Fault Detection Enabled Optimal Of Vehicle Alert And Routing Problem Using Hybrid KP-OACO Algorithm For Balancing Load In Cloud Computing

M. Kannan, C. Priya

***Abstract*: *Traffic and vehicle routing is one of the nigh natural and common topic. Generally, vehicle routing is a condemnatory circulation. Many cities have considered lots of people. Specimen, Turkey. Generally turkey city has 6 cities with more millions of people, which is the 8th largest city, it has 14,804,116 (2019). In this paper produce the optimized solution for vehicle routing and waking up the people from the traffic. ACO (Ant Colony) is an optimization technique, which was specially made for hard combinatorial problems (NP-Hard), in which ACO (Ant Colony) was first invented by Dorigo. ACO (Ant Colony) is a heuristic tactic that is animated by the activity of the original ant. Many research peoples have already worked on this vehicle routing problem and discuss their results. Even though it has some alleviate like computation time and speed. This paper is re-analyzed and to propose the new hybrid Ant Colony Algorithm (ACA), namely, KP-OACO is to deal with the VARP using some variant of a bio-energy algorithm, scilicet, the Ant System (AS), Ant Colony System (ACS), and Hybrid KP-OACO (KP-Optimized Ant COlony) Algorithm to quest the better optimized result of the VAR problem (VARP). The main sequel of this paper is to attentive the person while he/she is on the vehicle and also find the optimized way from the traffic, through this we can solve the routing problem either the object is heavily loaded or if it is a normal vehicle. From this proposed work the speed will also increase through this algorithm and also we can remit our cost. At this paper KP-OACO algorithm is a proposed and modified algorithm for re-analyzing the VAR (Vehicle Routing and Alert) problem. The goal of the algorithm KP-OACO is to balance the mass. In this proposed work has been simulated using Cloud Analyst. ACO (Ant Colony) helps to analyze the new way from an existential way, to do this we can avoid the traffic.*

Index Terms: VARP, AS, ACS, Hybrid KP-OACO Algorithm, and Load Balancing.

I. INTRODUCTION

In the computerized world Vehicle routing with traffic is the major and universal problem. The sweeping instance of this problem is Travelling Sales Man Problem (TSP), which is the intimate problem; this TSP problem is solved by many researchers with using kinds of application such as [12].

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In this previous paper contains fault detection enabled optimal load balancing using virtual machine concept is to present, how the mass will be adjusted using this Load Balancing Techniques (LB). We have already known LB is nothing but, it is a technique to merge the unbalanced weight [5]. For example, if the client gives an N number of missions to the server, the VM load balancer is taking charge to assign the mission equally to the server. So the advantage is, we can receive the bandwidth to each file. So the downloading process might not be corrupted and it will be moved to the advanced level. The same concepts with hybrid ACO algorithms are used in this paper to remit the traffic and routing problem. The VARP is a different from the VRP [14]. The ecbatic of VRP is to trace the quickest route in which VARP is to find the quickest route without the traffic with the traffic alert message. In the recent year vehicle routing is the one of the crucial problems because of increasing population. Nowadays population has been increasing day by day in an every country. The cause of the population is traffic. Ant Colony is an optimization technique in which this algorithm has been used at many problems like VRP is to give the optimized solution. ACO is quite interesting and very fast algorithm; it will handle any combinatorial problems, in which it gives only the optimized solution to the user/client. In this paper containing Vehicle Alert and Routing Problem (VARP) with hybrid algorithm, is to show how this problem has been solved and how the algorithm will invoke. Basically ACO will pursue the First Come First Server manner (FCFS) concept. So the result is expressed in the concept of classic LIFO order. Many researchers have worked with that VRP, but in this paper containing VARP which is the routing and alert problem. And cloud computing is the major concern in which there techniques have been used in many applications and industries.

