

# Arduino Portfolio

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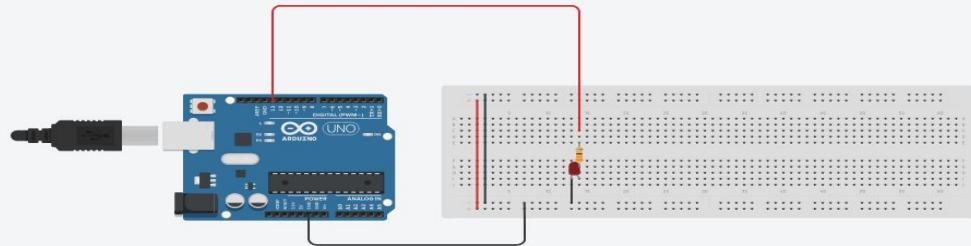
# Lab 1

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# Morse Code Circuit

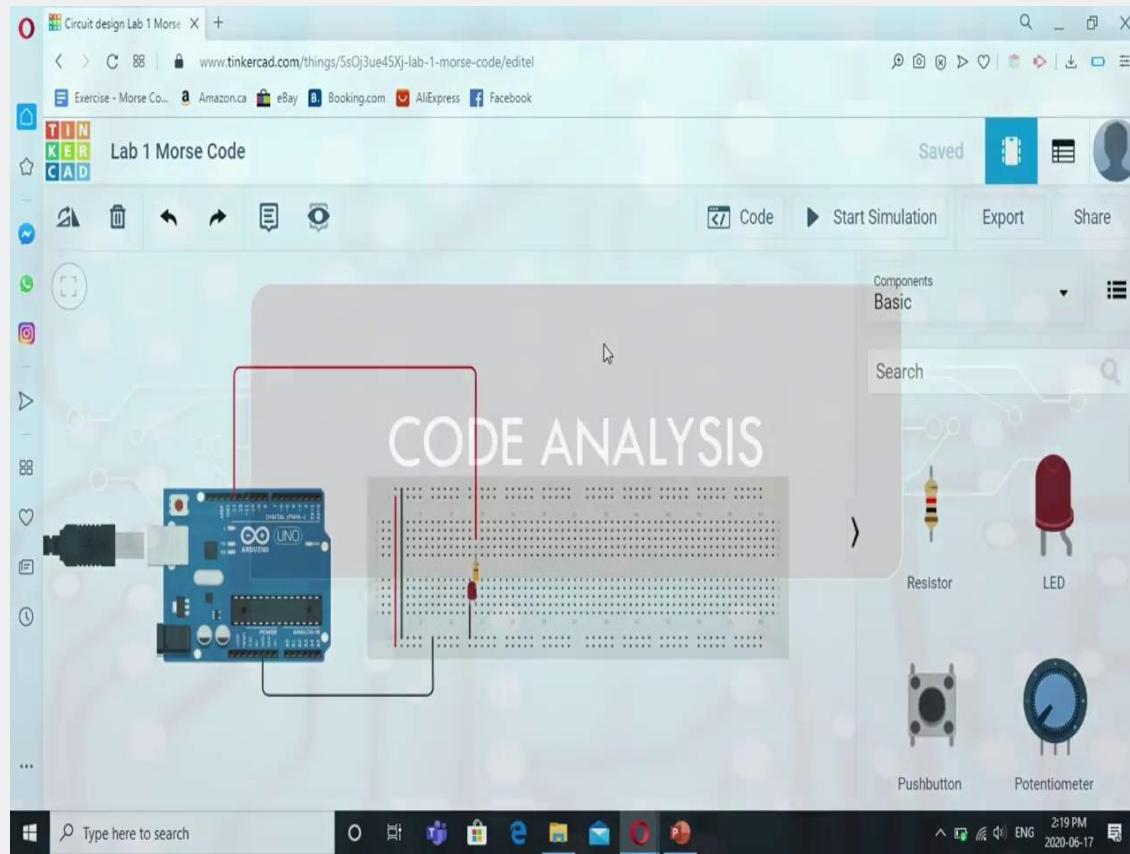
This circuit spells out the last three digits of my student number (897163) using the morse code where the dashes are represented by turning on the LED for 1000ms and the dots are represented by turning the LED for 333 ms



The circuit includes:

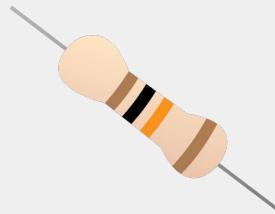
- 1x Resistor (330Ω).
- 1x LED

# Video



# Parts List Explanation

Resistor-Used to control the flow of the current going into the LED.



LED- Used to represent the morse code in the form of flashes.



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 04/06/2020
4  Description: This code is written to spell out a student number using a morse code blinking pattern
5  */
6  void pause()
7  {
8      //code for pause between every digit (1/3 of a second)
9      digitalWrite(13,LOW);
10     delay(333);
11 }
12
13 void dash ()
14 {
15     //code to represent the dash
16     digitalWrite(13,HIGH);
17     delay (1000);
18 }
```

# Code continued

```
16     digitalWrite(13,HIGH);
17     delay (1000);
18 }
19
20 void dot ()
21 {
22     //code to represent the dots
23     digitalWrite(13,HIGH);
24     delay(333);
25 }
26
27 void setup()
28 {
29     Serial.begin(9600);
30     pinMode(13, OUTPUT);
31 }
32
```

# Code continued

```
33 void loop()
34 {
35 //code to print out the last 3 ditit of my student number (163)
36 //code for 1
37 dot();
38 dash();
39 dash();
40 dash();
41 dash();
42 pause();
43 //code for 6
44 dash();
45 dot();
46 dot();
47 dot();
48 dot();
49 pause();
--
```

# Code continued

