COMPUTERIZED WELDING PROCESS SELECTION AND PARAMETER DETERMINATION

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"I hereby declare that I have read this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the degree of Master of Engineering (Mechanical – Advanced Manufacturing Technology)"

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A project report submitted in partial fulfillment of the
requirements for the award of the degree of
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MAY 2010

I declare that this project report entitled “Computerized Welding Process Selection and Parameter Determination” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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To my beloved Family and Friends

To my respected supervisor

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ABSTRACT

Welding is a materials joining process in which two or more parts are coalesced at their contacting surfaces by a suitable application of heat and/or pressure. In today technology, welding is an important process in manufacture and assembly project. There is a need for welding expertise to get the best welding qualities. For small and medium industry, employing a welding expert is quite costly. The purpose of this study is to design and develop an expert system to select suitable welding process and determining the optimum welding parameters. While conducting this project, the important question that the project focused on was how an effective and efficient computerized system can help in selecting the welding process and determine process selection parameters. Also an exclusive research was done to collect data about the arc and other welding processes parameters, designing database for the welding processes, welding parameters, and work-pieces characteristics related to the parameters of welding process, and also an algorithms was developed to find out the most suitable welding process and its parameters related to a specific work-piece. So having an expert system that helps in selecting the suitable welding process and determine process parameters can help industries and welders to set the welding process time, less expensive and extensive clerical work, and provide reliable and consistent welding processes. However, the required methodology for this project development began from initial planning, an analysis, design, development of a prototype, and finally

implementation and application testing of the system was executed. Farther more, evolutionary prototype is chosen as the system development methodology for this project. On the other hand, a prototype of the proposed system was developed and deployed by using Oracle Application Express version 3.2 as a web page developer tool and Oracle Database 11*g* as data storage application. Finally, this project is developed to achieve the objective of improving the welding processes selections by using expert system, which is a computer program with reasoning capabilities to solve a particular problem.

ABSTRAK

Penaterian merupakan satu proses pencantuman bahan di mana satu atou lebih bahagian disatukan pada permukaan sentuhan setiaprya, dengan mengaplikasikan haba dan atau tekanan. Dalam teknologi hari ini, pematesian merupalcan proses yang penting dalam projek pemosangon dan pembuatan. Wujudanya satu keperivan terhadap pakar pematerion bagi mendapatkan kualiti pematerian yang terbaik. Bagi industri kecil dan sederhana, mengambil seorang pakar pematerian adalah agak mohal. Tujvan kajian ini adalah untuk merekabentuk dan membangunkan sebuah sistem pakar untuk memilib proses pematesian yang sesuai dan menentvkan parameter pematerian yang optimum. Semasa mengendalikan projek ini, persoalan penting yang difokuskan adalah bagaimana sebuah sistem berkomputer yang berkesan dan cekap (efektif dan efisyen) dapat membontu dalam memilih proses pematesian dan menetukan pemilihan parameter proses. Satu kajian ekslusif juga telah telah dilaksanakan untuk mengumpul data tentag lengkok dan parameter proses pematerian yang lain, merekapentuk rujukan data untuk proses pematerian , juga sebuah algorithm telah dibongunkan untuk menentukon proses pematerian yang paling sesuai peserta parameternya yang berkenaan dengan hasil keja tertentu. Maka, mempunyai sebuah sistem pakar yang mambantu memilib proses pematerian yang sesuai dan menentukan parameter proses dapat membantu industri dan juga pemateri untuk menentukan masa proses pematerian, kerja-kerja perkeranian yang lebih murah dan singkat, dan menyediakan satu proses pematerian yang boleh dipercayai dan konsisten. Walaubgaimanapon, kaedah yang diperlukan bagi pembangunan projek ini bermula daripada perancangan awal, analisis, rekabantuk, pembinaan prototaip, dan

akhirnya pelkasanaan dan pengaplikasian ujian terhodop sistem yang telah dibina. Tambahan lagi, evolvsi prototaip telah dipilih sebagai kaedah pembangunan sistem projek ini. Dengan kata lain, prototaip sistem yang dicadangkan telah dibargunkan dan dilaks anakan dengar menggunakon Oracle Application Express version 3.2 sebagai pembangun muka web, dan Oracle database 11g sebagai aplikasi peroyimpan data. Akhir sekah, projek ini telah dijayakan untuk mencapai objektifnya meperbaiki pemilihan proses pematerian dengan meggunakan sistem pakar yang merupokan sebuah program berkomputer yang perkebolehan 'reasoning' untuk menyelesaikan masalah terkntu.

