

SOFTWARE OPTIMIZATION FOR INPUT CONVERTER UTILITY TOOL SOFTWARE
USING DEEP LEARNING TECHNIQUE

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ABSTRACT

The world continues to move very fast when it comes to technology, different fields of industry continue to develop and apply many new found ideas and concepts that will help ease and give the best throughput results in their corresponding production area. One sample firm of this industry is “Finisar” in which the contribution of this research work will give credit. This thesis will study the problem of how to optimize and what optimization method that can suit to improve and mitigate the errors encountered by one of Finisar's software tools which is called Horsham Converter Tool. It will also study what are the differences and improvements between the current and the proposed optimized software. Upon completing this research, it should be identified already what optimization methods that will be used to lower the risk in error and enhance the current process for converting Specification Files. This work also aims to evaluate and show the comparison between the current and proposed optimized method using the actual software simulation. The method proposed is the deep learning technique which is one field in AI algorithms and will also discuss other different related fields in AI that can contribute to clarification on this research. Also, it adds some data structure concepts in processing the array data which is an additional optimization of the software tool. The results of the simulation of the research were measured by accuracy and the time lapse or the execution time. From an accuracy of 29.40% in the old method to 94.44% in the new proposed method was achieved upon simulation of the proposed method. Upon simulation of the new Input Converter Utility Tool Software, different product codes were tested and gave different accuracies and their time lapses or execution times. It shows from the tabulated table that the accuracy varies accordingly and is directly proportional to the amount of data that was used.

ABSTRAK

Dunia terus bergerak dengan pantas ketika datang ke teknologi, bidang industri yang berlainan terus berkembang dan menerapkan banyak idea dan konsep baru yang akan membantu memudahkan dan memberikan hasil pencapaian terbaik dalam bidang pengeluaran yang sesuai. Satu sampel firma industri ialah "Finisar" di mana sumbangan kerja penyelidikan ini akan memberi kredit. Tesis ini akan mengkaji bagaimana mengoptimumkan dan kaedah pengoptimuman yang boleh dipadankan untuk memperbaiki dan mengurangkan kesilapan yang dihadapi oleh salah satu alat perisian Finisar yang dipanggil "Horsham Converter Tool". Ia juga akan mengkaji apa perbezaan dan peningkatan antara perisian yang dioptimumkan dan terkini. Setelah menyelesaikan penyelidikan ini, perlu diidentifikasi apakah kaedah pengoptimuman yang akan digunakan untuk mengurangkan risiko dalam kesilapan dan meningkatkan proses semasa untuk menukar Fail Spesifikasi. Kerja ini juga bertujuan untuk menilai dan menunjukkan perbandingan serta mencadangkan kaedah yang dioptimumkan menggunakan simulasi perisian sebenar. Kaedah yang dicadangkan adalah teknik pembelajaran mendalam yang merupakan satu bidang dalam algoritma kecerdasan buatan dan juga akan membincangkan bidang-bidang lain yang berkaitan dengan kecerdasan buatan yang dapat menyumbang penjelasan mengenai penyelidikan ini. Juga menambah beberapa struktur data dalam memproses data seragam yang mengoptimumkan alat perisian. Hasil simulasi penyelidikan diukur dengan ketepatan dan masa berlalu atau masa pelaksanaan. Dari ketepatan kaedah 29.40% kepada kaedah lama hingga 94.44% kepada kaedah yang dicadangkan baru dicapai setelah simulasi kaedah yang dicadangkan. Setelah simulasi Alat Input Utiliti Input Converter baru, kod produk yang berbeza telah diuji dan memberikan ketepatan yang berbeza dan masa berlakunya atau masa pelaksanaan. Ini menunjukkan dari jadual yang ditakrifkan bahawa ketepatan bervariasi dengan sewajarnya dan secara langsung berkadar dengan jumlah data yang digunakan.

