

House_Experiment_2__

Comparsion of controllers

-Global planner: NavFn

Controller type	Trajectory type	Success rate (%)	Average execution time (sec)	CPU(%)		Memory usage(%)		Average number of recoveries	Average path length(m)	Min distance to obstacles(m)	Average Path Deviation
				Mean	Max	Mean	Max				
DWB	single_goal_0	40.0	189.48	19.98	29.1	8.17	8.3	12.07	13.62	0.31	2.33
DWB	waypoints_1	100.0	106.37	20.17	48.2	8.21	8.3	1.13	22.20	0.25	2.55
DWB	circle_2	100.0	46.12	19.12	26.5	8.20	8.2	0.53	8.78	0.36	0.73
DWB	square_3	100.0	49.57	19.35	27.7	8.20	8.3	0.87	10.26	0.27	1.16
RPP	single_goal_0	100.0	75.77	19.21	49.4	8.26	8.3	0.53	16.98	0.27	1.21
RPP	waypoints_1	100.0	98.58	19.01	26.4	8.26	8.4	0.07	22.57	0.28	2.17
RPP	circle_2	100.0	39.85	17.50	23.0	8.20	8.3	0.00	8.82	0.29	0.67
RPP	square_3	100.0	48.32	19.56	41.4	8.39	9.0	0.27	10.36	0.36	1.37
DWB_RSC	single_goal_0	46.67	187.75	20.34	47.2	8.58	8.7	11.73	14.09	0.3	2.25
DWB_RSC	waypoints_1	100.0	116.05	20.48	30.7	8.59	8.7	1.73	22.42	0.28	2.26
DWB_RSC	circle_2	100.0	43.21	19.86	29.7	8.51	8.6	0.13	8.72	0.33	0.68
DWB_RSC	square_3	100.0	47.78	19.97	28.2	8.50	8.6	0.00	10.23	0.36	1.07
RPP_RSC	single_goal_0	100.0	74.69	19.51	26.0	8.42	8.5	0.00	16.96	0.3	1.09
RPP_RSC	waypoints_1	100.0	98.06	19.39	26.3	8.44	8.5	0.00	22.50	0.28	2.08
RPP_RSC	circle_2	100.0	39.48	18.50	27.2	8.40	8.5	0.00	8.82	0.29	0.67
RPP_RSC	square_3	100.0	48.65	18.84	25.3	8.40	8.5	0.00	10.37	0.35	1.4
MPPI	single_goal_0	100.0	88.21	21.59	30.4	8.48	8.5	1.53	16.79	0.3	1.26
MPPI	waypoints_1	100.0	92.01	21.92	29.2	8.50	8.6	0.00	22.30	0.34	1.73
MPPI	circle_2	100.0	86.78	20.36	28.3	8.50	8.6	4.80	8.87	0.35	1.45
MPPI	square_3	100.0	41.87	21.09	27.2	8.50	8.6	0.00	10.14	0.36	0.9
Graceful	single_goal_0	100.0	88.68	20.26	27.7	8.54	8.6	0.00	17.34	0.31	0.97
Graceful	waypoints_1	100.0	125.69	20.04	27.5	8.60	8.7	0.00	23.42	0.32	1.95
Graceful	circle_2	100.0	46.88	19.31	46.3	8.58	8.6	0.00	8.94	0.3	0.89
Graceful	square_3	100.0	58.62	19.50	25.8	8.59	8.6	0.00	10.60	0.39	1.47

-Global planner: smac_planner

Controller type	Trajectory type	Success rate (%)	Average execution time (sec)	CPU(%)		Memory usage(%)		Average number of recoveries	Average path length(m)	Min distance to obstacles(m)	Average Path Deviation
				Mean	Max	Mean	Max				
DWB	single_goal_0	60.0	150.88	20.93	49.1	8.61	8.7	8.13	14.25	0.27	2.04
DWB	waypoints_1	100.0	105.64	20.42	29.4	8.60	8.7	1.27	21.54	0.25	2.43
DWB	circle_2	100.0	48.39	19.69	29.1	8.60	8.7	2.07	8.85	0.29	0.75
DWB	square_3	100.0	48.57	20.13	26.5	8.60	8.7	0.20	10.23	0.31	1.0
RPP	single_goal_0	100.0	74.20	19.46	27.1	8.61	8.7	1.40	16.47	0.3	1.08
RPP	waypoints_1	100.0	94.94	19.62	26.1	8.63	8.7	0.40	21.79	0.15	2.13
RPP	circle_2	100.0	42.42	19.39	26.7	8.60	8.7	2.00	8.83	0.29	0.71
RPP	square_3	100.0	49.06	19.06	25.4	8.61	8.7	0.73	10.38	0.31	1.51
DWB_RSC	single_goal_0	53.33	163.82	20.95	29.3	8.70	8.8	10.40	14.03	0.26	2.11
DWB_RSC	waypoints_1	93.33	116.36	21.26	32.7	8.71	9.2	2.27	21.61	0.25	2.28
DWB_RSC	circle_2	100.0	47.26	21.07	29.0	8.70	8.8	2.33	8.83	0.32	0.72
DWB_RSC	square_3	100.0	47.99	20.72	29.0	8.70	8.7	0.00	10.23	0.32	1.04
RPP_RSC	single_goal_0	93.33	70.13	20.43	27.5	8.75	8.8	1.20	15.60	0.3	1.04
RPP_RSC	waypoints_1	100.0	94.95	19.83	27.7	8.78	8.9	0.20	21.86	0.28	2.07
RPP_RSC	circle_2	100.0	41.28	19.74	25.7	8.77	8.8	0.80	8.83	0.3	0.7
RPP_RSC	square_3	100.0	48.05	19.76	25.5	8.78	8.9	0.00	10.31	0.34	1.48
MPPI	single_goal_0	100.0	67.88	22.76	29.8	8.82	9.0	0.00	16.06	0.33	0.95
MPPI	waypoints_1	100.0	87.99	22.60	49.3	8.88	8.9	0.00	21.57	0.34	1.86
MPPI	circle_2	100.0	38.83	21.86	29.9	8.83	8.9	1.33	8.57	0.37	0.67
MPPI	square_3	100.0	41.88	22.25	28.4	8.83	8.9	0.00	10.11	0.33	0.76
Graceful	single_goal_0	100.0	84.17	21.11	29.5	8.89	9.0	0.00	16.71	0.32	1.03
Graceful	waypoints_1	100.0	114.48	20.63	27.1	8.90	9.0	0.00	22.49	0.33	1.91
Graceful	circle_2	100.0	48.51	20.37	27.3	8.90	9.0	1.80	8.94	0.28	1.06
Graceful	square_3	100.0	56.83	20.54	28.4	8.90	8.9	0.73	10.49	0.34	1.14

-Global planner: ThetaStar

Controller type	Trajectory type	Success rate (%)	Average execution time (sec)	CPU(%)		Memory usage(%)		Average number of recoveries	Average path length(m)	Min distance to obstacles(m)	Average Path Deviation
				Mean	Max	Mean	Max				
DWB	single_goal_0	53.33	136.47	22.77	42.7	8.93	9.5	10.07	13.81	0.14	1.98
DWB	waypoints_1	86.67	118.18	22.69	33.5	8.94	9.1	3.20	20.27	0.13	2.77
DWB	circle_2	100.0	50.82	22.14	29.2	8.91	9.0	2.20	8.92	0.13	0.86
DWB	square_3	93.33	59.86	22.02	28.5	8.93	9.0	1.27	12.01	0.28	1.64
RPP	single_goal_0	86.67	73.57	21.62	27.9	8.97	9.1	4.00	15.46	0.24	1.13
RPP	waypoints_1	66.67	85.99	21.31	29.5	8.99	9.0	5.47	17.32	0.16	1.92

RPP	circle_2	100.0	40.97	20.81	25.9	8.99	9.1	0.87	8.83	0.32	0.72
RPP	square_3	100.0	49.74	20.99	26.4	8.99	9.0	1.27	10.37	0.25	1.34
DWB_RSC	single_goal_0	93.33	91.88	23.16	31.8	9.00	9.1	3.53	15.82	0.27	1.23
DWB_RSC	waypoints_1	80.0	121.33	23.02	30.1	9.02	9.1	4.20	19.14	0.22	2.4
DWB_RSC	circle_2	100.0	48.20	22.66	29.0	9.00	9.1	1.13	8.85	0.35	0.74
DWB_RSC	square_3	93.33	57.50	23.19	29.2	9.02	9.1	1.33	10.97	0.29	1.29
RPP_RSC	single_goal_0	100.0	74.59	22.15	29.2	9.07	9.1	3.13	16.11	0.24	1.13
RPP_RSC	waypoints_1	100.0	93.49	21.73	27.3	9.09	9.1	1.47	20.88	0.23	2.06
RPP_RSC	circle_2	100.0	41.53	21.38	25.8	9.07	9.1	0.93	8.85	0.31	0.73
RPP_RSC	square_3	100.0	52.33	22.13	28.9	9.09	9.1	2.27	10.42	0.27	1.28
MPPI	single_goal_0	100.0	70.92	24.63	32.7	9.05	9.1	1.80	15.86	0.32	1.07
MPPI	waypoints_1	100.0	85.47	24.62	31.0	9.09	9.1	0.00	20.86	0.34	1.88
MPPI	circle_2	100.0	53.81	23.64	31.0	9.10	9.2	2.33	8.65	0.37	0.82
MPPI	square_3	93.33	46.67	24.12	30.4	9.10	9.1	1.47	10.35	0.13	0.79
Graceful	single_goal_0	100.0	75.87	23.43	29.6	9.12	9.2	0.00	16.17	0.34	0.89
Graceful	waypoints_1	100.0	106.60	22.37	27.6	9.15	9.2	0.00	21.50	0.35	1.74
Graceful	circle_2	100.0	47.58	22.29	27.2	9.11	9.2	0.73	8.99	0.3	1.14
Graceful	square_3	100.0	58.22	22.12	29.5	9.11	9.2	1.53	10.49	0.28	1.05

-Global planner: Lattice

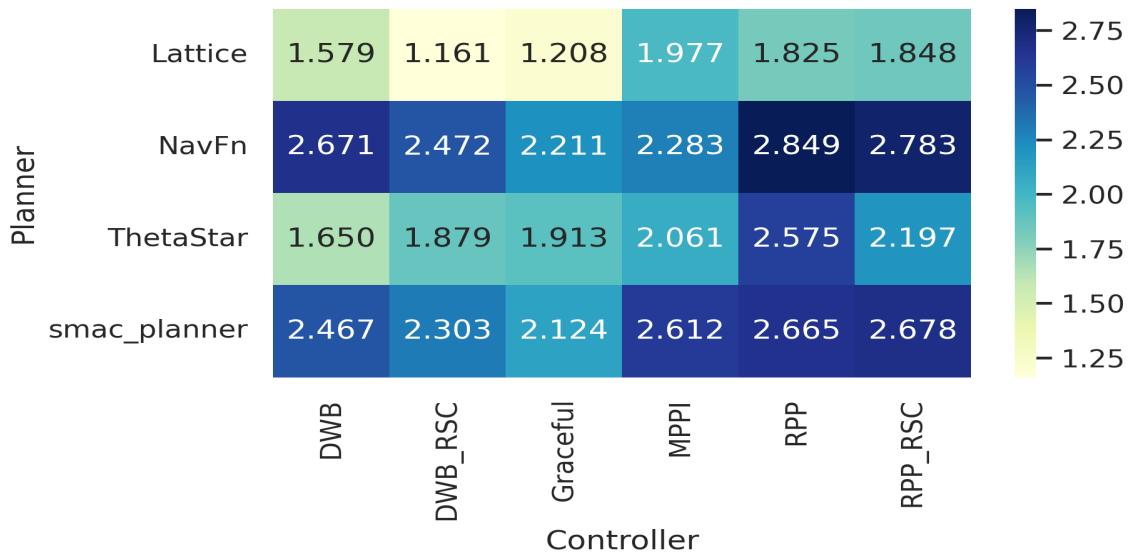
Controller type	Trajectory type	Success rate (%)	Average execution time (sec)	CPU(%)		Memory usage(%)		Average number of recoveries	Average path length(m)	Min distance to obstacles(m)	Average Path Deviation
				Mean	Max	Mean	Max				
DWB	single_goal_0	93.33	74.71	24.49	31.7	9.18	9.2	1.67	15.93	0.27	1.45
DWB	waypoints_1	46.67	151.96	23.99	34.5	9.20	9.3	9.20	18.63	0.13	3.6
DWB	circle_2	100.0	44.81	24.22	29.8	9.19	9.3	0.93	8.79	0.36	0.82
DWB	square_3	93.33	56.53	23.88	29.9	9.20	9.3	1.07	11.45	0.29	1.49
RPP	single_goal_0	100.0	70.57	23.22	29.9	9.23	9.3	0.27	16.30	0.29	1.09
RPP	waypoints_1	93.33	102.84	23.03	28.8	9.28	9.4	6.73	20.84	0.25	2.42
RPP	circle_2	100.0	44.04	22.64	27.4	9.27	9.3	1.27	9.23	0.28	0.86
RPP	square_3	100.0	49.99	22.30	28.5	9.27	9.4	0.27	10.66	0.29	1.21
DWB_RSC	single_goal_0	100.0	86.86	24.80	33.6	9.30	9.4	1.80	16.41	0.32	1.28
DWB_RSC	waypoints_1	40.0	167.44	24.10	34.5	9.32	9.4	9.33	18.55	0.22	3.98
DWB_RSC	circle_2	100.0	44.56	24.38	31.0	9.30	9.3	0.73	8.77	0.38	0.81
DWB_RSC	square_3	86.67	73.02	23.77	32.3	9.31	9.4	1.93	12.38	0.27	1.78
RPP_RSC	single_goal_0	100.0	70.88	23.18	30.7	9.33	9.4	0.27	16.33	0.29	1.1
RPP_RSC	waypoints_1	80.0	92.86	22.81	30.2	9.36	9.4	5.27	19.34	0.23	2.21
RPP_RSC	circle_2	100.0	45.88	22.64	28.4	9.36	9.4	1.33	9.28	0.32	0.87

RPP_RSC	square_3	100.0	52.28	22.06	28.3	9.36	9.4	1.87	10.68	0.27	1.35
MPPI	single_goal_0	100.0	67.93	26.04	48.4	9.40	9.5	0.00	15.97	0.3	1.1
MPPI	waypoints_1	100.0	87.29	25.03	31.4	9.40	9.5	0.07	21.19	0.33	1.97
MPPI	circle_2	100.0	37.91	25.01	30.0	9.40	9.5	0.93	8.58	0.37	0.8
MPPI	square_3	100.0	44.54	24.92	29.6	9.40	9.5	0.47	10.46	0.33	0.94
Graceful	single_goal_0	100.0	80.85	23.85	30.9	9.46	9.5	0.00	16.48	0.31	1.11
Graceful	waypoints_1	100.0	118.16	23.37	34.8	9.48	9.6	0.47	21.61	0.25	2.2
Graceful	circle_2	100.0	54.03	22.98	28.7	9.48	9.6	1.40	9.28	0.31	1.26
Graceful	square_3	100.0	73.51	22.82	28.1	9.49	9.6	2.40	10.78	0.29	1.82

