



Mapúa University

School of Electrical, Electronics and Computer Engineering

Real-Time Embedded System COE187P/ E01

Basic Digital Input and Output Lab: #01

Submitted By:
Sardina, Kent Johnric M.

Submitted To:
Engr. Jocelyn Villaverde



I. Introduction

Digital and Analog signal inputs and outputs are used in every part of the programming of a microcontroller. Digital inputs and outputs are generally about 5 to 3 volts and 0 volts that microcontroller interprets it as 0|1, HIGH|LOW, etc. Digital Input and Output in Arduino can be used using `digitalWrite()` and `digitalRead()` functions of the Arduino but you first need to set the `pinMode` of the pin of the Arduino, Analog inputs and outputs are also used in every part of programming a microcontroller but the signal can be changed 5 to 0 volts smoothly like a Sine Wave that continues over time, different sensors that are used in Arduino are using analog for the Arduino to read or write on the sensor since some signal tend to have the very small value that digital signal cannot read or write. Analog Input and Output in Arduino can be used by using an analog pin, it has a (A) symbol beside the number of the pin, to program it you need to use `AnalogWrite` and `AnalogRead()` functions of the Arduino.

II. Objectives

1. Familiarize the basic connection of Arduino
2. Familiarize on how to code the Arduino
3. Using `digitalWrite()` and `digitalRead()` of the Arduino
4. Familiarize reading signals and writing signal from the Arduino
5. Using LED, 7-segment display and a push-button switch

