AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

Faculty of Engineering

Lab Report

Experiment # 04

Experiment Title: Study of a Digital Timer using the millis () function of Arduino.

Date of Perform:	Date Month 2023	**Date of Submission:**	19 June 2023
Course Title:	MICROPROCESSOR AND EMBEDDED SYSTEM LAB		
Course Code:	COE3104	**Section:**	N/A
Semester:	Summer 2022-23	**Degree Program:**	BSc in CSE/EEE
Course Teacher:	**Prof. Dr. Engr. Muhibul Haque Bhuyan**		

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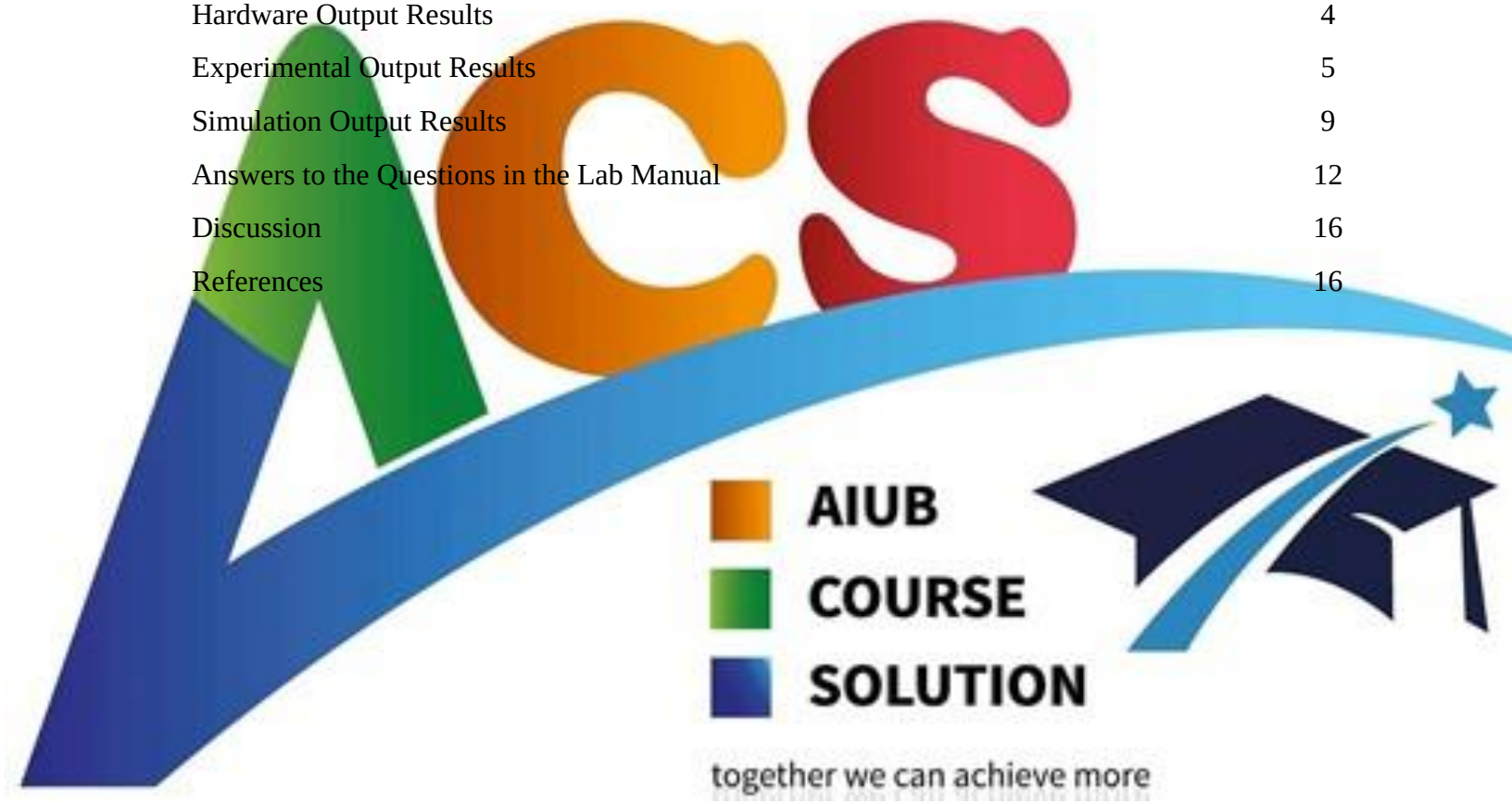


Experiment Title: Study of a Digital Timer using the millis () function of Arduino.

Objectives:
The objectives of this experiment are to-

- Familiarize with the application of millis() function of Arduino
- Develop a digital timer to turn on several LEDs on an Arduino Microcontroller Board
- Implement a sequential LED light pattern control system using input switch and Arduino Microcontroller Board

Equipment List:

1. Arduino IDE (2.0.1 or any recent version)
2. Arduino Microcontroller board
3. LED lights (Red, Green, and Yellow- each 2)
4. Six 100 Ω resistors and one 10 kΩ resistor
5. One tilt switch
6. Jumper wires

Circuit Diagram:
The Arduino platform is made up of the following components.

