## AUTHOR: Kieran Owen Wand (14yrs)

## ASSISTANT: Christopher John Butcher (DAD, 35yrs)

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## CREDITS

# - ASTROPI FORUM MEMBERS, HELP AND SUPPORT FOR SCRIPTS AND FAULT FINDING

# - RASPBERRY PI FORUM MEMBERS, HELP AND SUPPORT FOR SCRIPTS AND FAULT FINDING

# - Tsena Wand (MUM), ASSESSING THE EASE OF USE FOR THE READING DISPLAYS AND WARNING STATES

## IMPORT MODULES REQUIRED FOR PROGRAM ##

import RPi.GPIO as GPIO

import time, logging

from datetime import datetime

import sys, os

import astro\_pi

from astro\_pi import AstroPi

from time import sleep, asctime

## SETS ASTROPI MODULES AS FRIENDLY NAME ##

ap = astro\_pi.AstroPi()

# SETTING UP RASPBERRYPI FOR FLIGHT BUTTONS TO USE GPIO PINS

GPIO.setwarnings(False)

GPIO.setmode(GPIO.BCM)

# ASSIGNING FRIENDLY NAMES FOR GPIO PINS

UP = 26

DOWN = 13

LEFT = 20

RIGHT = 19

A = 21

B = 16

# FORCING PROGRAM TO RUN WITHIN WHILE LOOP

running = True

## CREATE TIMESTAMP AS FRIENDLY NAME ##

tmstmp = time.strftime("%Y%m%d-%H%M%S")

## ASSIGNING LEVELS TO LED'S AND COLOURS ##

# ADJUSTABLE LED LIGHT LEVELS

led\_level = 150

# ASSIGNING LEVELS TO COLOURS

red = 255 # TEMPERATURE LED LIGHT LEVEL

blue = 255 # PRESSURE LED LIGHT LEVEL

## ASSIGNING DEFAULTS TO TEMP + HUM OR PRESSURE PAGES ##

temp\_hum\_on = 0

psi\_on = 0

## ASSIGNING DEFAULTS VALUES TO ALARM TRIGGERS ##

tmp\_alarm = 0

hum\_alarm = 0

psi\_alarm = 0

id\_num = 0

## ASSIGNING DEFAULTS TO WARNINIG PAGES (MUTE / SHOW) ##

tmp\_mute = 0

hum\_mute = 0

psi\_mute = 0

## ASSIGNING DEFAULT TO DISPLAY OFF TRIGGER ##

display\_mute = 0

## CREATES A LOG FILE WITH THE TITLE "log/{timestamp:%Y-%m-%d-%H-%M}watchdog.csv" ##

## THIS ALSO ADDS A TIMESTAMP TO THE START OF THE FILE NAME CREATED ##

count = 0

file = open('log/'+(str(tmstmp))+' watchdog-log.csv', 'w')

file.write("\"Time\",\"Display\",\"Temperature\",\"Temp\_Reading\",\"Temp\_Alarm\",\"Humidity\",\"Hum\_Reading\",\"Hum\_Alarm\",\"Pressure\",\"PSI\_Reading\",\"PSI\_Alarm\",\"Pitch\",\"Roll\",\"Yaw\"\n")

## EXAMPLE FOR WRITING INFORMATION ONTO LED MATRIX PIXELS:

#ap.set\_pixel(x, y, red, green, blue)

## TEMPERATURE NUMBERS MATRIX BELOW ##

def temp\_num\_matrix\_1(num):

if num == '0':

# number 0\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, led\_level, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '1':

# number 1\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, 0, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, led\_level, 0, 0)

ap.set\_pixel(1, 2, led\_level, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, 0, 0, 0)

ap.set\_pixel(2, 1, 0, 0, 0)

ap.set\_pixel(2, 2, 0, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '2':

# number 2\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, 0, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, led\_level, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, 0, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '3':

# number 3\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, 0, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, led\_level, 0, 0)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '4':

# number 4\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, led\_level, 0, 0)

ap.set\_pixel(0, 3, 0, 0, 0)

ap.set\_pixel(1, 0, 0, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, led\_level, 0, 0)

ap.set\_pixel(1, 3, 0, 0, 0)

ap.set\_pixel(2, 0, 0, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '5':

# number 5\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, led\_level, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, 0, 0, 0)

ap.set\_pixel(2, 2, 0, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '6':

# number 6\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, led\_level, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, 0, 0, 0)

ap.set\_pixel(1, 1, led\_level, 0, 0)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, 0, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '7':

# number 7\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, 0, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, 0, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '8':

# number 8\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, led\_level, 0, 0)

ap.set\_pixel(0, 3, led\_level, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, led\_level, 0, 0)

ap.set\_pixel(1, 3, led\_level, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '9':

# number 9\_top\_left - TEMPERATURE

ap.set\_pixel(0, 0, led\_level, 0, 0)

ap.set\_pixel(0, 1, led\_level, 0, 0)

ap.set\_pixel(0, 2, led\_level, 0, 0)

ap.set\_pixel(0, 3, 0, 0, 0)

ap.set\_pixel(1, 0, led\_level, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, led\_level, 0, 0)

ap.set\_pixel(1, 3, 0, 0, 0)

ap.set\_pixel(2, 0, led\_level, 0, 0)

ap.set\_pixel(2, 1, led\_level, 0, 0)

ap.set\_pixel(2, 2, led\_level, 0, 0)

ap.set\_pixel(2, 3, led\_level, 0, 0)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

def temp\_num\_matrix\_2(num):

if num == '0':

# number 0\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, led\_level, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '1':

# number 1\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, 0, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, led\_level, 0, 0)

ap.set\_pixel(5, 2, led\_level, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, 0, 0, 0)

ap.set\_pixel(6, 1, 0, 0, 0)

ap.set\_pixel(6, 2, 0, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '2':

# number 2\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, 0, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, led\_level, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, 0, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '3':

# number 3\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, 0, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, led\_level, 0, 0)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '4':

# number 4\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, led\_level, 0, 0)

ap.set\_pixel(4, 3, 0, 0, 0)

ap.set\_pixel(5, 0, 0, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, led\_level, 0, 0)

ap.set\_pixel(5, 3, 0, 0, 0)

ap.set\_pixel(6, 0, 0, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '5':

# number 5\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, led\_level, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, 0, 0, 0)

ap.set\_pixel(6, 2, 0, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '6':

# number 6\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, led\_level, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, 0, 0, 0)

ap.set\_pixel(5, 1, led\_level, 0, 0)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, 0, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '7':

# number 7\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, 0, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, 0, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '8':

# number 8\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, led\_level, 0, 0)

ap.set\_pixel(4, 3, led\_level, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, led\_level, 0, 0)

ap.set\_pixel(5, 3, led\_level, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '9':

# number 9\_top\_right - TEMPERATURE

ap.set\_pixel(4, 0, led\_level, 0, 0)

ap.set\_pixel(4, 1, led\_level, 0, 0)

ap.set\_pixel(4, 2, led\_level, 0, 0)

ap.set\_pixel(4, 3, 0, 0, 0)

ap.set\_pixel(5, 0, led\_level, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, led\_level, 0, 0)

ap.set\_pixel(5, 3, 0, 0, 0)

ap.set\_pixel(6, 0, led\_level, 0, 0)

ap.set\_pixel(6, 1, led\_level, 0, 0)

ap.set\_pixel(6, 2, led\_level, 0, 0)

ap.set\_pixel(6, 3, led\_level, 0, 0)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

def temp\_num\_error\_high():