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE
	DECLARATION	**ii**
	DEDICATION	**iii**
	ACKNOWLEDGEMENTS	**iv**
	ABSTRACT	**v**
	ABSTRAK	**vii**
	TABLE OF CONTENTS	**ix**
	LIST OF TABLES	**xiii**
	LIST OF FIGURES	**xv**
	LIST OF ABBREVIATIONS	**xvii**
	LIST OF APPENDICES	**xix**
1	**Project Overview**	**1**
	1.1. Introduction	1
	1.2. Problem Background	2
	1.3. Statement of the Problem	2
	1.4. Project Objectives	3
	1.5. Scope	3
	1.6. Importance of the Project	3
	1.7. Chapter Summary	4
2	**LITERATURE REVIEW**	**5**
	2.1. Introduction	5

2.2. General Welding 6
2.3. Arc Welding 7
2.3.1. Shielded Metal-Arc Welding (SMAW) 7
2.3.2. Gas Tungsten Arc (TIG) Welding (GTAW) 9
2.3.3. Plasma Arc Welding (PAW) 13
2.3.4. Gas Metal-Arc Welding (GMAW) 16
2.3.5. Flux-Cored Arc Welding (FCAW) 18
2.3.6. Submerged Arc Welding (SAW) 20
2.4. Resistance Welding (RW) 22
2.4.1. Advantage and Disadvantages of RW 22
2.4.2. Resistance Spot Welding (RSW) 23
2.4.3. Resistance Seam Spot Welding (RSEW) 24
2.4.4. Resistance Projection Welding (RPW) 25
2.4.5. Flash Welding (FW) 27
2.4.6. Upset Welding (UW) 28
2.4.7. Percussion Welding (PEW) 29
2.5. Oxyfuel Gas Welding (OFW) 29
2.5.1. Advantages and Disadvantages of Oxyfuel Gas Welding 30
2.5.2. Oxyacetylene Welding (OAW) 31
2.5.3. Oxyhydrogen Welding (OHW) 32
2.5.4. Pressure Gas Welding (PGW) 32
2.6. Expert System 33
2.6.1. Definition 33
2.6.2. Current Expert Systems 33
2.6.3. Advantage of Expert System 35
2.7. Welding Process Selection 36
2.7.1. Introduction 36
2.7.2. Selection Criteria 37
2.7.3. Technical Consideration 37
2.7.4. Cost Consideration 39

	2.8. Parameter Selection	40
	2.9. Chapter Summary	43
3	**METHODOLOGY**	**44**
	3.1. Introduction	44
	3.2. Project Methodology	45
	3.2.1. Phase 1: Initial Planning Phase	47
	3.2.2. Phase 2: Analysis	47
	3.2.2.1. Literature Review	47
	3.2.2.2. Study Current Expert Systems in Welding Process Selection	48
	3.2.3. Phase 3: Develop Prototype	48
	3.3. System Development Methodology	50
	3.3.1. Evolutionary Prototype	51
	3.3.2. Justification of Chosen Methodology	52
	3.4. System Requirements Analysis	53
	3.4.1. Hardware Requirements	53
	3.4.2. Software Requirements	54
	3.5. Project Schedule	55
	3.6. Chapter Summary	55
4	**SYSTEM DESIGN IMPLEMENTATION AND TESTING**	**56**
	4.1. Introduction	56
	4.2. Database Design	57
	4.3. Welding Process Algorithm/Model	61
	4.3.1. Arc and Other Welding Processes	63
	4.3.2. Resistance Welding Processes	67
	4.3.3. Oxyfuel Welding Process	71
	4.4. Program Chart	73
	4.5. Interface Chart	73

4.6. System Architecture 75
4.7. Coding Approach 75
4.8. System Evaluation 77
4.8.1. User Interface Testing 77
4.8.2. System Testing 78
4.8.2.1. Requirement Testing 78
4.8.2.2. Usability Testing 78
4.8.2.2.1. Usability Requirement 79
4.9. Organizational Strategy 81
4.9.1. Business Continuity Plan (BCP) 81
4.9.2. Expected Organizational Benefit 81
4.10. Chapter Summary 82

5 DISCUSSION AND CONCLUSION 83
5.1. Achievement 83
5.2. Constraints and Challenges 84
5.3. Aspirations 84
5.4. Chapter Summary 85

REFERENCES 87
APPENDIX A – B 89 - 120

LIST OF TABLES

TABLE NO	TABLE NAME	PAGE
2.1	Current Expert System	34
2.2	Keywords	40
2.3	Material Process Selection	41
2.4	Material Thickness Selection category	42
3.1	Details in every phase of project development	49
3.2	Activities in Evolutionary Prototype	51
3.3	Workflows of Every Phase in Evolutionary Prototype	52
3.4	Hardware Requirements	53
3.5	Software required for developing the system	54
4.1	Database Design	57
4.2	Arc and Other Welding Process Weldability	63
4.3	Arc Welding Thickness Suitabilities	64
4.4	General Characteristics of Fusion Welding Processes	65
4.5	Spot- welding metal combinations and weld abilities	67
4.6	Schedule for Spot welding Stainless Steel	68
4.7	Schedule for seam welding Stainless Steel	69
4.8	Design and welding data for project welding low carbon steels	70
4.9	Data for leftward welding	71
4.10	Data for rightward welding	71
4.11	Oxyfuel Welding Thickness Suitability	72
4.12	Interface Layout Standards	74

