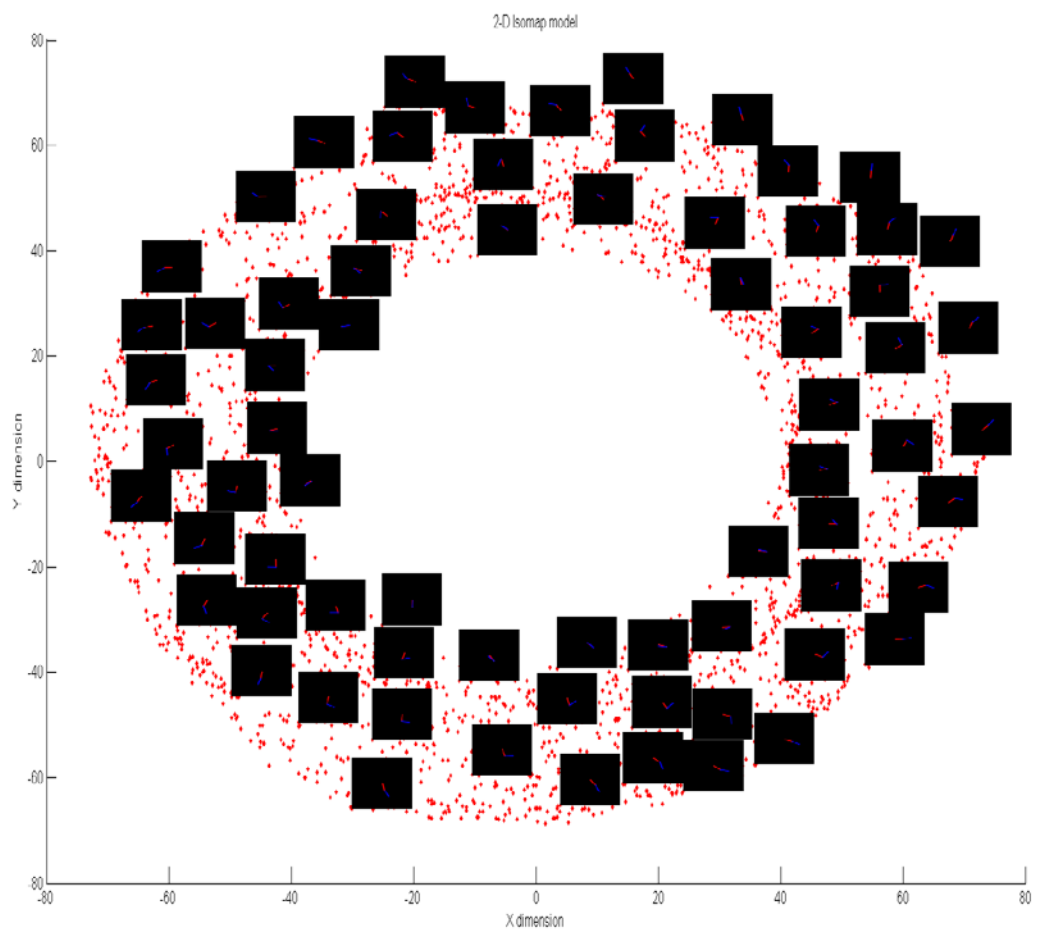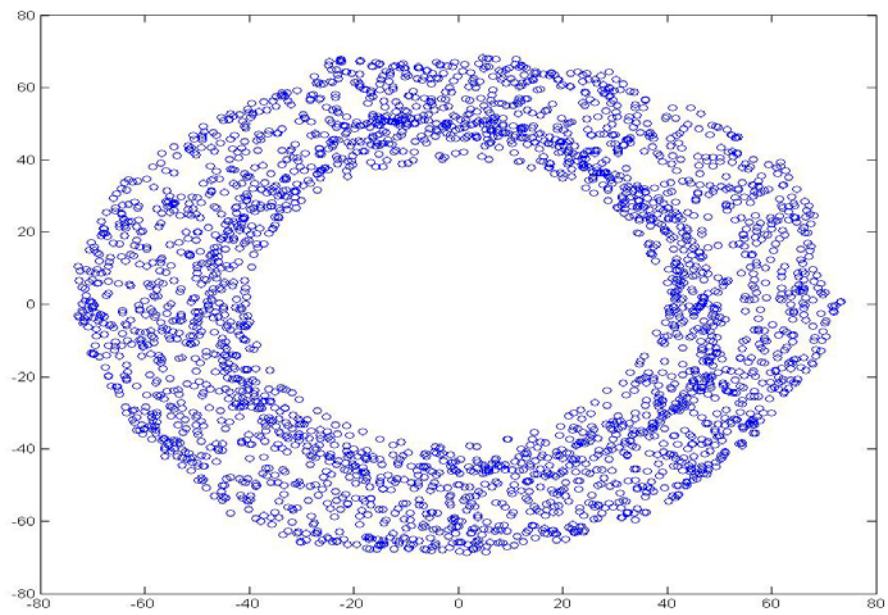