```
43 //code for 6
44 dash();
45 dot();
46 dot();
47 dot();
48 dot();
49 pause();
50 //code for 3
51 dot();
52 dot();
53 dot();
54 dash();
55 dash();
56 pause();
57 }
```

# Troubleshooting Steps

## Problem:

- My functions were not declaring

## Solution

- Added the two brackets in front of my function
  - Ex, function ()

# Discussion Question

**1) Search online for an Arduino project that interests you. Choose one of the projects and explain the scope of the project in YOUR own words and provide a link and/or video within your portfolio. Clearly explain why this would be a good project to try and why it interests you.**

- An Arduino project that interests me is a piano project.
- A piano project can be simply made with an Arduino, buzzer, resistors, and push buttons. To start with, Arduino can produce PWM (Pulse Width Modulation) signals. With the help of PWM we can use the function tone which is also another feature of Arduino which generates different frequency of tones. Furthermore, with the help of these features we can start coding. The first thing would be to declare all the push buttons as the inputs and declare the buzzer as the output. Second assign the pin number to each push button so that the Arduino will be able to read the values of the pushbutton. Lastly, assign each push buttons different frequency (highest to lowest) in the conditional part. Finally, after your done you can relish your sensational piano project.
- This would be a good project to try as it is extremely easy to understand, even for those who are beginners like myself. Furthermore, it expands a lot of knowledge upon different functions and features that Arduino has as well as it gives a broad understanding on the purpose and uses of different electrical components such as buzzer, resistors, push buttons etc.
- This project interests me as I am a music producer therefore, I am extremely fascinated and passionate toward a lot of different musical instrument.

# Discussion Question Continued

**2) Explain what the difference is between a digital and an analog signal. Give a specific example of each. Which pins are used for digital input / output and which are used for analog on the Arduino Uno? What types of values or range of values can you expect for each type of signal?**

- The difference between a digital signal and an analog signal is that an analog signal is a continuous signal that represents physical measurements and it is denoted in sine waves where as a digital signals are time separated signals which are generated using digital modulation in simple terms analog signals use a range of values to represent signals where as a digital signal uses discrete of 0 and 1 to represent signals
- An example of digital signal is a thermometer and an example of a digital signal are phones, computers etc.
- The pins used for digital input/output are pin 0 to 13 and pins used for analog input/output are pin A0 to A5 in Arduino Uno.
- Analog signals have a range of values such as 2.5V, 3.1V, etc where as a digital signals have 2 values such as 1 and 0.

# Discussion Answers Continued

**3) If you run out of all 14 digital I/O pins (meaning that you are using them for another purpose), which other pins on the Arduino can you use for digital I/O? How would you declare one of those pins using the pinMode function? Be clear and fully explain your answer.**

You can use the analog pins for digital I/O. You would declare one of those pins by using the pinMode function such as pinMode(pin #,mode) for example pinMode(5,LOW).

**4) Writing to the Console using Serial.println and providing comments throughout your code have no impact on the execution of your running Arduino program. Provide two different reasons why programmers would want to use these techniques.**

Programmers would want to use these techniques:

- To send data from the Arduino to another electronic device such as a computer, so that someone can see the values displayed on the computer monitor.
- To display the user of what the code does (almost like a comment).

# Discussion Answers Continued

**5) Describe what effect this command would have in a sketch: digitalWrite(5, LOW);**

This command would output a voltage of 0 from pin 5.

**6) You had the choice of doing extension #1 or #2. If you chose #1, there were two versions of the built-in tone() function that you could use. What are the arguments for the two different versions of tone (one has two arguments and the other has three)? What is the range of audible frequencies humans can hear?**

- The two argument for the first version of the tone function include pin number and frequency measured in Hertz.
- The three argument of the second version of the tone function includes pin number, frequency (Hertz), and duration (milliseconds).
- The range of audible frequencies humans can hear is 20 Hz to 20 kHz

# Lab 1 Extension

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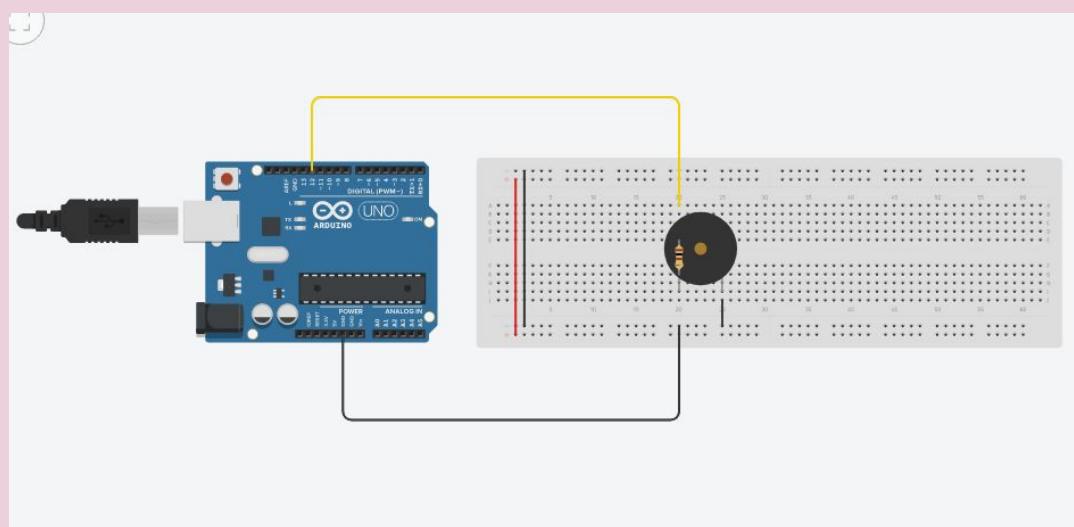
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# Buzzer Circuit

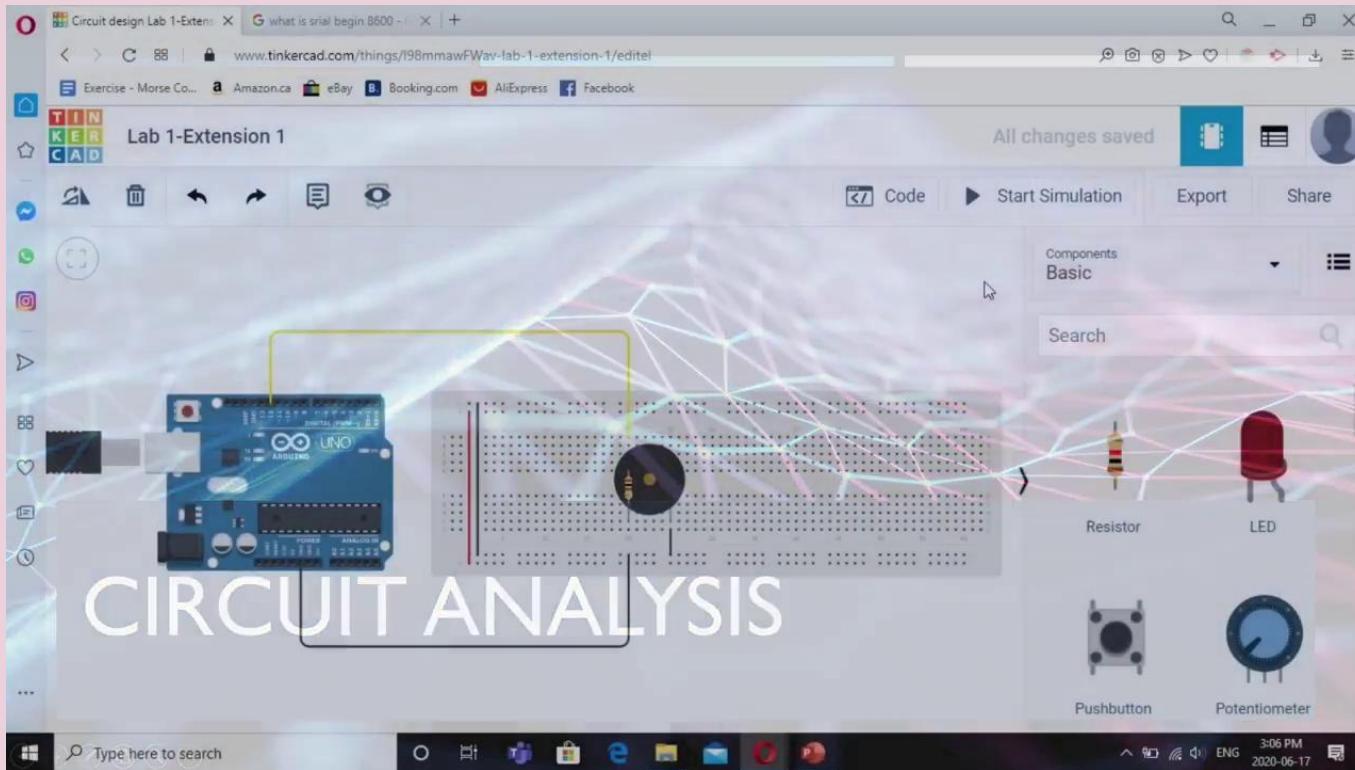
This circuit spells out the last three digit of my student number (897**163**) using the morse code where the dashes are represented when the buzzer beeps at 1000 Hz and the dots are represented when the buzzer beeps at 333 Hz

The circuit includes:

- 1x Resistor ( $10\text{k}\Omega$ ).
- 1x Buzzer

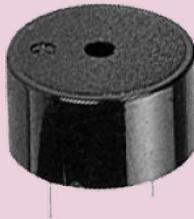


# Video

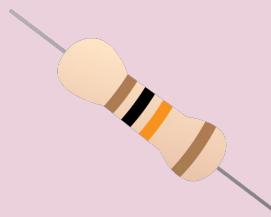


# Parts List Explanation

**Buzzer** - Also known as a beeper, is an audio signaling device which makes tones based on the frequency (Hz) and voltages (V) and these tones are usually pitches that are higher in frequency. Buzzers are often used in alarm devices, timers etc.



**Resistor**- Limits the current flow through the parts of the circuit so that the required amount of current is flowing and the parts don't get damaged.



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 04/06/2020
4  Description: This code is written to spell out student number using morse code by chaning the frequency of buzzer.
5  */
6 //variables
7 int piezoPin = 12;
8
9 void dash()
10 {
11 //Code for the function tone to output dash.
12 tone(piezoPin,1000); //set dash frequency
13 }
14 void dot()
15 {
16 //Code for the function tone to output dot.
17 tone(piezoPin,333); //set dot frequency
18 }
```