# error state warning for - HIGH TEMPERATURE

ap.set\_pixel(0, 0, red, 0, 0)

ap.set\_pixel(0, 1, red, 0, 0)

ap.set\_pixel(0, 2, red, 0, 0)

ap.set\_pixel(0, 3, red, 0, 0)

ap.set\_pixel(1, 0, red, 0, 0)

ap.set\_pixel(1, 1, red, 0, 0)

ap.set\_pixel(1, 2, red, 0, 0)

ap.set\_pixel(1, 3, red, 0, 0)

ap.set\_pixel(2, 0, red, 0, 0)

ap.set\_pixel(2, 1, red, 0, 0)

ap.set\_pixel(2, 2, red, 0, 0)

ap.set\_pixel(2, 3, red, 0, 0)

ap.set\_pixel(3, 0, red, 0, 0)

ap.set\_pixel(3, 1, red, 0, 0)

ap.set\_pixel(3, 2, red, 0, 0)

ap.set\_pixel(3, 3, red, 0, 0)

ap.set\_pixel(4, 0, red, 0, 0)

ap.set\_pixel(4, 1, red, 0, 0)

ap.set\_pixel(4, 2, red, 0, 0)

ap.set\_pixel(4, 3, red, 0, 0)

ap.set\_pixel(5, 0, red, 0, 0)

ap.set\_pixel(5, 1, red, 0, 0)

ap.set\_pixel(5, 2, red, 0, 0)

ap.set\_pixel(5, 3, red, 0, 0)

ap.set\_pixel(6, 0, red, 0, 0)

ap.set\_pixel(6, 1, red, 0, 0)

ap.set\_pixel(6, 2, red, 0, 0)

ap.set\_pixel(6, 3, red, 0, 0)

ap.set\_pixel(7, 0, red, 0, 0)

ap.set\_pixel(7, 1, red, 0, 0)

ap.set\_pixel(7, 2, red, 0, 0)

ap.set\_pixel(7, 3, red, 0, 0)

def temp\_num\_error\_low():

# error state warning for - LOW TEMPERATURE

ap.set\_pixel(0, 0, 0, 0, blue)

ap.set\_pixel(0, 1, 0, 0, blue)

ap.set\_pixel(0, 2, 0, 0, blue)

ap.set\_pixel(0, 3, 0, 0, blue)

ap.set\_pixel(1, 0, 0, 0, blue)

ap.set\_pixel(1, 1, 0, 0, blue)

ap.set\_pixel(1, 2, 0, 0, blue)

ap.set\_pixel(1, 3, 0, 0, blue)

ap.set\_pixel(2, 0, 0, 0, blue)

ap.set\_pixel(2, 1, 0, 0, blue)

ap.set\_pixel(2, 2, 0, 0, blue)

ap.set\_pixel(2, 3, 0, 0, blue)

ap.set\_pixel(3, 0, 0, 0, blue)

ap.set\_pixel(3, 1, 0, 0, blue)

ap.set\_pixel(3, 2, 0, 0, blue)

ap.set\_pixel(3, 3, 0, 0, blue)

ap.set\_pixel(4, 0, 0, 0, blue)

ap.set\_pixel(4, 1, 0, 0, blue)

ap.set\_pixel(4, 2, 0, 0, blue)

ap.set\_pixel(4, 3, 0, 0, blue)

ap.set\_pixel(5, 0, 0, 0, blue)

ap.set\_pixel(5, 1, 0, 0, blue)

ap.set\_pixel(5, 2, 0, 0, blue)

ap.set\_pixel(5, 3, 0, 0, blue)

ap.set\_pixel(6, 0, 0, 0, blue)

ap.set\_pixel(6, 1, 0, 0, blue)

ap.set\_pixel(6, 2, 0, 0, blue)

ap.set\_pixel(6, 3, 0, 0, blue)

ap.set\_pixel(7, 0, 0, 0, blue)

ap.set\_pixel(7, 1, 0, 0, blue)

ap.set\_pixel(7, 2, 0, 0, blue)

ap.set\_pixel(7, 3, 0, 0, blue)

## HUMIDITY NUMBERS MATRIX BELOW ##

def hum\_num\_matrix\_1(num):

if num == '0':

# number 0\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, led\_level, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '1':

# number 1\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, 0, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, led\_level, 0)

ap.set\_pixel(1, 6, 0, led\_level, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, 0, 0)

ap.set\_pixel(2, 5, 0, 0, 0)

ap.set\_pixel(2, 6, 0, 0, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '2':

# number 2\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, 0, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, led\_level, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, 0, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '3':

# number 3\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, 0, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, led\_level, 0)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '4':

# number 4\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, led\_level, 0)

ap.set\_pixel(0, 7, 0, 0, 0)

ap.set\_pixel(1, 4, 0, 0, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, led\_level, 0)

ap.set\_pixel(1, 7, 0, 0, 0)

ap.set\_pixel(2, 4, 0, 0, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '5':

# number 5\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, led\_level, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, 0, 0)

ap.set\_pixel(2, 6, 0, 0, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '6':

# number 6\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, led\_level, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, 0, 0)

ap.set\_pixel(1, 5, 0, led\_level, 0)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, 0, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '7':

# number 7\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, 0, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, 0, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '8':

# number 8\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, led\_level, 0)

ap.set\_pixel(0, 7, 0, led\_level, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, led\_level, 0)

ap.set\_pixel(1, 7, 0, led\_level, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '9':

# number 9\_bot\_left - HUMIDITY

ap.set\_pixel(0, 4, 0, led\_level, 0)

ap.set\_pixel(0, 5, 0, led\_level, 0)

ap.set\_pixel(0, 6, 0, led\_level, 0)

ap.set\_pixel(0, 7, 0, 0, 0)

ap.set\_pixel(1, 4, 0, led\_level, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, led\_level, 0)

ap.set\_pixel(1, 7, 0, 0, 0)

ap.set\_pixel(2, 4, 0, led\_level, 0)

ap.set\_pixel(2, 5, 0, led\_level, 0)

ap.set\_pixel(2, 6, 0, led\_level, 0)

ap.set\_pixel(2, 7, 0, led\_level, 0)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

def hum\_num\_matrix\_2(num):

if num == '0':

# number 0\_bottom\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, led\_level, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '1':

# number 1\_bottom\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, 0, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, led\_level, 0)

ap.set\_pixel(5, 6, 0, led\_level, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, 0, 0)

ap.set\_pixel(6, 5, 0, 0, 0)

ap.set\_pixel(6, 6, 0, 0, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '2':

# number 2\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, 0, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, led\_level, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, 0, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '3':

# number 3\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, 0, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, led\_level, 0)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '4':

# number 4\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, led\_level, 0)

ap.set\_pixel(4, 7, 0, 0, 0)

ap.set\_pixel(5, 4, 0, 0, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, led\_level, 0)

ap.set\_pixel(5, 7, 0, 0, 0)

ap.set\_pixel(6, 4, 0, 0, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '5':

# number 5\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, led\_level, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, 0, 0)

ap.set\_pixel(6, 6, 0, 0, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '6':

# number 6\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, led\_level, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, 0, 0)

ap.set\_pixel(5, 5, 0, led\_level, 0)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, 0, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '7':

