International Journal of Research
International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 06, June 2015
Available at http://internationaljournalofresearch.org

Simulation of a Banking Queue with Varying Servers and Customers with Calculation, Optimization and Automation of Banking System using Simulink

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ABSTRACT

Purpose *– Many models have been proposed to counter Bulk customer congestion. Most of them are inefficient and does not reduce load on the main server. Proposed model calculates performance of a customer queue under varying servers and optimizes the performance of a queuing system. It also provides with a tool to automate the whole system.*

Methodology used - Simulating *system response to randomly generated customers with varying servers*

Findings *– Proposed model gives methods that can be used to optimize the queue length and manage the average queue length of the costumers. It automates the behavior of queue according to varying servers for processing the customers. Model not only simulates a random and variable queue of customers but it also calculates average queue length of customers.*

CHAPTER – 1

INTRODUCTION

Queuing system with vacations has been attracted considerable attention to many authors. It has effectively been applied in computers and communication systems production/inventory system. It is presented an excellent survey of queuing system with server vacations. One of the important achievements for vacation queuing system is the famous stochastic decomposition results, which was first established by authors (Zadeh et al., 2012). . They derived the system size distribution which confirmed the famous stochastic decomposition property, and the optimal stationary operating policy was also investigated. At the present day, batch arrival queuing system under N-policy with different vacation policies have been received considerable attention because of its practical implication in production/inventory system have considered batch arrival queuing system under N-policy with various vacation policies (Baruah et. Al., 2013). Batch arrival queuing system under N-policy with a single vacation and setup times, which can model queue-like manufacturing/production/inventory system. Consider a system of processing in which the operation does not start until some predetermined number (N) of semi-finished products waiting for processing. To be more realistic, the machine need a setup time for some preparatory work before starting processing (Wang et. Al.,2009). When all the semi-finished products in the system are processed, the machine is shut down and leaves for a vacation. The operator performs machine repair, preventive maintenance and some other jobs during the vacation. After these extra operations, the operator returns and checks the number of semi-finished products in the queue determining whether or not start the machine. The N-policy was first introduced by which is a control policy turning the server on whenever N (a predetermined value) or more customers in the system, turning off the server when system is empty. it is successfully combined the batch arrival queue with N-policy and obtained the analytical solutions. Later, it is analyzed in detail a batch arrival Mx/G/1 queue under N-policy with a single vacation and repeated vacation respectively. It is to be noted that few authors involved above considered the probability distribution of the number of customers in the system for batch arrival queue under N-policy with different vacations policies. Recently, it is analyzed the behaviors of queue length distributions of a batch arrival queue with server vacations and breakdowns based on a maximum entropy approach it is also used the maximum entropy solutions for batch arrival queue with anun-reliable server and delaying vacations. They all derived the approximate formula for the probability distribution of the number of customers in the system. For example, the queue-length distribution has been applied for the communication system buffer design (Yu et. Al., 2010) . Morse considers discouragement in which the arrival rate falls according to a negative exponential law. We consider a single-server queuing system in which the customers arrive in a Poisson fashion with rate depending on the number of customers present in the system at that time i.e. $(n+1)\lambda$. (Kumar et al., 2014) An impatient customer (due to reneging) may be convinced to stay in the service system for his service by utilizing certain convincing mechanisms. Such customers are termed as retained customers. When a customer gets impatient (due to reneging), he may leave the queue with some probability, say and may remain in the queue for service with the probability $p(= 1- q)$ (Peschansky et. Al., 2011). Queues with discouraged arrivals have applications in computers with batch job processing where job submissions are discouraged when the system is used frequently and arrivals are modeled as a Poisson process with state dependent arrival rate. The discouragement affects the arrival rate of the queuing system (Brill et. Al., 2013). In modern computer communication networks, queuing theory is a useful tool to analyze node-to-node communication parameters. This is especially true in Packet Switched Computer Communication Systems. Nodes of many networks can be analyzed in terms of a standard M/G/1 queuing system. However, some situations require researchers to investigate complex M/G/1 queuing systems (Gandole, 2011). Daigle illustrates how the M/G/1 paradigm can be used to obtain fundamental insight into the behavior of a slotted-time queuing system that represents a statistical multiplexing system. This time may be utilized by the server to carry out some additional work. On return from a vacation, if he finds "*a*" or more customers waiting, he takes them for service. Otherwise, he may remain idle (dormant) and continue to do so until the queue length reaches "*a*." In queuing literature, such types of queues are known as bulk service queues with single vacation. Bulk service queues are, generally speaking, hard to analyze (Kukla, 2008). The server works until all customers in the queue are served then takes a vacation; the server takes a second vacation if when he is back, there are no customers waiting, and so on, until he finds one or more waiting customers at which point he resumes service until all customers, including new arrivals, are served (Gandole, 2011).

