import cv2

import numpy as np

url = "http://192.168.54.237:5000/video\_feed" # Your Raspberry Pi IP

cap = cv2.VideoCapture(url)

mode = 1

first\_frame = None

while True:

ret, frame = cap.read()

if not ret:

break

key = cv2.waitKey(1) & 0xFF

# Toggle between modes

if key == ord('1'):

mode = 1

first\_frame = None # reset motion detector

elif key == ord('2'):

mode = 2

elif key == ord('q'):

break

output = frame.copy()

if mode == 1:

# ======= Algae Detection (green regions) =======

hsv = cv2.cvtColor(frame, cv2.COLOR\_BGR2HSV)

lower\_green = (35, 40, 40)

upper\_green = (85, 255, 255)

mask = cv2.inRange(hsv, lower\_green, upper\_green)

algae = cv2.bitwise\_and(frame, frame, mask=mask)

output = cv2.addWeighted(output, 0.6, algae, 0.4, 0)

# ======= Motion Detection =======

gray = cv2.cvtColor(frame, cv2.COLOR\_BGR2GRAY)

gray = cv2.GaussianBlur(gray, (21, 21), 0)

if first\_frame is None:

first\_frame = gray

frame\_delta = cv2.absdiff(first\_frame, gray)

thresh = cv2.threshold(frame\_delta, 25, 255, cv2.THRESH\_BINARY)[1]

thresh = cv2.dilate(thresh, None, iterations=2)

contours, \_ = cv2.findContours(thresh.copy(), cv2.RETR\_EXTERNAL, cv2.CHAIN\_APPROX\_SIMPLE)

for c in contours:

if cv2.contourArea(c) < 500:

continue

(x, y, w, h) = cv2.boundingRect(c)

cv2.rectangle(output, (x, y), (x + w, y + h), (0, 255, 255), 2)

cv2.putText(output, "Mode 1: Algae + Motion Detection", (10, 30),

cv2.FONT\_HERSHEY\_SIMPLEX, 0.7, (0, 255, 255), 2)

elif mode == 2:

# ======= Edge Detection =======

edges = cv2.Canny(frame, 100, 200)

edges\_colored = cv2.cvtColor(edges, cv2.COLOR\_GRAY2BGR)

output = cv2.addWeighted(output, 0.7, edges\_colored, 0.3, 0)

# ======= Contour Detection =======

gray = cv2.cvtColor(frame, cv2.COLOR\_BGR2GRAY)

\_, thresh = cv2.threshold(gray, 60, 255, cv2.THRESH\_BINARY)

contours, \_ = cv2.findContours(thresh, cv2.RETR\_EXTERNAL, cv2.CHAIN\_APPROX\_SIMPLE)

cv2.drawContours(output, contours, -1, (255, 0, 0), 2)

cv2.putText(output, "Mode 2: Edge + Contour Detection", (10, 30),

cv2.FONT\_HERSHEY\_SIMPLEX, 0.7, (255, 0, 0), 2)

cv2.imshow("Rover Camera Feed", output)

cap.release()

cv2.destroyAllWindows()