ECE 476/676 - Homework #11

BlueTooth - Due Wednesday, April 23rd

BlueTooth Motor & LED Control

Pick your favorite motor (DC servo motor, digital servo motor) and NeoPixel.

Write a Python program which uses BlueTooth to control the motor and NeoPixel

1) Requirements: Specify the

- Inputs (Bluetooth)
- Outputs (motor, NeoPixel, LCD display)
- How they relate (what your embedded system does)

Input a number from -100 to +100 on your cell phone.

The Pico then takes this number and drives a DC motor and NeoPixel:

- DC Motor: Motor speed varies from -100% to +100% using PWM
- NeoPixel:
    - Output green lights when positive
    - Output red lights when negative
    - Number of lights turned on proportional to the number
    - 0 = no lights
    - 100 = 16 lights
- LCD Display: Show the number received from -100 to +100
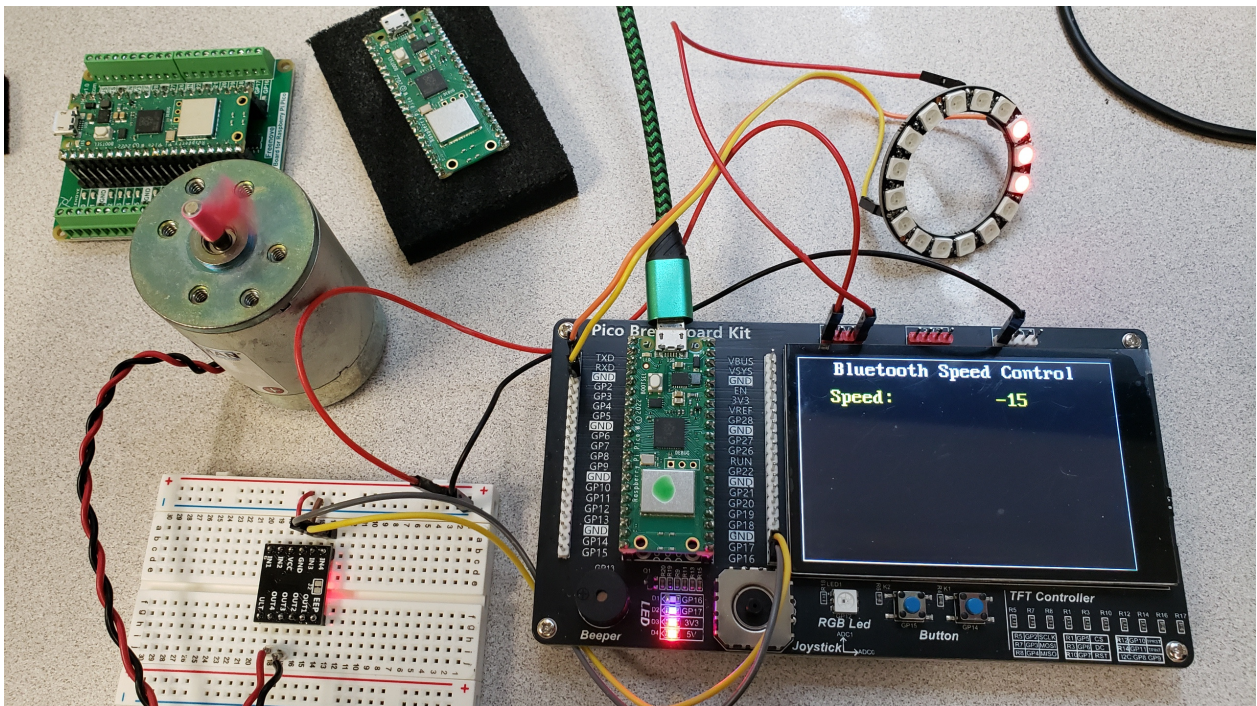
Result for -15% speed: Motor spinning CCW at 15% speed, PWM on GP16/16 at 15% PWM, NeoPixel lights up 15% of its lights as red, LCD display showing the speed as =15%

