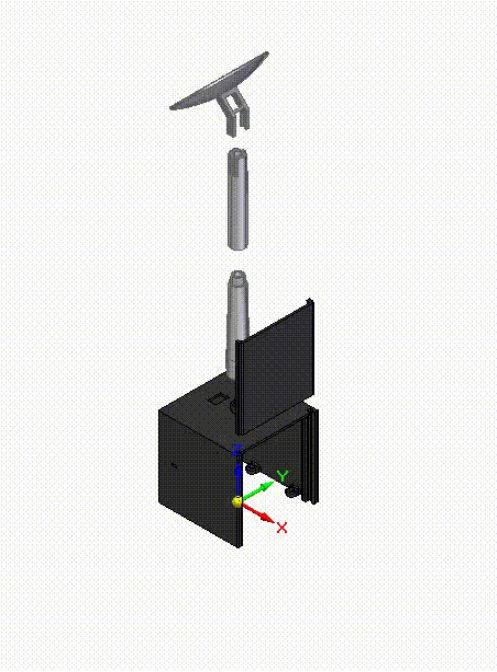
Antenna Construction Documentation

As specified in the ruleset, there are 4 antennas placed throughout the competition board, each in a specified location. This document will serve as a more in depth explanation into the wiring and programing of the antennas. The construction of the antennas is detailed in this document along with the *3D-Printed Part Assembly Guide.*

General Antenna Construction

As mentioned in the ruleset, each antenna will have a unique task to complete to turn on the antenna. These different tasks result in the base of each antenna being slightly different from each other.

Each antenna is constructed using 5 main 3D printed pieces: the base (consisting of the main box and the hatch), 2 cylindrical poles, and the antenna dish. The base should be printed using black filament while the antenna poles and dish are to be printed using the gray filament. The antenna poles and dishes are the exact same for all 4 antennas. The only part that differs from antenna to antenna is the antenna base, which has been altered to properly house the components for the antenna's task. A detailed construction of the antennas is provided in the *3D-Printed Part Assembly Guide.*



Before installing the antenna dish onto the poles, it is easiest to install the RGB LED into the antenna dish. The LED will be able to sit flush within the dish as shown in Figure #1.

Figure #1 – RGB Led shown mounted in Antenna Dish

Wires can then be soldered to the backside of the LED. It's best to put either electrical tape or heat shrink on the metal prongs to ensure they do not come in contact with one another. The wires then need to be threaded through the center of the antenna poles to be connected to the breadboard contained within the antenna box.

Once the 3D printed parts are fully assembled, a switch can be inserted at the top of the antenna base and a green LED can be placed on the side of the base as shown in Figure #2. The switch is slightly loose in the antenna base, so some glue is needed to properly keep it in place.

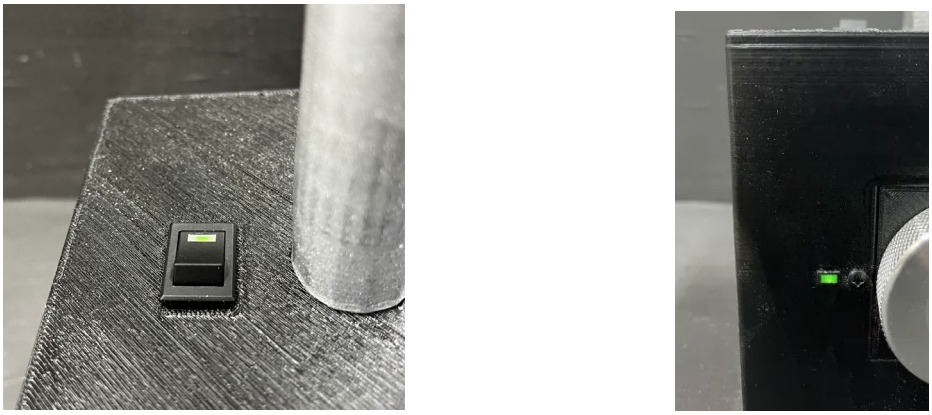


Figure #2 - Illuminated Switch and LED

The antenna is now ready for all other wiring. The Arduino nano's, 9volt battery, breadboard for holding components and wiring are all contained in the antenna base cube.

