‘Making’ Internet of Things:

Lecturette series

Prototyping New Ideas

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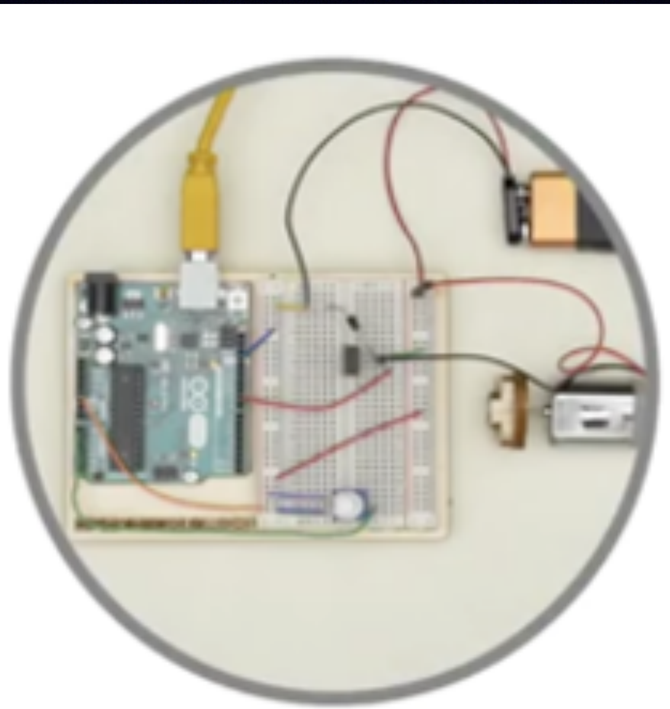
Revisiting lecture discussion

- Making prototypes and an example process
- Basic electronics
- C Programming
- Hands on with the emulator and digitalWrite()

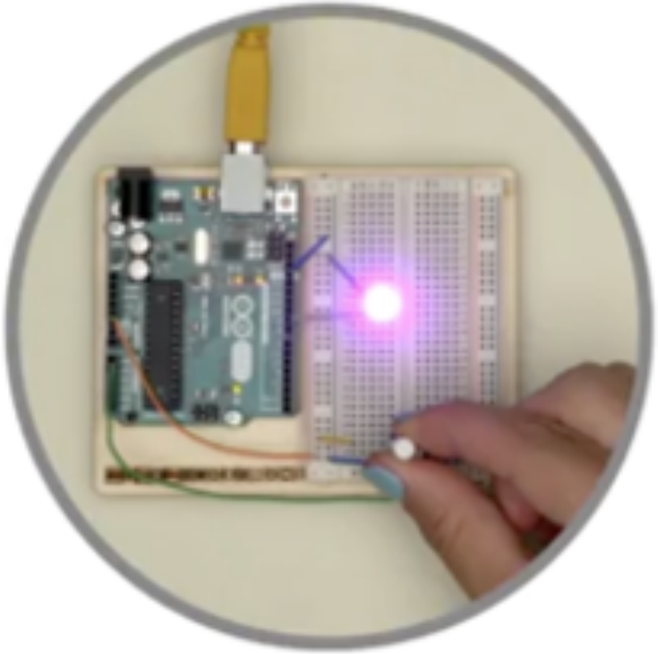
This lecture

- Understand different functions supported by Arduino
- Utilizing these to perform different tasks