# number 7\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, 0, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, 0, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '8':

# number 8\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, led\_level, 0)

ap.set\_pixel(4, 7, 0, led\_level, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, led\_level, 0)

ap.set\_pixel(5, 7, 0, led\_level, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '9':

# number 9\_bot\_left - HUMIDITY

ap.set\_pixel(4, 4, 0, led\_level, 0)

ap.set\_pixel(4, 5, 0, led\_level, 0)

ap.set\_pixel(4, 6, 0, led\_level, 0)

ap.set\_pixel(4, 7, 0, 0, 0)

ap.set\_pixel(5, 4, 0, led\_level, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, led\_level, 0)

ap.set\_pixel(5, 7, 0, 0, 0)

ap.set\_pixel(6, 4, 0, led\_level, 0)

ap.set\_pixel(6, 5, 0, led\_level, 0)

ap.set\_pixel(6, 6, 0, led\_level, 0)

ap.set\_pixel(6, 7, 0, led\_level, 0)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

def hum\_num\_error\_high():

# error state warning for - HIGH HUMIDITY

ap.set\_pixel(0, 4, red, 0, 0)

ap.set\_pixel(0, 5, red, 0, 0)

ap.set\_pixel(0, 6, red, 0, 0)

ap.set\_pixel(0, 7, red, 0, 0)

ap.set\_pixel(1, 4, red, 0, 0)

ap.set\_pixel(1, 5, red, 0, 0)

ap.set\_pixel(1, 6, red, 0, 0)

ap.set\_pixel(1, 7, red, 0, 0)

ap.set\_pixel(2, 4, red, 0, 0)

ap.set\_pixel(2, 5, red, 0, 0)

ap.set\_pixel(2, 6, red, 0, 0)

ap.set\_pixel(2, 7, red, 0, 0)

ap.set\_pixel(3, 4, red, 0, 0)

ap.set\_pixel(3, 5, red, 0, 0)

ap.set\_pixel(3, 6, red, 0, 0)

ap.set\_pixel(3, 7, red, 0, 0)

ap.set\_pixel(4, 4, red, 0, 0)

ap.set\_pixel(4, 5, red, 0, 0)

ap.set\_pixel(4, 6, red, 0, 0)

ap.set\_pixel(4, 7, red, 0, 0)

ap.set\_pixel(5, 4, red, 0, 0)

ap.set\_pixel(5, 5, red, 0, 0)

ap.set\_pixel(5, 6, red, 0, 0)

ap.set\_pixel(5, 7, red, 0, 0)

ap.set\_pixel(6, 4, red, 0, 0)

ap.set\_pixel(6, 5, red, 0, 0)

ap.set\_pixel(6, 6, red, 0, 0)

ap.set\_pixel(6, 7, red, 0, 0)

ap.set\_pixel(7, 4, red, 0, 0)

ap.set\_pixel(7, 5, red, 0, 0)

ap.set\_pixel(7, 6, red, 0, 0)

ap.set\_pixel(7, 7, red, 0, 0)

def hum\_num\_error\_low():

# error state warning for - LOW HUMIDITY

ap.set\_pixel(0, 4, 0, 0, blue)

ap.set\_pixel(0, 5, 0, 0, blue)

ap.set\_pixel(0, 6, 0, 0, blue)

ap.set\_pixel(0, 7, 0, 0, blue)

ap.set\_pixel(1, 4, 0, 0, blue)

ap.set\_pixel(1, 5, 0, 0, blue)

ap.set\_pixel(1, 6, 0, 0, blue)

ap.set\_pixel(1, 7, 0, 0, blue)

ap.set\_pixel(2, 4, 0, 0, blue)

ap.set\_pixel(2, 5, 0, 0, blue)

ap.set\_pixel(2, 6, 0, 0, blue)

ap.set\_pixel(2, 7, 0, 0, blue)

ap.set\_pixel(3, 4, 0, 0, blue)

ap.set\_pixel(3, 5, 0, 0, blue)

ap.set\_pixel(3, 6, 0, 0, blue)

ap.set\_pixel(3, 7, 0, 0, blue)

ap.set\_pixel(4, 4, 0, 0, blue)

ap.set\_pixel(4, 5, 0, 0, blue)

ap.set\_pixel(4, 6, 0, 0, blue)

ap.set\_pixel(4, 7, 0, 0, blue)

ap.set\_pixel(5, 4, 0, 0, blue)

ap.set\_pixel(5, 5, 0, 0, blue)

ap.set\_pixel(5, 6, 0, 0, blue)

ap.set\_pixel(5, 7, 0, 0, blue)

ap.set\_pixel(6, 4, 0, 0, blue)

ap.set\_pixel(6, 5, 0, 0, blue)

ap.set\_pixel(6, 6, 0, 0, blue)

ap.set\_pixel(6, 7, 0, 0, blue)

ap.set\_pixel(7, 4, 0, 0, blue)

ap.set\_pixel(7, 5, 0, 0, blue)

ap.set\_pixel(7, 6, 0, 0, blue)

ap.set\_pixel(7, 7, 0, 0, blue)

## PRESSURE NUMBERS MATRIX BELOW #

def psi\_num\_matrix\_1(num):

if num == '0':

# number 0\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, led\_level)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '1':

# number 1\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, 0)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, led\_level)

ap.set\_pixel(1, 2, 0, 0, led\_level)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, 0)

ap.set\_pixel(2, 1, 0, 0, 0)

ap.set\_pixel(2, 2, 0, 0, 0)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '2':

# number 2\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, led\_level)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, 0)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '3':

# number 3\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, 0)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, led\_level)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '4':

# number 4\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, led\_level)

ap.set\_pixel(0, 3, 0, 0, 0)

ap.set\_pixel(1, 0, 0, 0, 0)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, led\_level)

ap.set\_pixel(1, 3, 0, 0, 0)

ap.set\_pixel(2, 0, 0, 0, 0)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '5':

# number 5\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, led\_level)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, 0)

ap.set\_pixel(2, 2, 0, 0, 0)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '6':

# number 6\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, led\_level)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, 0)

ap.set\_pixel(1, 1, 0, 0, led\_level)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, 0)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '7':

# number 7\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, 0)

ap.set\_pixel(0, 3, 0, 0, 0)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, 0)

ap.set\_pixel(1, 3, 0, 0, 0)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '8':

# number 8\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, led\_level)

ap.set\_pixel(0, 3, 0, 0, led\_level)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, led\_level)

ap.set\_pixel(1, 3, 0, 0, led\_level)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

if num == '9':

# number 9\_top\_left - PRESSURE

ap.set\_pixel(0, 0, 0, 0, led\_level)

ap.set\_pixel(0, 1, 0, 0, led\_level)

ap.set\_pixel(0, 2, 0, 0, led\_level)

ap.set\_pixel(0, 3, 0, 0, 0)

ap.set\_pixel(1, 0, 0, 0, led\_level)

ap.set\_pixel(1, 1, 0, 0, 0)

ap.set\_pixel(1, 2, 0, 0, led\_level)

ap.set\_pixel(1, 3, 0, 0, 0)

ap.set\_pixel(2, 0, 0, 0, led\_level)

ap.set\_pixel(2, 1, 0, 0, led\_level)

ap.set\_pixel(2, 2, 0, 0, led\_level)

ap.set\_pixel(2, 3, 0, 0, led\_level)

ap.set\_pixel(3, 0, 0, 0, 0)

ap.set\_pixel(3, 1, 0, 0, 0)

ap.set\_pixel(3, 2, 0, 0, 0)

ap.set\_pixel(3, 3, 0, 0, 0)

def psi\_num\_matrix\_2(num):

if num == '0':

