

Background and Summary

The purpose of this project is to provide a foraging puzzle that will measure the force produced by the red crossbill (*Loxia curvirostra*) while it forages for seed. The physical device will hang from the side of a cage and apply a variable force to a hinge that the birds will open for seeds. The force produced will be then examined to determine different feeding behaviors in risk-reward scenarios and how willing they are to work for food. The goal of this project is to find a way to accurately measure the force produced by the red crossbill so the information can be used for research purposes.



Figure 1: Foraging Bird

Engineering Requirements

- Measure Force
- Safety for the Birds
- Data Visualization
- Cleanability of System
- Damage Resilient
- Mounting to Side of Cage
- Bird Accessibility
- Budget

Foraging Puzzle for Songbirds

Researching foraging methods & behavior

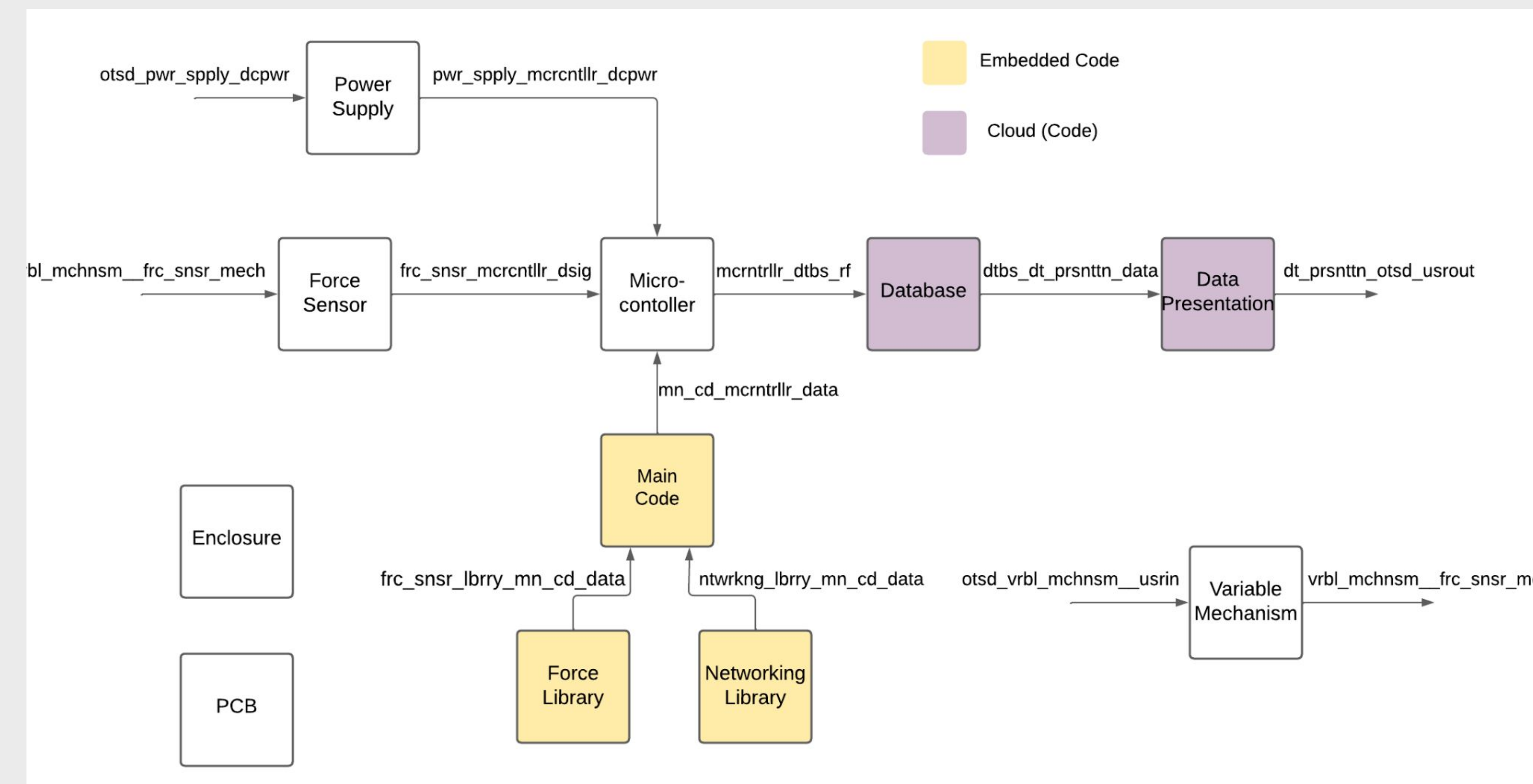


Figure 2: Block Diagram

Key Components:

Force Mechanism → Sensor → MC → DB → Data Presentation

- Force Mechanism - Hinge mechanism that bird interacts with to collect food reward. Resistive force determined changeable by variable force spring. Includes safety system to protect the birds.
- Sensor - A load cell and amplifier that takes data (10 samples/sec) on the force applied to the force mechanism, which is sent to the microcontroller.
- Microcontroller (MC) - Receives data from the force sensor and sends this data to the database wirelessly. Able to connect to secure and unsecure networks.
- Database (DB) - MySQL database is used to manage the data collected from the load cell.
- Data Presentation - PHP website using the chart.js API to display data as a graph.

