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Application of Queuing Theory to Minimize the Waiting Time of Customer at Bill Paying Counter of Supermarket

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Abstract: ***The purpose of this paper is to study how the Queuing theory is applied to minimize the waiting time of customer at bill paying counter of supermarket. By measuring the different parameters of existing Queuing model, a new model has been suggested here to minimize the waiting time of customers. After anlysing the parameters of Queuing model it has been observed that the new suggested model gives better result than the existing model.***
Keywords: Average arrival rate, Average service rate, Utilization factor, Percentage of idle workstation.

I. INTRODUCTION

In today's life each and every person is facing a problem of Queuing. This problem is very much common in many of fields for example marketing, business management, information technology, reservation of tickets, library management, traffic control, paying various bills etc. Queuing theory is applied to such problems to analyze it and apply it to improve and modify the system to minimize the waiting time of customers, minimize the service cost to optimum level. This theory was first introduced in 1909 by AgnerKrarupErlang. In this paper we analyze the different parameter of Queuing model of bill paying counters at Vikas Mega Mart Supermarket, Nagpur and suggested a new Queuing model to reduce the waiting time of customers. Here the Queuing model is multi server and infinite population.It gives the idea about the improvement of customer's satisfaction rate.

A. Methodology

We collect the data from Vikas Mega Mart Supermarket, Nagpur at peak hours from 7.00 pm to 8.00 pm. Number of arriving customers at every 10 minutes has been noted and from this information different parameters of Queuing models were calculatedto analyse the efficiency of the system .From the data it has been observed that many of the customers purchase very few material required less time for bill preparation, but because of others they have to wait for bill paying in the queue. There are two bill paying counters in the supermarket. We suggest here a Queuing model that customers purchasing minimum materials clear their bills at counter-1 and rest of the customers at counter-2.

1) Different Parameters of Queuing model:

a) Average arrival rate of customer, λ 2. Average service rate of server, μ

b) $\rho = \frac{\lambda}{\mu}$ Utilization factor, 4. $P_0 = \left(1 - \frac{\lambda}{\mu}\right)$ is the probability of no units in the system,

c) Percentage of idle workstation $= (1-\rho)100\%$

2) Little's Formula: $L = \lambda T$ where L is expected number of customers in the system, ƛ is average arrival rate of customer and T is the average service time for a customer.

By using the value of L we can calculate $\mu = \frac{\lambda(1+L)}{L}$

3) Observations of counter -1

Time in Min	Number of customers in queue	Arrival rate	Avg. arrival rate
Start time 0 min	10		
After 10 min	18	0.8	

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After 20 min	25	0.7	0.88
After 30 min	30	0.5	
After 40 min	42	1.2	
After 50 min	55	1.3	
After 60 min	63	0.8	

4) Observations of counter -2

Time in min	Number of customers in queue	Arrival rate	Avg. arrival rate
Start time 0 min	8		0.82
After 10 min	15	0.7	
After 20 min	22	0.7	
After 30 min	33	1.1	
After 40 min	39	0.6	
After 50 min	48	0.9	
After 60 min	57	0.9	

B. Calculations

It is to be noted that on an average each customer spend 5 min to pay bill.

Average arrival rate of counter-1 and counter-2 $\lambda = \frac{0.88 + 0.82}{2} = 0.85$

$L = \lambda T = 0.85 \times 5 = 4.25$ customers

$\mu = \frac{\lambda(1+L)}{L} = 1.05$ c.p.m.

$\rho = \frac{0.85}{1.05} = 0.8095$

$P_0 = 1 - 0.8095 = 0.1905$

Percentage of idle workstation= 19.05%

C. For the new suggested model

For counter-1: On an average each customer spend 2 min to pay bill

$L = \lambda T = 0.88 \times 2 = 1.76$ customers

$\mu = \frac{\lambda(1+L)}{L} = 1.38$ c.p.m.

$\rho = \frac{0.88}{1.38} = 0.6377$

$P_0 = 1 - 0.6377 = 0.3623$

For counter-2: On an average each customer spend 7 min to pay bill

$L = \lambda T = 0.82 \times 7 = 5.74$ customers

$\mu = \frac{\lambda(1+L)}{L} = 0.9629$ c.p.m.

