Section A-Research paper
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Improve the order shipments from a warehouse using queuing theory

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ABSTRACT-

Queuing theory is a managemnt science that's all about finding the best way to use limited resources. Queuing model can be used to determine the density of the terminal networks, the size and the capacity of the warehouses , determine the types of handling equipment and others. By application of queue the process can be addressed and realized in the warehouses management such as activities in the central warehouses. By applying queuing theory a business can develop more efficient systems, processes, pricing mechanisms, reduce customer wait times and increase the number of customers that can be served. Queuing theory is not helpful in management of warehouse but also in the quantity , quality, minimum cost from consumer to customer in shortest time. In this paper we explain the problem of warehouse and the mathematical method to solve them.

Keywords- Queuing theory, limited resources, logistics system, mathematical method, warehouse management

INTRODUCTION –

Queuing theory means waiting in line. Queuing theory has various practical application including streaming workplace , developing efficient implementing better people management. This theory helps you to learn about queue characterstics and provide you better queue management techniques to improve customer's experience. Its finding can be hepful in expediting customer service, increasing customer service, increasing traffic flow, enhancing order shipments from a warehouse and designing data network. This theory directs proffesional to investigate the optimal method and set up the environment orderly. It places a premium on achieving a balance between service efficiency andd system's financial viability. The examples of queuing theory is customers trying to deposit or withdraw money are the customerrs, and bank tellers are the servers in a bank queuing station . Queuing theory can used to analyze the flow of traffic on the approach to and through an intersection controlled by a traffic signal. This is accomplished by analyzing the cumulative passage of vechicles as a function of time. The queuing diagram for interrupted flow shows the flow on one intersection approach.

The cause of improper behviour have been categorized in studies of queuing systems with with impatient clients. As a result, we emphasise in the literature the models that are developed for impatient clients as a result of service vaccations. Queue management is a smart, efficient way to balance costs, minimize loss, and avoid overinvesting in equipment, products, or labour hours all you don't need all while mainting a high level of customer satisfaction.

Queuing theory means solving problem in limited resources. In every business there are many steps such as production , ship, stock and sell an item. As soon as item moves through one step then it joins a queue to pass through the next phase. Similarly customer has to wait in line and have to comlete multiple steps in order to purchase your item from the first window and then go to next window for picking up food. Choosing the right method and its following application to a particular process in the supply chain can deducw the time request of the implemented processes, thereby reducing costs.

The logistics chain consist of subsystems and these in turn are made up of scientific processes and activities. In this warehousing subsystem processes are mainly related to income and expenses by establishing the material , but also process such as packing, storage, receiving, picking ans shipping. To solve these problems several mathematical methods can be applied to be used as a part of the decision making and management of logistic processes.

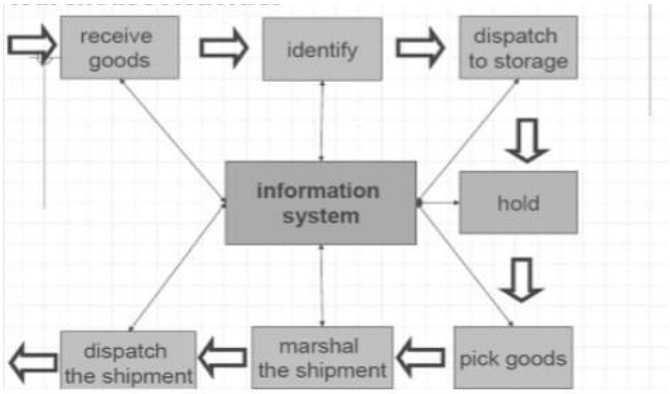
The several mathematical methods uses as a tool to solve warehouse management includes-

- Inventory managemnt models
- Queuing theory
- Methods of graph theory etc

RESEARCH DESIGN -.

