American International University- Bangladesh
Department of Electrical and Electronic Engineering
EEE 4103: Microprocessor and Embedded Systems Laboratory

Title: Familiarization with a microcontroller, the study of blink test and implementation of a traffic control system using microcontrollers.

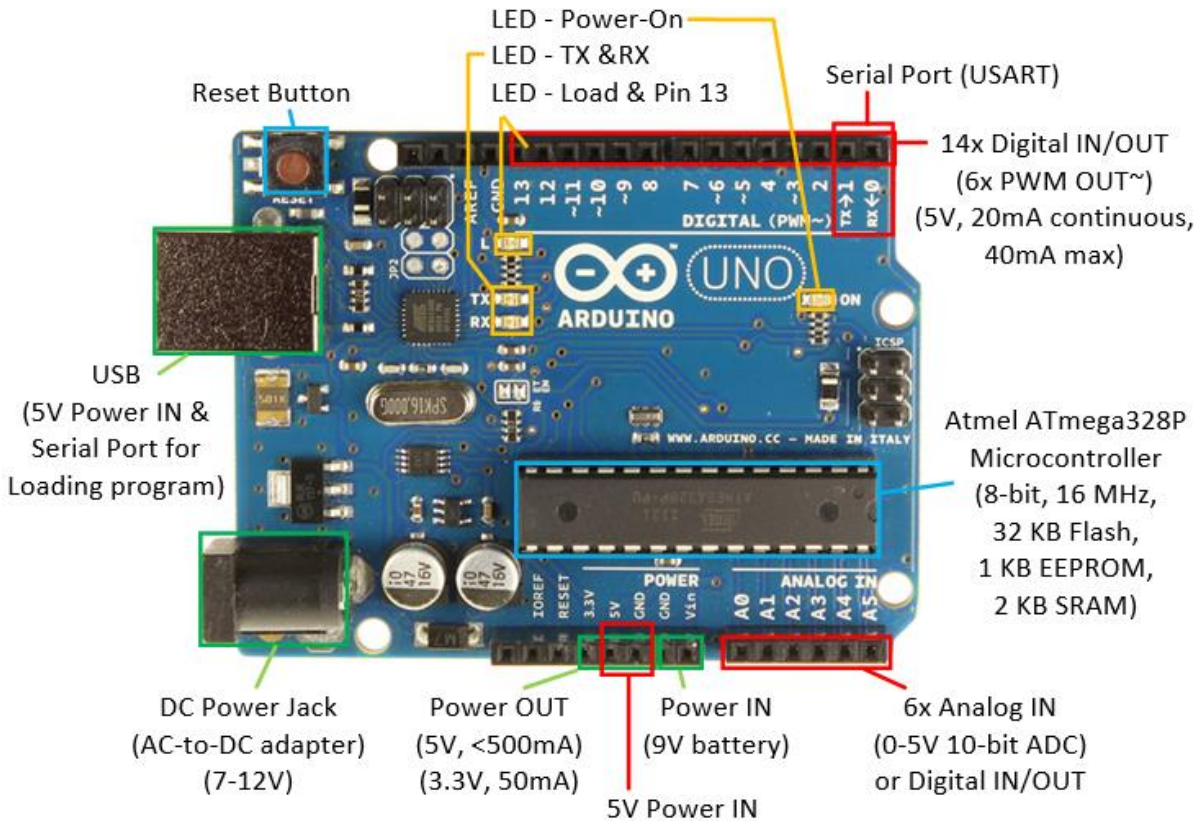
Introduction:

The objective of this experiment is to get familiarized with Microcontroller.
- Learning to make the LED blink using Arduino and the delay functions
- Implementation of a traffic control system using Arduino.

Theory and Methodology:

Arduino is an open-source platform used for creating interactive electronics projects. Arduino consists of both a programmable microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the microcontroller board. Arduino Uno also doesn't need a hardware circuit (programmer/ burner) to load a new code into the board. We can easily load a code into the board just using a USB cable and the Arduino IDE (which uses an easier version of C++ to write code).

