

**EE Student Names:** \_\_\_\_\_ **Period:** \_\_\_\_\_

**Freshmen Engineering Collaborators:** \_\_\_\_\_

### Windmill Assessment

The 9<sup>th</sup> grade Freshmen Engineering students have designed and build miniature windmills, but they need your help to make them move! You will need to use your experience with motors to attach a motor to the mini-windmill and program it to rotate.

In class, we discussed how different motors work and experimented with DC motors, servo motors, and stepper motors. You will need to choose an appropriate type of motor, attach it securely to the windmill so that the blades can spin freely, and program it to spin continuously. You should also incorporate one or more inputs (button switch, toggle switch, potentiometer, or remote control) that allow the user to turn the windmill on/off and control the speed.

*This assignment counts 40 points in the Assessment category of your grade.*

#### Technical specifications/grading criteria:

- Windmill spins freely (10%)
- Motor is securely attached (10%)
- Motor is correctly wired to the Arduino (10%)
- Arduino is programmed to spin the motor at an appropriate speed for a display windmill (10%)
- One or more switches are correctly wired to the Arduino (10%)
- Arduino is programmed so that the user can turn the windmill on/off (15%)
- Arduino is programmed so that the user can control the speed of the windmill (15%)
- Worksheet below is completed (20%)

#### Optional extensions:

- Add an LED at the top of the windmill that blinks every time it completes one revolution
- Save the birds! Add an ultrasonic sensor that causes the windmill to stop rotating if an object (or animal) gets too close
- Add an LCD screen and display a count of the number of revolutions and power that would be generated by a real windmill (this will require some research)

Video of functioning windmill. Make sure to include your names in the video. Make sure the video displays all the functionality of the windmill (i.e. show how to turn the windmill on/off and change the speed).

Paste your completed code here:

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Explain why you chose the motor type that you selected. What are the benefits, and what drawbacks will you need to overcome?

There are many different ways to program the button(s) so that the user can turn the windmill on/off and control the speed. Explain how the buttons work in your project and why you chose to make them work this way.

Identify one bug that you encountered while coding (OTHER than mistyping a word or forgetting a semicolon). What was your original code and why didn't it work? What did you change it to and why did that work? *(If you didn't encounter any bugs while programming, then you haven't challenged yourself enough—make your program more complex or add some of the extensions until you encounter a bug)*