# Code Continued

```
16 //Code for the function tone to output dot.  
17 tone(piezoPin,333); //set dot frequency  
18 }  
19 void pause()  
20 {  
21 delay(333); //set delay  
22 }  
23 void setup()  
24 {  
25 Serial.begin(9600);  
26 pinMode(piezoPin, OUTPUT); //state output  
27 }  
28  
29 void loop()  
30 {  
31 //code to output the last 3 ditit of my student number (163) in notes.  
32 //code for 1  
33 dot();  
34 dash();  
35 dash();
```

# Code Continued

```
34 dash();  
35 dash();  
36 dash();  
37 dash();  
38 pause();  
39 //code for 6  
40 dash();  
41 dot();  
42 dot();  
43 dot();  
44 dot();  
45 pause();  
46 //code for 3  
47 dot();  
48 dot();  
49 dot();  
50 dash();  
51 dash();  
52 //
```

# Troubleshooting Steps

## **Problem:**

- My variable int piezoPIn was not declared in my void loop () scope
- Had declared my variable in the void setup ().

## **Solution:**

- Declared the variable on top of the void setup() loop.

# Lab 2

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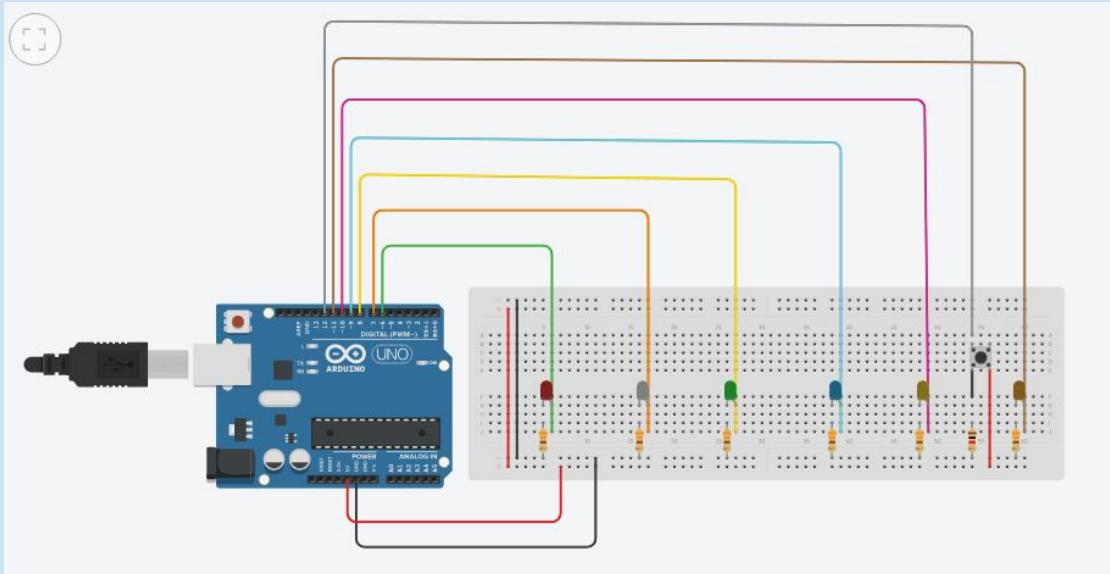
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Lab 2: Digital Input - Intro & Circuit	<a href="#">27</a>
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# Digital Input Circuit

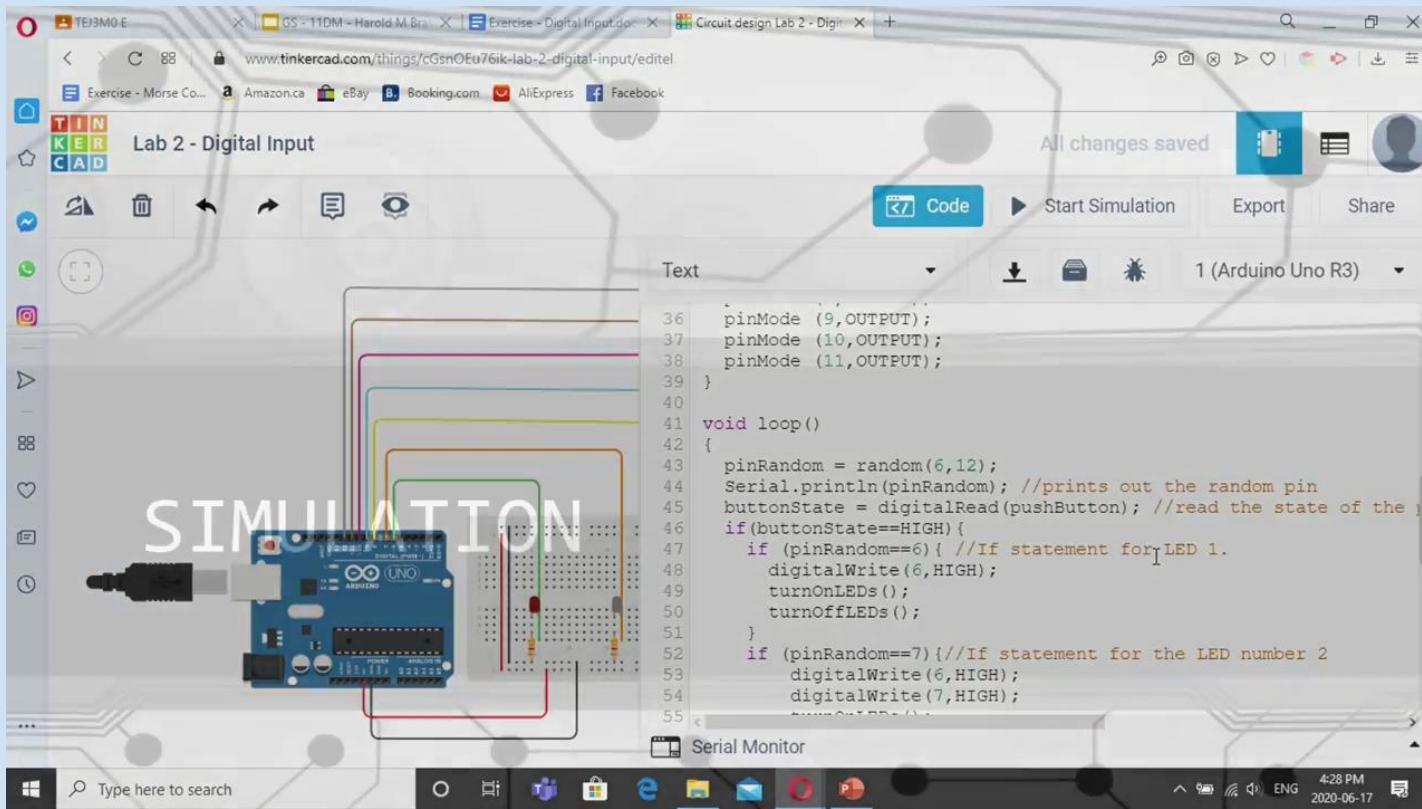
This circuit chooses a random LED and turns that LED on for 5 seconds exactly. When the LED 2 is on, first two LED from left to right turn on and when LED 5 s on, then all 5 LED from left to right turn on.