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LIST OF ABBREVIATIONS

ADT	-	Abstract Data Type
AI	-	Artificial Intelligence
ANN	-	Artificial Neural Network
AOT	-	Ahead-Of-Time
AV	-	Absolute Value
BOM	-	Bill of Material
BSD	-	Berkeley Software Distribution
EV	-	Experimental Value
GA	-	Genetic Algorithms
GBIC	-	Gigabit Interface Converter
GPS	-	Global Positioning System
GUI	-	Graphical User Interface
ICUTS	-	Input Converter Utility Tool Software
OOP	-	Object-Oriented Programming
PHP	-	Hypertext Preprocessor
PN	-	Part Number
PSO	-	Particle Swarm Optimization
QSFP	-	Quad Small Form-factor Pluggable
RDS	-	Recursive data structure
SCIA	-	Software Change Impact Analysis
SFF	-	Small Form Factor
SFP	-	Small Form-factor Pluggable
SFP+	-	Enhanced Small Form-Factor Pluggable
SOM	-	Self-Organizing Maps
TV	-	Theoretical Value

T-XFP	-	Tunable - 10 Gigabit Small Form Factor Pluggable
VB	-	Visual Studio
XFP	-	10 Gigabit Small Form Factor Pluggable
XPAK	-	Expansion Pack

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CHAPTER 1

INTRODUCTION

1.1 Overview

In Manufacturing Industry, especially in Electronics or Telecommunication field, thorough process, assembly and testing must give significance. Testing will be last stage of the flow, where some use machine alone or accompanied with software. If required Testing Software, it should be properly coded and set up so effective testing can achieve.

Most of the company uses software as their good resources and development. It can lessen company budget allocation. Software testing is costly in software development, but if software testing is avoided, it could be costlier. “Many different regular software companies spend up to 40-50% of development efforts on software testing (Barham, 2017)

Test Software varies for every company, how it built the structure, framework and interface in different utility tools and systems. It can also use different database for data handling, input and output. Software Application like this can encounter different problem and issues needed to fix under different stages and scenarios.

Encountering troubles and bugs in software field which applied in manufacturing firm, can be improved in many ways. This paper will give some view and solution that can

be used to to explain how can enhanced those problems which commonly encountered in manufacturing firm and one cited sample is this research paper.

1.2 Background of the Problem

Finisar is a company that produce and manufacture transceiver modules that being used in the Telecommunication Company or Networking Company and applied in online social media and internet, such as YouTube, Facebook, and other social media being used many internet users. To produce these modules, need thorough passed testing and accurate assembly. There are different data rates being produced in the company, some are short wave and other is long wave transceivers. There are also multichannel and single channel transceivers with different form factor(i.e. pluggable format at the end of the module) such as QSFP, SFP, SFP+, SFF, XFP, GBIC, XENPAK, XPAK, X2, XAUI. Some transceivers are Tunable and some are just being tested at the back end station.

The Transponder line in Finisar is one sample of Tunable XFP (T-XFP) 10G Multichannel Longwave (1550nm) transceivers. It is called also as Horsham Line where most of the product research and development came from Horsham Pennsylvania. This production line does have the Tuning and Testing Process where one software being used and interfaced with Database (Camstar System) and its equipment. This software is called “Partest” and tie up with different system and different utility software. One of the software being tie up with this Partest and use in Transponder Line is “Horsham Converter” where the data in one database (Oracle database being maintained by the Horsham and Wuxi China people) is being use as input for this utility software. The output of this software is being fed in the “Partest” software (main software in Finisar Ipoh for all transceiver testing). The output of the Partest is the passed or failed test of the module transceiver.

The Horsham Converter is a software tool that converts and encrypts parameter data from a database (i.e. Camstar Database). The output of this software tool is an

encrypted .fin type file and a converted .xml type file. Under current algorithm of this software tool, the .fin file type is already being called and used by the “Partest Software” (i.e. Finisar Testing Software for transceivers). After .fin file is being called, the start-up test will initialize the testing then proceed the tuning of different parameters and finally testing of the transceiver module will begin. But since there is a lot of development in the Horsham line, the .fin output file readable by Partest software is being altered and customized. This will be done by copying the .fin output file and transfer in excel file then do the customization of the existing formatted .fin type file. This .fin file type is arranged in a proper way so that the Partest software can read correctly. Also the splitting and rearranging of different type of testing process is consider when preparing the new excel file which being done manually. This manual process is a gate to errors and can seldom or frequently happened, and also, it is a time consuming to fix the error encountered, then throughput suffer. Once this error occurred, it can delay the normal procedure or step of the process.

