

AMERICAN INTERNATIONAL UNIVERSITY- BANGLADESH



Microprocessor And Embedded Systems

[Section: F]

OEL-LAB

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Title:

Building a decade counter (Even Number) using Arduino Uno and a 7 segment display.

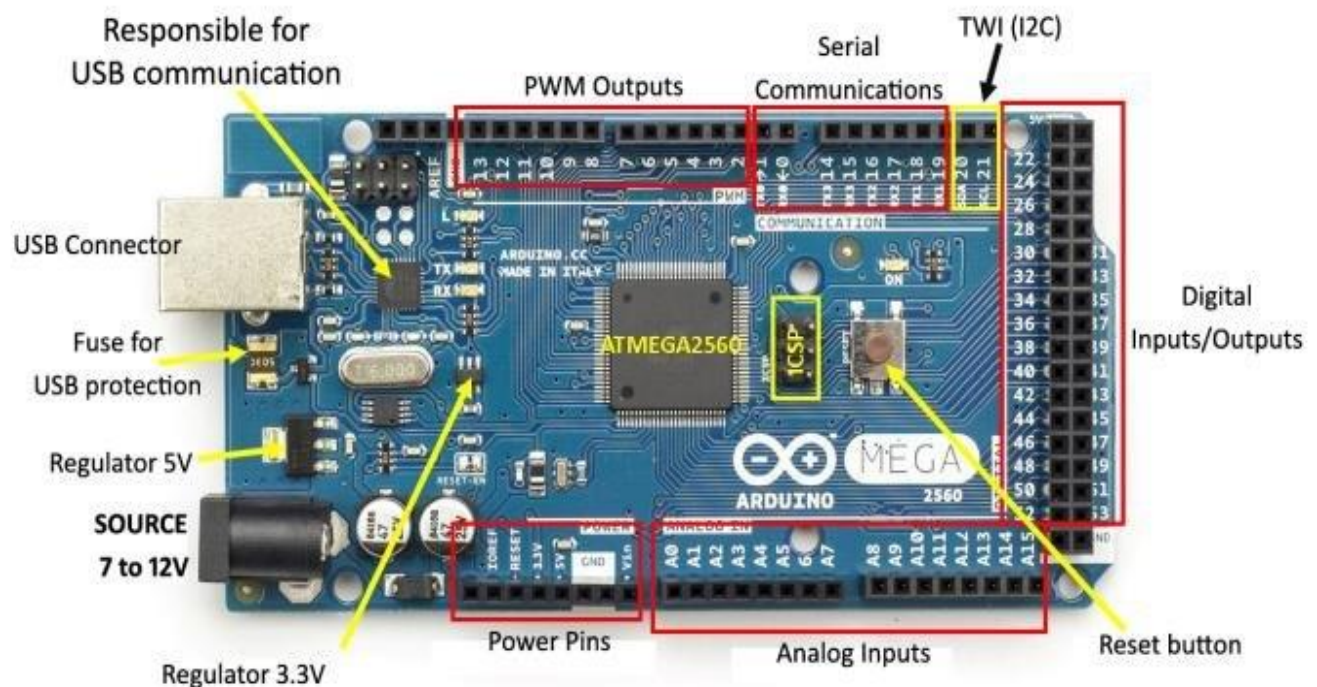
Introduction:

The goal of this project is to connect a 7-segment display to an Arduino Uno.

Theory and Methodology:

