Train Driver Rescheduling System Using Multi Agent System (TDRSMAS).

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TRAIN DRIVER RESCHEDULING SYSTEM USING MULTI AGENT SYSTEM (TDRSMAS)

ROS 'AMIRA BINTI RAZIKI

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

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2011

DECLARATION

I hereby declare that this project report entitled

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

STUDENT : _____ Date: 7/7/19
(ROS 'AMIRA BINTI RAZIKI)

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DEDICATION

Special thanks I dedicated to my parents who giving me full support and motivation throughout my PSM. To my respectful PSM supervisor, Dr. Abdul Samad Shibghatullah, a lot thanks I would like to dedicate to him for the consultation, advices, comments and support in order to make sure that I can finish this PSM successfully. Not forgotten, thanks to all my friends that always by my side as I working on this project.

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ABSTRACT

Train Driver Rescheduling System with Multi-Agent System (TDRSMAS) is being developed as an alternative that may help supervisors to make quick rescheduling decisions by automating the crew rescheduling process. The purpose of this system is to minimize the effect of unpredictable event (UE) problem to train driver schedule. This system will be used by the train company's administrator which is assistant foreman and the staffs. Multi Agent System (MAS) is applied to this system to do the rescheduling and matching process between agents. It used Multi Agent System because it is a system composed of multiple interacting intelligent agents and it can be used to solve problems which are difficult and impossible for an individual agent to solve.

ABSTRAK

Train Driver Rescheduling System with Multi-Agent System (TDRSMAS) telah dibangunkan sebagai alternatif yang dapat membantu penyelia untuk membuat keputusan bagi penjadualan semula dengan lebih pantas dengan cara mengautomasikan proses penjadualan semula krew.Sistem ini bertujuan untuk meminimakan kesan masalah perkara yang tidak dijangka berlaku dalam jadual pemandu keretapi.Sistem ini akan digunakan oleh pihak pentadbiran syarikat keretapi iaitu pembantu mandur dan juga pekerja.Sistem agen pelbagai telah digunakan dalam sistem ini untuk membuat penjadualan semula dan melakukan proses pemadanan antara agen.Projek ini menggunakan sistem agen pelbagai kerana ianya merupakan sistem yang terdiri daripada pelbagai agen pintar yang saling berhubung dan ia boleh digunakan untuk menyelesaikan masalah yang rumit dan mustahil untuk individu agen menyelesaikannya.

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AF	-	Assistant Foreman
CA	-	Crew Agent
DA	-	Duty Agent
DM	-	Database Manager
FMSR	-	Federated Malay State Railways
KTMB	-	Keretapi Tanah Melayu Berhad
K/T	-	Kakitangan
MAS	-	Multi Agent System
MRA	-	Malayan Railway Administration
M/T	-	Masa bertolak
P.F.G	-	Pembantu Formen Geredar
PL	-	Pemandu Lokomotif
PLR	-	Pemandu Lokomotif Rendah
PNG	-	Penumpang
RM	-	Rehat
SP	-	Spare
SP/LP	-	Spare di Kuala Lipis
SP X LPS	-	Spare di Kuala Lipis
TDRSMAS	-	Train Driver Rescheduling System Using Multi Agent System
UE	-	Unpredictable Event
UH	-	User Handler

LIST OF ATTACHMENTS

CHAPTER I

INTRODUCTION

1.1 Project Background

Railways have been an important means for transporting materials and people for well over a hundred years. This kind of transportation is very popular in Malaysia due to its fare that is reasonable and much safer compare to other mode of transportation. In Malaysia, one of the well known organizations that manage this transportation is known as Keretapi Tanah Melayu Berhad (KTMB).There are three main important processes in the operational planning of train which is timetabling, train scheduling and crew scheduling. However, this project only focuses on crew scheduling which involve the train drivers only. It is good to know that train driver's scheduling is important because it involves high cost and also involves a complex process to do it.

The complexity of making train driver's scheduling is due to the time taken to find or create the schedule that can optimize the number of train drivers. Besides, the high cost due to the crew expenses also should be considered. Thus, it is important for the train operators to manage crews efficiently, in order to cut off the cost that has to be borne by the company. However, sometimes an unpredictable events (UE) such as crew not coming without prior notice; sick while on duty, coming late or suddenly had an emergency and had to take leave immediately may occurred. This will disrupt the existing schedule. Furthermore, when a certain UE problem occurs, the train operator must perform appropriate adjustments to the schedule and still, he has to maintain the company's cost so it will not increased too much.

Due to this problem, I have proposed a Train Driver Rescheduling System Using Multi Agent System (TDRSMAS) to minimize the effect of this UE problem to train driver schedule. This project used Multi Agent System (MAS) because it is a system composed of multiple interacting intelligent agents and it can be used to solve problems which are difficult and impossible for an individual agent to solve .Because of its advantage that can enhances overall system performance, specifically along the dimensions of computational efficiency, reliability, extensibility, robustness, maintainability, responsiveness, flexibility, and reuse, making MAS a suitable approach to be applied in this train driver's scheduling.