2) Python Code: Give the resulting Python Code

- Blue: NeoPixel Code
- Red: PWM Code
- Green: BlueTooth Code

```python
from machine import Pin, PWM, bitstream
import bluetooth
from ble_simple_peripheral import BLESimplePeripheral
import neopixel, LCD, time
from math import ceil

timing = [300, 900, 700, 500]
np = Pin(0, Pin.OUT)
N = 16

Out1 = Pin(16, Pin.OUT)
Out2 = Pin(17, Pin.OUT)
fwd = PWM(Pin(16))
rev = PWM(Pin(17))
fwd.freq(100)
rev.freq(100)

ble = bluetooth.BLE()
sp = BLESimplePeripheral(ble)
flag = 0

Speed = 0

def on_rx(data):
    global Speed, flag
    try:
        Speed = int(data[0:4])
        print("Data received: ", data, Speed)
        flag = 1
    except:
        print('invalid data entry')

LCD.Init()
White = LCD.RGB(250,250,250)
Black = LCD.RGB(0,0,0)
Yellow = LCD.RGB(250,250,0)
LCD.Clear(Black)
LCD.Box(1,1,479,319,White)
LCD.Text2('Speed: ', 50, 50, Yellow, Black)
LCD.Title('Bluetooth Speed Control', White, Black)
kV = 65535/100

while(1):
    if sp.is_connected():
        sp.on_write(on_rx)
    if(flag):
        print('Speed = ',Speed)
        LCD.Text2(str(Speed) + '  ', 300, 50, Yellow, Black)
        if(Speed > 0):
            fwd.duty_u16(int(Speed*kV))
            rev.duty_u16(0)
            NP = bytearray([0,0,0]*N)
            m = min(16, ceil(abs(Speed)*0.159))
            for i in range(0,m):
                NP[-3*i] = 20
            bitstream(np, 0, timing, NP)
        else:
            fwd.duty_u16(0)
            rev.duty_u16(int(abs(Speed)*kV))
```
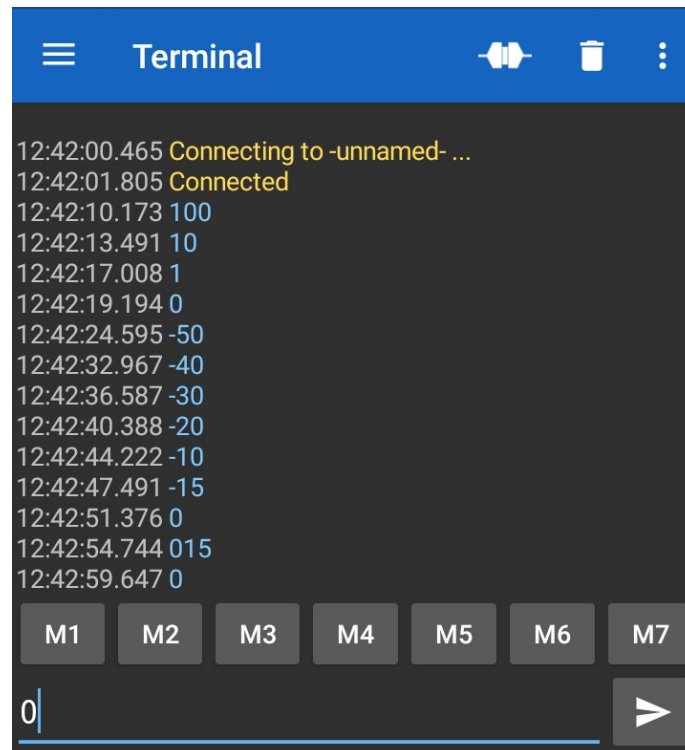
```
NP = bytearray([0,0,0]*N)
m = min(16, ceil(abs(Speed)*0.159))
for i in range(0,m):
    NP[3*i+1] = 20
bitstream(np, 0, timing, NP)

flag = 0
```
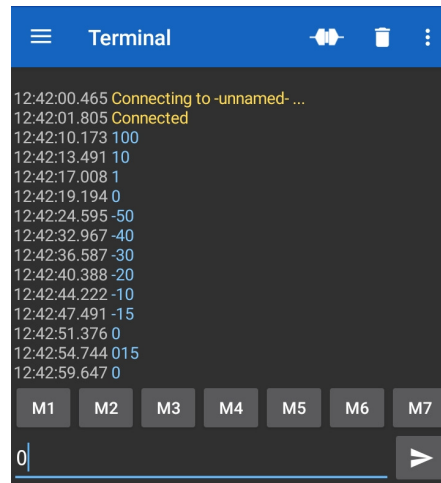

Cell Phone App: Connect to the Pi-Pico then input numbers from -100 to +100

3) Motor Testing: Collect data to verify that you are able to control the motor through a bluetooth connection.