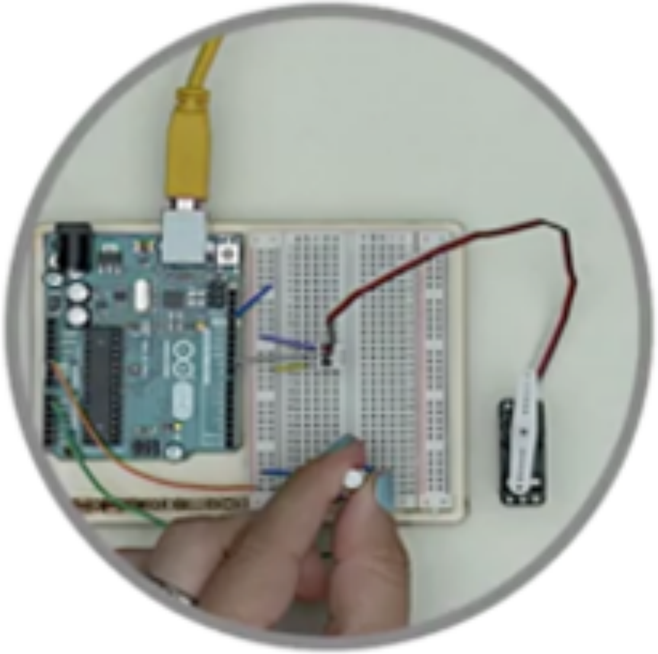
Analog Out



Motor Speed



LED Brightness

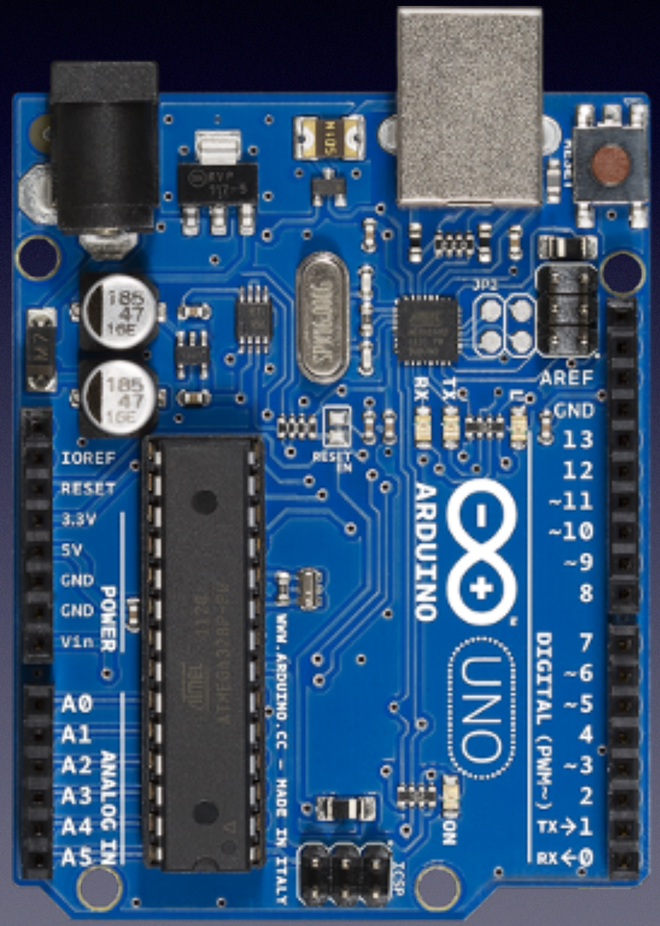


Servo Angle

Analog Out

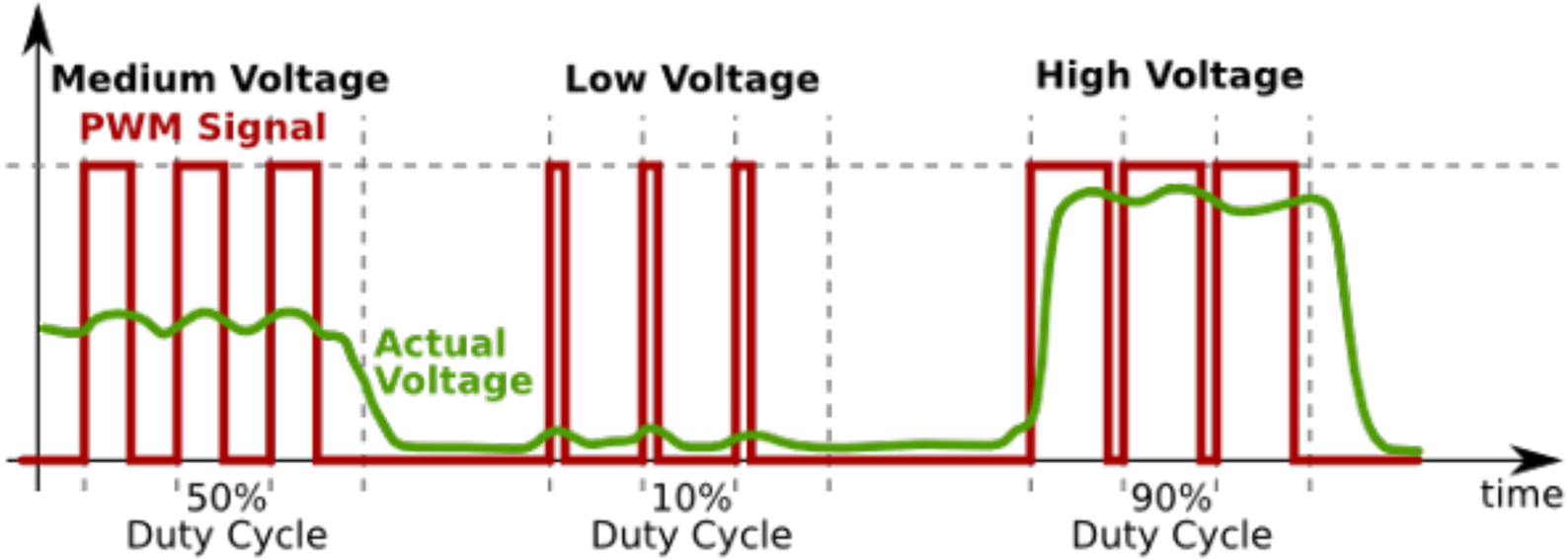
- A few PINs on the Arduino Digital PINs allow to modify the output to mimic analog signal: Pin 3, 5, 6, 9, 10, 11. They are indicated by a "~" besides the pin no.
- analogWrite(PIN, value)