II. RELATED WORKS

Ant Colony Optimization (ACO) was first introduced by Marco Dorigo who is a famous research director in the country of Italy. In which ACO is an optimization technique which is main used for, to track the optimized solution in a less time. In which ACO algorithm was animated by the activity of the original ant. Although ACO

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have been used in many applications to solve NP-Hard and combinatorial problems. VARP is one of the optimization problems, in which this problem has solved with many applications using a variety of tasks. For example, LIU Yan (2) proposes the new ACO algorithm for reaching an optimized result for the problem of VRP dangerous good recovery path. Many vehicle routing problems have analyzed and solved using this ant colony optimization algorithm. Basically ACO was functioned by the behavior of an original ant (26). VRP is a routing problem in which this problem was approached by many algorithms such as Genetic Algorithm (GA), Tabu Search Algorithm, ACO Algorithm, and ACS Algorithm, etc. The following figure is, finding an optimized route using the ACO concept. In that graph have more cities or nodes, the ant will acts like a vehicle to search and reach the optimized place. That will show in the below figure (1):

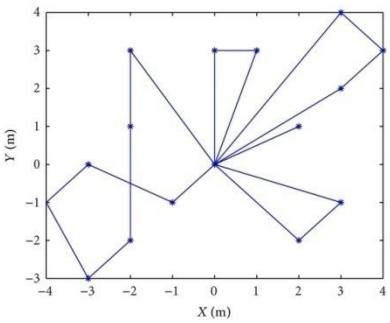

Figure 1: Finding Routes for vehicles to travel using Ant Colony Optimization

In this VARP is to find the optimum route without the traffic road, to quickly reach their destination with some traffic alert message. ACO Optimization, the ant can easily find their source (food). In this paper, we propose a new Hybrid KP-OACO algorithm for assigning an even load to the customer or a client and to solving a VARP. This Vehicle Alert and Routing Problem (VARP) are an extensive theory of the Vehicle Routing Problem (VRP). ACO will help to solve many VRP like [7, 9, 10, and 14]. In which the main goal of this VARP is to provide the un-traffic way and to produce the optimized route to travel the city. The best example of this VARP is an online shopping and home delivery [11]. The online shopping is quite easy because the user can easily purchase the item within a minute in their presented place. After placing the order, the ordered item is delivered by the respected application delivery man. During this time the delivery person might be facing the traffic, at that time he chooses the alternative way to reach the place. The same idea has been proposed in this paper using some ant algorithm, namely, AS, ACS, and Algorithm KP-OACO.

III. SPECULATIVE SCENARIO OF ACO, AS AND ACS

A. *Ant Colony Optimization (ACO)*

ACO is an optimization technique [3] which is used to track the optimal solution. ACO has many advantages to provide the result, such as, computation time, bandwidth proving, memory allocation, processing time, etc.

ACO was used to find out the quickest path with less time and also reduce the cost of the application. Dorigo creates this optimization technique with the help of real ant behavior and their pheromone trails.