Performance analysis

Based on the criteria: Time, path_length, CPU, Memory, Safety

The score of each controller and planner combinations are:



Success rate

Planners' success rate are:

Planner: Lattice, Success Rate: 93.06%

Planner: ThetaStar, Success Rate: 93.61%

Planner: smac_planner, Success Rate: 95.83%

Planner: NavFn, Success Rate: 95.28%

Controllers' success rate are:

Controller: Graceful, Success Rate: 100.00%

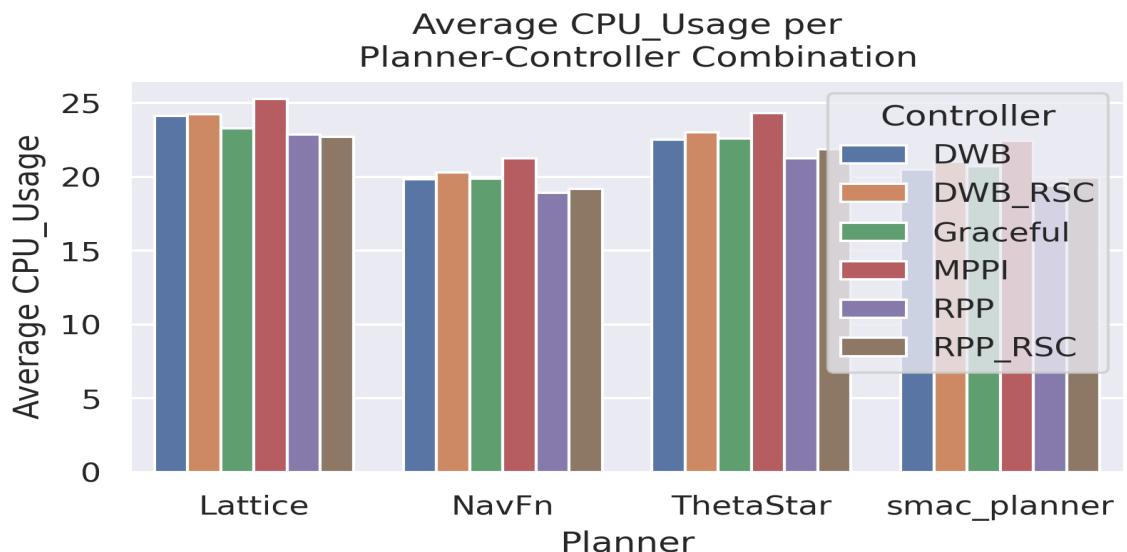
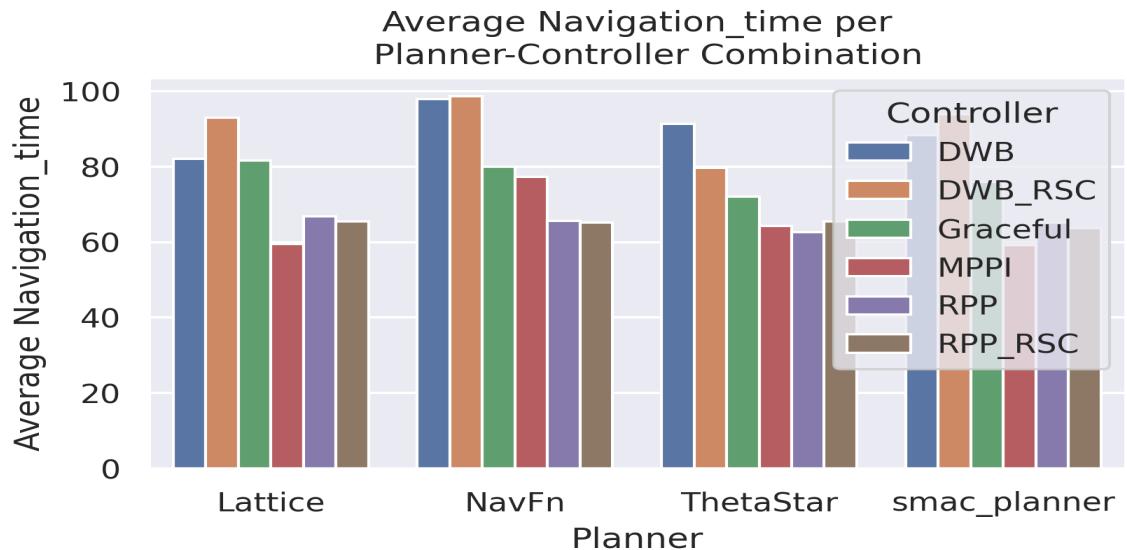
Controller: MPPI, Success Rate: 99.58%

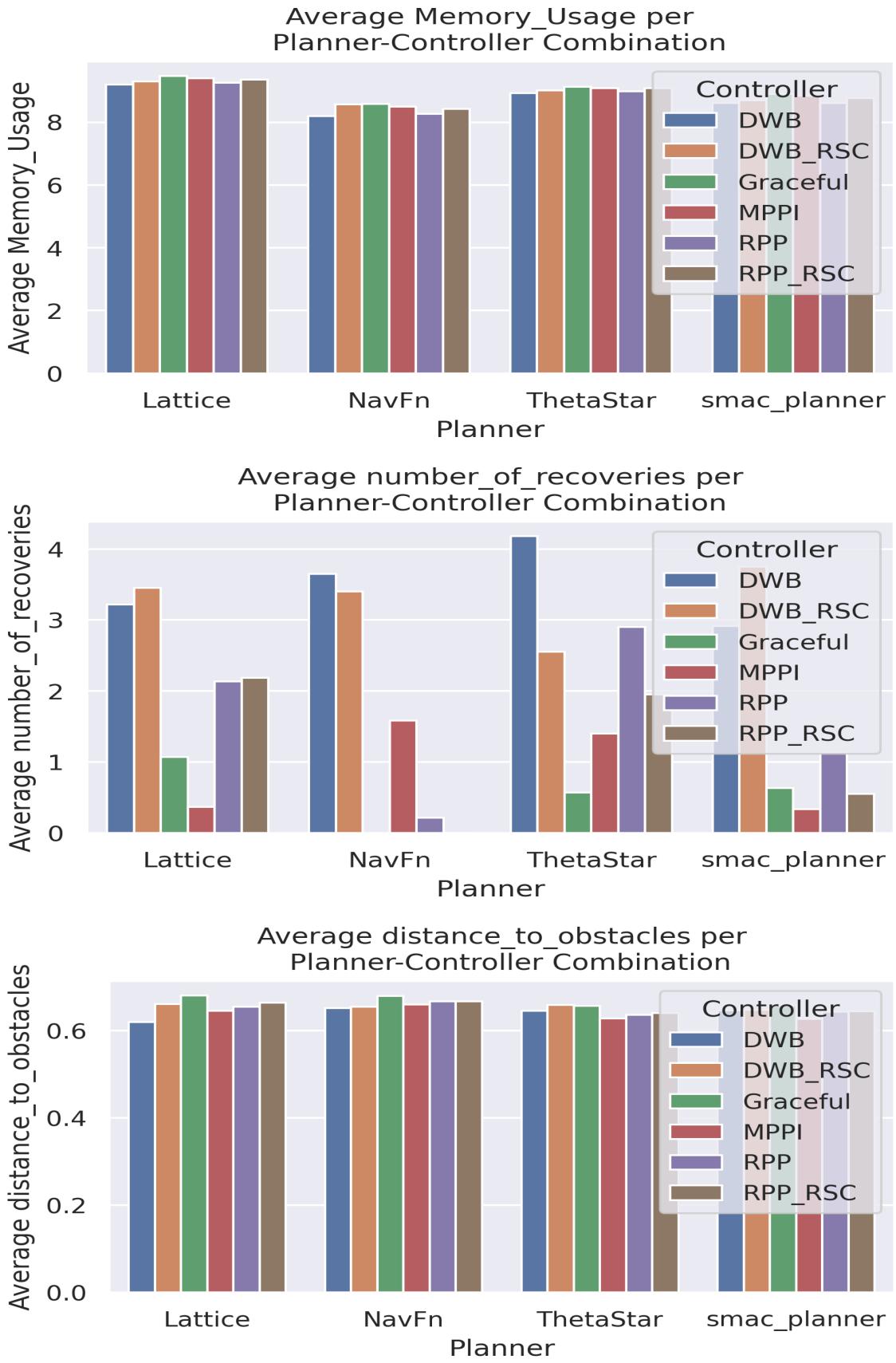
Controller: RPP_RSC, Success Rate: 98.33%

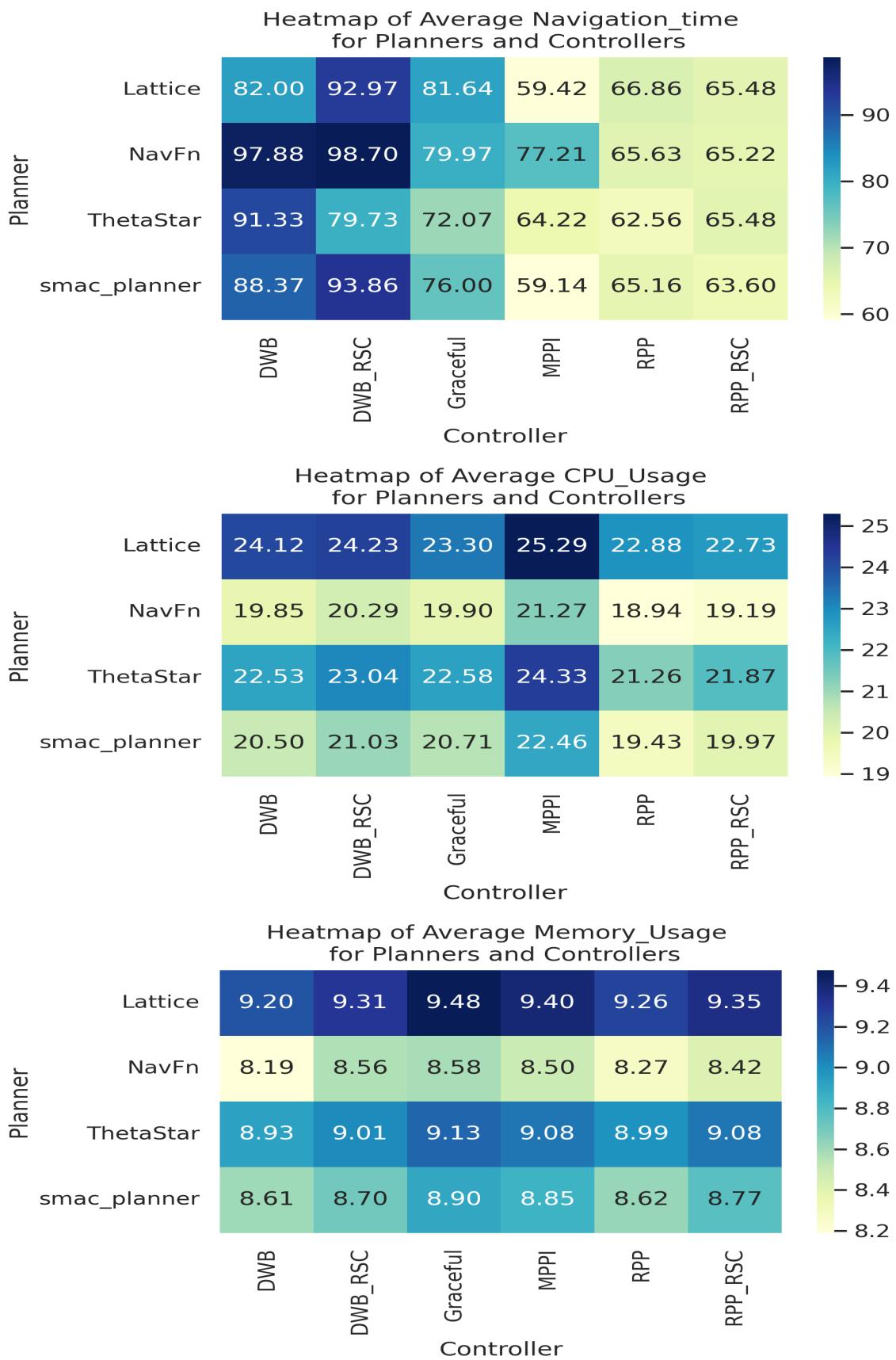
Controller: DWB_RSC, Success Rate: 86.67%

