ISSN Print : 2621-3745
ISSN Online : 2621-3753
Journal of Science and Applied Engineering (JSAE)
Vol. 6, No. 2, October 2023
(Page.65-70)
DOI : 10.31328/jsae.v6i2.5016

ANALYSIS OF QUEUING SYSTEMS AT MC DONALD'S OUTLETS IN MALANG WITH AN ARENA SIMULATION APPROACH

P. Rahayu[1]*, Sukram[2], S. Nugrowibowo[3]

[1,2,3]Department of Mechanical Engineering, Sekolah Tinggi Teknologi Gempol, Pasuruan, Indonesia
**Email:penyrare@gmail.com*

Submitted : 18 September 2023; *Revision :* 5 October 2023; *Accepted :* 28 October 2023

ABSTRACT

The purpose of this research is to analyze the queuing system at McDonald's outlets in Malang City using the Arena simulation approach. The novelty of this research is from the object of research, namely McDonald's in Malang City, which has never been studied before. This research uses quantitative research methods. Data collection techniques were carried out by observation and document study. The data source used in this research is primary data. The population of this study is one of McDonald's drive thru facilities in Malang City. In this study, the sample selection used nonprobability sampling techniques. The data that has been collected is used as input in the Arena simulation to model the queuing system at McDonald's outlets. This research is limited to McDonald's outlets on MT Haryono street, no 115 Malang City, so the results only apply to McDonald's outlets in this area. This research is also limited to a certain period of time according to the research period of August 24, 2023 at 12:00-15:00. The results showed that the average queue duration in the system reached 7.2 minutes. Therefore, the recommendation from the researcher is to increase the number of cashiers, and increase the work efficiency of cashiers during lunch or evening hours to reduce the average queue time. Based on the simulation results, with the addition of one cashier, the average queue time can be reduced by 3.2 minutes, namely to 4 minutes.

Keywords Queuing System; Mcdonald's Outlet; Malang
Paper type Research paper

INTRODUCTION

McDonald’s is a restaurant that originated in California, United States. It is one of the largest fast food restaurants in the world based on the number of branches worldwide, taking second place. Currently, McDonald’s has a presence in 119 countries around the world [1]. High visitor rates and the requirement for quick service define the fast food restaurant sector, which includes companies like McDonald’s. These fast food restaurants generally serve many customers in a short period of time, so efficiency in the ordering process, order processing, and food serving is very important. Customers expect fast and efficient service to fulfill their fast-paced modern lifestyles, where time is of the essence. Therefore, McDonald’s offers a drive through service. Drive through is a service concept in restaurants, stores, or other establishments that allows customers to place, pay, and pick up orders without having to get out of their vehicles. Customers can access this service by driving through a special lane designed in such a way that the vehicle can move smoothly through the queue [2]. As the number of customers arriving at the same time increases, the drive through concept creates a queue.

Queuing is a situation where the availability of service resources is insufficient to handle the number of existing customers or in other words, queuing occurs when the customer arrival pattern is not balanced with the available service capacity [3]. Queues can result in decreased customer satisfaction [4]. Long and inefficient waiting times will make customers feel unappreciated and dissatisfied with the services provided. Low customer satisfaction can have an impact on the brand image and reputation of the business [5]. In addition, queues can also result in decreased productivity. Employees who have to serve customers in queues may not be able to perform other more productive tasks. This can hamper operational efficiency and result in a waste of resources. Therefore, McDonald’s fast food restaurants should strive to ensure that the ordering and service processes are

ISSN Print : 2621-3745
ISSN Online : 2621-3753
DOI : 10.31328/js.v3i2.5016
(Page.65-70)

carried out quickly without compromising on food quality and customer experience. The queuing system will be simulated to find out how to reduce consumer waiting time [6].

