San Francisco Bay University

CE450 Fundamentals of Embedded Engineering
Lab 5 Driving 7-Segments LEDs

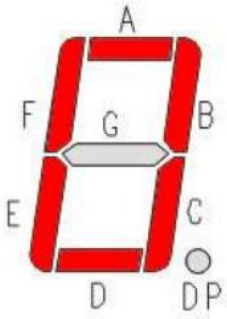
Objectives:

In this lab, the display for some numbers and alphabets will be designed by using several 7-segments LEDs on Raspberry Pi board through Python program and do hands-on exercise through lab assignments

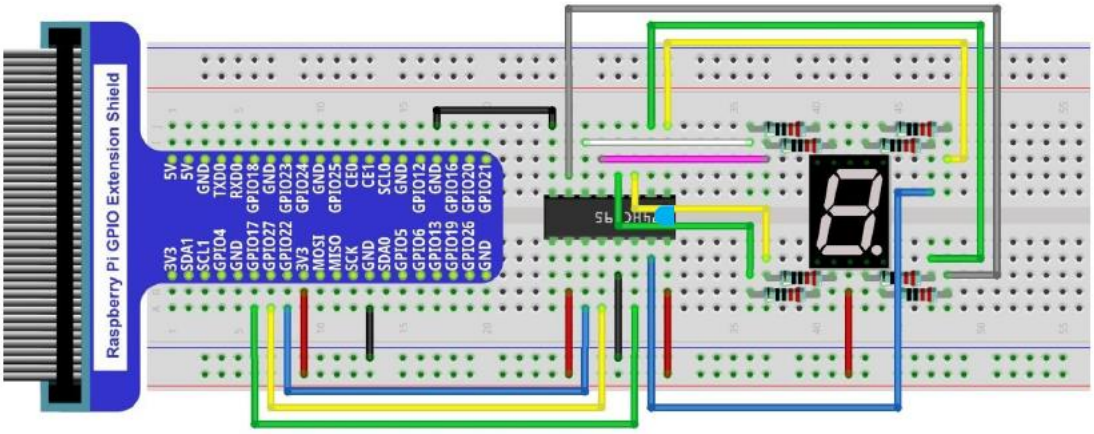
Introduction:

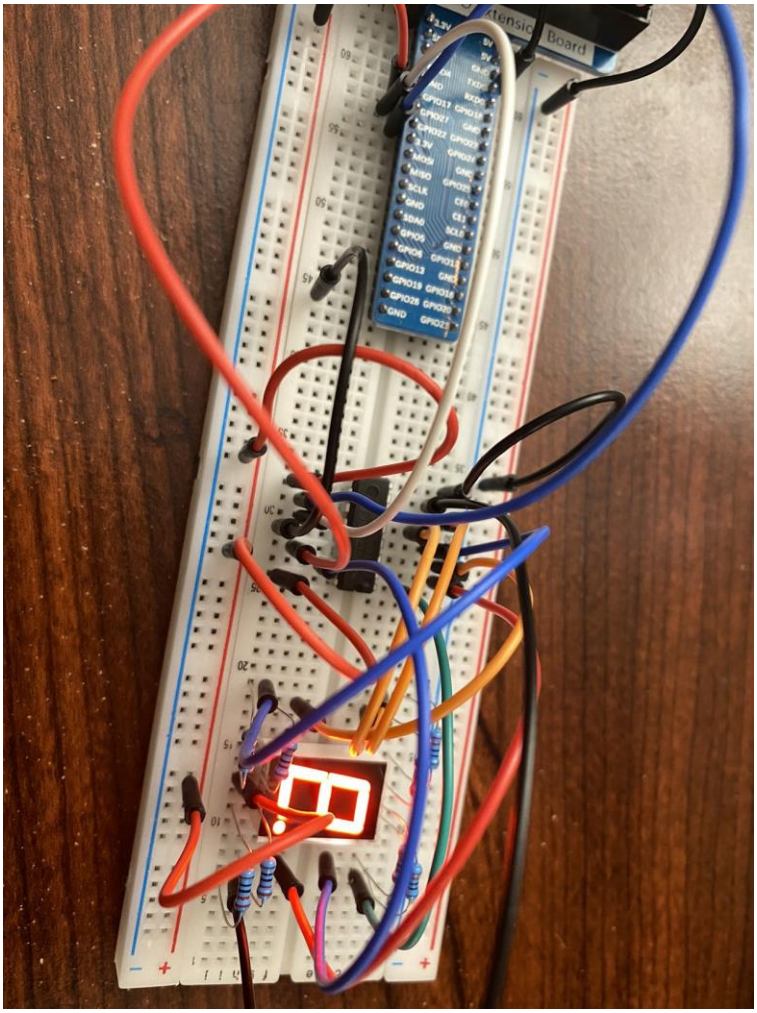
One 7-segments LEDs are available in Freemove accessory box. The control circuit has been shown using 74HC595(8-bit shift registers) to drive only one 7-segments LED in the following schematic. Three control signals generated from three pins in GPIO port are shifted into 74HC595

The Laboratory Assignments:
Hardware connection:



In this project, we will use a 7-Segment Display with a Common Anode. Therefore, when there is an input low level to an LED segment the LED will turn ON. Defining segment “A” as the lowest level and segment “DP” as the highest level, from high to low would look like this: “DP”, “G”, “F”, “E”, “D”, “C”, “B”, “A”. Character "0" corresponds to the code: 1100 0000b=0xc0.