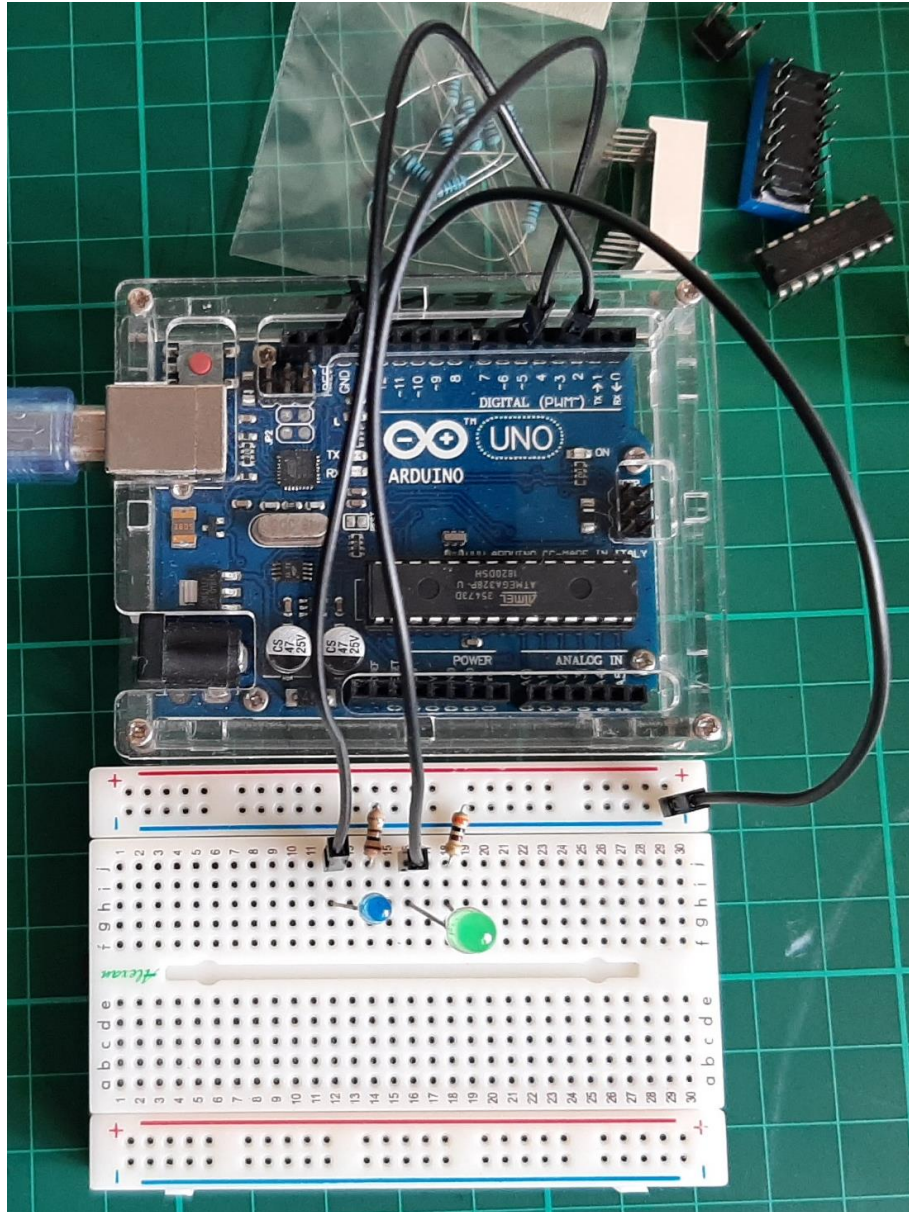
III. Materials and Components

1. Arduino UNO
2. Arduino UNO peripherals
3. LED
4. 7-segment display
5. Jumper Wires
6. Breadboard
7. 100-ohm resistor
8. Arduino IDE

IV. PROCEDURE

Part 01: Digital Switch

1. Follow the Connection of the LED to the Arduino



2. Connect Green LED to pin5 and Blue LED to pin3
3. Open Arduino IDE
4. Enter the Code Below

```
#define Bled 3
#define Gled 5

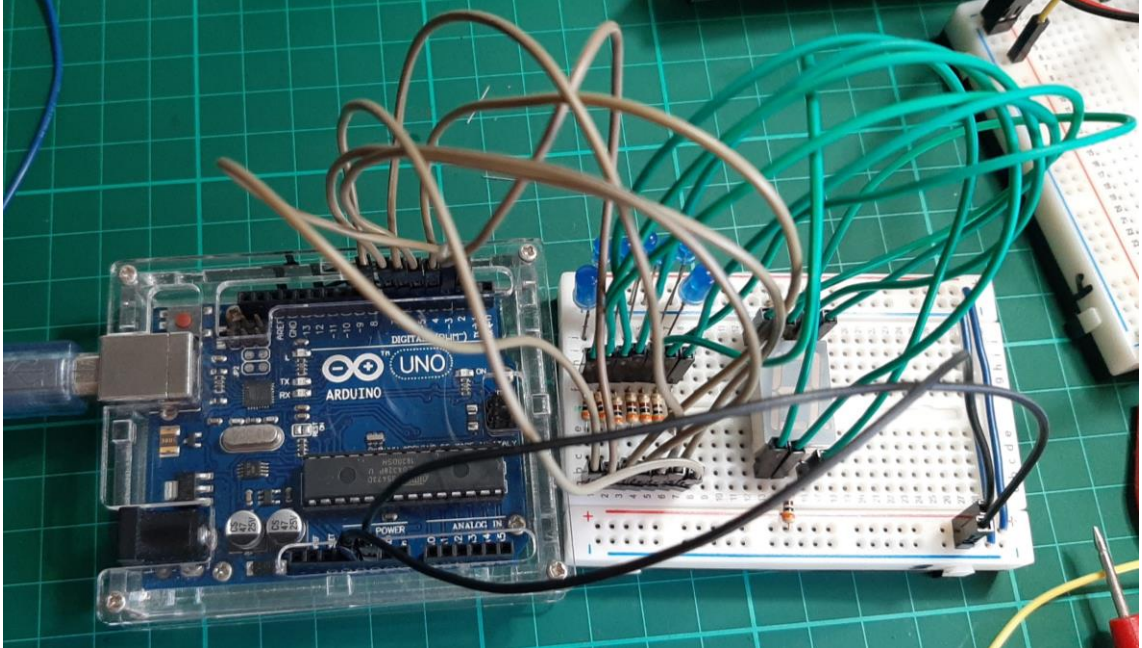
void setup() {
  pinMode(Bled, OUTPUT);
  pinMode(Gled, OUTPUT);
  Serial.begin(9600);
  Serial.println("type blue to turn on Blue LED and green for Green LED");
  digitalWrite(Bled, HIGH);
  digitalWrite(Gled, HIGH);
  delay(1000);
  digitalWrite(Bled, LOW);
  digitalWrite(Gled, LOW);
  delay(1000);
}

void loop() {
  if (Serial.available() > 0) {
    char inData = char(Serial.read());
    if (inData == 'b') {
      Serial.println("Blue LED in ON");
      digitalWrite(Bled, HIGH);
      digitalWrite(Gled, LOW);
    }
    else if (inData == 'g') {
      Serial.println("Green LED is ON");
      digitalWrite(Gled, HIGH);
      digitalWrite(Bled, LOW);
    }
  }
}
```

