

# UnReliant Energy

Sydney Madueke and Alec Liu

# Functionality

The objective of this project was to put to test all that we had learned over the course of the semester with a focus on using components and logic to create a windmill power generator with indicator lights.

Our goals:

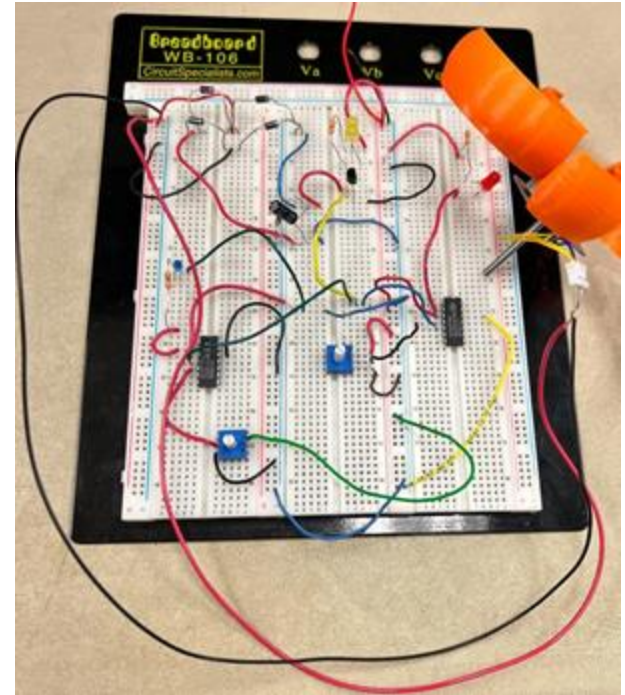
- Generate AC power from the AC motor
- Rectify that AC power into DC power
- Have a light indicate when not enough AC power is being generated
- Have a light indicate when too much AC power is being generated
- Have a light indicate in general how much power is being generated