Also important note about the functionality of the antennas. The antennas are programmed to ensure that once an antenna task has been completed and power has been restored for that antenna; the RGB LED will not turn off until the Nano is reset by turning the rocker switch to OFF then back ON.

Antenna #1 Button Task Additional Notes

Antenna #1 is the button task. For this task the red button needs to be pushed 3 times to restore power to the antenna. For this task a button and 3 additional LEDs will be mounted on the antenna base. The button can be placed on the antenna base and the black retaining is used to hold the button in place. The 3 additional LEDs will be red, yellow, and green and will be placed in the 3 mounting holes to the right of the button. The red will be the highest LED, followed by yellow, then green will be placed on the bottom. When assembled correctly it will look as shown in Figure #3.

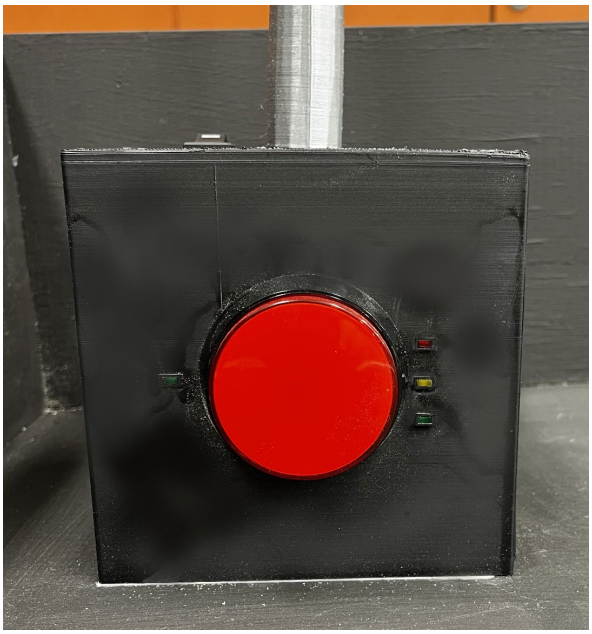


Figure #3 - Front of Button Task Antenna

The wiring for the Button Task Antenna is as shown in Figure #4:

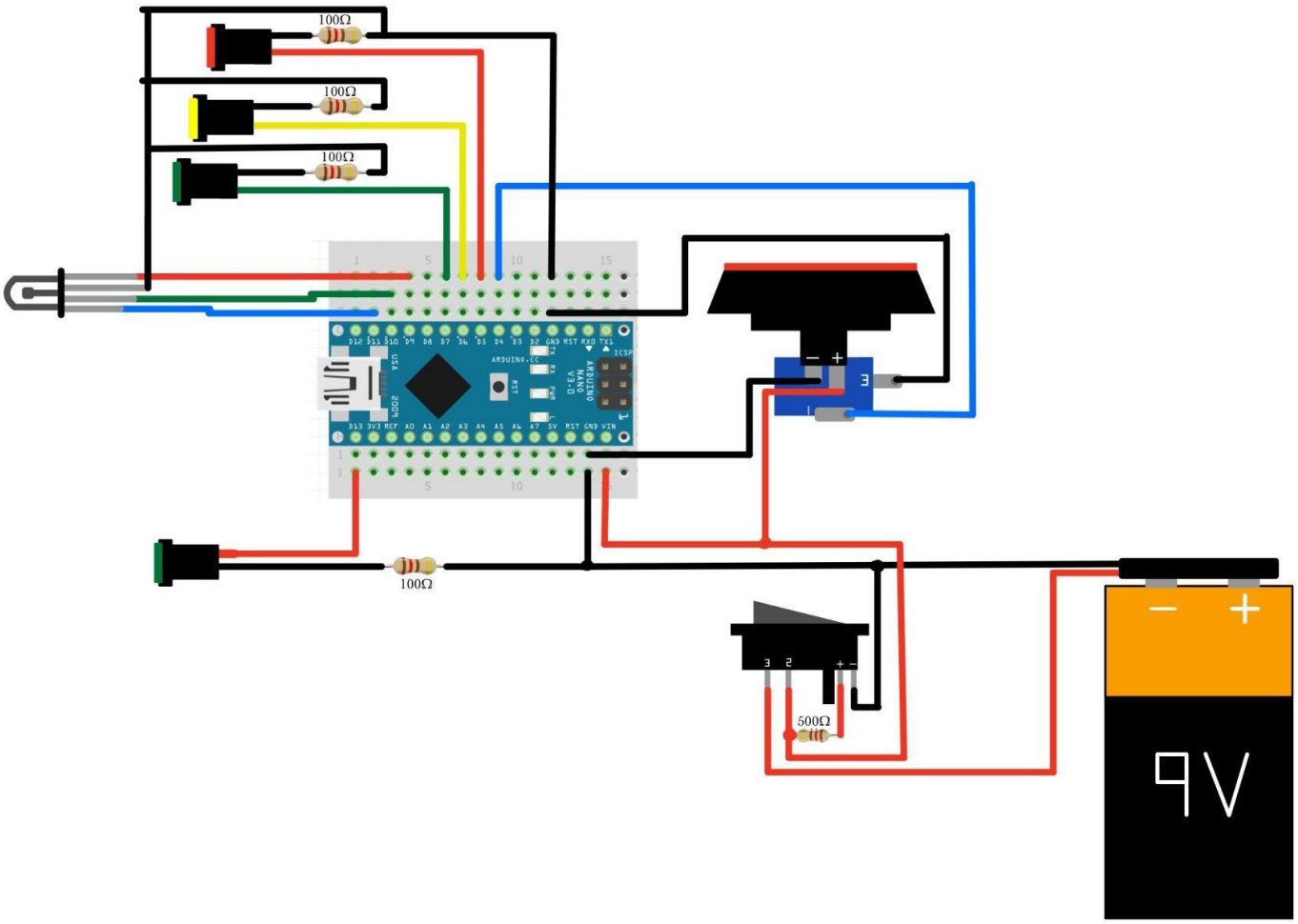


Figure #4 – Button Task Antenna Wiring Diagram

The code for this antenna is provided in a separate document/file. The Arduino Nano needs to be uploaded with the code “Button.ino.” Once properly assembled, wired, and coded, the antenna will look as shown in Figure #5 when the task is completed.

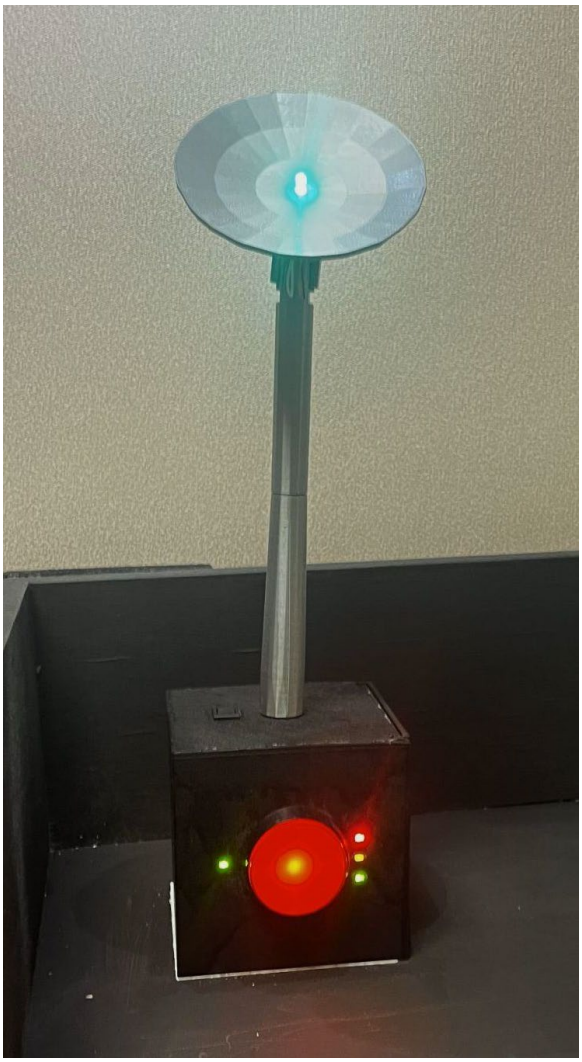


Figure #5 – Button Task Antenna Turned on

Antenna #2 Crank Task Additional Notes

Antenna #2 is the crank task. To restore power to the antenna, a crank needs to be rotated 540 degrees from its starting position at the top of the antenna to. This task has an additional 3D printed part that will store the encoder and mount the crank.