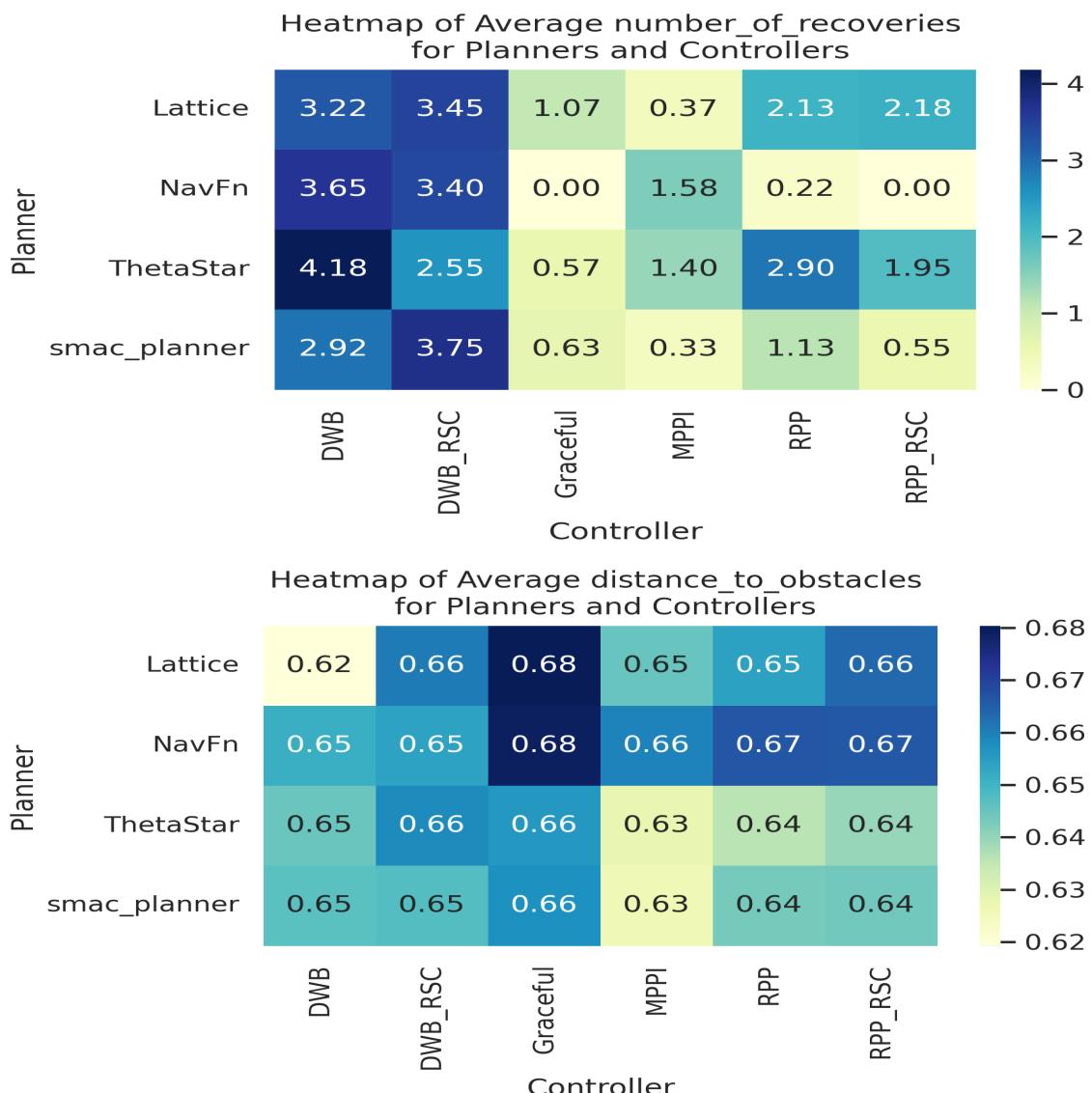
Controller: RPP, Success Rate: 96.67%

Controller: DWB, Success Rate: 85.42%

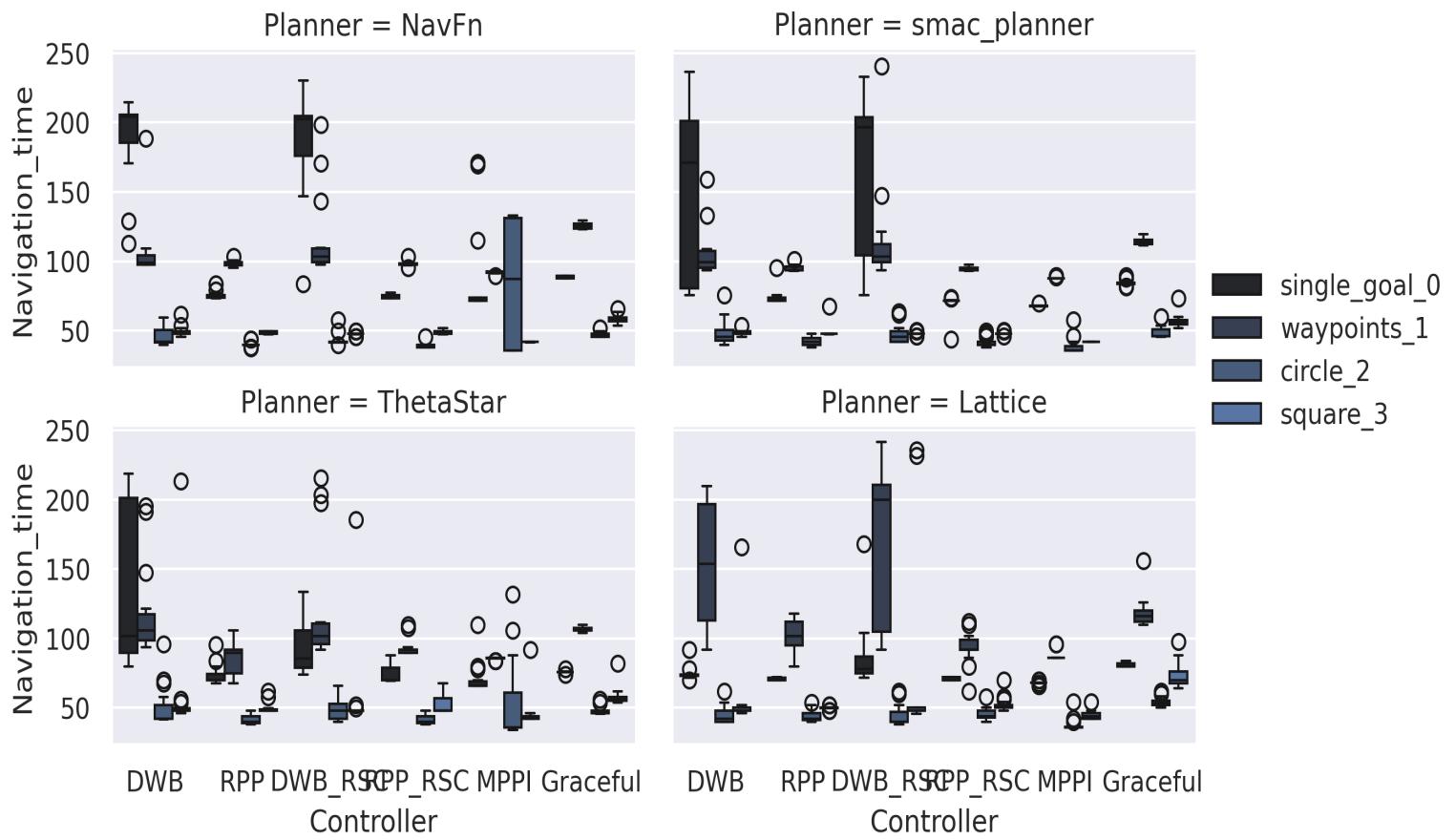




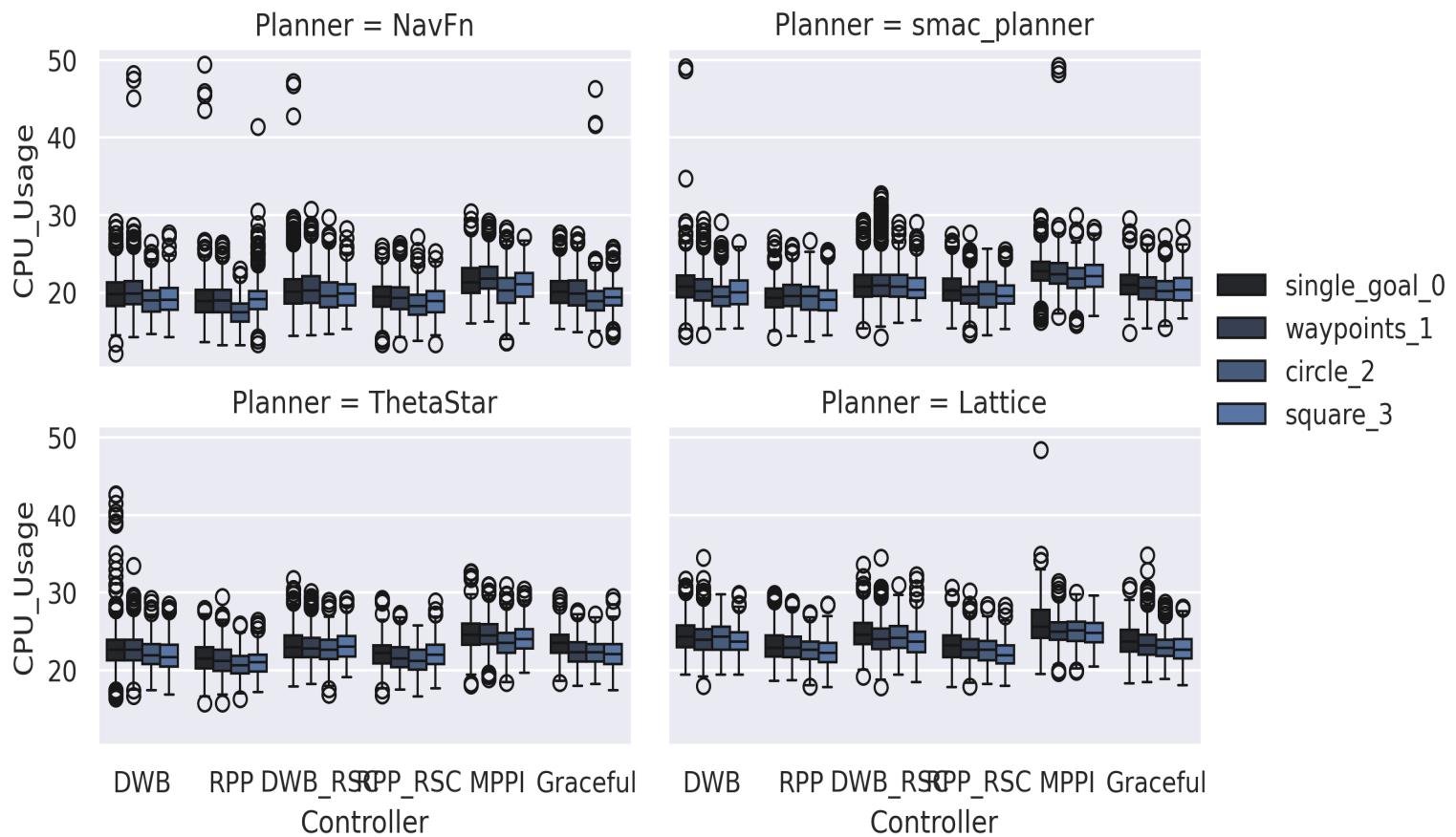




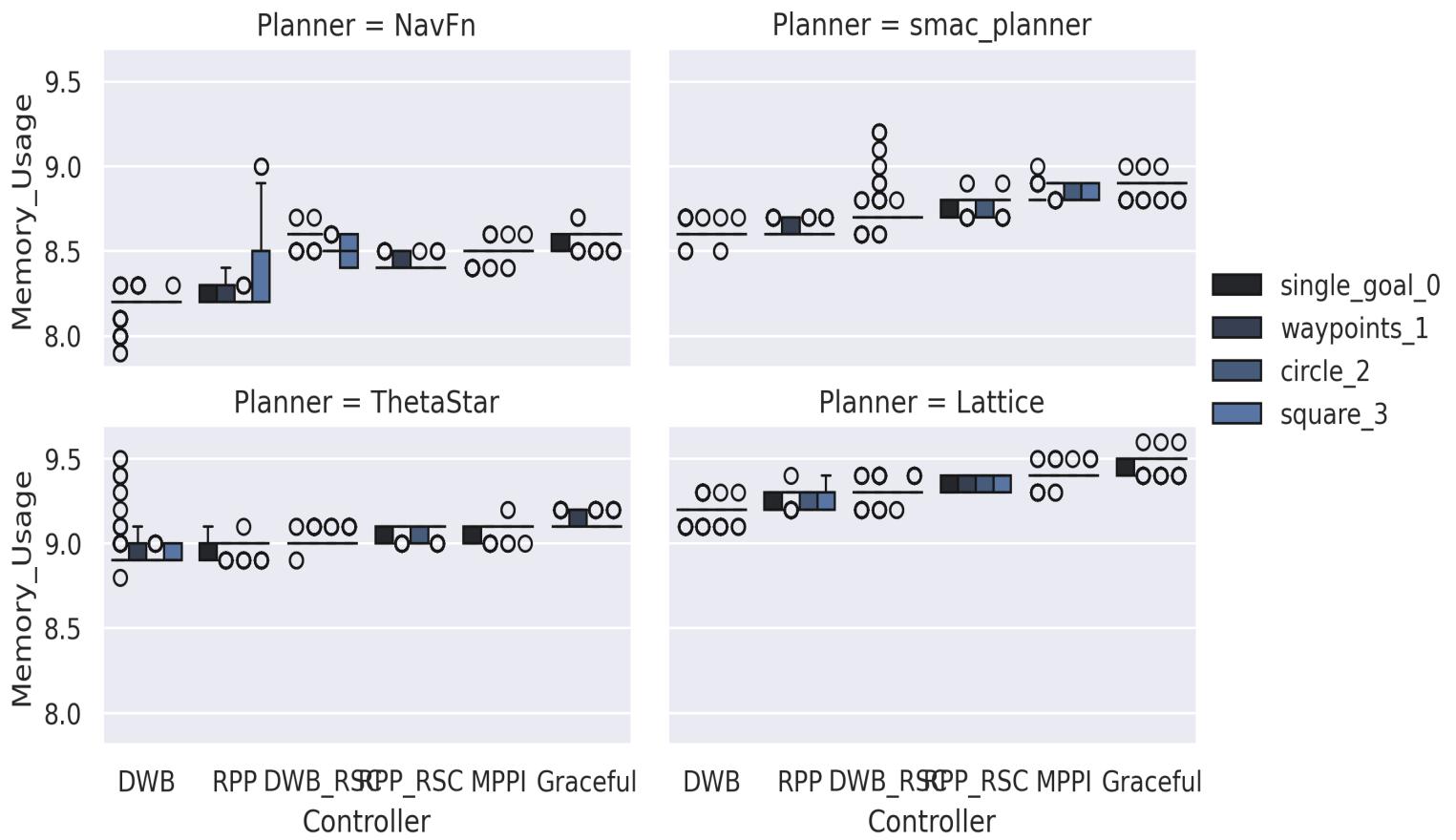
Complex Distribution of Navigation_time by Planner, Controller, and Trajectory Type