# Completed Assembly

Mount

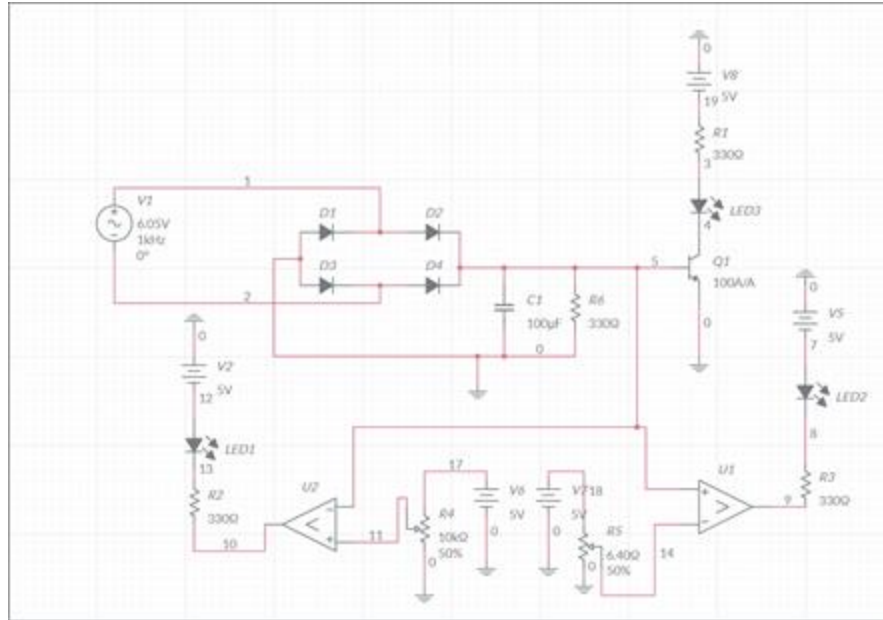


Breadboard

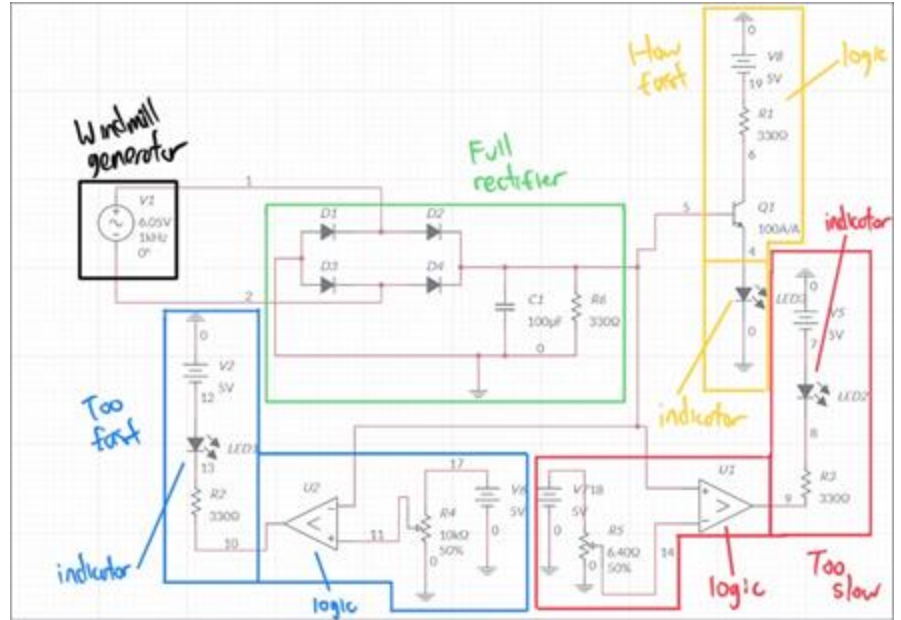


# Circuit

Multisim diagram

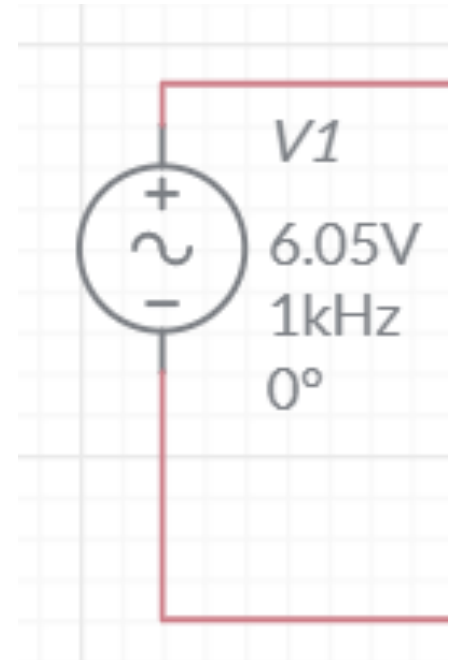


Functionality schematic

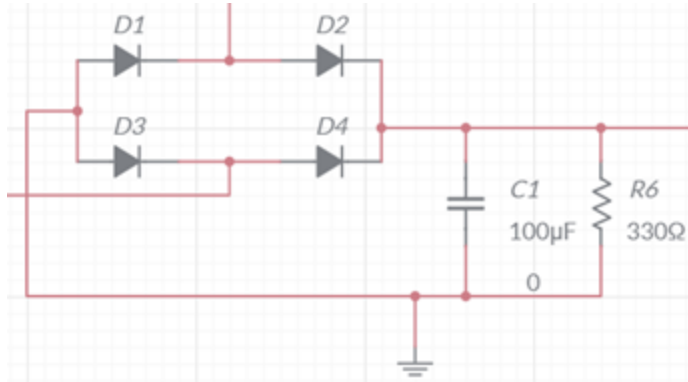


# AC Power

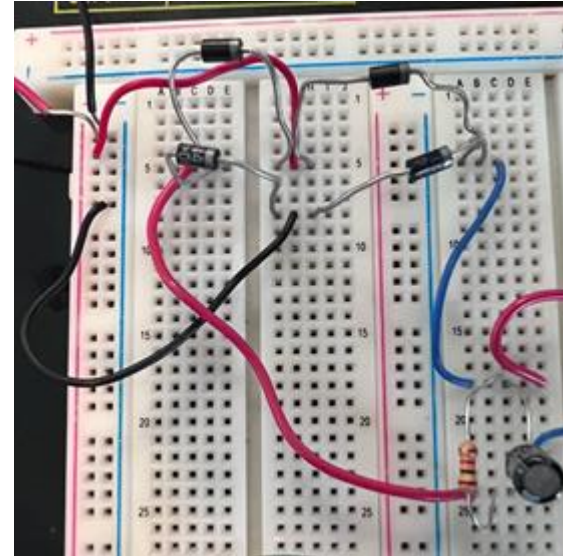
- Converts mechanical energy into electrical power via electromagnetic induction



