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Network Congestion Control Using Improved Edge based ANT (IACO) with Roulette Wheel Selection

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ABSTRACT

In network congestion control Wireless sensor networks (WSN)undergo from the difficulties of congestion, which isprime to packet loss and unnecessary energy consumption. In this research paper, we address both node-level and link-level congestion and propose a new routing protocol namely ant based routing with Edge based ant colony congestion control (EBARC), for wireless sensor networks, which takings into justification the congestion of the network at a assumedexample and suggests to decrease it and then discoveries the optimal paths. Also, a comparison of simulation with ainsufficient existing works highlights the edge that EBARC has over its generations in terms of numerous network quality parameters.

Keywords: Artificial Intelligence, Intelligent Agents, Dynamic Route Planning, Traffic Prediction

I.INTRODUCTION

The Real ants are accomplished of discovery of the shortest path from a foodstufffoundation to the nest deprived of using visual cues Also; they are skilled of familiarizing to variations in the environment, for example conclusion a new shortest path once the old one is no longer possible due to a new difficulty. An analogy with the method ant colonies purposes has recommended the definition of new computing example that is Ant System. The highestdistinguishing of this perfect are Positive feedback that accounts for rapid discovery of new solutions Distributed computation to circumvents for early convergence and the use of positive greedy heuristic that helps find satisfactory solutions in the early phase of the search process.

There are 3thoughts from natural ant performance that we have moved to our reproduction ant colony:

(i) The favorite for paths with a high pheromone level,

(ii) the developed rate of development of the volume of pheromone on shorter paths

(iii) Thetrackfacilitated communication amongst ants.

In the (a) portion of figure specifiedunder ants are affecting on a conventional line that attaches a food basis to their layer. It is well known that the mainresources for ants to form and preserve the line are a pheromone track. Ants credit a convinced amount of pheromone though walking, and every ant probabilistically desires to shadow a way rich in pheromone.

Although in (b) when the difficulty has seemed, those ants which are objective in front of the difficulty cannot last to monitor the pheromone track and consequently they have to selectamongrotating right or left. In this condition we can suppose half the ants to select to go right and the extra half to turn left.

In case of (c) It is motivating to memo that those ants which select, by accidental, the smaller path around the problem will newfastreconstruct the sporadic pheromone tracklikened to persons which select the longer path. Thus, the shorter path will obtain a greater amount of pheromone per time unit and in turn a superior number of ants will select the shorter path. Outstanding to this positive response (autocatalytic) procedure, all the ants will quicklyselect the shorter path.

In the (d) The greateststimulatingfeature of this autocatalytic procedure is that discovery the shortest path about the difficultyappears to be an developingstuff of the interaction among the obstacle outline and ants dispersed performance.