5. Select the current COM port for the Arduino
6. Verify, Save, and Upload the code to the Arduino
7. Open the Serial Monitor of the Arduino IDE
8. Test and observe the results of the Arduino

Part 02: LED and Seven-Segment Display

1. Follow the Connection of the LED and Seven-Segment Display



2. Connect the LED and the Seven-Segment pin to pin3 to pin8 to the Arduino in Order
3. Open Arduino IDE
4. Enter the Code Below

```
#define a 2
#define b 3
#define c 4
#define d 5
#define e 6
#define f 7
#define g 8

int COUNT = 0;
int ranCOUNT = 0;
void setup() {
    for(int i = 2; i < 9; i++){
        pinMode(i, OUTPUT);
    }
    Serial.begin(9600);
}

void loop() {
    switch(COUNT) {
        case 0:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, LOW);
            digitalWrite(f, LOW);
            digitalWrite(g, HIGH);
            break;
        case 1:
            digitalWrite(a, HIGH);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, HIGH);
            digitalWrite(e, HIGH);
            digitalWrite(f, HIGH);
            digitalWrite(g, HIGH);
            break;
        case 2:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, HIGH);
            digitalWrite(d, LOW);
            digitalWrite(e, LOW);
            digitalWrite(f, HIGH);
            digitalWrite(g, LOW);
            break;
```

```
        case 3:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, HIGH);
            digitalWrite(f, HIGH);
            digitalWrite(g, LOW);
            break;
        case 4:
            digitalWrite(a, HIGH);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, HIGH);
            digitalWrite(e, HIGH);
            digitalWrite(f, LOW);
            digitalWrite(g, LOW);
            break;
        case 5:
            digitalWrite(a, LOW);
            digitalWrite(b, HIGH);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, HIGH);
            digitalWrite(f, LOW);
            digitalWrite(g, LOW);
            break;
        case 6:
            digitalWrite(a, LOW);
            digitalWrite(b, HIGH);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, LOW);
            digitalWrite(f, LOW);
            digitalWrite(g, LOW);
            break;
        case 7:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, HIGH);
            digitalWrite(e, HIGH);
            digitalWrite(f, HIGH);
            digitalWrite(g, HIGH);
            break;
```

```
        case 8:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, LOW);
            digitalWrite(f, LOW);
            digitalWrite(g, LOW);
            break;
        case 9:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, HIGH);
            digitalWrite(f, LOW);
            digitalWrite(g, LOW);
            break;
    }
    switch(ranCOUNT) {
        case 10:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, LOW);
            digitalWrite(e, LOW);
            digitalWrite(f, LOW);
            digitalWrite(g, HIGH);
            break;
        case 11:
            digitalWrite(a, HIGH);
            digitalWrite(b, LOW);
            digitalWrite(c, LOW);
            digitalWrite(d, HIGH);
            digitalWrite(e, HIGH);
            digitalWrite(f, HIGH);
            digitalWrite(g, HIGH);
            break;
        case 12:
            digitalWrite(a, LOW);
            digitalWrite(b, LOW);
            digitalWrite(c, HIGH);
            digitalWrite(d, LOW);
            digitalWrite(e, LOW);
            digitalWrite(f, HIGH);
            digitalWrite(g, LOW);
            break;
```

