

SIMULATION MODEL TO IMPROVE THE SERVICE TIME AT
GAMBANG CLINIC

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ABSTARCT

The aim of this research is to improve the service time in the clinic. The service time in the clinic are important and depend to number of the patient that the clinic had in a day. A simulation of a system is the operation of a model of the system. The operation of the model can be studied, properties concerning the behaviour of the actual system or its subsystem that can be inferred. In its broadest sense, simulation is a tool to evaluate the performance of a system, existing proposed, under different configurations of interest and over long periods of real time. By using the simulation, the actual output is appears and it can be improved the system by using Arena software. Therefore, the important part in service time in the clinic is the queuing duration along the process in the clinic. Moreover, the Arena software can analyze the actual system and it can be modified to be more successful system. The objectives of this study are to improve the efficiency of the service time, to analyze system and working process, and to decrease the patient waiting duration. Furthermore, the result shows that by using Arena simulation, the service time at the clinic can be improved.

ABSTRAK

Tujuan kajian ini adalah untuk meningkatkan masa perkhidmatan di klinik. Masa perkhidmatan di klinik adalah penting dan bergantung kepada beberapa pesakit bahawa klinik itu ada dalam sehari. Simulasi sistem adalah pengendalian model sistem. Operasi model yang boleh dikaji, sifat-sifat yang berkaitan dengan tingkah laku sistem sebenar atau subsistem yang boleh disimpulkan. Dalam makna yang lebih luas, simulasi adalah alat untuk menilai prestasi sistem, sedia ada dicadangkan, di bawah konfigurasi yang berbeza kepentingan dan dalam tempoh yang panjang masa sebenar. Dengan menggunakan simulasi, masa sebenar adalah muncul dan ia boleh diperbaiki sistem dengan menggunakan perisian Arena. Oleh itu, bahagian yang penting dalam masa perkhidmatan di klinik adalah tempoh beratur di sepanjang proses di klinik. Selain itu, perisian Arena boleh menganalisis sistem yang sebenar dan ia boleh diubah suai untuk menjadi sistem yang lebih berjaya. Objektif kajian ini adalah untuk meningkatkan kecekapan masa perkhidmatan, untuk menganalisis sistem dan proses kerja, dan untuk mengurangkan tempoh menunggu pesakit. Tambahan pula, hasilnya menunjukkan bahawa dengan menggunakan simulasi Arena, masa perkhidmatan di klinik yang boleh diperbaiki.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

A simulation of a system is the operation of a model of the system. The operation of the model can be studied, properties concerning the behavior of the actual system or its subsystem that can be inferred. In its broadest sense, simulation is a tool to evaluate the performance of a system, existing proposed, under different configurations of interest and over long periods of real time. Simulation modeling has been used in a wide range of physical and social sciences and engineering fields. For different types of situations and systems, different types of models are used. In classifying simulations, there are important distinctions among the types of models that are being simulated, and among the types of program structures that are used to carry out the simulation.

Furthermore, there are many benefits of using the simulation model such as it can be used to compress a time frame, a simulation model run on a computer system can be used to investigate quickly the effects of a change in a real life situation that take place over several years. It also can be used to study complex systems that would otherwise be difficult to investigate. Moreover, it can be used in engineering and product design to investigate the effect of changes without producing a physical prototype. Then, it can be used to investigate situation that would be dangerous in real life.

There are a variety of techniques available today that can be applied for the analysis of existing systems. Presently, the simulation approach is the popular technique used in the management of healthcare. Simulation has been applied successfully in many different areas such as manufacturing, system services, medical sector, transportation, supply chain and so on. In addition, simulation approach is one of the best techniques for decision-makers to review, analyze and evaluate any operating systems from the simplest to the most complex condition to be solved.

Therefore, the simulation model is the best method that should use to improve the service time at clinic. Clinic is the most important place for the patients to get their treatment. In University Malaysia Pahang, there have one clinic that gives services to the staff and students. The clinic receives a quite large numbers of patients every day, so the clinic becomes full mostly of the time. There have some problem that the patients not really comfortable with the clinic which is the queuing time for the patients get their services. Making the patients wait for any reason in the phase of treatment is not good because the disease that the patients had will get worse.