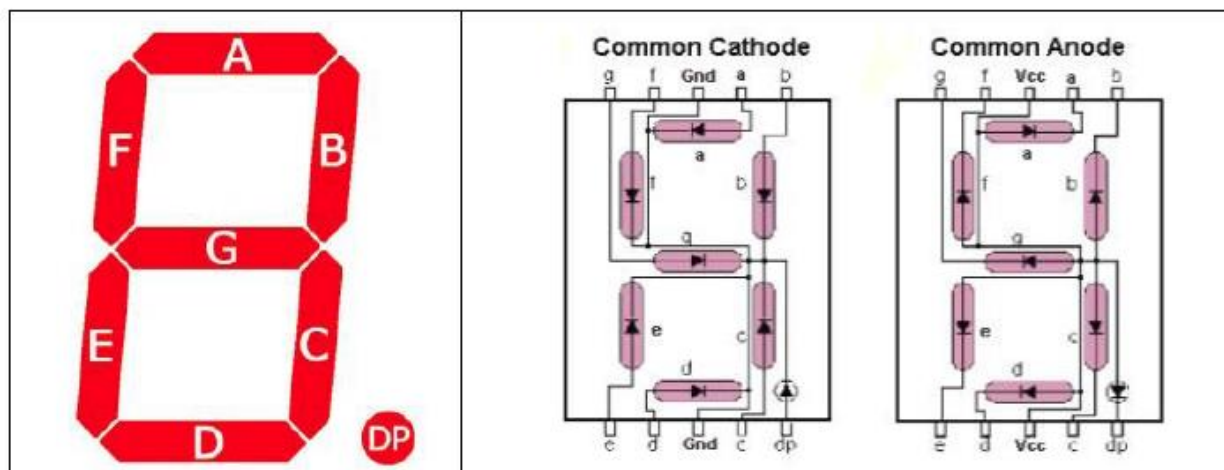
Arduino is a free and open-source platform for building interactive electronics projects. Arduino is made up of a programmable microcontroller and a piece of software known as an IDE (Integrated Development Environment) that runs on your computer and is used to develop and upload computer code to the microcontroller board. A hardware circuit (programmer/burner) is also not required to load fresh code into the Arduino Uno. We can simply load code into the board via a USB connection and the Arduino IDE (which utilizes a simplified version of C++ to write code).

Pin configuration of the board (Arduino Mega):



Basis of a 7-segment display:

A seven segment display is made up of seven LEDs/segments grouped in the shape of the number "8." The majority of the segment display includes 8 segments (with a dot denoting the decimal point on the right side of the digit). All seven segments are named in alphabetical order, beginning with "A" and ending with "G" and "DP" for the decimal point. And, much like a standard LED, each segment may be controlled independently. LED or light emitting diode is P-N junction diode which emits the energy in the form of light, differ from normal P-N junction diode which emits in the form of heat. Whereas LCD use properties of liquid crystal for displaying and do not emit the light directly. These LED's or LCD's are used to display the required numeral or alphabet.



CODE:

```
int a = 2;
int b = 3;
int c = 4;
int d = 5;
int e = 6;
int f = 7;
int g = 8;
void setup() {
  pinMode(a, OUTPUT); pinMode(b, OUTPUT); pinMode(c, OUTPUT); pinMode(d,
  OUTPUT); pinMode(e, OUTPUT); pinMode(f, OUTPUT); pinMode(g, OUTPUT);
}
void loop() {
  //for 8
  digitalWrite(a, HIGH); digitalWrite(b, HIGH); digitalWrite(c, HIGH); digitalWrite(d,
  HIGH); digitalWrite(e, HIGH); digitalWrite(f, HIGH); digitalWrite(g, HIGH);
  delay(1000); //delay of 1second digitalWrite(a, LOW); digitalWrite(b, LOW);
```

```
digitalWrite(c, LOW); digitalWrite(d, LOW); digitalWrite(e, LOW); digitalWrite(f, LOW);  
digitalWrite(g, LOW);
```

```
//for 6
```

```
digitalWrite(a, HIGH); digitalWrite(b, LOW); digitalWrite(c, HIGH); digitalWrite(d,  
HIGH); digitalWrite(e, HIGH); digitalWrite(f, HIGH); digitalWrite(g, HIGH);  
delay(1000); //delay of 1second digitalWrite(a, LOW); digitalWrite(b, LOW);  
digitalWrite(c, LOW); digitalWrite(d, LOW); digitalWrite(e, LOW); digitalWrite(f, LOW);  
digitalWrite(g, LOW);
```

```
//for 4
```

```
digitalWrite(a, LOW); digitalWrite(b, HIGH); digitalWrite(c, HIGH); digitalWrite(d,  
LOW); digitalWrite(e, LOW); digitalWrite(f, HIGH); digitalWrite(g, HIGH);  
delay(1000); //delay of 1second digitalWrite(a, LOW); digitalWrite(b, LOW);  
digitalWrite(c, LOW); digitalWrite(d, LOW); digitalWrite(e, LOW); digitalWrite(f, LOW);  
digitalWrite(g, LOW);
```

```
//for 2
```

```
digitalWrite(a, HIGH); digitalWrite(b, HIGH); digitalWrite(c, LOW); digitalWrite(d,  
HIGH); digitalWrite(e, HIGH); digitalWrite(f, LOW); digitalWrite(g, HIGH);  
delay(1000); //delay of 1second digitalWrite(a, LOW); digitalWrite(b, LOW);  
digitalWrite(c, LOW); digitalWrite(d, LOW); digitalWrite(e, LOW); digitalWrite(f, LOW);  
digitalWrite(g, LOW);
```

```
//for 0
```

```
digitalWrite(a, HIGH); digitalWrite(b, HIGH); digitalWrite(c, HIGH); digitalWrite(d,  
HIGH); digitalWrite(e, HIGH); digitalWrite(f, HIGH); digitalWrite(g, LOW);  
delay(1000); //delay of 1second digitalWrite(a, LOW); digitalWrite(b, LOW);  
digitalWrite(c, LOW); digitalWrite(d, LOW); digitalWrite(e, LOW); digitalWrite(f, LOW);  
digitalWrite(g, LOW);  
}
```

