UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPOINTMENT SCHEDULING IN HEALTH CARE INDUSTRY BY USING MODELING AND SIMULATION: A CASE STUDY

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Management Hons.)

by

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DECLARATION

I hereby, declared this report entitled "Appointment Scheduling in Health Care Industry by Using Modelling and Simulation" is the results of my own research except as cited in the references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.) The member of the supervisory is as follows:

.....

(NOR AKRAMIN BIN MOHAMAD)

ABSTRAK

Dalam projek ini, jadual temujanji ialah sistem yang berfungsi untuk mengaturkan jadual temujanji antara pelanggan dan doktor. Salah satu poliklinik komuniti di Melaka dipilih sebagai satu kajian yang bertumpukan pada jabatan kesihatan ibu dan anak. Tujuan kajian ini adalah untuk meningkatkan kecekapan jadual temu janji melalui kaedah permodelan dan simulasi. Soal selidik dilakukan untuk mengetahui suara pelanggan tentang senario jadual temujanji pada masa kini. Dari tinjauan ini, kebanyakan pelanggan yang melawat poliklinik ini adalah jenis ibu mengandung dan kesihatan bayi. Tambahan pula, kebanyakan pelanggan melawat poliklinik ini adalah dalam sesi pagi dan lebih daripada 60% pelanggan perlu meluangkan masa lebih daripada satu jam di dalam sistem. Parameter yang digunakan adalah tempoh masa perkhidmatan, antara waktu mendaftar masuk dan bilangan pelanggan dan doktor. Kesemua data yang dikumpul adalah taburan normal. Kemudian, data dimodelkan kedalam simulasi WITNESS dan masalah utama yang dapat dikenalpasti adalah kesesakan berlaku di Bilik 21 (Doktor) dan makmal. Beberapa alternatif telah dicadangkan dan diaplikasikan dalam model simulasi untuk mengkaji tingkah laku dan pretasi sistem. Dengan mengubah aliran proses, peningkatan bilangan pelanggan kepada 19.17% dengan mengekalkan seorang doktor dengan tiada implikasi kos. Lebih mengejutkan, dengan mempunyai dua orang doktor dalam sistem, jumlah pelanggan hanya meningkat kepada 6.41%. Maka, aliran proses yang baru dengan seorang doktor telah dipilih sebagai penyelesaian terbaik dalam kajian ini.

ABSTRACT

In this project, appointment scheduling is system that functionally to arrange the scheduling appointment between customer and doctors. One of the polyclinic community in Melaka been selected as a case study which emphasis in maternal and children health department. The aim of this study to increase the efficiency of appointment scheduling through modelling and simulation methodology. The questionnaire developed to capture the voice of customer about the current appointment scheduling scenario. From this survey, the most type of customer visit maternal and child health department are antenatal and neonatal. Furthermore, mostly customers visit this polyclinics are in morning session and more than 60% of the customer need to spend more than a hour in the system. The parameters that use are duration service time, inter-arrival time and quantity of customer and doctor. All the data collected are normal distribution. Then, data are translated into WITNESS simulation and the main problem identified is the bottlenecks occur at Room 21 (Doctor) and laboratory. Several alternatives recommended in this simulation model are conducted to study the behaviour and performance of the system. By changing the process flow, the number of customer increase to 19.17% by maintaining one doctor with no cost implication. Surprisely, with having two doctors in the system, the number of customer only increase to 6.41%. Hence, the new process flows with one doctor are chosen as best solution in this case studies.

DEDICATION

Dedicated to my beloved mother and father, Hjh. Norzihan Binti Abdul Kader and Hj. Baharudin Bin Wahab for always give support to me for finishing this project. Other, Dedicated to those who had never give up support and encourage me, especially my supervisor and friends.