An efficiently running queuing system plays a very important role in ensuring that the customer experience is satisfactory and waiting times are minimized. In environments such as fast food restaurants, a smooth queuing process can contribute greatly to customer satisfaction, with a good queuing system in place, customers can feel that their time is spent effectively and not wasted in long queues. Careful timing allows waiting times to be shortened, and customers can more quickly enjoy the service or product they want. As a result, an efficient queuing system helps create a positive experience for customers, builds a good image for the venue, and has a positive impact on overall customer satisfaction. Previous research by Hanggara & Putra showed that the absence of queues in the system can be attributed to the fact that the server has a utility with a value of one, which indicates a high level of busyness [7]. Therefore, it is necessary to design an improvement proposal model with the aim of increasing utility efficiency at the filling station. This effort involves increasing the number of servers in each refueling line as well as increasing the number of operators in each server. Lestari did a similar study utilizing simulation tools and the queuing theory methodology. The findings indicated that adding additional cashiers improved the situation and prevented lineups from building up [3]. The impact of these changes is a reduction in the average number of customers as well as the average time spent in the system. The purpose of this research is to analyze the queuing system at McDonald's outlets in Malang City using the Arena simulation approach.

METHOD

This study uses quantitative research methods. According to Sugiyono, quantitative data is a research method based on positivistic (concrete data), research data in the form of numbers that will be measured using statistics as a calculation test tool, related to the problem under study to produce a conclusion [7]. Data collection techniques are carried out by observation and document study. The data source used in this research is primary data, namely data taken directly through the observation process. The primary data is in the form of customer arrival time data and service time data. The population of this study is the McDonald's drive through facility in Malang City. In this study, the sample selection used nonprobability sampling techniques. Sampling was conducted on August 24, 2023 at 12:00-15:00 at McDonald's, to be precise on MT Haryono Street, no 115 Malang City. The sample represents customers who queue for food orders at McDonald's in Malang City. Then, data processing was carried out using ARENA software to carry out simulations [9]. The data that has been collected is used as input in the Arena simulation to model the queuing system at McDonald's outlets. Data processing is carried out in the form of testing data uniformity and data distribution, creating queue simulations, designing system improvement solutions, and simulating queuing system improvements.

DISCUSSION

In this study, observations were made at McDonald's Malang City, precisely on MT Haryono Street, no 115 Malang City. McDonald's purchases implement a single channel single queue. McDonald's purchasing activity starts with customers arriving, then waiting until the McDonald's purchase service is carried out by the operator. After that, customers will immediately make payments. The following is an analysis of customer arrival times at McDonald's Malang City.

TABLE I. STATISTICS ANALYSIS OF SERVER I ARRIVAL TIME

Server I Arrival Time	
Data Range	652
Number of Classes	5,82940843
Number of Classes	6
Class Width	121
average	123,8042152
standard deviation	153,2856787
min	12
max	678
modus	15

ISSN Print : 2621-3745
ISSN Online : 2621-3753
Journal of Science and Applied Engineering (JSAE)
Vol. 6, No. 2, October 2023
(Page.65-70)
DOI : 10.31328/jsae.v6i2.5016

TABLE II. DESCRIPTIVE STATISTICAL ANALYSIS OF SERVER II ARRIVAL TIME

Server II Arrival Time	
Data Range	432
Number of Classes	5,4765982
Number of Classes	6
Class Width	83
average	132,3222254
standard deviation	127,23146587
min	13
max	472
mode	13

The observation data that has been recapitulated is then processed with the Input Analyzer in ARENA Software to determine the distribution of the data. Based on data processing with Input Analyzer, the results show that arrival time data has an exponential distribution type.

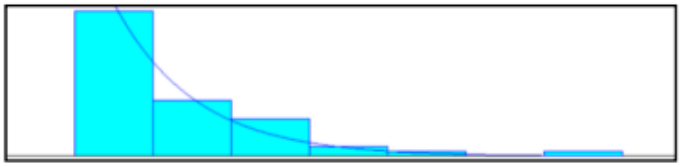

Figure 1. Exponential distribution on Arrival Time

The following is an analysis of service time at McDonald's Malang City. Service time is the length of time from when buyers can start ordering food at the cashier until they get the food they ordered [10].