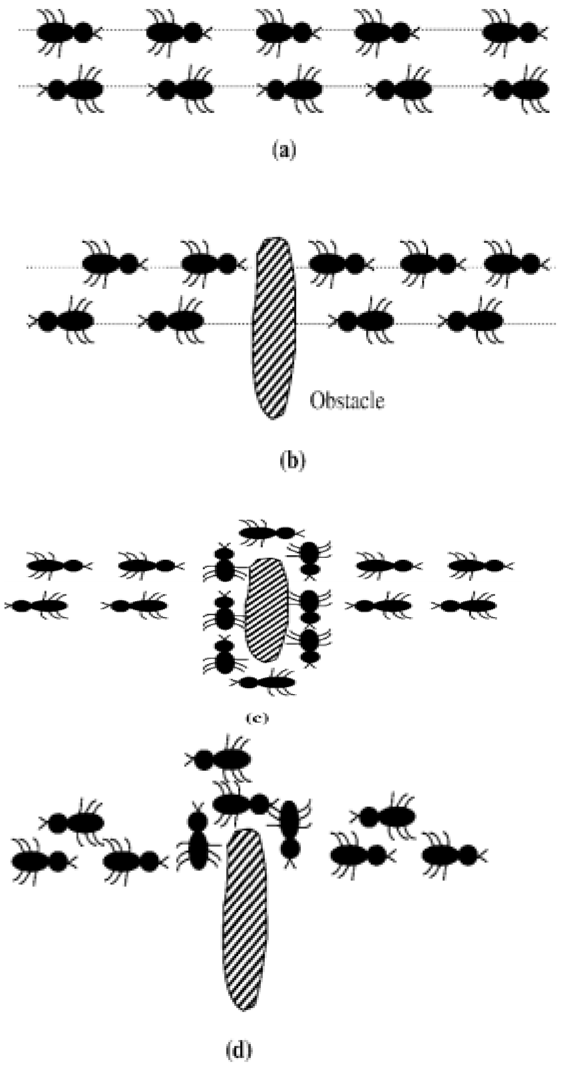


Figure 1: An example of ACO

II.LITRATURE REVIEW

JavadVazifehdan et.al [1] recommends two novel energy-aware routing algorithms for wireless ad hoc networks, called Consistent Minimum Energy Cost Routing (RMECR) and Reliable Minimum Energy Routing (RMER). RMECR addresses 3significantsupplies of ad hoc networks: energy-efficiency, reliability, and extending network lifetime. It reflects the energy consumption and the residual battery energy of nodes as well as excellence of relations to find energyefficient and dependable routes that growth the working lifetime of the network.

Giampaolo Bella et.al [2]presents a power-aware route conservation protocol for Mobile Ad Hoc Networks (MANETs). Named Dynamic Path Switching (DPS), the new protocol setsanloaded node to sleep earlier a route link disruptions because that node innings out of energy, and takes other appropriate nodes into showin its place. Once the battery charge of a node ranges a specified level, the node can advance a demand to modification to a sleep state for a while. The request is flatteredexceptexistence of certain path breaks on the forwarding movement of that very node. All nodes are expected to be concerted.

Bibhash Roy et.al [3]presents that the difficultyupsurges due to numerousfeatures like dynamic topology, time varying QoS requirements, limited capitals and energy etc. QoS routing showsansignificantpart for providing QoS in wireless ad hoc networks. The main challenge in this kind of networks is to novelty a path between the communiqué end points filling user's QoS requirement.

JavadVazifehdan et.al [4] suggestsnumerous energy-aware routing algorithms for such ad hoc networks. The future algorithms feature guiding the traffic load animatedlynear mains-powered devices keeping the hop count of designated routes minimal. They unite these procedures into aoutline in which the route selection is expressed as a criteria decision making problem.

Sarala.P et.al [5]usages the Multipath dynamic source routing protocol (MPDSR) to determine multipath route under MANET nodes. The MPDSR protocol customs the local link material for the route findingprocedure. The MPDSR protocol is improved with ant colony optimization technique to deliver multipath route info using global link information. EMPDSR offersQoS factors such as end to end reliability.

III.PROBLEM STATEMENT

Shortest Path Problem: The shortest path problem is defined as that of discovery a minimum-length (cost) path among anassumed pair of nodes. The Dijkstra algorithm is careful as the maximum efficient technique for shortest path calculation in IP networks. But once the network is very big, then it becomes incompetentthen a lot of calculations need to be frequent.

IV. SYSTEM MODEL

After all the ants whole the structure of path, that is afterwardattainment the terminus router node, the pheromone on every edge will be efficient, explicitlyANT-CYCLE model, and there are likewise other approaches, such as it determinationinform once after the ant permits a node, experimentationsdisplay that inform is better after success the terminus. First of all, all the pheromone on all edges will decrease the size of a constant factor, and the pheromone will be augmented on the edges that ants pass through. The evaporation of pheromone performsgiving to the subsequent:

$$p_{ij}^{k} = \frac{\left[\tau_{ij}\right]^{\alpha}\left[\eta_{ij}\right]^{\beta}}{\sum_{l\in N^{k}}\left[\tau_{il}\right]^{\alpha}\left[\eta_{il}\right]^{\beta}}, \quad j \in N^{k} \qquad \text{............1}$$

$$\tau_{ij} \leftarrow (1-\rho)\tau_{ij}, \forall (i,j) \in L \qquad \text{..................2}$$

Among them ρ is the evaporation rate of pheromone, $0\ 1 < \leq \rho$. The role of ρ parameter is to circumvent the pheromone’s infinite buildup, and still can create the algorithm "forget" the selection of poorer path ago, to decrease the incidence of local best. After the evaporation stage of pheromone, all the ants release pheromone on the transient edges:

$$\tau_{ij} \leftarrow \tau_{ij} + \sum_{k=1}^{m} \Delta\tau_{ij}^{k}, \forall (i,j) \in L \qquad \text{............3}$$

