2022

Image Processing

PHASE I SUBMISSION

Team Members

Name	ID
Heba Mahmoud Abd Elhafez Bakry	1900402
Ahmed Elsayed Rashad Mohamed	1900730
Nada Amin Abdelsattar Ali	1900594
Mariam samir wassef	1900313
Jumana Emad Eldin Saleh Mohamed Elhak	1900980

Pipelining And Algorithm used:

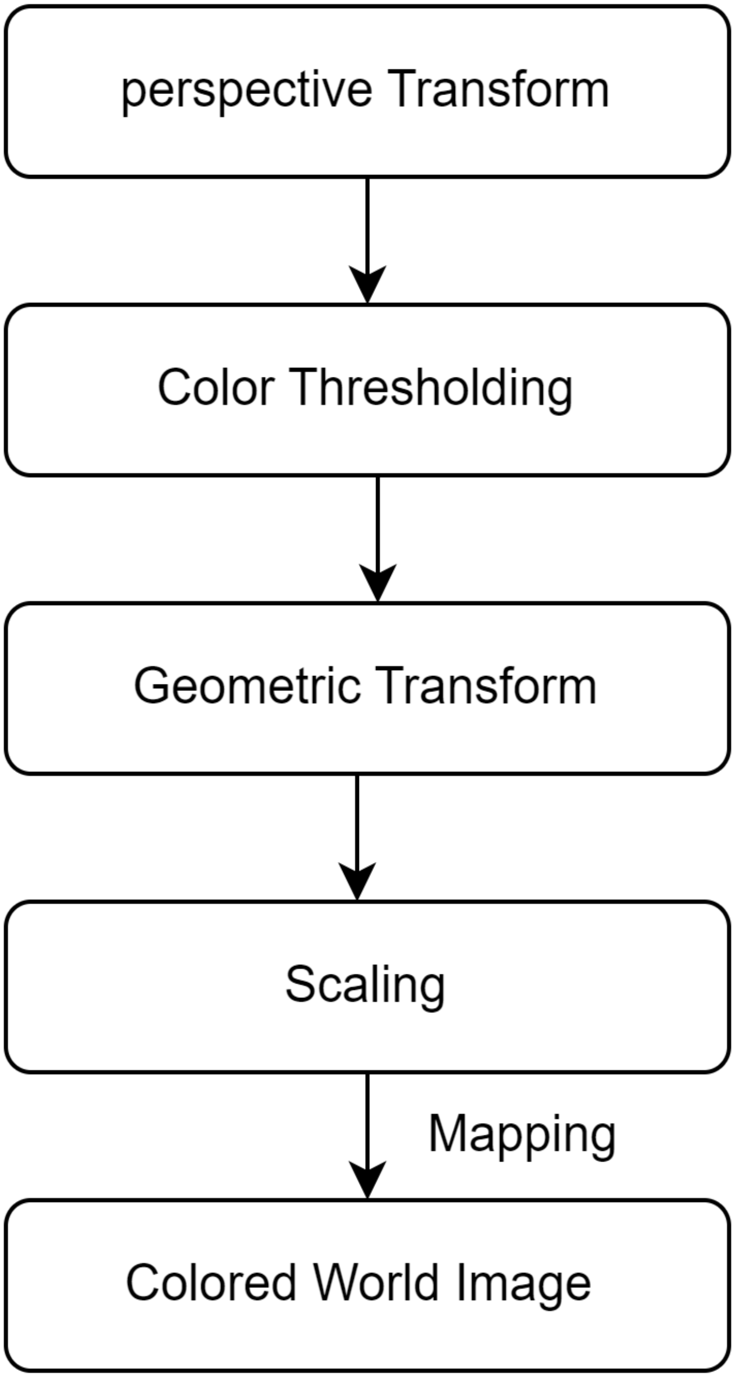
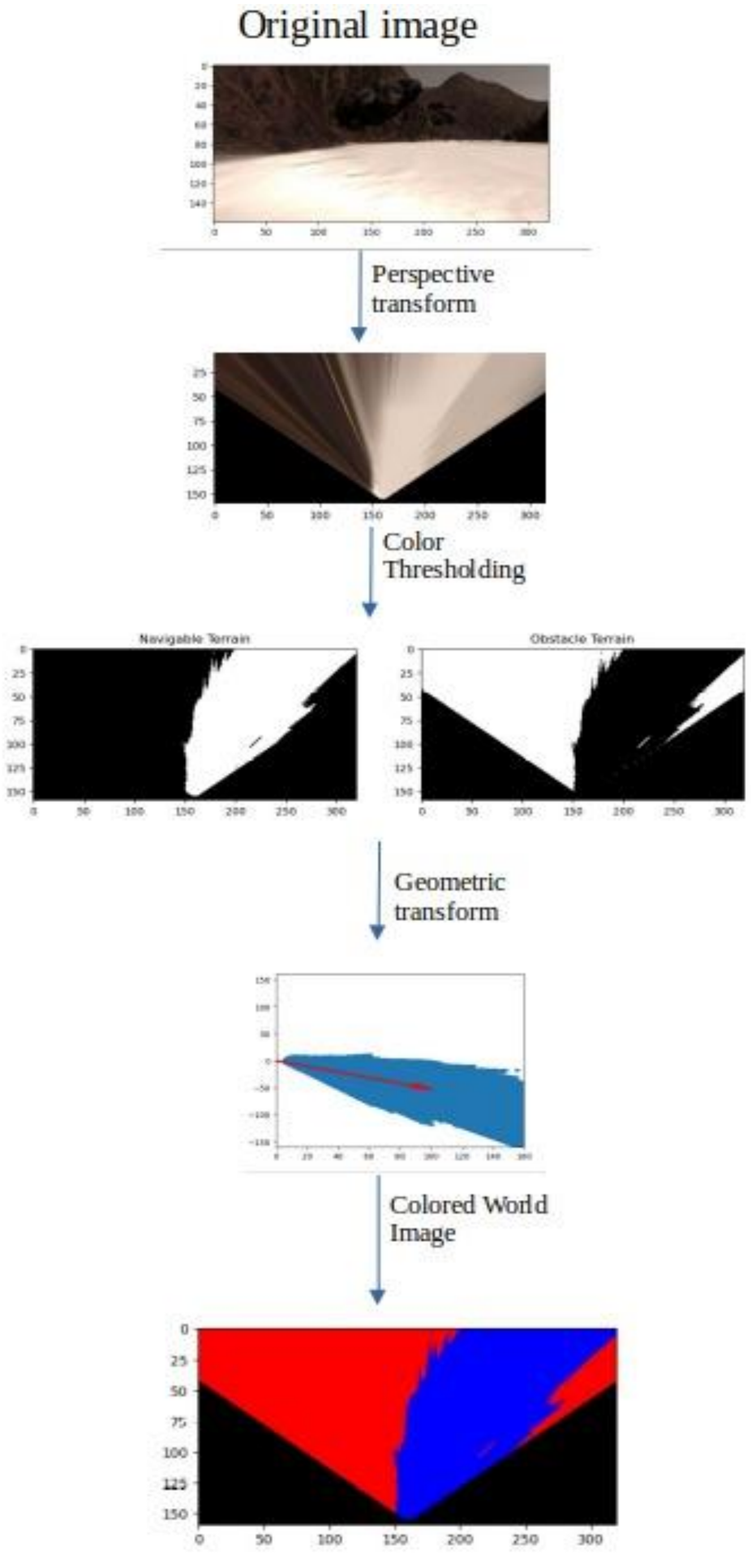
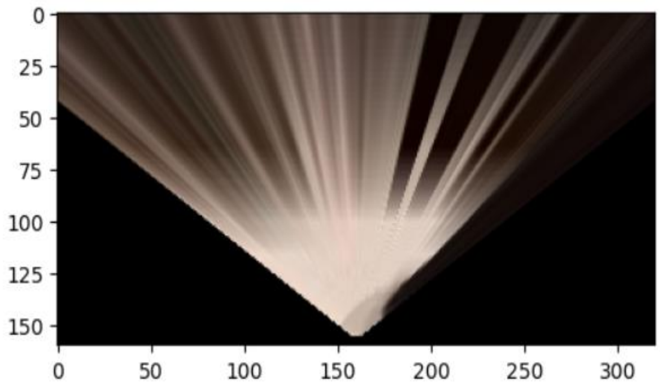