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CHAPTER – 2

LITERATURE SURVEY

RESEARCHER	OBJECTIVE	METHODOLOGY	FINDINGS
Abazi et al. (2014)	to propose a methodology for designing a central maintenance workshop, enabling the evaluation of performance in terms of cost and sojourn time, for a given budget.	modeling framework based on queue networks	leads to a maintenance decision support tool enabling to give the structure of the MW, performing at a higher level, but at a reasonable configuration cost.
La (2013)	to focus on the ED's operational level and determine an optimal fast track strategy to improve performance measures	analysis of scenarios for optimizing fast track.	Length of stay and queue length were most significantly reduced when there was an increased physician presence in the fast track system, followed by an additional emergency nurse practitioner in the system. Finally, the implementation of See - and - treat had a negligible effect on both performance measures for fast - tracked patients
Church (2006)	. Waiting time and the impact it has on customer perceptions of service quality is considered alongside a typology of customers, based on their waiting characteristics. A number of critical components that affect customer queuing and crowding emerge	Case study	that modern computer - based simulation packages offer a way of measuring most of the influencing factors, and is an opportunity for leading fast food retailers to optimize their (total) product positioning.

	as an inherent part of the production - line service system		
Lam (2004)	describes a restructuring effort of a Hong Kong - based company, which provides technical support services in office equipment, computer and system products	explore the different options and to evaluate the results for restructuring the existing call centers.	results have confirmed that the greatest improvement opportunity is to merge the existing resources into a single call center. Assured by the simulation findings, management is able to evaluate different tangible and intangible benefits before implementing the restructuring plan.
Lehaney (1996)	Suggests that hospitals are faced with variable demand patterns, and simulation provides managers with a powerful means to access the demands on resources created by different case scenarios	Case study	Outlines the iterative development of a case study of patient flows at one clinic in an out - patients department, describing the software used - a Windows - based simulation environ ment called SIMUL8.
Blosch (1999)	Royal Navy's manpower planning system represents a highly complex queue which aims to provide sufficient manpower to meet both operational and structural commitments	Experimental design	illustrates how computer simulation and experimental design was applied to identify the key risk variables within the manpower planning system at the UK's Royal Navy.

Doloi (2002)	focuses on a conceptual methodology for an integrated simulation model dubbed as dynamic simulation modeling system (DSMS) for proactive and optimal decision making within a project management framework.	simulation model	Possible extensions are outlined. The C++ programming language in association with the object - oriented database management system is used to achieve the aforementioned objectives.
Proctor, (1996)	Proposes discrete event simulation as an effective tool in the search for more efficient health care systems.	Case study	shows how efficiency might be improved by moderating available resources and times taken to complete tasks. Maintains that the principles expounded here are applicable to many different aspects of health care management

Work done by different researchers on queue simulation over the years.

CHAPTER -3

SCOPE OF THE PAPER

1. Simulation of a real time queuing system
2. Simulating average queue length of customer
3. Determining average queue length of the customer
4. Changing system from single server to multiple servers to manage server load
5. Optimizing the queuing system

CHAPTER – 4

METHODOLOGY USED IN THE PAPER

1. DERIVING A RANDOM NUMBER GENERATOR TO GENERATE N - RANDOM CUSTOMRS ARRIVING AT ANY INSTANT OF TIMES.
2. GENERAING A ODERED QUEUE
3. USING A SINGLE SERVER TO PROCESS N CUSTOMESRS
4. SIMULATING THE SYSTEM RESPONSE TO INCREASING

NUMBER OF CUSTOMERS WITH SINGLE SERVER USING SIMULINK.