Between them, k Δ τ $_{ij}$ is the pheromone quantity that the ant

k releases to the passed edges. kΔτ$_{ij}$ is clear as:

$$\Delta\tau_{ij}^{k} = \begin{cases} 1/C^{k}, & \text{if edge } (i,j) \text{ is in path } T^{k} \\ 0, & \text{otherwise} \end{cases} \qquad \text{..4}$$

Intimate the appearance, k C signifies the length of path k T that ant k recognized, that is the sum of all the length of edges in k T. According expression (4), better is the path created by ants, extra pheromone will be found on each edge of the path. Commonlylanguage, if an edge is designated by more ants, and the total length of the path counting this edge is shorter, thus this edge will get more pheromone, and in the later repetition it is extraprobableselected by ants [6].

V. PROPOSED IMPLEMENTATION

The Routing System

The routing system is the portion of the simulator which deals with calculating the route for a vehicle. It communicates with the authentic traffic simulator through sockets. The dominantfragment is signified by the TAntNetwork class.

Roulette wheel selection

Selection of the fittest

The elementaryportion of the assortmentprocedure is to stochastically choice from one group to generate the foundation of the following generation. The condition is that the rightestpersons have a greater accidental of existence than weaker ones. This repeats nature in that fitter individuals will incline to have a better likelihood of existence and will go forward to form the mating pool for the following generation. Weaker individuals are not without a chance. In nature such individuals might have genetic coding that may showvaluable to future generations.

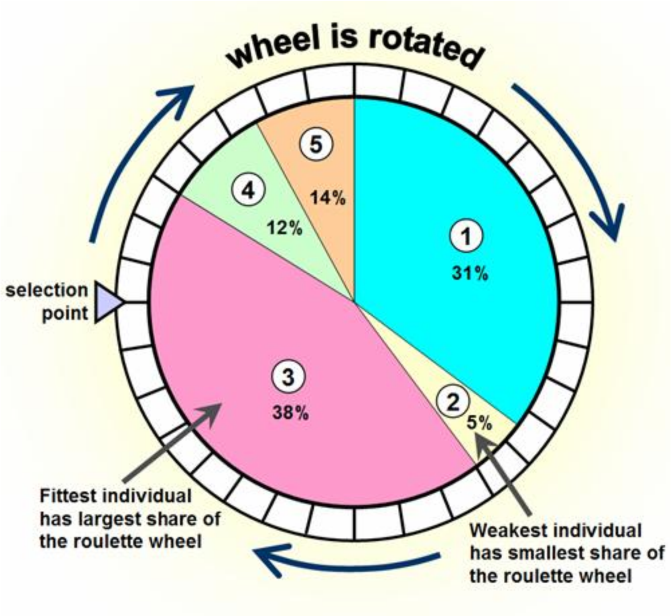
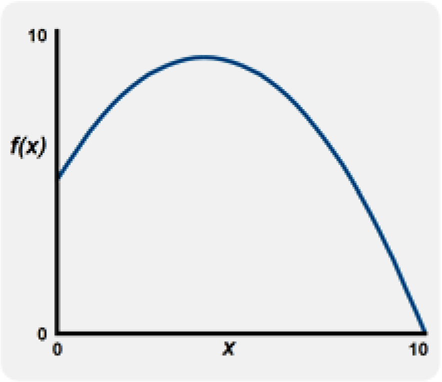


Figure 2: Roulette wheel approach: based on fitness

Example

The usualtechnique used is the roulette wheel (as exposed in Figure 2 above). The following table lists a sample population of 5 individuals (a characteristic population of 400 would be difficult to exemplify).



These individuals contain of 10 bit chromosomes and are existence used to enhance a simple mathematical function (we can undertake from this example. we are annoying to discovery the maximum). If the input variety for **x** is between 0 and 10, formerly we can map the binary chromosomes to base 10 values and then to an input value between 0 and 10.

The fitness values are then occupied as the function of x. We can see from the table (column **Fitness f(x)**) that individual No. 3 is the fittest and No. 2 is the weakest. Summing these fitness standards we can allocate a percentage total of fitness. This gives the sturdiest individual a value of 38% and the weakest 5%.

These percentage fitness values can then be used to configure the roulette wheel. Figure 2 highlights that individual No. 3 has a section equal to 38% of the area.

