AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)
Faculty of Engineering
Department of EEE and CoE
Undergraduate Program

Course: MICROPROCESSOR AND EMBEDDED SYSTEMS **Summer 2021-22, MID**

Experiment 3: Timers: Implementation of a traffic control system

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Objective:

To get familiar with Timers and use them for the implementation of a traffic control system.

Theory and methodology:

A sequential logic circuit's electronic component all operate on a time base. This time base aids in keeping all tasks in sync. Devices wouldn't know when to carry out specific tasks without a time base. As a result, the timer is a key idea in the field of electronics.

Hardware included with the Arduino controller is a timer/counter. It can be used to measure time events and is similar to a clock. A timer is a register whose value automatically grows or decreases.

In AVR, timers are of two types: 8-bit and 16-bit timers. In an 8-bit timer, the register used is 8-bit wide whereas, in a 16-bit timer, the register width is 16 bits. This means that the 8-bit timer is capable of counting 28=256 steps from 0 to 255. Similarly, a 16-bit timer is capable of counting 216=65536 steps from 0 to 65535.

Equipment List:

1) Arduino board
2) Breadboard
3) LED lights (red, yellow, green)
4) Jumper wires
5) Resistors

Circuit Diagram:

The Arduino platform is made up of the following components.

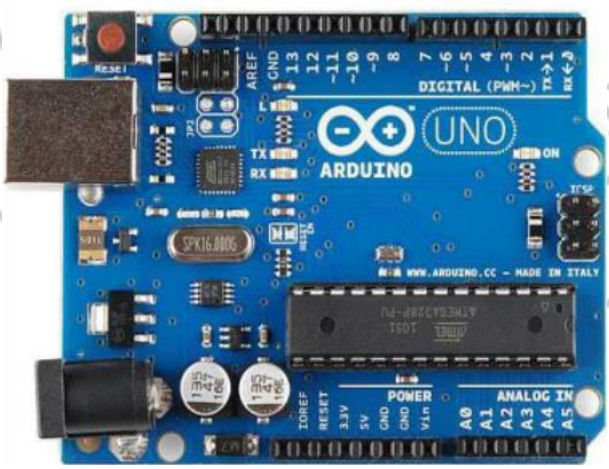

Figure 1: Arduino Uno (R3)

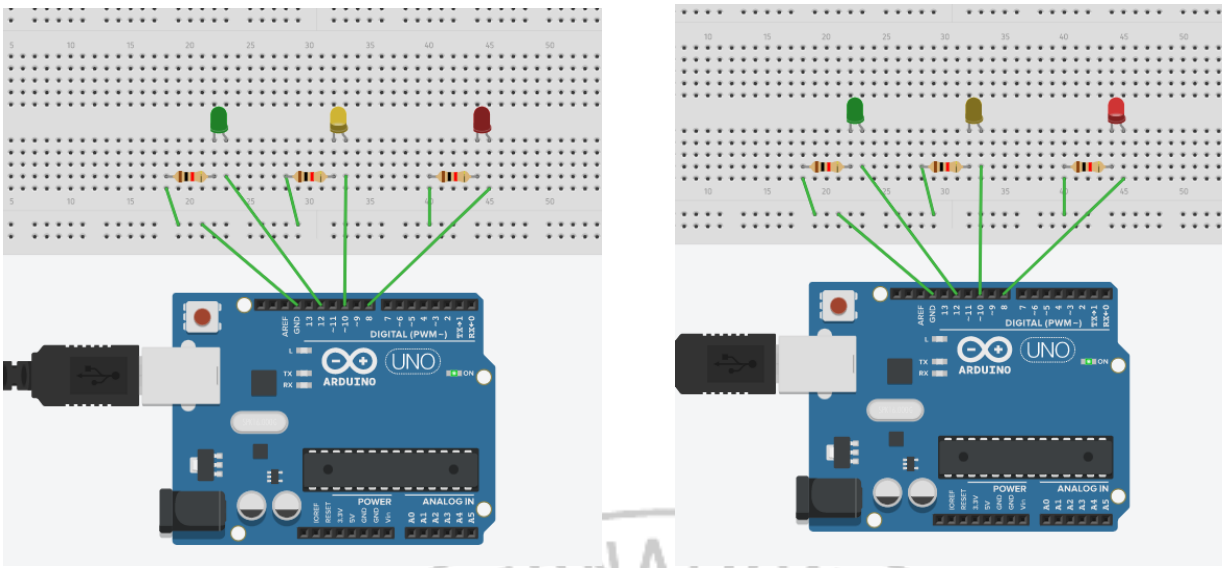

Figure 2: Hardware for traffic light

Hardware Setup:

In Multiple LED (Traffic Control system):

