



Jose Rizal University
College of Computer Studies Engineering
Computer Engineering Department

Lab Experiment Submission No. 1

CPE C312 – EMBEDDED SYSTEMS

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I. OBJECTIVES

This example aims to familiarize the student with the basic operation of the Arduino Uno board, and Integrated Development Environment (IDE).

Upon completion of this laboratory experiment, students should be able to:

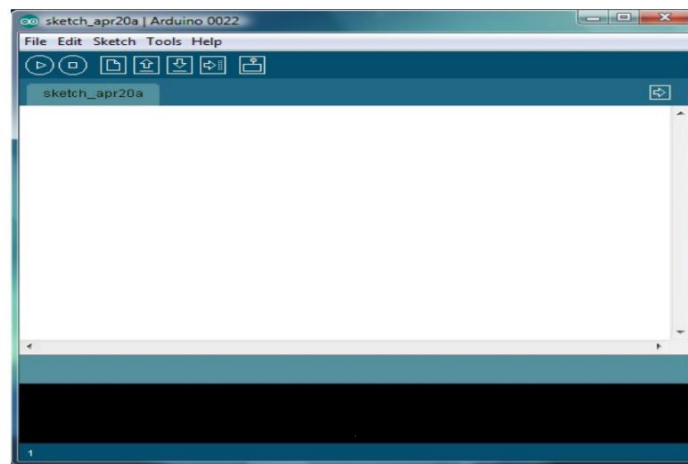
- Understand the basic functionalities of the IDE.
- Connecting and operating LED connected to the digital outputs of an Arduino

II. MATERIALS & TOOLS

1. 1 x Arduino Uno board and USB cable
2. 1 x 5mm/3mm Red LED
3. 1 x 470 Ω resistor
4. 1 x breadboard
5. Laptop for programming


III. BACKGROUND INFORMATION

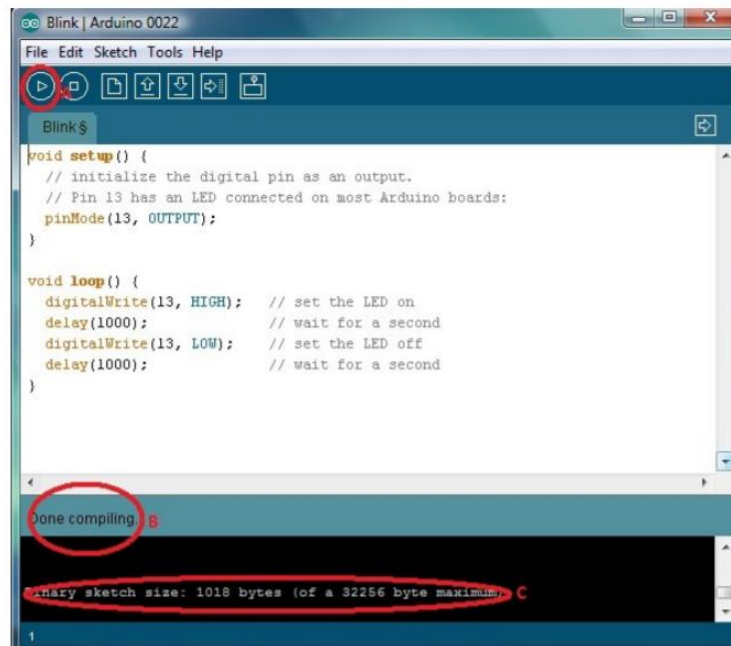
- A) Using the Arduino IDE. Proceed to the Arduino Folder and double-click the Arduino application to open the Arduino IDE which is also shown below:



- B) Type the following lines of code on the front panel. The code can also be found in the examples folder of Arduino. To copy it, just navigate from arduino-00XX > examples > Basics > Blink.

```
1 void setup() {  
2   pinMode(13,OUTPUT);  
3 }  
4 void loop() {  
5   digitalWrite(13,HIGH);  
6   delay(1000);  
7   digitalWrite(13,LOW);  
8   delay(1000);  
9 }
```

- C) Press Ctrl + S or  Icon on the IDE to save your sketch (the term for a source code in Arduino).
- D) Click the Verify Button to check if the sketch has no errors. At the bottom of the screen, you should see if the sketch was successfully scanned free of problems. Moreover, the size of the sketch file is also indicated on the black screen at the bottom to show that it fits the flash memory of the Arduino Uno.