$\rho = \frac{0.82}{0.9629} = 0.8516$

$P_0 = 1 - 0.8516 = 0.1484$

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Average of utilization factor $\rho = \frac{0.6377 + 0.8516}{2} = 0.7447$

Percentage of idle workstation= 25.53%

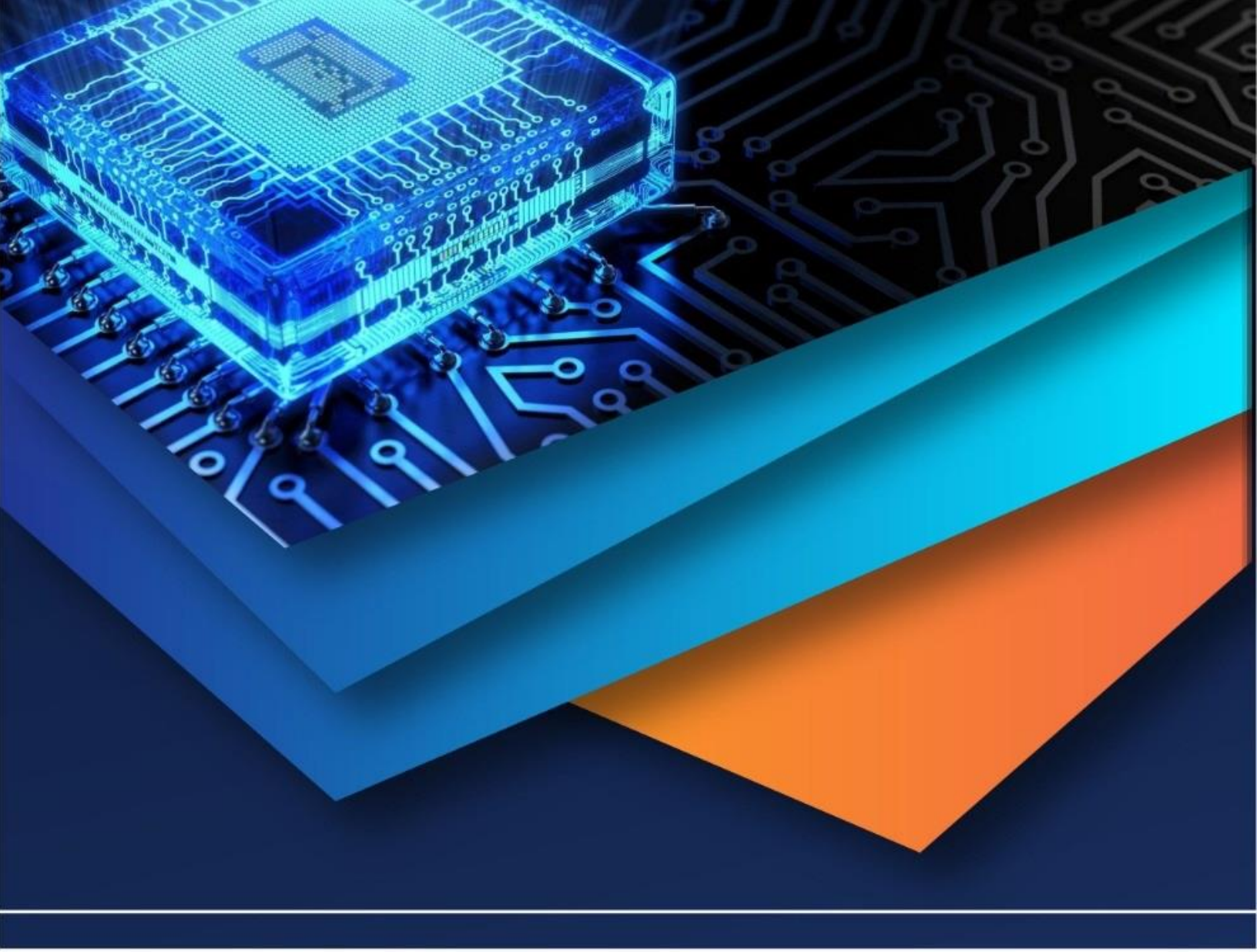
II. CONCLUSION

From the above results it has been observed that the utilization factor decreases and percentage of idle workstation has been increase in new suggested Queuing model as compared to the existing model .This will definitely reduce the waiting time of customer and will increase the customer satisfaction level.

