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Minimization of Time for Efficient Distribution

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Abstract:
The aim of this paper is to reduce the time in assigning the orders manually for vans that are transported to the customers. The operation of transportation determines the efficiency of moving products. The progress in techniques and management principles improves the moving load, delivery speed, service quality, operation costs, the usage of facilities and energy saving.
Time can be reduced by dividing the area into cluster based on the forecasting demand which is implemented using python language.

1. Introduction

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves. Within each organization, such as a manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service. Supply chain management for retail companies strives to control product Quality, inventory levels, timing, and expenses. The drivers of supply chain performance are Facilities, Inventory, Transportation, Information, Sourcing and Pricing. In E-retailing logistics and transportation plays a crucial role in supply the goods to the customer. Council of Logistics Management (1991) defined that logistics is 'part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements. Logistics describes the entire process of materials and products moving into, through, and out of firm. Logistics is Customer-oriented operation management'.It is the management of transport and storage activities of an organization, which includes management of material, information and financial flows in order to meet customer requirements. The aim of logistics is to ensure that the correct customer receives at the right time and at the right place goods or service at the right quality and right quantity. For industries, logistics helps to optimize the existing production and distribution processes based on the same resources through management techniques for promoting the efficiency and competitiveness of enterprises. Therefore, transportation is the base of efficiency and economy in business logistics and expands other functions of logistics system. In addition, a good transport system performing in logistics activities brings benefits not only to service quality but also to company competitiveness.

2. Problem Statement

Assigning of orders of the customer to the vans requires more time by entering each orders of the customer manually to their respective vans. To optimize the existing distribution processes based on the same resources through management techniques for promoting the service quality, time efficiency and competitiveness of enterprises.

3. Methodology

Based on the past month data collection of the customer's orders forecasting can be done by using these data. The different steps involved are:
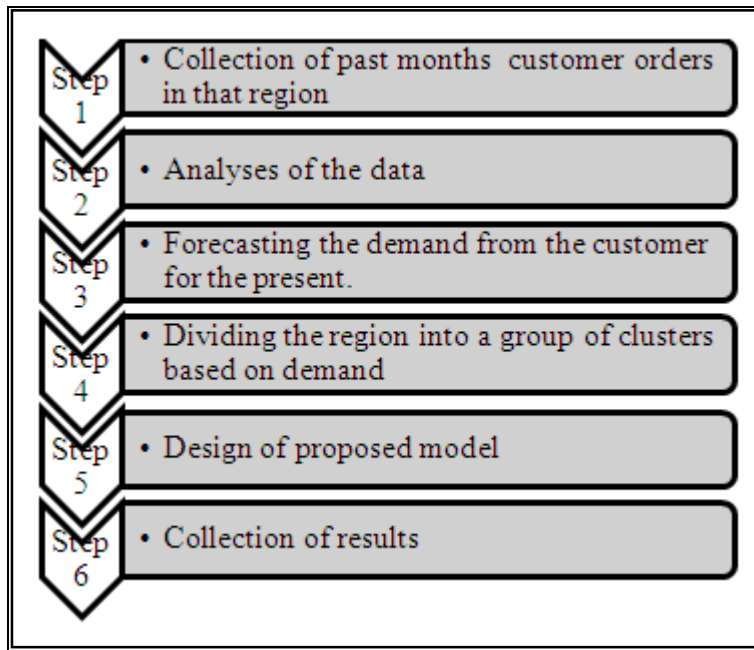
Figure 1: Different steps involved in methodology

3.1. Forecasting

Forecasting is the process of making statements about events whose actual outcomes (typically) have not yet been observed. Types of forecasting methods

3.1.1. Qualitative methods

These types of forecasting methods are based on judgments, opinions, intuition, emotions, or personal experiences and are subjective in nature. They do not rely on any rigorous mathematical computations.

3.1.2. Quantitative methods

These types of forecasting methods are based on mathematical (quantitative) models, and are objective in nature. They rely heavily on mathematical computations.

Based on the forecasting method the orders from the customer is categorized into four different segments that are

Peak
- Semi Peak 1
- Semi peak 2
- Non Peak

Peak Period: This is the period during which the customer orders are more compared to any other time slots. That is during the weekends and any other holidays.