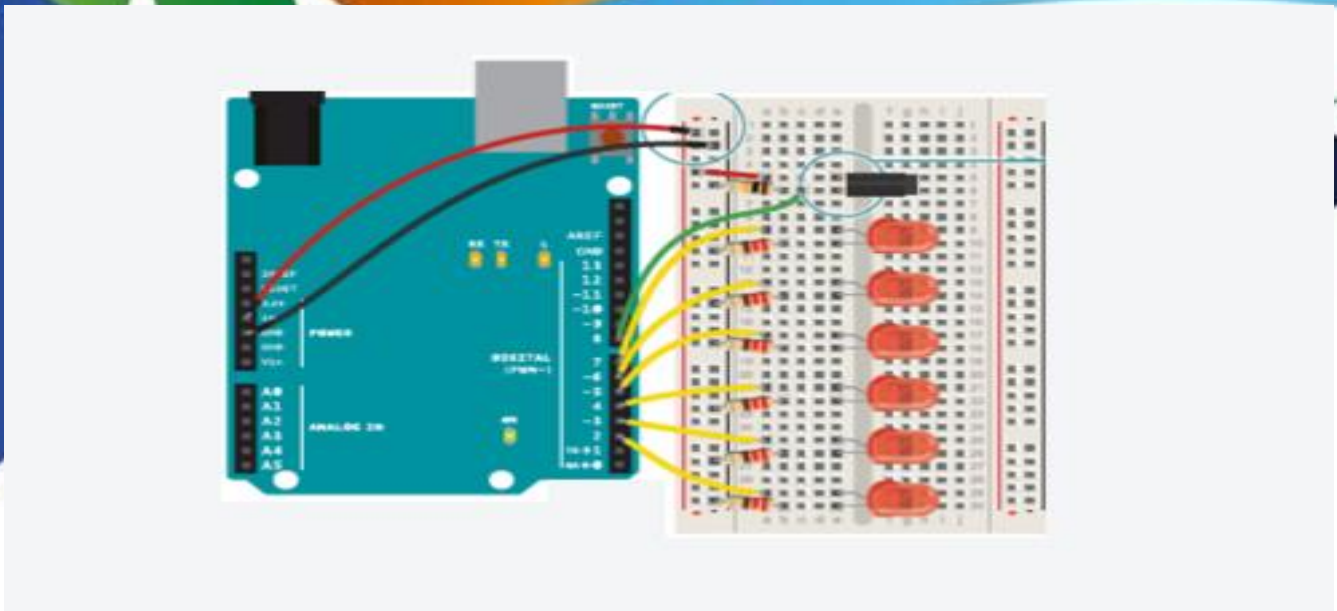


Fig. 1 Experimental Setup of an LED Light Pattern Control System using a Tilt switch and an Arduino Microcontroller Board

Code/Program:
The following is the code for the implementation of the digital timer using the millis() test with the necessary code explanation:

```
const int SwitchPin = 8;
unsigned long PreviousTime = 0;
```

```
int SwitchState = 0;
int PrevSwitchState = 0;
int led = 2;
long interval = 3000; // for 1 min = 60,000 ms delay
void setup() {
for (int x = 2; x < 8; x++) {
pinMode(x, OUTPUT);
}
pinMode(SwitchPin, INPUT);
}
void loop() {
unsigned long CurrentTime = millis();
if (CurrentTime - PreviousTime > interval) {
PreviousTime = CurrentTime;
digitalWrite(led, HIGH);
led++;
if (led == 7) {
}
}
SwitchState = digitalRead(SwitchPin);
if (SwitchState != PrevSwitchState){
for (int x = 2; x < 8; x++) {
digitalWrite(x, LOW);
}
led = 2;
PreviousTime = CurrentTime;
}
PrevSwitchState = SwitchState;
}
```

Hardware Output Results:

Here is the hardware implementation of the digital timer using the millis () test and the necessary explanation of the implementation:

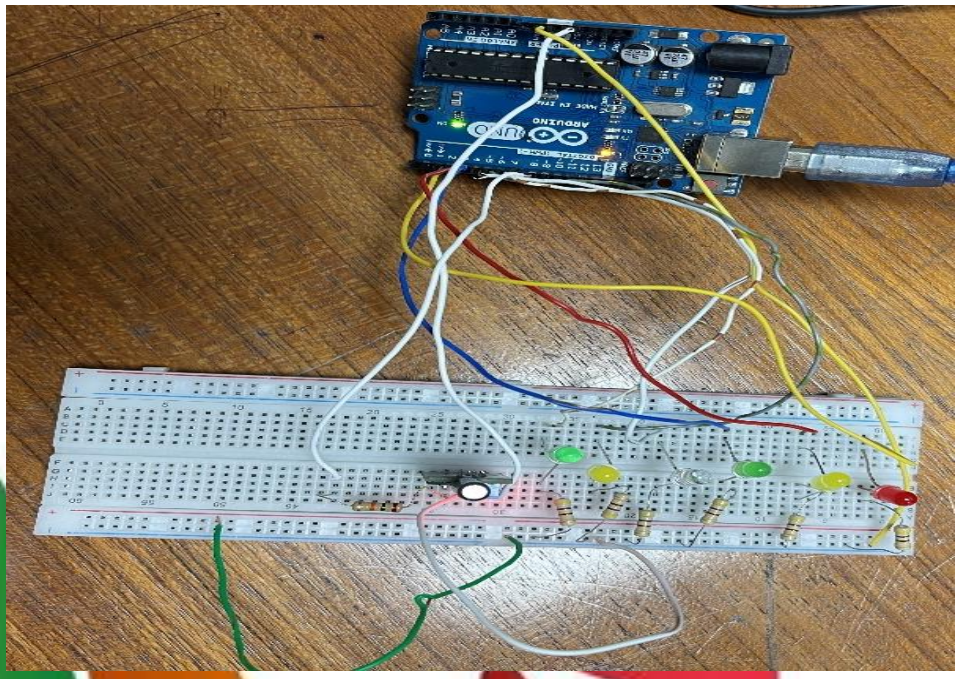


Fig:2 Hardware implementation of Digital Timer using the Millis () function

Explanation: WRITE EXPLANATION HERE

Experimental Output Results:

Here are the results of the digital timer using the Millis () function and the necessary explanation of the results:

