ENPM 809T – Autonomous Robotics

HW 4 – Arrow Orientation Detection – Raspberry Pi

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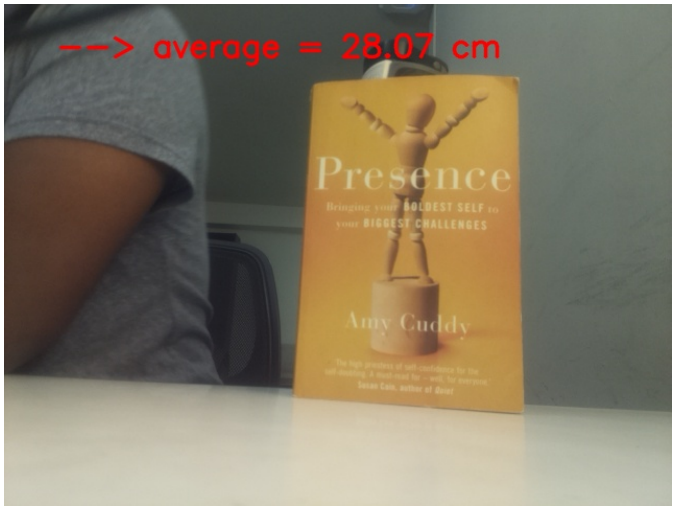
Question 2: Sonar Distance Measurement



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Question 3: Green Arrow Orientation Detection

Pipeline

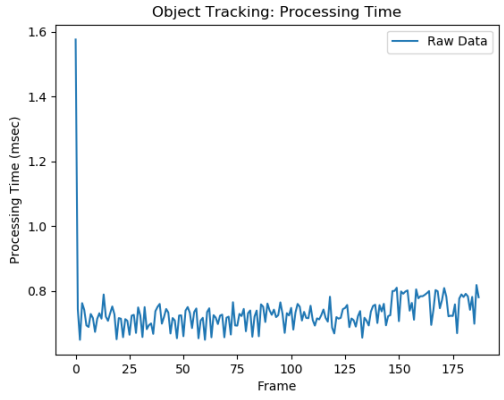
After the green mask is found by HSV thresholding, the corners are obtained using Shi Tomasi cv2.goodFeaturesToTrack() function and following methods were explored to detect orientation:

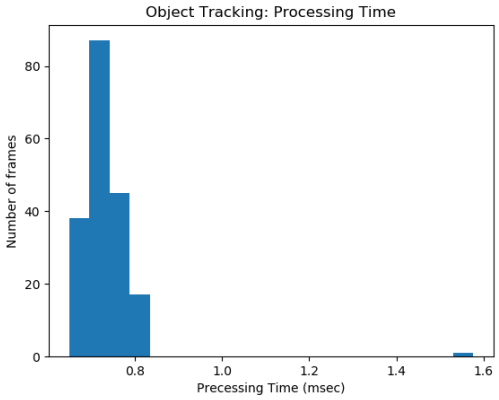
- Euclidean distance of x_min, x_max with respect to x_center and y_min, y_max with respect to y_center of all the corner points detected. (Final pipeline owing to robustness & simplicity even in tilted cases.)
- Fitting ellipse to the corner points and comparing with the moment of the corners to detect which way the arrowhead is pointed. (Very noisy when the arrow is slightly tilted).
- Also tried using Hough Lines Transform instead of cv2.goodFeaturesToTrack() and detected the arrow using the angle formed by the arrowhead lines. (Does not work when the arrow is tilted or warped.)

Green Arrow Orientation - https://youtu.be/AC22EwRHGFw

Analysis of hardware perfomance limitaions

Perfomance graphs are generated for each time step and corresponding histograms are shown below.





Hence, on an average the proposed Pipeline adds only ~0.5fps, Therefore, the perception module is more suitable for goal/object detection during path planning. For different pipelines, the noise and processing was slightly more than the final pipeline shown above.