Reducing patients waiting times is the responsibility of managers, and there will be several solution options to choose. As all of these optional choices would lead a cost, it may not be estimated as appropriate goals and objectives determined. Simulation technique refers to completing the processes of revised procedures, carrying out the trials and estimating the error times of the processes. With this method, new process designs possible reactions to changes could be learned. There are many solutions for the problem related to waiting durations in clinic as the options are increasing number of man power and changing the shape of quality. Before making a choice, working process should be analyzed and reviewed as to identify the factors of patients waiting time .Reducing the patient duration has become important as to serve more patients.

One of the important elements in improving services in the clinic is managing the patient flow. The patient flow represents the ability of healthcare system to serve patients quickly and efficiently throughout the treatment period. When the flow of the system operates properly, then the flow of patients becomes smoother and all the processes involved can be resolved with minimum delay. A good patient flow indicates

that a patient queuing can be reduced or minimized, while the inefficient patient flow contribute to the problem of long and outstanding queue. The queuing theory and patient flow systems are often associated with simulation techniques. Simulation is a powerful tool for the evaluation and analysis of a new system designs, modifications to existing systems and proposed changes to control systems and operating rules.

Time is always a valuable asset for patients in seeking treatment at any healthcare centre, either public or private provider, and even more valuable for patients who are in critical conditions. Doctors and specialists also need to maximize their service time since some of them are assigned with administrative works, reading medical reports, and keep moving from one department to another department. Waiting idly in the waiting room is not a productive situation where patients can spend their waiting time to do other activities that might benefit them rather than sitting for nothing.

1.2 PROBLEM BACKGROUND

The clinic is the place that people who get sick receive their treatment and get their medicine. They need treatment as soon as possible they enter the clinic. They also need to follow all the procedures of the clinic which is they need to wait until the previous patient exit the room then they can enter the room to get treatment from doctor. First, when they enter the clinic they need to show their identification of student or staff at the counter and then the assistant at the counter will give them the waiting number. They need to wait according their number to get the treatment. It will give some problem because it will take times when there are many patients in the clinic.

There are many problem when want to get treatment at the clinic. First is the queuing takes long time. The queuing takes long time because at University Malaysia Pahang, there are many people include staff and student. In a day, there will have many patients that need treatment at the clinic. Then, they need to take long time to get the service. Students usually busy because their time so worth and they need to study and attend the class. It also gives problem for staffs because they need to do their work. Second is the quality of the service. The most important part to get treatment is quality of service. When the clinic has many patients, there will have some problem with their

service. The service times of the clinic become slower because total of patient increase. They will not give the best service because they need to be fast to give treatment to others patient. The third problem is the less of staff. The important thing, when we want to reduced the waiting and service time, we need to increase the staff in the clinic .For this clinic, they need to add some doctors and nurse because it will make their service more efficient and smooth.

The clinic also needs to add more room for the patients according to their disease. It will much easier for the staff t the clinic and for patients because it will improve the service time at the clinic. The duration waiting time also will reduce and it will help the patient to do their usually work because it will take a short time for them to get treatment at the clinic.

1.3 PROBLEM STATEMENT

1.3.1 Queuing Takes Long Time

The queuing takes long time because at University Malaysia Pahang, there are many people include staff and student. In a day, there will have many patients that need treatment at the clinic. Then, they need to take long time to get the service. Students usually busy because their time so worth and they need to study and attend the class. It also gives problem for staffs because they need to do their work.

1.3.2 Quality of Service

The most important part to get treatment is quality of service. When the clinic has many patients, there will have some problem with their service. The service times of the clinic become slower because total of patient increase. They will not give the best service because they need to be fast to give treatment to others patient.

1.3.3 Less of Staff

The important thing, when we want to reduced the waiting and service time, we need to increase the number of the staff in the clinic .For this clinic, they need to add some doctors and nurse because it will make their service more efficient and smooth.

1.4 OBJECTIVE

- i.To improve the efficiency of the service time
- ii.To analyze system and working process
- iii.To decrease the patient waiting duration

1.5 RESEARCH QUESTIONS (RQ)

Based on the research objectives above, research questions are formulated as follows:

RQ1: How to improve the efficiency of the service time at the clinic?

RQ2: Why need to analyze system and working process at the clinic?RQ3: How want to decrease the patient waiting duration at the clinic?

