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**DESIGN AND DEVELOPMENT OF PROTOTYPE ROBOT FOR
BOILER HEADER INSPECTION**

By

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**A Thesis Submitted in Fulfillment of the Requirement for the Degree of
Master of Mechanical Engineering,
College of Graduate Studies
Universiti Tenaga Nasional**

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① Robots --- Design &
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ABSTRACT

In regular power plant inspection, one of the parts being examined is the boiler header which acts as to tie multiple steam mains to one boiler or multiple boilers to one or more steam mains. This is to prevent any carryover from the boiler to go into the steam mains. Due to the tedious inspection method and problems faced by technicians and engineer during the inspection process, a robotic device can be used to assist by integrating with the existing tool. Review on existing in-pipe robot designing was useful in coming up with the design of the boiler header inspection robot prototype, taking into account the nature of the boiler header being similar to pipelines. Concurrent with the literature review, a site visit to a TNB power plant at Manjung, Perak was done in order for data collection in term of working condition at the site during repair and maintenance operation. The geometry and arrangement of selected boiler headers also been taken as to estimate the size of prototype that will be developed later. Based on the data collected and literature review, several concepts of prototype have been generated and the final concept has been selected through the mechanical and electrical design processes. A 3D model prototype has been created using CAD software and preliminary analyses were done as to determine the prototype optimum design. Several calculations such as the gear ratio calculation are done in order to select the best motor to be used for the prototype. In fabrication stage the custom parts were sent out to the fabricator to be built while the standard parts were purchased from stores or directly order from special distributors. Concurrent with the building of hardware, a software also been developed as to complete the final prototype. A special GUI is developed to help the inspector to

control the robot via PC. A complete prototype was tested both in the laboratory and actual site at TNB power plant in Paka, Terengganu in order to verify the prototype's functionality. The results from the tests were positive and all objectives were met. There are still rooms for improvement for the robot to be more robust and capable of working in all sorts of boiler headers.

DECLARATION

I hereby declare that this thesis, submitted to Universiti Tenaga Nasional as fulfillment of the requirements for the degree of Master of Mechanical Engineering has not been submitted as an exercise for a similar degree at any other university. I also certify that the work described here is entirely my own except for excerpts and summaries whose sources are appropriately cited in the references.

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TABLE OF CONTENTS

	Page
DEDICATION	ii
ABSTRACT	iii
ACKNOWLEDGMENTS	v
DECLARATION	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	xi
LIST OF FIGURES	xiii
LIST OF ABBREVIATIONS / NOMENCLATURES / SYMBOLS	xviii
CHAPTER 1 - INTRODUCTION	
1.1 Introduction to Mobile Robotic In-Pipe Inspection Robot	9
1.2 Problem Statements	10
1.3 Objectives of Research	11
1.4 Scope of Works	11
1.5 Research Methodology	12
CHAPTER 2 - LITERATURE REVIEW	
2.1 Out-pipe Inspection Robot	15
2.2 In-pipe Inspection Robot	17
2.2.1 Pig Type	19

2.2.2	Wheel Type	21
2.2.3	Caterpillar Type	25
2.2.4	Wall-press Type	27
2.2.5	Walking Type	32
2.2.6	Inchworm Type	34
2.2.7	Screw Type	35

CHAPTER 3 - DESIGN ANALYSIS

3.1	Design Requirements	43
3.1.1	General Requirement	43
3.1.2	Specific Requirement	44
3.2	Engineering Specification	47
3.3	Design Process	49
3.3.1	Concepts Generation	51
3.3.2	Criteria of Selection	55
3.3.3	Design Selection	62
3.3.4	Prototype Final Concept	64
3.4	Analyses	65
3.4.1	Robot	66
3.4.2	Holder for Fiber Optic Camera (HFOC)	90
3.4.3	Platform Deployment Arm (PDA)	96
3.5	Prototype Fabrication	103
3.5.1	Robot & PDA Fabrication	104
3.5.2	Circuitry Fabrication	109

3.6	Control System & Graphical User Interface (GUI)	110
3.7	Robot Specifications	120

CHAPTER 4 – LAB TEST & FIELD TEST

4.1	Lab Test	123
4.1.1	Maneuverability Test	124
4.1.1.1	Results and Discussion	127
4.1.1.2	Conclusion on the Test	128
4.1.2	Camera	128
4.1.2.1	Results and Discussion	130
4.1.2.2	Conclusion on the Test	130
4.1.3	Wear & Tear	131
4.1.3.1	Results and Discussion	131
4.1.3.2	Conclusion on the Test	132
4.1.4	Platform Deployment Arm (PDA)	132
4.1.4.1	Results and Discussion	133
4.1.4.2	Conclusion on the Test	134
4.2	Field Test	134
4.2.1	Durability Test	135
4.2.1.1	Results and Discussion	137
4.2.1.2	Conclusion on the Test	138
4.2.2	Image Capturing	138
4.2.2.1	Results and Discussion	140
4.2.2.2	Conclusion on the Test	140

CHAPTER 5 - CONCLUSION AND RECOMMENDATION	
5.1 Conclusion	144
5.2 Recommendation	147
REFERENCES	148
APPENDIX A - Boiler-Header Data	156
APPENDIX B - Report on Site Visit to Sultan Azlan Shah Power Station, Manjung, Perak	167
APPENDIX C – Boiler Header Inspections Robot Prototype Drawings	173
APPENDIX D – Stesen Janaelektrik Sultan Ismail, Paka, Terengganu Site Job Procedure	205
BIODATA OF THE AUTHOR	212