5. DETERMINING AVERAGE QUEUE LENGHTH AT A GIVEN INSTANT OF TIME USING SIMULINK
6. PLOTTING THE SIMULATION OUTPUT WITH SINGLE SERVER
7. VARYING SINGLE SERVER TO MULTIPLE SERVER TO REDUCE THE AVERAGE QUEUE LENGTH AND LOAD ON THE SERVER
8. SIMULATING THE SYSTEM RESPONSE TO INCREASING NUMBER OF CUSTOMERS WITH MULTIPLE SERVERS.
9. PLOTTING THE OPTIMIZED OUTPUT USING SIMULINK
10. USING MATLAB CODE TO AUTOMATE THE SYSTEM

CHAPTER – 5

RESULTS AND CONCLUSION

1. A discrete event system is presented in the model.
2. The model is implemented with a FIFO queue.
3. Here we are measuring the average queue length of customers in a queue per unit of time
4. The model is ready to run as presented in the figure 1
5. Model is run for time unit t=10 units
6. Here we see queue length is steady in the beginning then it is rising high up to 2 customers in a queue (Fig 2)
7. Now when we stress test the system and run the system for time t=60 units (Fig 3), we see queue length rapidly increases to 11 customers per queue with time
8. In above cases we were dealing with single server only. It is evident that using single server a queue processing system cant run efficiently and queue length increases rapidly with increasing stress of customers.
9. To overcome this problem and optimize our system we are increasing the number of servers from 1 to 2.
10. Now we see average number of customers reduces to 1 from 12 with increasing servers. (Fig. 4)
11. Thus we are modeling and optimizing a discrete event system with Sim Events library in real time.

