Assignment 1

1. Camera Calibration:

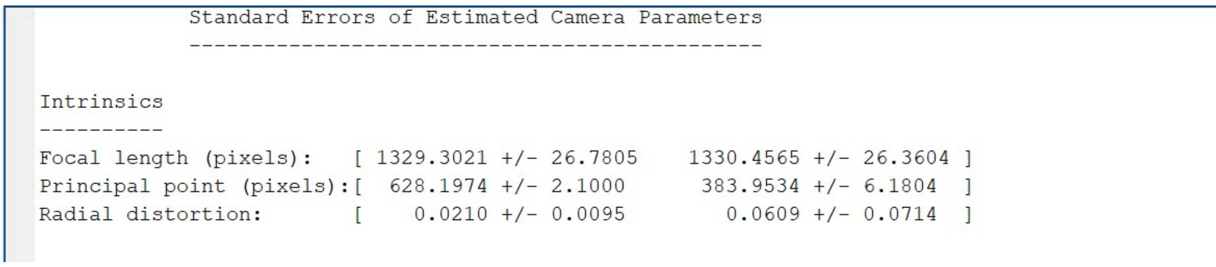
For camera calibration we have chosen a chess board of a square size 19.50 mm and placed it at a distance of 939.8 mm

Calibrating the camera using matlab.

```
% Auto-generated by cameraCalibrator app on 25-Sep-2022
%-------------------------------------------------------


% Define images to process
imageFileNames = {'E:\GSU\CV\new_worked imqgew\image1.jpg',...
    'E:\GSU\CV\new_worked imqgew\image2.jpg',...
    'E:\GSU\CV\new_worked imqgew\image3.jpg',...
    'E:\GSU\CV\new_worked imqgew\image4.jpg',...
    'E:\GSU\CV\new_worked imqgew\image5.jpg',...
    'E:\GSU\CV\new_worked imqgew\image6.jpg',...
    'E:\GSU\CV\new_worked imqgew\image7.jpg',...
    'E:\GSU\CV\new_worked imqgew\image10.jpg',...
    'E:\GSU\CV\new_worked imqgew\image13.jpg',...
    'E:\GSU\CV\new_worked imqgew\image14.jpg',...
    'E:\GSU\CV\new_worked imqgew\image15.jpg',...
    'E:\GSU\CV\new_worked imqgew\image18.jpg',...
    'E:\GSU\CV\new_worked imqgew\image19.jpg',...
    'E:\GSU\CV\new_worked imqgew\image20.jpg',...
    };
% Detect calibration pattern in images
detector = vision.calibration.monocular.CheckerboardDetector();
[imagePoints, imagesUsed] = detectPatternPoints(detector,
imageFileNames);
imageFileNames = imageFileNames(imagesUsed);

% Read the first image to obtain image size
originalImage = imread(imageFileNames{1});
[mrows, ncols, ~] = size(originalImage);

% Generate world coordinates for the planar pattern keypoints
squareSize = 1.950000e+01;  % in units of 'millimeters'
worldPoints = generateWorldPoints(detector, 'SquareSize', squareSize);

% Calibrate the camera
[cameraParams, imagesUsed, estimationErrors] =
estimateCameraParameters(imagePoints, worldPoints, ...
    'EstimateSkew', false, 'EstimateTangentialDistortion', false, ...
    'NumRadialDistortionCoefficients', 2, 'WorldUnits', 'millimeters',
...
    'InitialIntrinsicMatrix', [], 'InitialRadialDistortion', [], ...
    'ImageSize', [mrows, ncols]);

% View reprojection errors
h1=figure; showReprojectionErrors(cameraParams);
```

```
% Visualize pattern locations
h2=figure; showExtrinsics(cameraParams, 'CameraCentric');

% Display parameter estimation errors
displayErrors(estimationErrors, cameraParams);

% For example, you can use the calibration data to remove effects of
lens distortion.
undistortedImage = undistortImage(originalImage, cameraParams);

% See additional examples of how to use the calibration data.  At the
prompt type:
% showdemo('MeasuringPlanarObjectsExample')
% showdemo('StructureFromMotionExample')
```

Output:



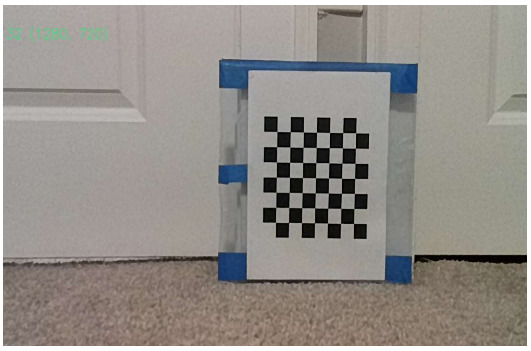
```
            Standard Errors of Estimated Camera Parameters
            ----------------------------------------------

Intrinsics
----------
Focal length (pixels):    [ 1329.3021 +/- 26.7805     1330.4565 +/- 26.3604 ]
Principal point (pixels):[  628.1974 +/- 2.1000       383.9534 +/- 6.1804  ]
Radial distortion:        [    0.0210 +/- 0.0095        0.0609 +/- 0.0714  ]
```