TABLE III. DESCRIPTIVE STATISTICAL ANALYSIS OF SERVER I SERVICE TIME

Server I Arrival Time	
Data Range	474
Number of Classes	5,87
Number of Classes	6
Class Width	87
Average	263,63
Standard Deviation	126,43
Min	74
Max	582
Mode	134

TABLE IV. DESCRIPTIVE STATISTICAL ANALYSIS OF SERVER II SERVICE TIME

Server II Arrival Time	
Data Range	252
Number of Classes	5,65
Number of Classes	6
Class Width	42
Average	187,549
Standard Deviation	69,21
Min	58
Max	347
Mode	149

The observation data that has been recapitulated is then processed with the Input Analyzer in ARENA Software to determine the distribution of the data. Based on data processing with Input Analyzer, the results show that arrival time data has a Triangular and Normal distribution type.

Jurnal Journal of Science and Applied Engineering (JSAE)
Vol. 6, No. 2, October 2021
ISSN Print : 2621-3745
ISSN Online : 2621-3753
DOI : 10.31328/js.v3i2.5016
(Page.65-70)

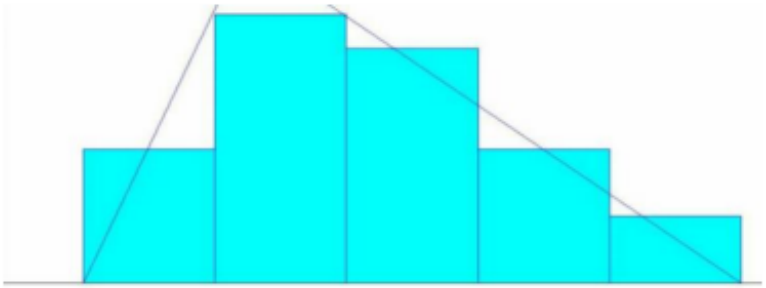

Figure 2. Data Distribution on Server I Service Time

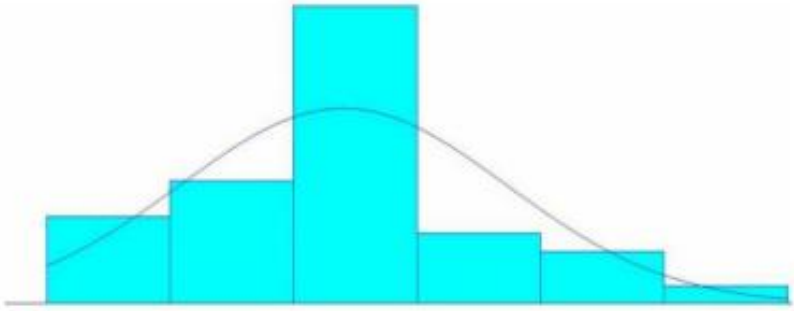

Figure 3. Data Distribution on Server II Service Time

After knowing the type of distribution of arrival time data and the length of service, the next step is to run a simulation model using Arena software. The following is the initial model of the McDonald's queuing system.