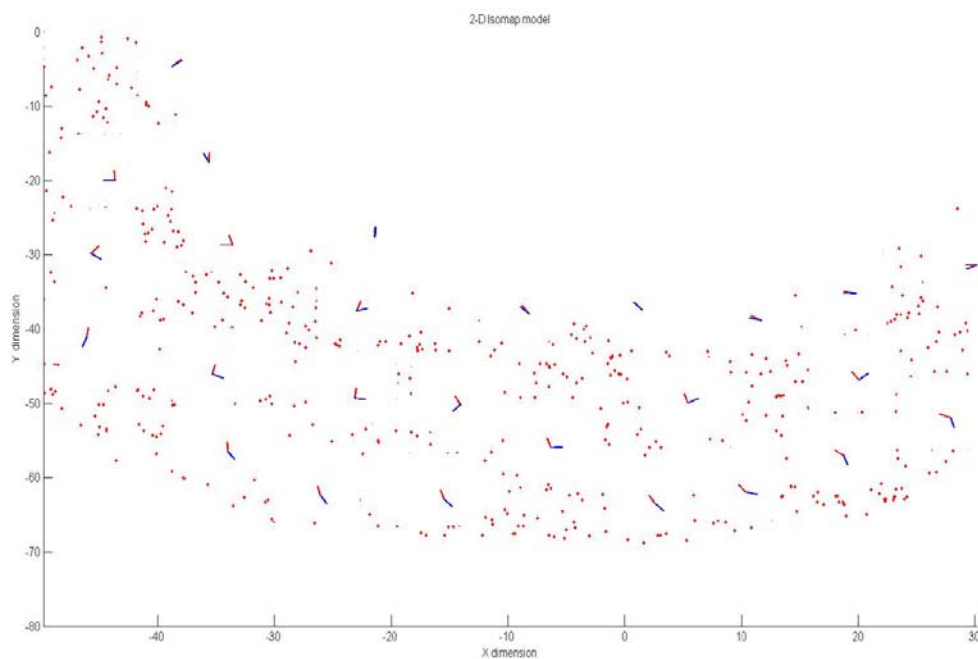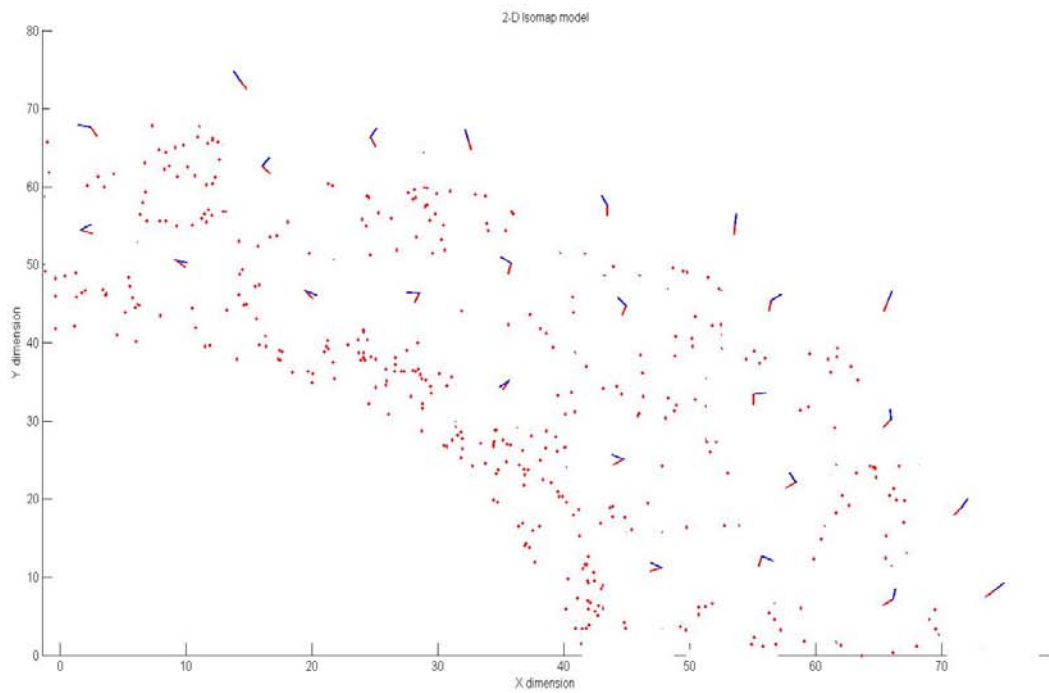Part A