  Example: **analogWrite(9, 125)**



PWM

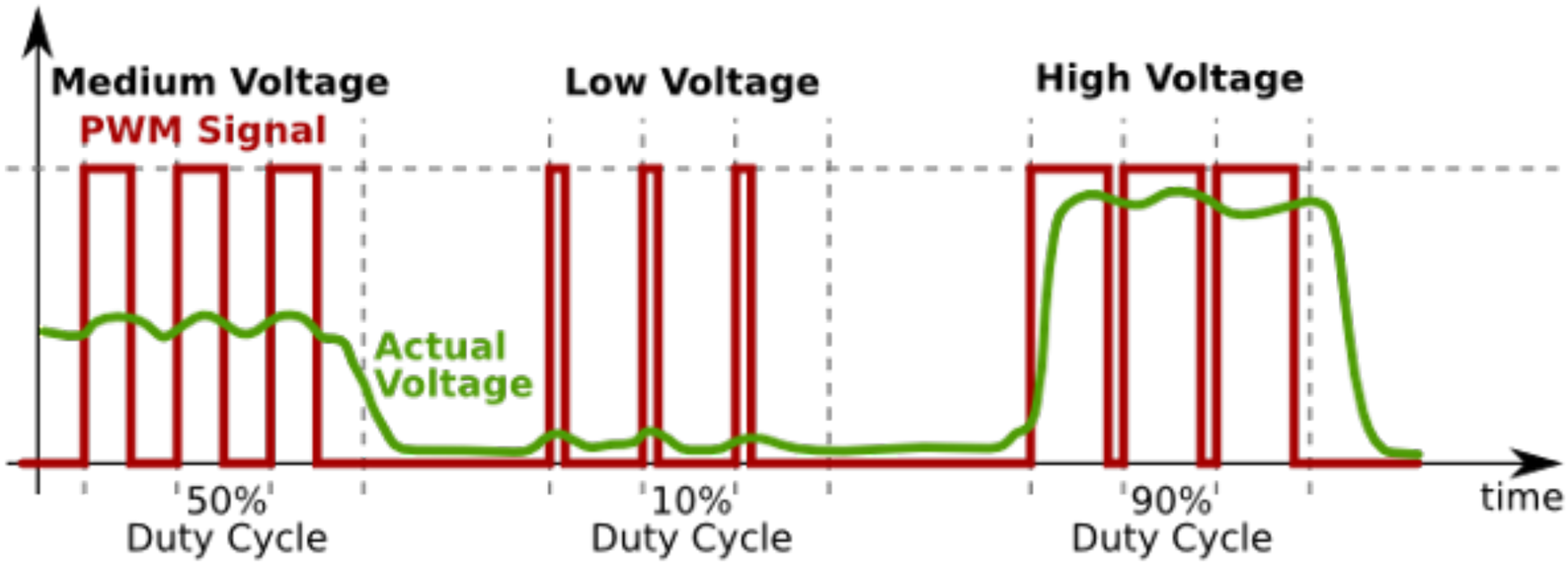
- To create an analog signal, the microcontroller use a technique called PWM. By varying the pulse width or duty cycle, we can create an analog voltage.



