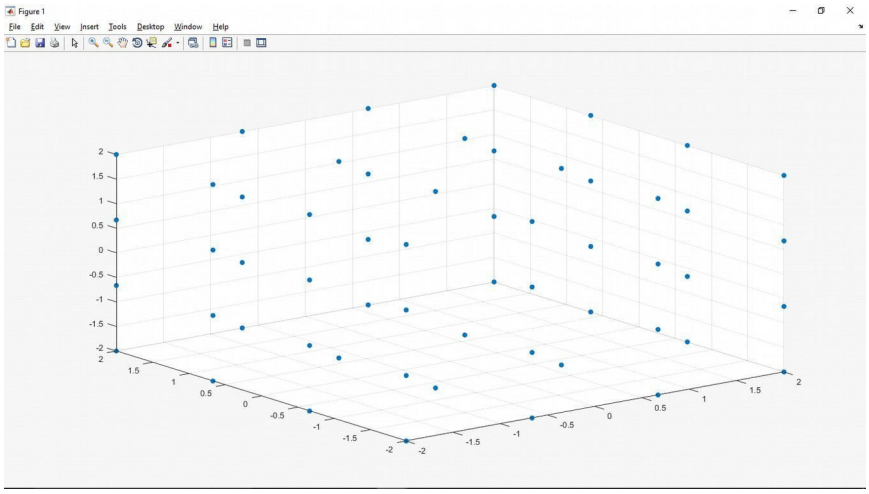
Part 1: Rigid Body Transformation

In this first the given length was divided such that there is equal distances between all the N points that line on a row/cloums

Now simple loop was run to get the coordinates of the points on the surface of the cube and not inside it .

The result was stored in *cube_pts_world* as mentioned

The below result is after using *scatter_plot* on the variable mentoind above.



First the homogeneous matrices were calculated using methods discussed in class .

Rotation was taken about Y axis and the matrix corresponding to it was taken

The matrices were like ->

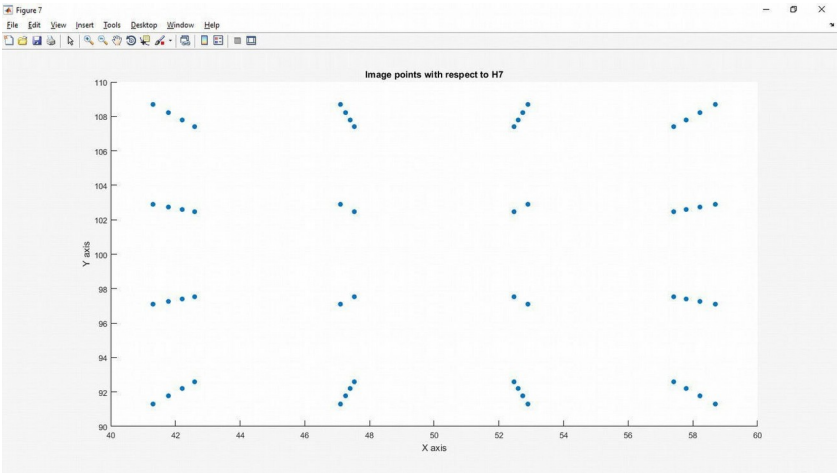
```
[R|t] =
[cosd(90+i*45),0,sind(90+i*45),0;

 0,1,0,0;
-sind(90+i*45),0,cosd(90+i*45),25]
```

To this `[0,0,0,1]` was padded in the end and was stored as "*H*" .

After that the cube was generated and corresponding homogeneous matrix was multiplied with the corresponding world frame coordinate to get the Camera frame coordinates.