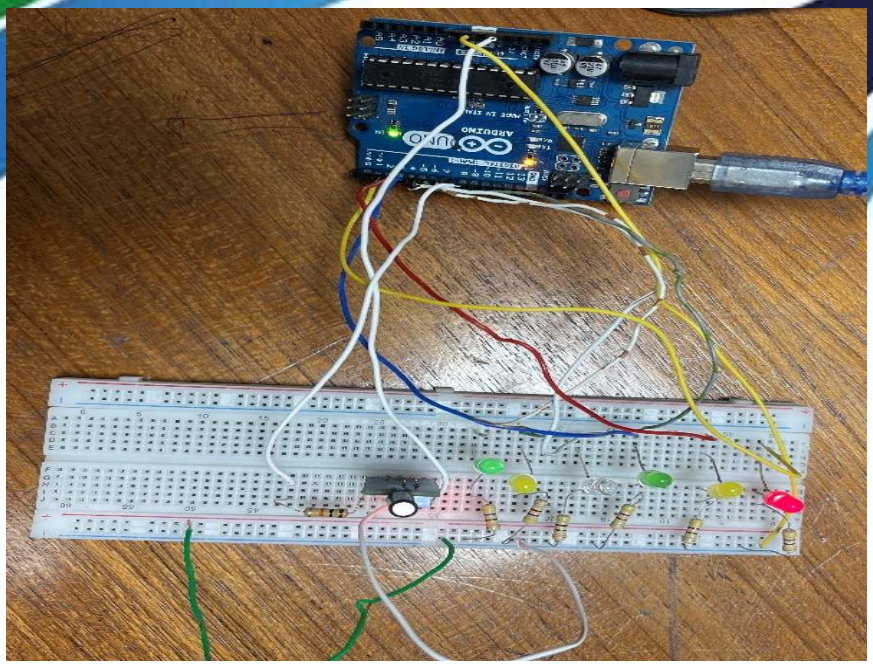


Fig.3 First LED is ON in the Digital Timer

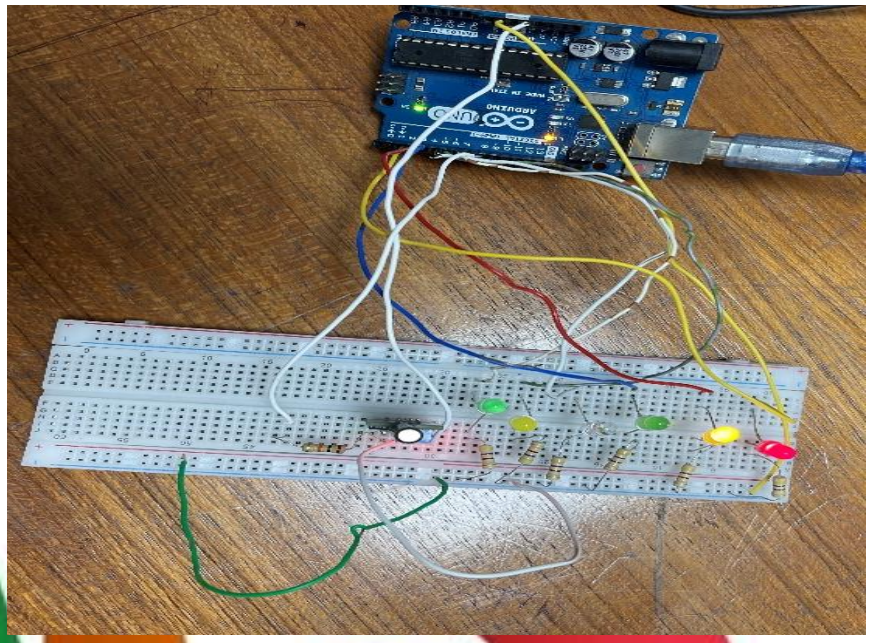


Fig.4 Second LED is ON in the Digital Timer

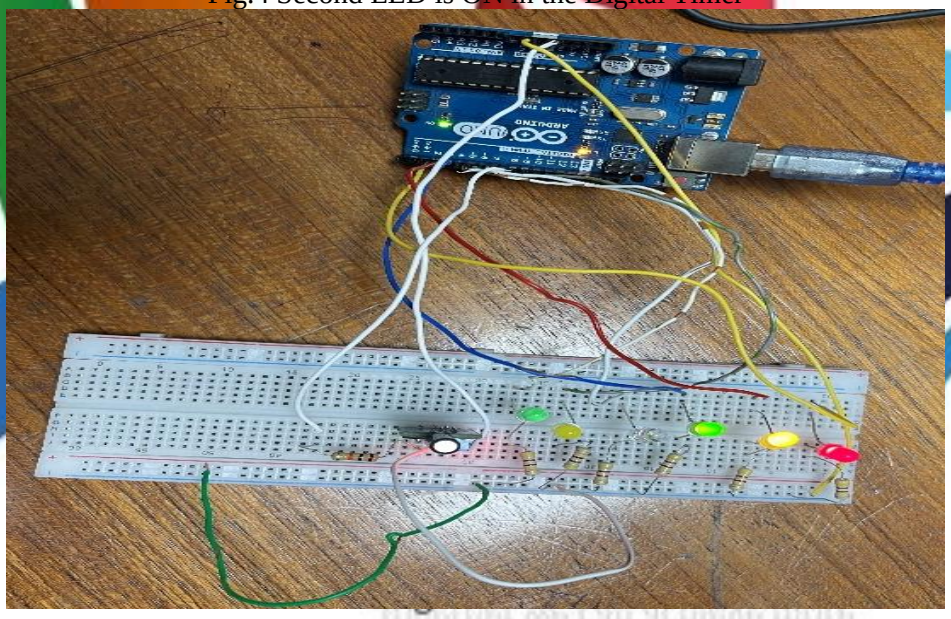


Fig.5 Third LED is ON in the Digital Timer

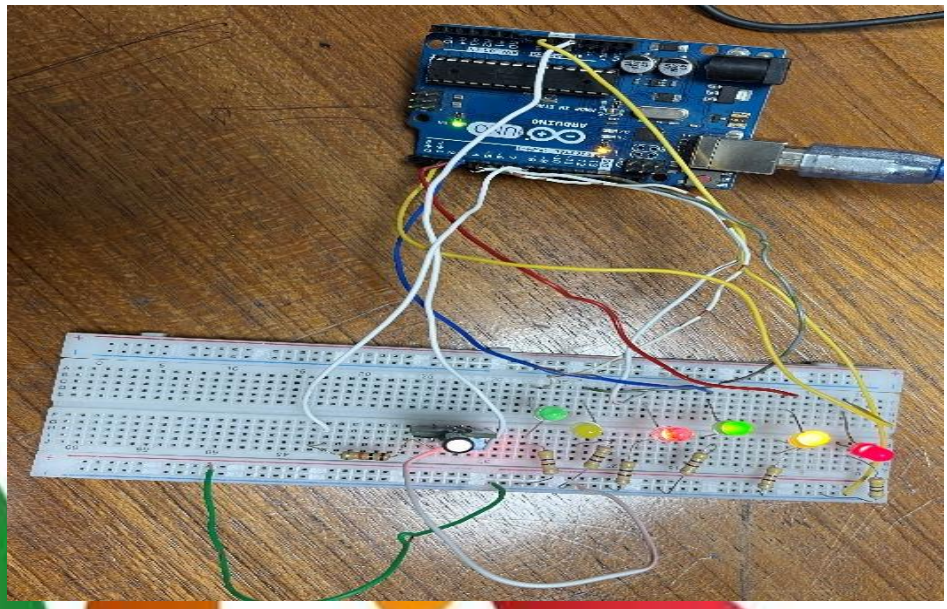


Fig.6 Fourth LED is ON in the Digital Timer