In the business value chain model, logistics are the primary functions, which play an important role in companies. The majority part of multi-element in this function is a warehouse. It is the process of converting theory into regression model. It consist of selecting appropriate functional form for the model and choosing which variables to include. Warehouse happens to be a key function and destination in the over all supply chain planning and execution. Using in- depth analysis of warehouse from different dimensions, the objective involved in the study are listed as follows-

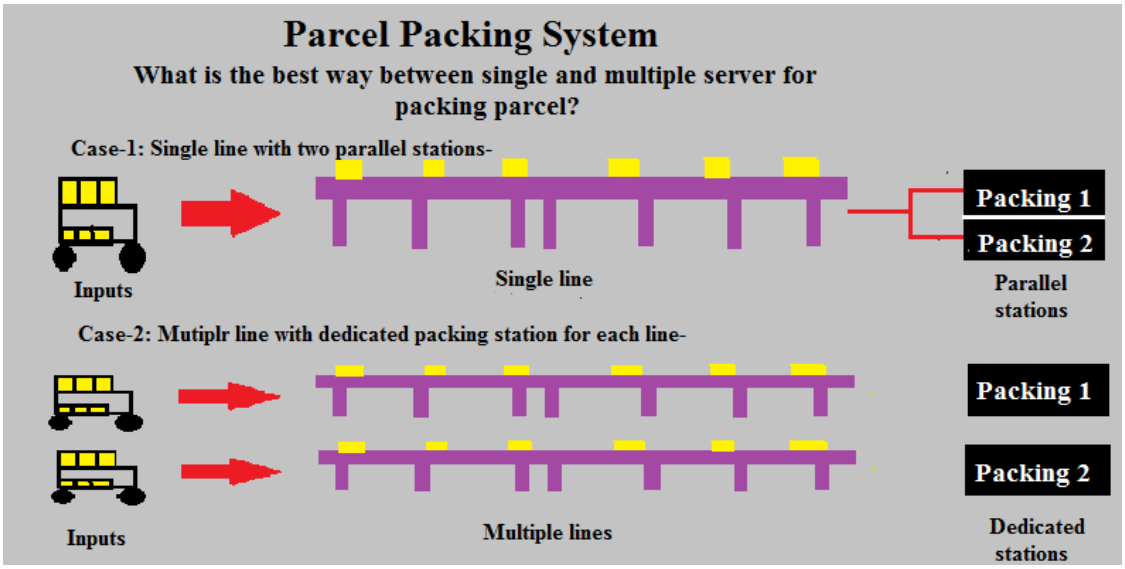
1. Receiving goods
2. Identifying the goods
3. Dispatching goods to storage by sorting and putting away
4. Holding goods by keeping and preserving
5. Picking goods
6. Marshalling the shipment such as goods making up a single order are brought together and checked for discrepancies
7. Dispatching the shipment



SUPPLY CHAIN PROCESS DESIGN -

After several principles of the queuing theory with Python to design a parcel packing process for an e- commerce fulfilment centre. In this paper we improve E-commerce fulfilment and parcel packing process using queuing theory.What is the best way solution between single and multiple lines solution.

Learn about process analysis, Little Law's , and how to minimize waiting time in queue.



PROBLEM STATEMENT-

You are the manager of the multinational food retail company producing packed food for children, teenegers, adults and senior citizen .

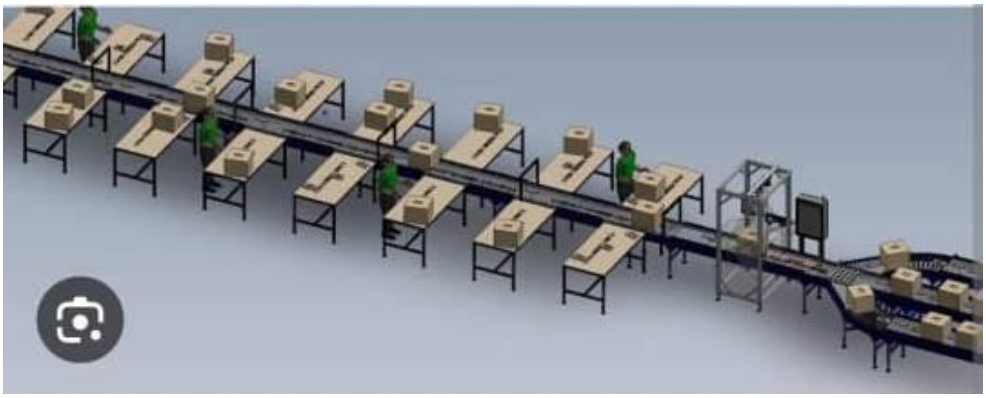
Besides receiving and transferring goods, managing a warehouse includes planning the storage, supply, and control of the inventory. Looking for new and better ways to manage a warehouse may lower costs, save time, and increase both income and costumer satisfaction.