Overview of Arduino Board :



Apparatus:

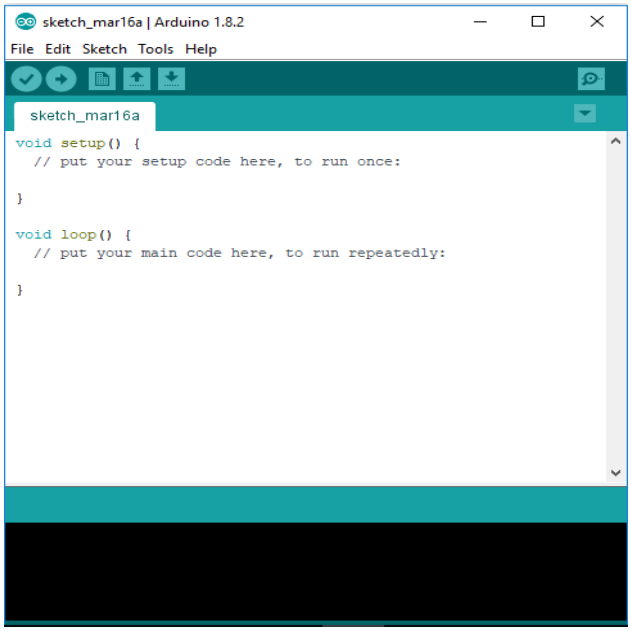
1) Arduino IDE (any version)

2) Arduino Uno (R3) board or Arduino mega 2560 board

3) LED lights (RED, GREEN, and YELLOW) and three 200 ohms resistors and jumper wires

Using Arduino IDE to write code:

Open the Arduino Uno IDE 1.8.2 and a blank sketch will open. The following window will come up on your PC: -

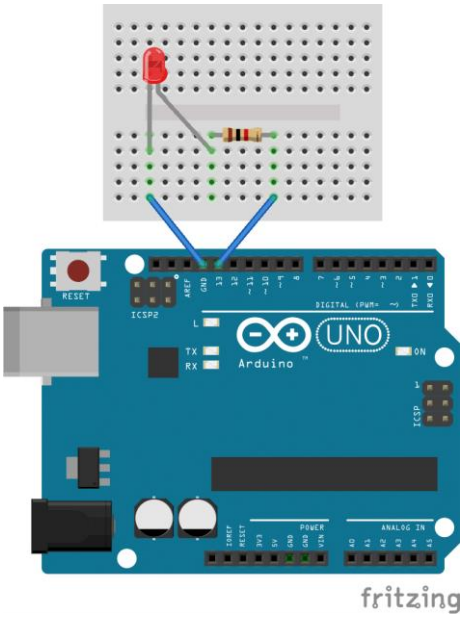


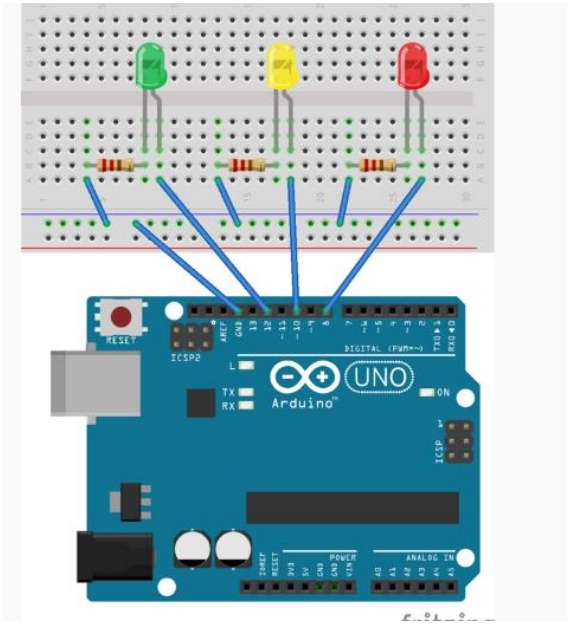
2. Now write the following program to a blank sketch for the blink test.

```
void setup() {
  // pin connections for the LED light
pinMode(5,OUTPUT);
}

void loop() {
  // turning on voltage at output 8(for red LED)

digitalWrite(5,HIGH);
delay(1000);     //  LED is on for 1 seconds
digitalWrite(5,LOW);
delay(1000);     //  LED is off for 1 seconds
}
```