The circuit includes:

- 7x Resistor ( $330\Omega$  &  $10k\Omega$ ).
- 6x LED
- 1x Push button

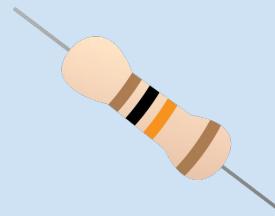


# Video



# Parts List Explanation

**Resistor** - Limits the current flow through the parts of the circuit so that the required amount of current is flowing and the parts don't get damaged.



**LED**- Electronic device that emits light when an electrical current is passed through it which we can see.



**Push button** - Electronic device designed to open and/or close an electrical circuit. For example when the button is pressed it closes the circuit allowing current to flow and when the button is released it opens the circuit restricting the current to flow.



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 06/06/2020
4  Description: This program picks a random number and turns on the LED at that index when the push button is pressed
5 */
6 //VARIABLES
7 int pinRandom = random(6,12); //Variable to choose a random pin.
8 int pushButton = 12; //Variable for the pusbutton pin
9 int buttonState = 0; //Variable for reading the pushbuton status (Higgh or low)
10 void turnOnLEDs () //Variable to turn on LED's for 5 seconds.
11 {
12     digitalWrite (pushButton,HIGH);
13     delay (5000);
14     digitalWrite(pushButton,LOW);
15 }
16 void turnOffLEDs()
17 {
```

# Code Continued

```
16 void turnOffLEDs()
17 {
18     digitalWrite(buttonState,LOW);
19     digitalWrite(6,LOW);
20     digitalWrite(7,LOW);
21     digitalWrite(8,LOW);
22     digitalWrite(9,LOW);
23     digitalWrite(10,LOW);
24     digitalWrite(11,LOW);
25 }
26
27 void setup()
28 {
29     Serial.begin (9600);
30     pinMode (pushButton,INPUT);
31     pinMode (pinRandom,OUTPUT);
32     pinMode (6,OUTPUT);
33     pinMode (6,OUTPUT);
34     pinMode (7,OUTPUT);
35     pinMode (8,OUTPUT);
```

# Code Continued

```
41 void loop()
42 {
43     pinRandom = random(6,12);
44     Serial.println(pinRandom); //prints out the random pin
45     buttonState = digitalRead(pushButton); //read the state of the pushbutton value
46     if(buttonState==HIGH){
47         if (pinRandom==6){ //If statement for LED 1.
48             digitalWrite(6,HIGH);
49             turnOnLEDs();
50             turnOffLEDs();
51         }
52         if (pinRandom==7){//If statement for the LED number 2
53             digitalWrite(6,HIGH);
54             digitalWrite(7,HIGH);
55             turnOnLEDs();
56             turnOffLEDs();
57         }
58         if (pinRandom==8){//If statement for the LED number 3
59             digitalWrite(8,HIGH);
60             turnOnLEDs();
```

# Code Continued