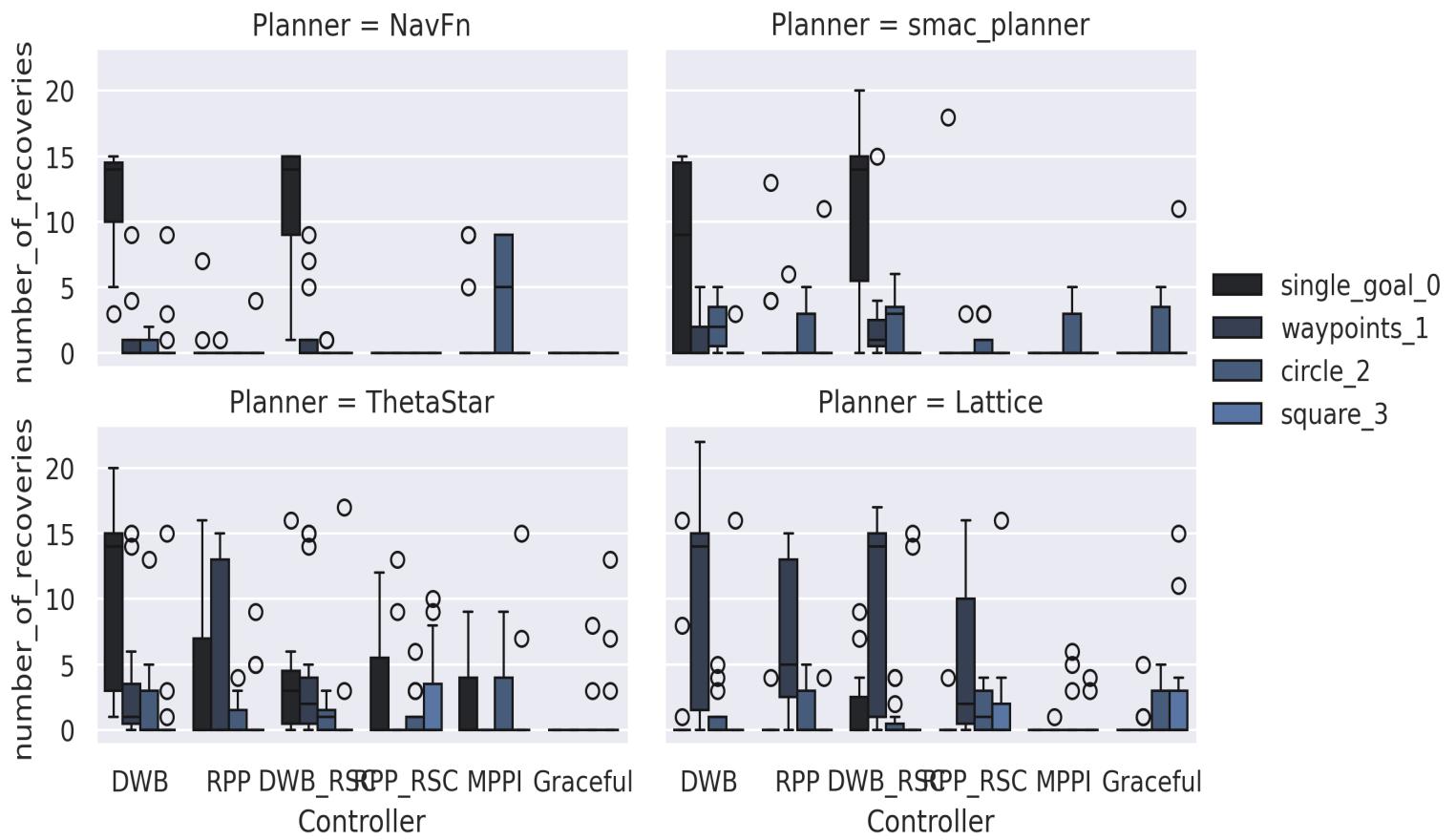
Complex Distribution of CPU_Usage by Planner, Controller, and Trajectory Type



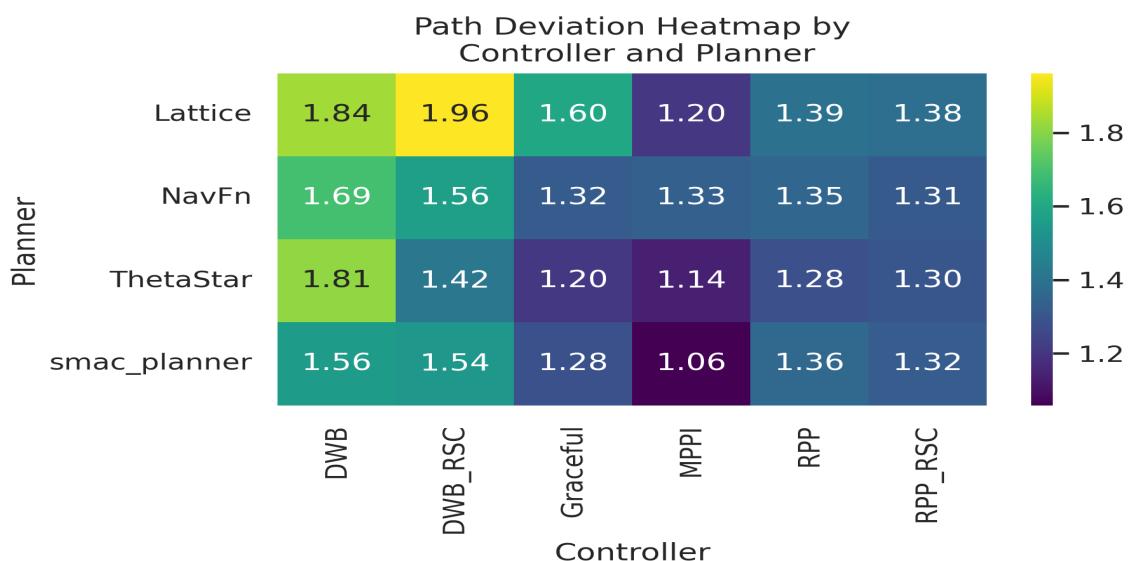
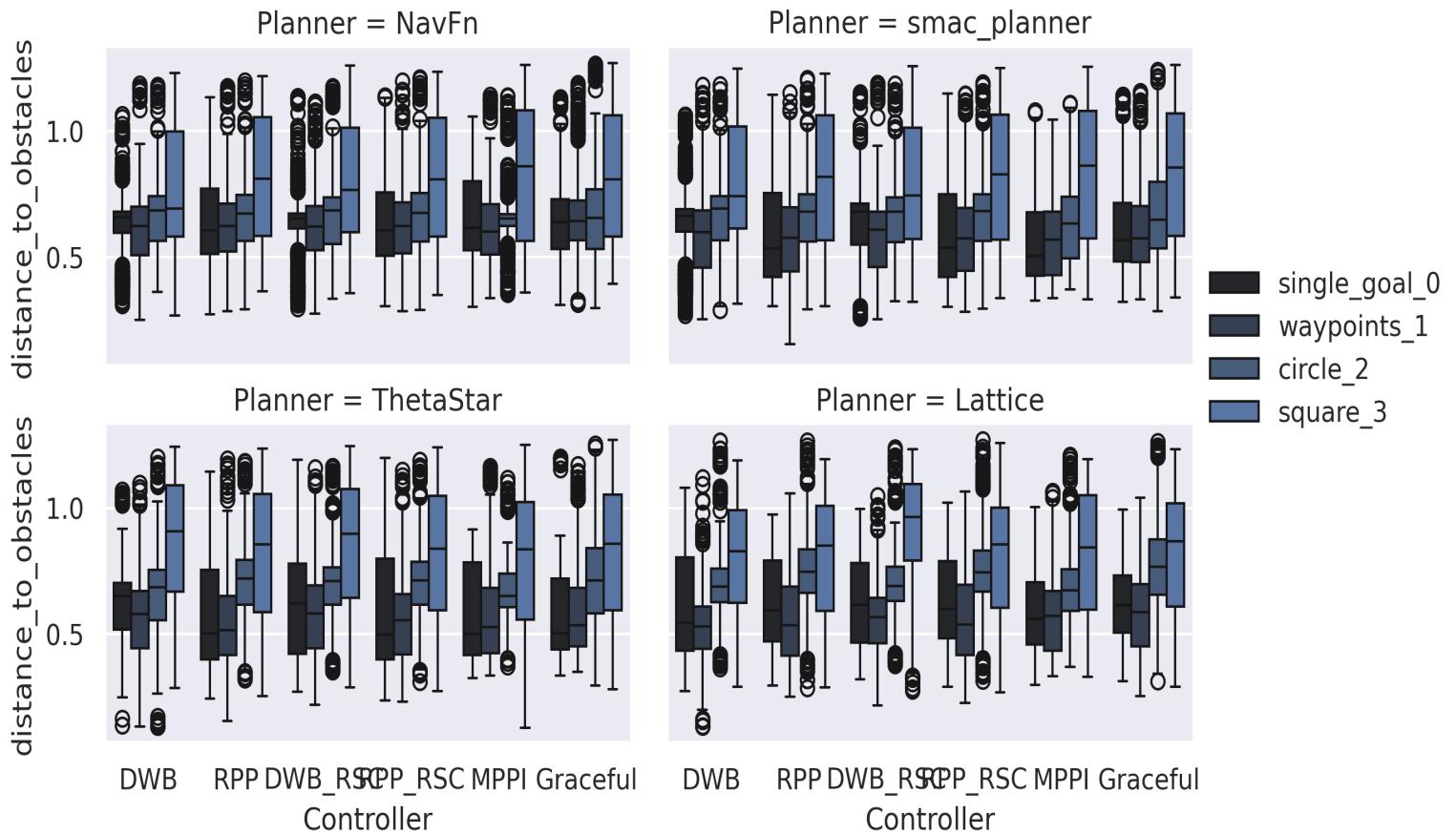
Complex Distribution of Memory_Usage by Planner, Controller, and Trajectory Type

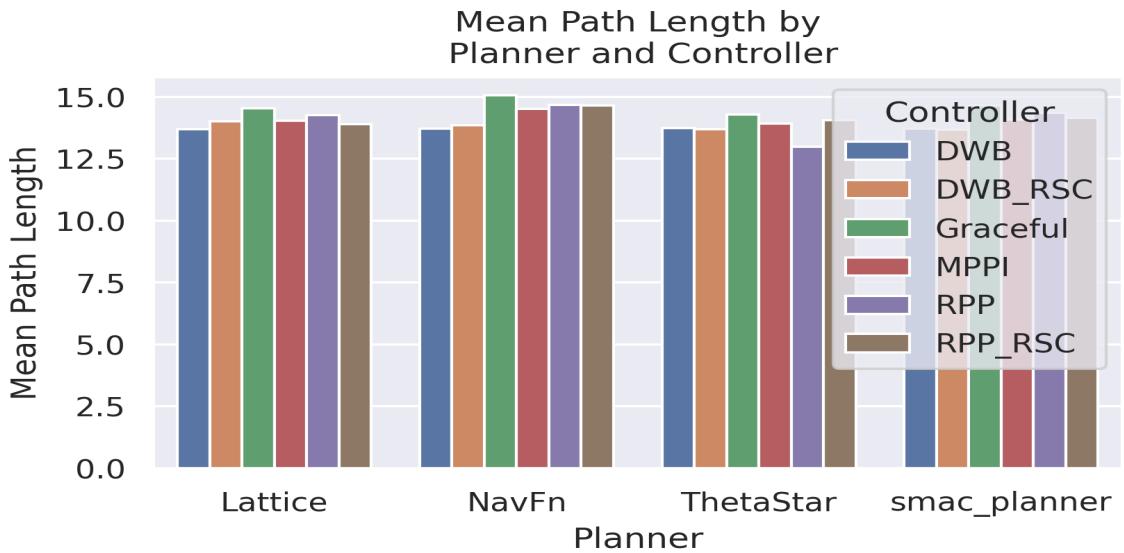


Complex Distribution of number_of_recoveries by Planner, Controller, and Trajectory Type



Complex Distribution of distance_to_obstacles by Planner, Controller, and Trajectory Type