Experimental Procedure:

The main task of our lab is to understand and implement a traffic control system after understanding to blink a LED light. Make the circuits first using the following connection system between all the elements.





Program for Traffic Control system:

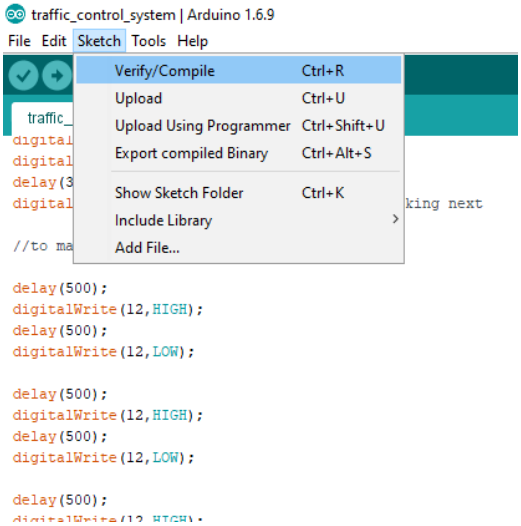
```
void setup() {
  // pin connections for the LED lights

pinMode(8,OUTPUT);
pinMode(10,OUTPUT);
pinMode(12,OUTPUT);
}

void loop() {
  // turning on voltage at output 8(for red LED)

digitalWrite(8,HIGH);
delay(3000);     // red LED is on
// turning on voltage at output 8(for red LED)

digitalWrite(10,HIGH);
delay(1000);   // yellow LED is on

//for turning off red and yellow and turning on green

digitalWrite(8,LOW);
digitalWrite(10,LOW);
digitalWrite(12,HIGH);
delay(3000);
digitalWrite(12,LOW);    //green is off for blinking next

//to make green on and off 3 times

delay(500);
digitalWrite(12,HIGH);
delay(500);
digitalWrite(12,LOW);
```

```
delay(500);
digitalWrite(12,HIGH);
delay(500);
digitalWrite(12,LOW);

delay(500);
digitalWrite(12,HIGH);
delay(500);
digitalWrite(12,LOW);

//to turn yellow on once

digitalWrite(10,HIGH);
delay(1000);
digitalWrite(10,LOW);
}
```

3. After writing the program you have to save the sketch, go to File->Save As->give a File name(Traffic_control_light)-> Select Save.

N.B. After saving your code a sketch file with the desired file name will be stored in a folder with the same file name.

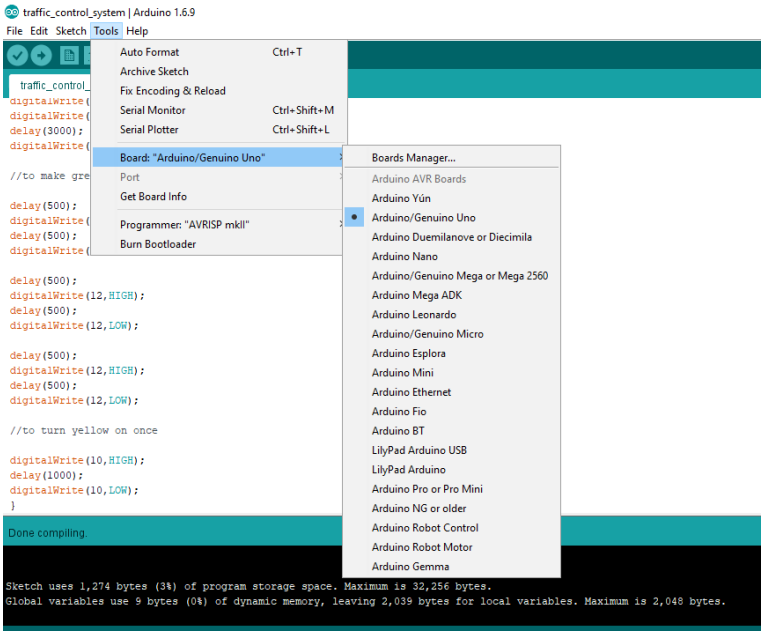
4. Now you need to verify/compile your code to find out and correct the errors, go to Sketch->Verify/Compile.