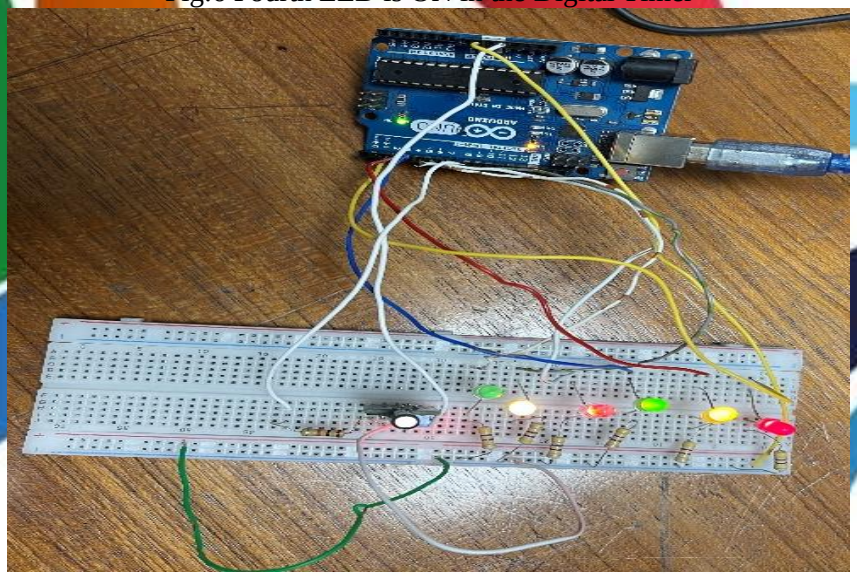


Fig.7 Fifth LED is ON in the Digital Timer

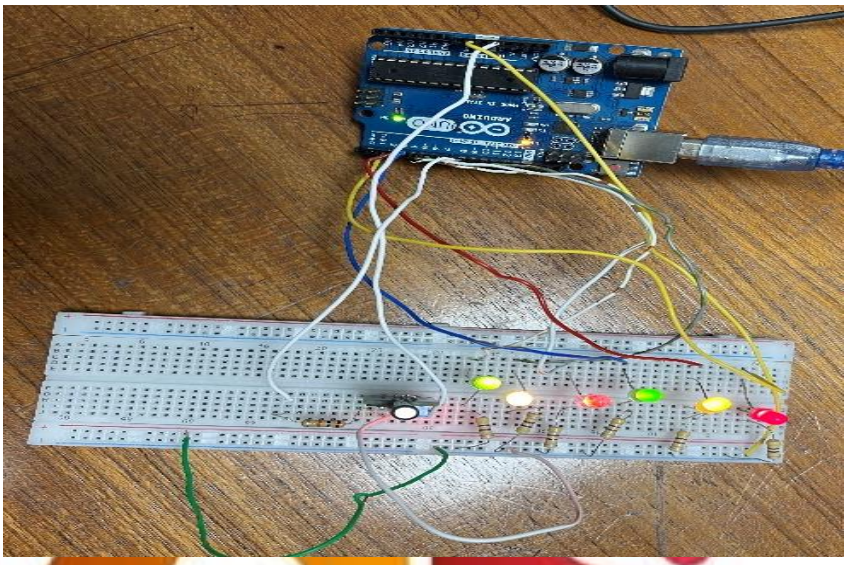


Fig.8 Sixth LED is ON in the Digital Timer

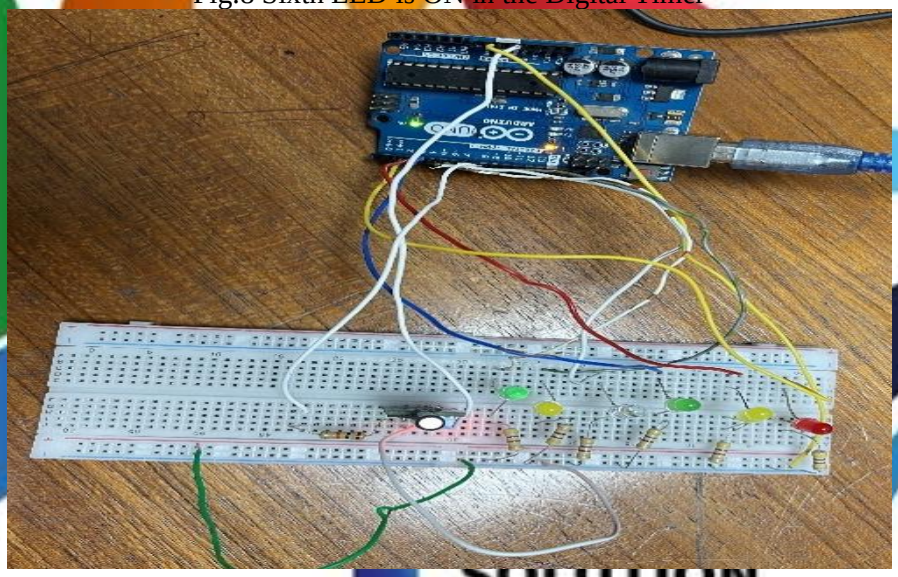


Fig.9 All LEDs turned OFF after giving vibration to the Tilt Switch

Explanation: WRITE EXPLANATION HERE

Simulation Output Results:

Here are the simulation output results of Digital Timer using the Millis () function on Proteus simulation and explanation:

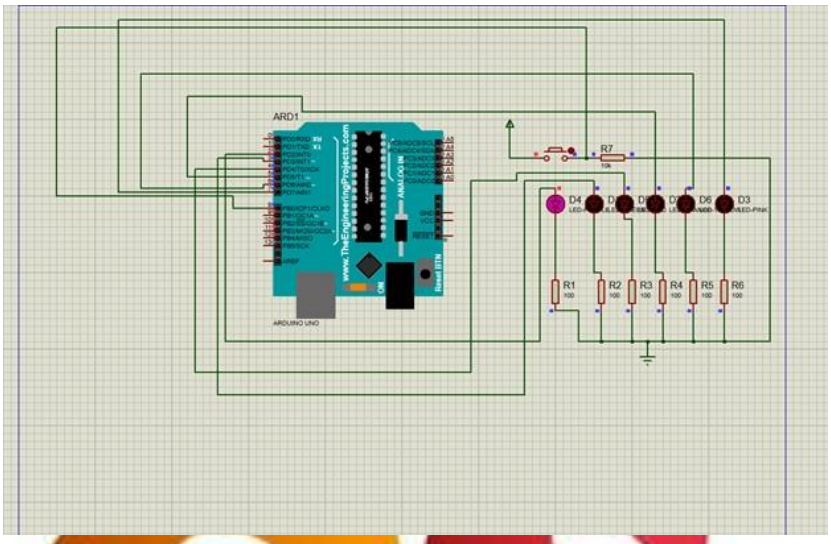


Fig.10 First LED is ON in the Digital Timer

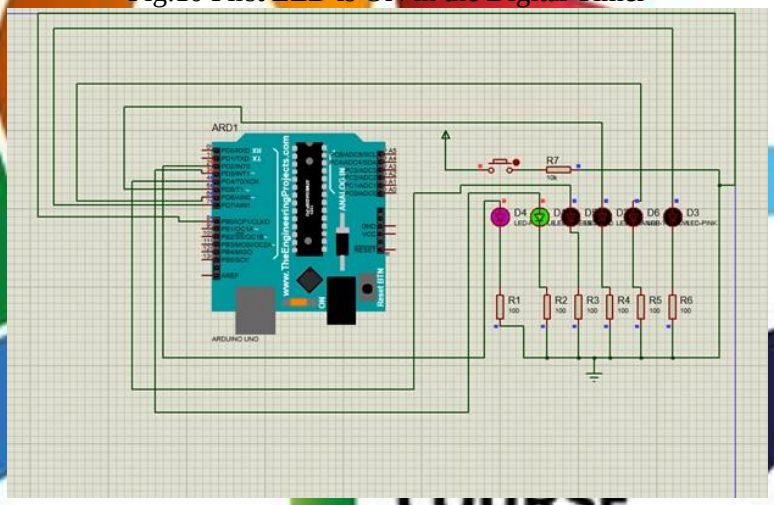
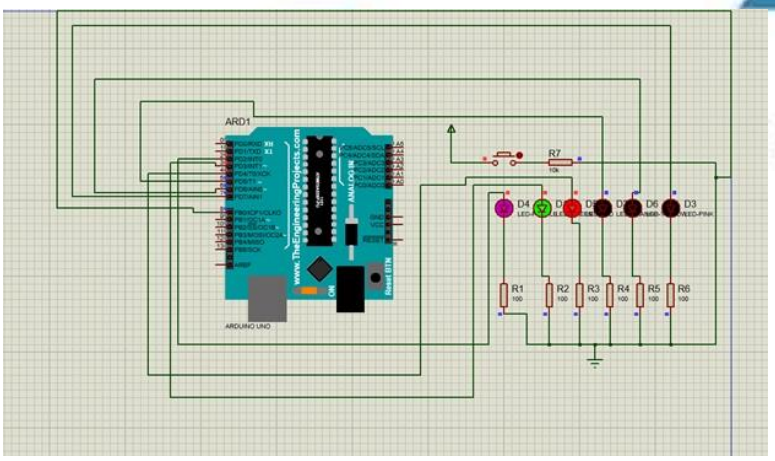