Part B

Question 2

Code:

```
I=imread("E:\GSU\CV\new_worked imqgew\image1.jpg")
imshow(I)
[x,y]=ginput(2)
z_dist=939.8
fx=1329.3020
fy=1330.4565
x1=z*(x(1)/fx)
x2=z*(x(2)/fx)
y1=z*(y(1)/fy)
y2=z*(y(2)/fy)
distance=sqrt((y2-y1)^2+(x2-x1)^2)
fprintf("Estimated distance B/W the 2 points",distance)
```



O/P

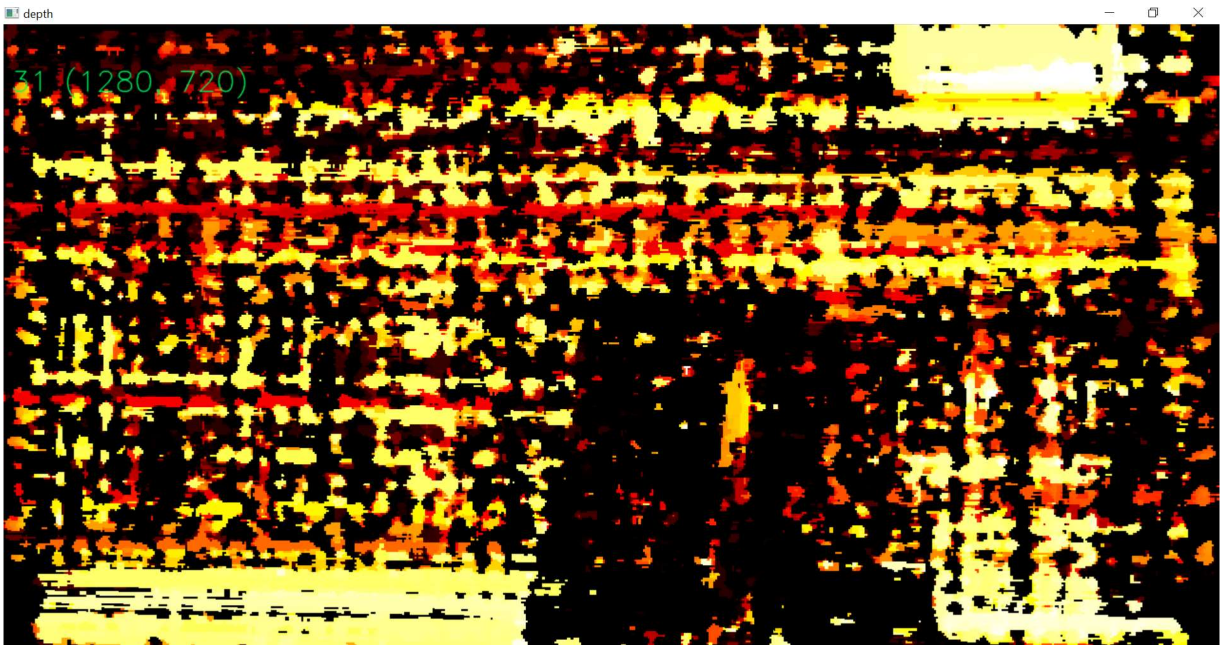
Estimated distance B/W the 2 points 32.9802 mm