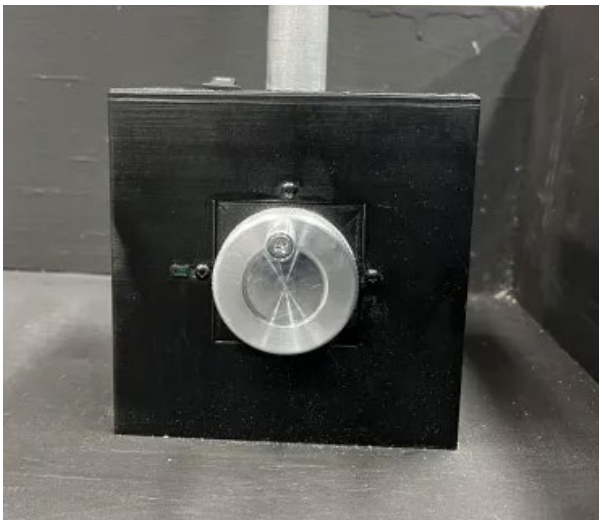


Figure #6 - Front of Crank Task Antenna

Once the crank and encoder are placed in the antenna. The antenna can then be wired as shown Figure #7

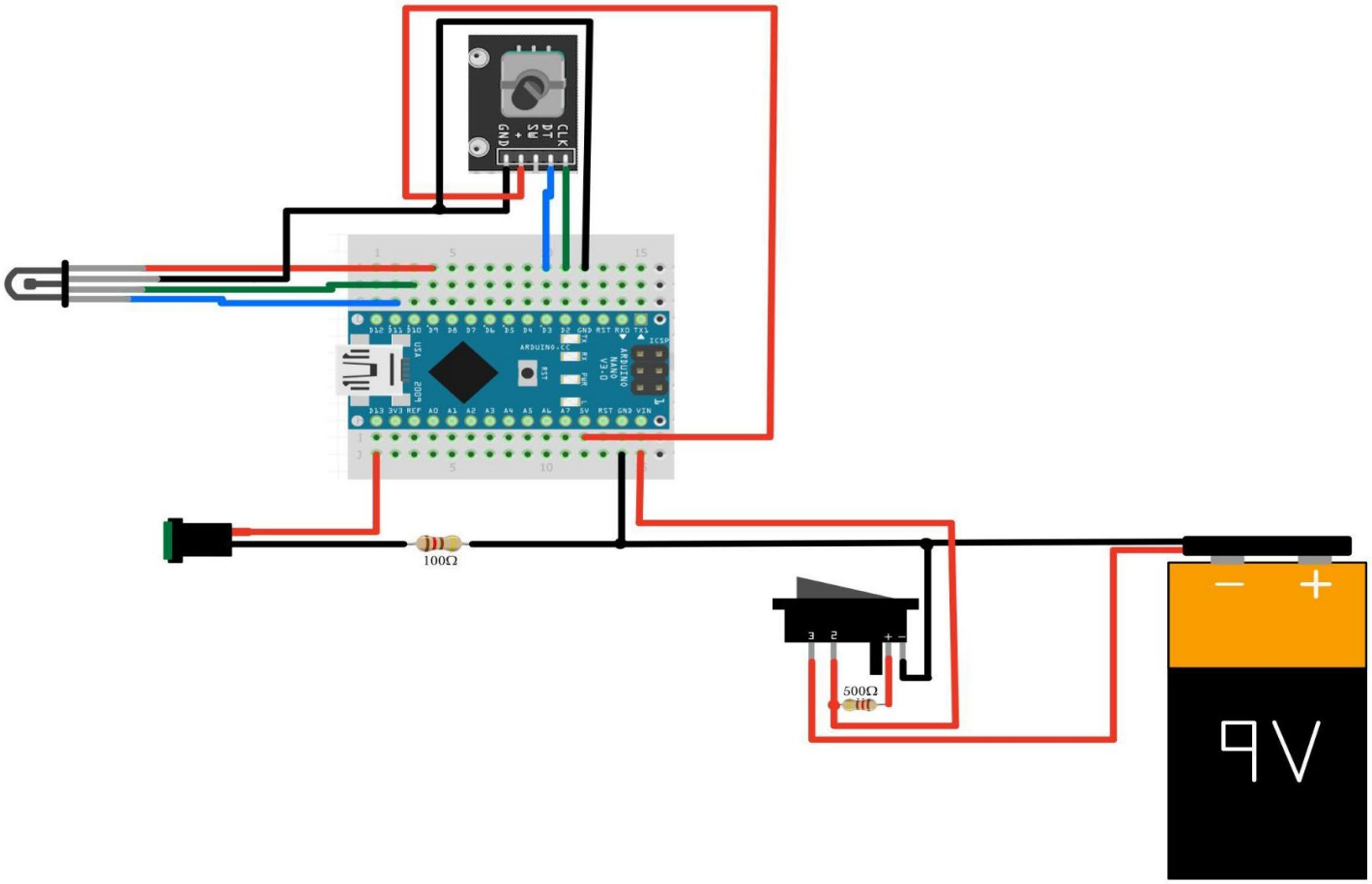


Figure #7 – Crank Task Wiring Diagram

The code for this antenna is provided in a separate document/file. The Arduino Nano needs to be uploaded with the code “Crank.ino.” Once properly assembled, wired, and coded, the antenna will look as shown in Figure #8 when the task is completed.