4) LED Testing: Collect data to verify that you are able to control the NeoPixel through a bluetooth connection.
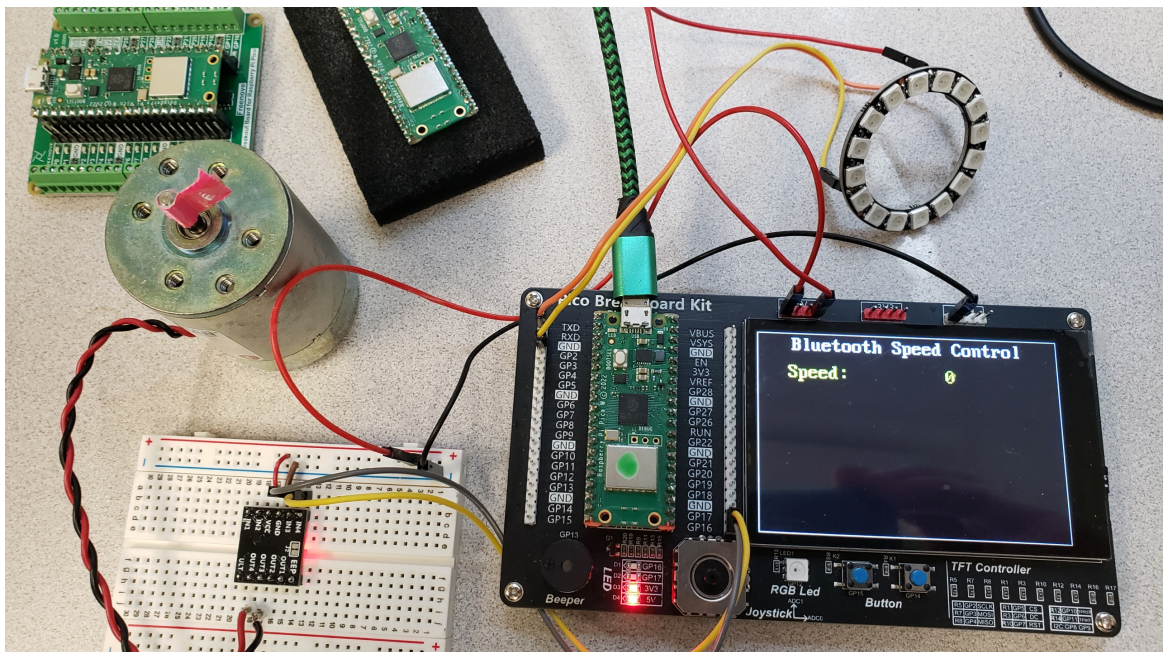

Cell Phone Bluetooth App: Input numbers from -100 to +100

Input 0:

- Motor is stopped
- LEDs are off
- Display shows 0

Shell Terminal:

```
MPY: soft reboot
Starting advertising
New connection 64
Data received:  b'0\r\n' 0
Speed =  0
```
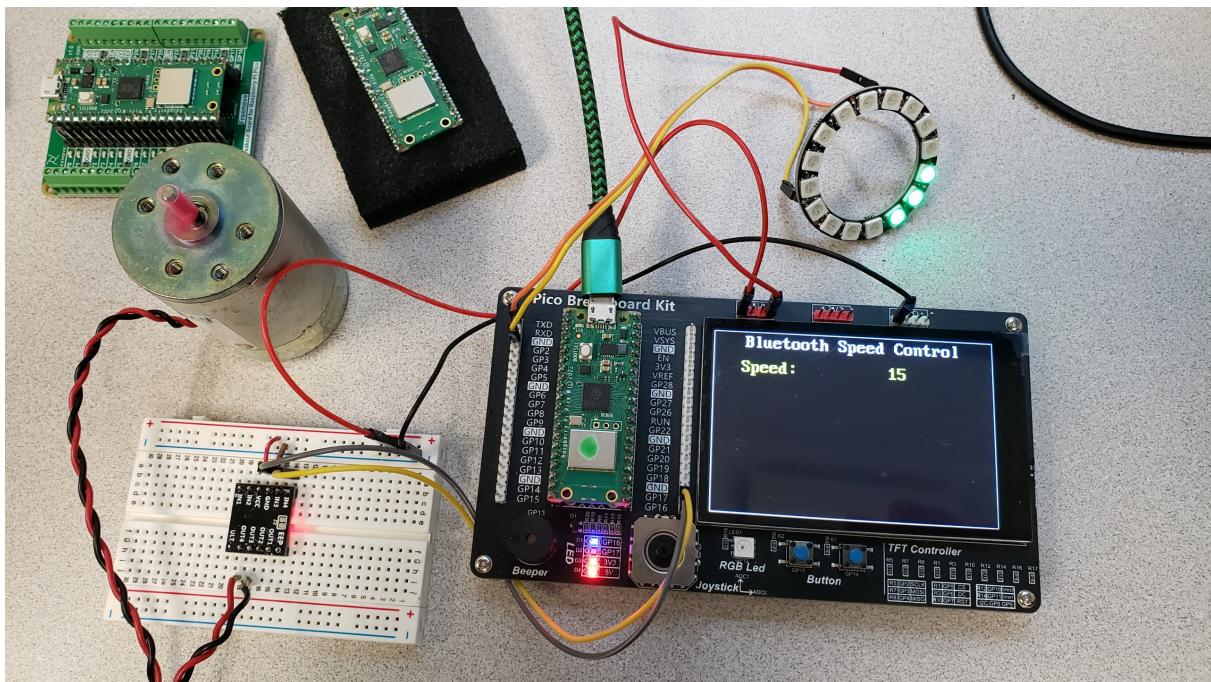
Input 1, 10, and 100