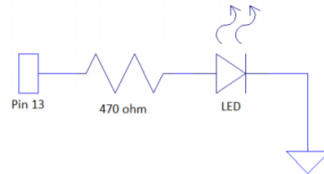


IV. PROCEDURES

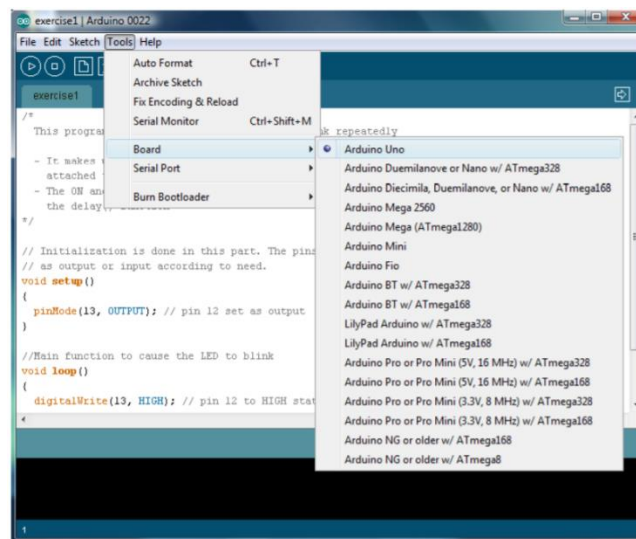
Test your Program

1. Connect an LED to a 470Ω resistor.

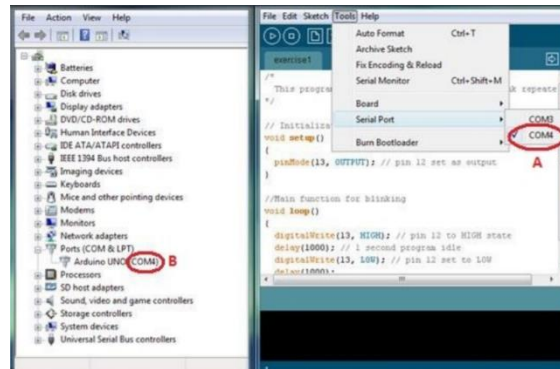
Note: that the longer leg of the LED is the positive (connected to one end of resistor and the shorter one is the negative (connected to the ground). The other end of the resistor should then be connected to the specified pin which is 13.




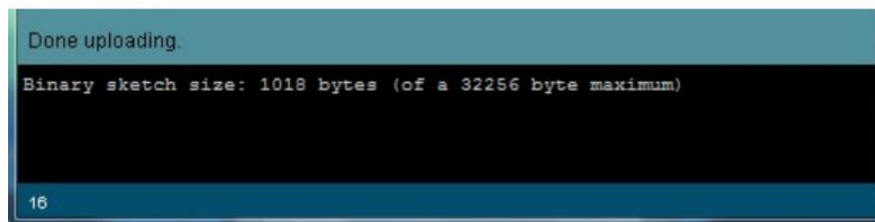
2. Check if the board selected in the IDE is the one you are using, the Arduino Uno board.



3. Next, make sure that the Arduino board's COM port is properly identified by the IDE. To do this, connect the board to the computer then from the IDE front panel go to Tools > Serial Port. A list of COMs should be there, choose the COM number associated with the microcontroller board. Note: the microcontroller board's COM no. is found near the name of the device's driver in Device Manager



4. Finally, upload the sketch made earlier into the board by clicking the  icon in the IDE. The status of the upload can be found near the bottom of the program.



Code explanations:

Line No.	Explanations
1	Creates a function called setup. The function type is void and therefore does not return any value after execution. This is only read once in a file execution and is required in a sketch.
2	The function pinMode() configures the specified pin which is 13 in this sample. It sets digital pin 13 as output.
3	Creates a function called loop. The function type is also void and therefore also does not return any value after execution. This is read repeatedly in a file execution and usually where the main program is. This is also required in a sketch.
4	The digitalWrite() function writes a high(5V) or low(0V) on a specified pin. In this case, a high state is written on pin 13 to light the LED.
5	The delay function needs a constant or variable of how long in millisecond the delay will be. This line prolongs for 1000 millisecond the LED at ON state.
6	Similar to line 4, pin 13 was set this time to low to turn off the LED.
7	This line is the same as line 5 and prolongs the LED at OFF state for 1 second.