CHAPTER – 6

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FIGURES USED IN THE PAPER

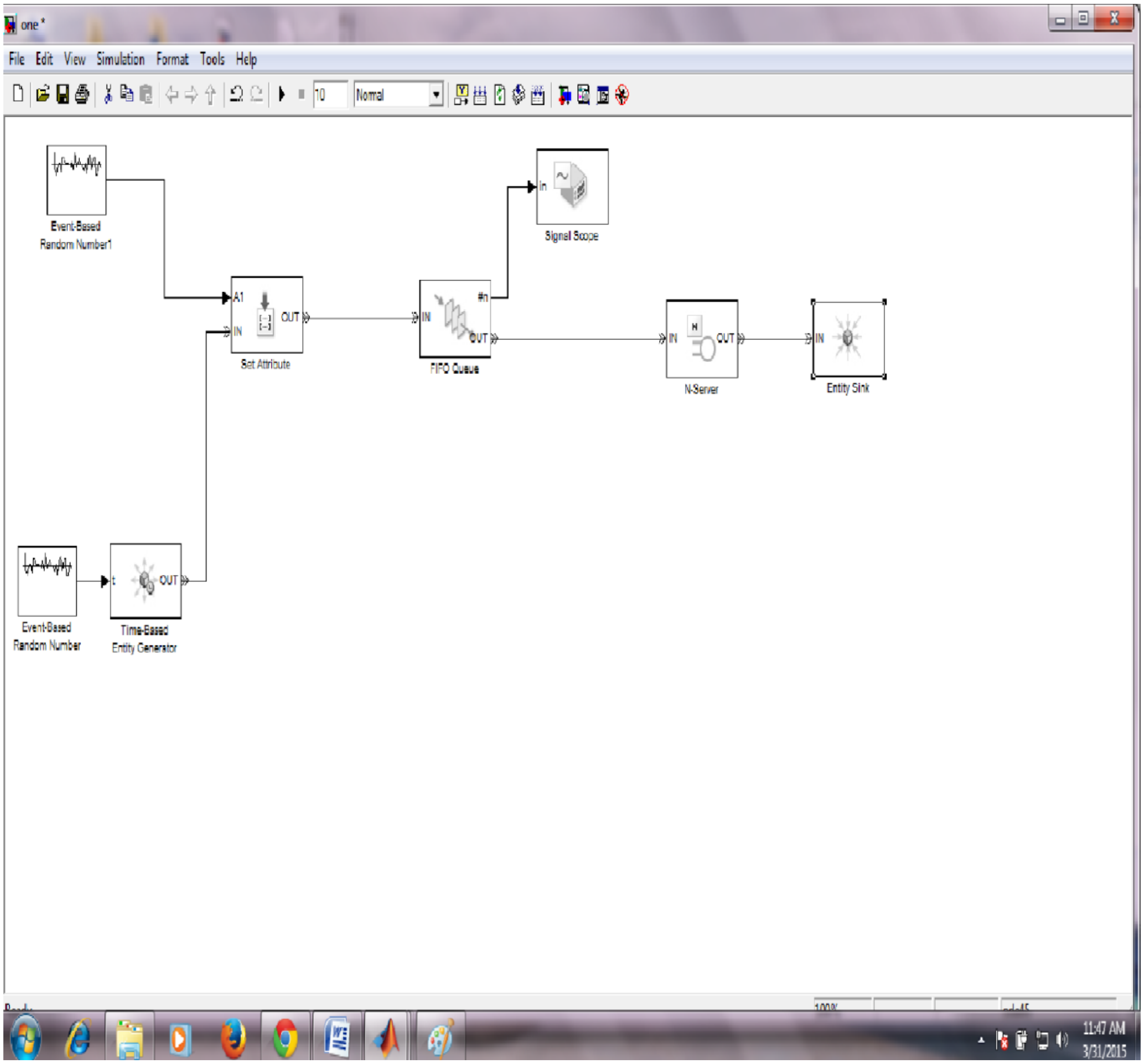

FIGURE 1

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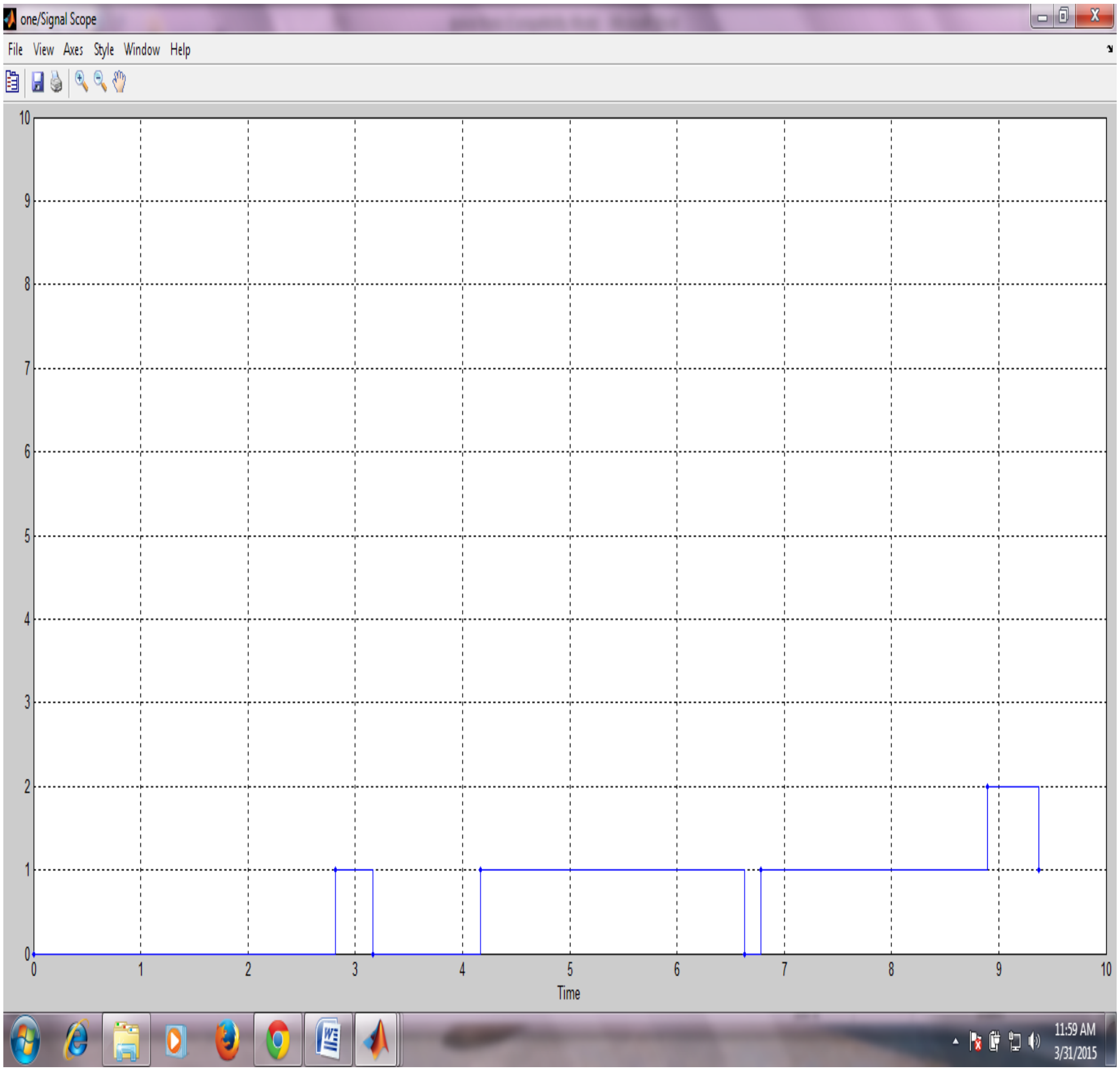