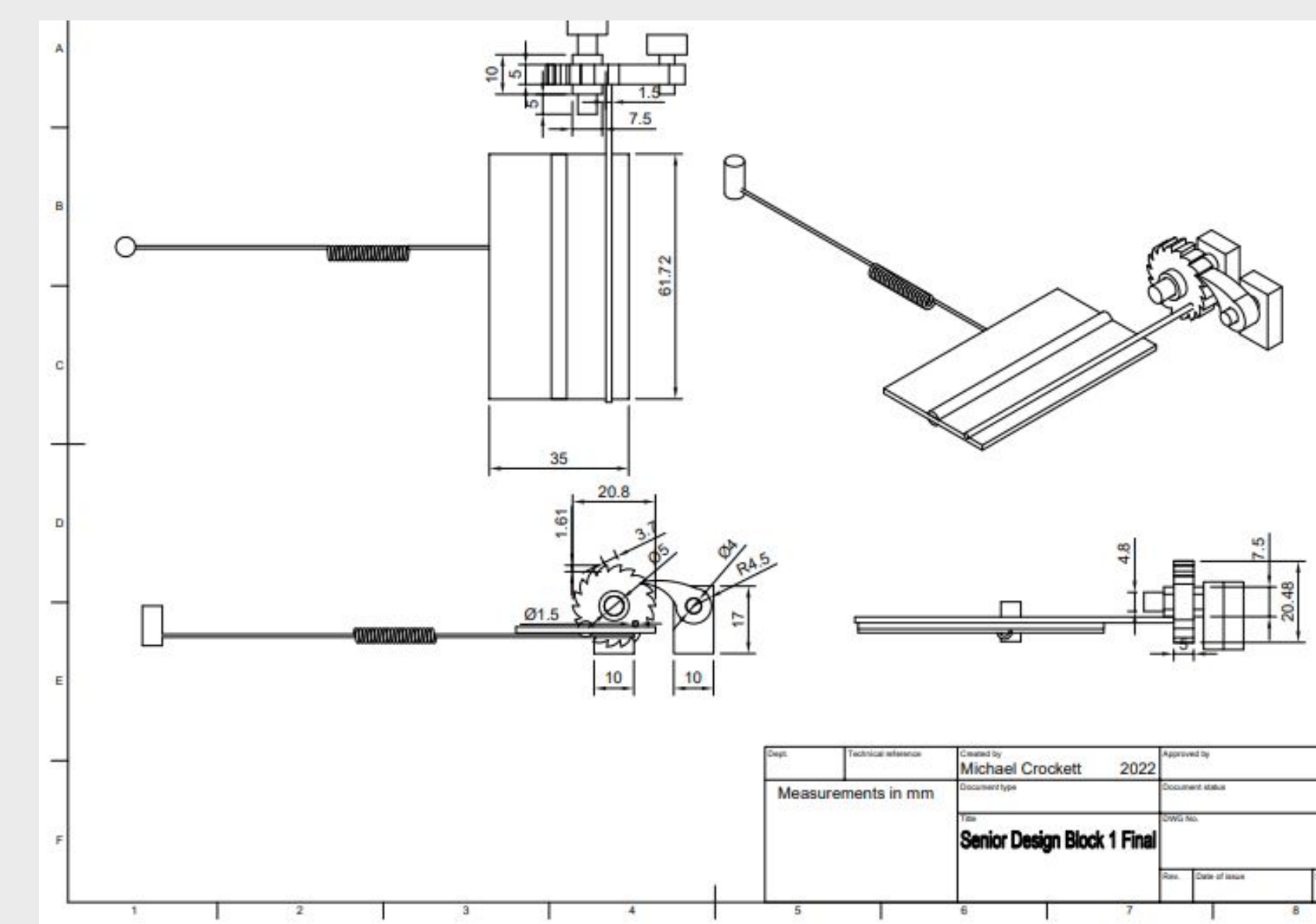


Figure 3: Mechanical Drawing

Next Steps

While the solution built fulfills the main purpose of the project; to measure and record data on force applied by the birds; there is still room for improvement in terms of the usage as well as the system itself. Ideally, 30 - 40 individual systems with differing resistive forces could be used in a proposed experiment to study behavior. Our system currently is designed to be used individually, as it requires its own microcontroller and power supply. To adapt our system for mass use, it could be modified to utilize a battery pack for power. Furthermore, rather than each system using its own microcontroller, the system could be designed to easily attach to a main microcontroller, that allows for multiple systems to take data.

Project Partner



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Figure 4: Bird Testing

Project Team



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