1.2 Problem Statement

Train Driver Rescheduling System Using Multi Agent System (TDRSMAS) is being developed to minimize the effect of UE problem to train driver schedule. There are some problems that have been capture and identified such as below

(i) Generating a flexible schedule/roster is complex.

- The crew schedule is complex to be generated due to the time taken to find or create the schedule that can optimize the number of train drivers. Besides, the high cost due to the crew expenses also plays a role.
- To avoid this problem, we prefer crew rescheduling compare to generating new schedule if an UE occurred. This will help to reduce the company cost also to save up time.

(ii) Difficult to do crew rescheduling manually when UE problems occurred.

- When UE problem occurred such as crew not coming without prior notice; sick while on duty, coming late or suddenly had an emergency and had to take leave immediately, the train operator has to find the spare drivers to replace the emptiness. Based on his experience and capabilities in managing UE, he has to reschedule the existing schedule.

• However, there are many limitations when doing crew rescheduling manually such as hard to make decisions, decision making being slow when many UE happen at the same time and the decisions not being optimum in the use of crew resources.

• To overcome these limitations, Train Driver Rescheduling System Using Multi Agent System is developed.

(iii) Hard to find quick solution in time whenever the UE problems is occurred.

• Whenever an UE problems occurred, the train operator need to find quick solution to solve it as it will cause the delay of the train.

• However, most of the current approaches, which are based on static schedules, do not provide the capability of rescheduling in a real time scenario.

• To overcome this problem, we used multi agent system.

1.3 Objective

The objectives of the Train Driver Rescheduling System Using Multi Agent System are as stated below

(i) To reschedule the existing schedule for train's driver using multi agent system if an UE occurred.

(ii) To minimize the effect of UE on train driver schedules and to reduce the amount of disruption to train operation.

(iii) To save up time finding solution to solve the UE problems using multi agent system.

1.4 Scope

The scopes of this project are listed below:

(i) The type of scheduling that had been chosen is crew/train driver's scheduling.

(ii) The approach that will be used to create the flexible schedule for train driver is multi agent system.

(iii) The target users that we focus on are train drivers and the administration of KTMB.

(iv) The type of train service that had been choosing for this project is intercity service. We will only focusing from Tumpat station until Kuala Lipis Station as so many stations to be covered if we take them all.

1.5 Project Significance

Train Driver Rescheduling System Using Multi Agent System is developed in purpose to minimize the effect of UE on train driver schedules and hence, reduce the amount of disruption to train operation. Thus, it will be very benefit to the train company, in this case Keretapi Tanah Melayu Berhad (KTMB) as it will helps to reduce the cost that had to be borne by them, also helps to save up time. This system is useful to the train operator as it will help him to overcome some limitation while managing the train driver rescheduling manually.

1.6 Expected Output

The output that will be expected from this project is that this system will be able to help minimizing the effect of UE problem to train driver schedule. By using this system, we hope that the difficulties faced by train operator when managing train driver

rescheduling manually will be reduced. We also expect after rescheduling, the optimum schedule will be produce as it will help the train company (KTMB) to reduce their cost and save up time.

1.7 Conclusion

In this chapter, we can concluded that this project is concerned with UE problem that can cause disruption to train driver schedules and more important to train operation. Thus, to overcome this problem we had to reschedule the train driver schedule. Normally, when UE problems occurred, the train operator will reschedule the crew schedule manually, based on his capabilities and experience in managing UE problems. However, manually reschedule the crew schedule have many limitation such as hard to make decisions and decision making being slow when many UE happen at the same time. Besides, it also will cause the decisions not being optimum in the use of crew resources. Fortunately, these limitations can be overcome using automated crew rescheduling system. This system will help the train operator in making decision of crew rescheduling while managing UE. As a conclusion, this chapter is an introduction to the project described in this dissertation. It sets the background; defines the problem; outlines the project aim and objectives; describes the scope of the project and its significance, also telling us the expected output from this project. The next chapter will discussed about the literature review and the methodology of this project.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

The literature review is one of the least understood parts of a project. A literature review can be defined as a summary of previous research on a topic. It can be either a part of a larger report of a research project, or it can be a bibliographic essay that is published separately in a scholarly journal. Both of these have the same purpose, which is to review the scholarly literature relevant to the topic that we are studying and it will help in designing the methodology and help others to interpret the project.

In this chapter, the important thing is we need to understand the UE problem first. After that, we have to concentrate on how to deal with it in detail, and try to see current crew scheduling approaches and whether they have mechanisms for dealing with UE. The information will help to identify limitations in dealing with UE and will be used as a foundation to propose a suitable approach to deal with such problems. Then this project also justifies the choice of MAS as a suitable tool to implement the approach. To achieve the above aim, we do a literature survey to find information on UE, to evaluate current crew scheduling approaches, and to justify the use of MAS. Also, we perform interview with the train operator of KTMB to obtain empirical information about the UE problem, the current scheduling system in use, and how to deal with UE. Findings from literature and interviews will identify the project gap and then the proposed approach (in Chapter Three) is our attempt to fill the gap.