, and four 0.47”x0.47” squares for the elevation blocks. These panels were adhered together with super glue to ensure a durable and stable product.

The landing pad for our final prototype has a different design that is not typical in most bat boxes. The purpose of this modification is to aid the load cell correctly sense when weight is applied to the landing pad. It consists of two panels with elevation blocks that are attached oppositely to the load cell. This creates space for the load cell to experience bending.

We faced some issues when testing our sensor after being attached to the landing pad. The issue originated from the elevation blocks. When weight was initially applied to the landing pad, the elevation block split in half. This resulting in us having to reassemble the landing pad and laser cut new blocks. We also thought about changing from glue to screws for just this part of our design so it can be more durable.

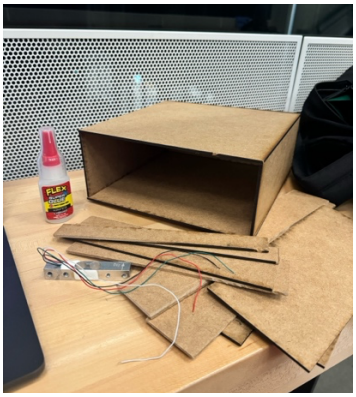

Figure 1 - Bat Box

2.2. Load Cell Sensor

To track entries, the load cell sensor detects weight that is applied to the landing pad by measuring the bending force that the cell experiences. Once weight is detected, an entry is tracked and added to a counter. This counter represents the number of bats that have used the landing pad.

For Prototype III, the load cell sensor underwent multiple test runs as we ran into some issues with the counting frequency and the sensitivity of the sensor. Eventually, we successfully fixed issues found in the code and now have a fully functional load cell sensor.

However, after we had to disassemble the bat box due to the elevation blocks splitting, the load cell was damaged in the process. When testing the damaged load cell, it did not meet expectations as it could no longer accurately sense weight.

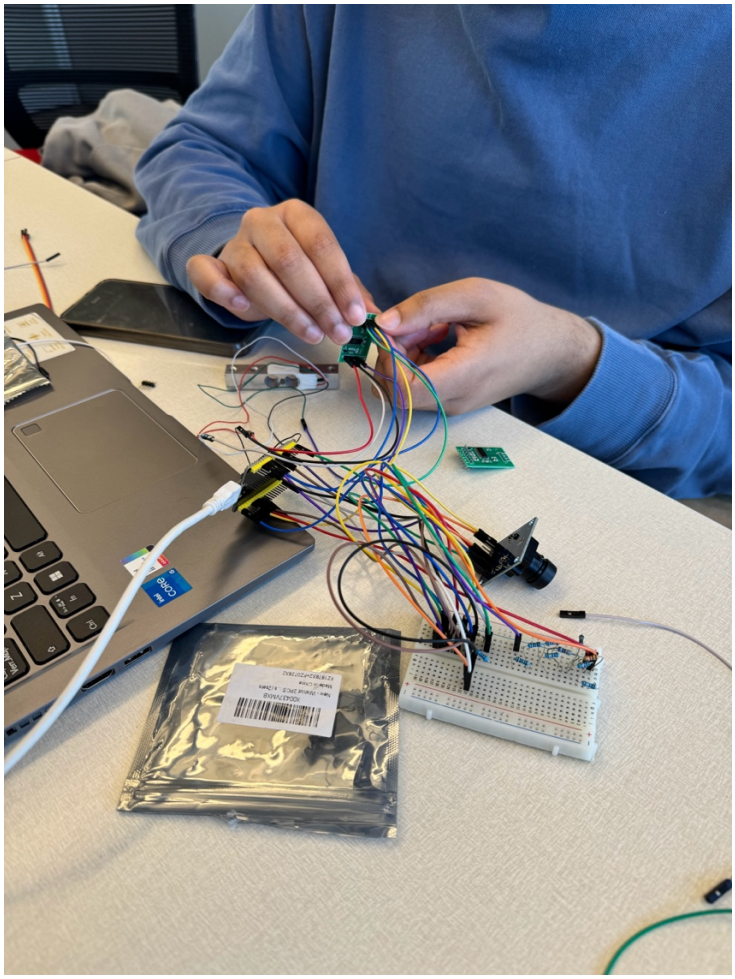

Figure 2. Wiring for Prototype III

2.3. Camera

To start testing the camera we first had to wire the camera module to the board. This took a lot more wires than we expected so we had to order more wires to complete it. The complex wiring also took more time than we expected.

When testing it alongside the sensor we discovered that the camera drew too much power from the board which stopped the sensor from functioning. Due to the time constraints, we decided that it was best to prioritize the functionality of other components instead of the camera.

