



PROJECT

Shape*ShiftV3.0*

Team Members:

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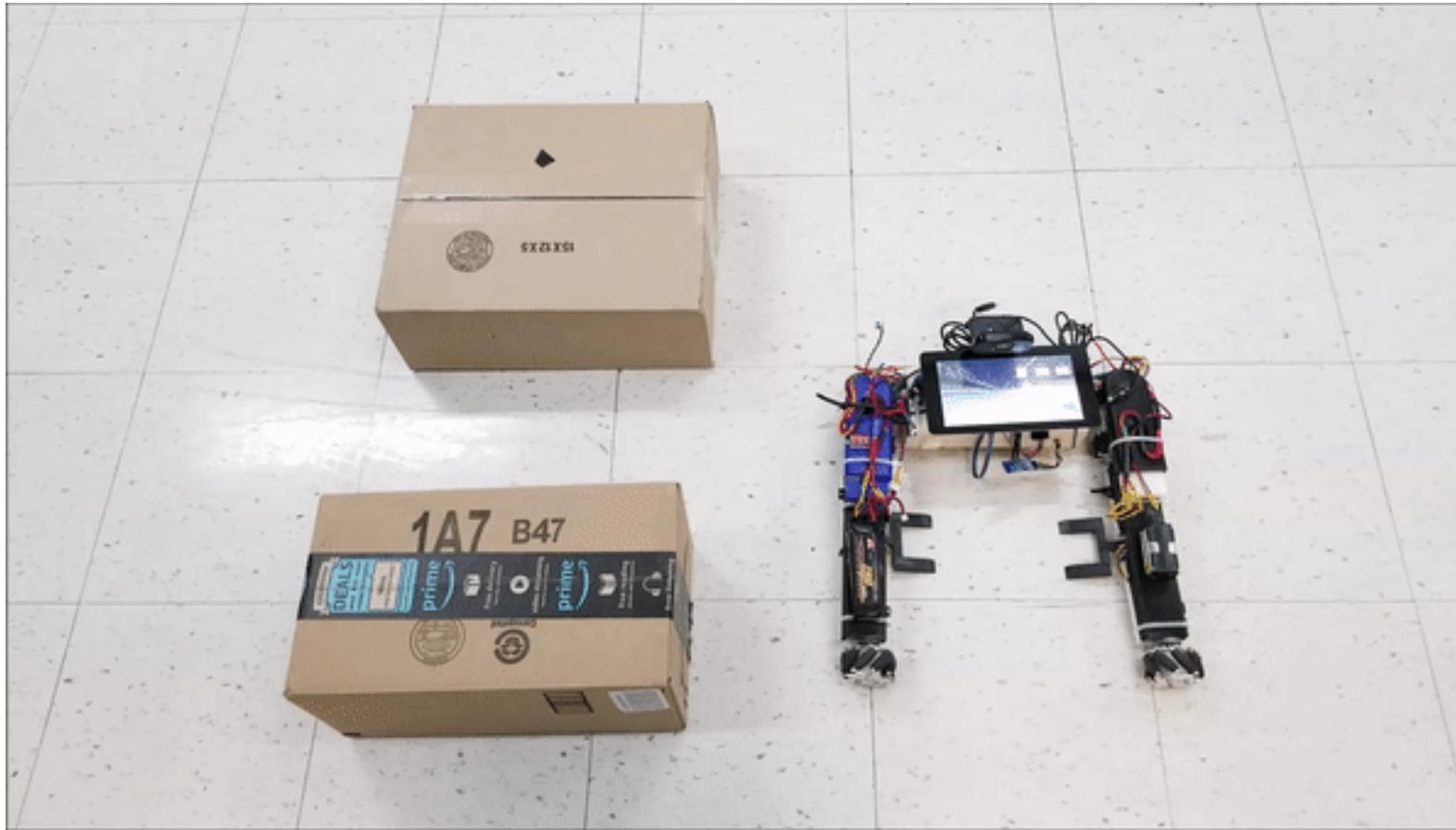
Project Overview

- The conventional robotic snakes are inefficient in locomotion and as the size of the robotic snake increases the complexity in controlling degree of freedom increases.