Semi Peak 1: This is the period during which the orders are more compared to Semi peak 2 but less than the peak period. This would be at the start of every month that is first 15 days and also the evening time slots.

Semi Peak 2: This is the period during which the orders are less compared to the Semi peak 1 and even this occurs at start of every month but in the morning time slots.

Non peak: This is period during which the orders less compared to other segments and this come during the end of every month that is from 16th- 31st any time slot.

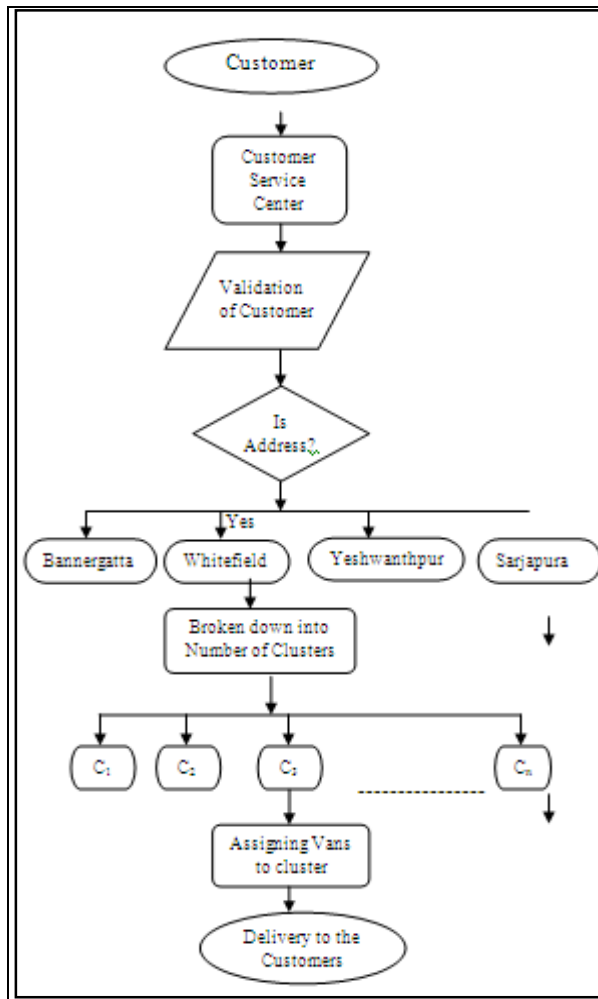*Figure 2: Division of Segements*

Figure 3: Flow diagram of the process

3.2. Cluster Formation
Based on this approach the orders of the customer are predicted for the present in the particular region. The region can be divided into a group of clusters based on longitude and latitude of the customers for the past months. Each cluster consists of many numbers of customers.
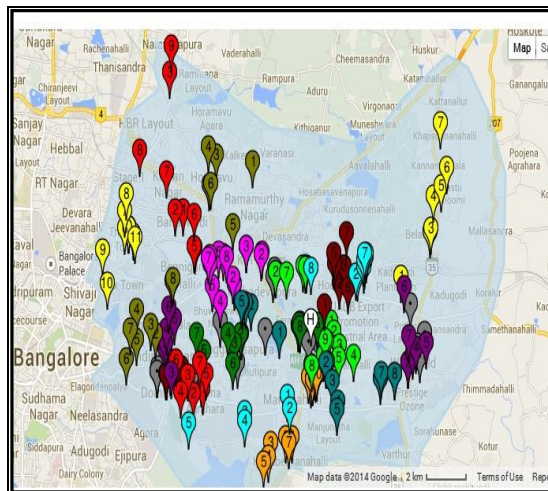

Figure 4: Region before the cluster formation

Divide the day into 4 time slots that are
7:00 AM to 9:30 AM
10:00 AM to 12:30 PM
5:00 PM to 7:30 PM
7:30 PM to 10:00 PM

Based on the division of orders into peak, Semi peak 1, Semi peak 2 and non peak, the assignment of vans and the cluster varies. They are Peak- During Saturdays S3 & S4, Sunday all the slots S1, S2, S3 & S4 and the Monday S3 & S4 they divide the hub into 25 clusters and additional of 6 clusters if it is required. Semi Peak 1- During $1^{st} – 15^{th}$ of every month's S3 and S4 slots they divide the hub into 23 clusters and additional of 6 cluster the order arrived are more. Semi peak 2- During $1^{st} – 15^{th}$ of every month's S1 and S2 slots so that they can divide the hub into 21 cluster and any additional if they required. Non peak- During 16th -31st of every month and it covers all the four slots the hub is divide into 21 clusters.

