KEEN Demonstrator

Project Status - Monthly Report

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Follow up points

Last week activities:

- Camera configuration and image capturing
- Camera calibration finding the parameters
- Color detection; Measuring the color present in the frame

This week activities:

- Liquid volume measurement using OpenCV color detection (slide #3) **Short term problem approach**
- Machine learning algorithm framework for Liquid Volume Estimation (slide #4)
- ML algorithm Framework layers (slide #5)

Long term problem approach

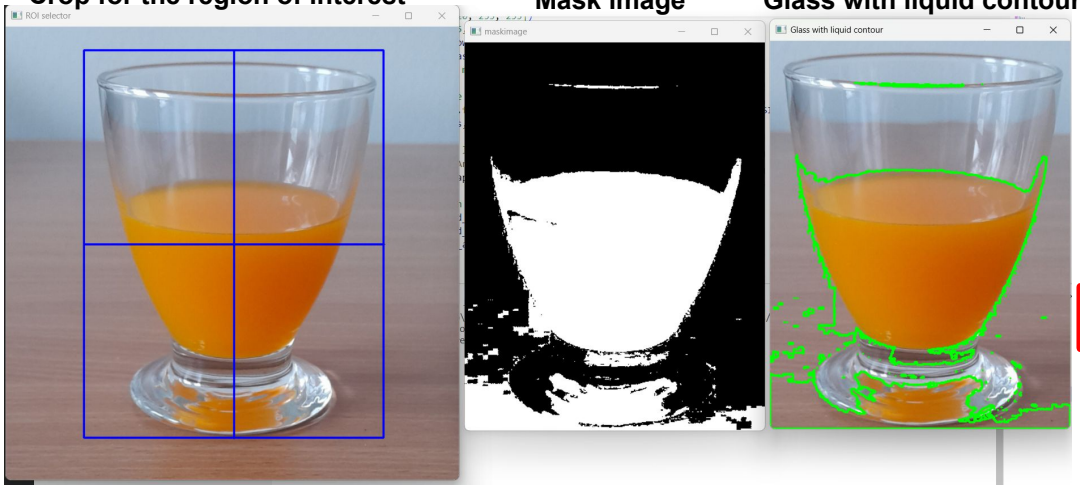
Volume detection using OpenCV color detection

- Volume proportion of the liquid is studied using color detection algm.
- Approximate results were obtained for liquid, glass area and liquid proportion.
- If it's a cylindrical glass will get even more accurate result as the crop ROI frame is rectangle

Crop for the region of interest

Mask image

Glass with liquid contour




```python
glass_roi = cv2.selectROI(img)
glass_img = img[int(glass_roi[1]):int(glass_roi[1]+glass_roi[3]),
                int(glass_roi[0]):int(glass_roi[0]+glass_roi[2])]

# Convert to grayscale and preprocess the image
gray = cv2.cvtColor(glass_img, cv2.COLOR_BGR2GRAY)
gray = cv2.GaussianBlur(gray, (5, 5), 0)
_, thresh = cv2.threshold(gray, 0, 255, cv2.THRESH_BINARY+cv2.THRESH_OTSU)

hsv = cv2.cvtColor(glass_img, cv2.COLOR_BGR2HSV)
#lower_red = np.array([0, 50, 50])
upper_orange = np.array([20, 255, 255])
lower_orange = np.array([5, 0, 0])
mask = cv2.inRange(hsv, lower_orange, upper_orange)
cv2.imshow('maskimage', mask)
#cv2.imwrite('maskimage', mask)

# Find the contours of the liquid mask
contours, hierarchy = cv2.findContours(mask, cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)
max_contour = max(contours, key=cv2.contourArea)

# Compute the area of the liquid mask and the area of the entire glass
liquid_area = cv2.contourArea(max_contour)
glass_area = glass_img.shape[0] * glass_img.shape[1]

# Calculate the proportion of liquid in the glass
liquid_proportion = liquid_area / glass_area
```

```
PS C:\Users\rajas\OneDrive\Desktop\ScaDS> & C:/Users/rajas/anaconda3/python.exe c:/Users/rajas/OneDrive/Desktop/ScaDS/volproprtion.py
Select a ROI and then press SPACE or ENTER button!
Liquid area 67363.5
Glass area 232352
Proportion of liquid in the glass: 0.2899200351191296
```

Volume level

https://github.com/RajasekarSankar/Image_Processing/tree/main/20.04.2023

Machine learning algorithm framework for Volume Estimation

Stage 1	Collect a dataset of images containing liquid with varying levels.
Stage 2	Annotate the images with bounding boxes that indicate the location of the liquid
Stage 3	Train a machine learning model on the annotated dataset to detect the liquid in the images.
Stage 4	Use the trained model to detect the liquid in a new image and calculate its level based on the location of the bounding box

Framework layers

Stage 1

Dataset collection

Collect a dataset of images containing liquid with varying levels.

- Images for liquid at different levels
- Consistent in terms of lighting, camera angle, and other factors.

Stage 2

Data annotation

Annotate the images with bounding boxes that indicate the location of the liquid.

- Bounding box generation using opencv
- Save annotations in YOLO format

Stage 3

Model training

Train a machine learning model on the annotated dataset to detect the liquid in the images

- Object detection framework like YOLO or Faster R-CNN
- The model will learn to identify the liquid in the annotated images.

Stage 4

Model prediction

Use the trained model to detect the liquid in a new image and calculate its level based on the location of the bounding box.

- Once model is trained, to detect the liquid in a new image.
- The bounding box calculates the level of the liquid in the container.