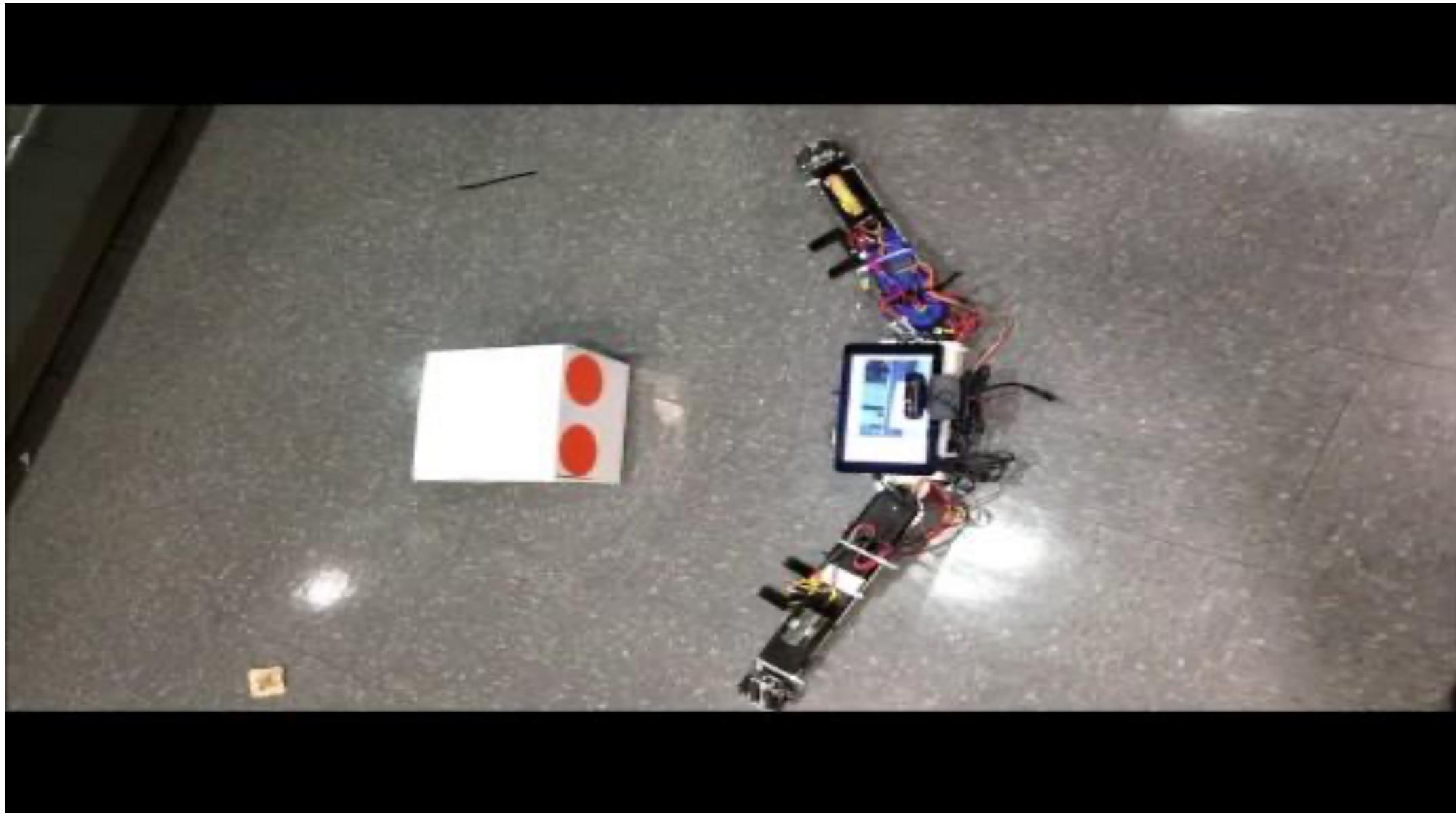
Why ShapeShift?





Manual vs Auto







Challenges

- The added weight resulted in less torque, which required to be replaced with high torque motors
- Brownout issue occurred due to single power source. A separate voltage source was supplied to Arduino.
- Color detection in different lighting conditions and backgrounds which was solved by applying fusion algorithm using different color spaces and then applying different filters.