# number 0\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, led\_level)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '1':

# number 1\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, 0)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, led\_level)

ap.set\_pixel(5, 2, 0, 0, led\_level)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, 0)

ap.set\_pixel(6, 1, 0, 0, 0)

ap.set\_pixel(6, 2, 0, 0, 0)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '2':

# number 2\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, led\_level)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, 0)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '3':

# number 3\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, 0)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, led\_level)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '4':

# number 4\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, led\_level)

ap.set\_pixel(4, 3, 0, 0, 0)

ap.set\_pixel(5, 0, 0, 0, 0)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, led\_level)

ap.set\_pixel(5, 3, 0, 0, 0)

ap.set\_pixel(6, 0, 0, 0, 0)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '5':

# number 5\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, led\_level)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, 0)

ap.set\_pixel(6, 2, 0, 0, 0)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '6':

# number 6\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, led\_level)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, 0)

ap.set\_pixel(5, 1, 0, 0, led\_level)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, 0)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '7':

# number 7\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, 0)

ap.set\_pixel(4, 3, 0, 0, 0)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, 0)

ap.set\_pixel(5, 3, 0, 0, 0)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '8':

# number 8\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, led\_level)

ap.set\_pixel(4, 3, 0, 0, led\_level)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, led\_level)

ap.set\_pixel(5, 3, 0, 0, led\_level)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

if num == '9':

# number 9\_top\_right - PRESSURE

ap.set\_pixel(4, 0, 0, 0, led\_level)

ap.set\_pixel(4, 1, 0, 0, led\_level)

ap.set\_pixel(4, 2, 0, 0, led\_level)

ap.set\_pixel(4, 3, 0, 0, 0)

ap.set\_pixel(5, 0, 0, 0, led\_level)

ap.set\_pixel(5, 1, 0, 0, 0)

ap.set\_pixel(5, 2, 0, 0, led\_level)

ap.set\_pixel(5, 3, 0, 0, 0)

ap.set\_pixel(6, 0, 0, 0, led\_level)

ap.set\_pixel(6, 1, 0, 0, led\_level)

ap.set\_pixel(6, 2, 0, 0, led\_level)

ap.set\_pixel(6, 3, 0, 0, led\_level)

ap.set\_pixel(7, 0, 0, 0, 0)

ap.set\_pixel(7, 1, 0, 0, 0)

ap.set\_pixel(7, 2, 0, 0, 0)

ap.set\_pixel(7, 3, 0, 0, 0)

def psi\_num\_matrix\_3(num):

if num == '0':

# number 0\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, led\_level)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '1':

# number 1\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, 0)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, led\_level)

ap.set\_pixel(1, 6, 0, 0, led\_level)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, 0)

ap.set\_pixel(2, 5, 0, 0, 0)

ap.set\_pixel(2, 6, 0, 0, 0)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '2':

# number 2\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, led\_level)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, 0)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '3':

# number 3\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, 0)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, led\_level)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '4':

# number 4\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, led\_level)

ap.set\_pixel(0, 7, 0, 0, 0)

ap.set\_pixel(1, 4, 0, 0, 0)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, led\_level)

ap.set\_pixel(1, 7, 0, 0, 0)

ap.set\_pixel(2, 4, 0, 0, 0)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '5':

# number 5\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, led\_level)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, 0)

ap.set\_pixel(2, 6, 0, 0, 0)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '6':

# number 6\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, led\_level)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, 0)

ap.set\_pixel(1, 5, 0, 0, led\_level)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, 0)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '7':

# number 7\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, 0)

ap.set\_pixel(0, 7, 0, 0, 0)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, 0)

ap.set\_pixel(1, 7, 0, 0, 0)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '8':

# number 8\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, led\_level)

ap.set\_pixel(0, 7, 0, 0, led\_level)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, led\_level)

ap.set\_pixel(1, 7, 0, 0, led\_level)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

if num == '9':

# number 9\_bot\_left - PRESSURE

ap.set\_pixel(0, 4, 0, 0, led\_level)

ap.set\_pixel(0, 5, 0, 0, led\_level)

ap.set\_pixel(0, 6, 0, 0, led\_level)

ap.set\_pixel(0, 7, 0, 0, 0)

ap.set\_pixel(1, 4, 0, 0, led\_level)

ap.set\_pixel(1, 5, 0, 0, 0)

ap.set\_pixel(1, 6, 0, 0, led\_level)

ap.set\_pixel(1, 7, 0, 0, 0)

ap.set\_pixel(2, 4, 0, 0, led\_level)

ap.set\_pixel(2, 5, 0, 0, led\_level)

ap.set\_pixel(2, 6, 0, 0, led\_level)

ap.set\_pixel(2, 7, 0, 0, led\_level)

ap.set\_pixel(3, 4, 0, 0, 0)

ap.set\_pixel(3, 5, 0, 0, 0)

ap.set\_pixel(3, 6, 0, 0, 0)

ap.set\_pixel(3, 7, 0, 0, 0)

def psi\_num\_matrix\_4(num):

if num == '0':

# number 0\_bottom\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, led\_level)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '1':

# number 1\_bottom\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, 0)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, led\_level)

ap.set\_pixel(5, 6, 0, 0, led\_level)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, 0)

ap.set\_pixel(6, 5, 0, 0, 0)

ap.set\_pixel(6, 6, 0, 0, 0)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '2':

# number 2\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, led\_level)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, 0)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '3':

# number 3\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, 0)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, led\_level)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '4':

# number 4\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, led\_level)

ap.set\_pixel(4, 7, 0, 0, 0)

ap.set\_pixel(5, 4, 0, 0, 0)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, led\_level)

ap.set\_pixel(5, 7, 0, 0, 0)

ap.set\_pixel(6, 4, 0, 0, 0)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '5':

# number 5\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, led\_level)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, 0)

ap.set\_pixel(6, 6, 0, 0, 0)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '6':

# number 6\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, led\_level)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, 0)

ap.set\_pixel(5, 5, 0, 0, led\_level)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, 0)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '7':

# number 7\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, 0)

ap.set\_pixel(4, 7, 0, 0, 0)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, 0)

ap.set\_pixel(5, 7, 0, 0, 0)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '8':

# number 8\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, led\_level)

ap.set\_pixel(4, 7, 0, 0, led\_level)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, led\_level)

ap.set\_pixel(5, 7, 0, 0, led\_level)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

if num == '9':

# number 9\_bot\_right - PRESSURE

ap.set\_pixel(4, 4, 0, 0, led\_level)

ap.set\_pixel(4, 5, 0, 0, led\_level)

ap.set\_pixel(4, 6, 0, 0, led\_level)

ap.set\_pixel(4, 7, 0, 0, 0)

ap.set\_pixel(5, 4, 0, 0, led\_level)

ap.set\_pixel(5, 5, 0, 0, 0)

ap.set\_pixel(5, 6, 0, 0, led\_level)

ap.set\_pixel(5, 7, 0, 0, 0)

ap.set\_pixel(6, 4, 0, 0, led\_level)

ap.set\_pixel(6, 5, 0, 0, led\_level)

ap.set\_pixel(6, 6, 0, 0, led\_level)

ap.set\_pixel(6, 7, 0, 0, led\_level)

ap.set\_pixel(7, 4, 0, 0, 0)

ap.set\_pixel(7, 5, 0, 0, 0)

ap.set\_pixel(7, 6, 0, 0, 0)

ap.set\_pixel(7, 7, 0, 0, 0)

def psi\_num\_error\_high():