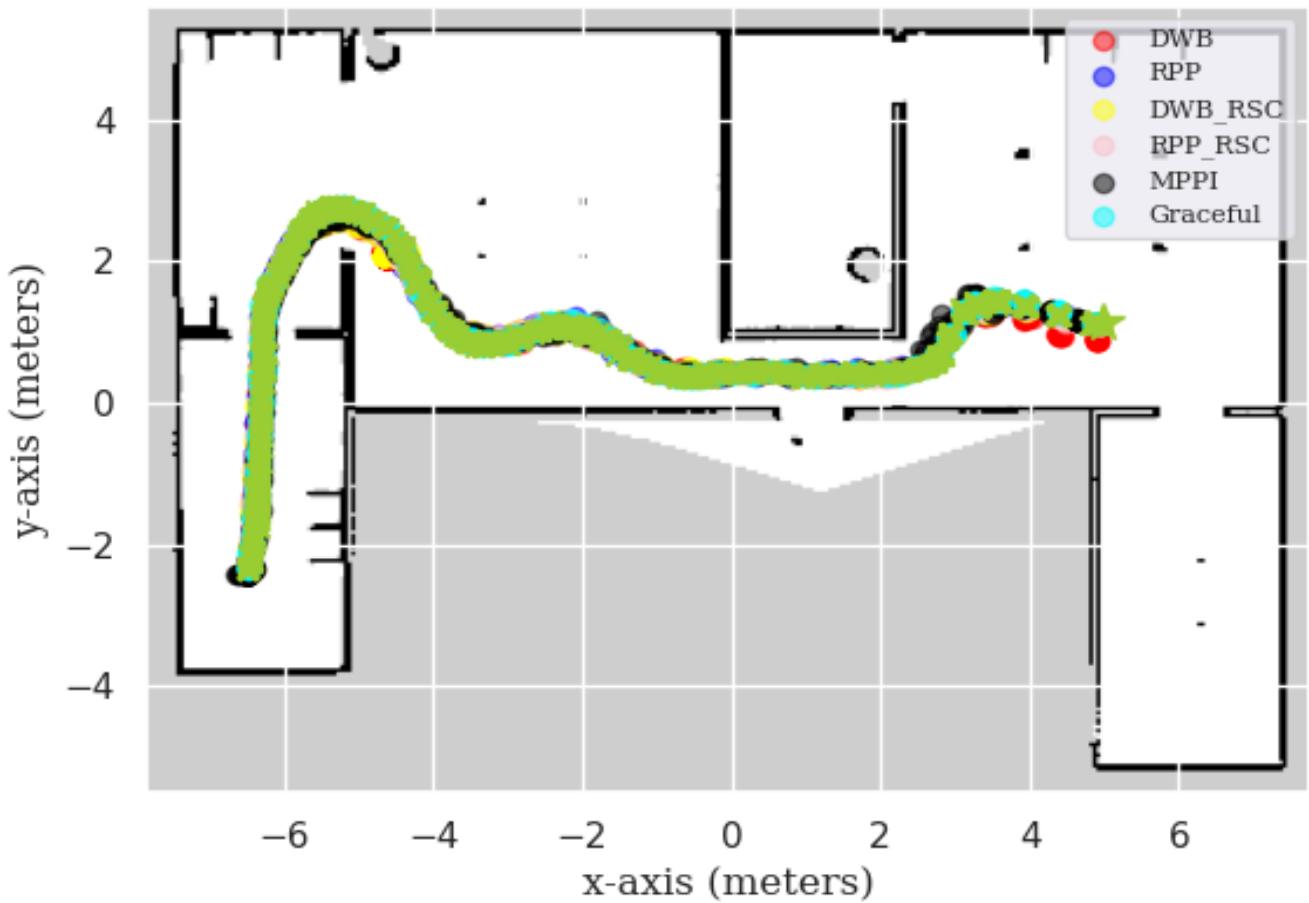
-Global planner: NavFn

Traveled path

-Trajectory type: single_goal_0

✖ Global planner path * Waypoints

★ Initial pose



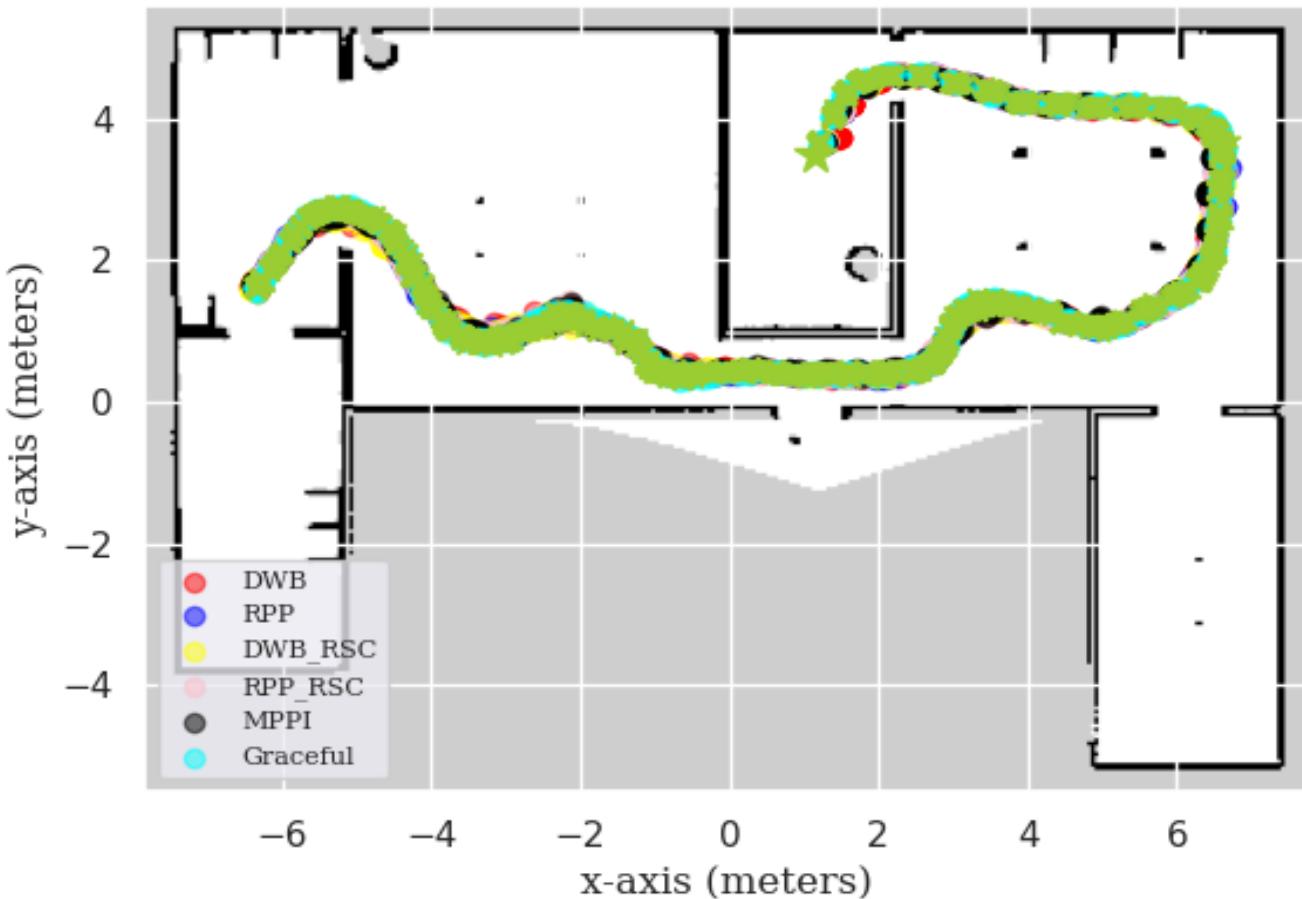
-Global planner: NavFn

Traveled path

-Trajectory type: waypoints_1

x Global planner path * Waypoints

★ Initial pose



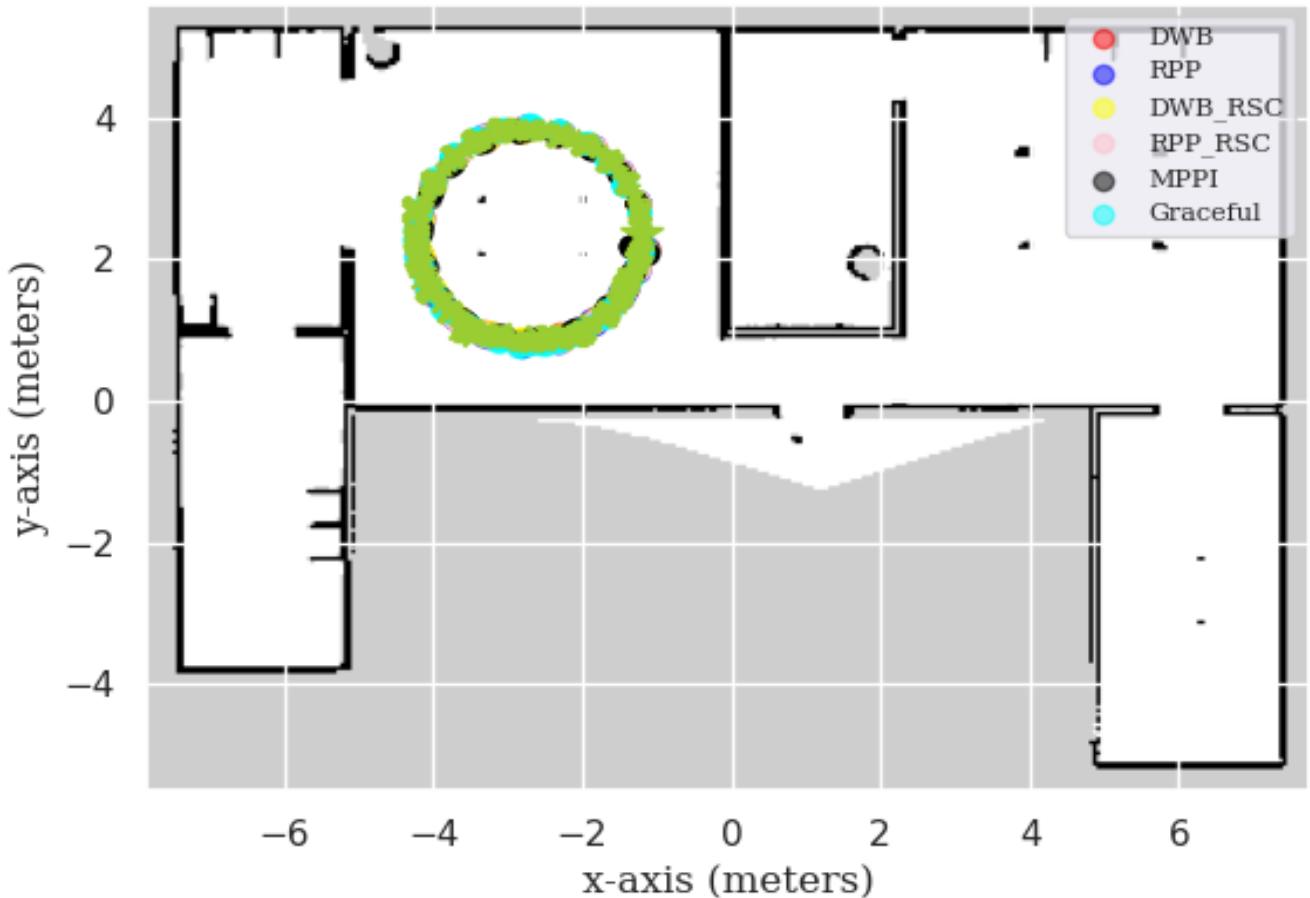
-Global planner: NavFn

Traveled path

-Trajectory type: circle_2

x Global planner path * Waypoints

★ Initial pose



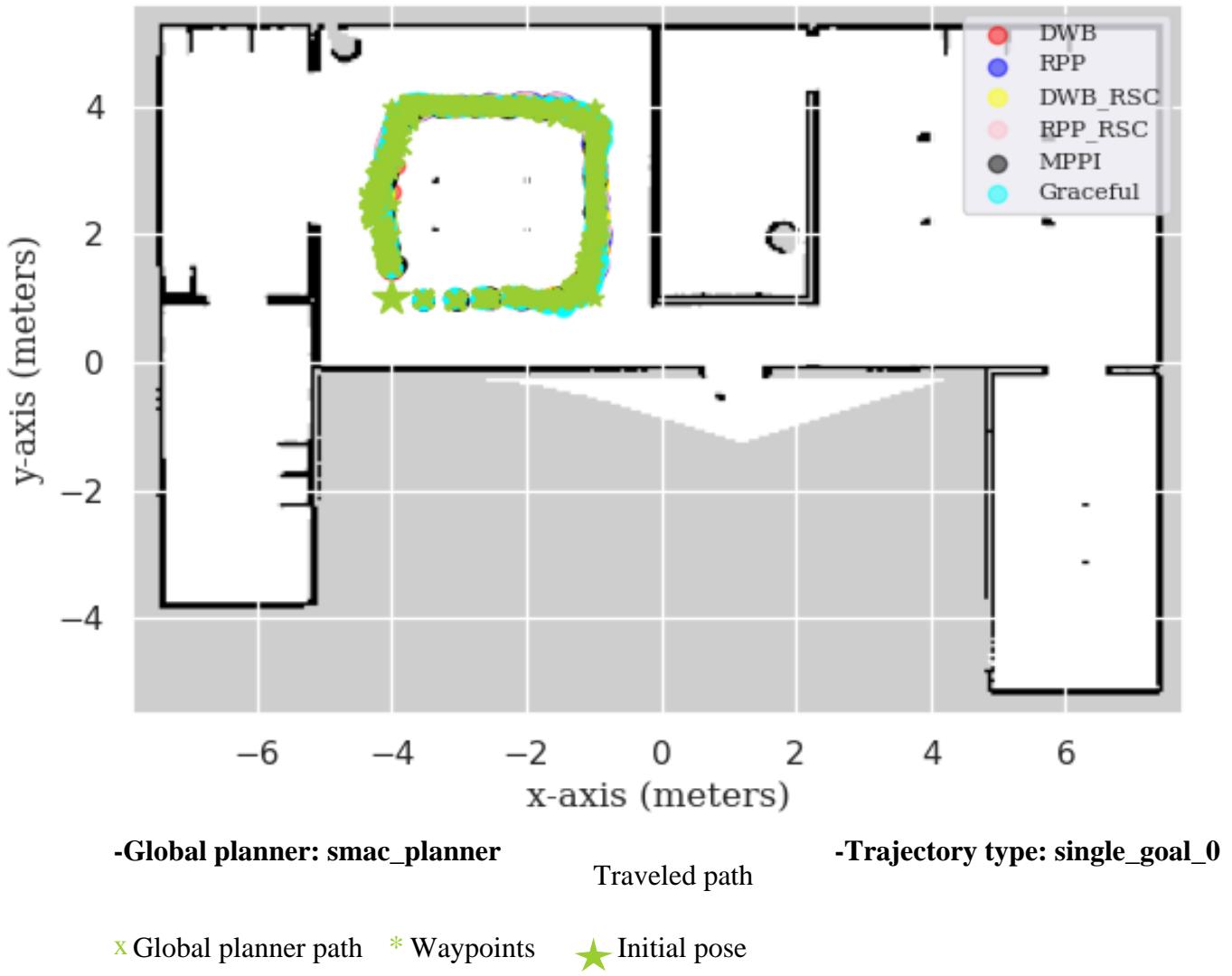
-Global planner: NavFn

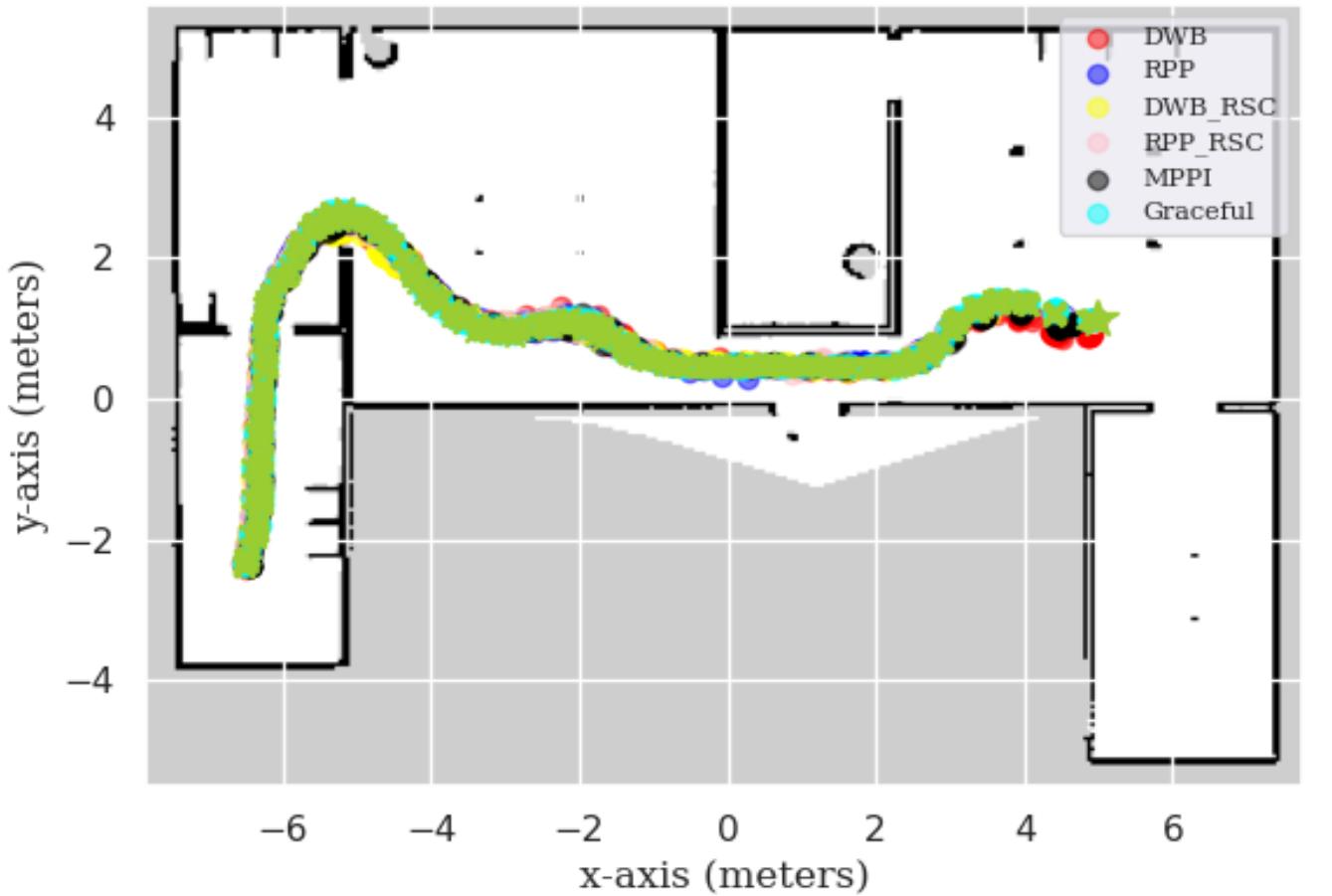
-Trajectory type: square_3