Fig.11 Second LED is ON in the Digital Timer



Fig,12 Third LED is ON in the Digital Timer

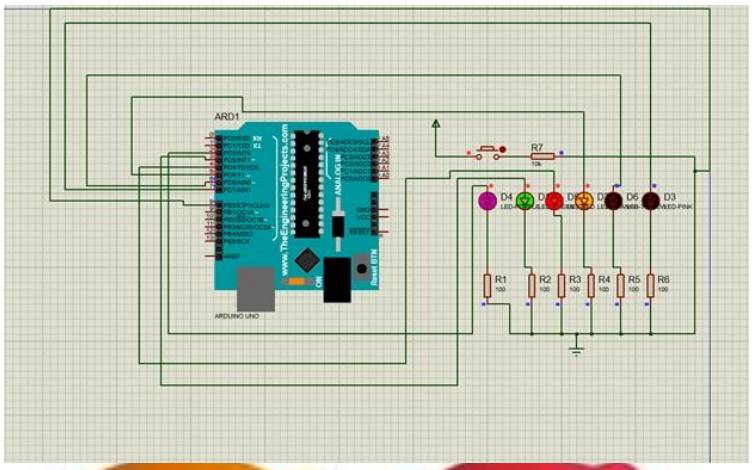


Fig.13 Fourth LED is ON in the Digital Timer

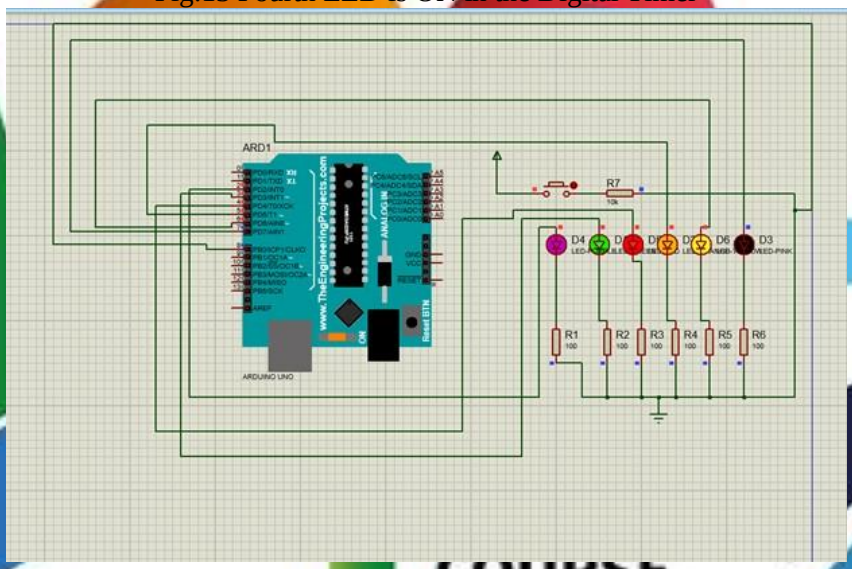


Fig.14 Fifth LED is ON in the Digital Timer

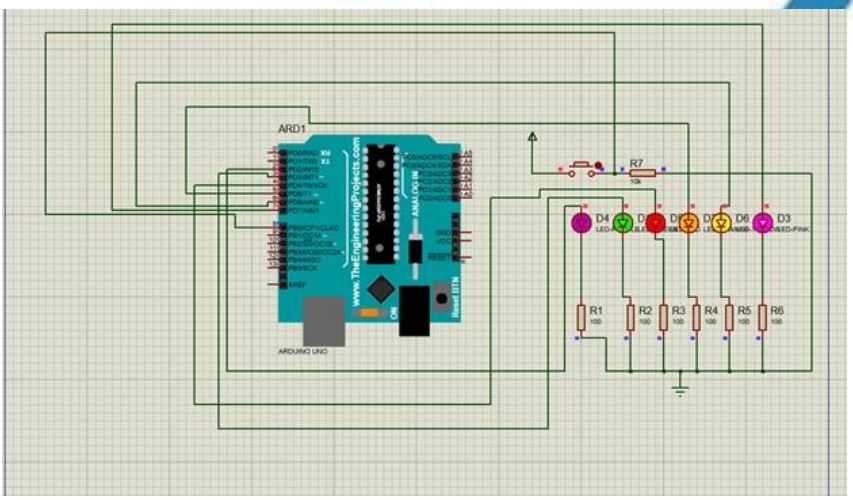


Fig.15 Sixth LED is ON in the Digital Timer

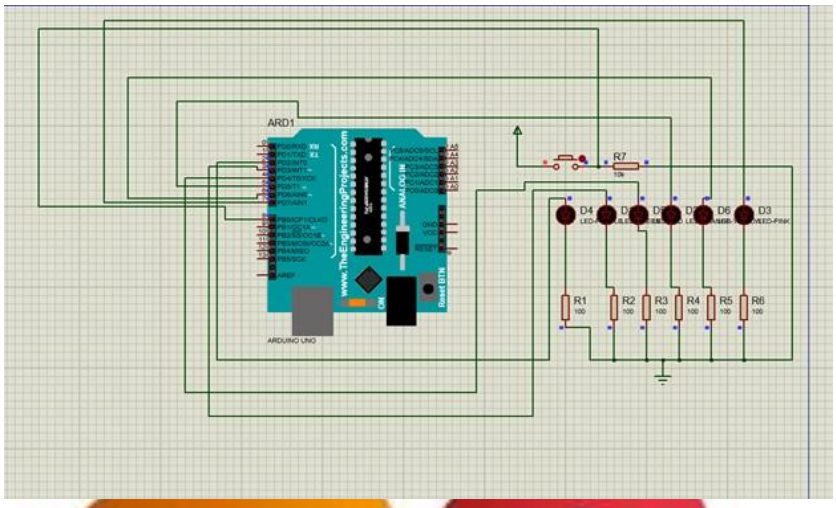


Fig.16 All LEDs turned OFF after giving vibration to the Tilt Switch

Explanation: WRITE EXPLANATION HERE

Answers to the Questions in the Lab Manual:

3) Configure the system to have delays for outputs according to your ID. Consider the last six digits from your ID (if your ID is XY-PQABC-Z then consider P s delay for the 1st LED and Z s delay for the last LED). In case any digit is zero then use Z s delay by default. Include the program and results within your lab report.

Solution: The following university ID was used:

2	1	-	4	4	6	4	9	-	1
X	Y	-	P	Q	A	B	C	-	Z

Here are the values that will be used:
LED1 Delay, P = 4 s
LED2 Delay, Q = 4 s
LED3 Delay, A = 6 s
LED4 Delay, B = 4 s
LED5 Delay, C = 9 s
LED6 Delay, Z = 1 s

The following is the code for the implementation of the digital timer using the millis() function:

```
CODE GOES HERE FOR THE Q&A PART
```

Here are the simulation output results of Digital Timer using the Millis () function on Proteus simulation:

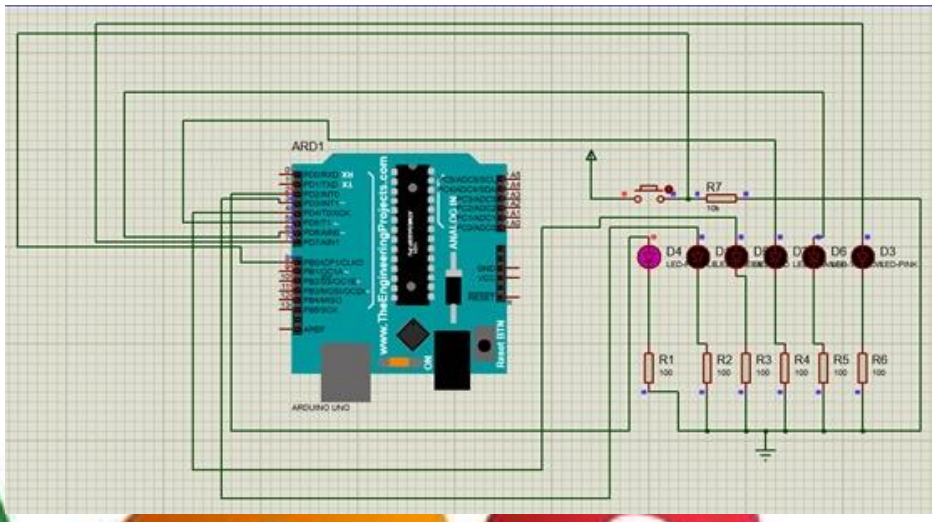


Fig.17 First LED is ON in the Digital Timer

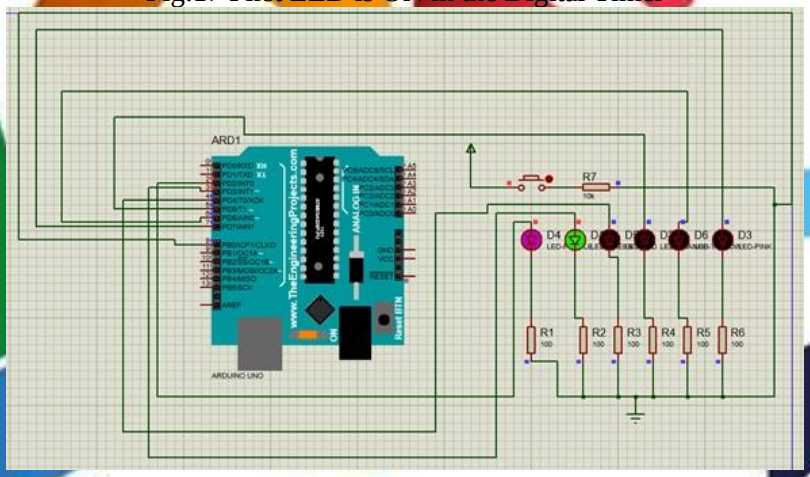
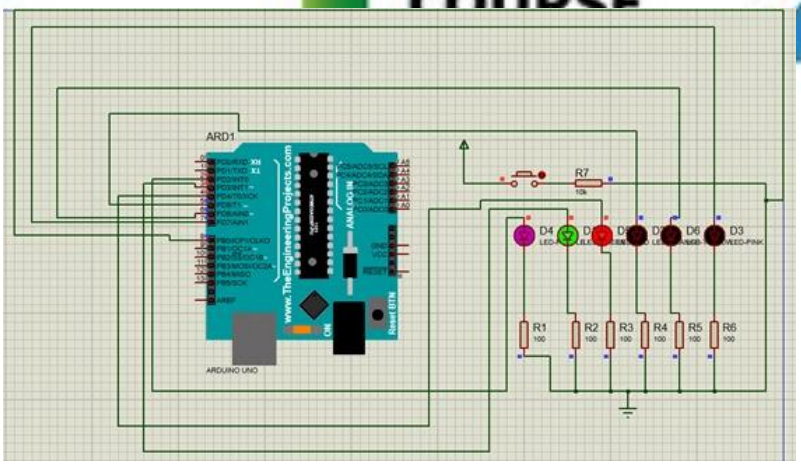