# error state warning for - HIGH PRESSURE

ap.set\_pixel(0, 0, red, 0, 0)

ap.set\_pixel(0, 1, red, 0, 0)

ap.set\_pixel(0, 2, red, 0, 0)

ap.set\_pixel(0, 3, red, 0, 0)

ap.set\_pixel(1, 0, red, 0, 0)

ap.set\_pixel(1, 1, red, 0, 0)

ap.set\_pixel(1, 2, red, 0, 0)

ap.set\_pixel(1, 3, red, 0, 0)

ap.set\_pixel(2, 0, red, 0, 0)

ap.set\_pixel(2, 1, red, 0, 0)

ap.set\_pixel(2, 2, red, 0, 0)

ap.set\_pixel(2, 3, red, 0, 0)

ap.set\_pixel(3, 0, red, 0, 0)

ap.set\_pixel(3, 1, red, 0, 0)

ap.set\_pixel(3, 2, red, 0, 0)

ap.set\_pixel(3, 3, red, 0, 0)

ap.set\_pixel(4, 0, red, 0, 0)

ap.set\_pixel(4, 1, red, 0, 0)

ap.set\_pixel(4, 2, red, 0, 0)

ap.set\_pixel(4, 3, red, 0, 0)

ap.set\_pixel(5, 0, red, 0, 0)

ap.set\_pixel(5, 1, red, 0, 0)

ap.set\_pixel(5, 2, red, 0, 0)

ap.set\_pixel(5, 3, red, 0, 0)

ap.set\_pixel(6, 0, red, 0, 0)

ap.set\_pixel(6, 1, red, 0, 0)

ap.set\_pixel(6, 2, red, 0, 0)

ap.set\_pixel(6, 3, red, 0, 0)

ap.set\_pixel(7, 0, red, 0, 0)

ap.set\_pixel(7, 1, red, 0, 0)

ap.set\_pixel(7, 2, red, 0, 0)

ap.set\_pixel(7, 3, red, 0, 0)

ap.set\_pixel(0, 4, red, 0, 0)

ap.set\_pixel(0, 5, red, 0, 0)

ap.set\_pixel(0, 6, red, 0, 0)

ap.set\_pixel(0, 7, red, 0, 0)

ap.set\_pixel(1, 4, red, 0, 0)

ap.set\_pixel(1, 5, red, 0, 0)

ap.set\_pixel(1, 6, red, 0, 0)

ap.set\_pixel(1, 7, red, 0, 0)

ap.set\_pixel(2, 4, red, 0, 0)

ap.set\_pixel(2, 5, red, 0, 0)

ap.set\_pixel(2, 6, red, 0, 0)

ap.set\_pixel(2, 7, red, 0, 0)

ap.set\_pixel(3, 4, red, 0, 0)

ap.set\_pixel(3, 5, red, 0, 0)

ap.set\_pixel(3, 6, red, 0, 0)

ap.set\_pixel(3, 7, red, 0, 0)

ap.set\_pixel(4, 4, red, 0, 0)

ap.set\_pixel(4, 5, red, 0, 0)

ap.set\_pixel(4, 6, red, 0, 0)

ap.set\_pixel(4, 7, red, 0, 0)

ap.set\_pixel(5, 4, red, 0, 0)

ap.set\_pixel(5, 5, red, 0, 0)

ap.set\_pixel(5, 6, red, 0, 0)

ap.set\_pixel(5, 7, red, 0, 0)

ap.set\_pixel(6, 4, red, 0, 0)

ap.set\_pixel(6, 5, red, 0, 0)

ap.set\_pixel(6, 6, red, 0, 0)

ap.set\_pixel(6, 7, red, 0, 0)

ap.set\_pixel(7, 4, red, 0, 0)

ap.set\_pixel(7, 5, red, 0, 0)

ap.set\_pixel(7, 6, red, 0, 0)

ap.set\_pixel(7, 7, red, 0, 0)

def psi\_num\_error\_low():

# error state warning for - LOW PRESSURE

ap.set\_pixel(0, 0, 0, 0, blue)

ap.set\_pixel(0, 1, 0, 0, blue)

ap.set\_pixel(0, 2, 0, 0, blue)

ap.set\_pixel(0, 3, 0, 0, blue)

ap.set\_pixel(1, 0, 0, 0, blue)

ap.set\_pixel(1, 1, 0, 0, blue)

ap.set\_pixel(1, 2, 0, 0, blue)

ap.set\_pixel(1, 3, 0, 0, blue)

ap.set\_pixel(2, 0, 0, 0, blue)

ap.set\_pixel(2, 1, 0, 0, blue)

ap.set\_pixel(2, 2, 0, 0, blue)

ap.set\_pixel(2, 3, 0, 0, blue)

ap.set\_pixel(3, 0, 0, 0, blue)

ap.set\_pixel(3, 1, 0, 0, blue)

ap.set\_pixel(3, 2, 0, 0, blue)

ap.set\_pixel(3, 3, 0, 0, blue)

ap.set\_pixel(4, 0, 0, 0, blue)

ap.set\_pixel(4, 1, 0, 0, blue)

ap.set\_pixel(4, 2, 0, 0, blue)

ap.set\_pixel(4, 3, 0, 0, blue)

ap.set\_pixel(5, 0, 0, 0, blue)

ap.set\_pixel(5, 1, 0, 0, blue)

ap.set\_pixel(5, 2, 0, 0, blue)

ap.set\_pixel(5, 3, 0, 0, blue)

ap.set\_pixel(6, 0, 0, 0, blue)

ap.set\_pixel(6, 1, 0, 0, blue)

ap.set\_pixel(6, 2, 0, 0, blue)

ap.set\_pixel(6, 3, 0, 0, blue)

ap.set\_pixel(7, 0, 0, 0, blue)

ap.set\_pixel(7, 1, 0, 0, blue)

ap.set\_pixel(7, 2, 0, 0, blue)

ap.set\_pixel(7, 3, 0, 0, blue)

ap.set\_pixel(0, 4, 0, 0, blue)

ap.set\_pixel(0, 5, 0, 0, blue)

ap.set\_pixel(0, 6, 0, 0, blue)

ap.set\_pixel(0, 7, 0, 0, blue)

ap.set\_pixel(1, 4, 0, 0, blue)

ap.set\_pixel(1, 5, 0, 0, blue)

ap.set\_pixel(1, 6, 0, 0, blue)

ap.set\_pixel(1, 7, 0, 0, blue)

ap.set\_pixel(2, 4, 0, 0, blue)

ap.set\_pixel(2, 5, 0, 0, blue)

ap.set\_pixel(2, 6, 0, 0, blue)

ap.set\_pixel(2, 7, 0, 0, blue)

ap.set\_pixel(3, 4, 0, 0, blue)

ap.set\_pixel(3, 5, 0, 0, blue)

ap.set\_pixel(3, 6, 0, 0, blue)

ap.set\_pixel(3, 7, 0, 0, blue)

ap.set\_pixel(4, 4, 0, 0, blue)

ap.set\_pixel(4, 5, 0, 0, blue)

ap.set\_pixel(4, 6, 0, 0, blue)

ap.set\_pixel(4, 7, 0, 0, blue)

ap.set\_pixel(5, 4, 0, 0, blue)

ap.set\_pixel(5, 5, 0, 0, blue)

ap.set\_pixel(5, 6, 0, 0, blue)

ap.set\_pixel(5, 7, 0, 0, blue)

ap.set\_pixel(6, 4, 0, 0, blue)

ap.set\_pixel(6, 5, 0, 0, blue)

ap.set\_pixel(6, 6, 0, 0, blue)

ap.set\_pixel(6, 7, 0, 0, blue)

ap.set\_pixel(7, 4, 0, 0, blue)

ap.set\_pixel(7, 5, 0, 0, blue)

ap.set\_pixel(7, 6, 0, 0, blue)

ap.set\_pixel(7, 7, 0, 0, blue)