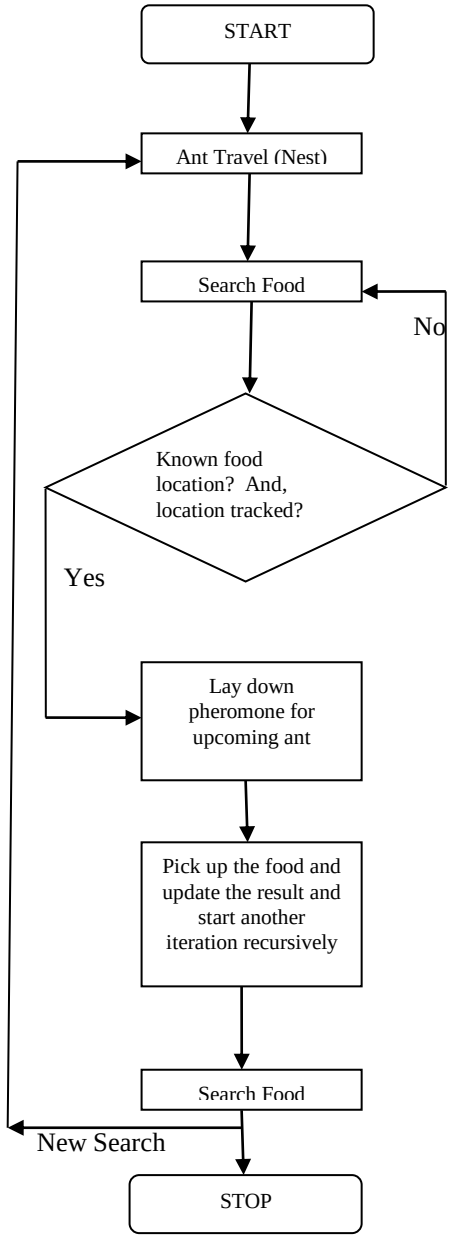

Figure 2: Basic ACO flowchart

By this trail, the ant can easily find out the routes and they reach their destination in a quick moment. The block diagram of basic ACO concept is represented in the above figure (2). For the general use, the original Ant Colony Optimization Pseudo code has been represented below:

```
procedure  ACO_MetaHeuristic
while (not_termination)
generate Solutions()
daemon Actions()
pheromone Update()
end while
end procedure
```


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B. *Ant System (AS)*

The Ant System algorithm is one of the models of an Ant Colony Optimization method is extracted from the field of, Metaheuristics concepts. Basically Ant System is the term used to refer the Ant Cycle. The AS algorithm is motivated by scrounge of the original ant behavior. Which means, we have already known from the ACO theory, each ant must lay down the pheromone trails for communicating with the upcoming ant. So the main goal of the each ant is to asset the food and come back their nest. So the pheromone is the best and good way for communicating with other ants. Through this trail, the ant can easily discover their food. This contraption is also called as ***Stigmergy***.

$$\tau_{i,j} \leftarrow (1-\rho) \times \tau_{i,j} + \sum_{k=1}^{m} \Delta^{k}_{i,j} \qquad (1)$$

Where, $\tau_{i,j}$ represents the graph edge or the pheromone for the component i and j. ρ is the decay factor, *m* is the number of ants, and $\sum_{k=1}^{m} \Delta^{k}_{i,j}$ is the sum of maximizing solution cost.

$$P_{i,j} \leftarrow \tau_{i,j}^{\alpha} \times \eta_{i,j}^{\beta} \sum_{k=1}^{c} \tau_{i,k}^{\alpha} \times \eta_{i,k}^{\beta} \qquad (2)$$

Here, $\eta_{i,j}$ is maximizing contribution. α is the heuristic coefficient, β is the history coefficient, c is the set of usable components. $\tau_{i,j}$ is the pheromone value for the component.

C. *Ant Colony System (ACS)*

This is similar to the ant system [5], is extracted from the original ACO, which is, the main notion of the ACS is used to find the best tour among the ant problem. When comparing to AS with ACS, ACS is much intricate [5]. Almost ACO will follow the two main regulations such as,

- Local Update Rule – Pheromone is reduced, every time ant passes by the boundary.
- Global Update Rule – Pheromone is updated, after ant finds the premier and optimized tour.

$$S = \begin{cases} \text{argmax}_{u \in \text{AllowedNodes}} [\tau_{i,j}(t)]^{\alpha} \times [1/d_{i,j}]^{\beta}, & \text{if } q <= q_0 \\ S, & \text{otherwise} \end{cases}$$

Here,

- $\tau_{i,j}$ is the quantity on pheromone between the nodes i and j.
- $d_{i,j}$ is the heuristic distance between node i and j.
- q is the random number.
- q_0 is a user-defined parameter.
- α and β are two parameters which is the amount of pheromone.
- S is a randomly chosen.

IV. MODIFIED ALGORITHM-KP-OACO FOR VEHICLE ALERT ROUTING PROBLEM

A. *Problem Description*

In this paper, a new modified algorithm KP-OACO was nominated to solve the VARP problem. The vehicle routing is one hand, in which this routing problem will contain high population cities. And managing traffic is another problem for the passenger and/or a rider. Ant Colony Optimization is one of the major key algorithm, is to handle this type of problems. The following diagram will shows the multiple routes, for the users.