Outdoor



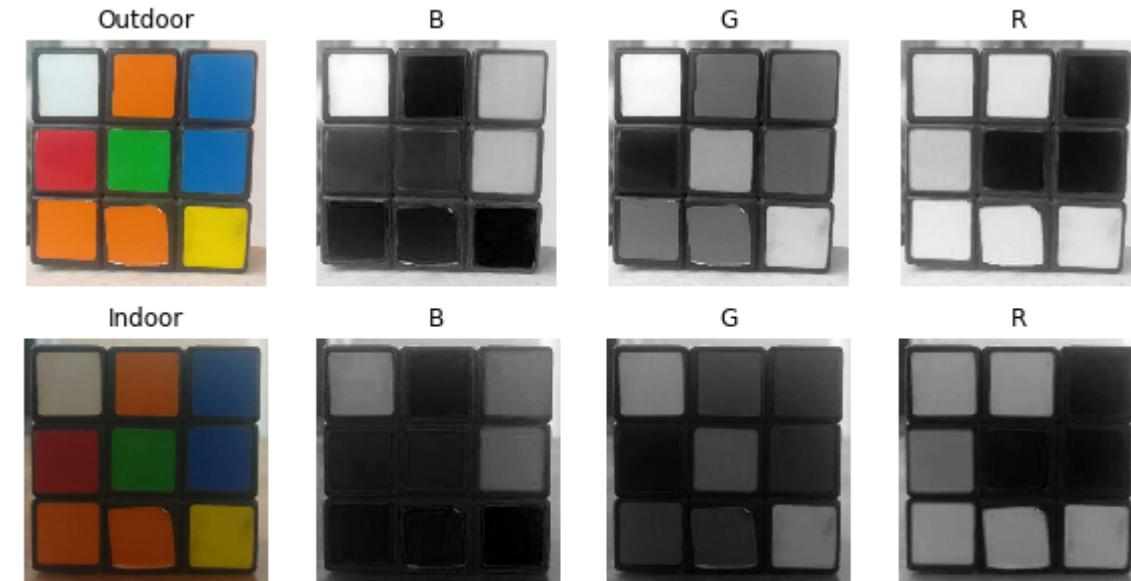
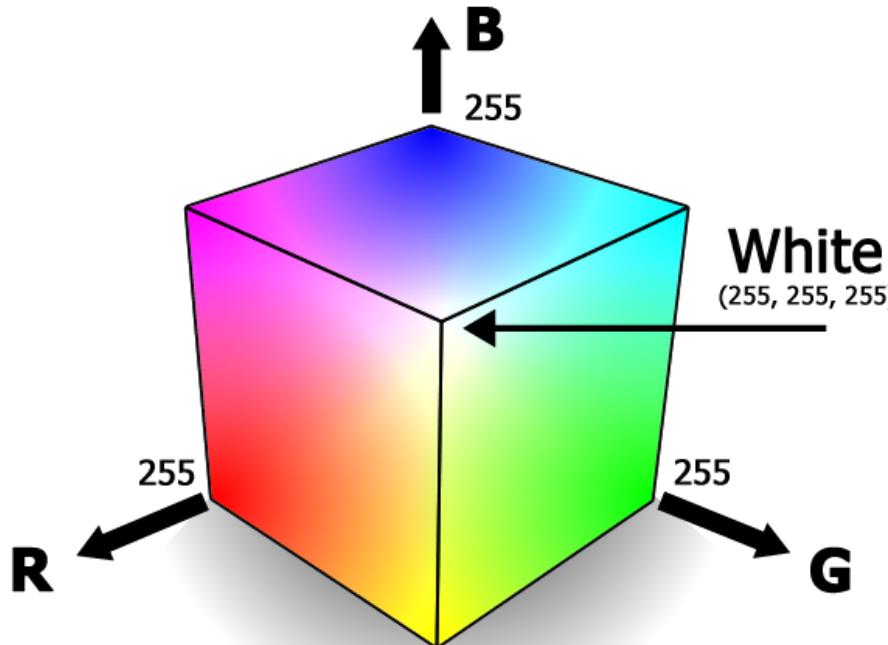
Indoor