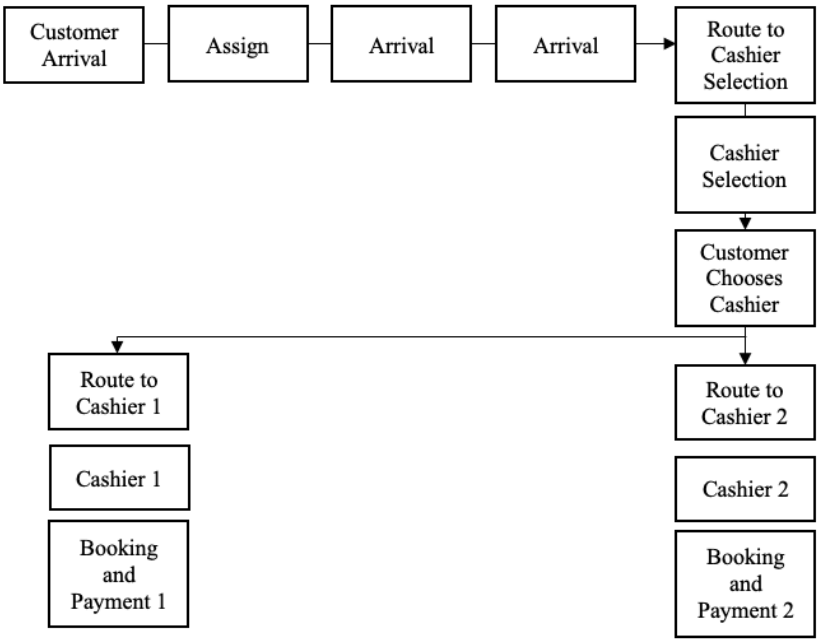

Figure 4. McDonald's Queuing System Initial Model

ISSN Print : 2621-3745
ISSN Online : 2621-3753
Journal of Science and Applied Engineering (JSAE)
Vol. 6, No. 2, October 2023
(Page.65-70)
DOI : 10.31328/jsae.v6i2.5016

TABLE V. MCDONALD'S QUEUING SYSTEM INITIAL MODEL

	Time per Entity		
	Total Time	VA Time	Wait Time
Server I	0.28	0.13	0.15
Server II	0.29	0.11	0.18

Based on the running results table, the average for parameters on server 1 is the average queuing time of 0.15 hours or 9 minutes and the average service time of 0.10 hours or 7.8 minutes. And for server 2, the average queuing time is 0.18 hours or 10.8 minutes and the average service time is 0.11 hours or 6.6 minutes.

To reduce the average queue time, 1 server is added. In this case, alternative improvements to system performance are given which aim to overcome the problems that occur. In the repair model, the servers that work to serve consumers are 3 servers. The following is the improvement model.

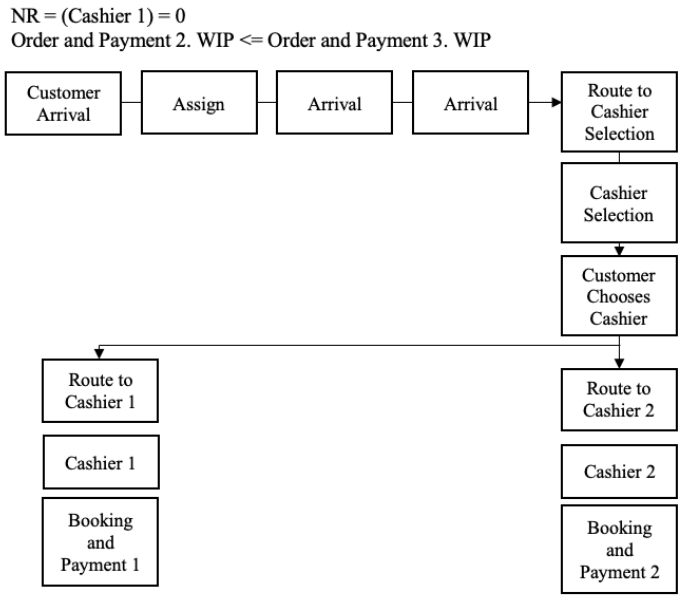

Figure 5. McDonald's Queuing System Improvement Model

TABLE VI. SIMULATION RESULTS OF MCDONALDS QUEUE SYSTEM IMPROVEMENT MODEL

	Time per Entity		
	Total Time	VA Time	Wait Time
Server I	0.21	0.08	0.13
Server II	0.19	0.08	0.11
Server III	0.12	0.065	0.07

Based on the running results table, the average obtained for parameters on server 1 is the average queuing time of 0.13 hours or 7.8 minutes and the average service time of 0.08 hours or 4.8 minutes. For cashier 2, the average queuing time is 0.11 hours or 4.8 minutes and the average length of service is 0.08 hours or 4.8 minutes. And for cashier 3, the average queuing time is 0.07 hours or 4.2 minutes and the average length of service is 0.065 hours or 3.9 minutes.

