

RGB Controller

Related Lectures

- Analog I/O
- Edge Interrupts
- LCD Graphic Display
- NeoPixels

1) Requirements

Outputs

LCD

The LCD will display a box on a 12x8 grid. The box's vertical position will determine which NeoPixel is being currently set (8 vertical Positions for 8 NeoPixels) while the horizontal position will determine the intensity for that R,G, or B value. The box will also change color to match the color value that's being currently set (Red, Green, or Blue) for the selected NeoPixel.

NeoPixel

Each NeoPixel on the 1x8 strip will be individually RGB addressed based on the LCD box's Coordinates.

Inputs

Button RGB

This button's falling edge IRQ will select a NeoPixel and cycle through each of its R, G, B value as it sets them in accordance with the box's coordinates.

Button Clear

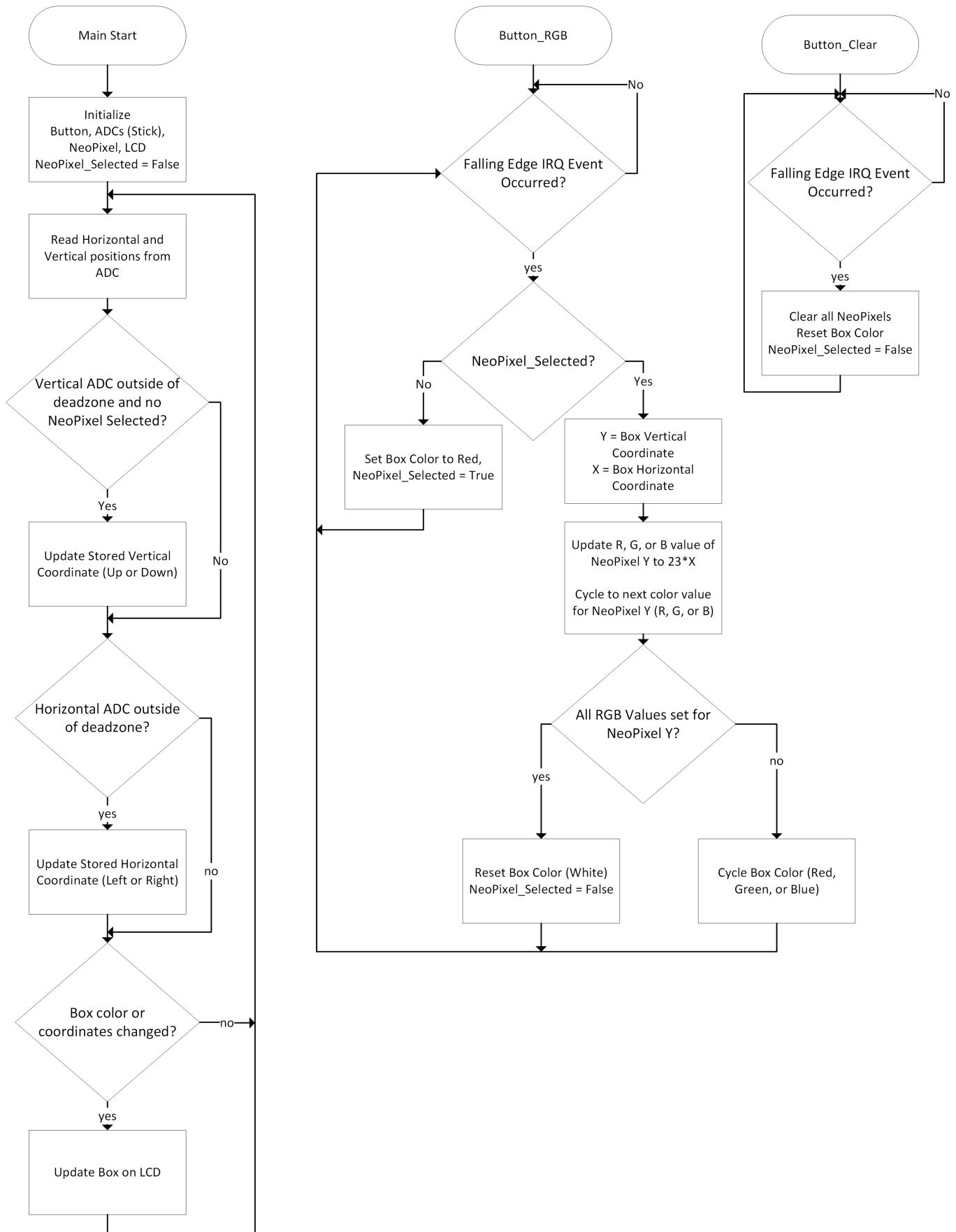
This button's falling edge IRQ will clear all NeoPixel RGB values.