2.4. Wi-Fi

Initially, code to send pictures taken from the camera to excel was missing. Members began to change our code to account for this as others worked on the functionality of our camera. After we determined that we could not use the camera, this part of the code was discarded.

Once the load cell sensor was finally working, testing of the WIFI module was able to start. As data began to be collected from the load cell, issues seemed to present themselves when we tried to send the data over to excel. Our code proved to not function as we wished for it to intend to. In order to send data over to excel, a third party was required. Due to our lack of research and programming inexperience, we understood that this would take a lot of time to correct. Due to the time constraints of this project, we were unable to complete this task.

2.5. Data Application

Minor changes have been done to the data application since the last prototype. The data application is functional and successfully navigates through different screens. It successfully inserts and returns data from excel spreadsheets that is used to register devices and validate logins. The application also displays the number of entries over different time ranges and all data collected.

Although we have a functional data application, major improvements and modifications still need be done before it can be put into use as a real product. These consist of having live updates to data, and the ability to edit data in the spreadsheet and discard or sort entries. These problems proved to be very difficult to fix and would require much more time for us to solve with our level of programming.

Figure 3. Data Application

3. Feedback

3.1. Feedback

Since the third client meeting, we have not received any additional feedback from client. However, we gathered feedback from our teacher's assistant and project manager, who emphasised on making sure that our sensor was functioning to meet our expectations and the expectations of our client. They said that the camera and data application are additional features that were not necessarily needed for our product. However, if we managed to complete the load cell sensor, having additional features would be beneficial to the success of our product.

3.2. What is Next

Our designed would have to be re-analyzed before proceeding with future steps. When testing all subsystems together, multiple issues presented themselves. In future steps, the landing pad would be redesigned to be more durable, our power supply would have to be re-analyzed, and more time would be spent working on the functionality of our WIFI module.

4. Project Updates

4.1. Updated Project Schedule

Table 1. Updated Project Plan

Item	Description	Teammates	Date Due	Duration
In-Class Presentation	The team will prepare and give a presentation on our project to our classmates.	Whole Team	November 26	2 Days
Design Day	The team will write a pitch that one member will present to a panel of judges on design day.	Whole Team	November 28	2 Days
User Manual	The team will write an easy-to-understand manual for potential users.	Whole Team	December 3	6 Days

4.2. Updated Bill of Materials

Minor adjustments were made to the Bill of Materials. To demonstrate our sensor on design day, we decided that we would use tennis balls to simulate the landing of the bats. This will be done by throwing the tennis balls onto the landing pad that is covered in velcro strips. The Velcro strips that were used were added to the Bill of Materials.

Table 2. Updated Bill of Materials

Item/material	Description	Quantity	Size/Dimensions	Est. Cost per	Total est. Cost
Legend					
Green	We have the item				
Yellow	We might not the item				
Grey	We might not need				
Bat Box					
MDF	Material used for bat box panels and landing pad	2	18" x 24	$2.50	$5.00
Glue	Used to assemble the bat box	1	1" long	$7.96	$7.96
Velcro Strips	Used to help with our demonstration	1	1"x4"	$10.99	$10.99
Sensor					
Load Sensor	Used to track bat entires by attaching to landing pad	1	3.0" x 0.5" x 0.5"	$17.99	$17.99
Camera	Takes snapshot when load cell is triggered. Used for additional information	1		$9.99	$9.99

Wi-Fi (ESP32)	Used to send data to data application	1		$12.00	$12.00
Bread Board	Electric circuit for our device	1		$5.00	$5.00
Wires	Used to wire sensors	3		$1.00	$3.00
Software					
Python v3.14	Programming software used to create our data application	1	N/A	N/A	free
tkinter library	Python library used in data application code	1	N/A	N/A	free
Arduino IDE	Programming software used to create our sensor	1	N/A	N/A	free
DFRobot_HX711.h	Library used for our load cell	1	N/A	N/A	free
ArduImageCapture plugin	Library used for our camera	1	N/A	N/A	free
Ada_fruitOV7670	Library used for our camera	1	N/A	N/A	free
ESP32	Library used for WiFi module	1	N/A	N/A	free
LiveOV7670	Library used for our camera	1	N/A	N/A	free
openpyxl library	Python library used in data application code	1	N/A	N/A	free
datetime library	Python library used in data application code	1	N/A	N/A	free
TOTAL (with tax)		$81.28			

5. Conclusion

In conclusion, many issues arose during the development of Prototype III. This prototype proved to be the most challenging of all which tested our abilities to work well and maintain positive teamwork under stressful situations. Although the functionality of our product does not meet our expectations, we are all satisfied with the efforts made throughout this project. As final presentations and Design Day approaches, our team will reflect on all lessons learnt throughout this experience.