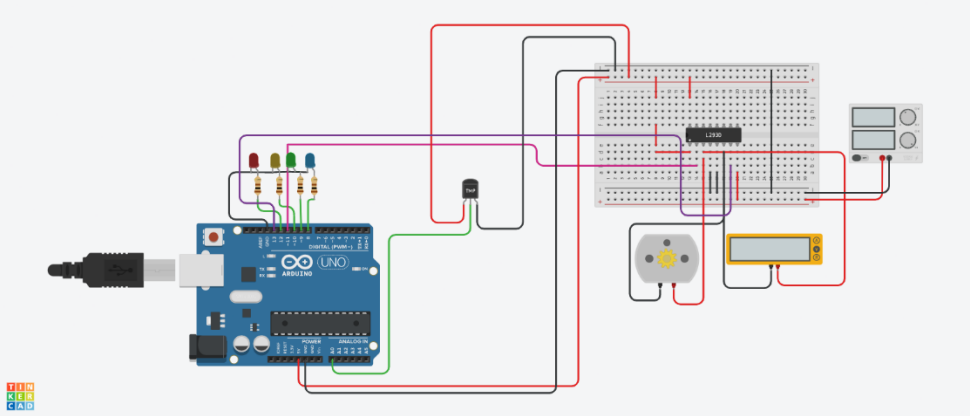
# IoT for Building Energy Management

## Project 1: Temperature Controlled Fan



Link: https://www.tinkercad.com/things/gwMSpRrgGWX

Components: Arduino, TMP36(Temperature Sensor), DC motor, External power source, L293D motor Driver, LEDs, Resistors, Breadboard, Voltmeter, Connecting wires.

Explanation:

- The above circuit has been made and stimulated in TinkerCad.
- TMP36 is a temperature sensor, which can sense temperature in range ($-40^0$C, $125^0$C) and gives analog output in range (0,358) to analog pin A0 of the Arduino. Let the output be x. Then the output signal is converted to temperature by the formula: temperature = ((x*(5.0/1024))-0.5)/0.01. Temperature is displayed in serial monitor.
- After calculating temperature, we control the speed of the DC motor which is indicated as fan in this circuit. But changing the speed of fan for every small change in the temperature is not logical, therefore we change the speed of fan for some range of the temperature. This is done by giving PWM signal by Arduino through pin 11.
- L293D is used to control the motor as the DC motor requires max of 12V to operate but Arduino can output only 5V at maximum. To activate this IC it is powered with 5V output by Arduino to its Vcc1 pin. Vcc2 pin is supplied with 12V external power supply to power the motor. Enable 1,2 is activated by 5V supply by Arduino to activate the left side of the IC. PWM signal to control the speed of the motor is given to pin input 1 by the Arduino. The terminals of the motor and voltmeter (to measure voltage across the motor) are connected between pin output 1 and output 2 pin of the IC. Both the ground pins on the same side are grounded. Input 2 pin is always on LOW (by Arduino).
- PWM signal is provided by Arduino to control the speed of the DC motor for 5 range of temperature. Arduino has the capacity of analogWrite in range of (0,255), we will divide this in number of ranges here it is 5. For 0 to $15^0$C the fan is off and the blue LED is lit, for 15 to $25^0$C PWM of 64 is provided for which the speed is 25% and green LED is lit. For 25 to $40^0$C PWM of 122 for 50% speed is provided and for 40 to $60^0$C PWM of 180 which corresponds to 75% of speed and for both the green LED is lit. For temperature above $60^0$C PWM of 255 is supplied and the fan runs on full speed and red LED is lit.
- Resistance is connected with LEDs to limit current supply to 20mA.