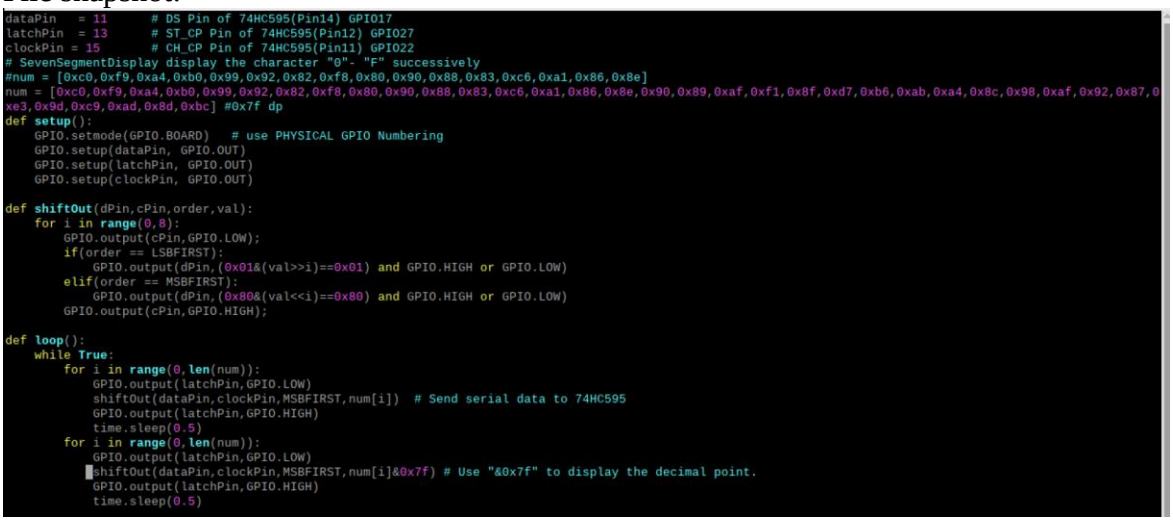


1. Implement the 7-segment LEDs control based on the above example program

   It will display 0-9 and A-F.
   Yotube video link:
   https://youtube.com/shorts/K3_XRrN2WTw?feature=share

2. Add one 7-segment LED to the above design for the continuous display of the decimal number from *0-9* and alphabet from *A-Z* display, such as the following

File snapshot:



```
dataPin   = 11      # DS Pin of 74HC595(Pin14) GPIO17
latchPin  = 13      # ST_CP Pin of 74HC595(Pin12) GPIO27
clockPin = 15       # CH_CP Pin of 74HC595(Pin11) GPIO22
# SevenSegmentDisplay display the character "0"- "F" successively
#num = [0xc0,0xf9,0xa4,0xb0,0x99,0x92,0x82,0xf8,0x80,0x90,0x88,0x83,0xc6,0xa1,0x86,0x8e]
num = [0xc0,0xf9,0xa4,0xb0,0x99,0x92,0x82,0xf8,0x80,0x90,0x88,0x83,0xc6,0xa1,0x86,0x8e,0x90,0x89,0xaf,0xf1,0x8f,0xd7,0xb6,0xab,0xa4,0x8c,0x98,0xaf,0x92,0x87,0
xe3,0x9d,0xc9,0xad,0x8d,0xbc] #0x7f dp
def setup():
    GPIO.setmode(GPIO.BOARD)   # use PHYSICAL GPIO Numbering
    GPIO.setup(dataPin, GPIO.OUT)
    GPIO.setup(latchPin, GPIO.OUT)
    GPIO.setup(clockPin, GPIO.OUT)

def shiftOut(dPin,cPin,order,val):
    for i in range(0,8):
        GPIO.output(cPin,GPIO.LOW);
        if(order == LSBFIRST):
            GPIO.output(dPin,(0x01&(val>>i)==0x01) and GPIO.HIGH or GPIO.LOW)
        elif(order == MSBFIRST):
            GPIO.output(dPin,(0x80&(val<<i)==0x80) and GPIO.HIGH or GPIO.LOW)
        GPIO.output(cPin,GPIO.HIGH);

def loop():
    while True:
        for i in range(0,len(num)):
            GPIO.output(latchPin,GPIO.LOW)
            shiftOut(dataPin,clockPin,MSBFIRST,num[i])  # Send serial data to 74HC595
            GPIO.output(latchPin,GPIO.HIGH)
            time.sleep(0.5)
        for i in range(0,len(num)):
            GPIO.output(latchPin,GPIO.LOW)
            shiftOut(dataPin,clockPin,MSBFIRST,num[i]&0x7f) # Use "&0x7f" to display the decimal point.
            GPIO.output(latchPin,GPIO.HIGH)
            time.sleep(0.5)
```

Yotube video link:
https://youtube.com/shorts/hRfyaSTHiBg?feature=share