Try this using A multumeter Attached to Arduino

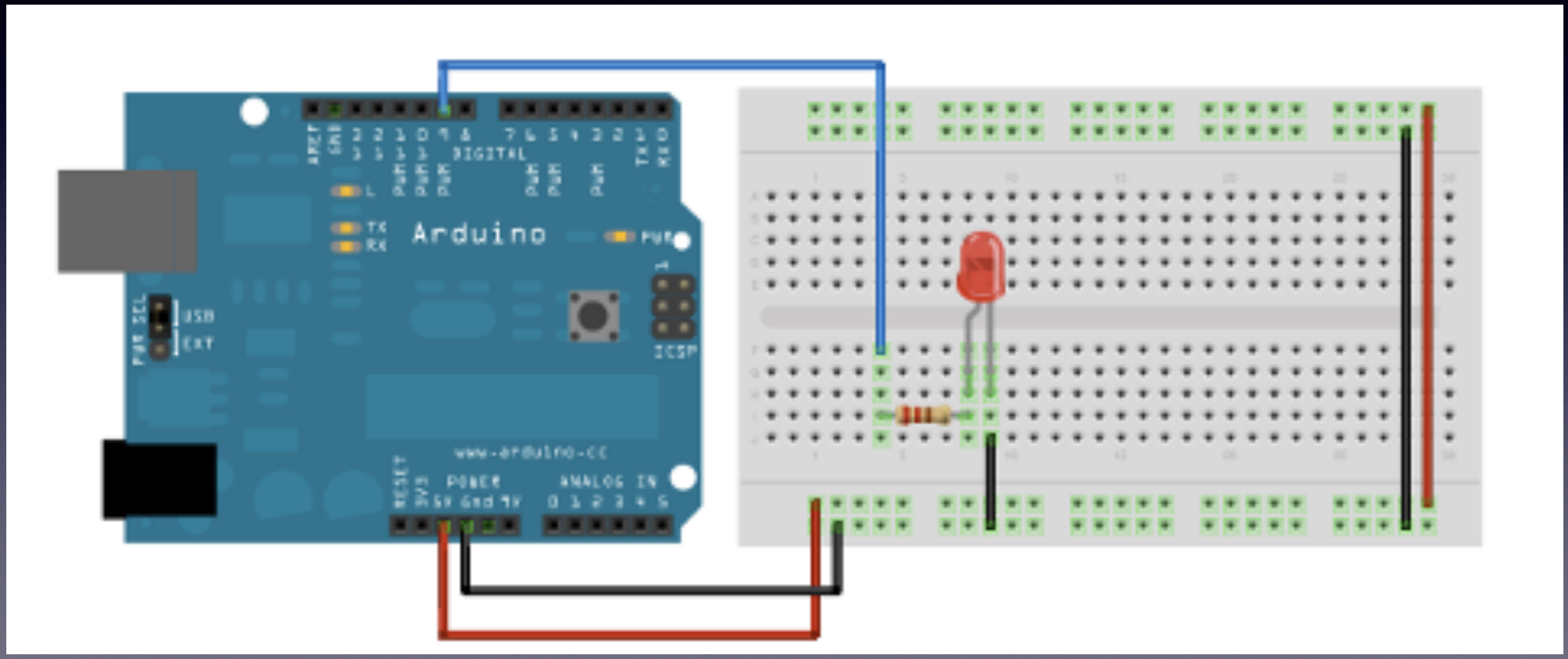
PWM

- analogWrite: 0-255, frequency stays the same! (remember)
- analogRead (later): Arduino boards contain a multichannel, 10-bit analog to digital converter. So, Value range: 0-1023



Try this using A multumeter Attached to Arduino

Emulate it (vary the intensity of led with time)



```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(9, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  analogWrite(9, 0)   ;
  delay(1500);                      // wait for a second
  analogWrite(9, 50)  ;
  delay(1500);
  analogWrite(9, 150)  ;
  delay(1500);
   analogWrite(9, 255);
  delay(1500); // wait for a second
}
```

1. Write a simple sketch to change the brightness the LED light from low to high repeatedly

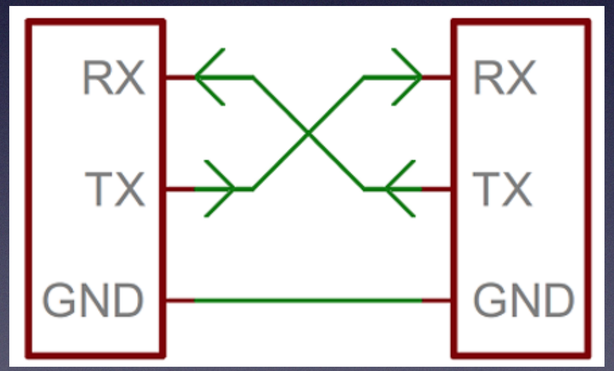
2. Write a sketch to fade the LED brightness from low to high, and high to low repeatedly.