## SETTING UP FLIGHT BUTTONS FOR USE AND ASSIGNING COMMANDS

def button\_pressed(button): ## CONTINUOUSLY MONITORS FOR BUTTON EVENTS

global running

global ap

global led\_level

global temp\_hum\_on

global psi\_on

global tmp\_mute

global hum\_mute

global alarm\_count

if button == UP and led\_level < 250: ## ADJUST LED MATRIX BRIGHTNESS - UP

led\_level = led\_level + 10

if button == DOWN and led\_level > 40: ## ADJUST LED MATRIX BRIGHTNESS - DOWN

led\_level = led\_level - 10

if button == LEFT: ## FORCE TEMPERATURE AND HUMIDITY PAGE ON (5s)

temp\_hum\_on = 1

temp\_num\_matrix\_1(temp[0]) ## FIRST DIGIT - TEMPERATURE

temp\_num\_matrix\_2(temp[1]) ## SECOND DIGIT - TEMPERATURE

hum\_num\_matrix\_1(hum[0]) ## FIRST DIGIT - HUMIDITY

hum\_num\_matrix\_2(hum[1]) ## SECOND DIGIT - HUMIDITY

time.sleep(5.0) ## WAIT 5 SECONDS TO ENSURE READING CAN BE RECORDED

temp\_hum\_on = 0 ## CLOSE TEMPERATURE AND HUMIDITY PAGE OFF

tmp\_mute = 0 ## SHOWS THE WARNING FOR TEMPERATURE

hum\_mute = 0 ## SHOWS THE WARNING FOR HUMIDITY

if button == RIGHT: ## FORCE PRESSURE PAGE ON (5s)

psi\_on = 1

psi\_num\_matrix\_1(psi[0]) ## FIRST DIGIT - PRESSURE

psi\_num\_matrix\_2(psi[1]) ## SECOND DIGIT - PRESSURE

psi\_num\_matrix\_3(psi[2]) ## THIRD DIGIT - PRESSURE

psi\_num\_matrix\_4(psi[3]) ## FOURTH DIGIT - PRESSURE

time.sleep(5.0) ## WAIT 5 SECONDS TO ENSURE READING CAN BE RECORDED

psi\_on = 0 ## FORCE PRESSURE PAGE OFF

if button == A: ## ALLOWS ASTRONAUT (Tim) TO MUTE ALARMS

alarm\_count = 0 # RESETS 'alarm\_count' TO ZERO TO START COUNTDOWN

tmp\_mute = 1 # MUTES THE WARNING FOR TEMPERATURE

hum\_mute = 1 # MUTES THE WARNING FOR HUMIDITY

psi\_mute = 1 # MUTES THE WARNING FOR PRESSURE

if button == B:

alarm\_count = 0 # RESETS 'alarm\_count' TO ZERO TO START COUNTDOWN

tmp\_mute = 0 # SHOWS THE WARNING FOR TEMPERATURE

hum\_mute = 0 # SHOWS THE WARNING FOR HUMIDITY

psi\_mute = 0 # SHOWS THE WARNING FOR PRESSURE

for pin in [UP, DOWN, LEFT, RIGHT, A, B]:## SETUP GPIP PIN VALUES

GPIO.setup(pin, GPIO.IN, pull\_up\_down=GPIO.PUD\_UP)

GPIO.add\_event\_detect(pin, GPIO.FALLING, callback=button\_pressed, bouncetime=500)

## SET PREVIOUS TEMPERATURE, HUMIDITY, & PRESSURE VALUES TO ZERO ##

temp\_prev = 0 # PREVIOUS TEMPERATURE READING

temp\_int = 0 # CURRENT TEMPERATURE READING

hum\_prev = 0 # PREVIOUS HUMIDITY READING

hum\_int = 0 # CURRENT HUMIDITY READING

psi\_prev = 0 # PREVIOUS PRESSURE READING

psi\_int = 0 # CURRENT PRESSURE READING

pitch = 0 # CURRENT PITCH (ORIENTATION) READING

roll = 0 # CURRENT ROLL (ORIENTATION) READING

yaw = 0 # CURRENT YAW (ORIENTATION) READING

sec\_count = 0 # CURRENT TRIGGER READING FOR RECORDING RESULTS INTO LOG

alarm\_count = 0 # TRIGGER FOR RE-ENABLING ALARM AFTER A SET PERIOD OF TIME

alarm\_timer = 0

## NEW ASTROPI CLASS FILE TO ENSURE ORIENTATION READING IS DISPLAYED CORRECTLY ##

ap = AstroPi()

class AstroPiContinuous(AstroPi): # NEW CLASS FILE WRITEN BY 'LetHopeItsSnowing' (ASTROPI FORUM)

"""

A class which continuously reads orientation data from AstroPi as without

it the orientatin data looses sync

"""

def \_\_init\_\_(self,

fb\_device='/dev/fb1',

imu\_settings\_file='RTIMULib',

text\_assets='astro\_pi\_text',

sample\_rate = 0.1):

AstroPi.\_\_init\_\_(self, fb\_device, imu\_settings\_file, text\_assets)

self.sample\_rate = sample\_rate

self.stopped = True

self.running = False

def start(self):

"""

starts the thread that continuously reads the astro pi orientation data

"""

#initialise the IMU by getting the orientation

self.get\_orientation()

#start the orientation thread

thread.start\_new\_thread(self.\_get\_orientation\_threaded, ())

def \_get\_orientation\_threaded(self):

"""

reads the orientation data every sample rate to ensure astro pi is kept in sync

"""

self.stopped = False

self.running = True

#keep reading the orientation data, this keeps AstroPi in sync

while(not self.stopped):

self.get\_orientation()

sleep(self.sample\_rate)

self.running = False

def stop(self):

"""

stops the continous read thread

"""

self.stopped = True

#wait for the thread to stop

while(self.running):

sleep(0.01)

def \_\_enter\_\_(self):

self.start()

return self

def \_\_exit\_\_(self, type, value, traceback):

self.stop()