Residual value decreases sharply as we increase dimensionality of isomap from 1 to 2 but doesn't changes significantly after that. So it suggests that dimensionality of manifold is best explained at 2.

Part B

2-D Isomap model

Part C

2-D Isomap model

2-D Isomap model

In above isomap theta 1 is varying along the circle with theta 2 being constant and theta 2 is varying along the radius with theta 1 constant.
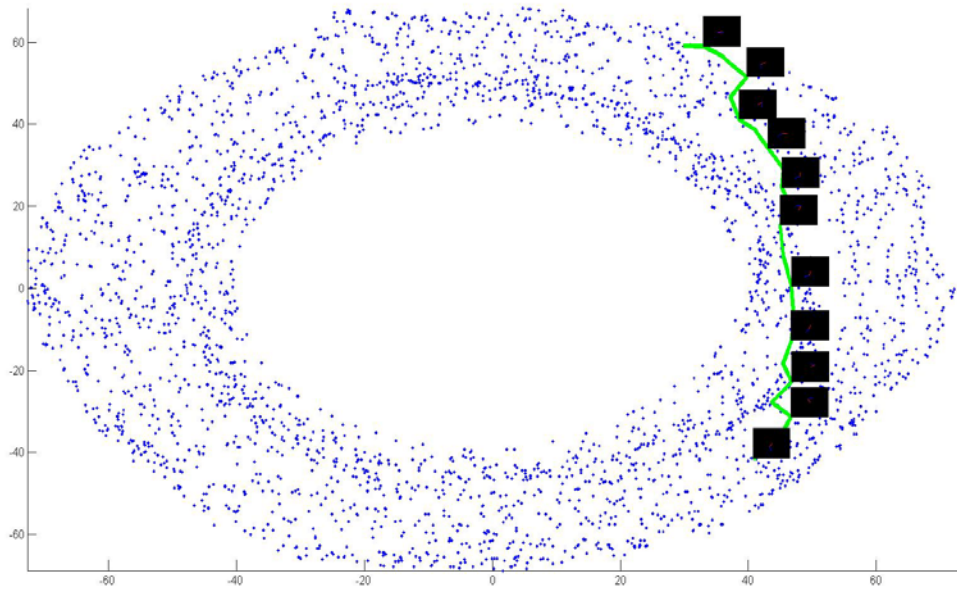
Map is able to capture the topology of the graph as any point corresponding to robot motion can be translated to isomap and from isomap to corresponding configration of robot.