SIMULATION:

sketch_mar30a | Arduino 1.8.19

File Edit Sketch Tools Help

```
sketch_mar30a
int a = 2;
int b = 3;
int c = 4;
int d = 5;
int e = 6;
int f = 7;
int g = 8;
void setup() {
  pinMode(a, OUTPUT); pinMode(b, OUTPUT); pinMode(c, OUTPUT); pinMode(d, OUTPUT); pinMode(e, OUTPUT); pinMode(f, OUTPUT); pinMode(g, OUTPUT);
}
void loop() {
  //for 8
  digitalWrite(a, HIGH); digitalWrite(b, HIGH); digitalWrite(c, HIGH); digitalWrite(d, HIGH); digitalWrite(e, HIGH); digitalWrite(f, HIGH); digitalWrite(g, HIGH); delay(1000);
  //for 6
  digitalWrite(a, HIGH); digitalWrite(b, LOW); digitalWrite(c, HIGH); digitalWrite(d, HIGH); digitalWrite(e, HIGH); digitalWrite(f, HIGH); digitalWrite(g, HIGH); delay(1000);
  //for 4
  digitalWrite(a, LOW); digitalWrite(b, HIGH); digitalWrite(c, HIGH); digitalWrite(d, LOW); digitalWrite(e, LOW); digitalWrite(f, HIGH); digitalWrite(g, HIGH); delay(1000);
  //for 2
  digitalWrite(a, HIGH); digitalWrite(b, HIGH); digitalWrite(c, LOW); digitalWrite(d, HIGH); digitalWrite(e, HIGH); digitalWrite(f, LOW); digitalWrite(g, HIGH); delay(1000);
  //for 0
  digitalWrite(a, HIGH); digitalWrite(b, HIGH); digitalWrite(c, HIGH); digitalWrite(d, HIGH); digitalWrite(e, HIGH); digitalWrite(f, HIGH); digitalWrite(g, LOW); delay(1000);
}
```

Done compiling.

Sketch uses 1876 bytes (0%) of program storage space. Maximum is 253952 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 8183 bytes for local variables. Maximum is 8192 bytes.