```
63 if (pinRandom==9){//If statement for the LED number 4
64     digitalWrite(9,HIGH);
65     turnOnLEDs();
66     turnOffLEDs();
67 }
68 if (pinRandom==10){ //If statement for the LED number 5
69     digitalWrite(6,HIGH);
70     digitalWrite(7,HIGH);
71     digitalWrite(8,HIGH);
72     digitalWrite(9,HIGH);
73     digitalWrite(10,HIGH);
74     turnOnLEDs();
75     turnOffLEDs();
76 }
77 if (pinRandom==11){//If statement for the LED number 6
78     digitalWrite(11,HIGH);
79     turnOnLEDs();
80     turnOffLEDs();
81 }
82 }
```

# Troubleshooting Steps

## Problem:

- Did not initialize the random function inside the void loop therefore my random number kept being the same as the loop void kept repeating

## Solution

- Printed my values to the monitor to troubleshoot
  - Ex. Serial.print(random);
- Initialize the random function inside the void loop () therefore number kept changing every time the loop repeated

# Lab 2 Extension

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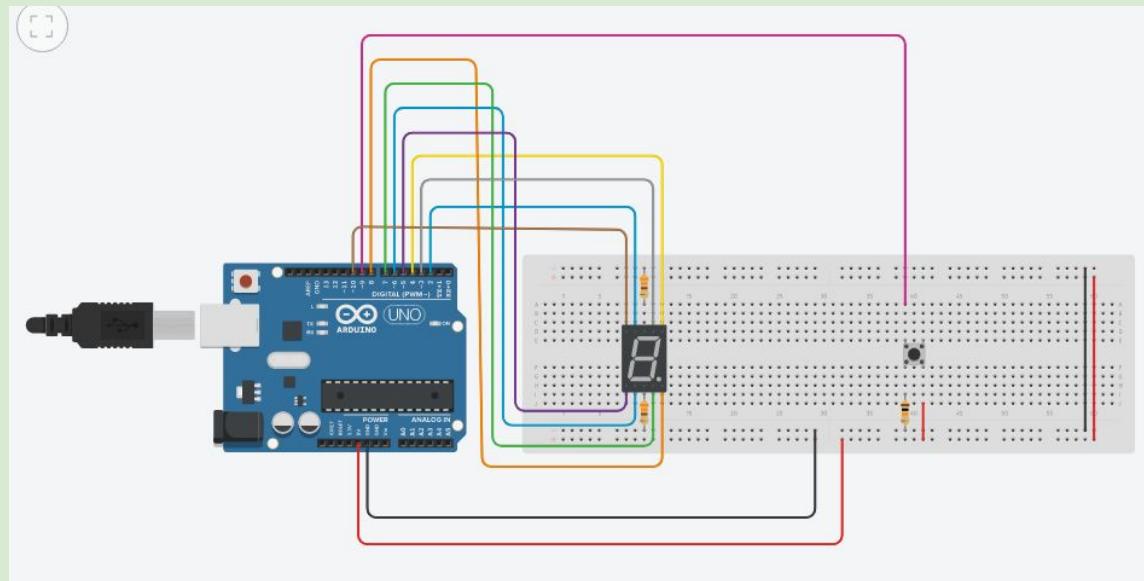
<b>Title</b>	<b>Slide/s</b>
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# Seven Segment Circuit

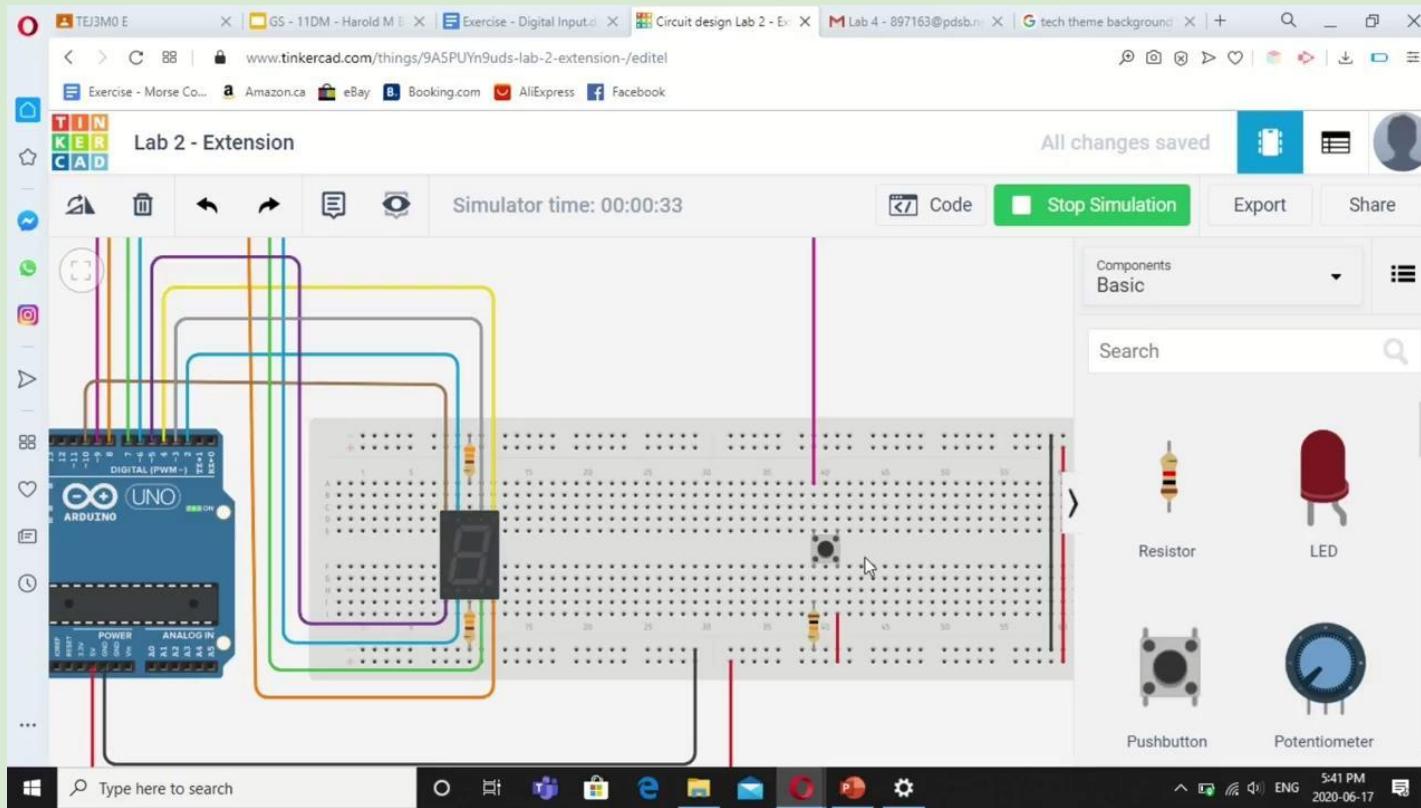
This circuit generates a random number from 1 to 6 and display it on the 7 segment display.

The circuit includes:

- 3x Resistor ( $330\Omega$  &  $10k\Omega$ ).
- 1x 7 Segment Display
- 1x Pushbutton

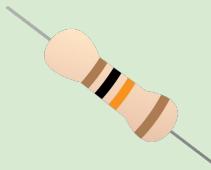


# Video



# Parts List Explanation

**Resistor** - Limits the current flow through the parts of the circuit so that the required amount of current is flowing and the parts don't get damaged.



**Push button** - Electronic device designed to open and/or close an electrical circuit. For example when the button is pressed it closes the circuit allowing current to flow and when the button is released it opens the circuit restricting the current to flow.



**7 Segment Display** - Electronic device for displaying decimal numbers. Widely used in digital clocks, electronic meters, calculators and other devices that display numerical data



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 07/06/2020
4  Description: This program generates a number between 1 and 6 when the push button is pressed and displays it.
5 */
6 //VARIABLES
7 int pushButton = 9; //Variable for push button
8 long (randomNumber); //Variable for random number from (1-6).
9 int buttonState = 0; //Reads the status of the button.
10 //Variables for the 7 segments
11 int A = 3;
12 int B = 4;
13 int C = 7;
14 int D = 6;
15 int E = 5;
16 int F = 2;
17 int G = 10;
18
```

# Code Continued

```
19 void clear()
20 {
21     delay(2000);
22     digitalWrite (A,LOW);
23     digitalWrite (B,LOW);
24     digitalWrite (C,LOW);
25     digitalWrite (D,LOW);
26     digitalWrite (E,LOW);
27     digitalWrite (F,LOW);
28     digitalWrite (G,LOW);
29 }
30
31
32 void one () //Variable for 1
33 {
34     digitalWrite (B,HIGH);
35     digitalWrite (C,HIGH);
36 }
37
38 void two () //Variable for 2
```

Serial Monitor

# Code Continued

```
38 void two () //Variable for 2
39 {
40     digitalWrite(A,HIGH);
41     digitalWrite(B,HIGH);
42     digitalWrite(G,HIGH);
43     digitalWrite(E,HIGH);
44     digitalWrite(D,HIGH);
45 }
46 void three ()//Variable for 3
47 {
48     digitalWrite(A,HIGH);
49     digitalWrite(B,HIGH);
50     digitalWrite(C,HIGH);
51     digitalWrite(D,HIGH);
52     digitalWrite(G,HIGH);
53 }
54 void four () //Variable for 4
55 {
56     digitalWrite(C,HIGH);
57     digitalWrite(B,HIGH);
58 }
```

Serial Monitor

# Code Continued

```
60 }
61 void five() //Variable for 5
62 {
63     digitalWrite(A,HIGH);
64     digitalWrite(C,HIGH);
65     digitalWrite(D,HIGH);
66     digitalWrite(F,HIGH);
67     digitalWrite(G,HIGH);
68 }
69 void six () //Variable for 6
70 {
71     digitalWrite(A,HIGH);
72     digitalWrite(F,HIGH);
73     digitalWrite(E,HIGH);
74     digitalWrite(D,HIGH);
75     digitalWrite(G,HIGH);
76     digitalWrite(C,HIGH);
77 }
78
79 void setup()
```

# Code Continued

```
90  pinMode (G,OUTPUT);
91 }
92
93 void loop()
{
94     buttonState = digitalRead (pushButton);
95     randomNumber = random(1,7); //Picks a random number
96     if (buttonState==HIGH && randomNumber==1) {
97         one();
98         clear();
99     }
100    if (buttonState==HIGH && randomNumber==2) {
101        two();
102        clear();
103    }
104    if (buttonState==HIGH && randomNumber==3) {
105        three();
106        clear();
107    }
108    if (buttonState==HIGH && randomNumber==4) {
```

# Code Continued

```
105 if (buttonState==HIGH && randomNumber==3) {  
106     three();  
107     clear();  
108 }  
109 if (buttonState==HIGH && randomNumber==4) {  
110     four();  
111     clear();  
112 }  
113 if (buttonState==HIGH && randomNumber==5) {  
114     five();  
115     clear();  
116 }  
117 if (buttonState==HIGH && randomNumber==6) {  
118     six();  
119     clear();  
120 }  
121  
122 delay(100);  
123 }  
124 }
```

# Troubleshooting Steps

## Problem:

- Forgot to include the variable that checks whether the push button is on or off into my if statements for all random numbers.