Two images of the same cube taken under different illumination



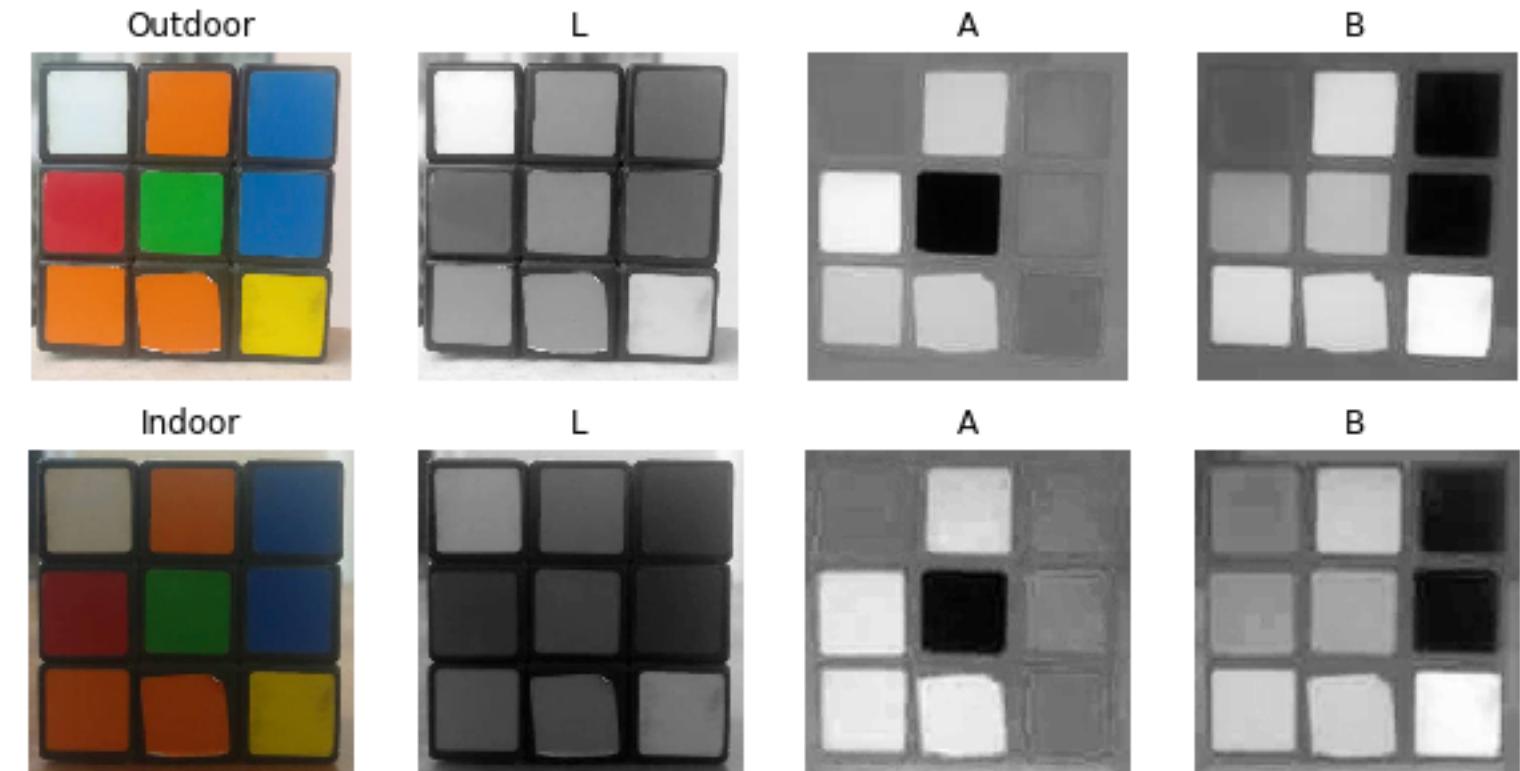
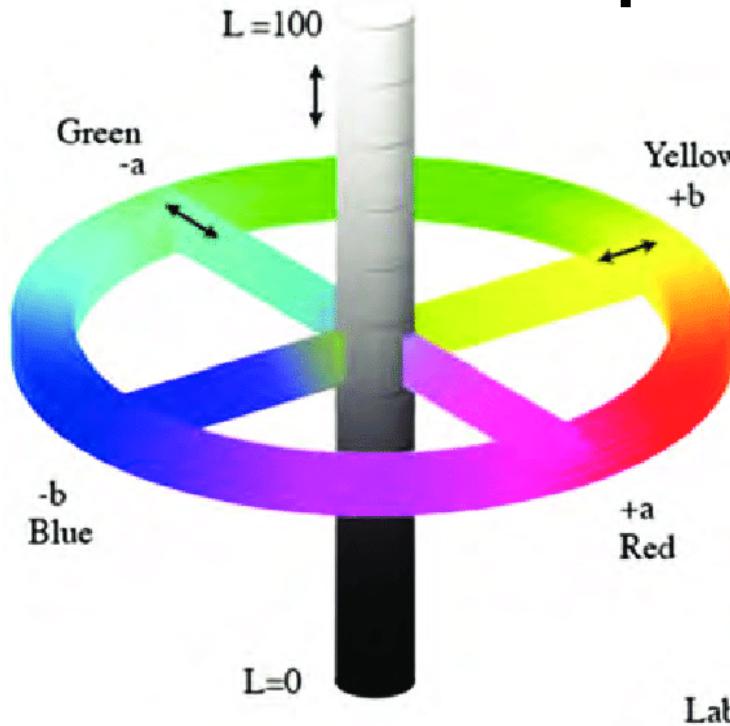
RGB Color Space



Different Channels Blue (B), Green (G), Red (R) of the RGB color space
shown separately



LAB Color Space



L – Lightness (Intensity).

a – color component ranging from Green to Magenta.

b – color component ranging from Blue to Yellow.