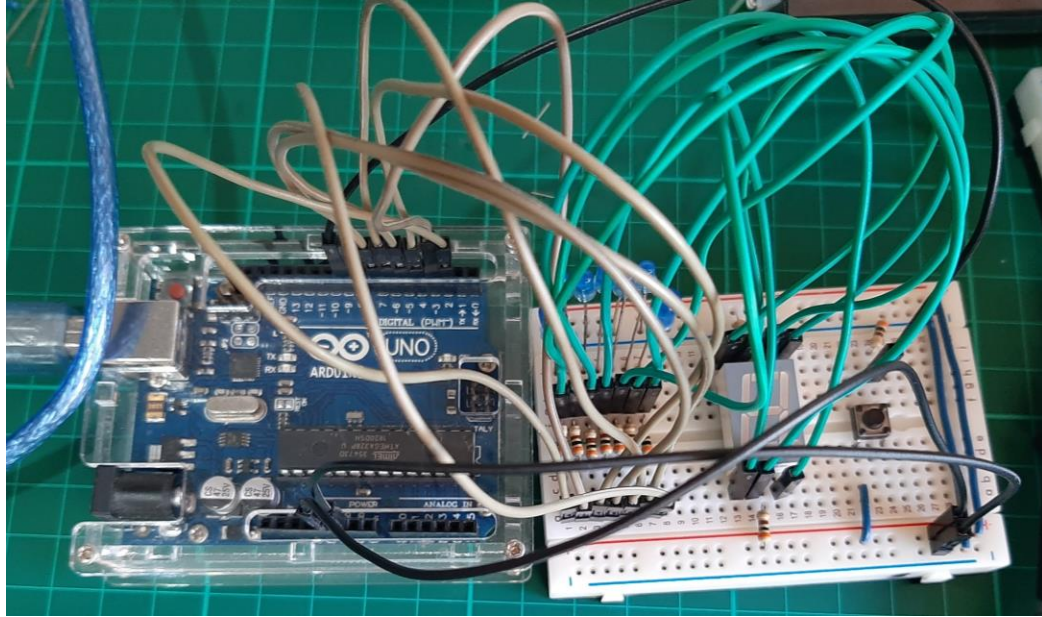



```
case 13:
    digitalWrite(a, LOW);
    digitalWrite(b, LOW);
    digitalWrite(c, LOW);
    digitalWrite(d, LOW);
    digitalWrite(e, HIGH);
    digitalWrite(f, HIGH);
    digitalWrite(g, LOW);
    break;
case 14:
    digitalWrite(a, HIGH);
    digitalWrite(b, LOW);
    digitalWrite(c, LOW);
    digitalWrite(d, HIGH);
    digitalWrite(e, HIGH);
    digitalWrite(f, LOW);
    digitalWrite(g, LOW);
    break;
case 15:
    digitalWrite(a, LOW);
    digitalWrite(b, HIGH);
    digitalWrite(c, LOW);
    digitalWrite(d, LOW);
    digitalWrite(e, HIGH);
    digitalWrite(f, LOW);
    digitalWrite(g, LOW);
    break;
case 16:
    digitalWrite(a, LOW);
    digitalWrite(b, HIGH);
    digitalWrite(c, LOW);
    digitalWrite(d, LOW);
    digitalWrite(e, LOW);
    digitalWrite(f, LOW);
    digitalWrite(g, LOW);
    break;
case 17:
    digitalWrite(a, LOW);
    digitalWrite(b, LOW);
    digitalWrite(c, LOW);
    digitalWrite(d, HIGH);
    digitalWrite(e, HIGH);
    digitalWrite(f, HIGH);
    digitalWrite(g, HIGH);
    break;
case 18:
    digitalWrite(a, LOW);
    digitalWrite(b, LOW);
    digitalWrite(c, LOW);
    digitalWrite(d, LOW);
    digitalWrite(e, LOW);
    digitalWrite(f, LOW);
    digitalWrite(g, LOW);
    break;
case 19:
    digitalWrite(a, LOW);
    digitalWrite(b, LOW);
    digitalWrite(c, LOW);
    digitalWrite(d, LOW);
    digitalWrite(e, HIGH);
    digitalWrite(f, LOW);
    digitalWrite(g, LOW);
    break;
}
if(COUNT <10){
    Serial.println(COUNT);
    COUNT ++;
    delay(1000);
}
else if (COUNT >= 10){
    Serial.println(ranCOUNT);
    ranCOUNT = random(10, 19);
    delay(50);
}
}
```