Analog Stick

The stick's ADCs will move the on-screen box's position in the vertical and horizontal direction.

3) Flowchart & Program

Flowchart



Program

lcd.py

```
import st7796
from machine import ADC, Pin

CHUNKS = [[],[]]

for i in range(0, 12):
    CHUNKS[0].append(i*40)

for j in range (0, 8):
    CHUNKS[1].append(280 - (j*40))

RGB_VALUES = [st7796.RGB(255, 0, 0), st7796.RGB(0, 255, 0), st7796.RGB(0, 0, 255)]
DEFAULT_BOX_RGB = st7796.RGB(255, 255, 255)
BACKGROUND_RGB = st7796.RGB(0, 0, 0)

class LCD:
    def __init__(self, stick_x_gpio: int, stick_y_gpio: int):
        self._stick_x = ADC(Pin(stick_x_gpio, Pin.IN))
        self._stick_y = ADC(Pin(stick_y_gpio, Pin.IN))
        self._box_rgb = DEFAULT_BOX_RGB
        self._last_box_rgb = self._box_rgb
        self.box_pos = [0,0]
        self._box_last_pos = [0,1]
        self._box_moved = [False, False]
        self.vertically_constrained = False

    def init(self):
        st7796.Init()
        st7796.Clear(BACKGROUND_RGB)

    def tick(self):
        self._update_pos()
        self._update_lcd()

    def switch_box_rgb(self, pointer: int):
        self._last_box_rgb = self._box_rgb
        self._box_rgb = RGB_VALUES[pointer]

    def clear_box_rgb(self):
        self._last_box_rgb = self._box_rgb
        self._box_rgb = DEFAULT_BOX_RGB

    def _update_pos(self):
        input_x = self._stick_x.read_u16()
        input_y = self._stick_y.read_u16()
        hor_move = 0
        ver_move = 0
```

```

if input_x > 55000:
    hor_move = 1
elif input_x < 10535:
    hor_move = -1

if not self.vertically_constrained:
    if input_y > 55000:
        ver_move = 1
    elif input_y < 10535:
        ver_move = -1

if not self._box_moved[0]:
    self.box_pos[0] = min(max(self.box_pos[0] + hor_move, 0), 11)

if not self._box_moved[1]:
    self.box_pos[1] = min(max(self.box_pos[1] + ver_move, 0), 7)

self._box_moved[0] = bool(hor_move)
self._box_moved[1] = bool(ver_move)

def _update_lcd(self):
    if ((self.box_pos[0] != self._box_last_pos[0]) or (self.box_pos[1] != self._box_last_pos[1]) or (self._last_box_rgb != self._box_rgb)):
        st7796.Solid_Box(CHUNKS[0][self._box_last_pos[0]], CHUNKS[1]
        [self._box_last_pos[1]], CHUNKS[0][self._box_last_pos[0]]+39, CHUNKS[1]
        [self._box_last_pos[1]]+39, BACKGROUND_RGB)
        st7796.Solid_Box(CHUNKS[0][self.box_pos[0]], CHUNKS[1]
        [self.box_pos[1]], CHUNKS[0][self.box_pos[0]]+39, CHUNKS[1][self.box_pos[1]]+39,
        self._box_rgb)

    if self._last_box_rgb != self._box_rgb:
        self._last_box_rgb = self._box_rgb

    self._box_last_pos[0] = self.box_pos[0]
    self._box_last_pos[1] = self.box_pos[1]

# Test script
if __name__ == "__main__":
    lcd = LCD(stick_x_gpio=26, stick_y_gpio=27)
    lcd.init()
    while True:
        try:
            lcd.tick()
        except KeyboardInterrupt:
            break

