ECE 342 Final Project

Smart Coop 13

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1   System Overview

The goal of the project is to create a Smart Chicken Coop that will meet many different requirements (partially depending on engineer-defined requirements). This implementation will be reliant upon an Arduino Mega in order to work as expected. Using something like an Arduino is something that allows for the use of prior skills to be applied. Using the Arduino as the "brains" of the operation helps the user to have an automated chicken coop that can keep track of food and water measurements and keep track of sunlight, as well as the chicken coop door functions with sunlight, so it closes and opens depending on sunlight levels. The chicken coop has a signal light tower that lights up when either the food or water levels have drop or the heat lamp is malfunctioning, which helps the user to stay on track with the things that are happening with the coop. This document will outline the electrical specifications, how to setup the system, some of the main artifacts creating during the design, vital information/photos of the student-designed PCB and also information about all of the parts used in the project.

2   Electrical Specifications

Below is a table (Figure 1) of all of the specifications that concern the entire system and each of the specifications are listed under the different voltage levels.

Type	Min Voltage	Max Voltage	Nomial Current	Max Current	Operating Temp.
120V AC Supply	114V	126V	0.75A	15A	20°F to 65°F
24V DC	23.8V	24.7V	0.5A	2A	-20°F to 65°F
5V DC	4.9V	5.1V	0.5A	3A	20°F to 65°F

Figure 1: All of the Electrical Specifications needed for the system listed in a table.

3   User Guide

1. Mount brain box enclosure to the inside wall of the chicken coop within reach of a 120v plugin.

2. Mount 24v door motor 18 inches above the chicken entrance.

3. Mount reed relay magnet to chicken door at the bottom. Mount reed relay that has the wires coming from it beside the chicken coop door so that when the chicken door is closed both pieces line up. Next, mount the second reed relay with wires next to the magnetic reed relay when the chicken door is all the way open

4. Hang feed scale between hook and feeder.

5. Install the water measurement device on the top of the 5-gallon water jug.

6. Connect all peripheral 4 pin female connectors to their respective male connector on the bottom of the brain box.

7. Connect the brain box to 120V AC.

4 Design Artifacts

The block diagram consists of all blocks that enter and leave the system. Following the conventional layout of the diagram, the inputs to the system are on the left and the output of the system is on the right. The majority of the inputs are Analog input signals and input from the environment. Also the majority of the output comes from the digital signals from the Arduino. Part of the output is mechanical due to the automated door. One key output is dependent upon the level of light and that will be considered environmental output as the the door will be opening/closing when it is dark or light outside.
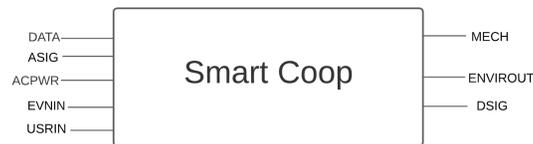

Figure 2: Overview block diagram

The schematic for the entire system is seen in Figure 2. This can be seen as what the main system consists of as the PCB directly connects to the pins of the Arduino Mega and then the various components have corresponding connections to the various pins that are needed from the Arduino. Some of the connections consist of other components needed for a specific test (for example, the LEDs have resistors that need to be connected in series in order to work). The main portion of the schematic is the Arduino Mega and each side of the input or output will have more components if needed.

One of the main 3D Model used is for the relay and it is enclosed within a box. Inside the 3D model, is going to be the 4 channel relay used for the coop in it and allow for some rooms for cables to be pushed through the slot created for wiring of the relays. This enclosure is designed to keep the 4 channel relay safe while enclosed from water and sun and ensures the safety of the electrical material inside the enclosure. With the slot for the wiring to the relay open for wiring, it will allow for easy access to the components in the area and also allows for the ability to switch out the relay box or another component that connects to the relay.
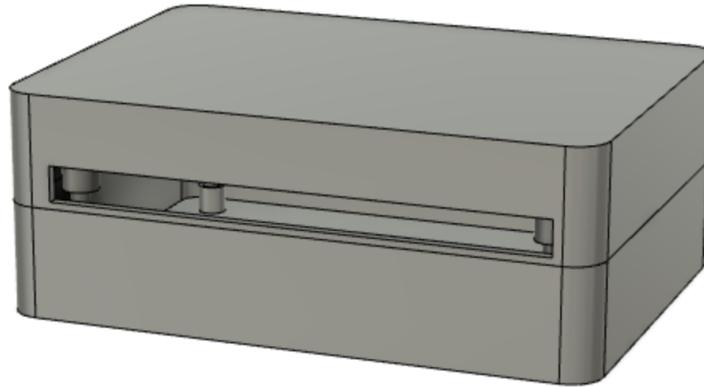
Figure 3: The 3D-designed enclosure that was made for the relays, which is a large part of the making the signal tower lights function.

