

Contents

Glossary	XIII
1 Introduction	1
1.1 Minimally-Invasive Surgery	2
1.1.1 A new kind of surgery	2
1.1.2 Ergonomic Challenges	4
1.2 Medical Robotics	10
1.3 Knowledge-based Cognitive Systems	17
1.4 Overview of Thesis	19
2 Endoscope Robots and Automated Camera Guidance	23
2.1 A Survey of Motorized Endoscope Holders	23
2.1.1 Endex	25
2.1.2 AESOP	26
2.1.3 Begin and Hurteau et al.	30
2.1.4 LARS / PLRCM	31
2.1.5 HISAR	33
2.1.6 Laparobot, EndoSista, EndoAssist	35
2.1.7 FIPS Endoarm	38
2.1.8 Munoz, ERM	40
2.1.9 LER, ViKY	42
2.1.10 Naviot	46
2.1.11 SOLOASSIST	48
2.1.12 LapMan	52
2.1.13 SWARM	54
2.1.14 COVER	55
2.1.15 SMART / P-arm	56
2.1.16 Tonatiuh II	58

6.3	Optional Action Components	204
6.3.1	Extended Field of View through Live Stitching	205
6.3.2	Optimization of Redundant Degree of Freedom	207
7	Evaluation Studies	209
7.1	Metrics for Objective Assessment of Surgical Tasks . .	210
7.2	Experimental Setup	211
7.2.1	OpenHELP	211
7.2.2	Laparoscopic Rectal Resection with Total Mesorectal Resection	212
7.3	Experimental Results	214
8	Conclusion	219
8.1	Discussion	219
8.2	Future Work	221