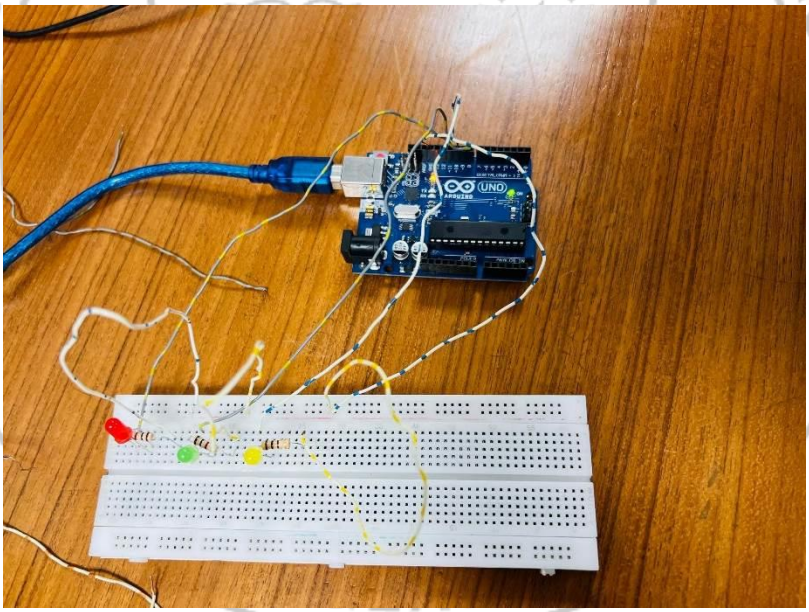

Figure 3.1: All LED off

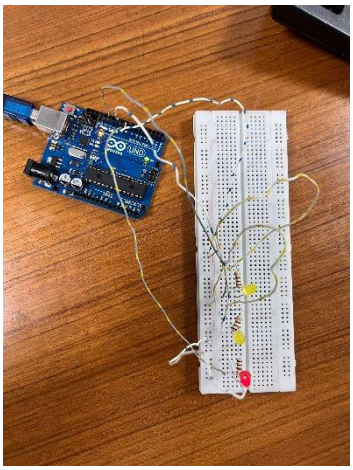

Figure 3.2: Red LED on

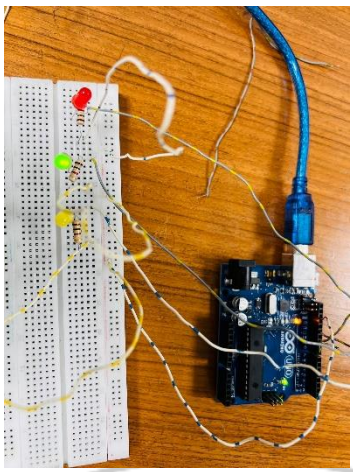

Figure 3.3: Green LED on

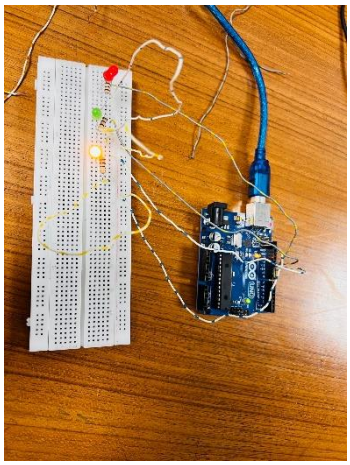

Figure 3.4: Yellow LED on

Code Analysis:

```
#define RED_PIN 8 //define name of pins used
#define YELLOW_PIN 10
#define GREEN_PIN 12
//define the delays for each traffic light color
int red_on = 3000; //3s delay
int red_yellow_on = 1000; //1s delay
int green_on = 3000; //3s delay
int green_blink = 500; //.5s delay
int yellow_on = 1000; //1s delay
int delay_timer (int milliseconds)
{
int count = 0;
while(1)
{
if(TCNT0 >= 16) // Checking if 1 millisecond has passed
```

```
{
TCNT0=0;
count++;
if (count == milliseconds) //checking if required milliseconds delay has passed
{
count=0;
break; // exits the loop
}
}
}
return 0;
}
void setup() {
//define pins connected to LEDs as outputs
pinMode(RED_PIN, OUTPUT);
pinMode(YELLOW_PIN, OUTPUT);
pinMode(GREEN_PIN, OUTPUT);
//set up timer
TCCR0A = 0b00000000;
TCCR0B = 0b00000101; //setting pre-scaler for timer clock
TCNT0 = 0;
}
void loop() {
//to make red LED on
digitalWrite(RED_PIN, HIGH);
delay_timer(red_on);
//to turn yellow LED on
```

```
digitalWrite(YELLOW_PIN, HIGH);
delay_timer(red_yellow_on);
//turning off RED_PIN and YELLOW_PIN, and turning on greenLED
digitalWrite(RED_PIN, LOW);
digitalWrite(YELLOW_PIN, LOW);
digitalWrite(GREEN_PIN, HIGH);
delay_timer(green_on);
digitalWrite(GREEN_PIN, LOW);
//for turning green Led on and off for 3 times
for(int i = 0; i < 3; i = i+1)
{
delay_timer(green_blink);
digitalWrite(GREEN_PIN, HIGH);
delay_timer(green_blink);
digitalWrite(GREEN_PIN, LOW);
}
//for turning on yellow LED
digitalWrite(YELLOW_PIN, HIGH);
delay_timer(yellow_on);
digitalWrite(YELLOW_PIN, LOW);
}
```

Discussion:

From this experiment the use of timers and timer function was learned. The Arduino Uno microcontroller was used to implement the study to blink a led using timer. This experiment was carried out in two ways. First, by using Arduino board, three colored animated LED lights (red, yellow, and green), three resistors breadboard and connecting wires, traffic control circuit was created. The LED lights (red, yellow, and green) were connected to ports 8, 10 and 12. Then the code was coded for the traffic control system in Arduino IDE. Then it was uploaded to the hardware to test the circuit in real life.