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TABLE OF CONTENT

Abstrak i

Abstract ii

Dedication iii

Acknowledgement iv

Table of content v

List of tables ix

List of figures x

List of abbreviations, symbols, specialized nomenclature xiii

CHAPTER 1: INTRODUCTION **1**

1.1 Background 1

1.2 Problem statement 2

1.3 Objectives 3

1.4 Scope 4

1.5 Target users 4

1.6 Project significance 4

1.7 Expected output 5

1.8 Report summary 6

1.8.1 Introduction 7

1.8.2 Literature review 7

1.8.3 Methodology 7

1.8.4 Result and discussion 7

1.8.5 Conclusion and recommendation 7

CHAPTER 2: LITERATURE REVIEW **9**

2.1 Appointment scheduling 9

2.1.1 Why appointment scheduling important 10

2.1.2 Scheduling disciplines 10
2.2 Health care industry 11
2.2.1 Polyclinic community 11
2.2.2 Maternal and children health department 12
2.3 Modelling and simulation 14
2.3.1 Purpose of modelling and simulation 14
2.3.2 When modelling and simulation be used 15
2.3.3 Develop simulation models 15
2.3.4 Types of simulation models 17
2.3.4.1 Discrete-event simulation modelling 17
2.3.4.2 Continuous simulation modelling 17
2.3.5 Advantages and disadvantages of simulation 18
2.3.5.1 Advantages 18
2.3.5.2 Disadvantages 18
2.4 Software simulation 19
2.4.1 WITNESS simulation software 19
2.5 Problem definition 19
2.5.1 No-shows 19
2.5.2 Punctuality 20
2.5.3 Duration of consulting 20
2.5 The review about appointment scheduling 21
2.6 Method solve appointment scheduling 23
2.7 Summary 24
2.8 Parameter 25

CHAPTER 3: METHODOLOGY 26
3.1 Process flow conducting project 27
3.1.1 Information research 28
3.1.2 Conceptualization 28
3.1.3 Methodology design 28
3.1.4 Implementation of project 29
3.1.5 Documentation 29
3.2 Methodology to achieve an objective 30

3.2.1 Questionnaire 31
3.2.1.1 Main modes questionnaire administration 31
3.2.1.2 Analysis of questionnaire 31
3.2.2 Model translation 32
3.2.3 Verification 32
3.2.4 Validation 32
3.2.5 Experimentation 33
3.2.6 Documentation 33

CHAPTER 4: RESULT AND DISCUSSION 34
4.1 Questionnaire result analysis 34
4.1.1 Category services: Question 1 35
4.1.2 Zone area: Question 2 36
4.1.3 Level satisfaction of customer: Question 3 37
4.1.4 Availability time for an appointment: Question 4 38
4.1.5 Current duration waiting time: Question 5 39
4.1.6 Maximum time willing to spend for the whole services: Question 6 40
4.1.7 Current whole service time: Question 7 41
4.1.8 Reason chooses this polyclinic: Question 8 42
4.1.9 Main problem in this polyclinic: Question 9 43
4.1.10 Suggestion improve services: Question 10 44
4.2 Process flow available in maternal and children department 45
4.3 Process flow for antenatal and neonatal 46
4.4 Data collection 47
4.5 Model translation 48
4.5.1 Input data 50
4.5.1.1 Cycle time 51
4.5.1.2 Command 52
4.5.1.3 Output 54
4.5.2 Command for each service area 56
4.6 Verification and validation 58
4.6.1 Verification 58

4.6.2 Validation 58
4.6.2.1 Distribution of data 58
4.6.2.2 Validation of result 60
4.7 Alternative for improvement 61
4.7.1 Alternatives 61
4.7.2 Command change 62
4.8 Result on simulation 66
4.8.1 Graph of output 79
4.8.2 Alternative chosen 80

CHAPTER 5: CONCLUSION AND RECOMMENDATION 81
5.1 Conclusion of research 81
5.2 Recommendation 82

REFERENCES 83

APPENDICES
A GANTT CHART 88
B PICTURE OF SERVICES AREA 89
C REQUEST PERMISSION LETTER BY STUDENT 91
D REQUEST PERMISSION LETTER BY SUPERVISOR 91
E PERMISSION LETTER BY DEPUTY DIRECTOR 94
F QUESTIONNAIRE 96
G PROCESS FLOW FOR ALL TYPE CUSTOMERS 98
H PICTURE OF COMMAND SIMULATION 102
I DATA COLLECTION 107

LIST OF TABLE

1.1	Problem statement identify in an appointment scheduling	3
1.2	Expected output of case study	5
2.1	The review of an appointment scheduling	21
2.2	Method and parameter used to solve appointment scheduling	23
2.3	The summary of other research	24
2.4	The parameter used in collecting data	25
4.1	Mean of cycle time for each service area	47
4.2	Mean of number of customer	47
4.3	Command from each service area and part	56
4.4	Differences number of customers between current simulations and real scenario	60
4.5	Description of each alternative	62
4.6	Comparing alternative that chosen	80
4.7	Summary of findings in this research	81