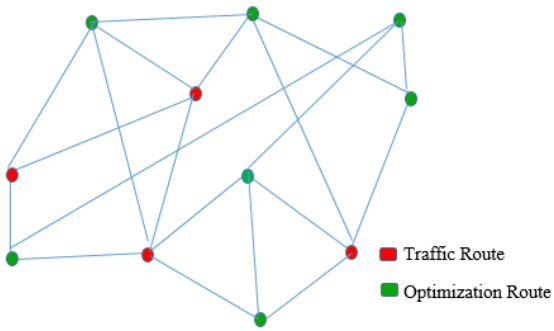

Figure 3: VARP Routes

ACO meta_heuristic method is the ability to find the feasible result, which is the Ant Colony Optimization (ACO) mastery.

In this paper is to take a VRP problem as the inspiration, is to solve the VARP problem to reach the optimized solution using the load balancing concept. In this modified algorithm contains several steps to reach the qualified solution using ACO meta_heuristic. The goal of the algorithm KP is to balance the mass of the vehicle and reducing cost. Through this algorithm the user can compare the previous solution with the new solution reached by the use of step (4). When we talk about in this VARP problem using ant colony algorithm, ant will find many available and possible routes to travel the vehicle, even though this algorithm will use the concept of ACO and meta heuristic to find the best routes among all possible routes. For this the rider can easily reach the nest of the place on time.

B. *Algorithm KP-OACO*

Step: 1 **(**Initialization and Importing Data)

Upload pheromone trails parameter. Like count of ants, count of elitist ants, number of virtual machine, virtual machine id (VMId), viz.

Step: 2 (Iteration Process)

Then place the Kth ant and get ready for them (ant). Or waking up the ant for to start up the initial iteration process $\tau_i = 0$.

Step: 3 (Path Selection)

Schedule the iteration to each VMId and K^{th} ant.

Step: 4 (Chart or Design)

Once, the ant choose their route of the path and VM, Look, if the Kth ant is starting to move with their path, then immediately note the

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starting pheromone τ_i value.

Step: 5 (Local Search)

Once ant completes their first tour → tabulate the ant result and evaporate the pheromone.

Step: 6 (Repeat)

Repeat above steps while an ant builds a solution. Tabulate the solution to which ant is to track the least cost path.

Step: 7 (Pheromone Updating)

After completing their tour and tabulate the previous solution, waking up the ant for a next iteration and to update the global pheromones after the verification.

Step: 8 (Optimization verification)

Check whether the given result is optimum. If the given result is non-optimum then re-check the ant build path and to verify, till any other ant is performed in the node or the city.

Step: 9 (Process Comparison)

For each ant completes their whole process of iteration, compare local pheromone values (existing optimal solution) with final optimal solution (new solution).

Step: 10 (Tabulate Updated pheromone result)

Calculate the output and update the least cost path or balanced path result.

Step: 11 (Reset Pheromone Values)

Stop the iteration if optimized solution is traced; else perform the same process until gets optimized and possible solution.

V. RESULT AND DISCUSSION

In this phase, we need to discuss two main things which are presented below: The marketing term Cloud Analytics is a tool used to achieve the analysis using cloud computing environment. This tool most commonly used for companies and research peoples for research-oriented purpose. Cloud analytics are invented to make official statistical data, which are obtainable in the user's web browser. While we are open the tool Cloud Analyst, the main page will look like (Figures 4 and 4 (a)). Cloud Analyst [25] is also referred as a tool which is used for a practical reference used by research fellows or a company and/or industrial peoples and it is used to represent the data as a pictorial point of view such as histogram, tabulation format like a slight activity of a MATLAB tool. Using cloud analyst, the user can easily understand the concept of the problem. And also cloud analyst is an open source, which is available at many Google sites. Cloud computing is predominately used in this cloud analyst tool for representing data.