1.6 SCOPE

The scope for this study is for the students and staffs of University Malaysia Pahang. The clinic is important for them to get treatment. They do not need to get treatment outside which are far away because the clinic are in University Malaysia Pahang. They also can reduce cost when get treatment at this clinic because the payment already include in the fees of study. Student usually did not enough time to go clinic that far away to get treatment because they need to study, complete the assignment and attend the class. It will give some burden for them if they just need take medicine for the usually pain such as headache, stomachache and others. They will feel much comfortable if the clinic have complete equipment and systematic. The clinic also give benefit to staffs because they have big responsible for UMP and they can go get

treatment to the clinic as soon as possible they get sick. It also reduced their worth time because they need to do their work.

1.7 METHOD

In order to execute the objective of the study the simulation method was considered. First of all, the simulation model of the existing system was demonstrated. On the simulation model installed, the scenarios have been established in order to determine critical factors which effects patient waiting durations. Thus, the goal of the study was to improve service times by considering method using simulation. In the built simulation model, all of the processes for patients applied to the clinic were considered beginning from their entry to the system and their exit from the system. In order to decline applied capacity plans and patients waiting durations a simulation model was executed in the clinic.

1.8 SIGNIFICANT OF STUDY

This study will imitate the patient waiting duration process that provide by the clinic using the simulation software. This imitation is to understand the patient service time process that is provided by the clinic. This includes understanding the patient service flow and identifying the problem that a patient have when they get treatment at the clinic. At the same time, the simulation study of this process will evaluate the actual service time at the clinic. There will have the new approach to improve service time at the clinic.

1.9 EXPECTED RESULT

At the end of the study, the expected result is able to identify the solution and improvement to the clinic. Therefore, the first is the duration of waiting time more shorter than usual and this will make the patient more comfortable to get their treatment. Then, it also can reduced the job to the staff, so the staff can do their work efficiently. Moreover, it also improve the system of the clinic and it will give a lot of benefits to patients.

In addition, the expected result of this study are important to the patients of the clinic because they want the smooth process during to get their treatment. They also want the shorter waiting duration because they need to do something else and their time are important, so they do not want to waste their time. Furthermore, the clinic will minimize their waiting duration, add more staff in the way to improve the service time at the clinic. The clinic could also add more doctor room, pharmacy, and others.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter will discuss about the literature review of service time at the clinic and simulation. First, it will review the concept about the clinic service time operation and this will review about elements and include giving treatment to the patient in clinic. Lastly, this chapter will review some of literature on simulations as a research tool

2.2 UMP CLINIC

The clinic is a place that people who get sick, get their treatment. The clinic is important because people sometimes get sick, mostly students and staffs in UMP. The clinic sometimes will get busy because there a lot of patients include students and staffs in UMP. The clinics are important because it is only nearest clinic for students and staffs in UMP. They totally depend to the clinic for their health care. The problem will occur when the clinic did not manage their service time well. The students are really concerned about duration time because they need to complete their work and also need to attend the class. They will not have enough time for wait and queuing to get their treatment at the clinic. The clinic needs to improve their service time to make their patients feel more comfortable and not waiting too long when they want get their treatment.

2.2.1 Patient Flow Concept

The important element in improving the efficiency in the healthcare services is managing the patient flow. The patient flow will show the ability based on the clinic system to serve patient efficiently and quickly throughout the period of the treatment. The flow of patient will become smooth if the flow of the system operates smoothly (A. F. Najmuddin, I. M. Ibrahim, S. R. Ismail, 2010). Furthermore, a good patient flow means that the queuing is shorter and a poor patient flow is when the patient queuing delay or longer (Hall, 1999).

Moreover, the characteristic of an efficient patient flow is by minimize patient waiting time, high patient throughput, short duration to wait, low clinic overtime, while maintain the staff utilization rates (Jun et al, 1999). Thus, patient flow analysis to define specific areas of inefficiency in patient visit and decrease the duration time of patient visit. These researcher found that patient flow analysis is an effective method for identify the inefficiency gathered patient flow data. Therefore, patient flow analysis are related to three main factors which is patient routing and flow schemes, scheduling and availability of resources, and patient scheduling and admissions (Jun et al, 1999).

Furthermore, incorporation of patient flow in a scheduling problem when the patient are given a fixed scheduling slots within the increase waiting time that are recommended for each flow (Patrick et al, 2008). Then, these researchers analyze the effect of using fast track lane to decrease waiting time of low patient flow in an emergency room. Thus, the emergency rooms are divided according to the level of patient sickness and the low patient flow is usually needed to take long time. It was found that a fast lane use a minimal amount of resources could minimize patient waiting time (Garcia et al, 1995).