FIGURE 2

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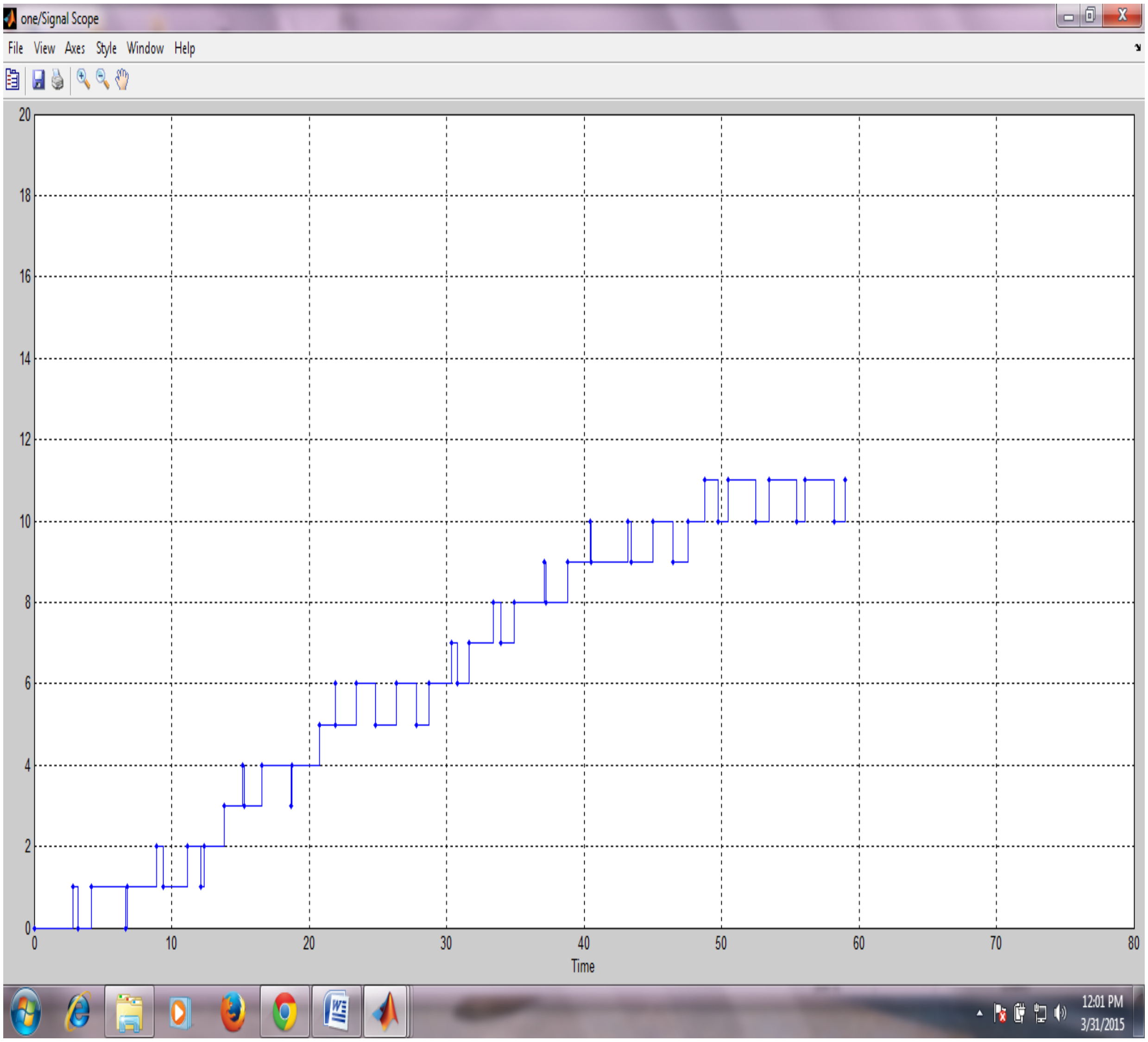