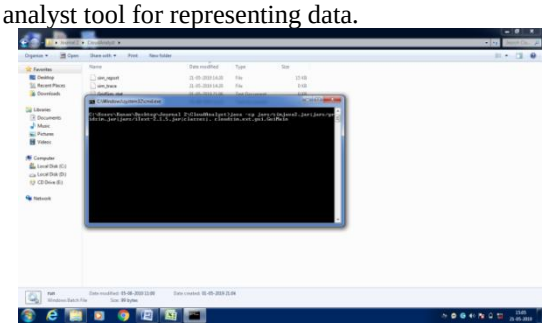

Figure 4: Starting Cloud Analyst

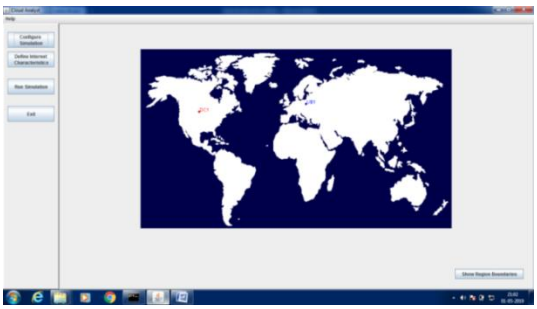

Figure 4 (a): Cloud Analyst Tool

Cloud analyst is developed (Marco Dorigo) as a Visual modeler's tool on a cloud simulator (Cloud Sim). Some of the Cloud Analyst tool snap shots are given below:

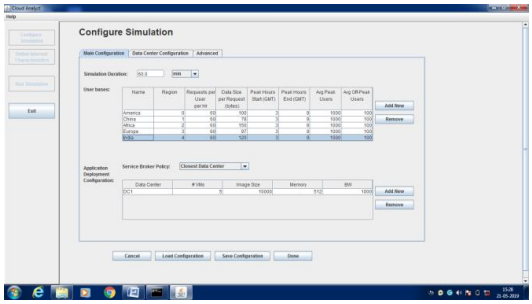

Figure 4 (b): Configuration Simulation (Main Configuration)

In which cloud analyst is chiefly used for geographical distribution of both servers and workload. Cloud analyst is based on the concept of Graphical User Interface (GUI). In the above figure 4 (b) containing various UB and regions with the peak hours of the simulation is also being presented. After giving all details i.e., Fig.4 (c) regarding with the simulation process, then we will proceed to run the simulation.

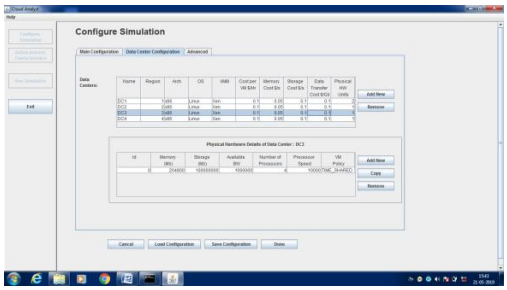

Figure 4 (c): Data Centre Configuration

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The following figure shows the simulation running process.

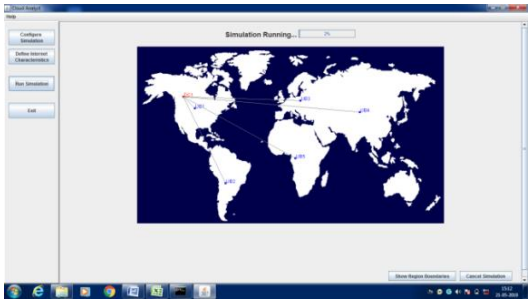

Figure 5: Simulation Running

The following figures shows all the simulation processes such as the complete simulation result and response time, which are represented in the blow figures.