```

rgb.py

```

from lcd import LCD
from machine import Pin
from neopixel import NeoPixel

```

```

RGB_STRING = "RGB"

class RGBController:
    def __init__(self, button_rgb: Pin, button_clear: Pin, neopixel: NeoPixel,
lcd: LCD):
        self._neopixel = neopixel
        self._lcd = lcd
        self._rgb_pointer = 0
        self._np_selected = False
        self._current_rgb = [0, 0, 0]
        self._button_rgb = button_rgb
        self._button_clear = button_clear
        self._button_rgb.irq(handler=self._rgb_handler, trigger=Pin.IRQ_FALLING)
        self._button_clear.irq(handler=self._clear_handler,
trigger=Pin.IRQ_FALLING)

    def _rgb_handler(self, pin: Pin):
        if not self._np_selected:
            self._lcd.switch_box_rgb(self._rgb_pointer)
            self._np_selected = True
            self._lcd.vertically_constrained = True
            print("Selected NeoPixel {}".format(self._lcd.box_pos[1]))
        else:
            self._current_rgb[self._rgb_pointer] = 23 * self._lcd.box_pos[0]
            self._neopixel[self._lcd.box_pos[1]] = tuple(self._current_rgb) #type:
ignore
            self._neopixel.write()
            print("Set {} value to {}".format(RGB_STRING[self._rgb_pointer],
self._current_rgb[self._rgb_pointer]))
            self._rgb_pointer = (self._rgb_pointer + 1) % 3

        if self._rgb_pointer == 0:
            self._np_selected = False
            self._lcd.vertically_constrained = False
            print("Set NeoPixel {} to RGB value
{}".format(self._lcd.box_pos[1], self._current_rgb))
            self._lcd.clear_box_rgb()
            self._current_rgb = [0, 0, 0]
        else:
            self._lcd.switch_box_rgb(self._rgb_pointer)

    def _clear_handler(self, pin: Pin):
        self._np_selected = False
        self._lcd.vertically_constrained = False
        self._lcd.clear_box_rgb()
        self._rgb_pointer = 0
        self._current_rgb = [0, 0, 0]
        self._neopixel.fill((0,0,0))
        self._neopixel.write()
        print("All NeoPixels Cleared")

```

main.py

```
from lcd import LCD
from neopixel import NeoPixel
from machine import Pin
from rgb import RGBController

if __name__ == "__main__":
    neopixel = NeoPixel(Pin(11), 8, bpp=3, timing=1)
    button_rgb = Pin(14, Pin.IN, Pin.PULL_UP)
    button_clear = Pin(15, Pin.IN, Pin.PULL_UP)
    lcd = LCD(stick_x_gpio=26, stick_y_gpio=27)
    strip = RGBController(button_rgb, button_clear, neopixel, lcd)
    lcd.init()
    while True:
        try:
            lcd.tick()
        except KeyboardInterrupt:
            break
```

4) Validation

Test print statements for analog stick deadzone

Modification to lcd.py

```
if input_x > 55000:
    hor_move = 1
    print("To the right of deadzone: {}".format(input_x))
elif input_x < 10535:
    hor_move = -1
    print("To the left of deadzone: {}".format(input_x))

if not self.vertically_constrained:
    if input_y > 55000:
        ver_move = 1
        print("Above deadzone: {}".format(input_y))
    elif input_y < 10535:
        ver_move = -1
        print("Below deadzone: {}".format(input_y))
```