Segments	Slots	Cluster size	Orders
Peak	Saturday -S3 & S4, Sunday- S1,S2,S3 & S4	25 Clusters and 6 additional	More
Semi peak 1	Start of every month-1st to 15th of S3 & S4 slots	23 Clusters and 6 additional	Less compared to peak
Semi peak 2	Start of every month-1st to 15th of S1 & S2 slots	21 Clusters and additional	Less compared to Semipeak1
Non peak	End of the month-16th to 30th of S1,S2,S3 & S4	21 Cluster	Less

Table 1

4. Tools and Techniques
The different tools and techniques used in this project are:
- Python language for programming
- PDCA cycle

4.1. Python language
Python is a widely used general purpose, language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C.The language provides constructs intended to enable clear programs on both a small and large scale. Python supports multiple programming paradigms, including object oriented, imperative and functional programming or procedural styles. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library.Each cluster has their respective vans assign to that cluster so as soon as the customer order arrives the orders can be placed in the van based on the customer address in which cluster they fall. The program for automatically assigning the orders to the vans that are assigned for each cluster is as follows

```
{Def do_initial_van_assignment(order): van,
van_assign_comp_rule=VanClusterGroupItem.get_active_van_in_boundary (order, pass_rule=True) if van is None:
logger.exception("INITIAL_VAN_ASSIGNMENT: There are no cluster group items set, found
While order id %s" %( order.id) return None try: VanAssign.objects.create(van=van,
Hub=order.hub, slot_date=order.slot.slot_date, slot_time=order.slot.slot_time,order=order)
except(MySQLdb.IntegrityError,IntegrityError): pass:  try:
van_assign_status=VanAssignStatus.objects.create (order=order, initial_van_assignment=van,\assigned_by=VAN_ASSIGN
EE_SYSTEM) except (MySQLdb.IntegrityError, IntegrityError): van_assign_status=VanAssignStatus.objects.get(order=order)
handle_van_capacity (order,van_assign_comp_rule.van_cluster_group, van_assign_status)  return van @classmethod def
get_active_van_in_boundary(cls, order, pass_rule=False): returns an active van such that the order's member location is within van
boundary from an active van cluster group     item.  Van Cluster Group Item is selected based on active van cluster group rule
van=none
```

```
valid_van_cluster_group_rule=VanClusterGroupRule.get_valid_cluster_group_rule(order.hub,order.slot.slot_time.group,order.slot.slo
t_date)  if valid_van_cluster_group_rule:order_member_address=order.get_order_address()
if order_member_address is None:
logger.exception('Order member address not found for order id %s' %(order.id))
point=order_member_address.member_address.contact_location
van_cgis=cls.objects.filter( geom__contains=point,
van_cluster_group=valid_van_cluster_group_rule.van_cluster_group)  van = van_cgi.van else:  logger.exception('There is no cluster
group rule set for hub %s and slot %s' %(order.hub, order.slot))
return van}
```
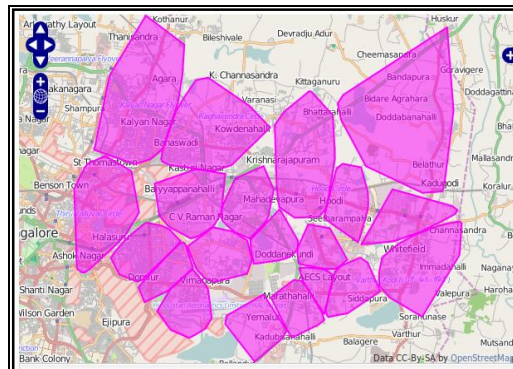