## Solution:

- Declared another variable called “buttonState” that checks the status of the push button (HIGH/LOW).
- Used the &&/and function into my if statement to make sure that the 7 segment display only outputs when the push button is on or HIGH.

# Lab 3

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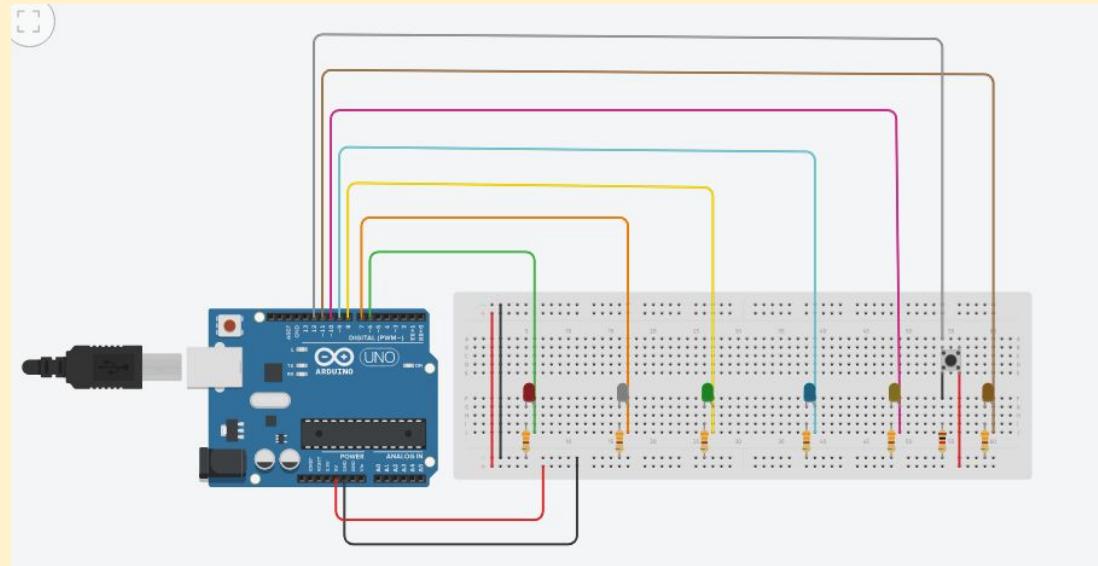
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Parts List Explanation	<a href="#">50</a>
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# Optimizing Circuit

This circuit chooses a random LED and turns that LED on for 5 seconds exactly for 5 second. When the LED 2 is on, first two LED from left to right turn on and when LED 5 s on, then all 5 LED from left to right turn on.

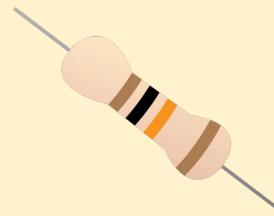
The circuit includes:

- 7x Resistor ( $330\Omega$  &  $10k\Omega$ ).
- 6x LED
- 1x Push button



# Parts List Explanation

**Resistor** - Limits the current flow through the parts of the circuit so that the required amount of current is flowing and the parts don't get damaged.



**LED**- Electronic device that emits light when an electrical current is passed through it which we can see.



**Push button** - Electronic device designed to open and/or close an electrical circuit. For example when the button is pressed it closes the circuit allowing current to flow and when the button is released it opens the circuit restricting the current to flow.



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 06/06/2020
4  Description: This program picks a random number and turns on the LED at that index when the push button is pressed
5 */
6 //VARIABLES
7 int pinRandom = random(6,12); //Variable to choose a random pin.
8 int pushButton = 12; //Variable for the pusbutton pin
9 int buttonState = 0; //Variable for reading the pushbutton status (Higgh or low)
10 void turnOnLEDs () //Variable to turn on LED's for 5 seconds.
11 {
12     digitalWrite (pushButton,HIGH);
13     delay (5000);
14     digitalWrite(pushButton,LOW);
15 }
```

# Code Continued

```
--  
16 void turnOffLEDs()  
17 {  
18     digitalWrite(buttonState,LOW);  
19     for (int x=6; x<12; x++){ //for loop to turn all led off  
20         digitalWrite(x,LOW);  
21     }  
22 }  
23  
24 void setup()  
25 {  
26     Serial.begin (9600);  
27     pinMode (pushButton,INPUT);  
28     pinMode (pinRandom,OUTPUT);  
29     for (int x=6; x<12; x++){ //For loop to initialize all LED pins to OUTPUT  
30         pinMode(x,OUTPUT);  
31     }  
32 }  
33 }
```

# Code Continued

```
33
34 void loop()
35 {
36     pinRandom = random(6,12);
37     Serial.println(pinRandom); //prints out the random pin
38     buttonState = digitalRead(pushButton); //read the state of the pushbutton value
39     if(buttonState==HIGH){
40         if (pinRandom==6){ //If statement for LED 1.
41             digitalWrite(6,HIGH);
42             turnOnLEDs();
43             turnOffLEDs();
44         }
45         if (pinRandom==7){//If statement for the LED number 2
46             for (int x=6; x<8; x++){ //For loop to turn on LED 1 and 2 (6 and 7 pin)
47                 digitalWrite(x,HIGH);
48             }
49             turnOnLEDs();
50             turnOffLEDs();
51     }
```

# Code Continued