ADC1 above deadzone of 55000

```
Above y deadzone: 60590
Above y deadzone: 59726
Above y deadzone: 59102
Above y deadzone: 58654
Above y deadzone: 58046
Above y deadzone: 57341
Above y deadzone: 56653
Above y deadzone: 56045
Above y deadzone: 55341
```

ADC1 below deadzone of 10535

```
Below y deadzone: 7649
Below y deadzone: 7985
Below y deadzone: 8274
Below y deadzone: 8738
Below y deadzone: 9170
Below y deadzone: 9730
Below y deadzone: 10242
```

ADC0 right of deadzone of 55000

```
Right of x deadzone: 58350
Right of x deadzone: 58062
Right of x deadzone: 57566
Right of x deadzone: 57149
Right of x deadzone: 56653
Right of x deadzone: 55901
Right of x deadzone: 55357
```

ADC0 left of deadzone of 10535

```
Left of x deadzone: 8145
Left of x deadzone: 8210
Left of x deadzone: 8482
Left of x deadzone: 8834
Left of x deadzone: 9314
Left of x deadzone: 9682
Left of x deadzone: 10018
Left of x deadzone: 10402
```

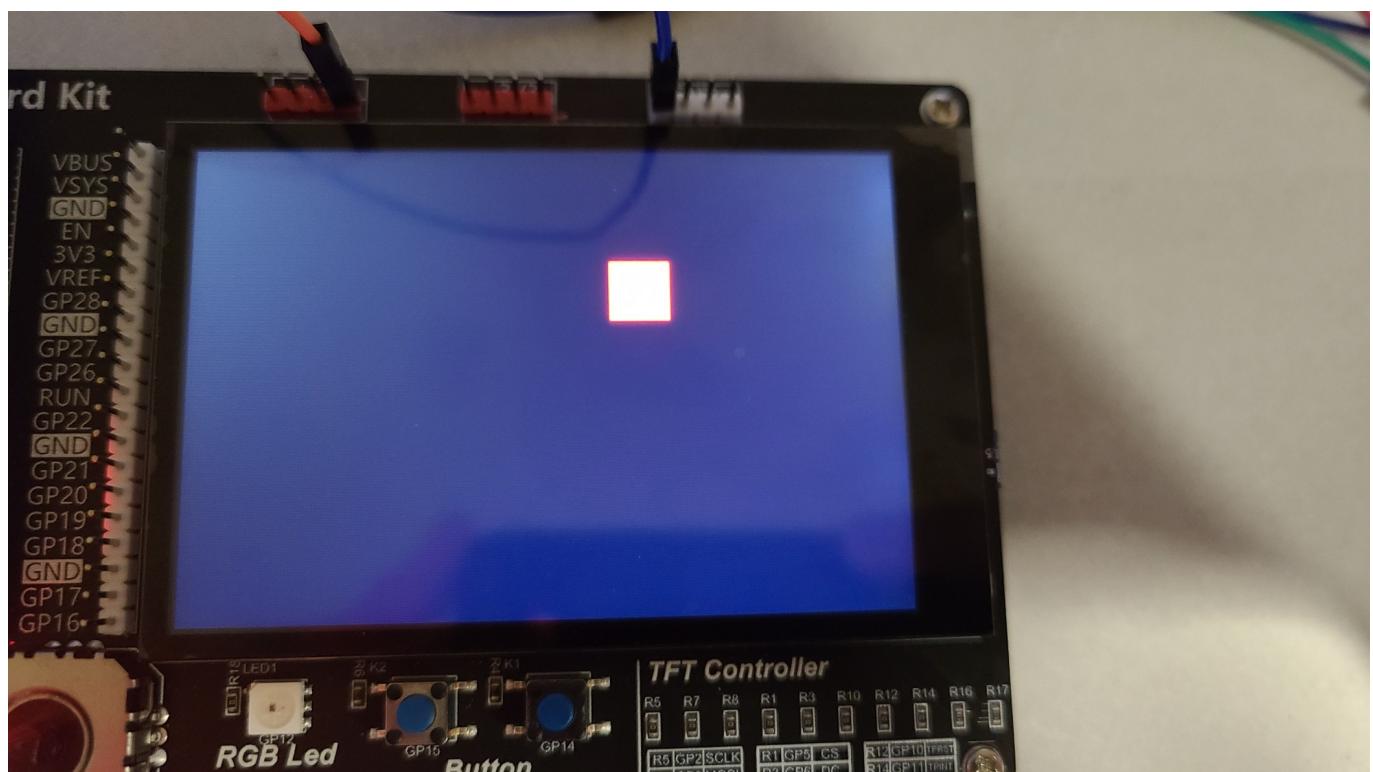
Test NeoPixel RGB from LCD coordinates

Box Y coordinate 5 + Button Push = Select NeoPixel 5 (0 index)



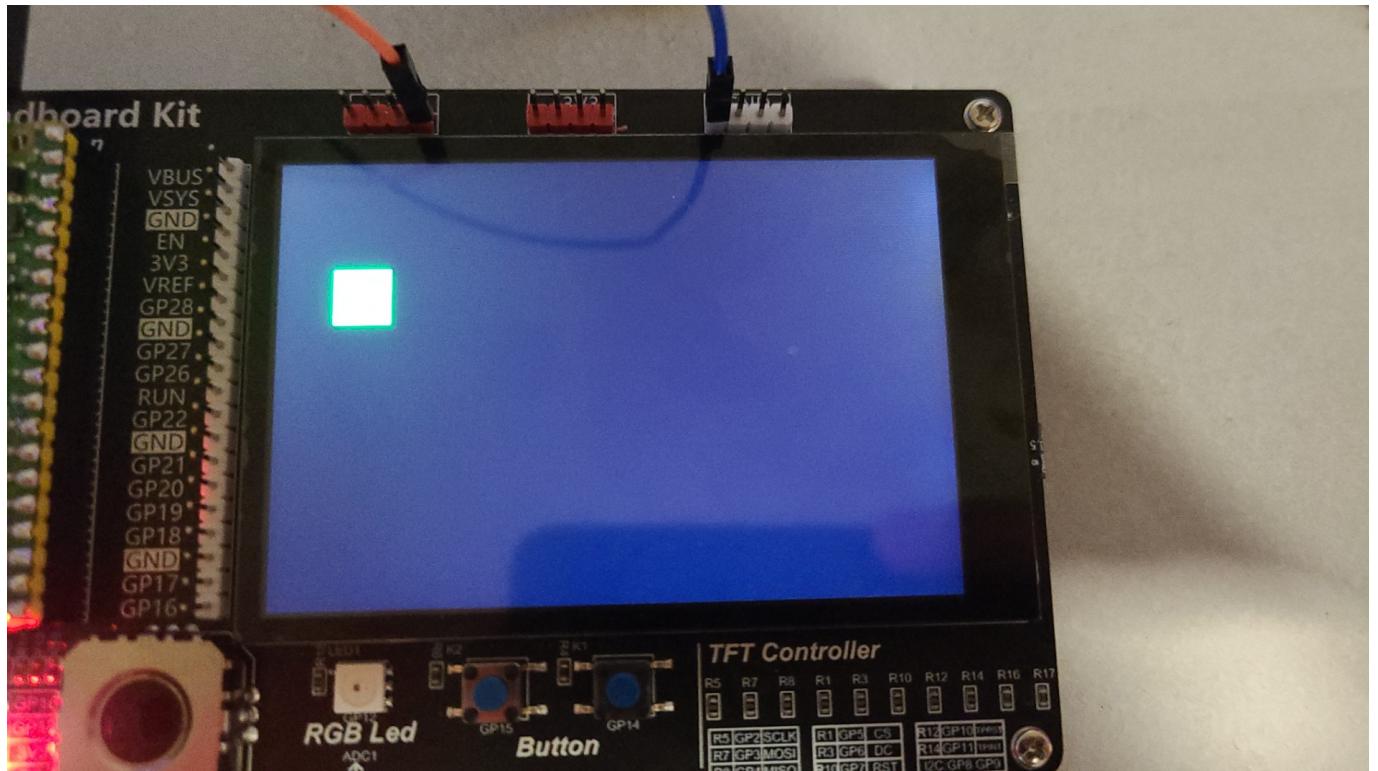
Once a NeoPixel is selected, box can't move vertically (as expected)