- Motor spins CW
- Motor speed increases with PWM
- LEDs turn on green
- Number of LEDs increases to all 16 at 100%

Shell Window

```
MPY: soft reboot
Starting advertising
New connection 64
Data received:  b'100\r\n' 100
Speed =   100
Data received:  b'10\r\n' 10
Speed =   10
Data received:  b'1\r\n' 1
Speed =   1
Data received:  b'0\r\n' 0
Speed =   0
```
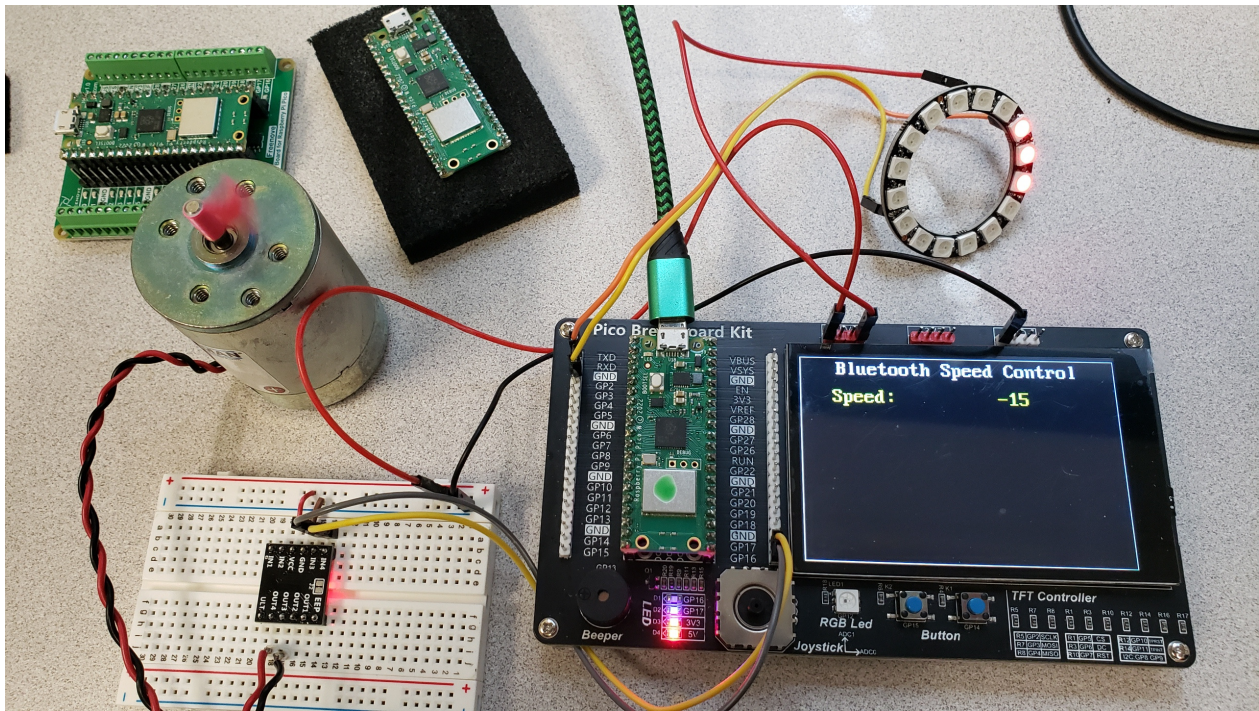
Input -1, -10, -100

- Motor spins CW
- Motor speed increases with PWM
- LEDs turn on green
- Number of LEDs increases to all 16 at 100%

Shell Window

```
MPY: soft reboot
Starting advertising
New connection 64
Data received:  b'-100\r\n' 100
Speed =  -100
Data received:  b'-10\r\n' 10
Speed =  -10
Data received:  b'-1\r\n' 1
Speed =  -1
Data received:  b'0\r\n' 0
Speed =   0
```


5) Demo. Video or in person.

- posted on Bison Academy