# Full Wave Rectifier

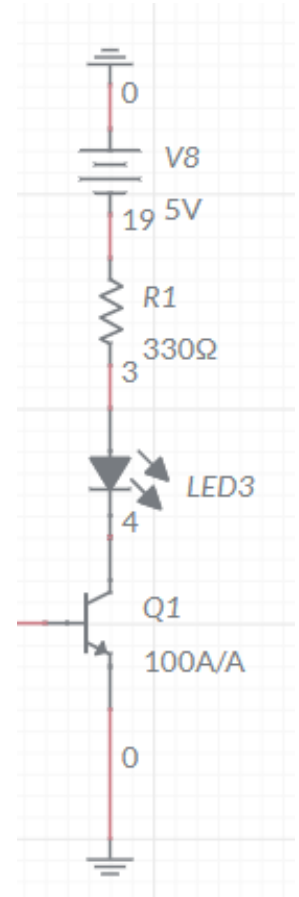
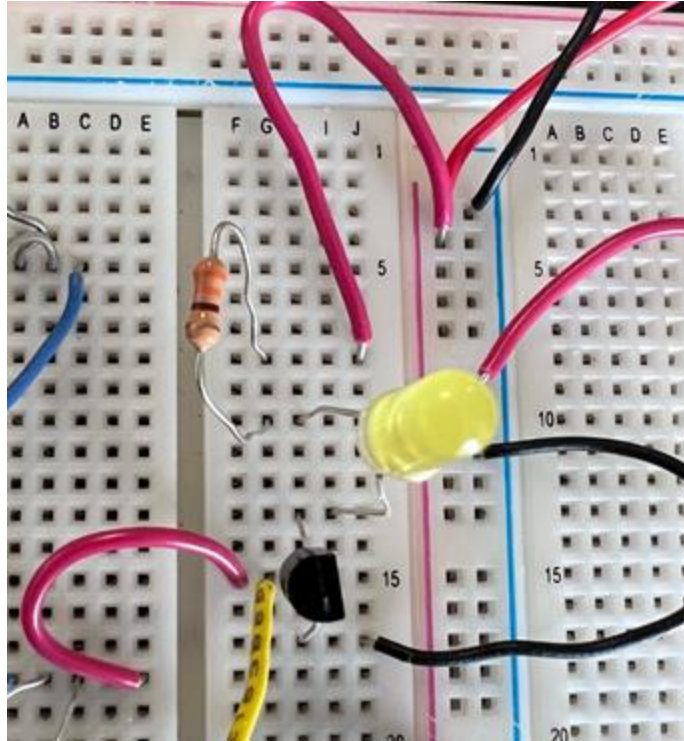


- Turns AC to DC
- Positive half current flows from diode 2 to 3
- Negative half current flows from diode 4 to 1
- Smoothing capacitor smooths voltage supplied to rest of circuit



# “Speed indicator” Transistor LED Circuit

- Increased base current results in increased collector current
- Op amps can achieve similar functionality. In general they are better at amplifying gain but they are more expensive



# Potentiometers

By turning the knob on the potentiometer to increase or decrease resistance, the voltage drop across the resistor can be changed.

This allows us to create a larger or smaller voltage at a terminal of the comparator to compare against the windmill's voltage.

This effectively allows us to adjust thresholds for the “too fast” or “too slow” logic.

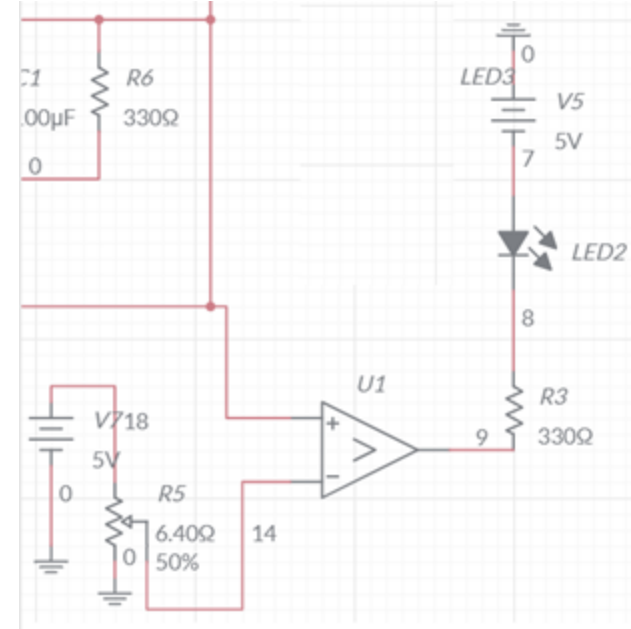
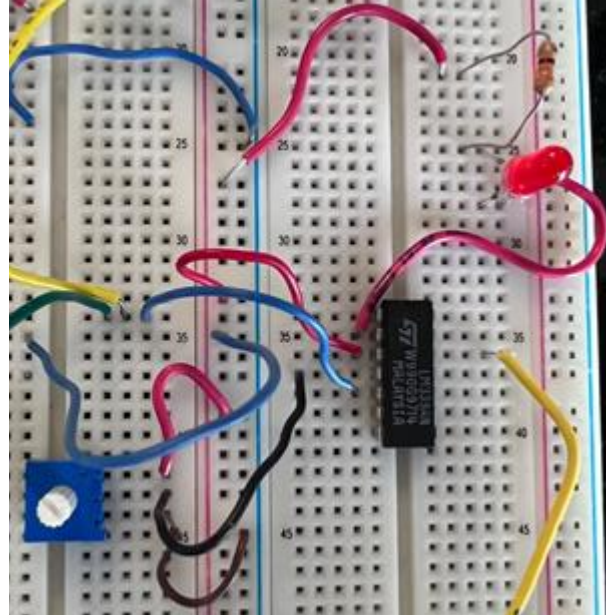