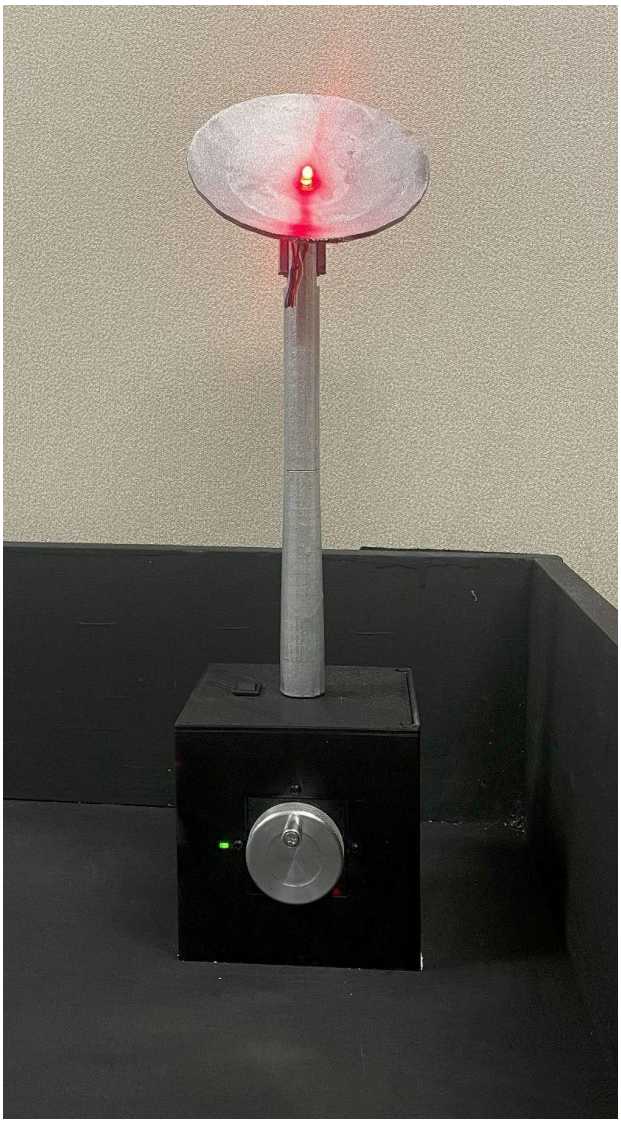


Figure #8 - Turned on of Crank Task Antenna

Antenna #3 Pressure Plate Task Additional Notes

Antenna #3 is the pressure plate task where an Astro-Duck needs to be removed from the top of the antenna to restore power. This task will have a pressure plate on the top of the antenna where an Astro-Duck will be placed before the round begins. The Astro-Duck then needs to be removed from the pressure plate restore power. The pressure