Box X coordinate 7 + Button Push = R value of 161 (7*23)



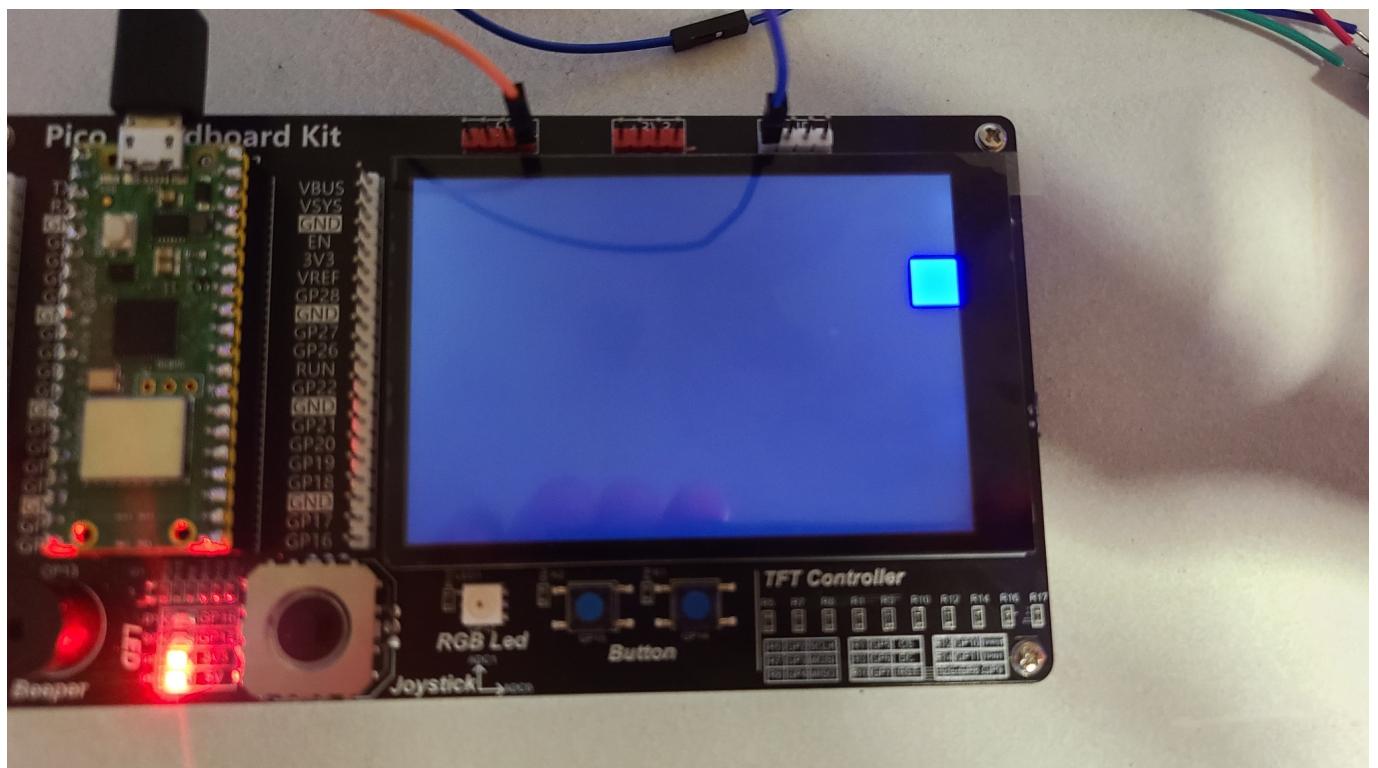
Set R value to 161

Box X coordinate 1 + Button Push = G value of 23 (1*23)