LIST OF FIGURES

1.1	Flow chart of report summary	6
2.1	Polyclinic community	12
2.2	Statistics of people in Malaysia	13
2.3	Maternal and child health department	13
2.4	Process flow to develop simulation models	16
3.1	Process flow chart for conducting project	27
3.2	Method use to achieve an objective	30
4.1	Graph of number respondent and percentages (Category services)	35
4.2	Graph of number respondent and percentages (Zone area)	36
4.3	Graph of number respondent and percentages (Level satisfaction of customer)	37
4.4	Graph of number respondent and percentages (Availability time for an appointment)	38
4.5	Graph of number respondent and percentages (Current duration waiting time)	39
4.6	Graph of number respondent and percentages (Maximum time willing to spend for the whole srvices)	40
4.7	Graph of number respondent and percentages (Current whole service time)	41
4.8	Graph of number respondent and percentages (Reason chooses this polyclinic)	42
4.9	Graph of number respondent and percentages (Main problem in this polyclinic)	43
4.10	Graph of number respondent and percentages (Suggestion improve services)	44
4.11	Process flow for antenatal and neonatal	46

4.12	WITNESS simulation model layout with one doctor	48
4.13	WITNESS simulation model layout with two doctors	49
4.14	Model simulation during running	50
4.15	An example input cycle time data	51
4.16	The command at Room 15 when the change process flow	52
4.17	The command in counter book when the change process flow	53
4.18	The action of start at pharmacy	54
4.19	The action to finish at the pharmacy	55
4.20	The actions on output	55
4.21	Data distribution	59
4.22	Probability plot for Room 17	59
4.23	Changing process flow	66
4.24	The output WITNESS simulation model layout with one doctor with opening Room 19	67
4.25	The output WITNESS simulation model layout with one doctor with change process flow	69
4.26	The output WITNESS simulation model layout with one doctor with reduce cycle time	70
4.28	The output WITNESS simulation model layout with one doctor without opening Room 19	71
4.29	The output WITNESS simulation model layout with one doctor with the combined change flow and reduce cycle time	72
4.30	The output WITNESS simulation model layout with one doctor without opening Room 19 and combine change process flow and reduce cycle time	73
4.31	The output WITNESS simulation model layout with two doctors and change process flow	74
4.32	The output WITNESS simulation model layout with two doctors and reduce cycle time	75
4.33	The output WITNESS simulation model layout with two doctors without opening Room 19	76
4.34	The output WITNESS simulation model layout with two doctors with opening Room 19 and combine change process flow and reduce cycle	77

time

4.35 The output WITNESS simulation model layout with two doctors without opening Room 19 and combine change process flow and reduce cycle time 78

4.36 Output for antenatal, neonatal and both for each alternative 79

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

FCFS	-	First Come First Serve
FIFO	-	First In First Out
SJF	-	Shortest Remaining Time or Shortest Job First
FPPS	-	Fixed Priority Pre-emptive Scheduling
RR	-	Round-Robin Scheduling
Sec	-	Seconds
Num	-	Number

CHAPTER 1
INTRODUCTION

This chapter will give an overview of the whole project, where it is essentially in five chapters. The project background will be introduced in section one. Next, problem statement will be stated in section two. Section three, four and five will be covered with objective of project, scope and target users respectively. Lastly, the second last and last section will discuss about the project significant and expected output respectively.

1.1 BACKGROUND

Health care industry, increasing rapidly due to increasing demand from the customer and while the rapid augmentation of technology, but as everyone knows, lacks of an appointment scheduling still cannot be solved. Appointment scheduling needs to be minimized due it comprises the patients' health. Lacks appointment scheduling is a cause of unbalance time between patient arrival and number of availability of doctor, patient no-shows, unpunctuality of patient and inconsistency service time. Nowadays, simulation is broadly used to present the real system in the health care industry in recognizing the exact problem, improve an efficiency appointment scheduling and finding the best alternatives to resolve a problem. Modeling and simulation are used to give a whole picture of the system. In the simulation, a model will construct through a programming on the computer where it will show close approximately the plan view of polyclinic with an animation of part moving through the system.

1.2 PROBLEM STATEMENT

Lacks of system in appointment still occur, although the technologies are increasing. From the current system, the duration to make an appointment take a long time especially at the registration counter. This situation is wasting time and sometime after waiting for a long time, an appointment cannot be made. These situations occur cause of the very worst efficiency at current system due the customer only can get a service after making an appointment. In case if the doctor was not available or doesn't have any time slots, the patient just wasted their time because cannot get any consultant.