V. REPORT

Write a report that summarizes this experiment. Your report brief must include:

- **Objective** - The objective of this experiment is to familiarize the student with the basic operation of the Arduino Uno board and Integrated Development Environment (IDE), and to learn how to connect and operate an LED connected to the digital outputs of an Arduino.
- **Procedure** - The experiment was conducted by connecting an LED to a 470Ω resistor and the specified pin on the Arduino Uno board. The Arduino IDE was then used to write a simple program that would turn on and off the LED. The program was uploaded to the Arduino board, and the LED was observed to turn on and off as expected.
- **Discussion** - The results of the experiment showed that it was possible to connect an LED to a 470Ω resistor and the specified pin on the Arduino Uno board. The Arduino IDE was also successfully used to write a simple program that would turn on and off the LED. The program was uploaded to the Arduino board, and the LED was observed to turn on and off as expected.

The principles involved in the experiment include:

- The use of a resistor to protect the LED from damage.
- The use of the Arduino IDE to write and upload Arduino code.
- The use of digital logic to turn on and off the LED.

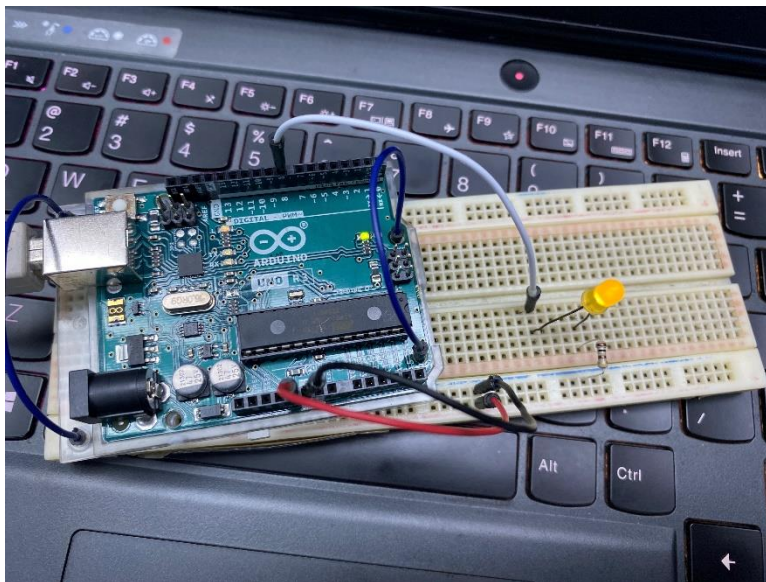
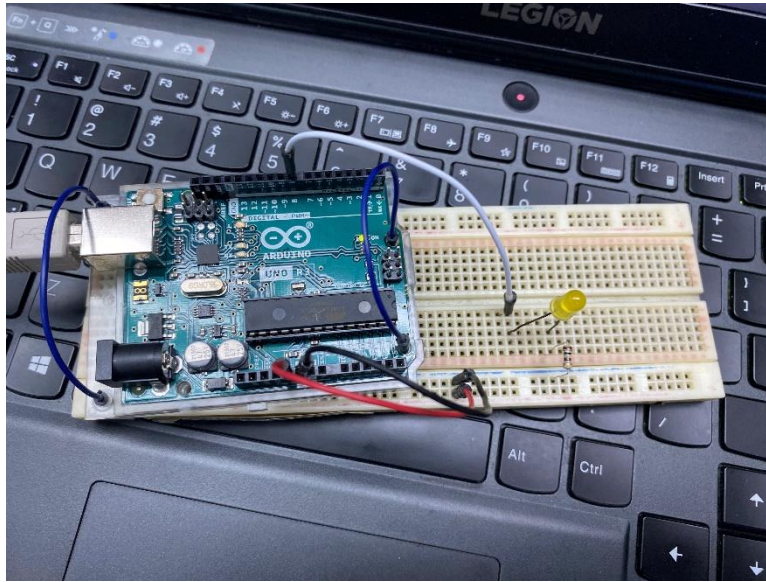
The experiment was successful in demonstrating the basic principles of Arduino programming. It also showed that it is possible to create simple but visually appealing LED animations using Arduino.

Code:

```
int LED = 8;
void setup() {
  pinMode(LED, OUTPUT);
}

void loop() {
  digitalWrite(LED, HIGH);
  delay(1000);
  digitalWrite(LED, LOW);
  delay(1000);
}
```


Actual Pictures:



VI. CONCLUSION

In conclusion, we have learned that it is possible to connect an LED to a 470 Ω resistor and the specified pin on the Arduino Uno board. We have also learned how to use the Arduino IDE to write and upload Arduino code. Learned about the basic principles of digital logic, which are used to turn on and off the LED. As well as how important it is to be careful when connecting the LED and resistor to the Arduino board, as even small errors can damage the LED.