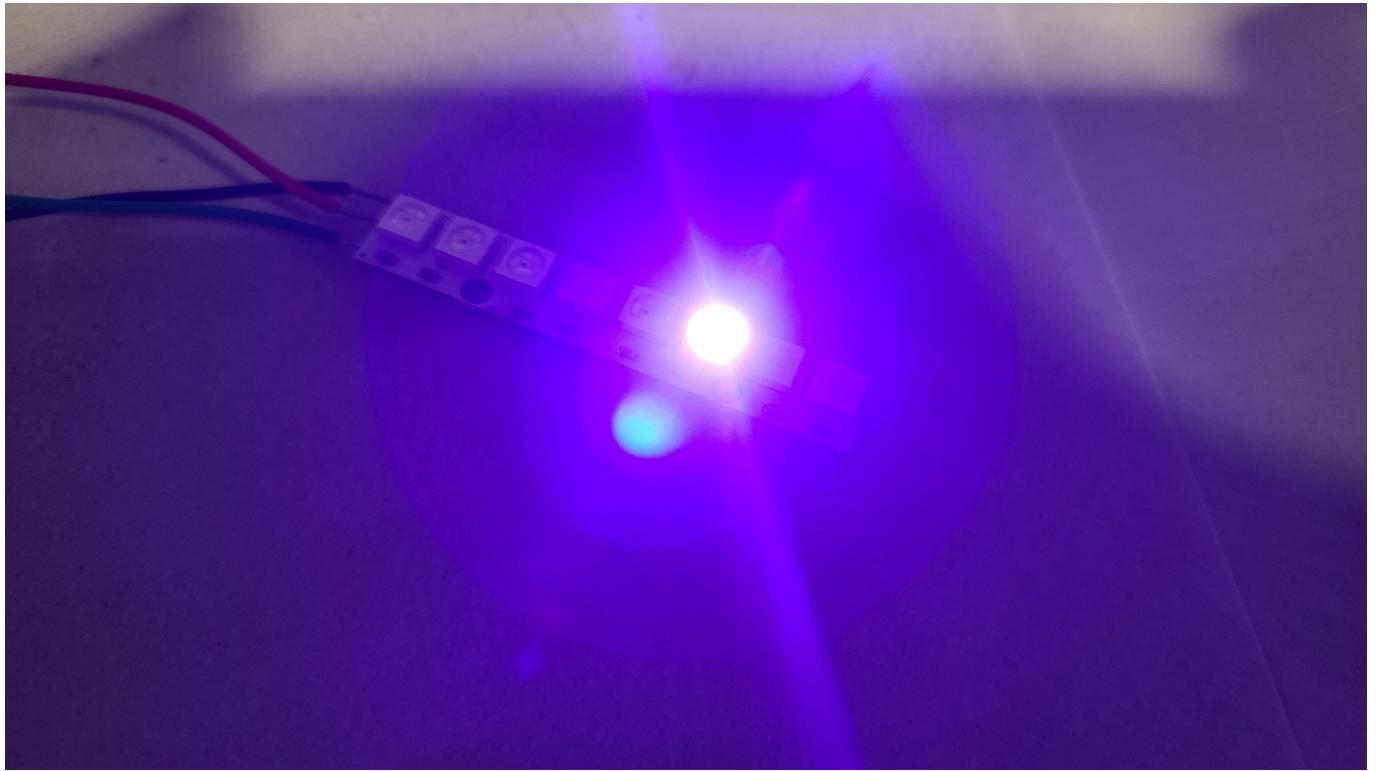
Set G value to 23

Box X coordinate 11 + Button Push = B value of 253 (11*23)