TABLE VI. RECAPITULATION OF MCDONALDS QUEUE SYSTEM IMPROVEMENT MODEL SIMULATION PARAMETERS

Server Name	Average Queuing Time (Hours)		Average Length of Service Time (Hours)	
	Initial Model	Improvement Model	Initial Model	Improvement Model
Server I	0.15	0.13	0.13	0.08
Server II	0.18	0.11	0.11	0.08
Server II		0.07		0.065

ISSN Print : 2621-3745
ISSN Online : 2621-3753
DOI : 10.31328/js.v3i2.5016
(Page.65-70)

Based on the table above, it can be concluded that the improvement system can reduce the average queue time from 0.12 hours or 7.2 minutes to 0.06 hours or 4 minutes. So it can be said that the proposed improvements are feasible to implement.

CONCLUSION

Queuing system analysis at McDonald's outlets in Malang City with the Arena simulation approach was carried out to assess the performance of the current queuing system. The simulation results show that the average waiting time of the queue duration in the system reaches 7.2 minutes. Therefore, the recommendation from the researcher is to increase the number of cashiers, and increase the work efficiency of cashiers during lunch or evening hours to reduce the average queue time. Based on the simulation results, with the addition of one cashier, the average queue time can be reduced by 3.2 minutes, namely to 4 minutes.

ACKNOWLEDGMENT

I would like to thank all those who have provided support and assistance during this research process. Thank you to my family, friends, and colleagues who provided encouragement and inspiration. All of this help has been invaluable in completing this research. Thank you.

REFERENCES

[1] Melinda ID, Marpaung ST, Liquiddanu E. Analisis sistem antrian restoran cepat saji McDonald's dengan menggunakan simulasi Arena. InSeminar dan Konferensi Nasional IDEC. Surakarta, tanggal 2018 (pp. 7-8).
[2] Wardana W. *Implementasi Marketing Public Relation Pada Indomaret Gunungsari Surabaya Dalam Program Drive Thru Dan Klik Food Ditengah Pandemi COVID-19* (Doctoral dissertation, Universitas Bhayangkara Surabaya). 2021.
[3] Lestari S. Usulan Model Sistem Antrian Pada Mc Donald's Cabang Shinta Kota Tangerang Dengan Pendekatan Teori Antrian dan Simulasi. Jurnal Ilmiah Fakultas Teknik. 2021;2(2):174-9.
[4] Widihastanti B. Pengembangan Model Perbaikan Waktu Tunggu Pelanggan Dengan Menggunakan Fungsi Kerugian Kualitas Taguchi Dan Kurva Belajar Untuk Sistem Antrian Single Channel Single Server. 2012.
[5] Rozi AF. Pengaruh Kualitas Layanan, Citra Merek Dan Kepercayaan Terhadap Minat Beli Online Produk Batik Tulis Mutiara Sendang Lamongan. Jurnal Studi Manajemen Dan Bisnis. 2020 Nov 18;7(2):126-40.
[6] Kaur, Ramandeep and Singh, Gurpeet Er. Analysis of Queuing System for Restaurant Using Arena Simulation Software. ICETEMR. 2017;1:357-367.
[7] Hanggara FD, Putra RD. Analisis Sistem Antrian Pelanggan SPBU Dengan Pendekatan Simulasi Arena. Jurnal INTECH Teknik Industri Universitas Serang Raya. 2020 Dec 7;6(2):155-62.
[8] Sugiyono. Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Alfabeta: Bandung. 2018.
[9] Hardiyatmo, A. *Usulan Perancangan Sistem Antrian dan Jumlah Kasir di Swalayan Luwes Dengan Metode Simulasi* (Doctoral dissertation, Universitas Sebelas Maret Surakarta). 2009.
[10] Ahsan, Md. Manjurul, Islam, Md. Raisul, Alam, Md. Ashikul. Study of Queuing System a Busy Restaurant and a Proposed Facilitate Queuing System. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE). 2014; 11(6):31-35.