The result was plotted using Scatter 3D and the result is as shown below



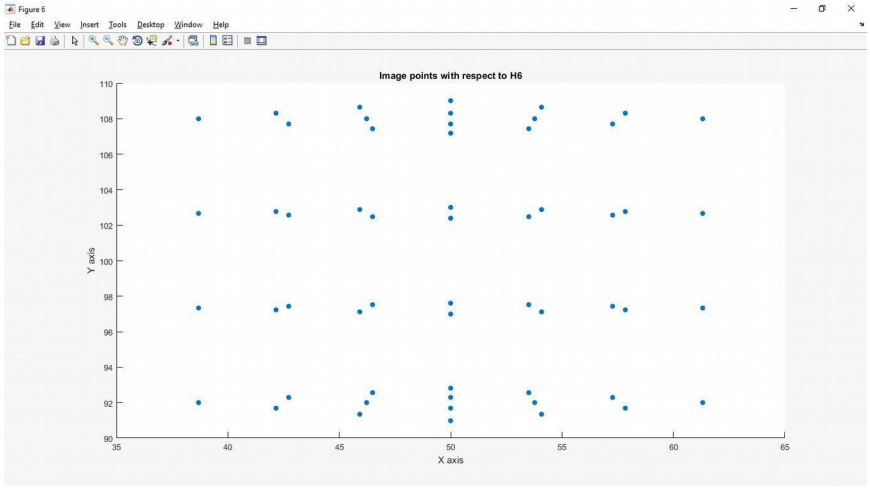


Figure 6
File Edit View Insert Tools Desktop Window Help
Image points with respect to H6
Y axis
X axis
110
108
106
104
102
100
98
96
94
92
90
35
40
45
50
55
60
65

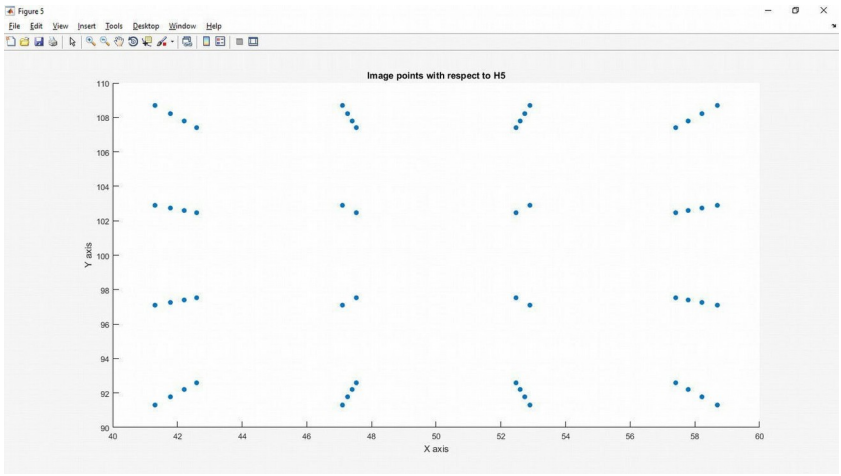


Figure 5
File Edit View Insert Tools Desktop Window Help
Image points with respect to H5
Y axis
X axis
110
108
106
104
102
100
98
96
94
92
90
40
42
44
46
48
50
52
54
56
58
60

