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Enhancement of Bee colony algorithm using 2-opt technique for constructing optimal path

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ABSTRACT
The Bees Algorithm is an optimization algorithm to find the optimal path solution.Bee Colony Optimization Algorithm depicts the natural behavior of real honey bees in food foraging. Honey bees use several mechanisms like waggle dance to optimally locate food sources and to search new ones. This makes them a good candidate for developing new intelligent search algorithms.The BCO model is used to generate a set of feasible solutions rather than using a pseudorandom approach. Our proposed 2-opt algorithm basically removes two edges from the tour, and reconnects the two paths created. This is very much better from existing method.Some advantages of applying 2-opt are the simplicity in its implementation and its ability to obtain
near optimal results. The basic idea is to eliminate two arcs in R in order to obtain two different paths.

Keywords- **Swarm intelligence, waggle dance, Bee colony.**

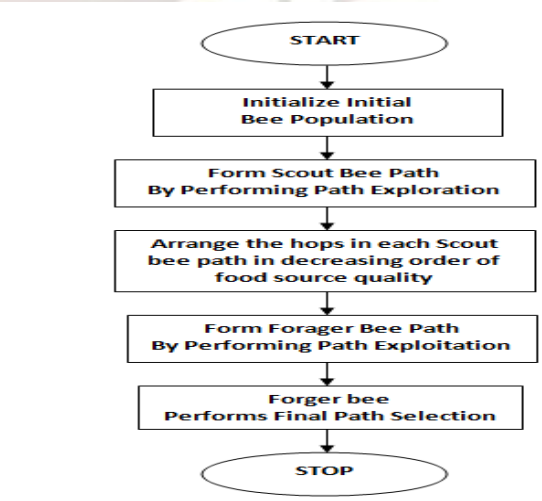
I. Introduction
Swarm Intelligence is a design framework based on social insect behaviour such as ants, bees, and wasps are unique in the way these simple individuals cooperate to accomplish complex, difficult tasks.Properties in swarm intelligent systems include: Robustness against individual misbehaviour or loss, Flexibility to change quickly in a dynamic environment. Swarm behavior can be seen in bird flocks, fish schools, as well as in insects like mosquitoes. The main principles of the collective behavior are:Homogeneity: every bird in flock has the same behavior model. The flock moves without a leader, even though temporary leaders seem to appear, Locality: the motion of each bird is only influenced by its nearest flock mates, Collision Avoidance: avoid collision with nearby flock mates, Velocity Matching: attempt to match velocity with nearby flock mates, Flock Centering: attempt to stay close to nearby flock mates

BCO depicts the natural behavior of real honey bees in food foraging. Honey bees use several mechanisms like waggle dance to optimally locate food sources and to search new ones. This makes them a good candidate for developing new intelligent search algorithms.Honey bees also exhibit swarm intelligence. They use an odour for conveying information.

Waggle dance is a term used for a particular figure-eight dance of the honey bees. By performing this dance, successful foragers can share with their hive mate's information about the direction and distance to patches of flowers yielding nectar and pollen, to water sources, or to new housing locations.Methods of decision making is done by following analysis:Colony-level analysis: selective exploitation of nectar sourcesIndividual-level analysis: assessing nectar source profitability.

The proposed 2-opt algorithm basically removes two edges from the tour, and reconnects the two paths created. This is often referred to as a 2-opt move. There is only one way to reconnect the two paths so that we still have a valid tour. We do this only if the new tour will be shorter. Continue removing and reconnecting the tour until no 2-opt improvements can be found. The tour is now 2-optimal.

II. PROPOSED ALGORITHIM
Here we will first see the existing BCO algorithm that is as follows.



BCO ALGORITHIM:-

procedureBCO

Initialize_Population( )

whilestop criteria are not fulfilled **do**

whileall bees have not built a complete path **do**

Observe_Dance( )

Forage_ByTransRule( )

Perform_enhanced2-Opt( )

Perform_Waggle_Dance ( )

end while

end while

end procedure BCO

ENHANCED2-OPT () ALGORITHM:-

This function returns a new graph$G_{new}$from G with set of m cities in V and a revised set of edges E_{new}.