## NEW CLASS FILE TO ALLOW CPU\_TEMP TO BE RECALLED AS NEEDED ##

class CPUTemp:

def \_\_init\_\_(self, tempfilename = "/sys/class/thermal/thermal\_zone0/temp"):

self.tempfilename = tempfilename

def \_\_enter\_\_(self):

self.open()

return self

def open(self):

self.tempfile = open(self.tempfilename, "r")

def read(self):

self.tempfile.seek(0)

return self.tempfile.read().rstrip()

def get\_temperature(self):

return self.get\_temperature\_in\_c()

def get\_temperature\_in\_c(self):

tempraw = self.read()

return float(tempraw[:-3] + "." + tempraw[-3:])

def get\_temperature\_in\_f(self):

return self.convert\_c\_to\_f(self.get\_temperature\_in\_c())

def convert\_c\_to\_f(self, c):

return c \* 9.0 / 5.0 + 32.0

def \_\_exit\_\_(self, type, value, traceback):

self.close()

def close(self):

self.tempfile.close()

## MAIN PROGRAM LOOP ##

try:

while running: ## ENSURES THAT THE SCRIPT IS ALWAYS RUNNING IN A LOOP

import thread ## ALLOWS THE SCRIPT TO IMPORT THE NEW CLASS FILE

with AstroPiContinuous() as ap: ## FORCES SYSTEM TO USE NEW ORIENTATION CLASS FILE

while(True): ## SCRIPT LOOP FOR DISPLAYING READINGS AND RECORDING DATA

o = ap.get\_orientation()

pitch = o["pitch"] # SEPARATES OUT THE PITCH SECTION FROM ORIENTATION READINGS

roll = o["roll"] # SEPARATES OUT THE ROLL SECTION FROM ORIENTATION READING

yaw = o["yaw"] # SEPARATES OUT THE YAW SECTION FROM ORIENTATION READING

## ALLOWS THE LOG SECTION TO RECALL INFORMATION FROM THE VARIOUS SECTIONS OF THIS SCRIPT

global display\_f

global temp\_f

global temp\_reading\_f

global temp\_alarm\_f

global hum\_f

global hum\_reading\_f

global hum\_alarm\_f

global psi\_f

global psi\_reading\_f

global psi\_alarm\_f

## SET VALUES FOR LOGGING INFORMATION ##

if sec\_count == 15: ## ONLY WRITES THE LOGGING INFORMATION EVERY 30 SECONDS(APPROX.)

print("Logged {}".format(count)) #KEEPS ASTRONAUT (Tim) UP TO DATE WITH READINGS RECORDED

file.write("\"{}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\",\"{:0.2f}\"\n".format(asctime(),display\_f,temp\_f,tmp\_reading\_f,tmp\_alarm\_f,hum\_f,hum\_reading\_f,hum\_alarm\_f,psi\_f,psi\_reading\_f,psi\_alarm\_f,pitch,roll,yaw))

sec\_count = 0

count+=1

alarm\_timer+=1 # ADDS 1 TO THE 'alarm\_timer' TRIGGER

## COUNTER TO RE-ENABLE ALARMS FOR THE TEMPERATURE, HUMIDITY AND PRESSURE READINGS

if alarm\_timer >= 5:

alarm\_count+=1 # ONCE 'alarm\_timer' EQUALS 5, ADDS ONE TO 'alarm\_count',

alarm\_timer = 0 # THIS ENSURES THE TIMERS ARE CLEARED ON A BUTTON PRESS

## RE-ENABLE ALARMS FOR THE TEMPERATURE, HUMIDITY AND PRESSURE READINGS

if alarm\_count >= 35: ## WAITS FOR 30mins (APPROX.) BEFORE RE-ENABLING ALARMS

tmp\_mute = 0

hum\_mute = 0

psi\_mute = 0

alarm\_count = 0 # RESETS 'alarm\_count' TO ZERO TO START COUNTDOWN AGAIN

## CALCULATIONS FOR TEMPERATURE TO COMPENSATE FOR CPU\_TEMP AFFECTING TEMPERATURE READINGS

t = ap.get\_temperature()

p = ap.get\_temperature\_from\_pressure()

h = ap.get\_temperature\_from\_humidity()

with CPUTemp() as cpu\_temp:

c = cpu\_temp.get\_temperature()

temp\_calc = ((t+p+h)/3) - (c/4.2) ## CALCULATION FOR CORRECTING FOR THE CPU TEMPERATURE AFFECT ON TEMPERATURE SENSORS ##

## VERIFIED AGAINST A STANDALONE TEMPERATURE GAUGE ##

## GET TEMPERATURE, HUMIDITY, & PRESSURE READINGS FROM ASTROPI SENSORS ##

## also CREATES INTERGAR FOR LOGGING INFORMATION CORRECTLY ON A TABLE ##

temp\_f = temp\_calc ## STORES TEMPERATURE READING WITHIN temp\_f

temp\_int = int(temp\_f) ## CREATES INTERGAR FROM TEMPERATURE READING

hum\_f = ap.get\_humidity() ## STORES TEMPERATURE READING WITHIN hum\_f

hum\_int = int(hum\_f) ## CREATES INTERGAR FROM HUMIDITY READING

psi\_f = ap.get\_pressure() ## STORES TEMPERATURE READING WITHIN psi\_f

psi\_int = int(psi\_f) ##CREATES INTERGAR FROM PRESSURE READING

## LOG IF THE DISPLAY HAS BEEN MUTED (BLACK BOX STYLE) ##

if led\_level < 50: # DOUBLE CHECK LED LIGHT LEVELS TO CONFIRM DISPLAY ACTIVE

display\_mute = 1

elif led\_level > 40:

display\_mute = 0

if display\_mute == 1: # TRANSLATES DISPLAY MUTE TO ON AND OFF FOR LOG FILE

display\_f = 0

elif display\_mute == 0:

display\_f = 1

## LOG IF THE TEMPERATURE ALARM READING AND IF IT HAS BEEN MUTED (BLACK BOX STYLE) ##

if tmp\_mute == 1: # TRANSLATES THE ALARM MUTE INTO ON AND OFF FOR LOG FILE

tmp\_alarm\_f = 0

elif tmp\_mute == 0:

tmp\_alarm\_f = 1

if tmp\_alarm == 2: # TRANSLATES THE READINGS INTO HIGH, LOW AND OK FOR LOG FILE

tmp\_reading\_f = 1

elif tmp\_alarm == 1:

tmp\_reading\_f = -1

elif tmp\_alarm == 0:

tmp\_reading\_f = 0

## LOG IF THE HUMIDITY ALARM READING AND IF IT HAS BEEN MUTED (BLACK BOX STYLE) ##

if hum\_mute == 1: # TRANSLATES THE ALARM MUTE INTO ON AND OFF FOR LOG FILE

hum\_alarm\_f = 0

elif hum\_mute == 0:

hum\_alarm\_f = 1

if hum\_alarm == 2: # TRANSLATES THE READINGS INTO HIGH, LOW AND OK FOR LOG FILE

hum\_reading\_f = 1

elif hum\_alarm == 1:

hum\_reading\_f = -1

elif hum\_alarm == 0:

hum\_reading\_f = 0

## LOG IF THE PRESSURE ALARM READING AND IF IT HAS BEEN MUTED (BLACK BOX STYLE)

if psi\_mute == 1: # TRANSLATES THE ALARM MUTE INTO ON AND OFF FOR LOG FILE

psi\_alarm\_f = 0

elif psi\_mute == 0:

psi\_alarm\_f = 1

if psi\_alarm == 2: # TRANSLATES THE READINGS INTO HIGH, LOW AND OK FOR LOG FILE

psi\_reading\_f = 1

elif psi\_alarm == 1:

psi\_reading\_f = -1

elif psi\_alarm == 0:

psi\_reading\_f = 0

## CONVERTS TEMPERATURE, HUMIDITY, PRESSURE READINGS TO A STRING ##

## also OVERWRITES AND STORES SENSOR READINGS WITHIN PREVIOUS READINGS ##

temp\_prev = temp\_int # STORE READING IN temp\_prev

temp = str(temp\_int) # CONVERT TEMPERATURE READING TO STRING ##

hum\_prev = hum\_int # STORE READING IN temp\_prev

hum = str(hum\_int) # CONVERT HUMIDITY READING TO STRING ##

psi\_prev = psi\_int # STORE READING IN temp\_prev

psi = str(psi\_int) # CONVERT PRESSURE READING TO STRING ##

## ROTATE THE LED MATRIX DISPLAY (if required) ##

ap.set\_rotation(270) ## ROTATION ENABLED TO WORK WITH ASTROPI NASA CASE

## WRITES VALUES ONTO THE LED MATRIX FOR THE TEMPERATURE, HUMIDITY, & PRESSURE ##

## WRITES TO TOP\_LINE ONLY - TEMPERATURE (2 DIGITS)##

temp\_num\_matrix\_1(temp[0]) # FIRST DIGIT - TEMPERATURE

temp\_num\_matrix\_2(temp[1]) # SECOND DIGIT - TEMPERATURE

## WRITE TO BOTTOM\_LINE ONLY - HUMIDITY (2 DIGITS)##

hum\_num\_matrix\_1(hum[0]) # FIRST DIGIT - HUMIDITY

hum\_num\_matrix\_2(hum[1]) # SECOND DIGIT - HUMIDITY

## TEMPERATURE - ERROR STATE CHECKING ##

if temp\_hum\_on == 1: # IF TEMP+HUMIDITY PAGE ACTIVE DISPLAY PREVIOUS READING FOR 5s

time.sleep(5.0)

elif temp\_hum\_on == 0:

time.sleep(0.5) # IF NOT ONLY WAIT FOR 0.5s

if tmp\_mute == 0: # ONLY WORKOUT ALARM STATES FOR READINGS WITHIN TEMPERATURE IF NOT MUTED

if temp\_int - 3 > temp\_prev: # IF RISE OF 3 DEGREES BETWEEN READINGS - ALARM STATE

temp\_num\_error\_high()

t\_h\_wait = 1

tmp\_alarm = 2

elif temp\_int + 3 < temp\_prev: # IF FALL OF 3 DEGREES BETWEEN READING - ALARM STATE

temp\_num\_error\_low()

t\_h\_wait = 1

tmp\_alarm = 1

elif temp\_int > 36: ## CHECKED AGAINST ISS REQUIREMENTS INC CPU READING

temp\_num\_error\_high()

t\_h\_wait = 1

tmp\_alarm = 2

elif temp\_int < 18: ## CHECKED AGAINST ISS REQUIREMENTS INC CPU READING

temp\_num\_error\_low()

t\_h\_wait = 1

tmp\_alarm = 1

else:

t\_h\_wait = 1 # IF NOTHING MATCHES WAIT ANOTHER 0.5s BEFORE MOVING FORWARD

tmp\_alarm = 0

## HUMIDITY - ERROR STATE CHECKING ##

if hum\_mute == 0: # ONLY WORKOUT ALARM STATES FOR READINGS WITHIN HUMIDITY IF NOT MUTED

if hum\_int - 3 > hum\_prev: # IF RISE OF 3 BETWEEN READINGS - ALARM STATE

hum\_num\_error\_high()

t\_h\_wait = 1

hum\_alarm = 2

elif hum\_int + 3 < hum\_prev: # IF FALL OF 3 BETWEEN READINGS - ALARM STATE

hum\_num\_error\_low()

t\_h\_wait = 1

hum\_alarm = 1

elif hum\_int > 70: ## CHECKED AGAINST ISS REQUIREMENTS

hum\_num\_error\_high()

t\_h\_wait = 1

hum\_alarm = 2

elif hum\_int < 50: ## CHECKED AGAINST ISS REQUIREMENTS

hum\_num\_error\_low()

t\_h\_wait = 1

hum\_alarm = 1

else:

t\_h\_wait = 1 # IF NOTHING MATCHES WAIT ANOTHER 0.5s BEFORE MOVING FORWARD

hum\_alarm = 0

## ALLOW ASTRONAUT (Tim) TO READ THE PREVIOUS TEMPERATURE & HUMIDITY READINGS ON LED MATRIX ##

if t\_h\_wait == 1:

time.sleep(0.5)

else:

time.sleep(0.5)

## WRITE TO BOTH TOP\_LINE & BOTTOM\_LINE - PRESSURE (4 DIGITS) ##

psi\_num\_matrix\_1(psi[0]) # FIRST DIGIT - PRESSURE

psi\_num\_matrix\_2(psi[1]) # SECOND DIGIT - PRESSURE

psi\_num\_matrix\_3(psi[2]) # THIRD DIGIT - PRESSURE

psi\_num\_matrix\_4(psi[3]) # FOURTH DIGIT - PRESSURE

## PRESSURE - ERROR STATE CHECKING ##

if psi\_on == 1: # IF PRESSURE PAGE ACTIVE DISPLAY PREVIOUS READING FOR 5s

time.sleep(5.0)

elif psi\_on == 0:

time.sleep(0.5) # IF NOT ONLY WAIT FOR 0.5s

if psi\_int - 5 > psi\_prev: # ONLY WORKOUT ALARM STATES FOR READINGS WITHIN PRESSURE IF NOT MUTED

psi\_num\_error\_high() # IF RISE OF 5 BETWEEN READINGS - ALARM STATE

psi\_wait = 1

psi\_alarm = 2

elif psi\_int + 5 < psi\_prev: # IF FALL OF 5 BETWEEN READINGS - ALARM STATE

psi\_num\_error\_low()

psi\_wait = 1

psi\_alarm = 1

elif psi\_int > 1040: ## CHECKED AGAINST ISS REQUIREMENTS

psi\_num\_error\_high()

psi\_wait = 1

psi\_alarm = 2

elif psi\_int < 1000: ## CHECKED AGAINST ISS REQUIREMENTS

psi\_num\_error\_low()

psi\_wait = 1

psi\_alarm = 1

else:

psi\_wait = 1

psi\_alarm = 0

## ALLOW ASTRONAUT (Tim) TO READ THE PREVIOUS PRESSURE READING ON LED MATRIX ##

if psi\_wait == 1:

time.sleep(0.5)

else:

time.sleep(0.5)

## RESETS THE LOGGING COUNTER & START LOOP AGAIN ##

sec\_count+=1 ## ADD 1 TO SEC\_COUNT FOR LOGGING

## PROGRAMMIG TO CLEANLY EXIT THE PYTHON PROGRAM AND STOP RECORDING READINGS (if required) ##

finally:

## CLEARS THE LED MATRIX ON ASTROPI ##

file.close() ## CLOSE CSV FILE TO ENSURE READINGS ARE RECORDED

ap.show\_letter( " ", back\_colour = [0, 0, 0]) ## SETS BACKGROUND COLOUR TO BLACK (off)

ap.clear ## CLEARS LED MATRIX

os.system("clear") ## CLEARS THE SSH DISPLAY

sys.exit() ## FORCES THE PYTHON PROGRAM TO EXIT