plate antenna base has a hole located at the top of the antenna which wires will run through to be connected to the Arduino Nano.

The pressure plate will be placed as follows on the antenna as shown in figure #9. In order to keep the wires from moving, glue is used to hold the plate and wires down.

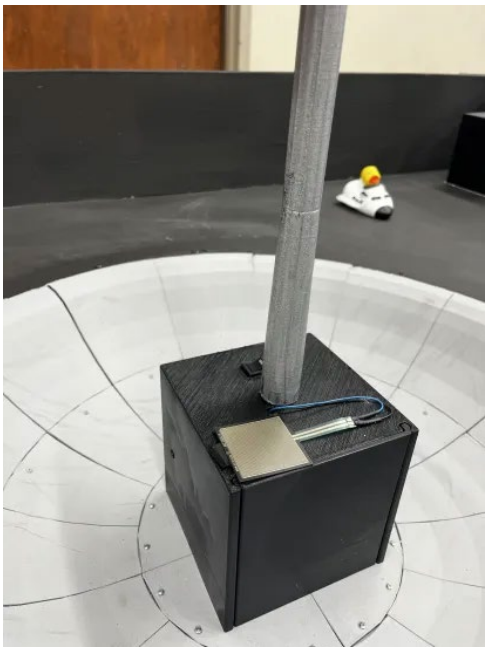


Figure #9 – Pressure Plate Task Antenna Sensor Placement

Once the pressure sensor is placed on the antenna, the antenna can then be wired as shown in Figure #10

The code for this antenna is provided in a separate document/file. The Arduino Nano needs to be uploaded with the code “Sensor.ino.” The code has a built in error state to prevent an error from the Astro-Duck not being placed right at the beginning of the round. Once properly assembled, wired, and coded, the antenna will look as shown in Figure #11.