Moreover, this researcher showed that changing a procedural policy could minimize the patient waiting time in the emergency room and increase in patient throughput (Ritondo and Freedman, 1993). Then, performed simulation to examine factors such as physician idle time relative to patient waiting time, and found that the

patient would have long waiting time if the physician overbooked the schedule (Goitein, 1990).

2.2.2 Queuing Concept

The queuing concept is common procedure for people to get their service or treatment. Patients are concern with time and they are not willing to wait for a long time to get treatment. Queuing indicates that queue or waiting line causes inconvenience to organizations. The clinic should try to minimize the total waiting duration for the patient (Katz, et al, 1991). Moreover, the patient evaluation of service quality affected by the perceived waiting time and also actual waits time. The satisfaction of the patient will disturb by amount of time that they need to spend (Davis and Vollman, 1990).

Furthermore, one of the issues in queue concept is the patient perceptions of the waiting time and also the actual amount of time that patient need to wait (Davis and Heineke, 1994). Then,(1) any system in which arrivals place demand upon a finite capacity resource can be called s a queuing system. (2) The queuing application is to minimize the cost of giving the treatment at clinic through minimization of delays and efficiency in the system (Singh, 2006). The queuing manages the patient flow by using the system. If the patient flow is good, it means it can minimize the delay and when the system is broken, it will increase the duration time (Hall, 1991).

Then, the queuing theory is mathematical approaches that apply to the analysis of waiting lines within the operations (Nosek and Wilson 2001). Furthermore, queuing theory uses queuing model to assess and can improve the patient flow through a queuing system (Gorney, 1981; Bunday, 1996). These researcher notice that queuing theory is important operation research tool, applicable for various system and queuing model can be build in a fraction of time for develop a simulation model (Jiang and Giachetti, 2008). Moreover, it is easy when use queuing while it does not require dedicated software codes, which give regular users, can afford to use it.

Furthermore, these researcher investigate the causes of delay in a clinic by adopted a queuing network model. The queuing analysis notices that the delays were due to scheduling problem rather than the registration area. It was include that although significant differences exist between the model assumptions and the real model. The queuing network models provide insight of the appointment clinic for the operation (Albin et al, 1990).

2.2.3 Patient Satisfaction.

The patient satisfaction is important to a clinic because when patient are satisfied with the service or treatment, they will continuously get the treatment at the same place. There are two approaches to increasing patient satisfaction regarding time. First, is through enhancing the patient waiting time and also through decreasing actual waiting time for patient to get their treatment (Davis and Heineke, 1994; Katz, Larson, and Larson, 1991). Moreover, the patient satisfaction not only affected by attribution of causes for the waiting or patient expectations but also by waiting time (Taylor, 1994).

Furthermore, the patient satisfaction is based on the quality of the service or treatment. Thus, the conceptualization of the patient satisfaction should be increase to include other evaluations in addition to get the high quality perception by the patient (Ross et al, 1987). Then, (1) the patient satisfaction are based on evaluation of the service or treatment. Instead, the patient satisfaction is an effective response or emotion to a service that they receive. (2) This position does not assume the patient do not make evaluation. More specifically, cognitive evaluation within the framework of patient expectation (cf.Oliver,1981).

These researchers define the satisfaction as the patient behavior toward medical care or treatment (Hulka et al, 1970).Then, patient satisfaction is the patient judgments toward the quality of the treatment that they receive and other relevant sources that can represent the level of patient satisfaction. Within the patient satisfaction, this definition has been opened accepted (Wolinsky,1976; Hines et al,1977; Doyle and Ware,1977; Ware et al,1918 and Dunt, 1978).

Thus, the first perspective notices that the situation is a big source of variation in evaluates the satisfaction. It posits that the patient satisfaction should be define as evaluation of the patient in term of quality of service in a healthcare situation and not just the global behavior across episodes (Shore and Frans, 1986).Therefore, these researchers notice that assessing satisfaction for patient encounters may give a fuller understanding of the nature of doctor and patient relationship (Inui and Carter (1985).

2.3 SIMULATION

Simulation can be define as process of conducting experiments with the model and designing model of real system to understand about the behavior of the system for the operation of the system (Sharnon, 1975). Simulation are refers to the collection of application and tool to imitate the characteristic of the real system that are usually use with the suitable software. Simulation also can be extremely general term since the ideas across many fields.

