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EET411

Senior Project

Instructor: Dr.Satinder Gill

**Project Title:** The Smart Bird Feeder

**Team Members:**

* Jeffery Wheeler: Project Lead
* Sean Copple: Team Member
* Joshua Tilson: Team Member
* Valentin Wolf: Team Member

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**Date:** 4/13/2025

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# Abstract

This project focuses on the design and development of a smart bird feeder that improves upon existing feeders by addressing a common issue: unwanted access by animals such as raccoons. The main objective is to create a bird feeder that limits food access to birds only, using a controllable cover mechanism. The initial approach involves opening and closing the feeder based on day and night cycles. Future improvements include the integration of a load cell to detect the weight of visitors and deny access if the detected weight exceeds that of a typical bird, helping to distinguish between birds and other animals.

Additional features planned include a camera for capturing images of feeding birds, a food level sensor to monitor and report when the food supply is low, and a solar panel with automatic sun tracking to power the device independently. The camera and load cell may also support bird identification and behavior analysis. The system will eventually be connected to a mobile app for live updates and alerts. The project uses a mix of sensors, automation, and app integration to enhance usability, sustainability, and data collection.

# Introduction

Bird feeding is a popular hobby that allows people to connect with nature, observe wildlife, and support local bird populations. However, many bird feeders on the market face a common problem: they are easily accessed by animals such as raccoons, squirrels, or larger pests that consume the bird food and often damage the feeder. This not only increases the cost of feeding birds but also limits the effectiveness and enjoyment of bird watching.

The main problem this project addresses is the lack of secure access control in traditional bird feeders. In many areas, especially near wooded or rural locations, raccoons and other animals frequently disrupt feeders. These intrusions reduce food availability for birds and can lead to frequent refilling and repair. While some commercial feeders offer partial solutions like baffles or weight-triggered perches, they are often not customizable, lack automation, and provide limited feedback to the user.

This project aims to design a smart bird feeder that not only prevents access by unwanted animals but also adds modern features such as automation, remote monitoring, and solar charging. By combining hardware like servo-controlled covers, load cells for weight detection, cameras, and level sensors, the feeder can intelligently respond to its environment. A mobile app will allow users to view bird photos, receive alerts about low food levels, and monitor feeder activity.

The goal of this project is to build a functional prototype of a smart bird feeder that solves the problem of animal intrusion while offering additional features to enhance the bird feeding experience. The project also explores ways to make the system energy-efficient and autonomous by incorporating solar power. Through this work, the team hopes to provide an innovative, practical solution for bird lovers and hobbyists.

# System Design

* Present a block diagram of your system architecture, clearly labeling each component.
* Briefly describe the function of each block and its connection to other components.
* Provide a high-level description highlighting key design decisions and considerations.

## Hardware Description

* Provide detailed descriptions of the hardware components used in your project.
* Include specifications for microcontrollers, sensors, actuators, and other relevant hardware.
* Discuss component selection criteria and justification.
* Explain any custom-designed hardware elements.

## Software Description

* Briefly explain the software architecture and development flow.
* Describe the functionalities and algorithms implemented in your software.
* Highlight key software libraries or frameworks used.
* Include code snippets or flowcharts for key functionalities (optional).

# Implementation & Testing

* Describe the process of implementing your project, including:
  + System assembly and hardware integration.
  + Software development and debugging.
  + Testing procedures and verification methods.
* Discuss any encountered challenges and implemented solutions.

## Construction

* Provide details on the physical construction of your project, including:
  + Fabrication methods and materials used.
  + Prototyping or final product construction process.
  + Calibration and fine-tuning steps.

## Testing Process

* Describe the comprehensive testing process conducted on your project.
* Explain the test cases designed to cover different functionalities and conditions.
* Present the results of your testing, including any identified issues or limitations.

# Data Interpretation & Analysis

* Present and analyze the data collected during testing and project operation.
* Discuss the meaning and implications of the obtained results.
* Compare your results with theoretical expectations and existing research.

# Conclusion

* Summarize the key findings and achievements of your project.
* Restate the project objectives and evaluate their fulfillment.
* Discuss the overall success of your project and its limitations.

# Future Work

* Propose potential future improvements or expansions for your project.
* Suggest further research directions based on your findings.
* Discuss the broader implications of your project and its potential applications.

# References

* List all references used in your report according to the IEEE referencing style.
* Ensure accurate and complete citation information for each reference.

# Appendices

## Appendix A: Block Diagram

## Appendix B: Trade Study

## Appendix C: Budget

### Budget

### Parts List

### Bill of Materials (BOM)

## Appendix D: Schedule/Gantt Chart

#### Team Structure:

The project team is composed of five members: Jeffery Wheeler, Sean Copple, Joshua Tilson, and Valentin Wolf. Each member brings a unique skill set to the group, allowing for a well-rounded and collaborative approach to the smart bird feeder project. Team roles were assigned based on individual experience and personal strengths.

Jeffery Wheeler is the project lead. He initially proposed the bird feeder idea and has extensive experience in mechanical systems and control design. He also owns a 3D printer and has a clear vision for the final product’s design and functionality. As the team lead, he will guide the project’s direction, coordinate tasks, and make final decisions when needed.

Sean Copple is highly skilled in both electrical and mechanical tasks and also owns a 3D printer. Shaun is responsible for identifying and sourcing critical hardware components and assisting with physical assembly and wiring.

Joshua Tilson is part of the Mechatronics program and brings strong experience in building control systems. Like the rest of the group, he has access to a 3D printer and is involved in selecting components for the project. Joshua will also support hardware integration and testing.

Valentin is responsible for the documentation and communication. He is responsible for writing and organizing project materials, scheduling meetings, and coordinating information flow between team members. He also supports all other areas of the project as needed.

Although specific roles have been assigned, all team members contribute across disciplines including software, hardware, and design. Tasks are divided to maximize efficiency and are reassigned as needed based on availability and progress. All major decisions are made collectively. If any disagreement arises, the project lead will make the final decision to maintain momentum and ensure consistency.

#### Communication Plan:

Effective communication is essential for this project, especially since the team members are located in different time zones. To stay connected and on track, the team has implemented a structured communication plan with multiple tools and channels.

A dedicated group chat was created for quick updates, sharing images and videos, and staying in regular contact. For more formal discussions, the team uses the ECPI Canvas group page, which includes discussion boards for each project topic. This platform is also used for collaboration on weekly assignments and lab reports.

In addition, the team shares and updates project files through a shared folder on the ECPI group page. All files are organized by week and labeled with clear names and timestamps to track progress and maintain version control.

The team meets twice a week. The first meeting takes place at the beginning of the week to plan tasks and delegate responsibilities. A second meeting is held every Sunday to review the week’s progress, discuss any issues, and prepare for the next steps. These meetings are held virtually to accommodate different time zones.

This structured plan ensures that all team members are informed, involved, and able to contribute effectively throughout the five-week project.

#### Gantt Chart:

## Appendix E: Code

### Flowchart

## Appendix F: Wiring Diagrams/Parts Design