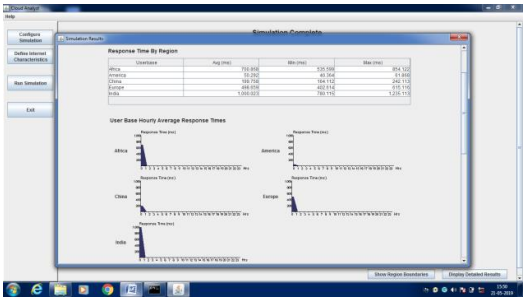

Figure 6: Simulation Result

After completing all the simulation process, the region boundary of each city with the optimized result has been shown to the user, which is represented as below figure 6 (a):

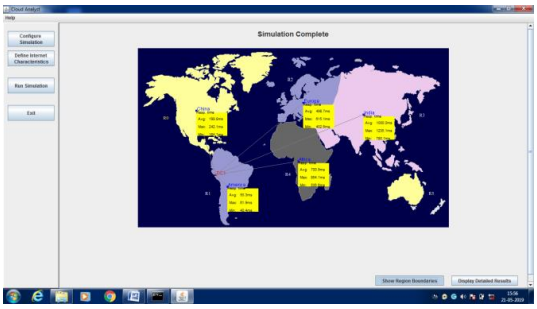

Figure 6 (a): Output (Simulation Completed)

In the above screen shot and the following figure shows the simulation result in command prompt.

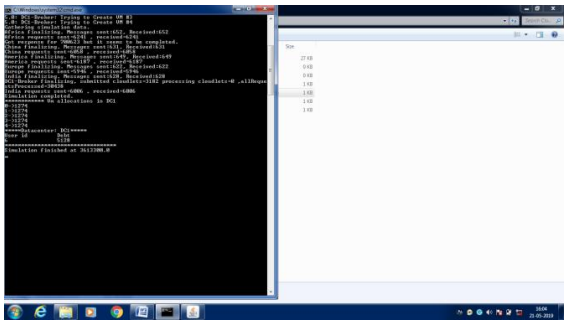

Figure 6 (b): Output in command prompt

A. In this performance analysis is used to compare our proposed algorithm with existing algorithms to which one yields a good result of the optimized problem VARP. When we are comparing with other optimization algorithm with the proposed algorithm KP-OACO, is providing the optimized solution for the VARP problem. Anyways ACO has meta_heuristic concepts to search an optimized result; it is slightly modified in KP-OACO. The optimized result of KP-OACO algorithm and this performance is also given below: The following tables are the data for performance analysis of vehicle alert and routing problem (figure 7 and 8).

Table 1: VARP performance Analysis using proposed algorithm KP-OACO

S.No	Algorithm	Num.of Vehicles	Num.of DC	Num.of VM	Time m/s
V10A1RP	KP-OACO	650	5	3	240.76
V10A2RP	ACO	630	5	3	295.86
V10A3RP	LIFO	435	5	3	288.64
V10A4RP	FIFO	360	5	3	256.12
V10A5RP	GA	489	5	3	317.96
V10A6RP	SHC	250	5	3	310.19

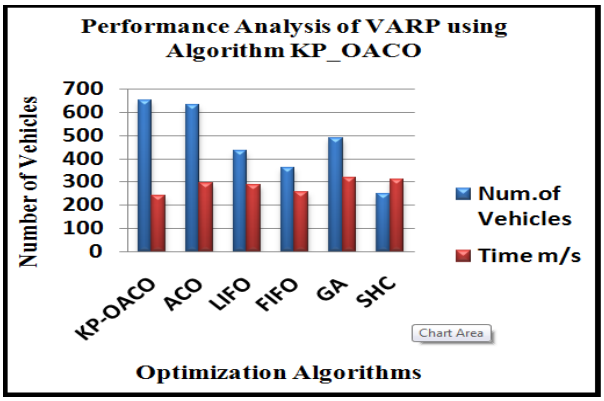

Figure 7: Performance Analysis of VARP with Various Algorithms

Above figure contains an optimized solution for vehicle alert and routing problem which provides the result in time m/s. An algorithm KP-OACO is also providing the best and average solution for VARP in m/s. The following figure represents a better and an average solution for VARP has presented below figure (8).

