

TABLE OF CONTENTS

	Page
List of Tables	ix
List of Figures	xi
1 Introduction	1
1.1 Motivation	1
1.2 Objective	2
1.3 Contribution of this thesis	2
1.3.1 Theoretical Perspective	2
1.3.2 Architectural Design Perspective	3
1.3.3 Experimental Perspective	3
2 Literature Review	5
2.1 Cognitive Agent	5
2.1.1 Embodied Cognition	6
2.1.2 Cognitive Agent Architecture	6
2.1.3 Collaborative Control	7
2.2 Robotic Simulation Environment	8
2.3 Control Framework	9
2.3.1 Iridium	10
2.3.2 MOAST	10
2.3.3 Player	10
2.3.4 ROS	10
3 Proposed Architecture for Collaborative Control	13
3.1 User Interface Layer	13
3.2 Superior Control Layer	15
3.2.1 Reactive Module	15
3.2.2 Reactive Navigator	19
3.3 Local Control Layer	22

TABLE OF CONTENTS

4 Simulation and Experimental Evaluation	23	
4.1 Evaluation Metrics	23	
4.2 Simulation	25	
4.2.1 System Requirement	26	
4.2.2 Expectation from User	27	
4.3 Result	27	
5 Further Work and Conclusion	31	
Bibliography	33	
A Appendix A	37	
A.1 subject_A Driving P3AT robot in maze Environment under Collaborative Control	37	
A.2 subject_B Driving P3AT robot in maze Environment through teleoperation		
<td>.....</td>	38
A.3 Procedure to be followed by "subjects" before simulation	38	

LIST OF TABLES

TABLE	Page
4.1 Detailed Specification of ROS nodes running inside the cognitive agent	27
4.2 Analysis of Finish time with subject_A	29
4.3 Analysis of Finish time with subject_B	29

LIST OF FIGURES

FIGURE	Page
2.1 Main Characteristics of the mostly used 3D simulators in the field of Robotics.	9
3.1 Collaborative Control Architecture.	14
3.2 Communication between USARSim Simulator and ROS.	20
3.3 Automated navigator of ROS with USARSimRos interface	21
4.1 P3AT robot in the Maze Environment	24
4.2 All ROS Nodes and Topics running concurrently for the cognitive agent.	25
4.3 Experimental simulation set up for the cognitive agent.	26
4.4 Single ROS launch file for initiating several ROS nodes.	28
4.5 Graph shows that collaboration improves the Agent's Performance	29
4.6 Graph shows that collaboration performs better than Human	30
A.1 subject_A testing the simulated cognitive agent	37
A.2 subject_B testing the simulated cognitive agent	38
A.3 Cognitive Score calculation of the User	39