1.3 Problem Statement

In line with the development of Module Testing in Horsham Tunable XFP Line, customization of equipment/testers and revamp of test sequences are ongoing procedure or process. However, this development generate problem in the existing Specs File (i.e. parameter specification and data of the transceiver module product which saved as in .fin file type or .xml file type or .xls file type), which is prone to human error. The current process which taking long time because of manual migration of all parameters from one file type to another file type then convert again to a new file type and use the Specs File Converter Apps to do this all file conversion and encryption. The output of these file conversion must able to read by the Finisar Partest Testing Software. Problem arises in the process of conversion, sometimes it is not successful and need more time to debug what characters causes the conversion error and this issue will be analyze. This error happen once the excel file is being converted again in .fin type file.

The following are the research problem:

1. What is the suitable software optimization technique or method that can improve and mitigate the errors during the process of converting Specification File?
2. How the suitable software optimization method that can smartly fix issues from the customized inputs that will be using in the ICUTS?
3. What is the differences and improvement between the current and the proposed optimized software?

1.4 Aim and Objectives

The aim of this study is to investigate on how to lessen the errors and to add smart method to the ICUTS or known as Horsham Converter Tool as mentioned above in the Finisar Manufacturing Firm.

The objective of the research is as follows:

1. To analyze, investigate and identify suitable optimization technique or method that can lower the risk in error and enhance the current process for converting Specification File.
2. To explore the optimization method that can suite to smartly fix the issues from the current customization of inputs that will be using in the ICUTS.
3. To evaluate and show the comparison between the current and propose optimized method using the actual software simulation.

1.5 Scope

The scope of this study are:

1. ICUTS capability for Specification File (i.e. Specs File) under Horsham Line Tunable-XFP Transceivers
2. Products. Specs File involve is profile data of a transceiver Product which properly arranged in a correct test and tune sequences.

1.6 Importance and Significance of the Research

This research will help to understand the current or existing Horsham Converter Tool or from the proposed name as Input Converter Utility Tool Software (ICUTS) and the proposed new tool (i.e. ICUTS). This will compare the current and proposed method or technique. Upon completing this research, it should be able to help and fix issues underlying to this Horsham Converter Tool used in Horsham Line Tunable-XFP Transceivers Products. This proposed enhanced tool will mitigate the prompt error during file conversion and while, on the process of testing. Lessen the error and smartly convertible the Specs File should be attainment of this research.

The research used some optimization method in the field of software. It will introduce different software optimization and how the data can be structure. It will show the normal optimization method and other hybrid software optimizations. The papers also will discuss and compare the current optimization that was being use nowadays. “Although, many approaches have been proposed and were successfully applied to predict software performance, still span of design space hinder the selection of the appropriate design alternative. Meta-heuristics such as Genetic Algorithms (GA) methods have proven its usefulness to solve the problem even with multi-degree of freedom. But, in recent investigations Particle Swarm Optimization (PSO), an alternative search technique, often outperformed GA when applied to various problems “(Saed and Kadir, 2011). “In recent

years, a new branch techniques of machine learning models called deep learning was presented” (Nguyen et al., 2016). At the end of the research, the papers should contribute some significant concept of mixing the AI especially in deep learning topic to be part of the optimization in the software.

This research paper also should contribute and impart some information and knowledge about data structure, since it will be added in the technique used. The addition of this data structure method is important to the deep learning technique that will be discuss in the following chapters. This was being added since the software will used big amount of data which data structure can handle. The discussion about linked list data structure will be provided in Chapter 2, then in Chapter 3, linked list data structure will discuss how it will support the optimization and lastly in Chapter 4 will show the implementation of the linked list data structure.

1.7 Thesis Structure

This chapter provided a brief discussion about the identified problem, brief overview about industry of electronics and digital communication and its module transceivers and background of the issue. It shows also here the main objectives of the research which answers the research problems that was listed and mentioned.

The research work scope also was discussed so that the boundary can be define, explain, discuss and evaluate. Added also on the last part is the research work importance and significance in other body of knowledge and information. It discussed a short overview of the method of optimization that will be later dig in the following chapters.

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