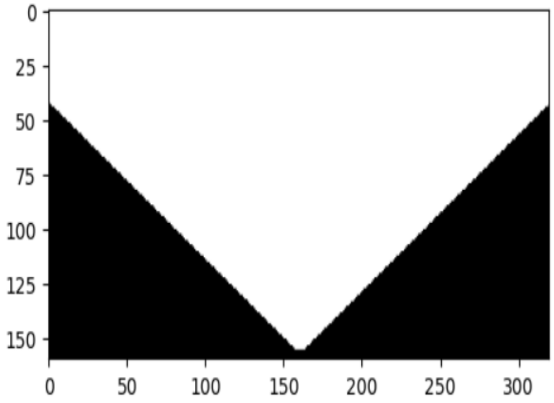
Image outputs:



Perspective Transform:

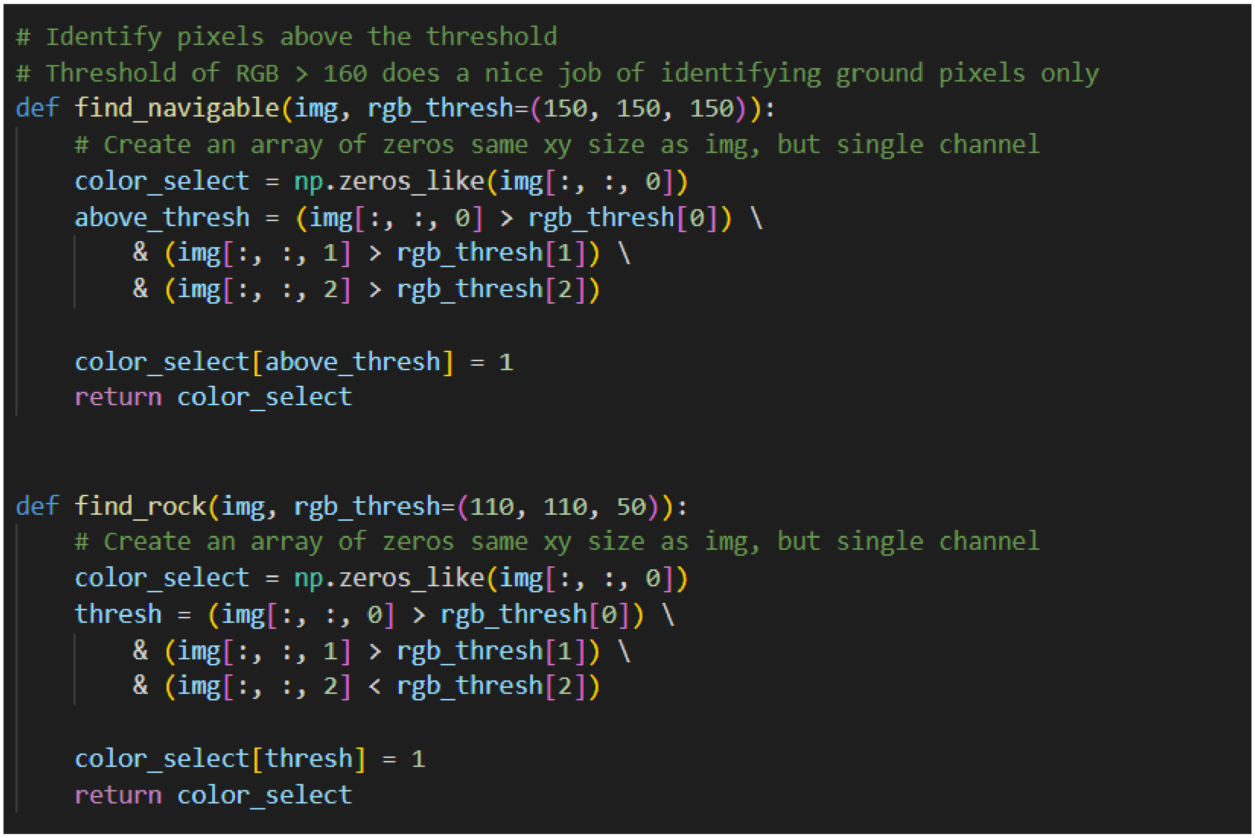
It is used to warp the image to top-down view before thresholding and by mask, we could ignore the pixels out of the field of view (the two dark triangular areas on the bottom left and right).