Fig.18 Second LED is ON in the Digital Timer



Fig,19 Third LED is ON in the Digital Timer

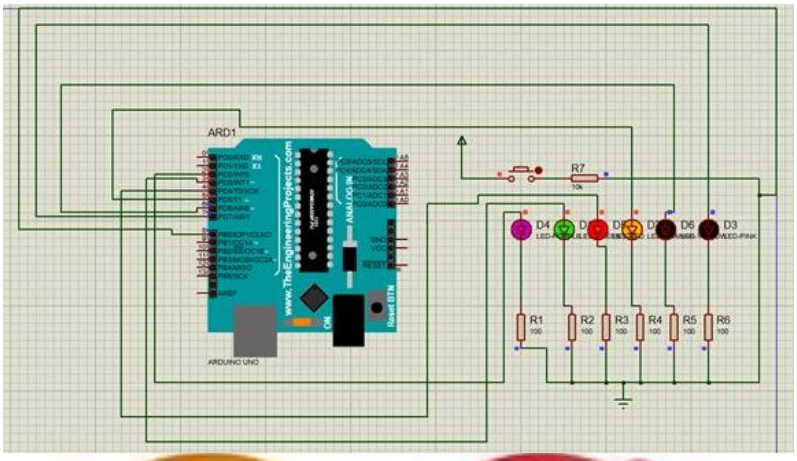


Fig.20 Fourth LED is ON in the Digital Timer

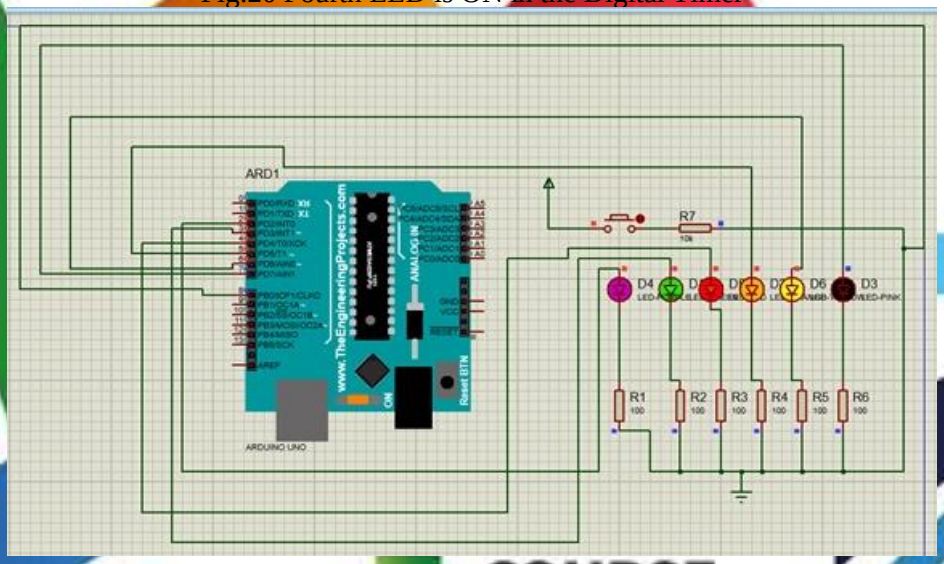


Fig.21 Fifth LED is ON in the Digital Timer

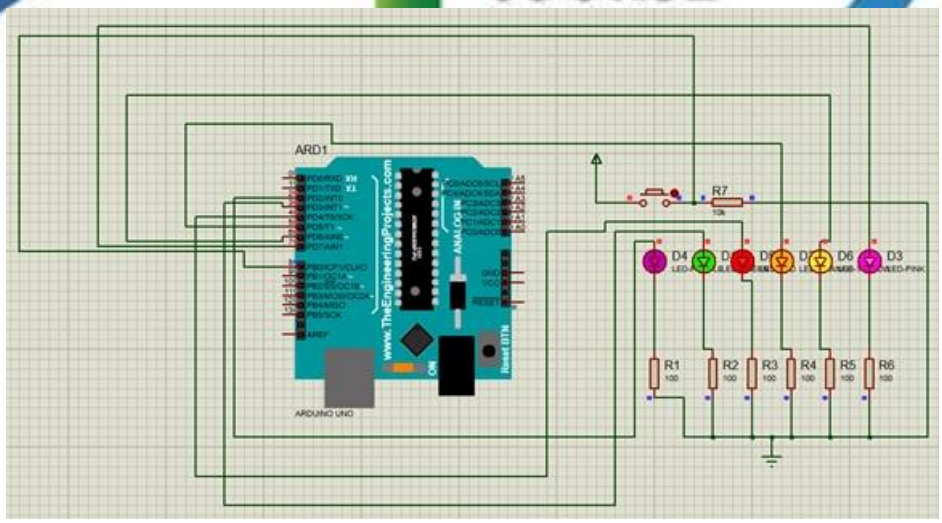


Fig.22 Sixth LED is ON in the Digital Timer

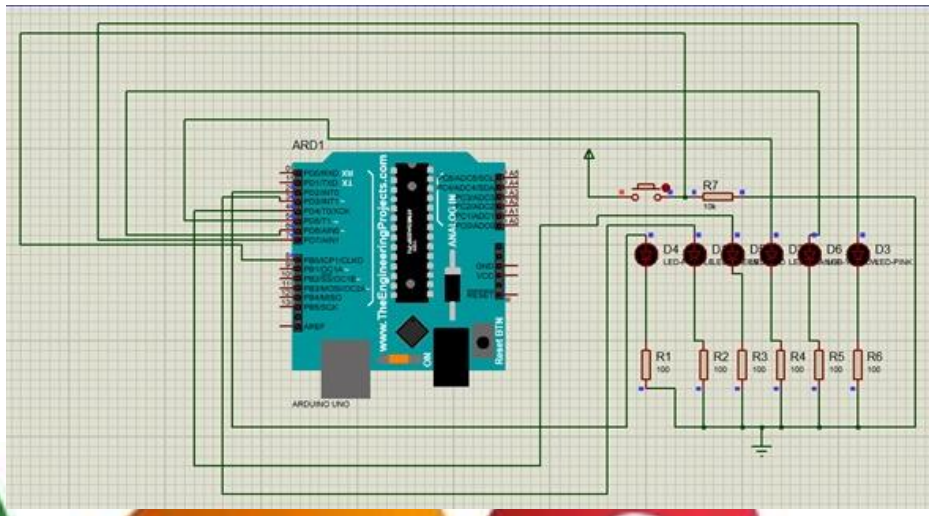


Fig.23 All LEDs turned OFF after giving vibration to the Tilt Switch

Discussion:

In the following experiment, a simple digital timer system was developed using millis function. The necessary observation has been done about millis function from various sources by using internet and study material. Necessary information and observation were collected for future reference and project implementation Also, the important information about millis function were documented properly for future work. The millis function was used to track the current time and if the specified interval had passed, the program advanced to the next LED. It was observed that millis was a built-in library of Arduino. Also, it was observed that the millis function was used as an alternative of delay function. Furthermore, it were observed that millis function allowed to execute other codes while waiting for the specified time that needed to be waited. From various observations and sources, it was found that millis function has some drawbacks as well. The difficulties that were found according to the observation: this is difficult to use in precise timing. Besides this, there were many more drawbacks that were found. Based on the logic and working methodology that were identified and acknowledged, the digital timer system was developed accordingly using resistors, LEDs, tilt switch, wire, Arduino UNO board and many more. The necessary code to run the digital timer program were also developed based on the collected information regarding the millis function and working methodology of a digital timer. The results of the developed system were observed and noted down for further analysis. Simulations verified that the results that were obtained was appropriate. For further observation a different kind of digital timer was developed using several delay duration that were obtained from a student ID. The results were observed and evaluated manually. Multiple simulation software was used to develop the simulation of the experiment. In this experiment, TinkerCAD and Proteus simulation software was used. The simulated results were verified accordingly. The simulated outcomes were observed carefully and documented for future work. From the observation it can be said that after both hardware and software implementation showed the expected outcomes and the experimental objectives was achieved.

References:

1) Circuit Digest Website, [Online: March 21, 2022], [Cited: June 19, 2023] Available: https://circuitdigest.com/article/everything-you-need-to-know-about-arduino-uno-board-hardware

2) Arduino CC Website, [Online] [Cited: June 19, 2023] Available: https://docs.arduino.cc/hardware/uno-rev3

3) Arduino CC Website, [Online] [Cited: June 19, 2023] Available: https://reference.arduino.cc/reference/en/language/functions/time/millis/

4) AIUB Microprocessor and Embedded Systems Lab Manual 4