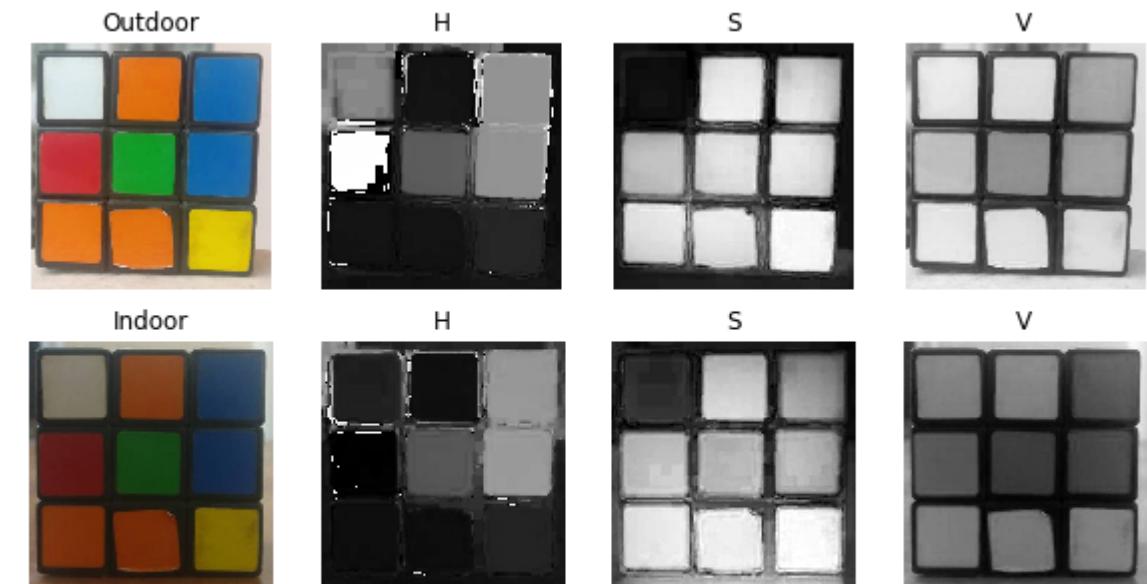
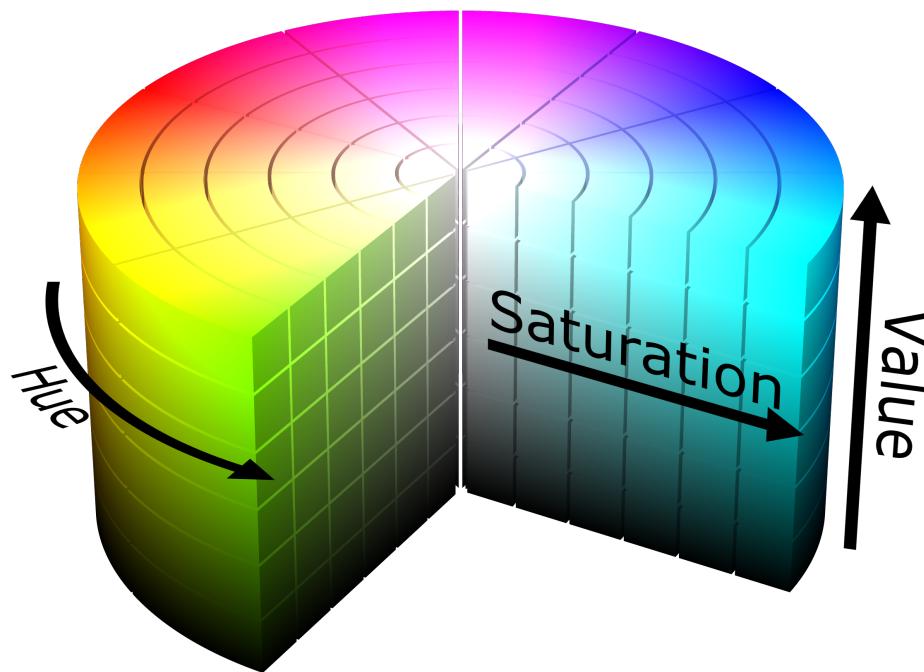
The Lightness (L), and color components (A, B) in LAB Color space.

References

https://www.researchgate.net/figure/Lab-color-coordinates-Photoscreenprintcom_fig1_319007940
<https://www.learnopencv.com/color-spaces-in-opencv-cpp-python/>



