PWM Generation in Arduino

PWM (Pulse Width Modulation) feature in Arduino allows the generation of rectangular waves of specific duty cycle on any of the PWM pins.

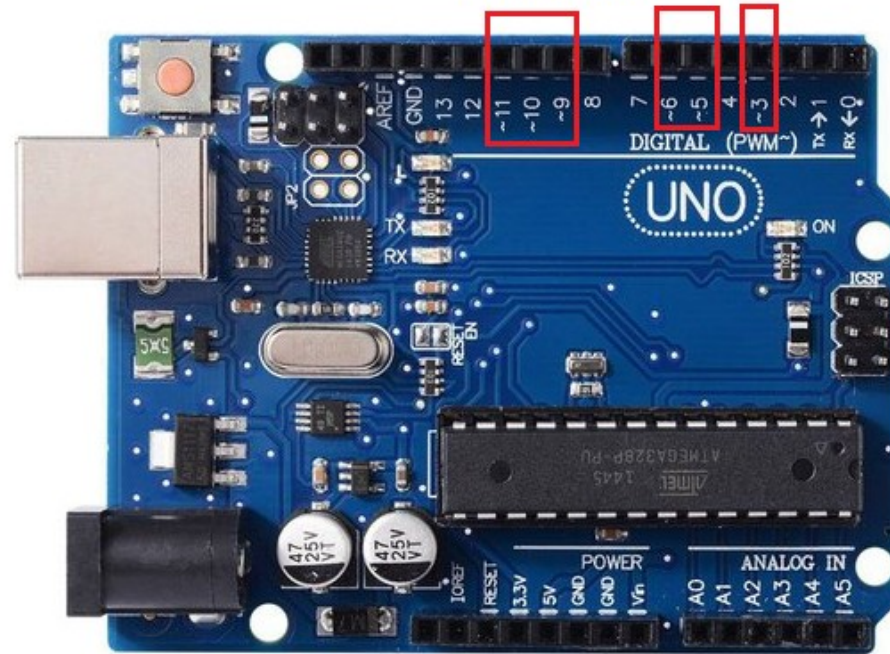$$\text{Duty Cycle} = \left[\frac{T_{ON}}{T_{ON} + T_{OFF}}\right] \times 100\%$$

Uses:
1. Speed Control of DC motor
2. LED Fading Effect
3. Controlling amount of power supplied to AC load

Arduino PWM Pins

PWM pins
(3, 5, 6, 9, 10, 11)
marked with ~ sign

analogWrite ( )

Syntax:

analogWrite (pin, value)

Here pin signifies the Arduino pin to which analog value needs to be written and for Arduino Uno it can be any of the PWM pins (Pin number 3, 5, 6, 9, 10, 11)

value represents the analog value which can be in the range of 0 to 255 where 0 represents always OFF and 255 represents always ON condition

LED Fading Effect

In order to create LED fading effect, we need to pass the value in between 0 to 255 with some delay in between the two consecutive analogWrite ( ) operations.

Increasing the PWM value from 0 to 255 will cause LED brightness to increase and decreasing it from 255 to 0 will cause the LED brightness to decrease.