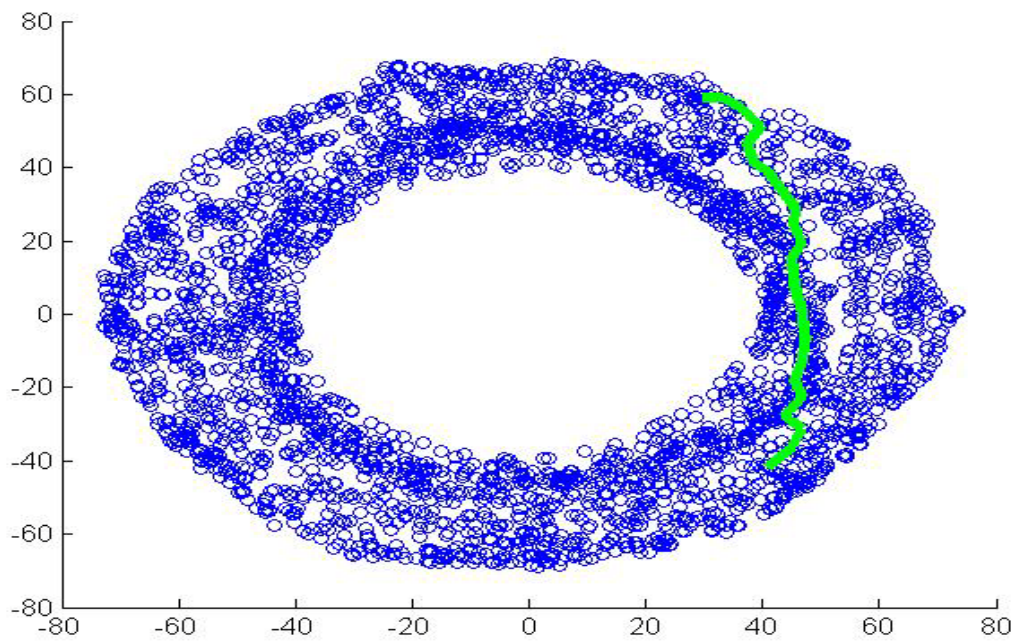
Part D
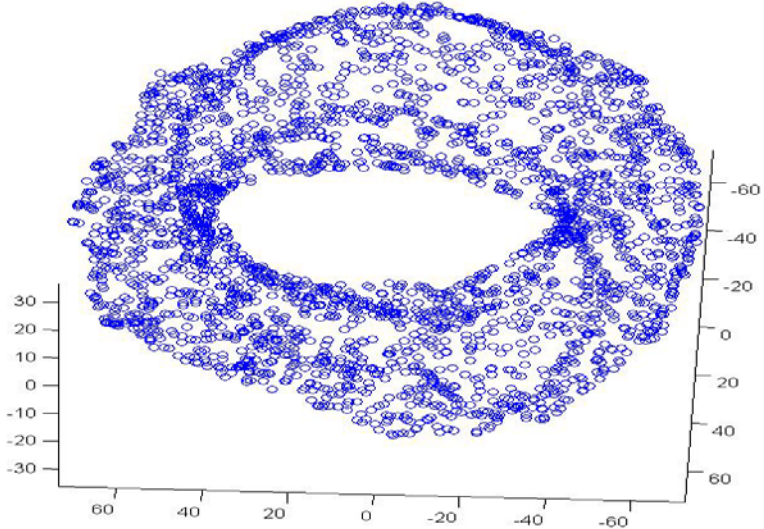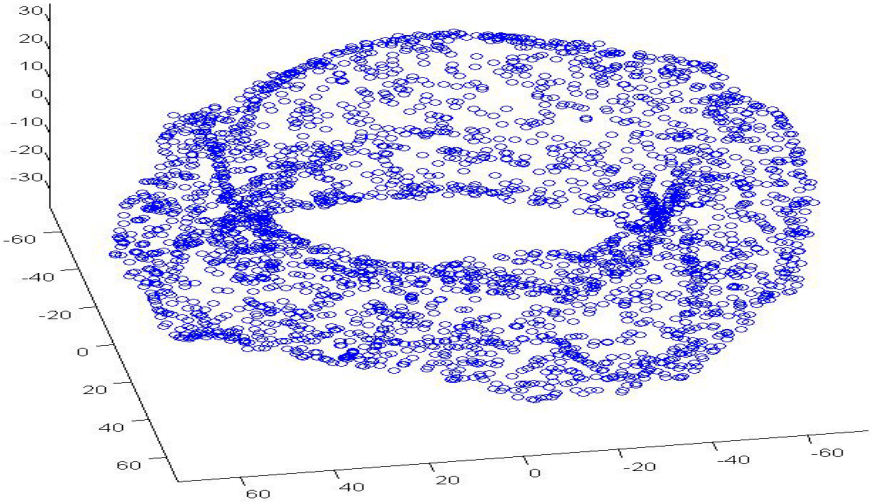
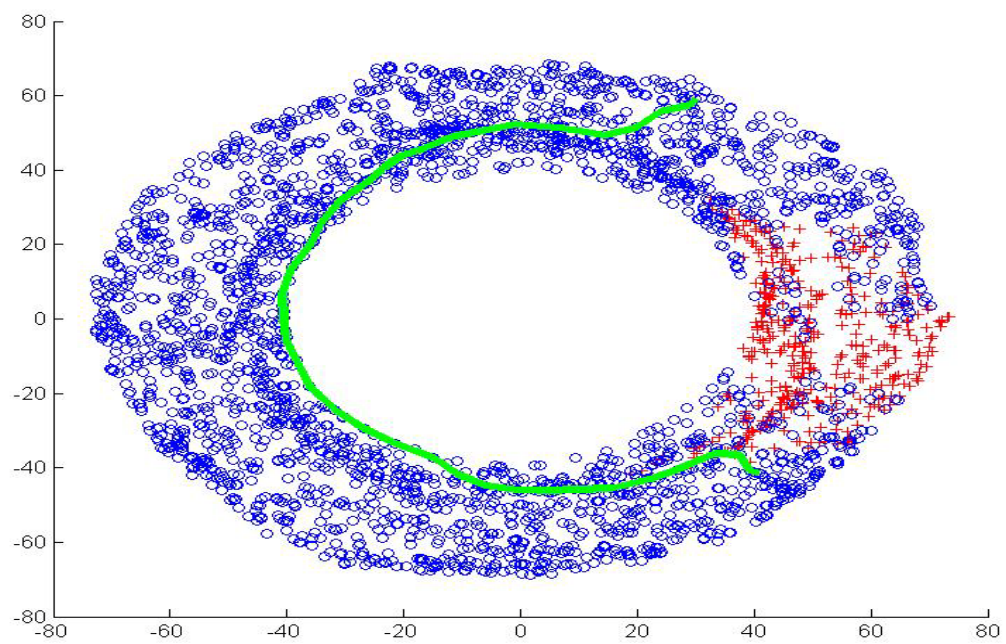Topology in 3 dimension looks like torus.
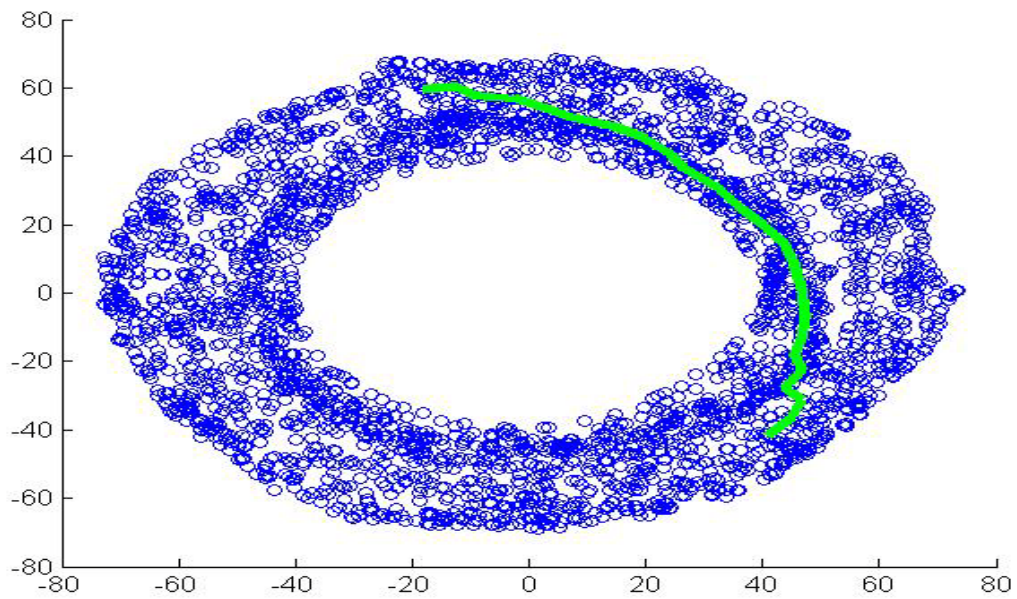
Part E