HSV Color Space

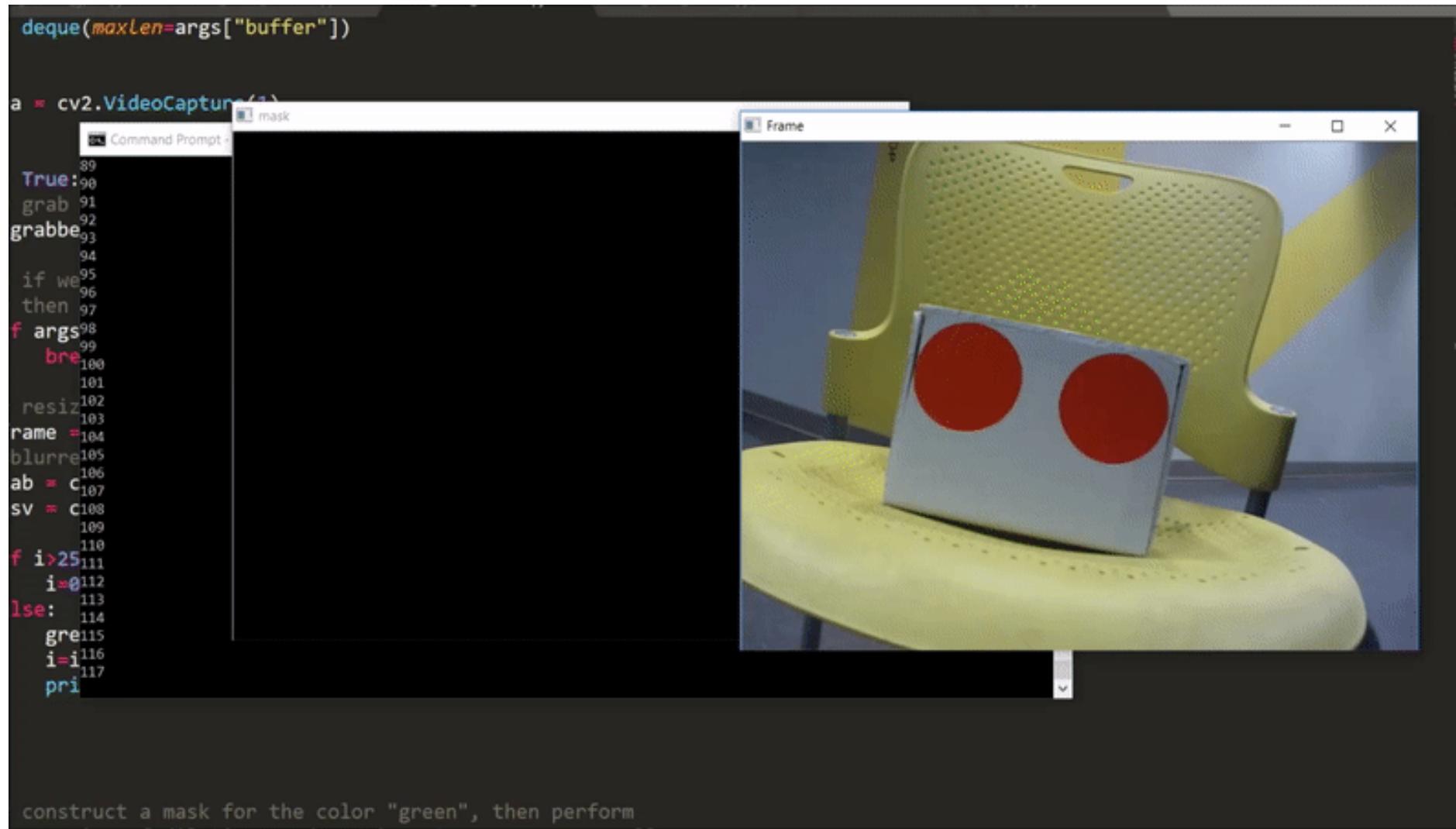


Hue (H), Saturation (S) and Value (V) components in HSV color space

1. H – Hue (Dominant Wavelength).
2. S – Saturation (Purity / shades of the color).
3. V – Value (Intensity).



Effect of varying the thresholds of different channels



The image shows a computer screen with a video frame and a code editor. The video frame, titled 'Frame', displays a yellow chair with a white rectangular object on its seat. The white object has two red circles on it. A small window titled 'mask' is overlaid on the video frame, showing a binary