Other than that, appointment also always full and the customer cannot make any appointment until the time is available. The current situation, the customer cannot get a service from the same doctor and this problem can give a bad impact to the customer because only doctor that have treated before knows the real disease of the customer. All this situation is occurring by lack effectively appointment scheduling from the current system cause of the use of paper and pen to make an appointment. By using a pen and an appointment card, the updates will be much slower when new appointments are being added. Moreover, the probability of losing the appointment card is higher.

Today, a lot of simulation software such as ARENA, Quest, ProModel and WITNESS that produce to model a real situation in the simulation. By applying simulation software, the actual problems can be modeled in the software rather than rearranging the actual system first before evaluation as it might be risky.

Table 1.1: Problem statement identify in an appointment scheduling

Criteria	Description of problem statement
Not have an efficiency of appointment scheduling	Duration to make appointment scheduling take a long time
	The appointment cannot be made because doctors always not available and the patient cannot get a service from the prior doctor
	Worst efficiency of the current system (Use appointment card and pen)
Problem with appointment scheduling	Unbalance between time patient arrival and availability, number of doctors (Mohamed Najib bin Salleh et al,. 2002)
	Patients no-shows or unpunctuality can increase waiting times (Diwakar Gupta et al,. 2007) and (Rockart et al., 1969)
	Inconsistency of service time (Diwakar Gupta et al,. 2007)

1.3 OBJECTIVES

a) To identify the level of customer satisfaction in these health care industries.
b) To analyze and evaluate the current flow scheduling in the health care service industry.
c) To develop models in the WITNESS simulation software.
d) To recommend solution and alternative for improvement in health care service industry.

1.4 SCOPE

The case study mainly focuses on the appointment scheduling in the health care industry at one of the Polyclinic Community in Melaka which emphasis on maternal and child health department. Only two types of customer; neonatal and antenatal, considered in this case study. The model of the real system will develop using the WITNESS simulation software.

1.5 TARGET USERS

a) Doctor/Nurses
b) Customer (Antenatal and neonatal)

1.6 PROJECT SIGNIFICANCE

By using modeling and simulation to solve appointment scheduling in health care industry will give benefits to manage an appointment with more organized and efficiency between patient and doctor. It is also can control the scheduling and eliminate any waste time. By having an efficiency of an appointment scheduling also can reduce the time and cost. Other than that, patients will more satisfy with the service and a doctor also can give their best service.

However, unorganized appointment scheduling is not only effected the time and cost, but also affect the condition of the patient. By applying modeling and simulation in health care services industry is cheaper. From modeling and simulation, the problem in appointment scheduling can be identified. Other than that, we also can try any other alternatives to solve the problem in appointment scheduling without disturbance a real system that may be costly.

1.7 EXPECTED OUTPUT

Table 1.2 shows the expected output from this case study. The expected output is very important to know and give a picture what to achieve from each objective that has been stated earlier in this project.

Table 1.2: Expected output of case study

Objective	Methodology	Expected Result
To identify the level of customer satisfaction in the health care industry.	Questionnaire	Identify the level satisfaction of patients with a current service
To analyze and evaluate the current flow scheduling in the health care service industry.	Data collecting through observation and interview by using a stopwatch and Minitab statistical software	Input data: a) Cycle time b) Inter-arrival time e) Quantity of patient and doctor
To develop models in the WITNESS simulation.	Model develop regarding a real situation to model simulation software as actual condition	Analyze the problem
To recommend solution and alternative for improvement in health care service industry.	Proposed alternative solution compared to existing systems	Only one the best of the alternatives will be chosen

1.8 REPORT SUMMARY

Figure 1.1 shows the summary of this report. This study is divided into five main parts which is chapter 1 (Introduction), chapter 2 (Literature review), chapter 3 (Methodology), chapter 4 (Result and discussion) and lastly chapter 5 (conclusion and recommendation).