Color Thresholding:

it's used to identify navigable terrain,obstacles and rock samples



```python
# Identify pixels above the threshold
# Threshold of RGB > 160 does a nice job of identifying ground pixels only
def find_navigable(img, rgb_thresh=(150, 150, 150)):
    # Create an array of zeros same xy size as img, but single channel
    color_select = np.zeros_like(img[:, :, 0])
    above_thresh = (img[:, :, 0] > rgb_thresh[0]) \
        & (img[:, :, 1] > rgb_thresh[1]) \
        & (img[:, :, 2] > rgb_thresh[2])

    color_select[above_thresh] = 1
    return color_select


def find_rock(img, rgb_thresh=(110, 110, 50)):
    # Create an array of zeros same xy size as img, but single channel
    color_select = np.zeros_like(img[:, :, 0])
    thresh = (img[:, :, 0] > rgb_thresh[0]) \
        & (img[:, :, 1] > rgb_thresh[1]) \
        & (img[:, :, 2] < rgb_thresh[2])

    color_select[thresh] = 1
    return color_select
```

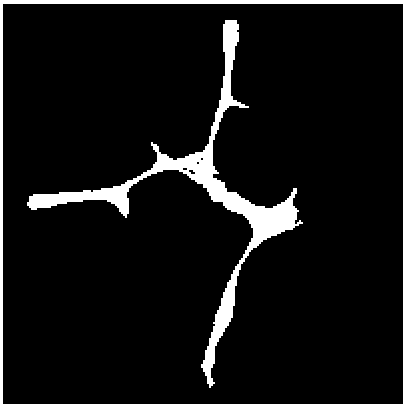
Apply color threshold to identify navigable terrain/obstacles/rock samples

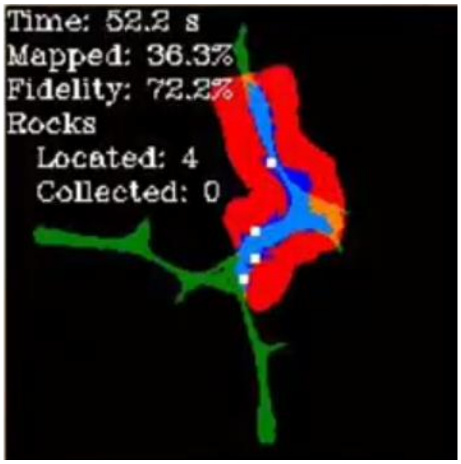
obstacles are defined as the absolute of navigableterrain-1 multiplied by the mask that we defined previously that removes the pixels that are not in the view of the rover’s camera; that we are not interested in.

for the vision image:

warped image channels are used to give the objects their color

to form the colored image instead of the black and white image





Time: 52.2 s
Mapped: 36.3%
Fidelity: 72.2%
Rocks
Located: 4
Collected: 0

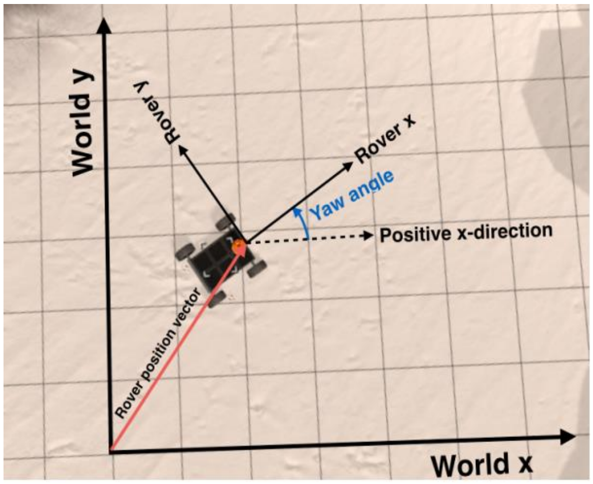
Geometric Transformation:

We have used some transformations to map the vision of our Rover to the World map and these transformations will be illustrated with the same sequence have been used.

1. Rotation:
   Using this transformation to
   Get the projection of the Rover coordinates on the world map using the angle called Yew to calculate this projection

- Rotation in a matrix form

$$\begin{bmatrix} x_2 \\ y_2 \end{bmatrix} = \begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \end{bmatrix}$$



2. Translation:

   Using translation to move the coordinates of the Rover to the origin of the world map using mathematical form of the Translation.

- Translation in a matrix form

$$\begin{bmatrix} x_2 \\ y_2 \end{bmatrix} = \begin{bmatrix} x_1 \\ y_1 \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$$