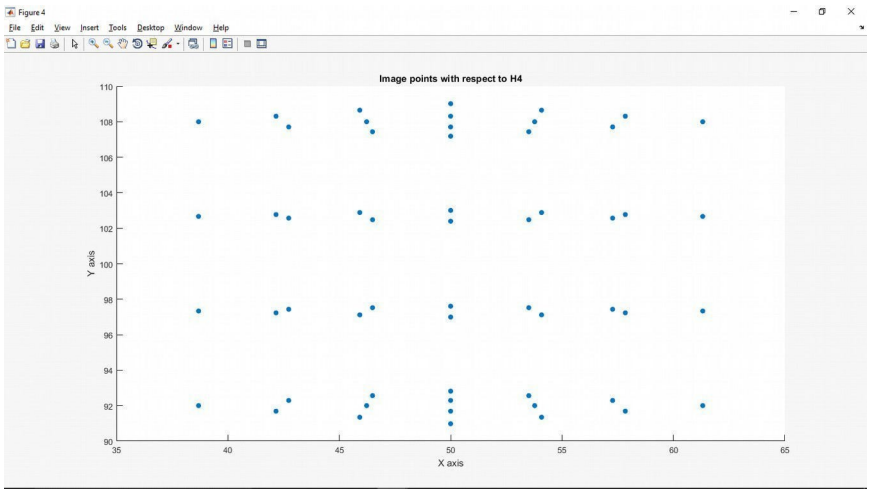


Figure 4
File Edit View Insert Tools Desktop Window Help
Image points with respect to H4
Y axis
X axis
110
108
106
104
102
100
98
96
94
92
90
35
40
45
50
55
60
65

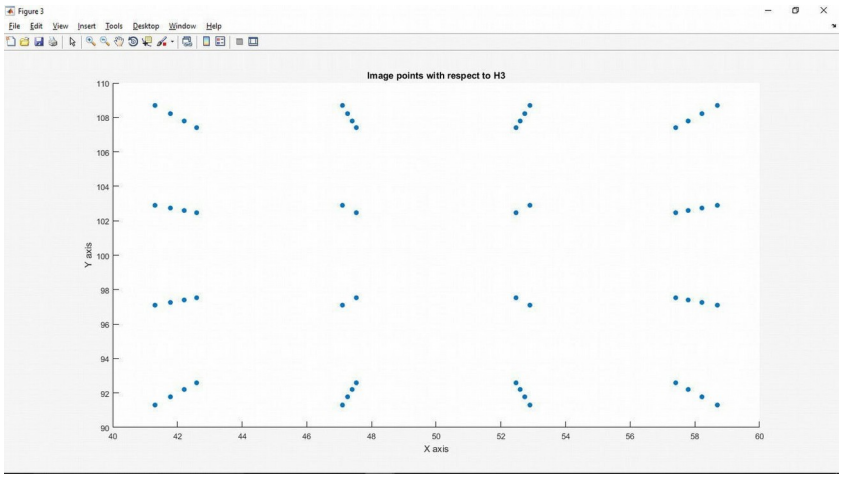


Figure 3
File Edit View Insert Tools Desktop Window Help
Image points with respect to H3
Y axis
X axis
110
108
106
104
102
100
98
96
94
92
90
40
42
44
46
48
50
52
54
56
58
60

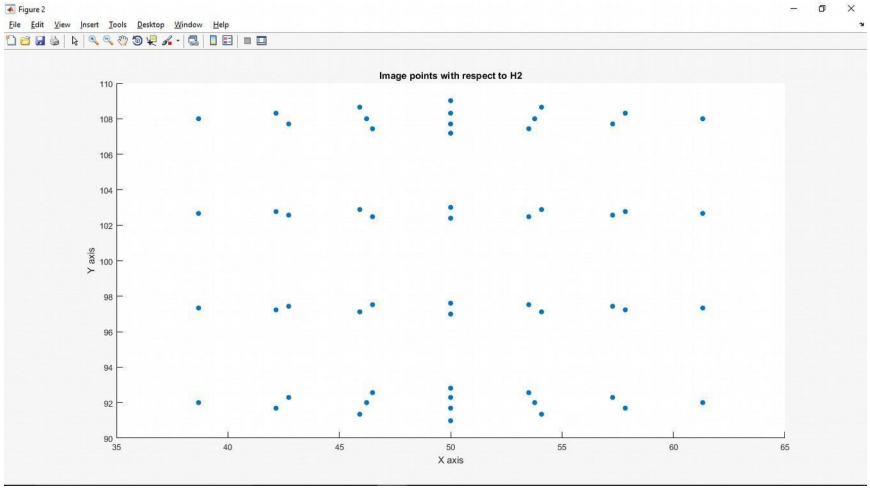


Figure 2
File Edit View Insert Tools Desktop Window Help
Image points with respect to H2
Y axis
X axis
110
108
106
104
102
100
98
96
94
92
90
35
40
45
50
55
60
65

