SCHEDULING OF DUTY ROSTER FOR TESCO STAFF USING GENETIC ALGORITHM

MOHAMAD FAHMI BIN NORDIN

UNVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*

JUDUL: **SCHEDULING OF DUTY ROSTER FOR TESCO STAFF USING GENETIC ALGORITHM**

SESI PENGAJIAN: **2008/2011**

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(TANDATANGAN PENULIS)

Alamat tetap : 5584,JALAN KURNIAWAN, KG KURNIA , 80250 JOHOR BAHRU, JOHOR.

Tarikh : 04/07/2011

(TANDATANGAN PENYELIA)

Nama Penyelia :CIK NUZULHA KHILWANI BTE IBRAHIM

Tarikh : 04/07/2010

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MOHAMAD FAHMI BIN NORDIN

This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Artificial Intelligence)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2010

DECLARATION

I hereby declare that this project report entitled

SCHEDULING OF DUTY ROSTER FOR TESCO STAFF USING GENETIC ALGORITHM

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : ..... Date: 04/07/2011

(MOHAMAD FAHMI BIN NORDIN)

SUPERVISOR : ..... Date: 04/07/2011

(NUZULHA KHILWANI BINTI IBRAHIM)

DEDICATION

To my beloved parents, Nordin Bin Moharam and Painah Binti Mukhari, and also my siblings for their love and support.

To my kind supervisor, Miss Nuzulha Khilwani Ibrahim for making it worthwhile.

To all my lecturers and friends for their support.

ACKNOWLEDGEMENTS

First and the foremost, I will praise to my God Allah S.W.T who always guide me to the correct path along the project session. I would like to appreciate all the knowledge that we have learn in our life. So that I would like to express my sincere appreciation and a lot of thanks to my respectable supervisor, Miss Nuzulha Khilwani Binti Ibrahim for his expert advice and knowledge that he give to me to finish my final year project. Beside that he always helps with the selection of topic, recommendation for solution and review of materials. Special thank also to her because proposed a well thesis idea to me, he has given me many useful suggestion and idea to finish the system.

Other than that I would like to thanks PSM (*Projek Sarjana Muda*) committee members on their kindness in organizing briefing, seminar and talk to student who took this subject. So that all this activity can help the student a lot for example can give an overview and idea to them begin doing the project.

Last but not least, I would like to thank all my course mates for their willingness to share their ideas, knowledge and resource so that I can use to develop the project. Also thanks to my beloved parents who have been giving me support and motivation while doing this final year project. They always remind me, you doing well if you want to success in the future.

ABSTRACT

Tesco Staff Scheduling System is the system that develops by using Matlab R2009a software to auto-generate duty roster for Tesco staff. This is a simple system that can be used to generate the duty roster or schedule for staff automatically by clicking on some buttons and done with it. The existing system cannot fix the schedule with consistent output. The technique that uses to develop this system is Genetic Algorithm which is this technique is one of the Artificial Intelligent techniques. Specifically, steps and methods are explained well so that it can be used for further research and learning. The Tesco Staff Scheduling System is dedicated for job scheduling field especially Administrator of Tesco Company to simplify their part of jobs.

ABSTRAK

Sistem Penjadualan Pekerja Tesco adalah sistem yang dibangunkan menggunakan perisian Matlab R2009a untuk menjana secara automatik jadual tugas untuk kakitangan Tesco. Ini adalah satu sistem yang mudah yang boleh digunakan untuk menjana jadual tugas atau jadual untuk kakitangan secara automatic dengan klik pada beberapa butang dan selesai. Sistem yang sedia ada tidak boleh menetapkan jadual dengan hasil keluaran yang konsisten. Teknik yang digunakan untuk membangunkan system ini adalah Algoritma Genetik dimana teknik ini adalah salah satu daripada teknik Kepintaran Buatan. Khususnya, langkah-langkah dan kaedah yang dijelaskan dengan baik supaya ia boleh digunakan untuk penyelidikan lanjut dan pembelajaran. Sistem Penjadualan Pekerja Tesco khusus untuk bidang penjadualan kerja terutama Pentadbir Syarikat Tesco untuk memudahkan bahagian kerja mereka.

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CHAPTER I

INTRODUCTION

1.1 Project Background

Scheduling is one of the important tasks encountered in real life situations. Various scheduling problem are present like personnel scheduling, production scheduling, education timetable scheduling etc. Educational timetable scheduling is a difficult task due to many constraints that are needed to be satisfied in order to get a feasible solution. Those constraints that involve when scheduling an educational timetable are the amount of available classroom or lab at faculty, the amount of student, the lecturer working hour and others. Educational timetable scheduling problem is known to be Non Polynomial Hard (NP Hard). Hence, evolutionary techniques have been used to solve the time table scheduling problem. Methodologies like Genetic Algorithms (GAs), Evolutionary Algorithms (EAs) etc have been used with mixed success. The method that implement in my project is Genetic Algorithms because it is a search heuristic that mimics the process of natural evolution. This heuristic is routinely used to generate useful solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover.

The system that will develop is a system that can automatically arrange and generate a timetable for month by month timetable for staff at Fresh Department in TESCO. The system that I will develop is using MATLAB software and the programming language will using MATLAB algorithm and the implementation of genetic algorithm which is one of the technique or method in the field of Artificial Intelligent. By the implementation of the AI technique or method, the system will be smarter and produce the most correct output. The Problem that always facing when done the job schedule manually by human power is the schedule got a clash part which a staff needs to work for lots of shifts in a week. It can be consider as a penalty on that particular schedule. On the other hand, the time or period is very long to arrange the job schedule manually because they need to done step by step and always done checking on the shifts and slots for every single staff that embed on the schedule. So, this show that schedule that arrange manually is not optimize at all.