Original distance is 31.75 mm

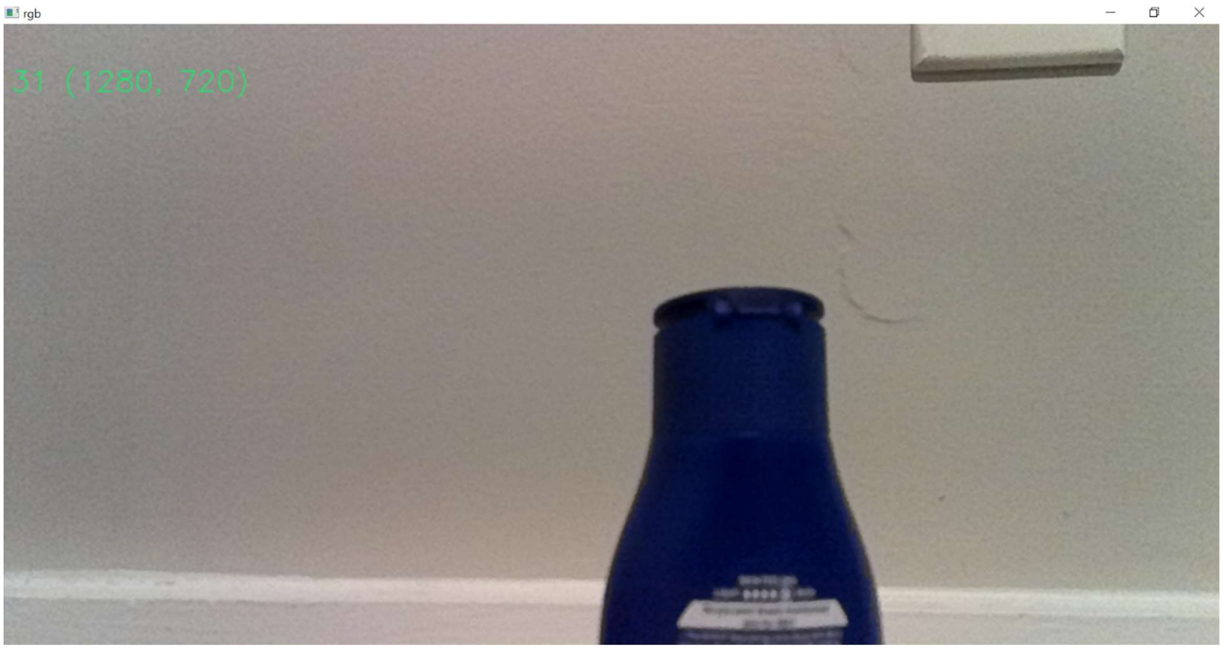
Part 3:

Question 3

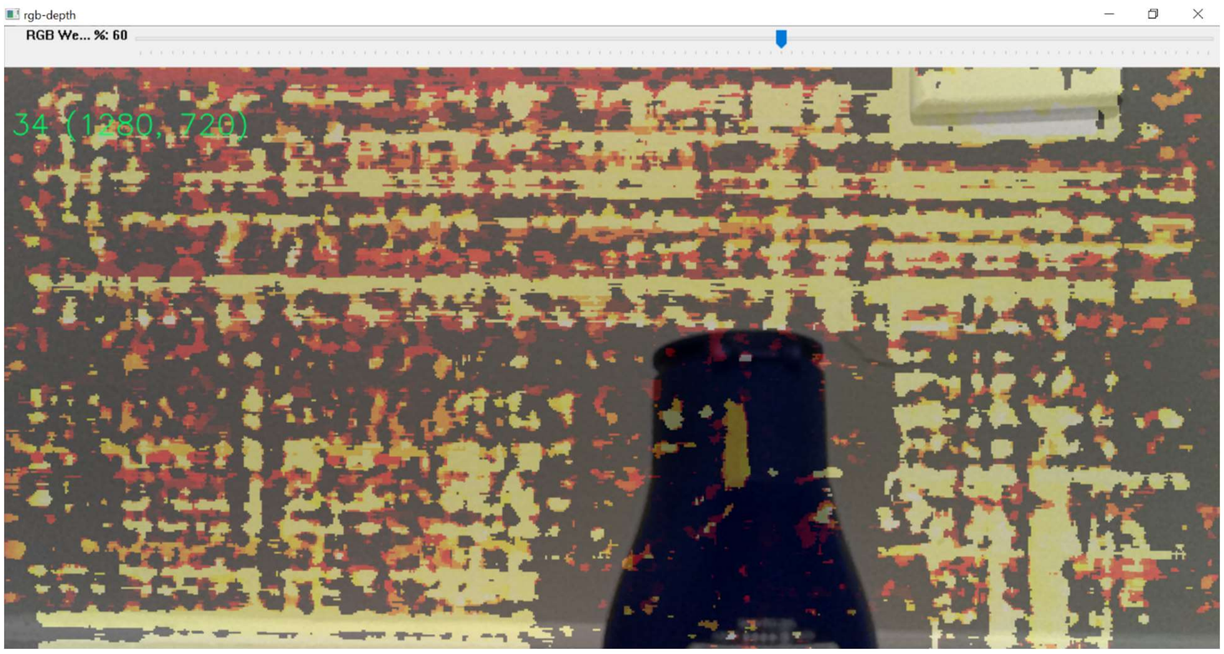
Yes, it is feasible to run both stereo camera and mono camera simultaneously



Depth Map



RBG image



Combination Of both rgb and depth Map

Maximum 34 fps
1280 720 resolution(720p)

Video link
https://drive.google.com/file/d/1JujT9_UjpocDn0CMJP69wXNX5Fz9gXy-/view

Github link

https://github.com/harshithkamisetty/Compuer_Vision