EEE:
Programming Tiny, Colorful Computers

Stephen A. Edwards
Columbia University, Department of Computer Science

March 30, 2019
The Arduino Nano

- Mini USB Jack
- Atmel Mega328P Microcontroller
- Reset Switch
- Receive and Transmit LEDs
- Power Light
- User-controlled LED
Getting Started

Start the Arduino IDE
Select Tools → Board → Arduino Nano
Connect Your Arduino

Plug the USB cable into your board

Plug your board into your computer

*The board’s power light should be on*

Select Tools → Port → COM7

*Which COM port may vary; choose the one that is there*

Under “Tools → Processor,” select “ATmega328P (Old Bootloader)”
Select File → Examples → 01. Basics → Blink
Upload the Sketch to the Board

Should say “Done uploading.” The user LED should blink
The Blink Example

```cpp
void setup() {
    pinMode(LED_BUILTIN, OUTPUT);
}

void loop() {
    digitalWrite(LED_BUILTIN, HIGH);
    delay(1000);

digitalWrite(LED_BUILTIN, LOW);
    delay(1000);
}
```
Connect the RGB LED and switch
Controlling the RGB LED (cycleRGB.ino)

```cpp
const int rpin = 3, gpin = 5, bpin = 6;

void setup() {
    pinMode(rpin, OUTPUT);
    pinMode(gpin, OUTPUT);
    pinMode(bpin, OUTPUT);
}

void rgb(int r, int g, int b) {
    analogWrite(rpin, r);
    analogWrite(gpin, g);
    analogWrite(bpin, b);
}

void loop() {
    rgb(10, 0, 0);
    delay(500);
    rgb(0, 10, 0);
    delay(500);
    rgb(0, 0, 10);
    delay(500);
    rgb(10, 10, 10);
    delay(500);
}
```
const int rpin = 3, gpin = 5, bpin = 6;
const int spin = 19;

void setup() {
    pinMode(rpin, OUTPUT);
    pinMode(gpin, OUTPUT);
    pinMode(bpin, OUTPUT);
    pinMode(spin, INPUT_PULLUP);
}

void rgb(int r, int g, int b) {
    analogWrite(rpin, r);
    analogWrite(gpin, g);
    analogWrite(bpin, b);
}

void wait() {
    while (digitalRead(spin) == LOW);  
    while (digitalRead(spin) == HIGH);
}

void loop() {
    rgb(10, 0, 0);
    wait();
    rgb(0, 10, 0);
    wait();
    rgb(0, 0, 10);
    wait();
    rgb(10, 10, 10);
    wait();
}
Controlling Each Color (fadeRGB.ino)

```cpp
const int rpin = 3, gpin = 5, bpin = 6;
const int spin = 19;
int red = 10, green = 0, blue = 0;

void setup() {
  pinMode(rpin, OUTPUT);
  pinMode(gpin, OUTPUT);
  pinMode(bpin, OUTPUT);
  pinMode(spin, INPUT_PULLUP);
}

void update(int &color) {
  while (digitalRead(spin) == HIGH);
  while (digitalRead(spin) == LOW) {
    color = (color + 1) % 12;
    analogWrite(rpin, red);
    analogWrite(gpin, green);
    analogWrite(bpin, blue);
    delay(200);
  }
}

void loop() {
  update(red);
  update(green);
  update(blue);
}
```
The input voltage to the board when it is running from external power. Not USB bus power.

**Absolute MAX per pin 40mA**

Recommended 20mA

**Absolute MAX 200mA**

For entire package

**USB JACK**

Mini Type B

**PWM Pin**

Port Power

**Analog exclusively Pins**
Each pin has a number (the pink boxes on “Nano pinout”)

Most pins can be either inputs or outputs

```c
pinMode(4, OUTPUT); // Control the voltage on pin 4
pinMode(6, INPUT);  // Observe the voltage on pin 6
pinMode(19, INPUT_PULLUP); // Observe 19; “suggest” it be high
pinMode(LED_BUILTIN, OUTPUT); // Control pin 13, LED “L”
```
Digital: on or off, high or low voltage; nothing in between

digitalWrite(13, LOW);  // Turn off the user LED
digitalWrite(13, HIGH);  // Turn on the user LED

A digital read from a pin reports either HIGH or LOW

if ( digitalWrite(19) == LOW ) {
    // Low voltage on pin 19, a "0"
}
if ( digitalWrite(19) == HIGH ) {
    // High voltage on pin 19, a "1"
}