5. After compiling is done you need to upload your code into the Arduino Uno board. To upload the program connect your Arduino Uno R3 board to your PC with a USB cable. Before uploading the code select the board type and port at your Arduino IDE, go to

- Tools-> Board:"Arduino/Genuino Uno" -> Arduino/Genuino Uno.
- Tools->Ports-> COMx

After you have selected the board and port select the upload option at the Arduino IDE (see the following figure) to upload the code.



How It Works:

Turn on the red signal (pin 8)
wait for 3 sec
Turn on the yellow signal (pin 10)
wait 1 sec
turn off red signal (pin 8)
turn off yellow signal (pin 10)
turn on green signal (pin 12)
wait 3 sec
turn off green signal (pin 12)
turn on green signal (pin 12)
wait 0.5 sec
turn off green signal (pin 12)
turn on green signal (pin 12)
wait 0.5 sec
turn off green signal (pin 12)
turn on green signal (pin 12)
wait 0.5 sec
turn off green signal (pin 12)
turn on yellow signal (pin 12)
wait 1 sec
turn off yellow signal (pin 12)

Let us rewrite the code again for the same operation and same circuit by defining the delays:

```
#define RED_PIN 8
#define YELLOW_PIN 10
#define GREEN_PIN 12

int red_on = 3000;
int red_yellow_on = 1000;
int green_on = 3000;
int green_blink = 500;
int yellow_on = 1000;

void setup() {
//ports for connecting LEDs
pinMode(RED_PIN, OUTPUT);
pinMode(YELLOW_PIN, OUTPUT);
pinMode(GREEN_PIN, OUTPUT);
}
```

```
void loop() {
//turning on voltage at output red LED
digitalWrite(RED_PIN, HIGH);
//to make red LED on
delay(red_on);
//to turn yellow LED on
digitalWrite(YELLOW_PIN, HIGH);
delay(red_yellow_on);

//turning off RED_PIN and YELLOW_PIN, and turrning on greenLEd
digitalWrite(RED_PIN, LOW);
digitalWrite(YELLOW_PIN, LOW);
digitalWrite(GREEN_PIN, HIGH);
delay(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(green_blink);
digitalWrite(GREEN_PIN, HIGH);
delay(green_blink);
digitalWrite(GREEN_PIN, LOW);
}
//for turning on yellow LED
digitalWrite(YELLOW_PIN, HIGH);
delay(yellow_on);
digitalWrite(YELLOW_PIN, LOW);
}
```

Questions for report writing:

1) Include all codes and scripts into the lab report following the writing template mentioned in appendix A of Laboratory Sheet Experiment 1.
2) Include the proteus simulation of the blink program and traffic light system. you can learn the simulation from the following link: *https://www.youtube.com/watch?v=yHB5it0s2oU*

Reference(s):

1) https://www.arduino.cc/.
2) https://www.coursera.org/learn/arduino/lecture/ei4ni/1-10-first-glance-at-a-program
3) Jeremy Blum; Exploring Arduino: Tools and Techniques for Engineering Wizardry