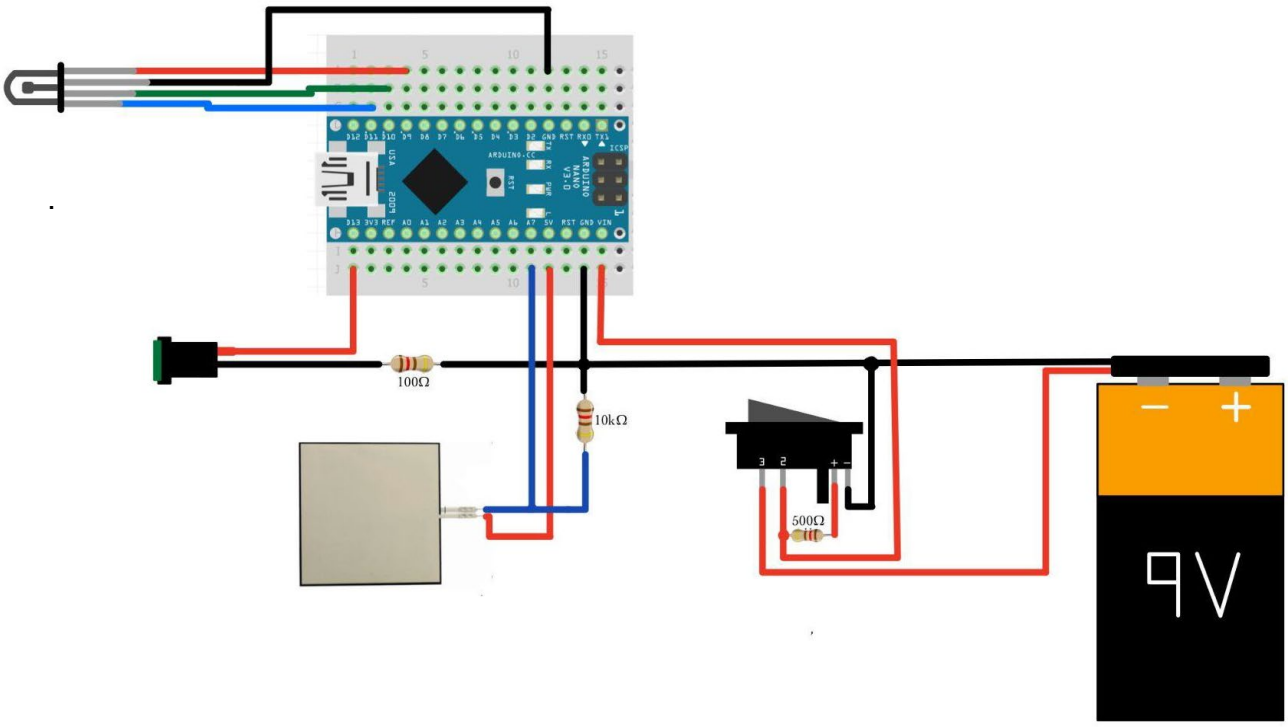


Figure 10 –Pressure Plate Task Wiring Diagram

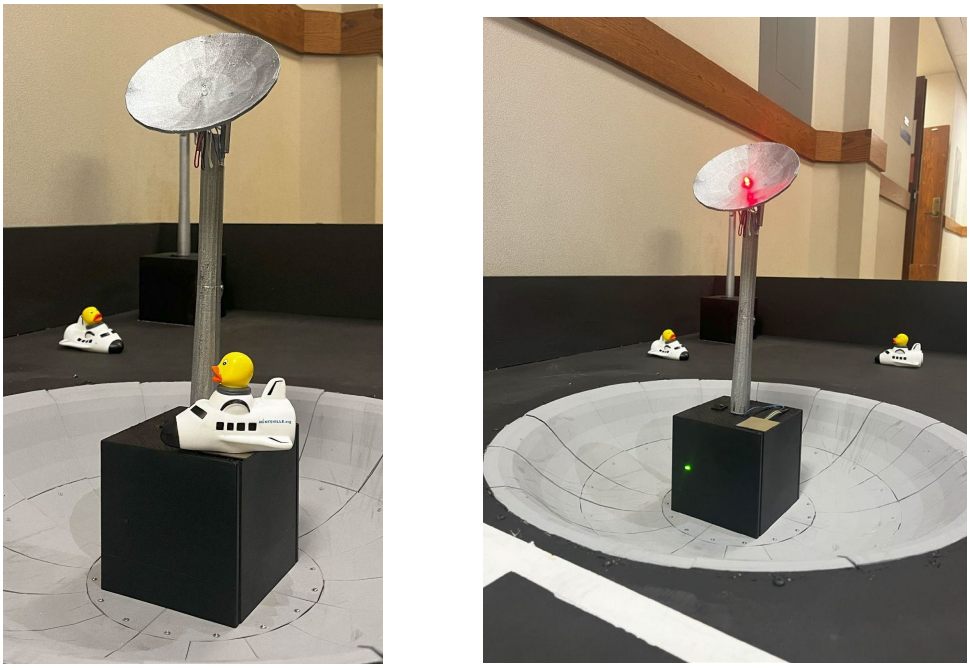


Figure 11 – Pressure Plate Task Antenna Starting Configuration and Turned on

Additionally, to ensure that the antenna is set up correctly, the code used will detect if the Astro-Duck is not placed on the pressure plate correctly. If the Astro-Duck is not

placed correctly on the pressure sensor when the antenna is turned on, The RGB LED in the antenna dish will be flashing red. Once the Astro-Duck is placed correctly, the RGB LED will turn green for one second and then turn off, indicating the antenna is ready.