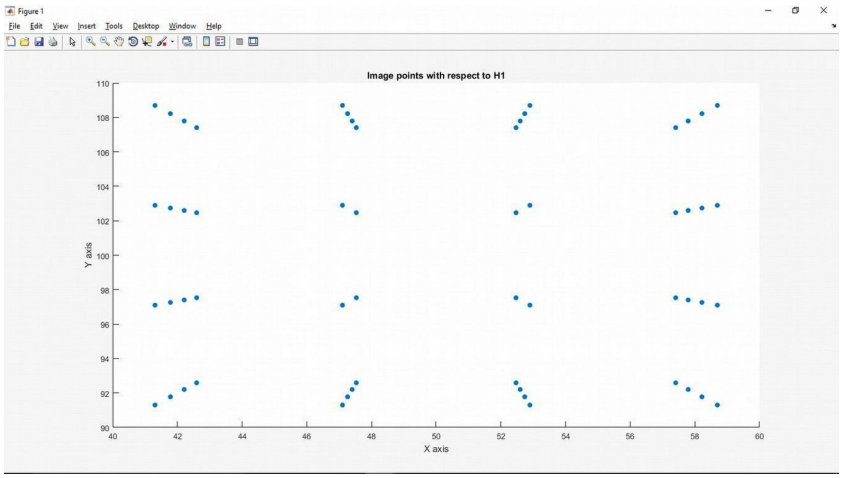
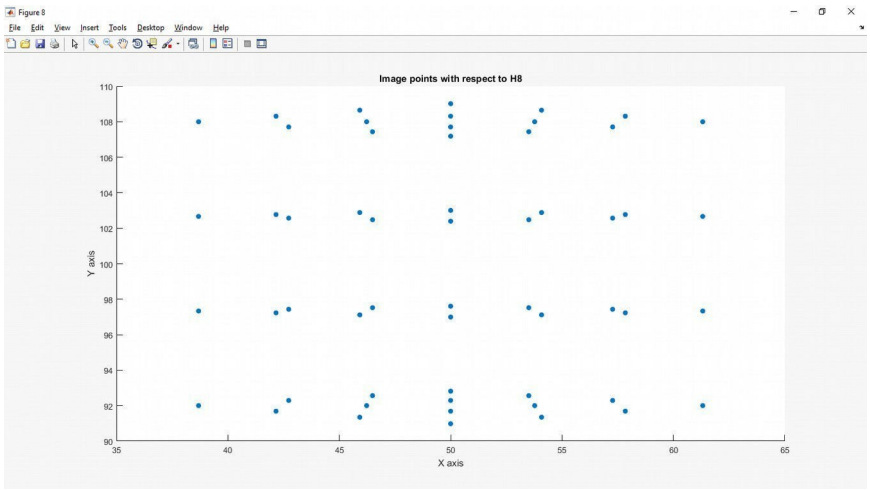


Figure 1
File Edit View Insert Tools Desktop Window Help
Image points with respect to H1
Y axis
X axis
110
108
106
104
102
100
98
96
94
92
90
40
42
44
46
48
50
52
54
56
58
60



1)Section 2: Your camera calibration toolbox!