Traveled path

Global planner path Waypoints

Initial pose





-Global planner: smac_planner

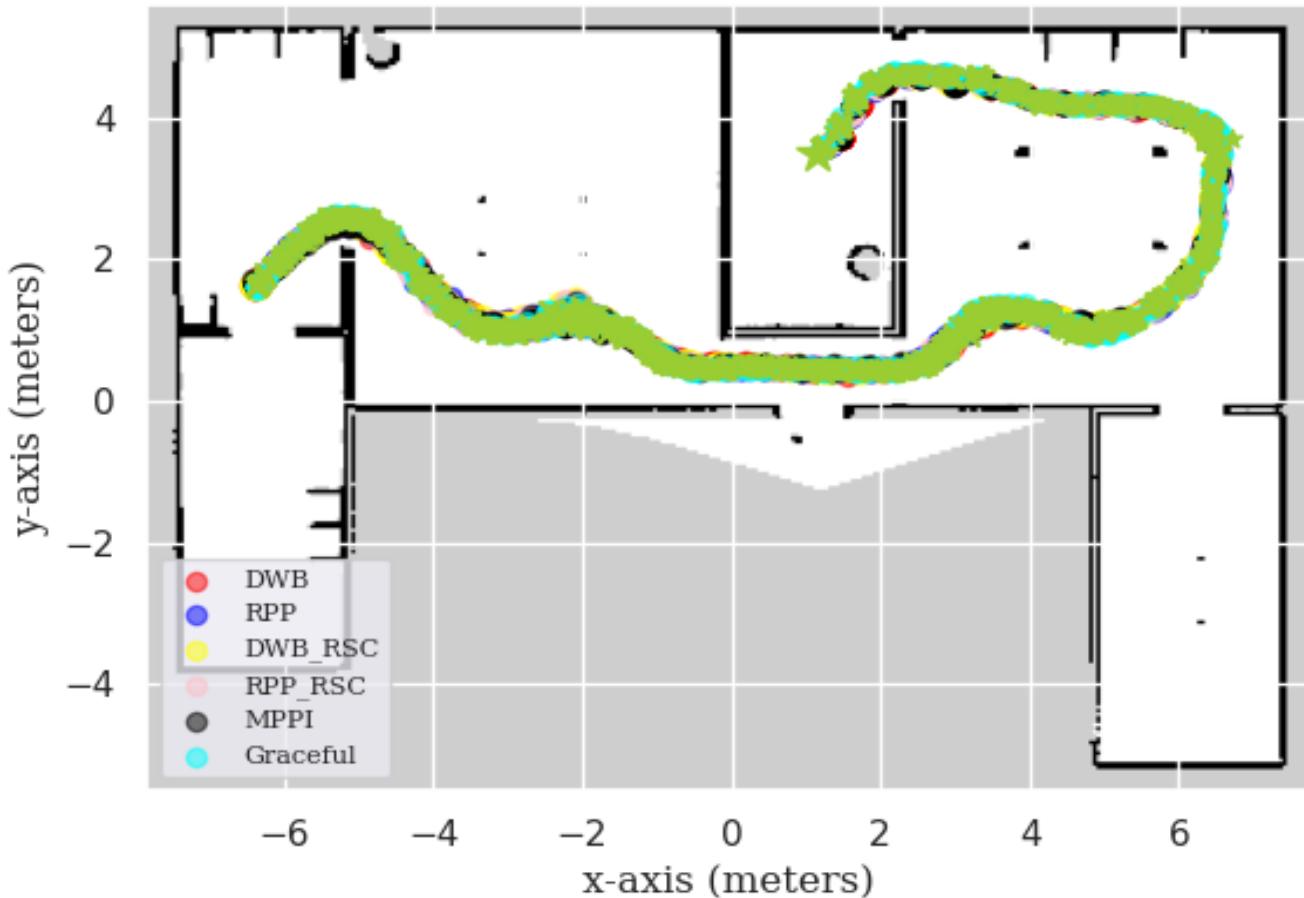
Traveled path

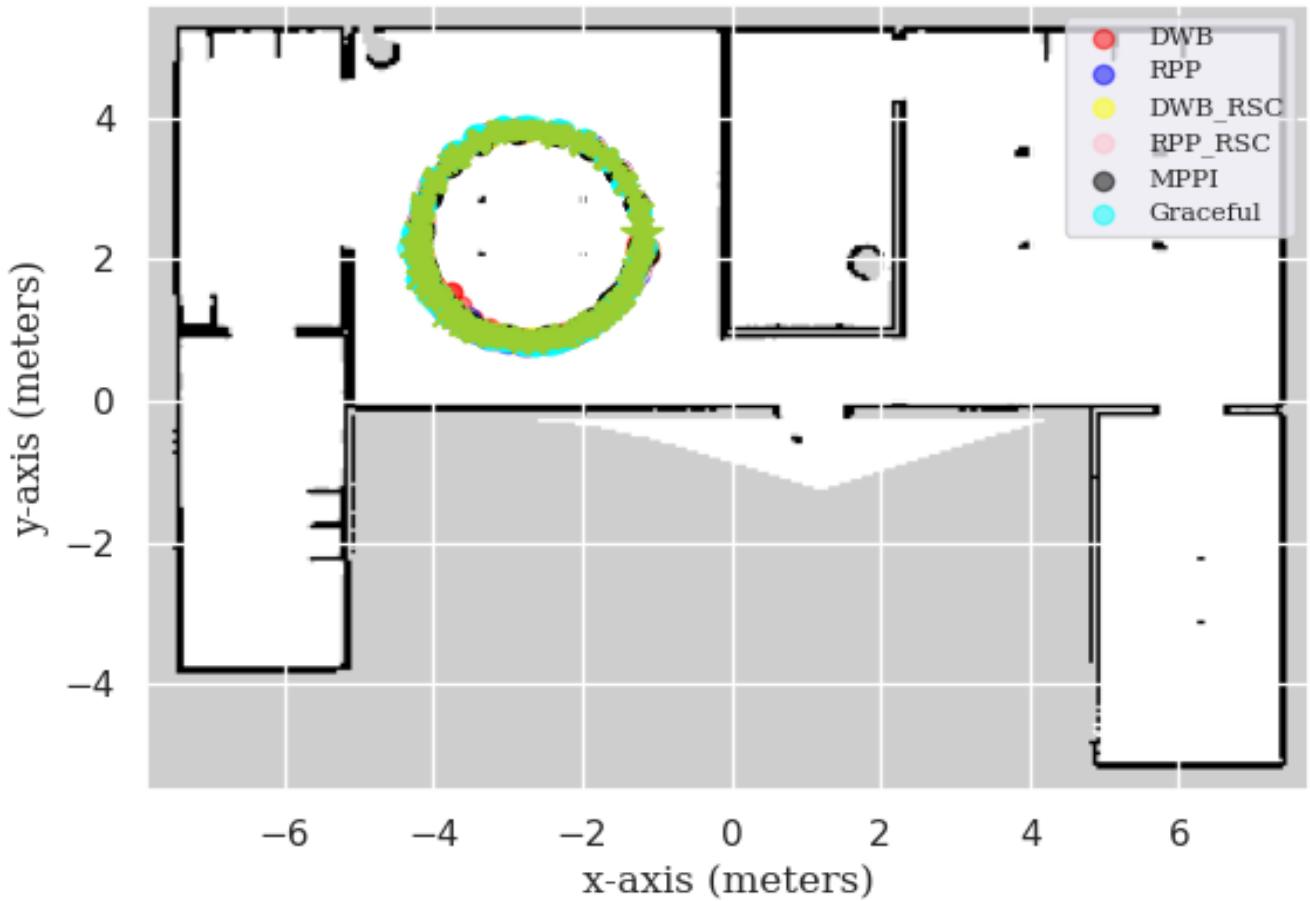
-Trajectory type: waypoints_1

✖ Global planner path

* Waypoints

★ Initial pose





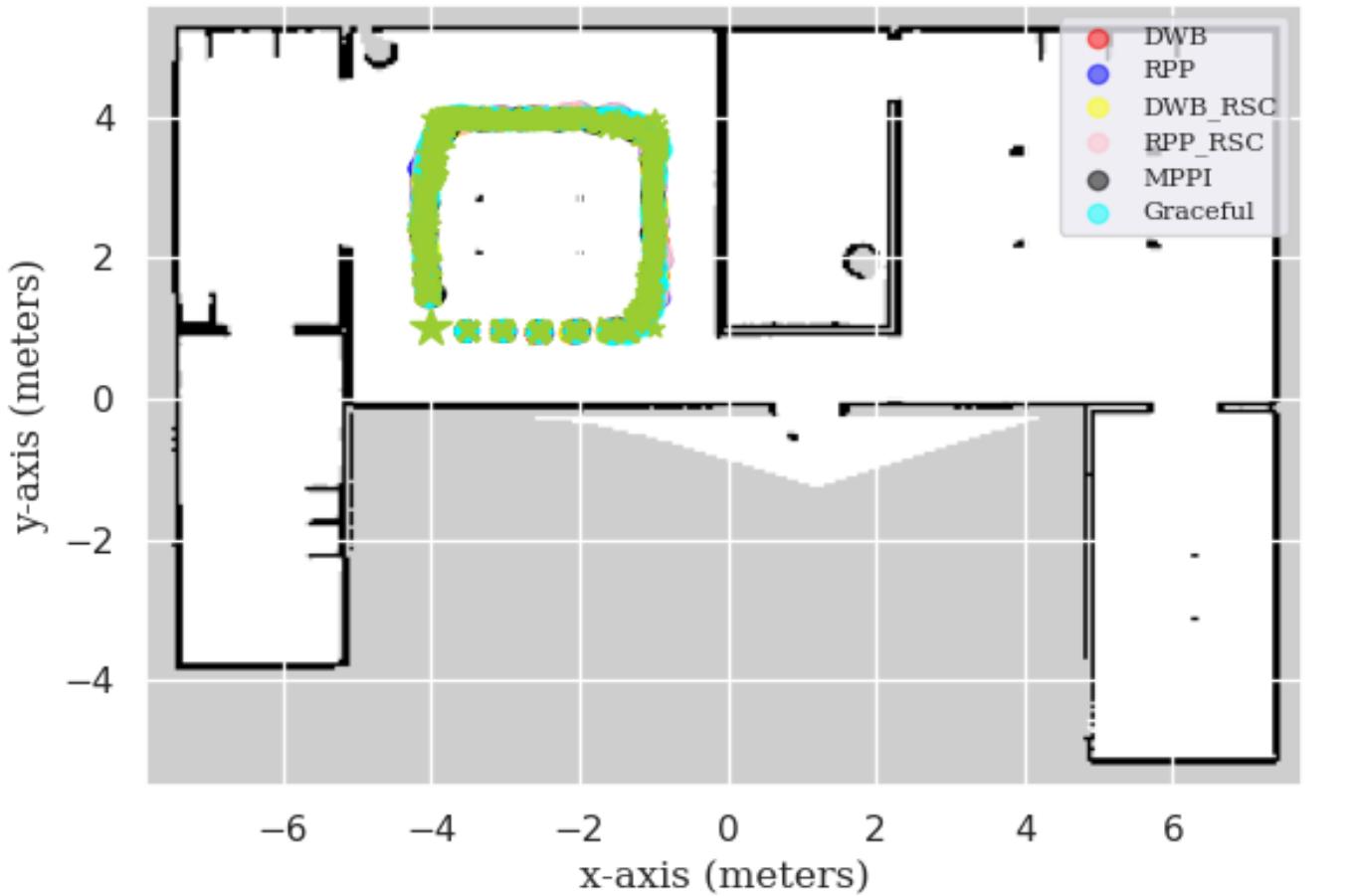
-Global planner: smac_planner

Traveled path

-Trajectory type: square_3

✖ Global planner path * Waypoints

★ Initial pose



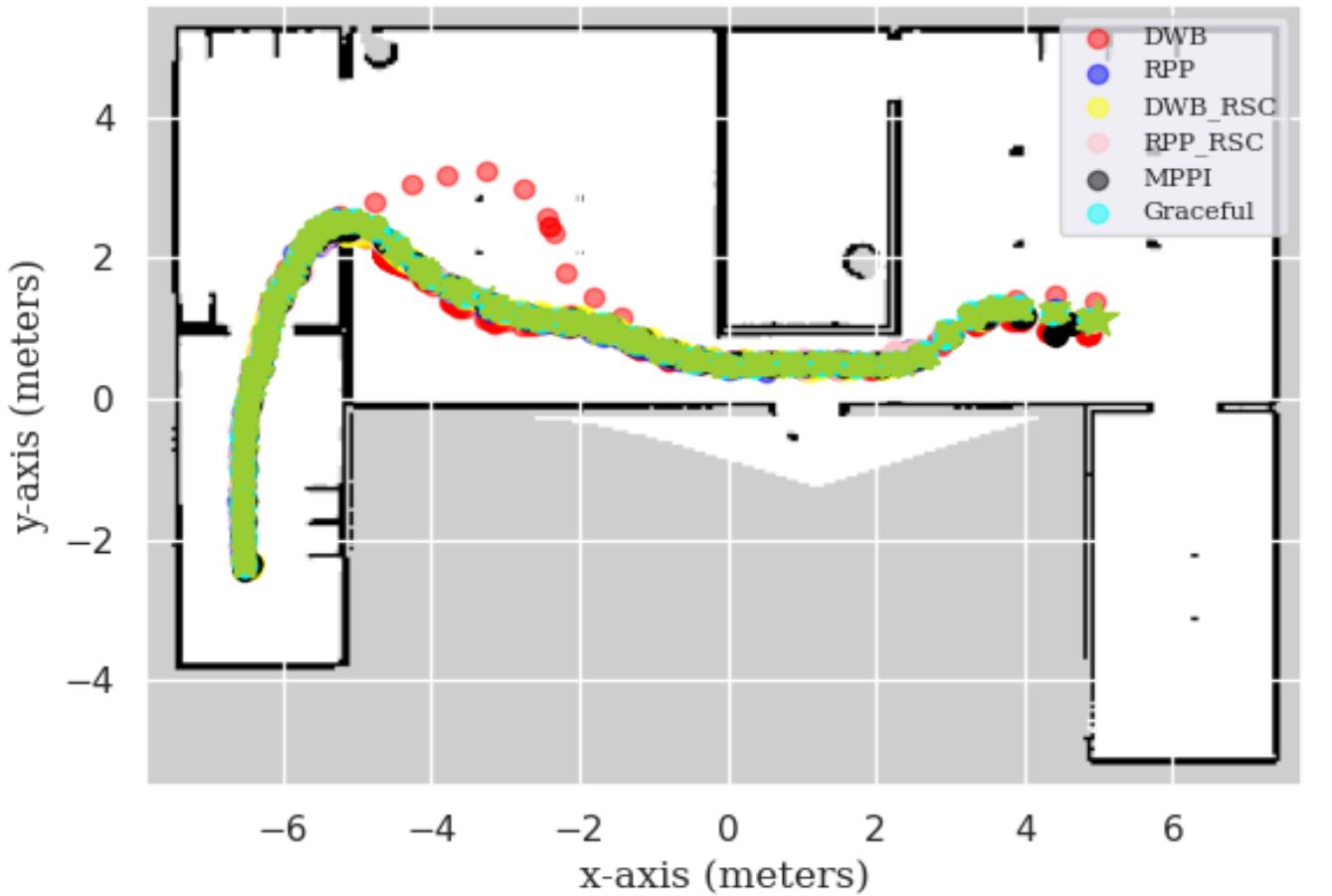
-Global planner: ThetaStar

Traveled path

-Trajectory type: single_goal_0

✖ Global planner path * Waypoints

★ Initial pose