Part F

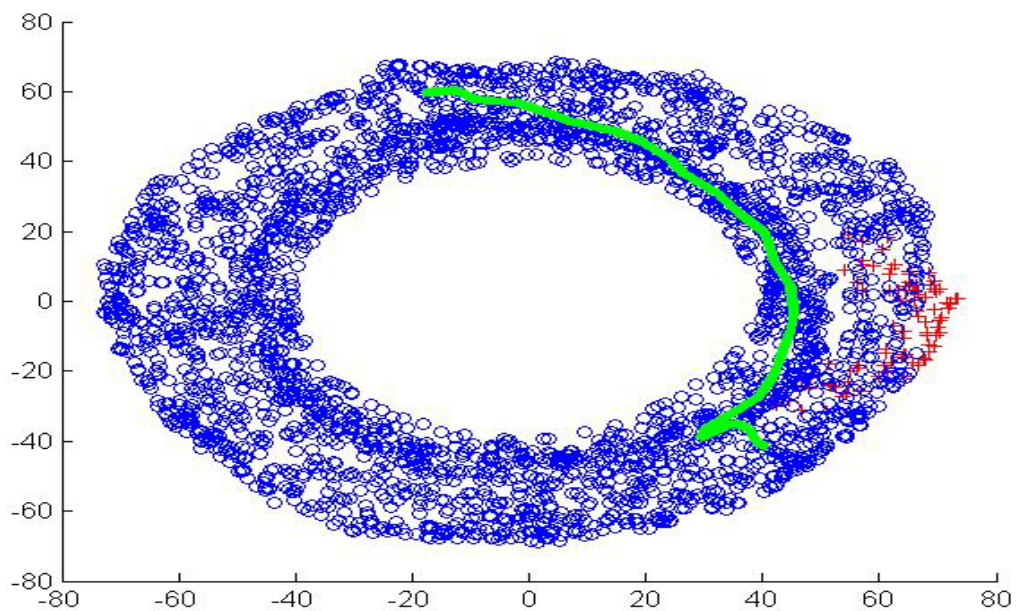path without obstacle

Path with obstacle

Part G

path without obstacle

Path with obstacle

In part F some particular values of theta 1 was not possible for any value of theta 2 so a block of isomap is absent so it has to go other way around in that part to reach the destination. But in this part some values of theta 1 is not attainable for some particular theta 2 and possible for other values of theta 2 so it is not blocking that path of isomap completely and destination can be still be reached by slight changes in path to avoid obstacles.

**Assignment done in group by Souraj Mishra and Ayush Jain.