25 Arduino Mega or Mega 2560, ATmega2560 (Mega 2560)

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oel - Proteus 8 Professional - Schematic Capture

File Edit View Tool Design Graph Debug Library Template System Help

ARD01 ARDUINO MEGA2560

Arduino Mega 2560

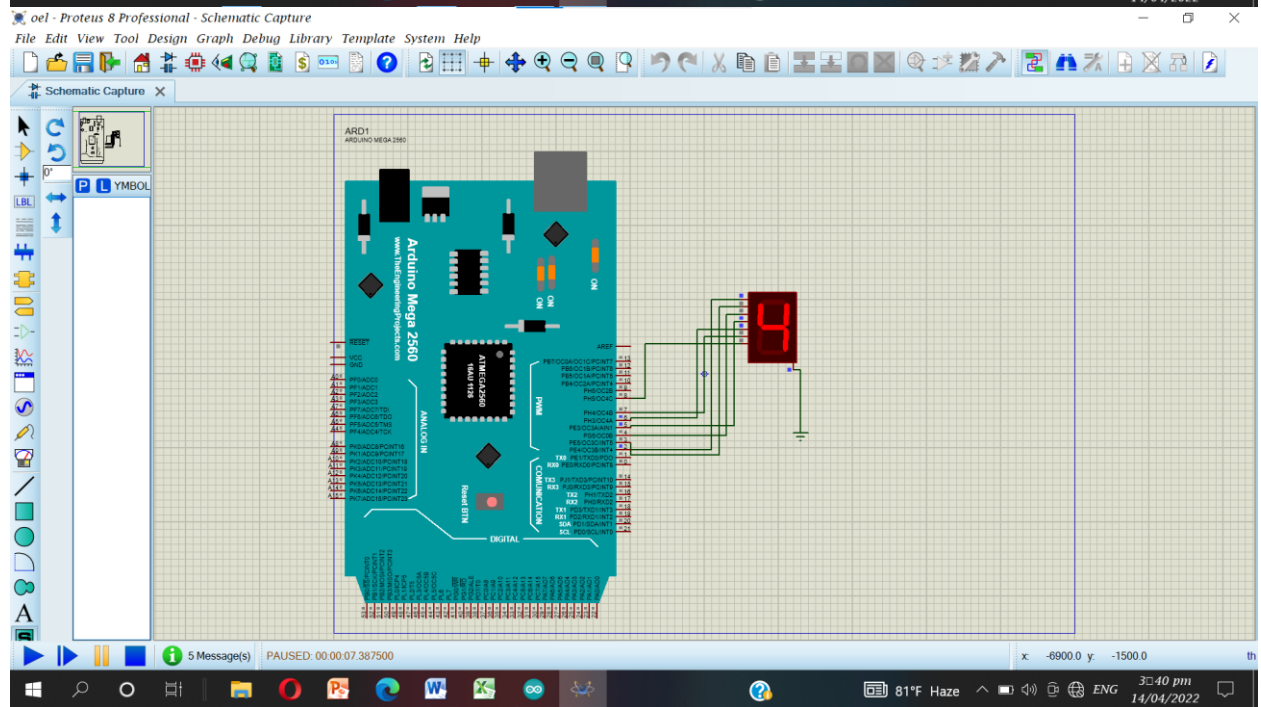
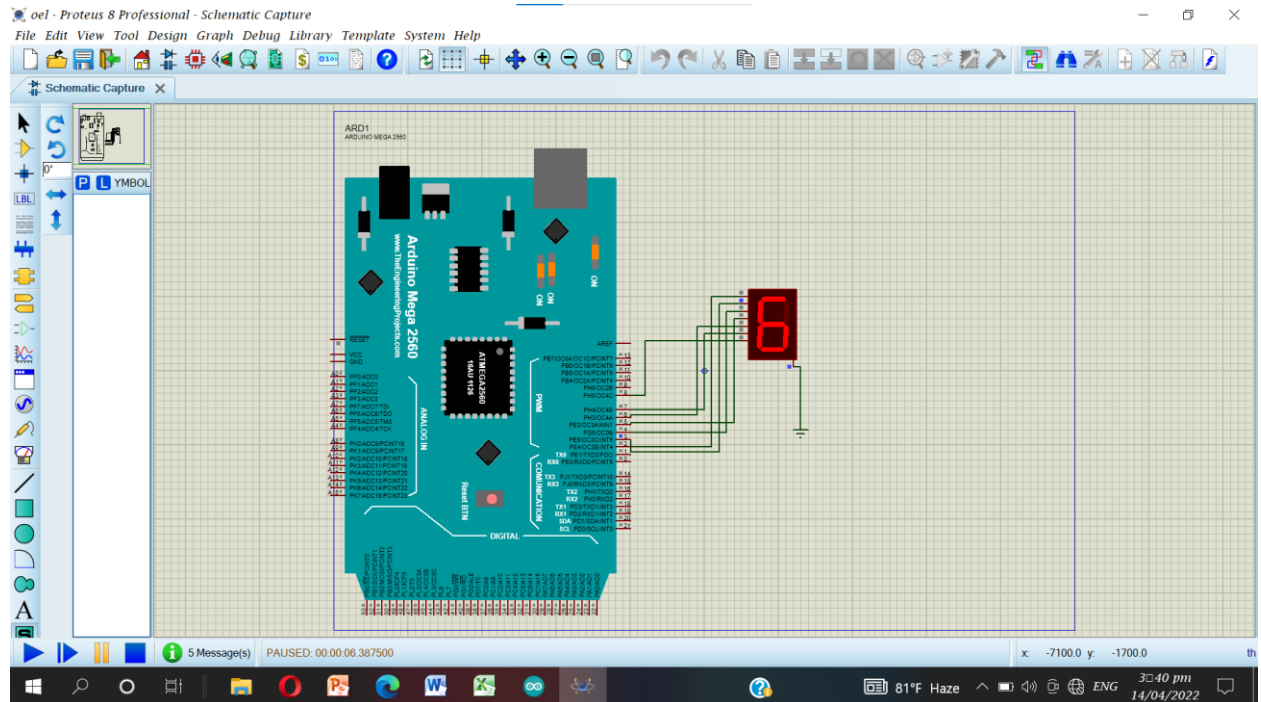
ATmega2560