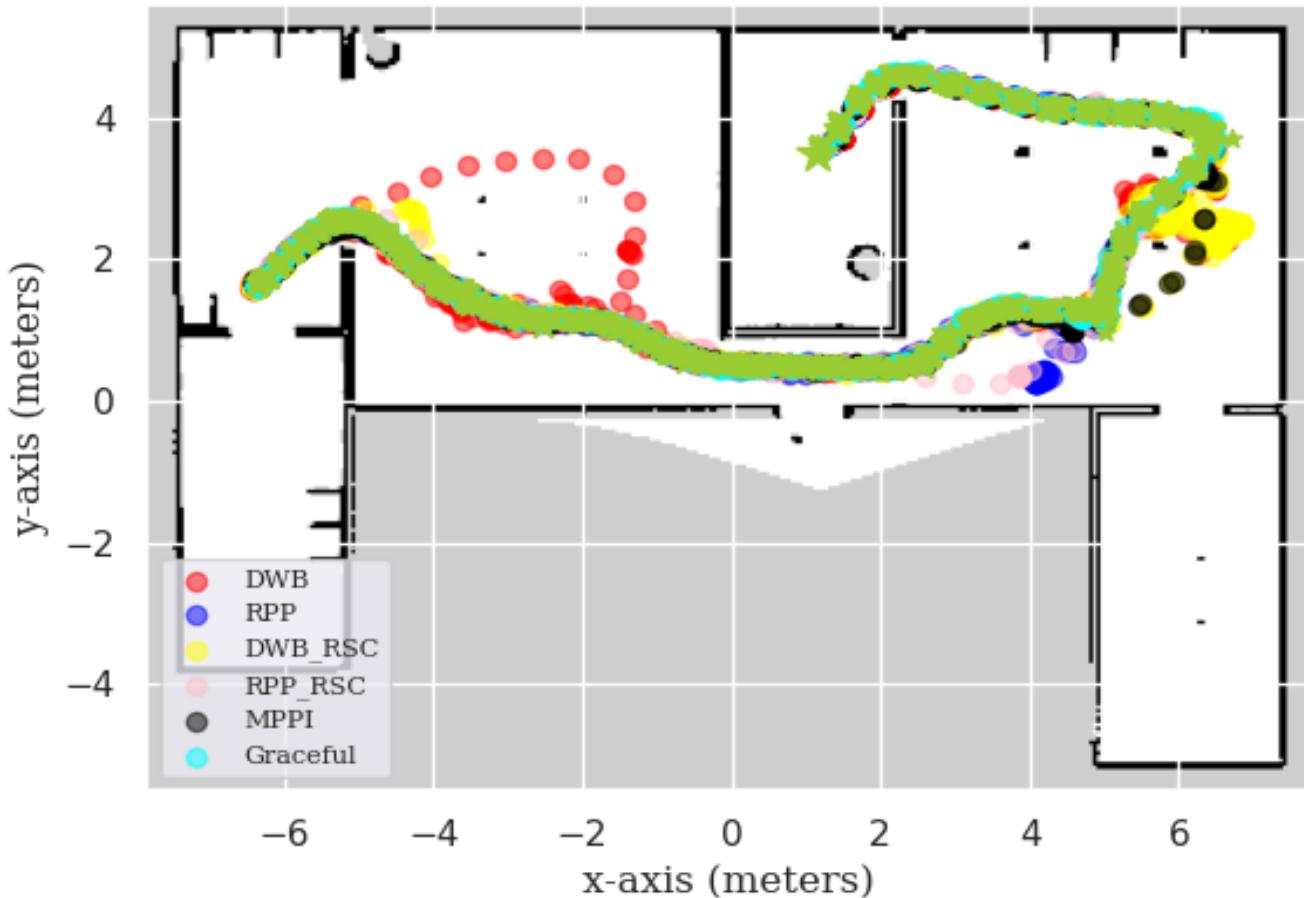
-Global planner: ThetaStar

Traveled path

-Trajectory type: waypoints_1

x Global planner path * Waypoints

★ Initial pose



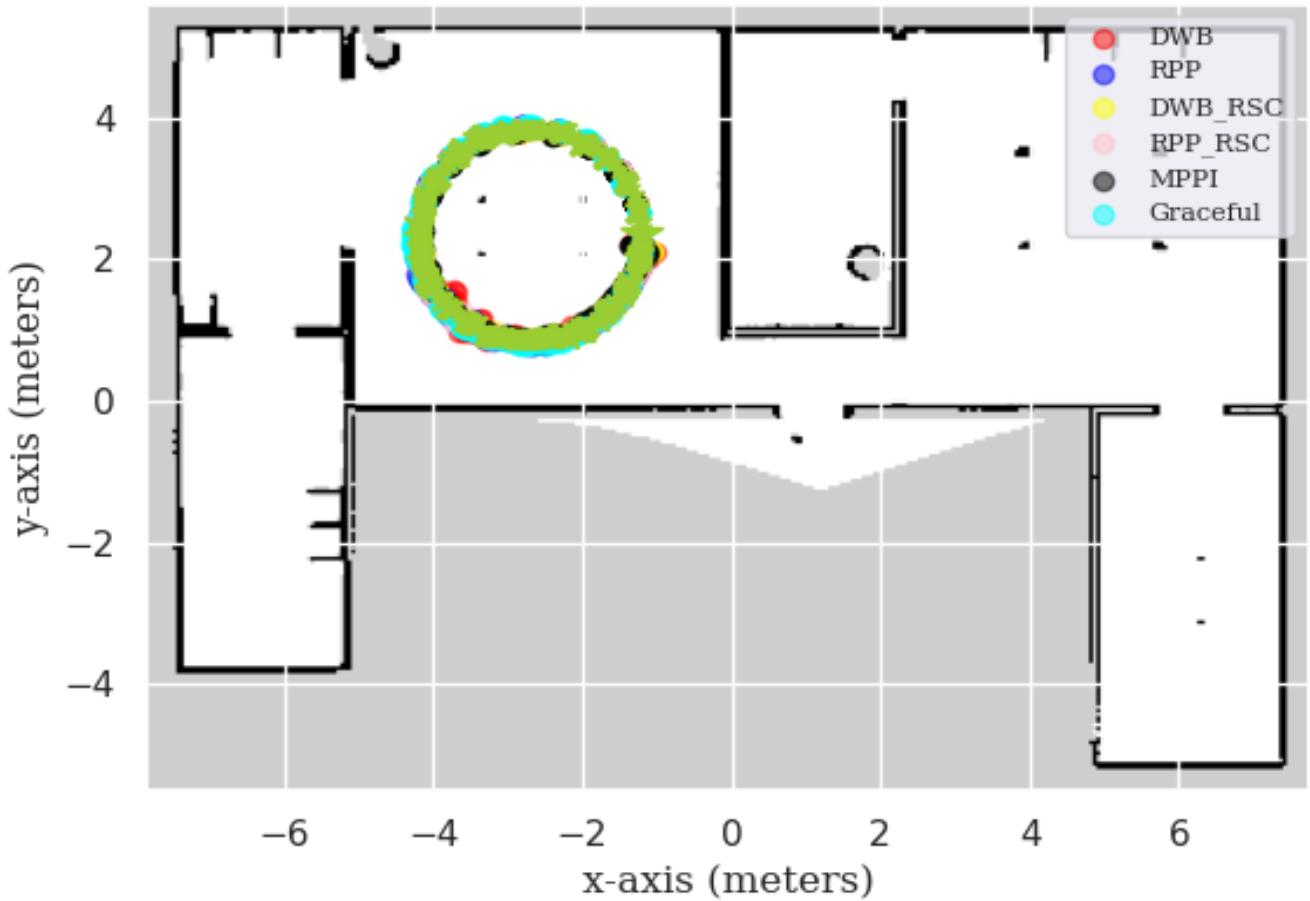
-Global planner: ThetaStar

-Trajectory type: circle_2

Traveled path

x Global planner path * Waypoints

★ Initial pose



-Global planner: ThetaStar

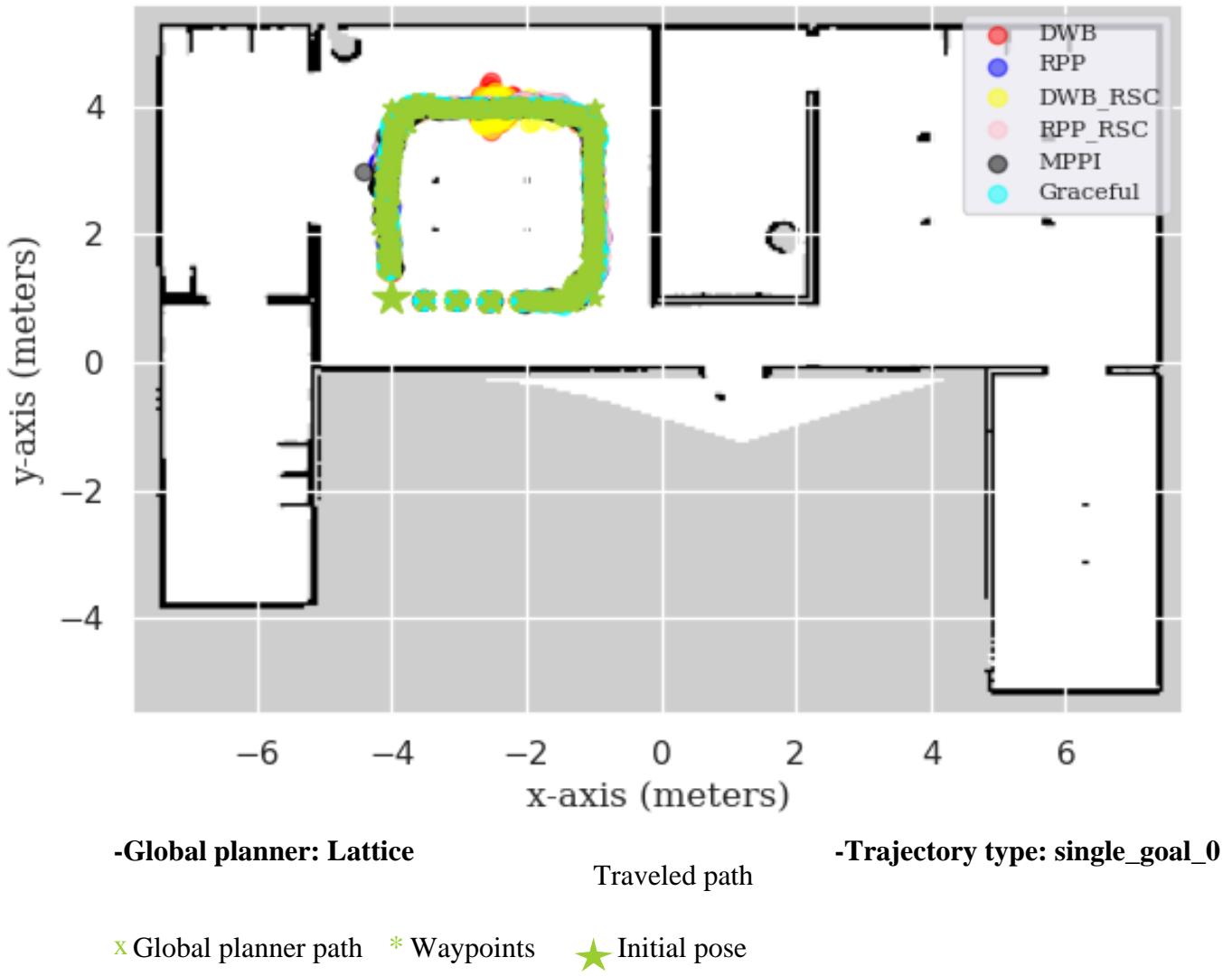
Traveled path

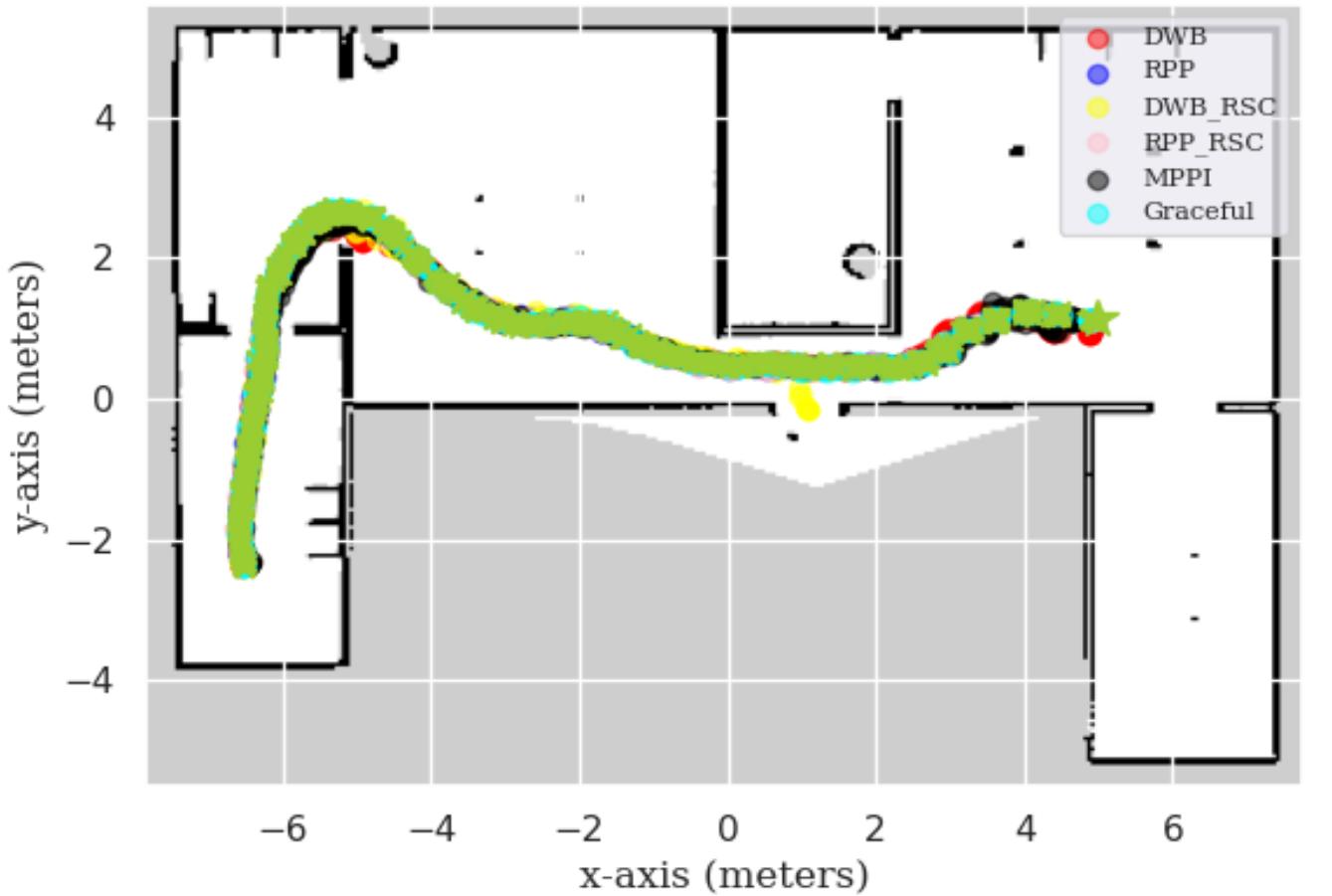
-Trajectory type: square_3

Global planner path

Waypoints

Initial pose





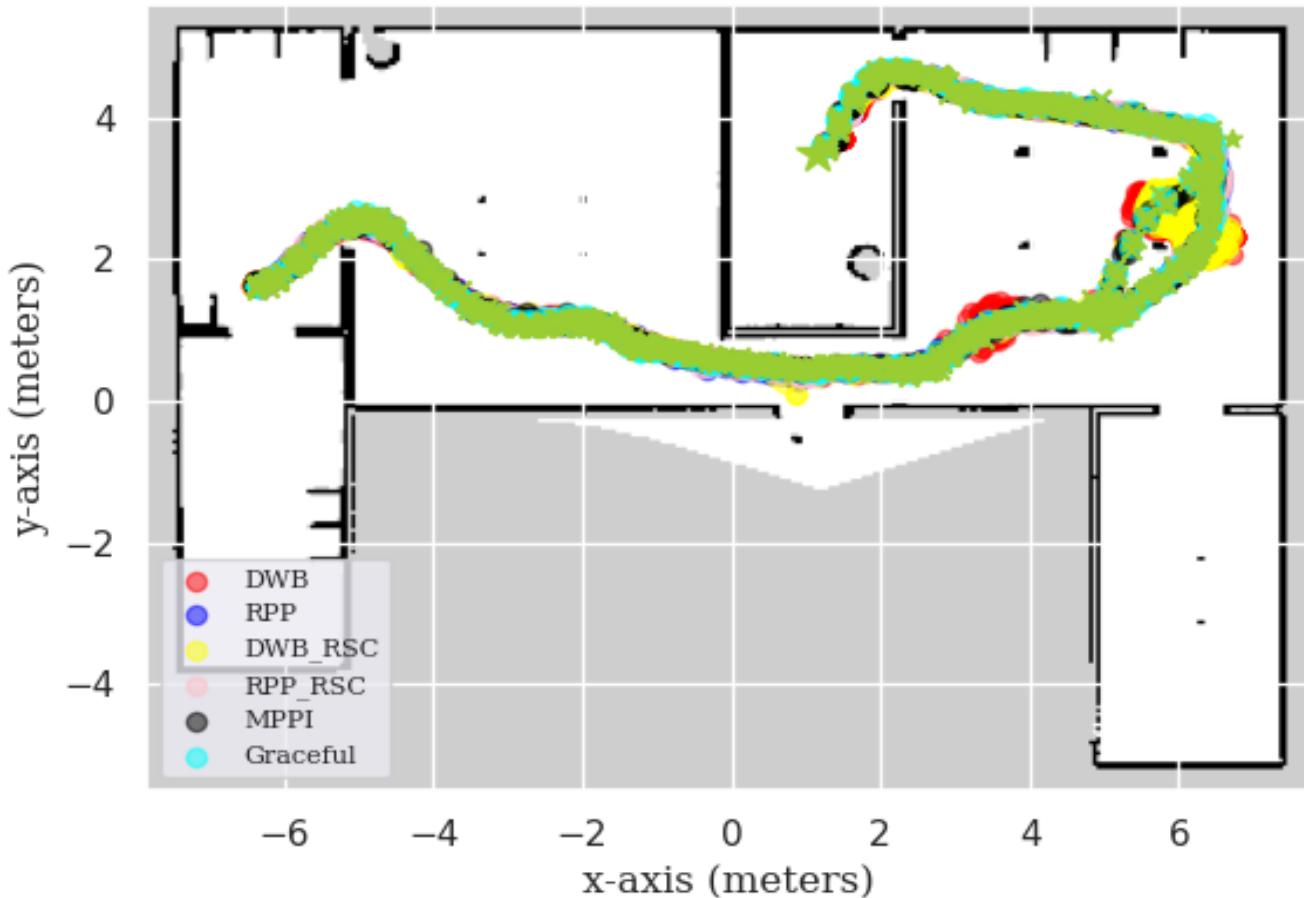
-Global planner: Lattice

Traveled path

-Trajectory type: waypoints_1