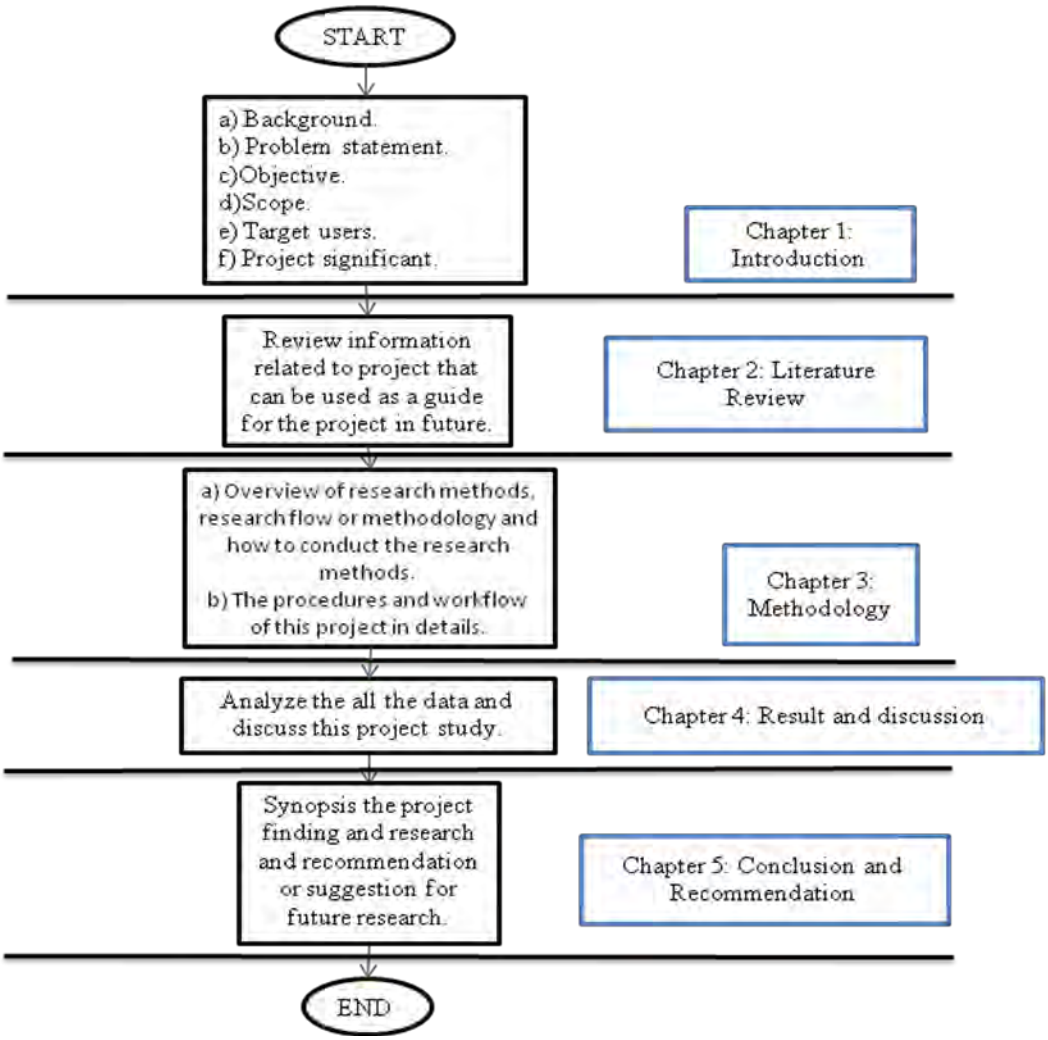

Figure 1.1: Flow Chart of Report Summary

1.8.1 Introduction

The introduction has been made through the analysis and review of the previous case study from the literature review. In this chapter is the second step to identify the whole review of this case study. The background of the project, the problem statement, objective, scope, target users and project significant are chosen before going to the next step. All of this being made after discussion with the supervisor to conduct the project.

1.8.2 Literature review

Literature review are the first step to conduct this report. The relevant and necessary information which regarding to the title of the project such as the title of the project, the parameter used, the finding from the previous case study and an example of a previous case study that relate to the project. These case studies have been done through a sources such as reference book, journal and article.

1.8.3 Methodology

In order to ensure the project are conduct smoothly, methodology of case study has been developed as shown in Figure 3.1 and Figure 3.2 after introduction and literature review be made. From these figures, there is four phase and every phase are shown the methods and tools used for each objective

1.8.4 Result and discussion

All the relate data and result are being collected and analyze. All the data are translate into WITNESS simulation to identifying the main problem and solve the services through the model in WITNESS simulation. Several alternatives have been conducted in these models to choose the best solving.

1.8.5 Conclusion and recommendation

Conclusion be made after through all of the process above. Each conclusion must relate what achieve from each objective. The recommendation is to give a suggestion from finding that got from these case studies.