Figure #12 – Pressure Plate Task Antenna Error State Pictures

Antenna #4 Keypad Task Additional Notes

Antenna #4 is the keypad task. To restore power to the antenna, the code 73738# needs to be entered into the keypad. If an incorrect digit is entered, the code can be reset by hitting, # or *. The antenna base for this task has a mounting hole for the keypad. The keypad is attached to the base with 4 screws as shown in Figure #13

Figure #13 - Front of Keypad Task Antenna

Once the keypad is placed on the antenna. The antenna can then be wired as shown in Figure 14. The keypad pinout is also provided in Figure 14.

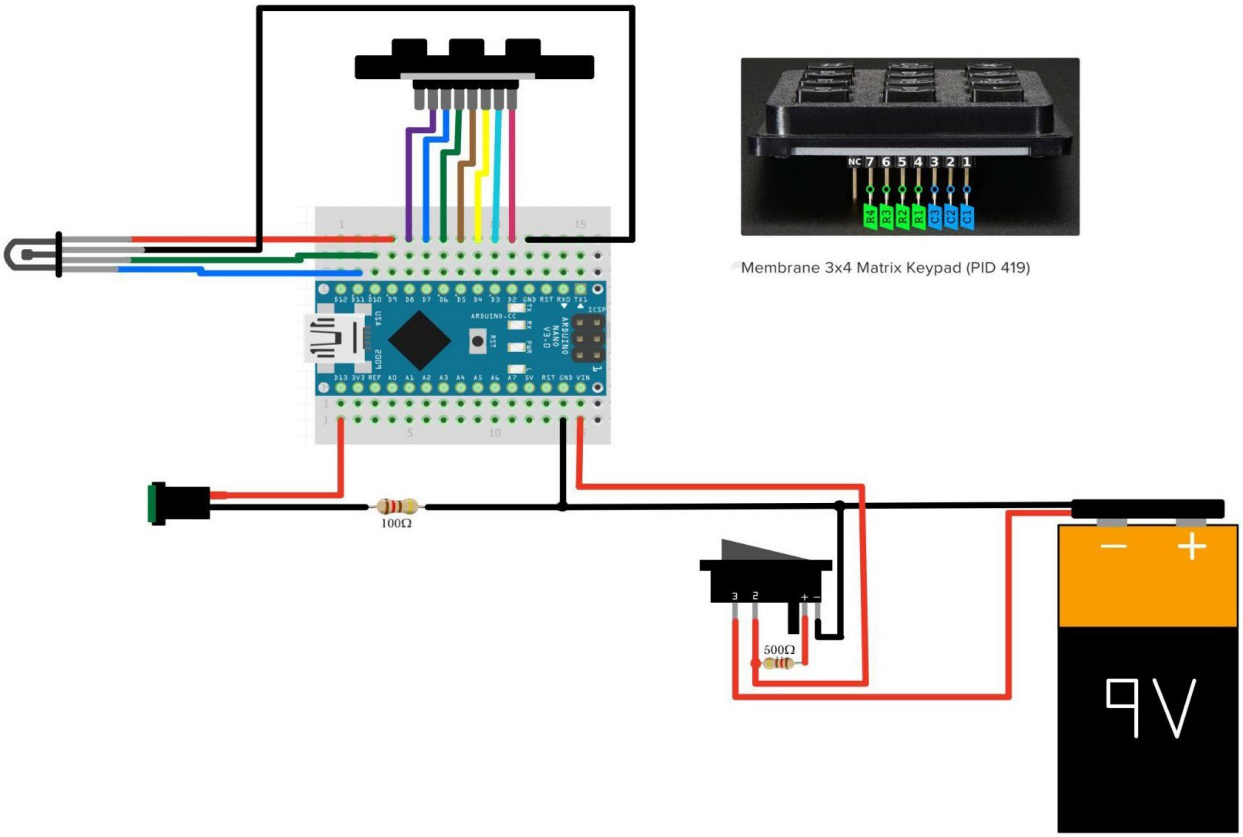


Figure 14 – Keypad Task Wiring Diagram

The code for this antenna is provided in a separate document/file. The Arduino Nano needs to be uploaded with the code “Keypad.ino.” Once properly assembled, wired, and coded, the antenna will look as shown in Figure #15 when the task is completed.

Figure #15 – Keypad Task Antenna Turned on