✖ Global planner path * Waypoints

★ Initial pose



-Global planner: Lattice

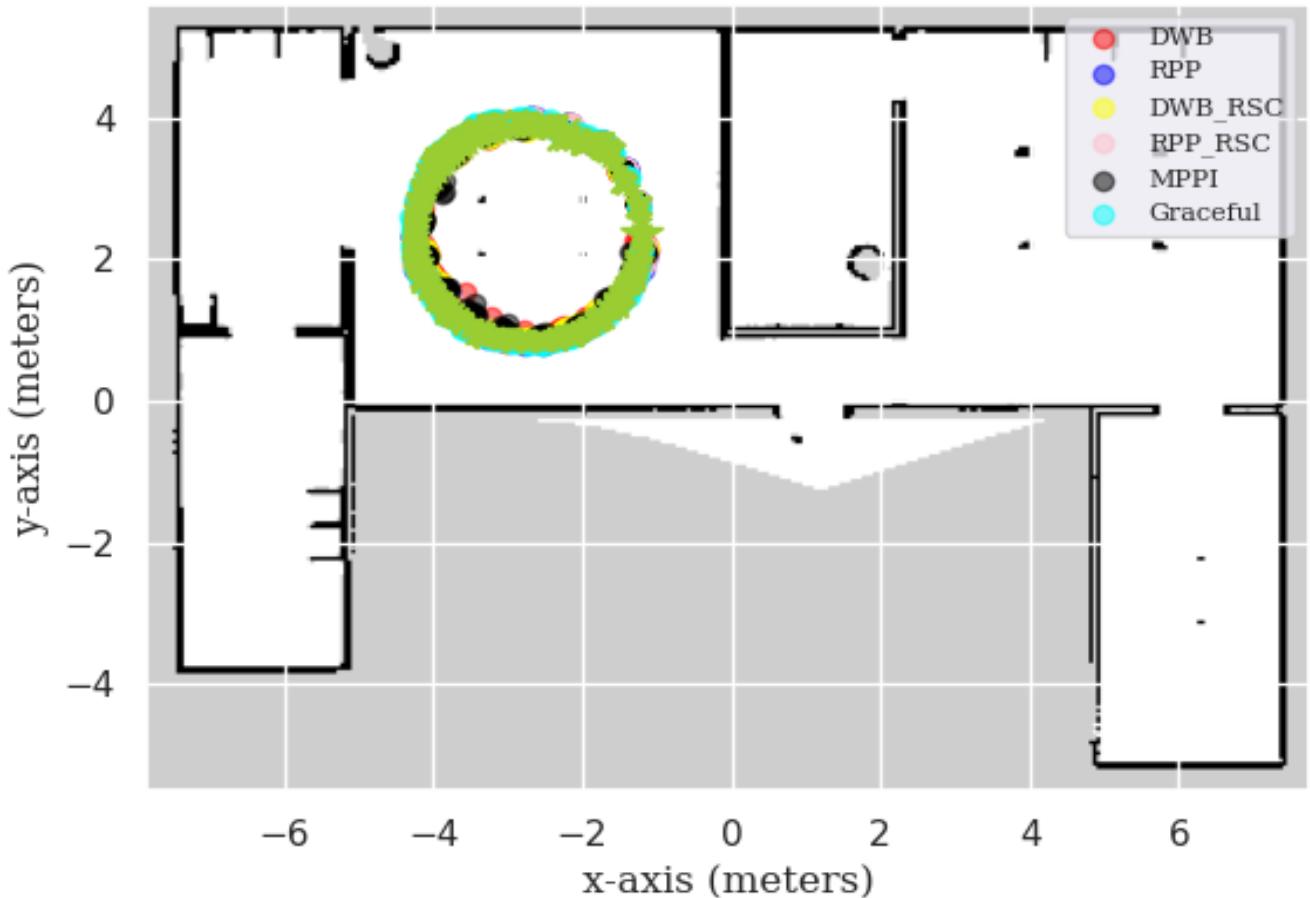
Traveled path

-Trajectory type: circle_2

Global planner path

Waypoints

Initial pose

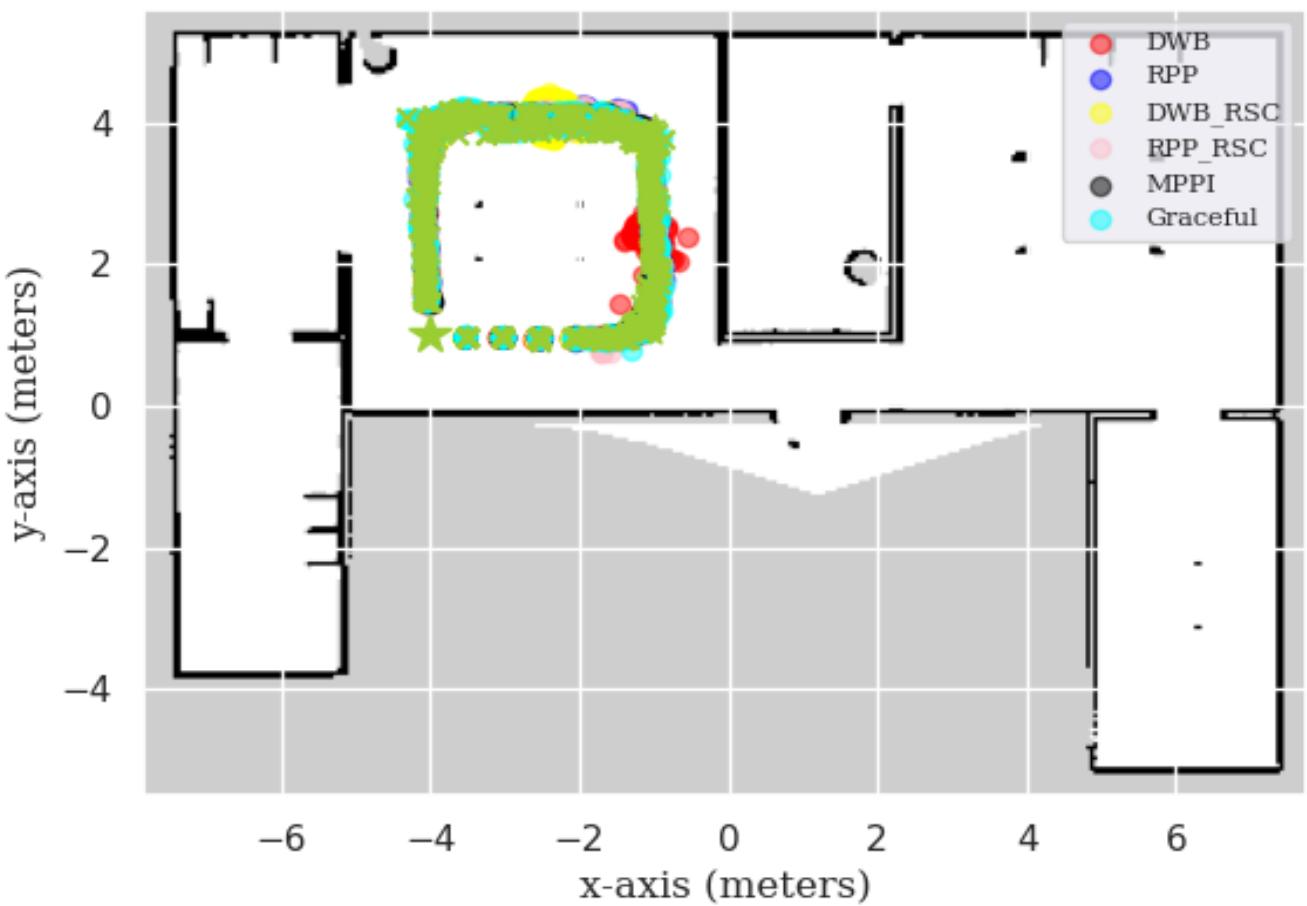


-Global planner: Lattice

Traveled path

-Trajectory type: square_3

✖ Global planner path * Waypoints ★ Initial pose



Failure report

Recorded log messages of navigation nodes, if any message is recorded

Global planner: Lattice		
Controller: DWB experiment#:74 iteration#:3		
Logger_name	Level	Message
controller_server	ERROR	Invalid path, Path is empty.