mask where the white object is white and the rest of the image is black. The code editor on the left contains Python code for image processing using OpenCV. The code is as follows:

```
deque(maxLen=args["buffer"])

a = cv2.VideoCapture("")

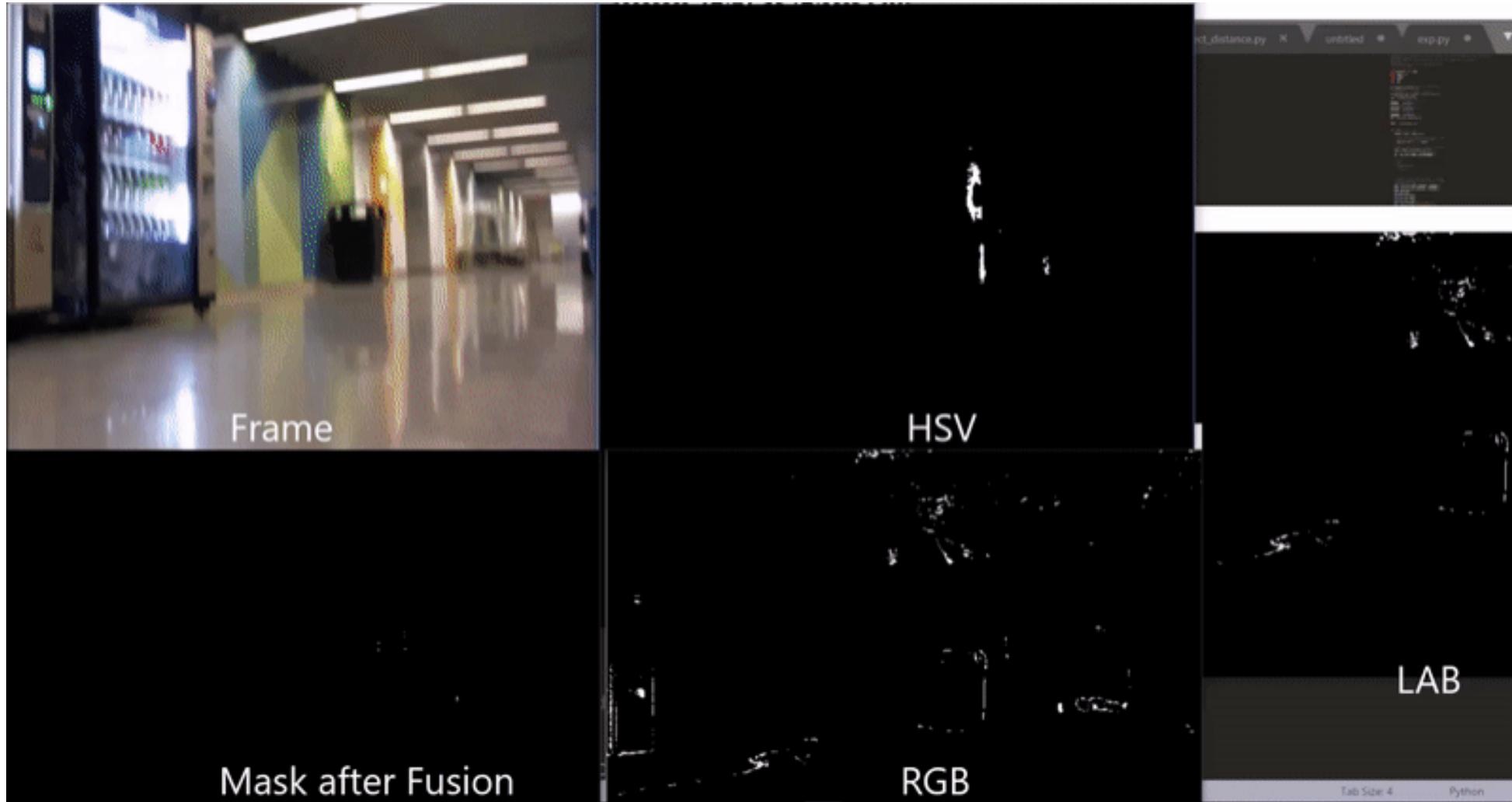
True:
grab
grabb
94
if we
then 97
f args
bre
100
101
resiz
name =
blurre
ab = c
sv = c
108
109
110
f i>25
i=0
111
112
lse:
113
gre
115
i=i
116
pri
117

construct a mask for the color "green", then perform
```

The code is incomplete, showing the start of a mask construction loop and a placeholder for a green mask.