4.13 User Interface Testing 78

LIST OF FIGURES

FIGURE NO	FIGURE NAME	PAGE
2.1	Welding Process Categories	6
2.2	Shielded Metal Arc Welding (SMAW)	8
2.3	Gas Tungsten Arc Welding (GTAW)	10
2.4	Plasma Arc Welding Transferred and Non-transferred	14
2.5	Gas Metal Arc Welding	17
2.6	Flux-cored Arc Welding (FCAW)	19
2.7	Submerged Arc Welding	20
2.8	Fundamental Resistance Welding Machine Circuit	22
2.9	Basic Periods of Spot Welding	24
2.10	Seam Welding Process	25
2.11	Resistance Projection Welding	26
2.12	Flash Welding	27
2.13	Upset Welding	28
2.14	Oxyfuel Gas Welding Operation	30
3.1	Project Methodology Frameworks	46
3.2	Project Development Workflows	50
4.1	Database Design	61
4.2	Welding Process Model	62
4.3	Welding Position Design	66
4.4	Windows Navigation Diagram	73
4.5	User Interface Standards	74

4.6 System Architecture 75

LIST OF ABBREVIATIONS

A	- Excellent,
AW	- Arc Welding
B	- Good
BCP	- Business Continuity Plan
C	- Fair
CL	- Cost of Labor and overheads P.M.O.W
CM	- Cost of consumable Material P.M.O.W
CR	- Cost Rate of labor and overheads
CW	- Cost of Welding P.M.O.W
D	- Poor
E	- Excellent
E	- Very poor
ER	- Cost of Rate of Electrode
F	- Impractical
FCAW	- Flux-Cored Arc Welding
FR	- Cost Rate of Flux
FW	- Flash Welding
G	- Good
GMAW	- Gas Metal-Arc Welding
GR	- cost Rate of Shielding Gas
GTAW	- Gas Tungsten Arc Welding
I	- Intermediate
M	- Medium

OAW	- Oxyacetylene Welding
OF	- Operating Factor of the welding process (arc time/total time)
OFW	- Oxyfuel Gas Welding
OHW	- Oxyhydrogen Welding
P	- Poor
PAW	- Plasma Arc Welding
PEW	- Percussion Welding
PGW	- Pressure Gas Welding
RPW	- Resistance Projection Welding
RSEW	- Resistance Seam Spot Welding
RW	- Resistance Welding
S	- Sheet
SAW	- Submerged Arc Welding
SMAW	- Shielded Metal-Arc Welding
T	- Thick
T	- Time required P.M.O.W
UW	- Upset Welding
VG	- Volume of shielding Gas consumed P.M.O.W
WE	- Weight of Electrode consumed P.M.O.W
WF	- Weight of Flux consumed P.M.O.W
X	- Recommended

LIST OF APPENDICES

APPENDIX NO	APPENDIX NAME	PAGE
A	Gant Chart	88
B	User Manual	90

CHAPTER 1

PROJECT OVERVIEW

1.1. Introduction

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrabmnbmnst with soldering and brazing, which involve melting a lower-melting-point material between the workpieces to form a bond between them, without melting the workpieces.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, however, welding remains dangerous,

and precautions must be taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light.

Besides that, Arc welding uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. Welding in general can be considered as a multi-input multi-output process. Finally, the process of arc welding is widely used because of its low capital and running costs.

1.2. Problem Background

In today technology, welding is an important process in manufacture and assembly project. Welding expertise is required to generate a good welding procedure.
For small and medium industry, employing a welding expert is quite costly. Therefore, it would be indeed an asset to the industry if the expertise on the particular domain could be pooled and configured into an expert system, which is a computer program with reasoning capabilities to solve a particular problem.

The existing computerized welding expert systems have same drawbacks regarding the selecting and determining the welding parameters.

1.3. Statement of the Problem

While conducting this study, the main question to be focused on is how an effective and efficient computerized system can help in selecting the welding process and determine process selection parameters.

1.4. Project Objectives

The main objective of this project is to design and develop an expert system to select suitable welding process and determining the optimum welding parameters

1.5. Scope

The scopes of this project are:

1. Collecting data about the welding processes parameters.
2. Designing database for The welding processes, welding parameters, and work-pieces characteristics related to the parameters of welding processes
3. Developing algorithms to find out the most suitable welding process and its parameters related to a specific work-piece.

1.6. Importance of the project

The selection of a suitable welding process and determining the optimum parameters is not an easy task. This requires experience and involves a substantial amount of the time, expensive and extensive clerical work. The availability of expertise to generate a set of welding procedure is either expensive, scarce, or situations for which specialists do not have time.

So, with using the expert system, the welder just need to specify the workpiece materials, dimensions. Then the system will provide the suitable welding process and the optimum welding parameters.

The advantages of this computerized welding process selection system are:

1. Provides reliable, and consistent welding processes
2. Available 24/7
3. Saving the expertise salaries and their benefits

1.7. Chapter Summary

This chapter contains brief introduction of arc welding, background of the problem, statement of the problem, objectives of the project, scope, importance of the project, and chapter summary.