Time: 10 mins

```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(9, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  analogWrite(9, 0)   ;
  delay(1500);                      // wait for a ~second
  analogWrite(9, 50)  ;
  delay(1500);
  analogWrite(9, 150)  ;
  delay(1500);
   analogWrite(9, 255);
  delay(1500); // wait for a second
}
```

Serial Communication

- A serial bus consists of just two wires - the transmitter TX wire for sending data and receiver RX wire for receiving data.



Print some text to the Serial Monitor. Eg

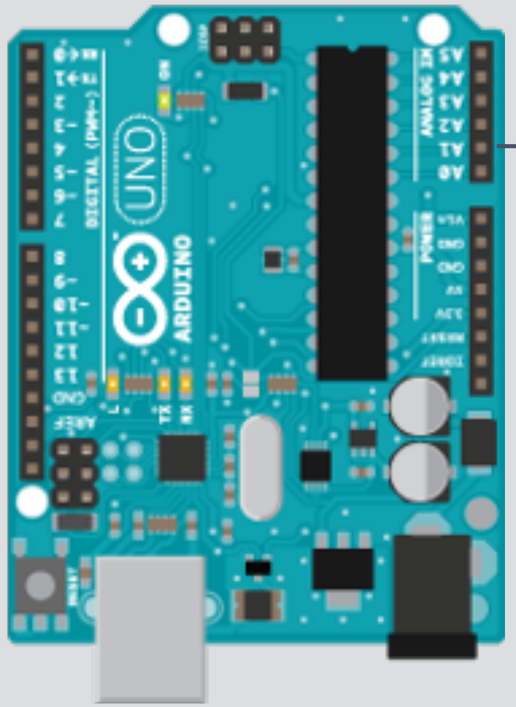
```
void setup() {

Serial.begin(9600);
Serial.println("Hello World");
}
```

Serial.begin(baudrate)

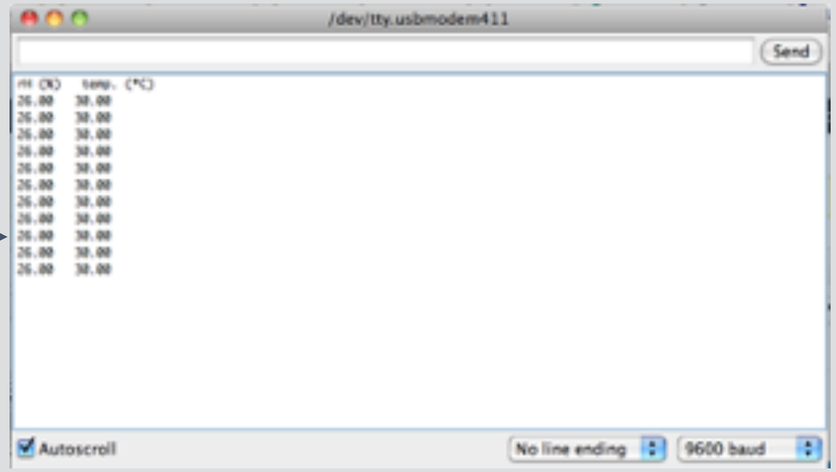
Serial.print(value)
Serial.println(value)

Serial.write(___)

Serial.read(___)


UNO
ARDUINO

COM Port


/dev/tty.usbmodem411
Send
Humi. (%) Temp. (°C)
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
26.00 30.00
Autoscroll
No line ending
9600 baud

Try

Use Serial Read to control the LED ON/OFF

If Serial Read value is 1, turn on LED

If Serial Read value is 0, turn off LED

Time: 10 mins

- Serial.available();
  Use this to check if you have sent something to the board.
- Serial.read();

```
void setup() {

Serial.begin(9600);

}


void loop() {

while (Serial.available() == 0);


int val = Serial.read() -'0';

Serial.println(val);

}
```