```
51
52     if (pinRandom==8){//If statement for the LED number 3
53         digitalWrite(8,HIGH);
54         turnOnLEDs();
55         turnOffLEDs();
56     }
57     if (pinRandom==9){//If statement for the LED number 4
58         digitalWrite(9,HIGH);
59         turnOnLEDs();
60         turnOffLEDs();
61     }
62     if (pinRandom==10){ //If statement for the LED number 5
63         for (int x=6; x<11; x++){//For loop to turn off LED 1,2,3,4 and 5 (6,7,8,9, and 10 pin)
64             digitalWrite(x,HIGH);
65         }
66         turnOnLEDs();
67         turnOffLEDs();
68     }
69     if (pinRandom==11){//If statement for the LED number 6
70         digitalWrite(11,HIGH);
71         turnOnLEDs();
```

# Troubleshooting Steps

## Problem:

- In the for loop I was not incrementing my variable therefore it kept repeating for ever.

## Solution:

- Started to increment my variable by 1 therefore it did not run infinite amount of times.
  - Ex. for (int x; x<6; x++)

# Lab 4

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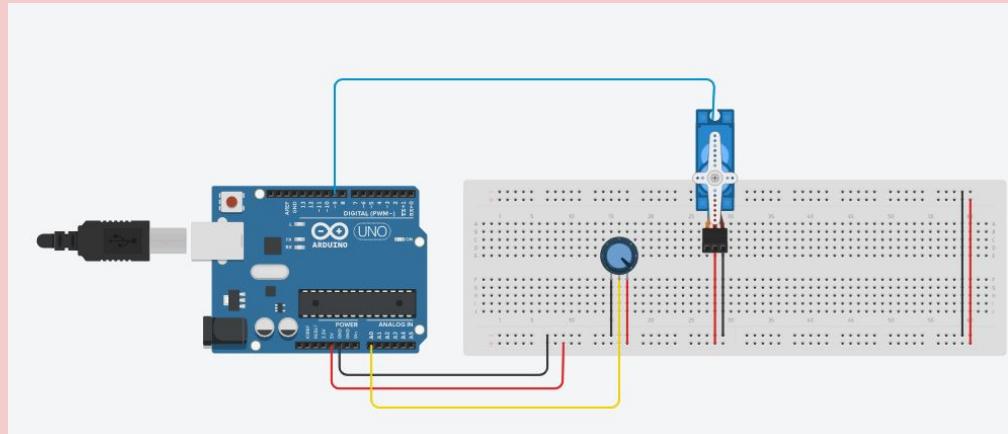
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# Servo Motor Circuit

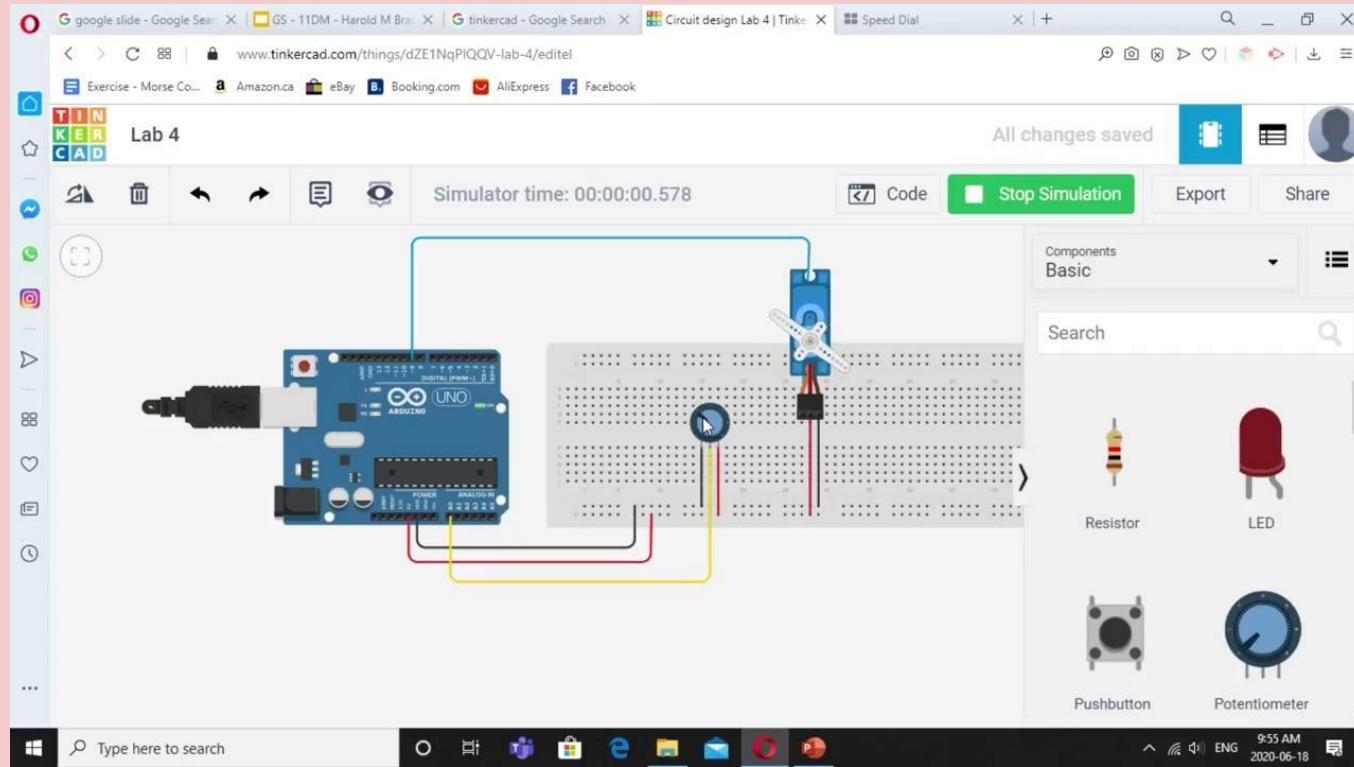
This circuit uses an potentiometer to control the rotation of the servo motor.

The circuit includes:

- 1x Potentiometer
- 1x Servo Motor



# Video



# Parts List Explanation

**Potentiometer** - An electronic device that acts as a voltage divider used for measuring electric potential (voltage). Used as a volume controller, speed controller sensor etc.



**Servo Motor** - An electrical motor made up of DC motor which is controlled by a variable resistor and some gears. Works on the principle of PMW where the angle of rotation is controlled by the duration of the pulse to its control PIN. Used to steer remote-controlled airplanes and cars etc.



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 17/06/2020
4  Description: This program makes the servo motor move from 0 degrees to 180 degrees using a potentiometer.
5  */
6
7 #include <Servo.h>          //include the servo library
8
9 int potPosition;           //this variable will store the position of the potentiometer
10 int servoPosition;        //the servo will move to this position
11
12 Servo myservo;            //create a servo object
13 |
14 void setup() {
15
16     myservo.attach(9);      //tell the servo object that its servo is plugged into pin 9
17
18 }
```

# Code Continued

```
// servo myservo;           // Create a servo object
13
14 void setup() {
15
16     myservo.attach(9);      //tell the servo object that its servo is plugged into pin 9
17
18 }
19
20 void loop() {
21
22
23     potPosition = analogRead(A0);          //use analog read to measure the position of the potentiometer (0
24
25     servoPosition = map(potPosition, 0, 1023, 0, 180); //convert the potentiometer number to a servo position from 0-180
26
27     //Note: its best to avoid driving the little SIK servos all the
28     //way to 0 or 180 degrees it can cause the motor to jitter, whi
29
30     myservo.write(servoPosition);        //move the servo to the 10 degree position
31 }
```

# Troubleshooting Steps

## **Problem:**

- When I was printing the value of the servo motor position or the potentiometer position, no values were being shown on the screen monitor

## **Solution:**

- I selected the correct baud rate 9600 which ensured that I was on the correct serial port

# Potentiometer Discussion Question

**In the first tutorial (covering the potentiometer) that you followed, what is the total range of values that you can expect from Serial.println(potPosition); ?**

The total range of values that you can expect from Serial.println(potPosition); are 0 -1023

**How is an analog signal different from a digital signal?**

Analog signals are infinite meaning that there are infinite values that there can be whereas digital signals are discrete or finite meaning that there are limited values there can be such as (0 or 1).

# Potentiometer Discussion Question Continued

**What does a reading of 512 refer to from the Analog Input pin? What voltage does it refer to? Hint: The operating voltage of an Arduino is 5 volts so the highest analog reading should be the max number you get from the Serial.println(potPosition) line. 0 would mean 0 volts.**

$$1023/5 \times V // 512$$

$$1023V = 2560$$

$$V = 2.50$$

Reading of 512 refers to 2.50 Volts.

**What are the two purposes of the potPosition variable in the code? Why is it necessary to have it to affect the LED?**

Two purposes of the potPosition variable in the code includes:

Set the values from 0-1023 based on how far the knob is turned.

Delay as many milliseconds as position.

# Servo Motor Discussion Question

- 1. What are the three pins of a servo motor and what do they do?**

**The three pins of servo motor include:**

**Power** - Makes the motor spins round and round

**Ground** - Grounds the servo motor

**Signal** - Retrieves signals (left/right) and moves a specific angle and stays there.

- 2. What is a PWM signal and a duty cycle mean? Which specific digital I/O pin would you have to specifically use to work with the Servo motor.**

PWM means Pulse Width Modulation and duty cycle describe the percentage of time a digital signal is on over an interval or period of time. It tells the motor which position to go to its rotation. In order to work the servo motor you would specifically have to use the 9 digital I/O pin.