Moreover, the operation of the model can be studied and the properties that include the characteristic of the actual system or its subsystem can be inferred. Simulation also a tool to evaluate the performance of a system, proposed or existing, over long periods of real time and under different configurations. Then, the simulation is used before an existing system is a new system built or altered, to optimize system performance, to prevent under or over-utilization of resources and to minimize the chances of failure to meet specifications (Sharnon, 1975).

Furthermore, the purpose of simulation is to achieve specific goals that are related to evaluation or learning. The simulation are not replace the need for study in the clinical practice setting but allows the students to develop their decision making skills, critical thinking and assessment in a supportive environment and safe places (Medley and Horne, 2005; Valler-Jones et al, 2011). Then, while documented and research with using simulation is increasing, there is limited research pertaining to give evidence based on theory or principles on how students can study using simulation (Walton, Chute and Ball, 2011).

Next, this also allows for the evaluation and the assessment of the student performance whereby if the student inaccurate patient assessment or slow clinical decision making, demonstrate a mistake, patient sickness is not affected and student also have chance to learn based on their experience. Simulation also needs to improve patient safety and linking the student theoretical knowledge with the practice (Ricketts, 2011). Therefore, simulation are not a technology but is an educational strategy (Decker, Sportsman, Puetz and Billings, 2008; Gaba, 2004; Ricketts, 2011).

2.3.1 Simulation Advantages

Simulations have their own advantages and it has ability to deal with difficult models of correspondingly complicated system. Furthermore, advance in flexibility, ease of use and simulation software power have moved the approach from the real of error-prone low level programming and valid the decision making. This is proven that simulation is the best tool to solve the problem.

Moreover, the simulation gives the opportunity to model statistic system that cannot be modeled accurately by mathematical model or by a deterministic. Then, for the usually cases which is in constructs, simulation is more feasible than experimenting with a physical model or the real system. The simulation allows a system to be studied over a bespoke time frame and it also allows us to study a system through varying the parameters and the inputs (Law et al, 2000).

Furthermore, simulation modeling is the most frequently used operations research tool. Hence, the advantage of the simulation are obtain a better understanding of the system by developing a mathematical model of a system and can observe the system operation in details over long time period. It also develops designed and robust systems and minimizes system development time. Then, it can study the effects of certain informational, organizational, policy change on the operation of the system by altering the system model. It can reduce the risk of experimenting with the real system (Maria, 1997).

Besides that, (1) the time constants of the system are not suitable with the experimenter. Simulation usually are performed because the real experiment proceed very quickly that it can difficult be observed or the real system proceed very slowly that the experimenter is long dead before the experiment is completed. The simulation will allow us to slow down or speed up the experiment. Then, (2) it control variables, and system parameters may be not access. Simulation usually performed because they allow us to access the input, where using the real system some input maybe cannot be access for manipulation (Gaines,1979).

2.3.2 Arena Software

Arena represents an improvement in simulation technology by enabling enterprise-wide simulation. The Arena is a comprehensive system that can addresses overall of a simulation study from input data analysis to the analysis of simulation output data. Moreover, Arena is focus to bring the use of simulation to broad new class of users. Its application focus to addresses the need of organization include decision support for many areas include medical system, logistics, data communication and others. Then, the benefit from simulation that is simulated can make high level of effort required to employ simulation technology successfully. The key to make simulation technology larger used is to make the method significantly easier to use and learn without sacrifice flexibility and modeling power (John E.Hammann and Nancy A.Markovitch, 1995).

The Arena simulation system was developed by System Modeling Corporation. It is one step animation system and graphical modeling that depend on concepts from hierarchical modeling and object-oriented programming (See Pegden, 1995). Moreover, the Arena software is widely used to model and stimulate supply chains and industrial process. The main major benefit of using this software is to anticipate the effect of designing difficult processes. Furthermore, it also produces Markov-system simulations that are depending on discrete events and maybe for duration of events and distributions for entering entities into the system. Then, this software also has the familiar look of Microsoft products. Next, Microsoft Visio flowcharts can be transfer into Arena

software. This software also can read from Access files and Excel (Bruce J. Neubauer and Shelley K. Stewart, 2008).

2.3.3 Steps in Simulation Model

Simulation model contained the process that usually start from the easy and simple then it will become higher and difficult. Modeling is arguably the most important part of a simulation study. Moreover, a simulation model is the same good as simulation study. The simulation modeling are usually consists eleven steps (Maria, 1997). There is also having the simulation modeling study steps by (Law et al, 2000).