Figure 3: Region after the cluster formation

4.2. PDCA
PDCA (plan–do–check–act or plan–do–check–adjust) is an iterative four-step management method used in business for the control and continuous improvement of processes and products.
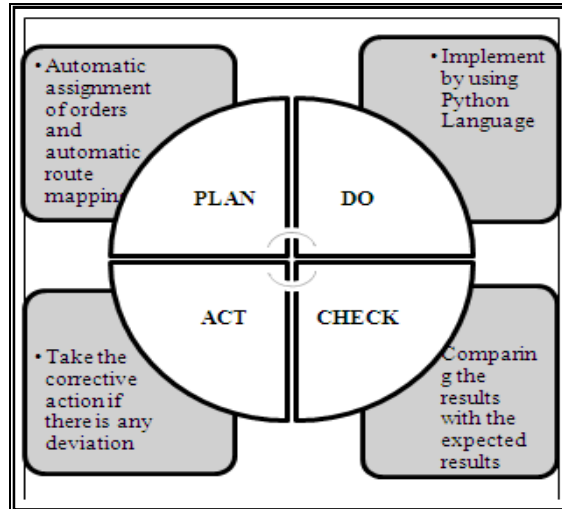

Figure 4

- Plan: Establish The Objectives And Processes Necessary To Deliver Results In Accordance With The Expected Output (The Target Or Goals).
- Do: Implement The Plan, Execute The Process, And Make The Product. Collect Data For Charting And Analysis In The Following "CHECK" And "ACT" Steps.
- Check: Study The Actual Results (Measured And Collected In "DO" Above) And Compare Against The Expected Results (Targets Or Goals From The "PLAN") To Ascertain Any Differences.
- Act: Request Corrective Actions On Significant Differences Between Actual And Planned Results

5. Result
Time required to assign the orders manually for the vans is 30 minutes for one slot.
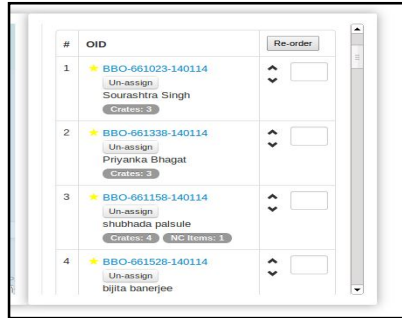

Figure 5: Before implementation

By implementing the proposed model assignment time is reduced by half of the manual assignment and also inventory is reduced. Whenever the order comes respective orders can placed to their respective vans so that the inventory is reduced and also customer satisfaction can be met.
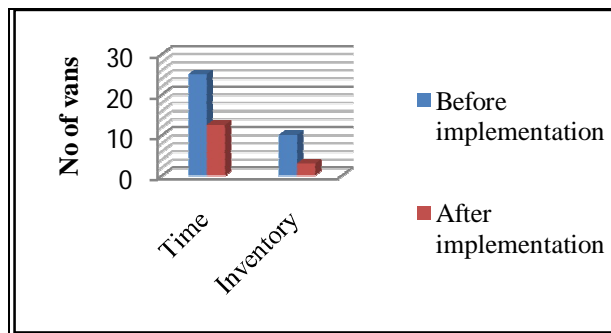

Figure 6: After implementation

Figure 7: Reduction of time & inventory

It calculates the distance from the last order and the time required to travel from the last order to the destination. The earliest time arrival is calculated automatically by using the following program
url="http://maps.googleapis.com/maps/api/distancematrix/json?origins=%s,%s&destinations=%s,%s&sensor=false&mode=driving"\
% (point1_latlng[1], point1_latlng[0], point2_latlng[1], point2_latlng[0])
signed_url = get_signed_url(url)response = requests.post(signed_url)if response.status_code != 200:return {'status': False} try:
Distance = json.loads(response.content)
 kms=distance['rows'][0]['elements'][0]['distance']['value'] / 1000return {'status': True, 'kms': kms} except (KeyError, IndexError): pass
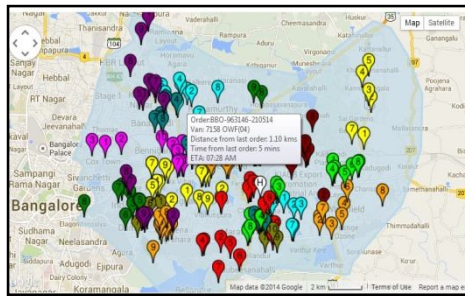Return {'status': False}

Figure 7: Calculation of the distance

6. Future Scope
By implementing the proposed model assignment of orders to van results in
- Customer satisfaction
- Better service quality
- Creates greater profitability.
- Create increase in sales
- Time can be used efficiently
- Job rotation

7. References
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