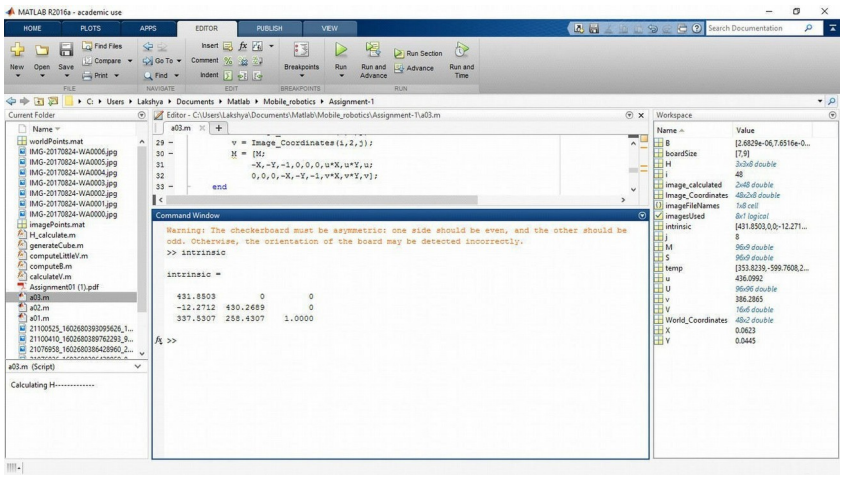
The method used to calcualte the intrinsic of the camera was as discussed in class using Zhangs Algorithm.Three images at various orientations was taken and the World Coordinates of some points were taken.

Then in each image corresponding to each Worl Coordinate its image coordinate was calculated . Minumum of 4 points were required here. We took 48 points for the same.

Then for each image Homogenous matrix was calculated using SVD.

Using this Homogenous matrices matrix B was calculated using SVD and then Intrinsic parametes were calculated using Choloesky decompostion and then inverse transpose of the ans.

Given below is a screen shot of the homogenous matrix obtained.


MATLAB R2016a - academic use
HOME
PLOTS
APPS
EDITOR
PUBLISH
VIEW
Search Documentation
New
Open
Save
Find Files
Compare
Print
Go To
Find
Insert
Comment
Indent
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
FILE
NAVIGATE
EDIT
BREAKPOINTS
RUN
C: ▸ Users ▸ Lakshya ▸ Documents ▸ Matlab ▸ Mobile_robotics ▸ Assignment-1
Current Folder
Name
worldPoints.mat
IMG-20170824-WA0006.jpg
IMG-20170824-WA0005.jpg
IMG-20170824-WA0004.jpg
IMG-20170824-WA0003.jpg
IMG-20170824-WA0002.jpg
IMG-20170824-WA0001.jpg
IMG-20170824-WA0000.jpg
imagePoints.mat
H_calculate.m
generateCube.m
computeLittleV.m
computeB.m
calculateV.m
Assignment01 (1).pdf
a03.m
a02.m
a01.m
21100525_1602680393095626_1...
21100410_1602680389762293_9...
21076958_1602680386428960_2...
a03.m (Script)
Calculating H----------
Editor - C:\Users\Lakshya\Documents\Matlab\Mobile_robotics\Assignment-1\a03.m
a03.m
29 – v = Image_Coordinates(i,2,j);
30 – M = [M;
31 -X,-Y,-1,0,0,0,u*X,u*Y,u;
32 0,0,0,-X,-Y,-1,v*X,v*Y,v];
33 – end
Command Window
Warning: The checkerboard must be asymmetric: one side should be even, and the other should be odd. Otherwise, the orientation of the board may be detected incorrectly.
>> intrinsic
intrinsic =
431.8503 0 0
-12.2712 430.2689 0
337.5307 258.4307 1.0000
fx >>
Workspace
Name
Value
B [2.6829e-06,7.6516e-0...
boardSize [7,9]
H 3x3x8 double
i 48
image_calculated 2x48 double
Image_Coordinates 48x2x8 double
imageFileNames 1x8 cell
imagesUsed 8x1 logical
intrinsic [431.8503,0,0;-12.271...
j 8
M 96x9 double
S 96x9 double
temp [353.8239,-599.7608,2...
u 436.0992
U 96x96 double
v 386.2865
V 16x6 double
World_Coordinates 48x2 double
X 0.0623
Y 0.0445