Next, we show the most frequent challenges of managing inventories and some actionss that help overcome them so we can have an efficient and relaiable supply chain.

Based on the site observation and productivity analysis you may the packing process.

Warehouse Area With Single Line Packing Station

Now the warehouse pickers bring the parcels and put them on conveyor.



Warehouse Packing Process (Step-1)

Warehouse packing operator take the parcels from the conveyor and check the damaged item, quantity, and packing of the parcel and then close the box.

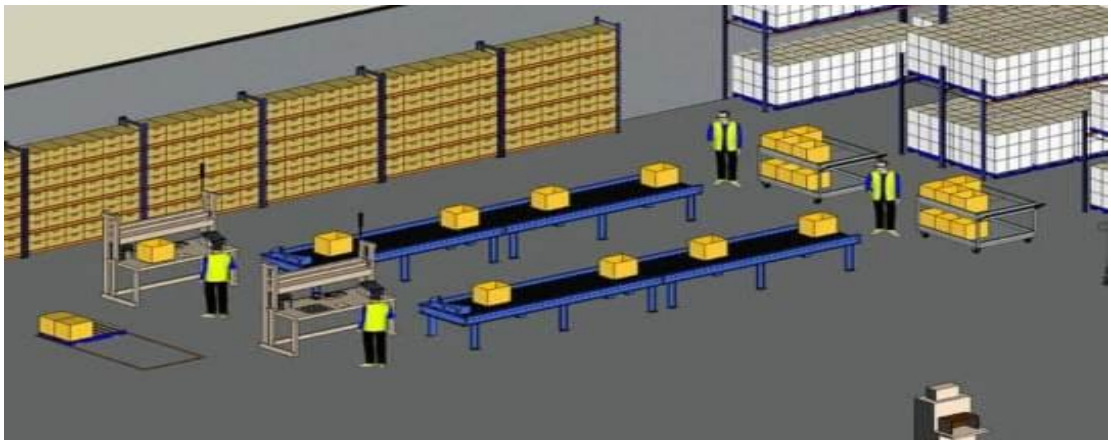
Packing operator checking the parcel (Step-2)

After then we got the approval form packing operator and then dispatch the pcking boxes.

SOLUTION-

1. A single line with two parallel stations.

2. Now add one more line with two dedicated station.



RESULTS AND FININGS -

1. In this paper we convert input into output in whole process.

2. Little Law-

Little's Law connects the capacity of a queuing system, the average time spent in the system, and the average arrival rate into the system without knowing any other features of the queue. The formula is quite simple and is written as follow:

$$L=\lambda w$$

Where:

- L is the average number of parcels in the system
- λ is the average arrival rate into the system
- W is the average amount of time spent in the system

3. However we face some problem while packing the item.
   1. The picker has picked the wrong item.
   2. Some item do not pass due to quality that is poor damaged item.

4. How we can estimate the waiting time-

Traffic density is calculated from the relationship:

$$\rho = x / y$$

The average number of items in the stack is determined from the relationship:

$$\Phi L = 2\rho /(1 - \rho)$$

The average waiting time in the stack is:

$$\Phi W = \rho / [y. (1 - \rho)]$$

Example 1- One single line and one front-

Suppose we have input of 12 items per hour and 14 service capacity per hour .