5   PCB Information

The size of the PCB was 85mm in width and 125mm is length. The PCB was made to be a father board to the Arduino Mega.
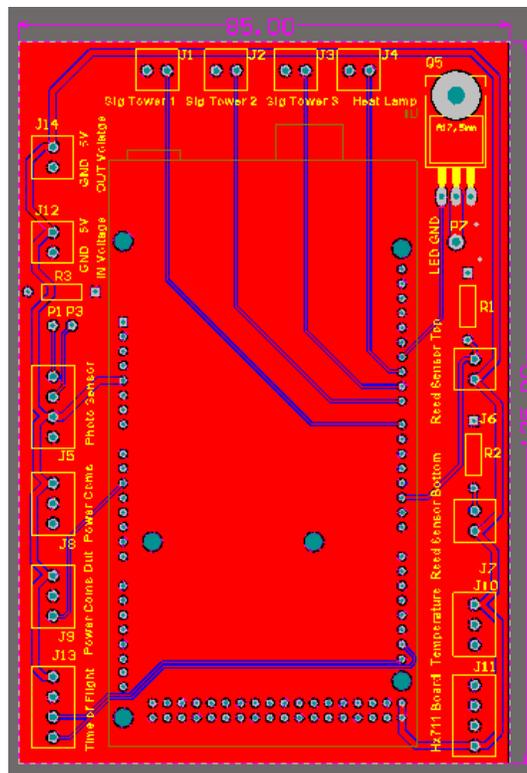

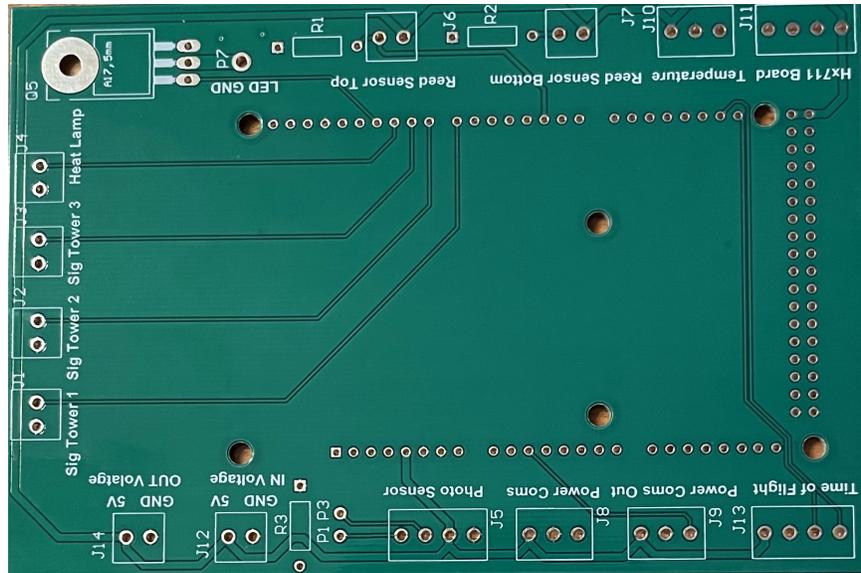Figure 4: The layout of the PCB that shows the internal traces.

Figure 5: The finalized PCB used in the the system.

There were significant errors with the PCB which caused lots of wasted time and frustration when trying to make the PCB work. A design feature of having a solder point to each of the Arduino pins was ignored, multiple sensor points were left out, A set of pentameters were left out. Although the PCB was able to be adapted as with any prototype the design shortcomings caused extra work for those testing and assembling the unit where there shouldn't have been stress/ wasted energy and time. For future deployment of our the PCB would need to be completely redesigned and reworked.

1. All of the connection points to the PCB would be connectors at one end of the PCB

2. The PCB would not cover the USB port or power jack.

3. There would be a solder-able point to access every pin on the Arduino. This allows for expansion or modifications even after the PCB was manufactured.

4. The PCB would connect to the correct corresponding Arduino pins for the respective sensor/peripherals

6 Part Information

General		
Arduino Mega 2560	Microcontroller	1
110V/220V AC to DC 24V 2A power	AC to DC converter	1
24V DC to 5V DC	DC to DC converter	1
PCB	PCB	1
Terminal block	Pwr distro	1
Cable sleve	Cable management	1
4 pin connectors water proof		1
Mounting Screws		1
Tupperware to mount everything in		2
Heat Shrink Tubbing	Heat Shrink for wire connections	2
Jumper Wires	Arduino Jumpers	1
Zip Ties		1
Crimp Connectors		1
Male headers for PCB	PCB to Arduino	1
Sub total:		
Automated Door (Declan)		
L298N Motor Driver	Dual H-Bridge stepper	1
DC 24V 20RPM Motor	Motor for auto door	1
Photo Resistor	Light sensor	1
Magnetic Reed Switch	Door limit switches	1
Sub total:		
Heat Lamp / Lighting (Declan)		
HiLetgo 4-channel relay	Relay for signal tower and heat lamp	1
Led Lights	Lights	1
Temperature Probe	Temp sensor	1
Receptacle	Wall plug	1
Plug	Electrical plug	1
TIP120	To dimm the LED's	1
Resource Consumption (Francisco)		
Food Weight Measurement	Load Cell with H7X11 board	1
Water Measurement	Time of Flight Sensor	1
Current Clamp	Pwr Consumption	1
Sub total:		
Data Collection (Francisco)		
Time Measurement	RTC	1
Ethernet Arduino Shield	SD Card Reader	1
Sub total:		
Signal Tower (Hamad)		
Light tower	Sgnal Status Light	1
Sub total:		
Enclosures (Hamad)	10 cents per gram	
Relay enclosure Print V1	38g	1
Relay enclosure Print V2	90g	1
Relay enclosure Print V3	90g	1
Relay enclosure Print V4	90g	1
Relay enclosure Print V5	90g	1
PCB enclosure Bttm V_0	90g	1

Figure 6: The part information of the entire project.