{ traversingalgo ();

array [pointer][data_elements]; //data elements= edges weight//

bubble_sort(data_elements); //for each node//

Set SL ← { }

for i = 1 to m,

{

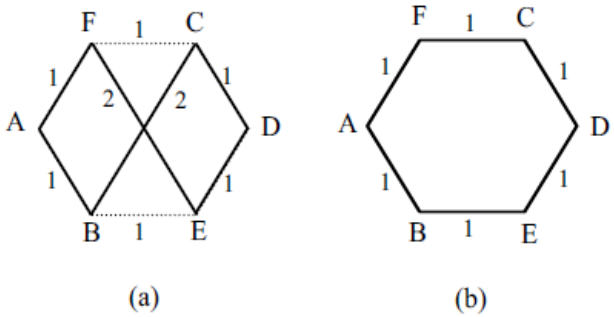
SL ← SL ∪ Extract $e_{i,j}$ of top two elements (connected edges of v_i)) where $v_i \in \mathbf{V}$

// don't consider $e_{i,j}$ or $e_{j,i}$ already in SL

}

}

2-OPT HEURISTIC EXAMPLE:-



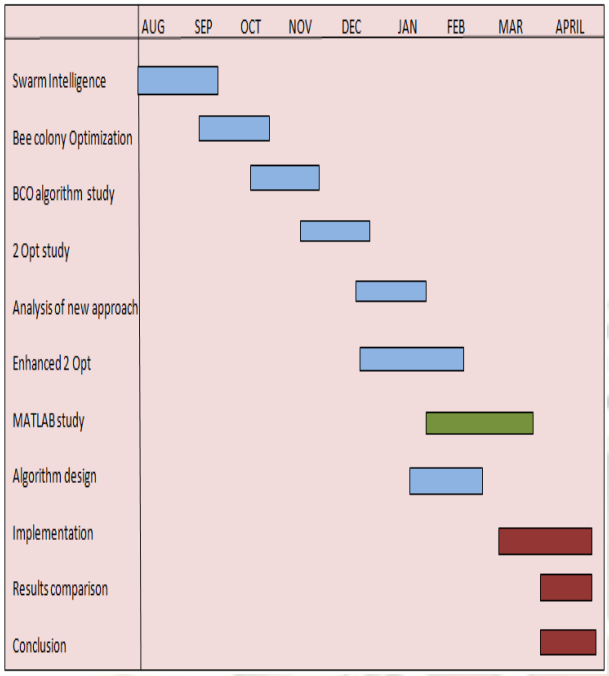
III. METHODOLOGY

The technique for TSP -2-opt is one of the most famous simple local search algorithms that was first proposed as edge exchange algorithms.It deletes two edges, thus breaking the tour into two separated paths, and then reconnects these two paths to form another possible tour. The new proposed approach works by taking into account only 2 minimum weight edges form each node and not considering the other ones.This can be useful to avoid huge amount of calculations in case of finding shortest distance in a graph containing large number of nodes.

RESEARCH DESIGN:

1) Study of swarm intelligence in which Bee Colony Optimization is chosen.
2) The applications of BCO are studied and concluded that it can be applied to find the shortest distance of a graph.
3) The different heuristics for finding shortest distance are studied in which 2-Opt is considered for developing a new algorithm for shortest distance using BCO.
4) Implementation of the algorithm and comparative study is done.

GANTT CHART:-



IV. CONCLUSION

BCO depicts the natural behavior of real honey bees in food foraging. Honey bees use several mechanisms like waggle dance to optimally locate food sources and to search new ones. The integration of the 2-opt heuristic in our BCO algorithm has improved its performance. This proposed algorithm will improve the BCO algorithm to obtain optimal solution for problems with larger dimension. Space utilization increases to store more results. The number of calculations can be decreased considerably and complexity of the system will also be decreased.

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