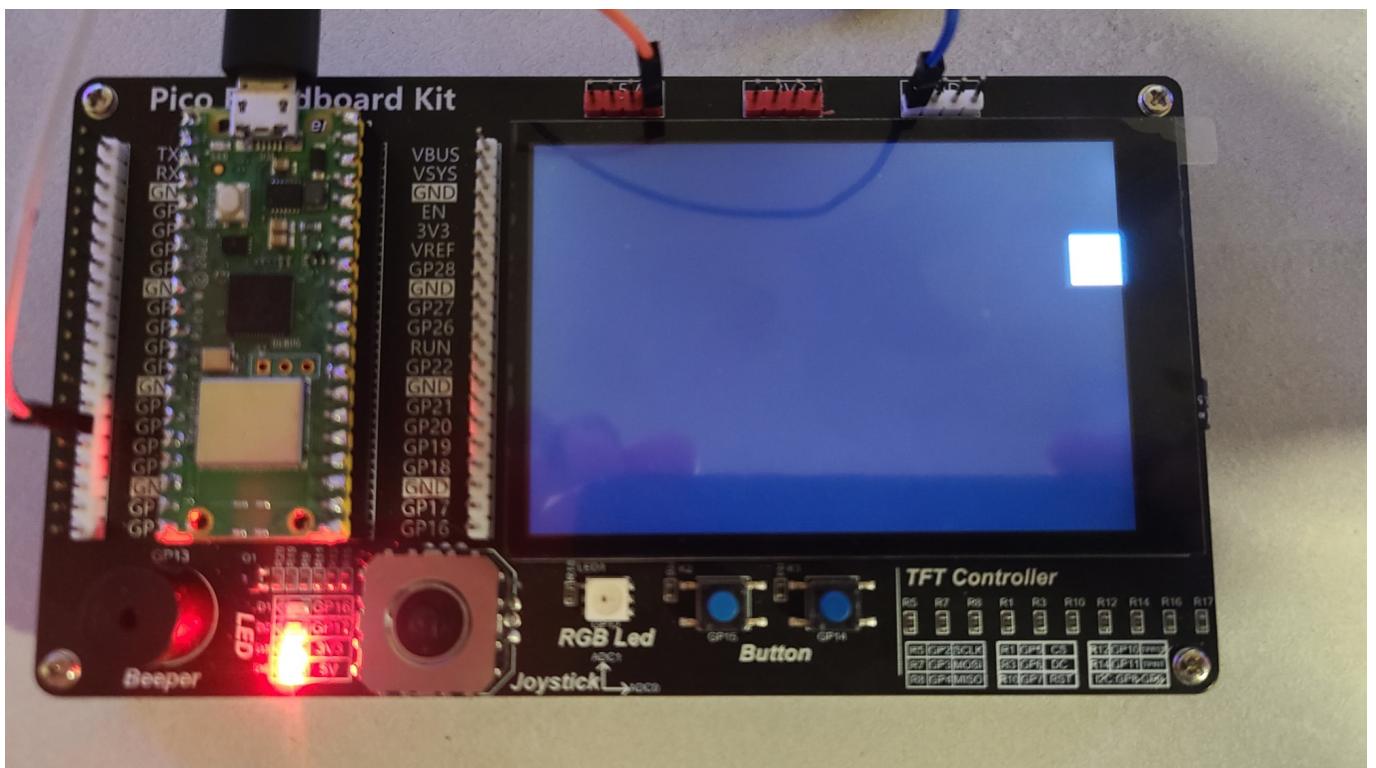
Set B value to 253

Purple



Set NeoPixel 5 to RGB value [161, 23, 253]

Box goes back to being white (expected)



Pushing the clear button clears all NeoPixels



5) Demo

<https://www.youtube.com/watch?v=PfXG66XNrC0>

Click image to access video