1.2 Problem Statement

The timetable that arrange manually by the TESCO administrator or scheduling officer is not very optimize and need a lot of time to produce it. So this system will help to auto-generate the job schedule. Sometimes, the job schedule that been outputted by the officer can extremely tired the staff in one week example like the for first week slot, the staff need to change to lots of shifts and it surely will tired the staff extremely.

1.3 Objectives

The objectives of this project are such as below:

- To investigate the optimize way on Tesco staff's job schedule using Genetic Algorithm

- To model Tesco staff's job schedule using Genetic Algorithm
- To apply and test the system to arrange Tesco staff's job schedule using Genetic Algorithm

1.4 Project Scope

The project is only the schedule for Tesco staff in a Fresh Department. The system will arrange the schedule in the most optimize way that satisfied all field like shifts, number of staff and days or weeks. The system will arrange the entire Tesco staff's job schedule for staffs and also the other departments if it is match the requirements.

The scopes of the project are listed as follows:

- The intelligent approach that will use in the system is Genetic Algorithm to the job scheduling for Tesco staff.
- The target user is the Administrator or head officer that will handle the schedule for Tesco staffs.
- The schedule is built for the Fresh Department in Tesco Cheng, Malacca.
- The system will generate the schedule automatically based on the hard and soft constraints.
- The system is built with MATLAB R2009a and Microsoft Excel. The output will be save as an excel file.

1.5 Project Significance

Tesco scheduling system precise and clearly defined set of requirement based on Tesco scheduling and management. It is used to generate an optimize scheduling by replace the manually scheduling method.

The research is mainly for the job scheduling problems for Fresh Department in Tesco Cheng, Malacca. It will use an Artificial Intelligence (AI) approach to solve the problems. It is important to help the Administrator or head officer to prepare the schedule as there are many constraints to be considered to produce a perfect schedule. The system will automatically generate the schedule for the Tesco staffs in Fresh Department by using Genetic Algorithm.

1.6 Expected Output

Hopefully, this system can make the staffs or Administrator easy to arrange optimize and a precise schedule. The important is Administrator can save lots of time by using this system with just a little click on this system to generate a schedule that more effective and practical than manually process job schedule.

Hence, this system is more well-organized by the Administrator and easy to manage the job schedule in Fresh Department and others if suitable and matching for the soft constraints and hard constraints. The output for the schedule is a month of job schedule. Then the schedule will save as an excel file so that it is easy to retrieve back the schedule and easy to manage.

1.7 Conclusion

As a conclusion, by all the brief explanation about the importance of the system development stated above, we can see that many benefits can be achieved by many people, Through this system, it is an effective way to create an optimize job schedule that will bring benefits to the staffs and administrator. The next chapter will be discussed on literature review and project methodology.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Project Background

As a general, software project or intelligent system development will pass through a few phases involve of technique and methodology in software development. There a few methodology methods as there are different types of projects with different resources and goals.

However, for the system, we have chosen object-oriented based application as our development, while Object-Oriented Analysis and Design (OOAD) as our project's methodology. This chapter shall discuss in details about the facts and finding, project methodology, project requirement project schedule and maintenance.

2.2 Facts and Findings

Facts and finding is data and research I can get from the internet resources, books, documentation and observation to the job scheduling pattern. Furthermore, this

chapter is more focused on the existing current manual system and facts related to the approach and technique in developing Tesco Staff's Scheduling System.

2.2.1 Domain

The domain of the project is mainly the job or staff scheduling problems that usually can be found in any organizations to set up the staff in the roster. Job scheduling can be considered as a Partial Constraint Satisfaction Problem (PCSP) (E. C. Freuder and R. J. Wallace, 1992). The job scheduling problem specifically concentrates on the problem of creating a scheduling, representing the assignments of staffs to shifts. The task is to find a consistent allocation of shift values (five shifts), for a numbers of staffs, over a fixed period of time (a month), that satisfy as many as possible of a set of schedule constraints. There are two types of constraints in the staff scheduling which are the hard constraints and soft constraints.

2.2.1.1 Hard Constraints

Hard constraints represent the requirements that must be met in order to make the schedule usable. If any one of the hard constraints is not meet in the project, the project is not working. The hard constraints that will be considered in my project are as following:

- Cover needs to be fulfilled (i.e. no shifts must be left unassigned).
- In one day, must have five working shifts (M70, M90, M11, A12, A30)
- For each day a staff may start only one shift.
- For a whole month, one staff get MRE (rest day) for four times or five times depends on the days of the moth (29, 30 or 31 days).
- During any period of 24 consecutive hours, at least 12 hours of rest is required. A night shift has to be followed by at least 14 hours rest. An

exception is that once in a period of 21 days for 24 consecutive hours, the resting time may be reduced to 8 hours.

- The number of consecutive shifts (workdays) is at most 6.
- No overlap between shifts.
- Minimum workers per day are 9 persons and maximum are 14 persons.
- Eight hours of work hours per day

2.2.1.2 Soft Constraints

Soft constraints are designed to push the actual schedule quality. Common soft constraints represent requests for free days, shift type preferences or requests for longer free time blocks between worked shifts. The soft constraints that will be considered in my project are as following:

- For weekend days (Friday, Saturday, Sunday), numbers of MRE (rest day) should be less than weekdays.
- For any employees avoid stand-alone shifts. A stand alone shift is an isolated working day i.e. a shift on a day which is flanked by two days without shifts.
- The main shifts are M70, M11 and A30. So, the number of workers at that shifts must be over the supplement shifts (M90 and A12).
- A *night* shift after an *early* shift should be avoided (number of night shifts after early shifts).
- An *early* shift after a *day* shift should be avoided (number of early shifts after day shifts).