5. Select the correct COM port for the Arduino
6. Verify, Save, and Upload the code to the Arduino
7. Open Serial Monitor
8. Test and Observe the results of the Arduino

Part 03: Switch and LED/7-Segment Display

1. Follow the connection to the Arduino



2. The connection of the LED and 7-segment display is the same from the 2nd Part
3. Connect the push button to pin9 of the Arduino
4. Open Arduino IDE
5. The code is the same from the 2nd Part but adds this code highlighted

```
#define a 2
#define b 3
#define c 4
#define d 5
#define e 6
#define f 7
#define g 8
#define button 9
int COUNT = 0;
int ranCOUNT = 0;
void setup() {
    pinMode(button, INPUT);
    for(int i = 2; i < 9; i++){
        pinMode(i, OUTPUT);
    }
    Serial.begin(9600);
}

}

}

if(COUNT <10){
    int state = digitalRead(button);
    if(state == 1){
        COUNT++;
    }
    Serial.println(COUNT);
    delay(200);
}
else if (COUNT >= 10){
    Serial.println(ranCOUNT);
    ranCOUNT = random(10, 19);
    delay(50);
}
}
```




6. Select the correct COM port for the Arduino
7. Verify, Save, and Upload the code to the Arduino
8. Open Serial Monitor
9. Test and Observe the results of the Arduino

V. Results and Discussion

In this experiment by using `digitalWrite()` and `digitalRead()` you can make any pins of the Arduino read the signal or write a signal (outputting 5 volts), In the first part of the experiment I used `DigitalWrite()` function of the Arduino to turn on and off a specific LED, I also used a serial monitor to control which LED will turn on by typing on it, I used the `Serial.read()` function and assign the value to `inData`. In the second part of the experiment I used a `for` statement to make the mode of the pins 1 to 8 to OUTPUT, then I used the `case` statement and set the `DigitalWrite()` for the 7-segment display and I also used an `if` statement to display of the numbers then used a `random()` function to display random numbers after that. In the third part of the experiment, I added a push button to the second part of the experiment which its function, when pressed the number, will increment and display the number to the 7-segment display.

VI. Conclusion

After the parts and activity, all objectives in this experiment are achieved. By using different functions of the Arduino helps to program the microcontroller easily, by using `digitalRead()` and `digitalWrite()` function you can set the pin to read or to write (outputting 5volts) to the pin but for this to work you need to set the mode of the pin by using this function `pinMode()`, by using `pinMode()` function you set the pin to INPUT or OUTPUT which is INPUT for `digitalRead()` and OUTPUT for `digitalWrite()`. I learned different functions from the Arduino Library and used it in this experiment.