# “Too slow” Comparator LED Circuit

When positive terminal is greater than the negative terminal the LED turns/is off

When negative terminal is greater than positive terminal the LED turns on



# “Too fast” Comparator LED Circuit

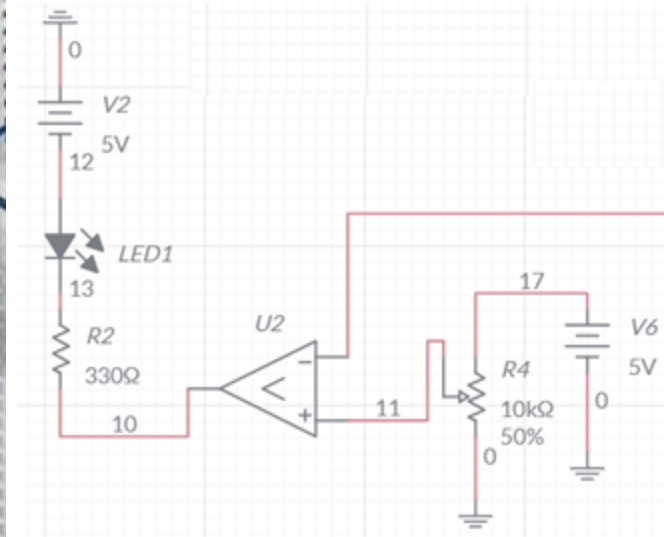
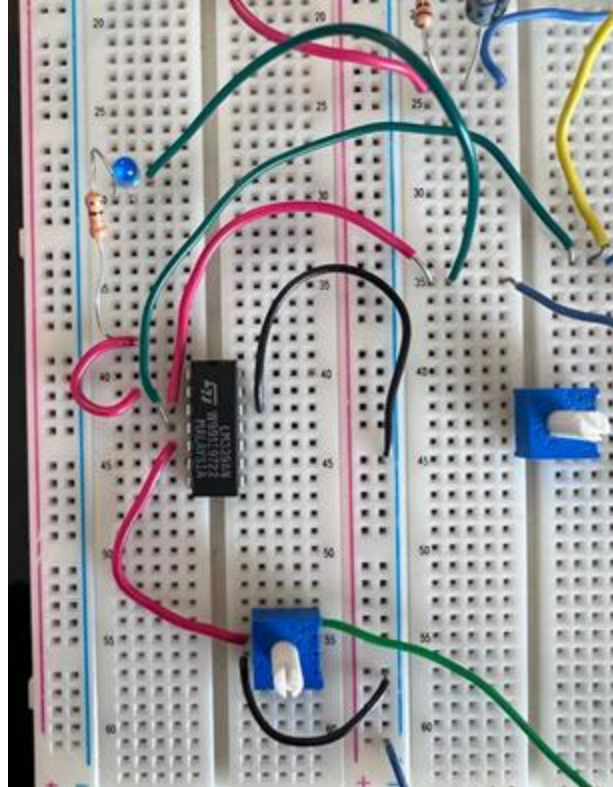
Same functionality as too slow circuit

Too fast circuit

- Negative terminal connected to output AC

Too slow circuit

- Positive terminal connected to output AC



# Difficulties

Almost ran out of lab time:

- Next time, we would spend more time building on the circuit instead of focusing too much initially on Multisim.

The full wave rectifier was incorrectly set up on the breadboard:

- Rebuilt it correctly.

The given breadboard didn't work:

- Was likely a dead spot somewhere on the breadboard. Rebuilding the circuit on a proper one fixed this issue.

Our indicator led flickered too much:

- Switched it from the emitter side to the collector side. Voltage drop across transistor might've been causing issues.

# Conclusions

The final project allowed us to demonstrate how wind energy could be harnessed to generate AC signal and converted to a stable, direct current for use in multiple functionalities.

The end result had several circuit implementations that allowed us to monitor the speed and power generation of the windmill by using various components.

With more time in the future, we may consider adding more capabilities with an Arduino such as sound effects when spinning too fast or slow. We could also improve the design of the base the generator is mounted on by making it taller, widening the base, and reducing the material used.