FIGURE 3

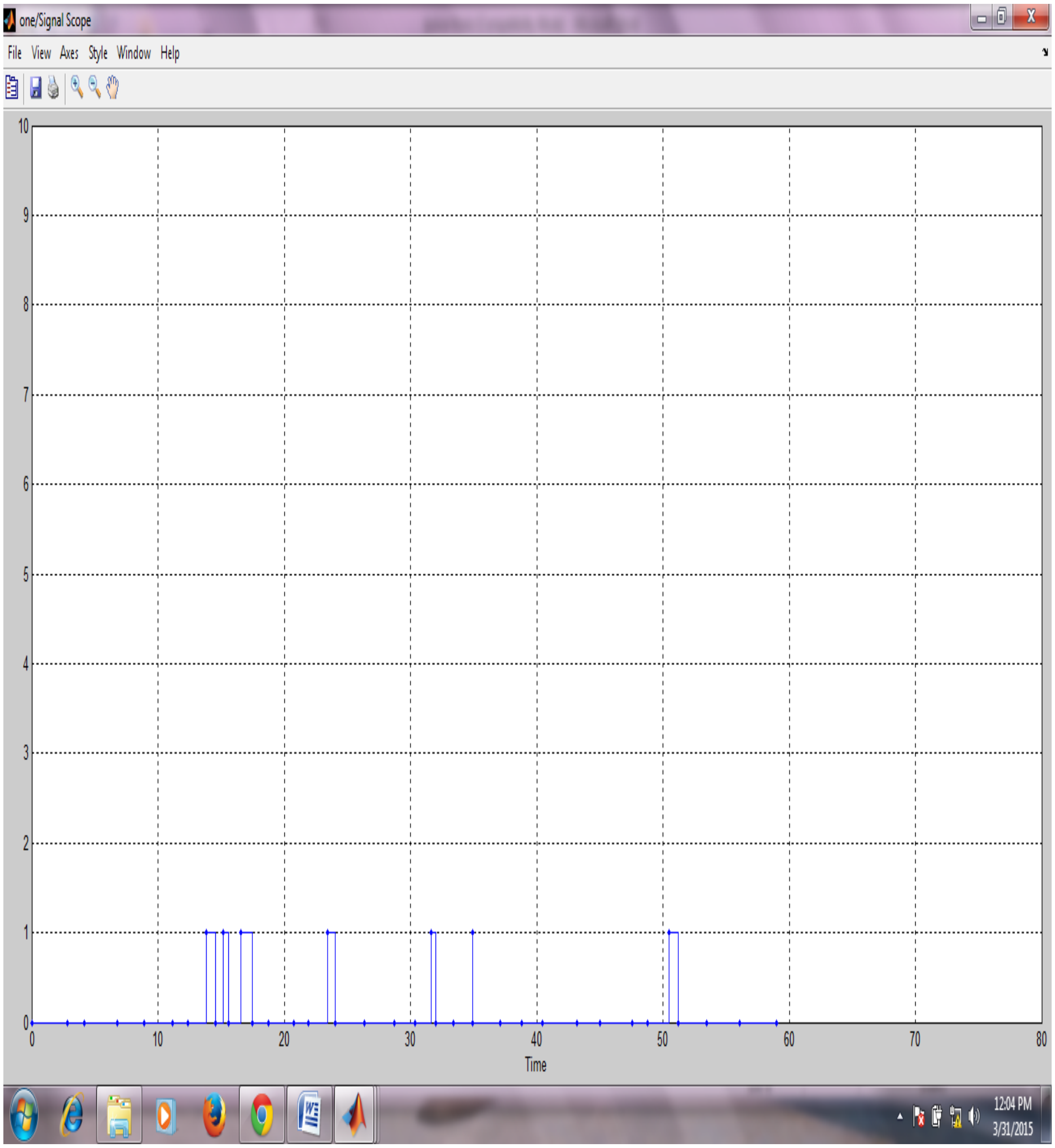
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FIGURE 4