REFERENCES

[1] Acharya U. H.,Ravindran G (1999), "Application of Queuing Theory to Libraries and Information Centres", DRTC Workshop on Information Management.
[2] Anish Amin, Piyush Mehta , AbhilekhSahay, Pranesh Kumar And Arun Kumar (2014),"Optimal Solution of Real Time Problems Using Queuing Theory", International Journal of Engineering and Innovative Technology,Vol. 3 Issue 10, pp.268-270.
[3] Babes M, Serma GV (1991), "Out-patient Queues at the Ibn-Rochd Health Centre", Journal of the Operations Research 42(10), pp.1086-1087.
[4] Bose K. Sanjay (2002), "An Introduction to Queuing System", Springer US.
[5] Davis M.M., Maggard M.J. (1990), "An Analysis of Customer Satisfaction with Waiting Time in a Two-Stage Service Process", Journal of Operation Management,9(3),pp.324-334.
[6] Dhari K, Tanzina Rahman (2013), "Case Study for Bank ATM Queuing Models", IOSR Journal of Mathematics, pp.01-05.
[7] Hana Sedlakova (2012), "Priority Queuing Systems M/G/I",Thesis, University of West Bohemia.
[8] Janos Sztrik (2010), "Queuing Theory and Its Application", A Personal View, 8th International Conference on Applied Infomatics, Vol. 1, pp.9-30.
[9] Kantiswarup, Gupta P.K., Manmohan (2012), "Operations Research", Excel Books Private Ltd. New Delhi, pp.215-231.
[10] Mala, Varma S.P. (2016), "Minimization of Traffic Congestion by Using Queuing Theory",IOSR Journal of Mathematics, Vol.12,Isssue 1,e-ISSN:2278-5728, p-ISSN:2319-765X, pp.116-122.
[11] MandiOrlic, MarijaMarinovic (2012), "Analysis of Library Operation Using the Queuing Theory",Informatol. 45,4, pp.297-305.
[12] Mital K.M. (2010), "Queuing Analysis For Out Patient and Inpatient Services: A Case Study", Management Decision, Vol. 48, No. 3 , pp.419-439.
[13] Mohamad F (2007), "Front Desk Customer Service for Queue Management System", Thesis, University Malaysia Pahang.
[14] Muhammad Imran Qureshi, Mansoor Bhatti, Aamir Khan and Khalid Zaman (2014), "Measuring Queuing System and Time Standards: Case Study", AfricanJournal of Business Management Vol.8 (2), pp.80-88.
[15] Patel B.,Bhathawala P.(2012), "Case Study for Bank ATM Queuing Model", International Journal of Engineering Research and Application, Vol.2, pp.1278-1284.
[16] Pieter-Tjerk de Boer's (2000), "Analysis And Efficient Simulation of Queuing Models of Telecommunication Systems", ISBN 90-365-1505-X, ISSN 1381-3617, CTIT Ph.D.-Thesis Series No. 00-01.
[17] Pokley S.S.,Gakhare S.S.(2002), "Waiting Line Theory Applied To Adequate Requirement Of Beds In Hospital", "Business Perspectives",BirlaInst.of Management Technology, Vol 4,No.2,pp.77-80.
[18] Prabhu N.U.(1997), "Foundation of Queuing Theory", Dordecht Netherlands; Kluwer Academic Publishers.
[19] Sharma J.K., (2001), "Operations Research Theory and Applications", pp.597-665 Macmillan India Ltd, pp.597-665.
[20] Shastrakar D. F., Pokley S.S., Patil K.D. (2016), "Literature Review of Waiting Lines Theory and its Applications in Queuing Model",International Journal of Engineering Research and Technology, Special Issue-2016, IC-QUEST-2016 Conference Proceeding, pp.13-15.
[21] Shastrakar D. F., Pokley S.S.,(2017), "Study of Different Parameters for the Electricity Bills Cash Counter Queuing Model",International Journal of Innovations in Engineering and Science, Vol.2 N0. 6, e-ISSN: 2456-3463, pp.195-197.
[22] Shastrakar D. F., Pokley S.S.,(2017),"Analysis of Different Parameters of Queuing Theory for the Waiting Time of Patients in Hospital",International Conference On Emanations in Modern Engineering Science and Management,Vol.5, Issue:3,ISSN: 2321-8169, pp. 98-100.
[23] Syed Shujauddin Sameer (2014), "Simulation: Analysis of Single Server Queuing Model", International Journal on Information Theory (IJIT), Vol.3, No.3, pp 47-54.
[24] Taylor S. (1995), "The Effect of Filled Waiting Time and Service provider Control Over the Delay on Evaluation of Service" Journal of Academic Market. Sci.23, pp.33-46.

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