Traffic density $\rho = 12/14 = 0.85714$

The average number of items in the stack –

$$\Phi L = 0.85714/ (1- 0.85714) = 5.999$$

The average waiting time in the stack is:

$$\Phi W = 0.85714 / [14 (1 – 0.85714)] = 0.42857 \text{ h}$$

Example 2- Multiple line with two fronts-

Suppose we have input of 6 item per hour and 11 servce capacity per hour.

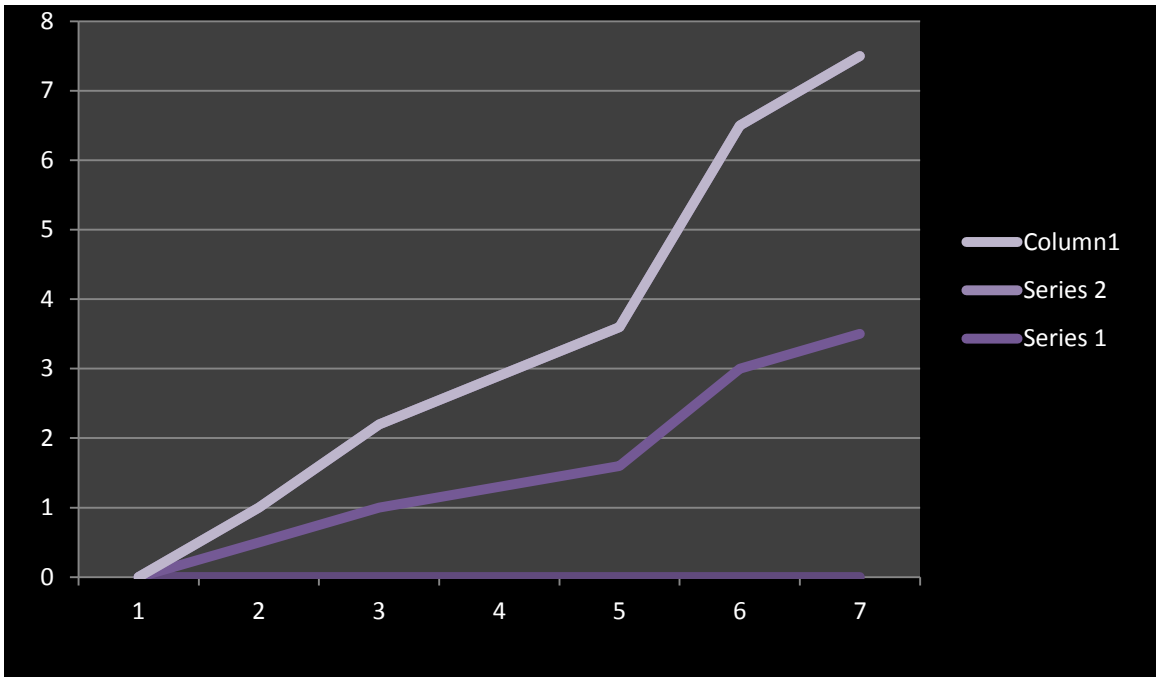
Traffic density $\rho = 6/11 = 0.5454$

The average number of items in the stack –

$$\Phi L = 0.5454 /(1-0.5454) = 1. 200$$

The average waiting time in the stack is:

$$\Phi W = 0.5454 / [11 (1-0.5454)] = 0.10909$$



Parcel Queuing time using single and multiple lines

We have seen that with single line there is huge delay in packing the parcel. Using multiple line is the best way in warehouses for packing the parcel and is helpul in time consuming of the warehouse workers and management. By this way more and more parcels are packed and order has shipped to the customer.

CONCLUSION-

In conclusion applying principles of queuing theory has help us to design parcel packing process and improve the efficiency of e-commerce fulfillment center. By using this method we can improve supply chain process and improve customer satisfaction. It has been shown that while increasing the number of service lines more items shipped per hour. However, it is important that the application of queuing theory on the created model determines the basic characteristics and the expected course of these processes and the behaviour of the warehouse.

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