And the clear details of data table have been represented in the tables (1) and (2).

Table 2: VARP Performance Analysis of algorithm KP-OACO

S.No	Algo	Num of Vehicles	Num of DC	Num of VM	Time m/s (Avg)	Time m/s (Best)
V10A1RP	KP-OACO	650	5	3	240.76	230.00
V10A2RP	ACO	630	5	3	330.45	320.06

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V10A3RP	FCFS	435	5	3	288.64	250.00
V10A4RP	LIFO	360	5	3	256.12	240.57
V10A5RP	GA	489	5	3	317.96	310.06
V10A6RP	SHC	250	5	3	310.19	284.09

Above Table (2) is for Figure 7, yielding average and best solution.

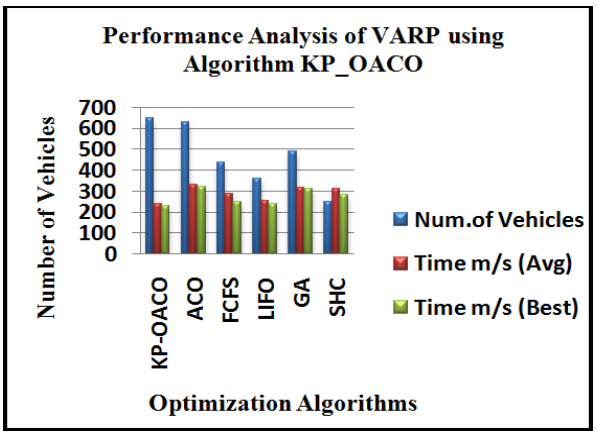

Figure 8: KP-OACO with Best and Average Solution

VI. SYNOPSIS OF VRP AND TSP

Travelling Sales Man Problem (TSP) is also one of the optimization problems which is used to finding a final optimum solution, related to the VRP model. The following figure (9) is the comparison of TSP with VRP is given below. Figure (9) containing some nodes or cities is to travel the vehicle. In which this figure is split into two parts, one for TSP and another for VRP.

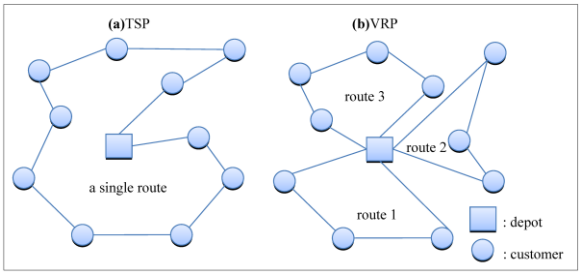

Figure 9: TSP Vs VRP

At first, TSP has some routes to find the optimum route and also VRP has some separate routes to find the optimum route, but the problem is same as to find the optimized route, this is the controversy for these two problems. In this above figure, TSP contains a single route where as VRP contain various routes to find the solution. In the above figure TSP has many nodes to travel, but it gives only one optimized route to the customer. So the customer has no choice to find the other route with low cost. And another drawback of TSP is, it has some restrictions to visit the nodes [24], but VRP has not. At the same, in the VRP will also have many nodes (like, route 1, route 2, route 3) to travel but it gives various optimized routes to the customer. So the customer can pick any optimized route among all optimized routes.

VII. CONCLUSION AND FUTUREWORK

Through this paper the vehicle alert and routing problem have been analyzed and the optimized result has also presented in this paper using new hybrid algorithm KP-OACO, will reach the best solution when we are comparing with the other optimized algorithm. In this paper, Cloud Analyst is one of the helpful tool have been used to represent the data as a table or pictorial form. Load balancing concepts are also included in that paper to reduce weight and cost of the problem. Many researchers have already tried in this vehicle routing problem and they presented their optimized solution using a variety of algorithms like NN, and many Hybridized algorithms. In this paper, we have extended to analyze the alert with routing problem and solving with the help of Ant Colony Optimization (ACO). In the future, we have to analyze the same problem in depth with using many cloud applications to find optimum result with the help of many optimized algorithms in different environments.

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