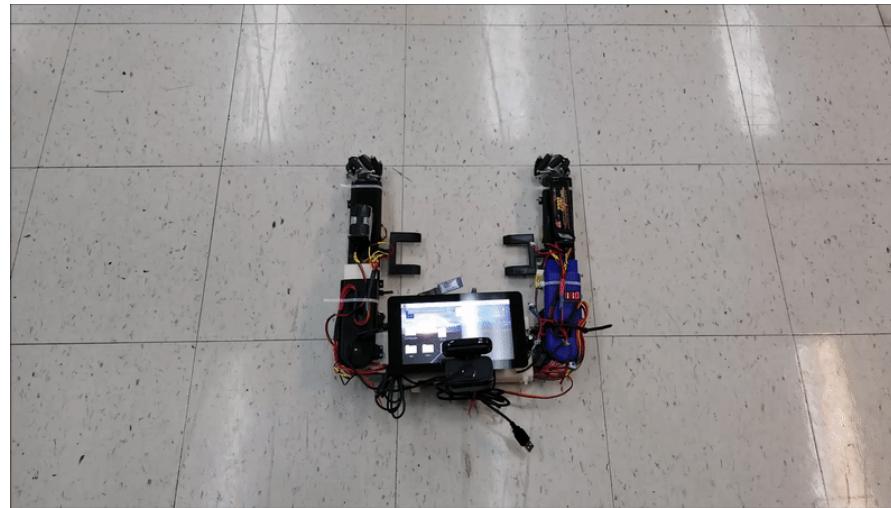
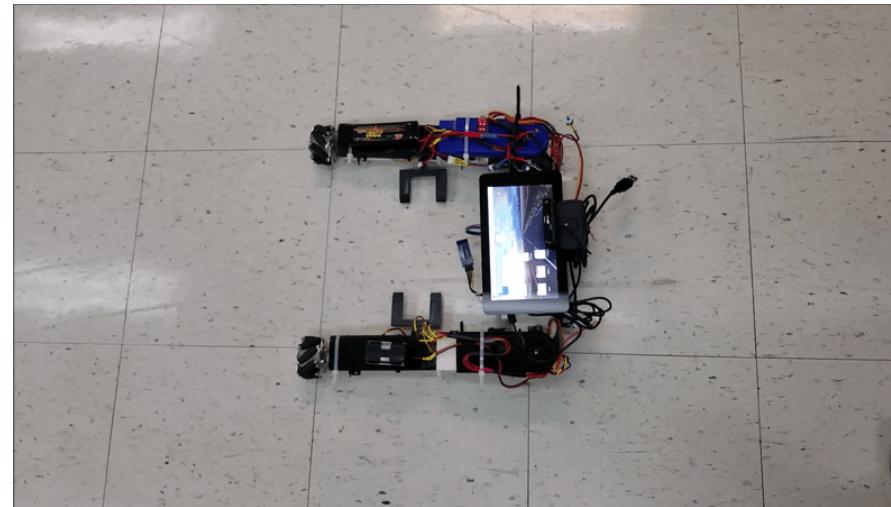


Color Space thresholding fusion



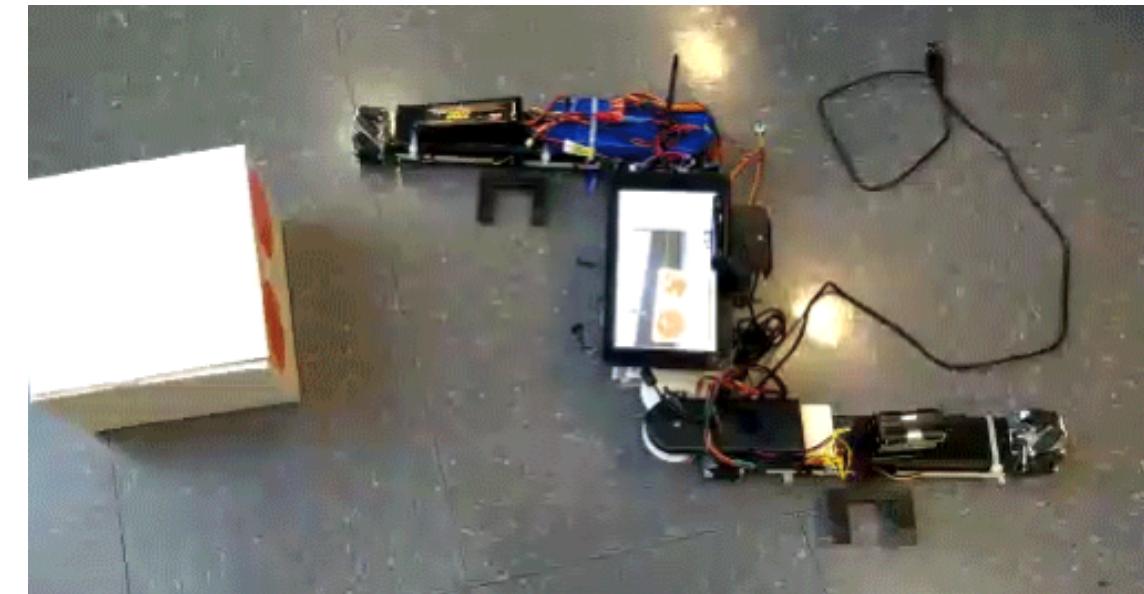


Possible Movements of Shape-Shift





Other Movements of Shape-Shift





Applications

- The bot can change shapes from conventional car mode to snake for ease in locomotion.
- The robotic snake has better dexterity which can aid in pipe inspections used in nuclear power plants, gas power plants and chemical plants.
- The bot can carry objects and deliver without physical human interventions.
- The bot can detect objects autonomously and pick it using forklift for transportation.



Thank You

ありがとう
спасибо
obrigado
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gràcies
OFRADA
Merci
ΔЗЯКУЙ
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grazie
謝謝
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