- 3. What is the total range (in degrees) of a servo motor?**

The total range of a servo motor is 0 to 180 degrees

# Lab 4 Extension

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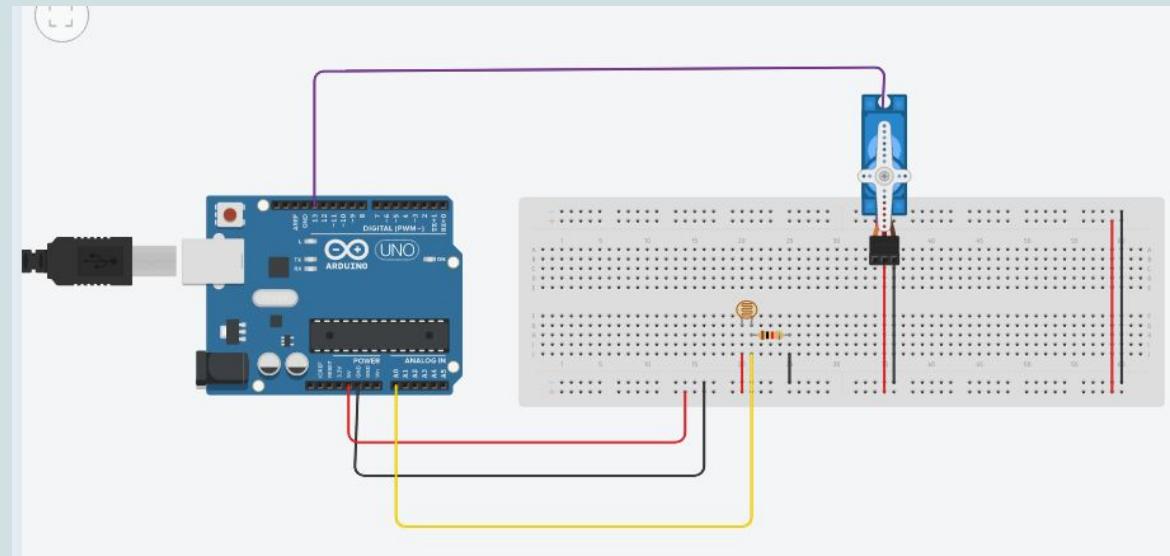
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# Lab 4 Extension Circuit

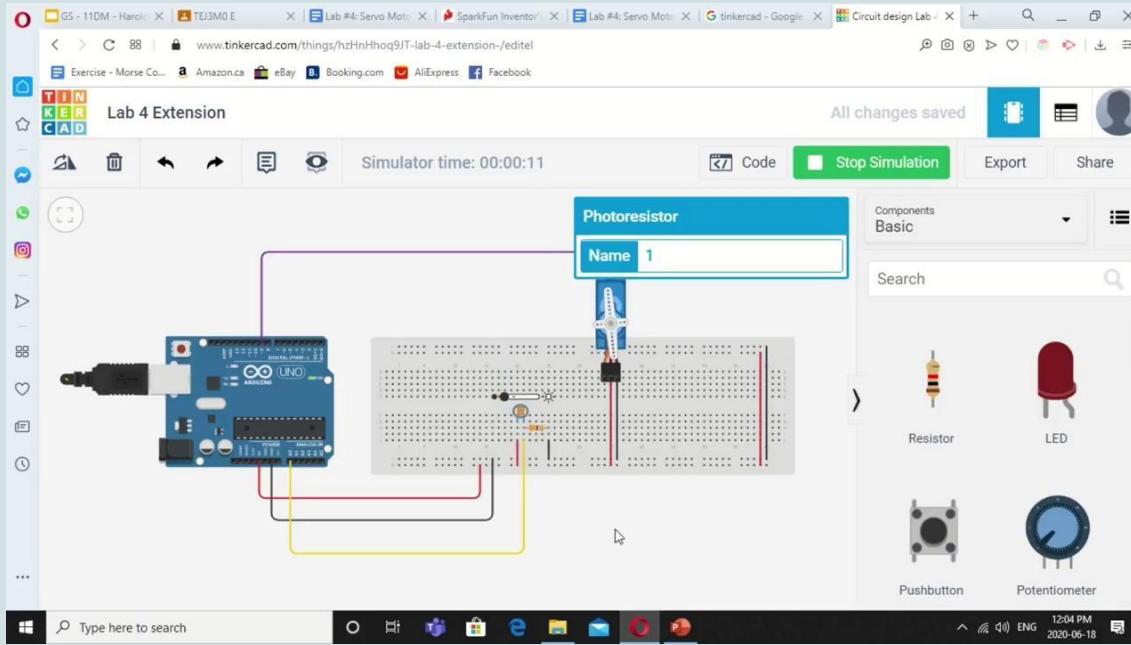
This circuit uses an Photoresistor (LDR) to control the rotation of the servo motor.

The circuit includes:

- 1x Photoresistor
- 1x Servo Motor



# Video



# Parts List Explanation

**Photoresistor** - Type of resistor whose resistance varies as a function of the intensity of the light exposed to it. For example as the light shines on the resistor's head the resistance decreases and as the light gets dimmer the resistance increases.



**Servo Motor** - An electrical motor made up of DC motor which is controlled by a variable resistor and some gears. Works on the principle of PMW where the angle of rotation is controlled by the duration of the pulse to its control PIN. Used to steer remote-controlled airplanes and cars etc.



# Code

```
1  /*
2  Author: Gurpreet Singh
3  Date: 17/06/2020
4  Description: This program control the servo motor based on the brightness of the photoresistor
5  */
6 #include <Servo.h>
7
8 int photoresistor = 0; //Variable that stores photoresistors position
9 Servo myservo; //Object for servo motor
10
11 void setup()
12 {
13   Serial.begin(9600);
14   myservo.attach(9); //Declaring that servo motor is attached to pin 9
15 }
16
17 void loop()
18 {
19   int photoresistor = analogRead(A0); //Declaring that photoresistor is wired to analog pin 0
20   Serial.println(photoresistor); //Displaying the position of the photoresistor
```

# Code Continued

```
8 int photoresistor = 0; //Variable that stores photoresistors position
9 Servo myservo; //Object for servo motor
10
11 void setup()
12 {
13     Serial.begin(9600);
14     myservo.attach(9); //Declaring that servo motor is attached to pin 9
15 }
16
17 void loop()
18 {
19     int photoresistor = analogRead(A0); //Declaring that photoresistor is wired to analog pin 0
20     Serial.println(photoresistor); //Displaying the position of the photoresistor
21
22     int lightValue = map(photoresistor, 0, 1023, 0, 994); //Map function for the ligh value
23
24     myservo.write(lightValue);
25     delay(100);
26 }
27
```

# Troubleshooting Steps

## Problem:

- Could not declare the map function as an error always appeared saying:
  - Expected primary expression before “:” token

## Solution:

- Added the position of my photoresistor variable therefore it declared the variable

# Extension Discussion Questions

- 1. What is the analog reading when the LDR is at its darkest setting?**

The analog reading at its darkest setting is 2.

- 2. What is the analog reading when the LDR is at its lightest setting?**

The analog reading when the LDR is at its lightest setting is 404

- 3. Copy your map() function call from your code. Explain it in words.**

```
int lightValue = map(photoresistor, 0, 1023, 0, 994);
```

This map function takes the 5 values in total (value, fromlow, fromhigh, tolow, tohigh). In this case, the range of the light value was from 0 to 1023 but we changed the range from 0 to 994 in order for the servo motor to move 180 degrees.

# Resources

<https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide---v41/circuit-1b-potentiometer>

<https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide---v41/circuit-3a-servo-motors>

<https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide---v41/circuit-1c-photosensor> -