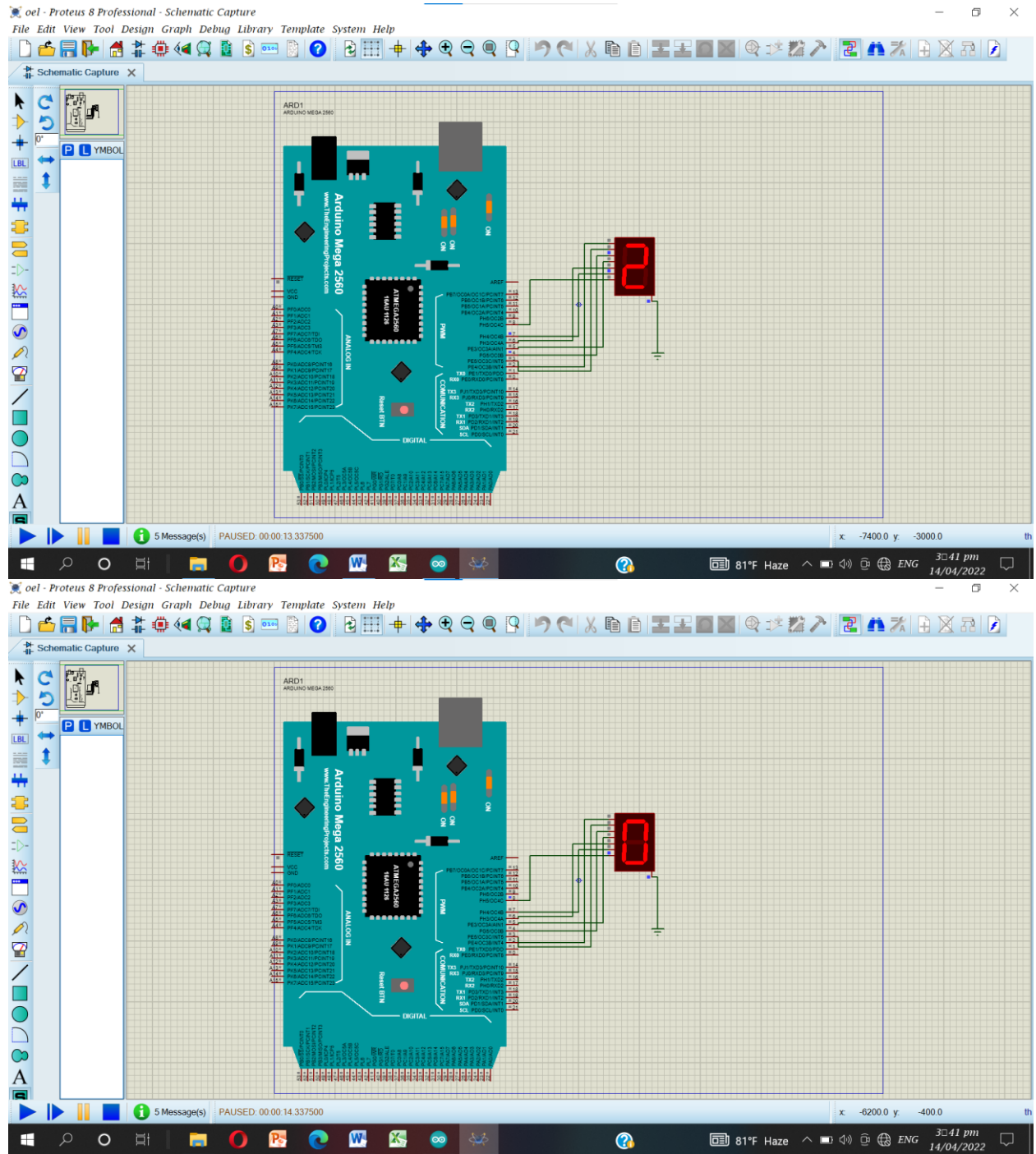
7-segment display

5 Message(s) PAUSED: 00:00:05.337500

x: -5200.0 y: -2200.0

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Experimental Procedure:

1. We have used ARDUINO input/output pin numbers to initialize the 7-Segment display object. We have connected ARDUINO input/output to the segments A, B, C, D, E, F, and G.
2. We have added ARDUINO pin from 2 to 8 and a to g.

3. We have used digit pins and their numbers to identify the display item in the form of an array. In the event of a common cathode, the digit pin is directly connected to ground, however in the case of a common anode, one ARDUINO I/O connection is required.
4. We have used user-defined function to notifies the seven-segment library that the linked display is common cathode.
5. We have used an object Active pin state to configure the segment and digit pins. The function accepts integer inputs and determines whether the segment and digital pins are active high or low.
6. We have used integer data types to build high-level printing functions that run for a user-defined number of loops.

Discussion:

ARDUINO based decade counter using a 7-segment LED display is devised using ARDUINO IDE software 1.0. The ARDUINO UNO can be powered via the USB connection or with an external power supply. It is designed in a way that allows it to be reset by software running on a connected computer. It provides a complete, easy-to-use and cost-efficient hardware and software solution for designing application-based circuits. It started off as a cheap means of implementing physical computing and control of interactive projects building. The relevance of using a seven-segment display as a method of showing a mathematical output for a decade counter was deliberated here. Though the basic framework provided here should harvest other applications also. The displays are highly versatile and with proper input can display a variety of numbers, letters, and figures. If the case occurs where multiple digits are needed to be displayed, then expanding of the applications is possible provided serial inputs should be found that allow control of a set of digits from only a few inputs.

Conclusion:

The experiment in this lab is easy to use and since it requires only one ARDUINO microcontroller is cost efficient as well. The biggest advantage of ARDUINO is that its library of examples is present inside the software for ARDUINO. The automatic unit conversion capability makes debugging effortless and time-saving. Moreover, this seven segment LED display is feasible and compatible for high level applications and functions as it requires very low power supply to operate. However, each segment requires a separate resistor otherwise the current per segment/brightness will vary with the number of segments involved in the display digit.