Circuit Diagram
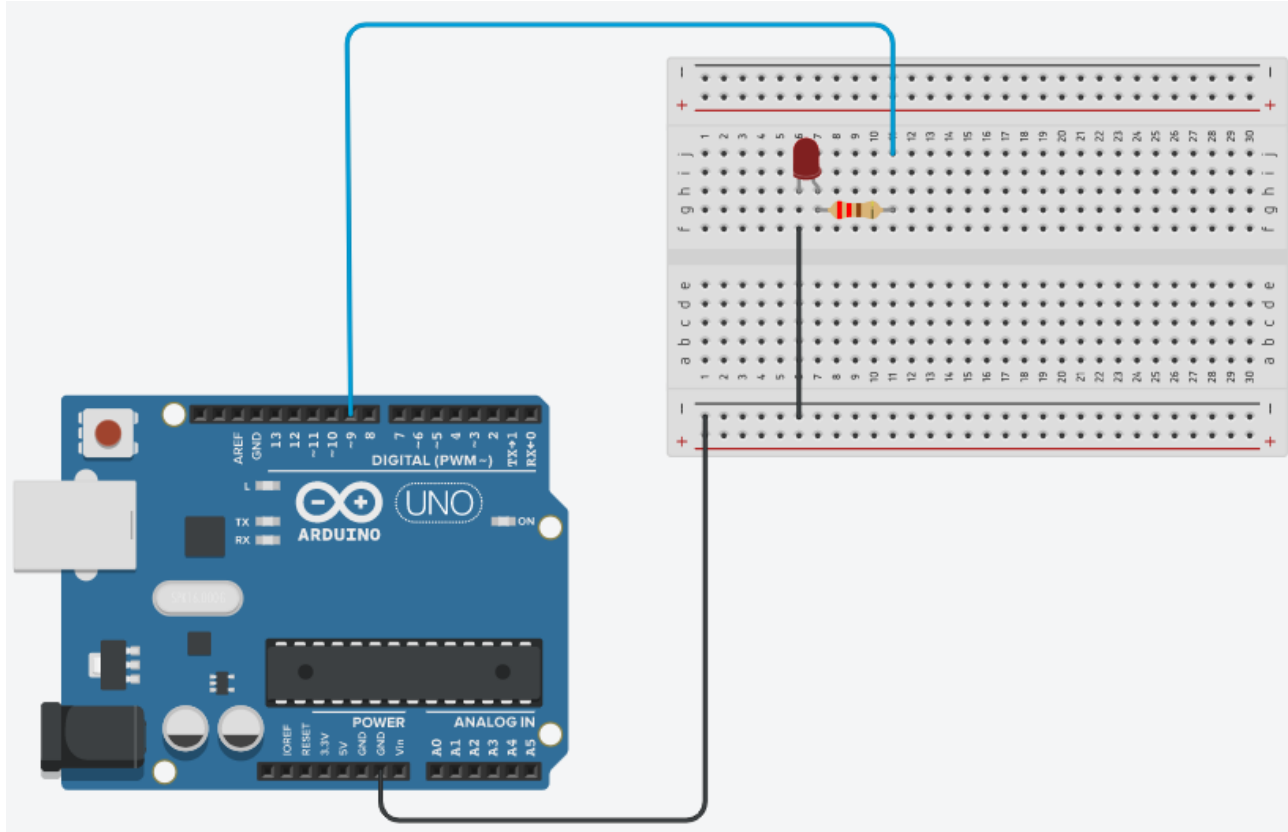
Code

```
int led = 9; // LED is connected to pin 9
int m; // variable for holding the PWM value
void setup() {
// put your setup code here, to run once:
Serial.begin(9600);
// initialize serial communication at 9600bps baud rate
}
void loop() {
// put your main code here, to run repeatedly:
Serial.println("LED brightness increasing");
//Increase the LED brightness
for(m =0; m<=255;m=m+5)
{
analogWrite(led,m); // write m value on pin 9
delay(50); // call delay of 50 msec
}

Serial.println("LED brightness decreasing");

//Increase the LED brightness

}

for(m=255;m>=0;m=m-5)

{

analogWrite(led,m);

// write m value on pin 9

delay(50); // call delay of 50 msec

}
```
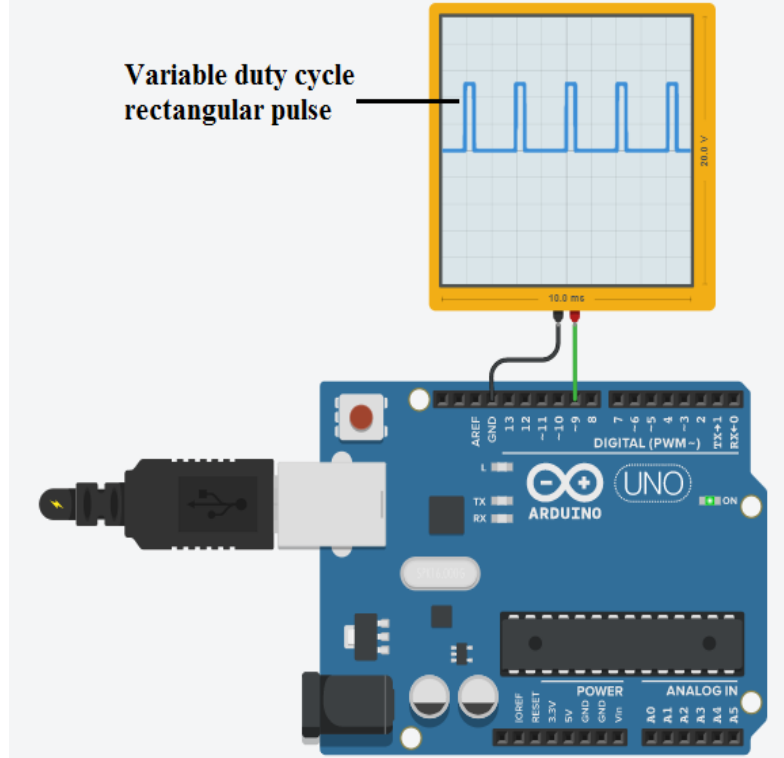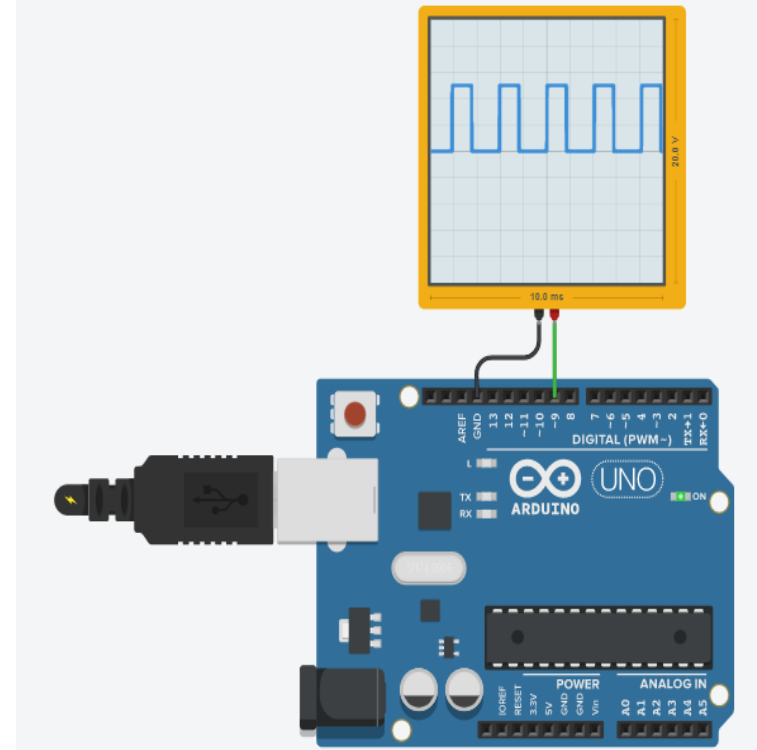
PWM Generation

Variable duty cycle rectangular pulse

PWM signal showing pulse generated on pin 9

PWM signal generated on pin 9 showing increased duty cycle