The number of times the roulette wheel is spun is equivalent to size of the population. As can be seen from the method the wheel is now alienated, each time the wheel halts this stretches the fitter individuals the highest chance of existencedesignated for the next generation and following.

mating pool.

What is perhaps more stimulating from this example is that as the peers progress and the population gets fitter the gene pattern for individual No. 3: **0100000101**$_2$ will become more predominant in the overall population because it is fitter, more apt to the setting we have placed it in - in this circumstance the function we are annoying to optimize.

ACO Algorithm

All network nodeslaunch forward ants to all terminuses in even time intermissions.

1. The ant finds a path to the destination randomly based on the current routing tables and residual pheromone table.

2. The forward ant creates Path using pheromone, for every node as that node ant is reached.

3. When the destination is reached, the backward ant wants to start for creating a reverse path.

4. The backward ant follows that path in reverse.

5. Each of visited nodes is updated based on the routing table.

6. The message ant is generated as link failure occurs and calculates the best link for new route setup. Input: qi,j =the outgoing queue length

Output: TQi,j =Total queue length τ r k+1 i,j(t)=residual Pheromone Begin: if (Forward ant)

{

Get the next node based on the value of qi,j if (the link is available)

then

{

Update forward ant using network status and Send forward ant to the next node

}

Else

if (no such link exist)

{

Create backward ant and load contents (L) of forward ant to backward ant and Send Backward ant towards source along the same path P as forward ant

} }

if (backward ant)

{

if current node is source node

{

Store path distance (Pd); Then kill the backward ant; Update routing table and residual pheromone (τ r k+1 i,j(t))

```
}
else
{
Proceeded the backward ant on to link available on queue Update routing table and residual pheromone ($\tau$ r k+1 i,j(t))
}
if (next node is not available) Kill backward ant Else
{
if (link failure) then Update forward ant with network
status as failure and stop sending information (data) or outgoing queue (qi,j ) Send message ant to the previous node regarding link failure update table for alternative path (P) and path distance (Pd) based on link stability parameter for path is recovered or restore.
}
}
// End of proposed algorithm End if End
```

VI.RESULT

Experiments reported in this section compare AntNet with the competing routing algorithms described in Section 5. We studied the performance of the algorithms for increasing traffic load, examining the evolution of the network status toward a saturation condition, and for temporary saturation conditions.

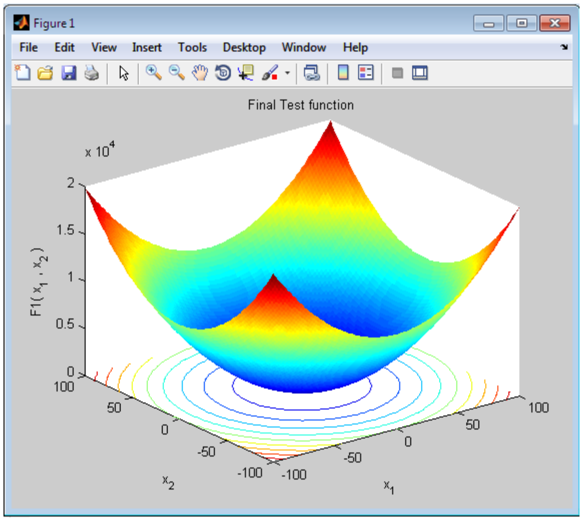


Figure 1: Final test function for minimum coverage

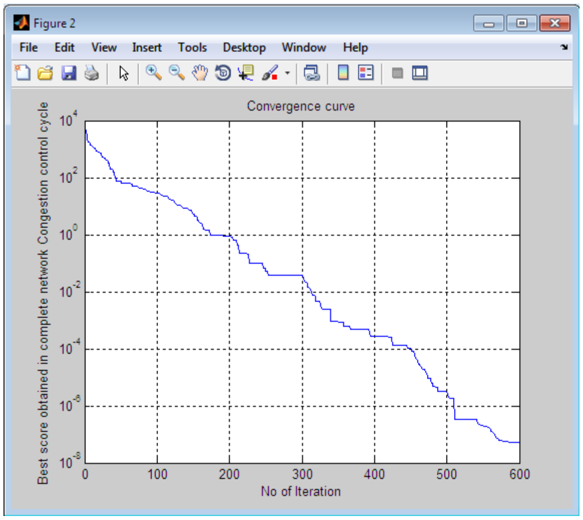


Figure 2: convergence curve of coverage

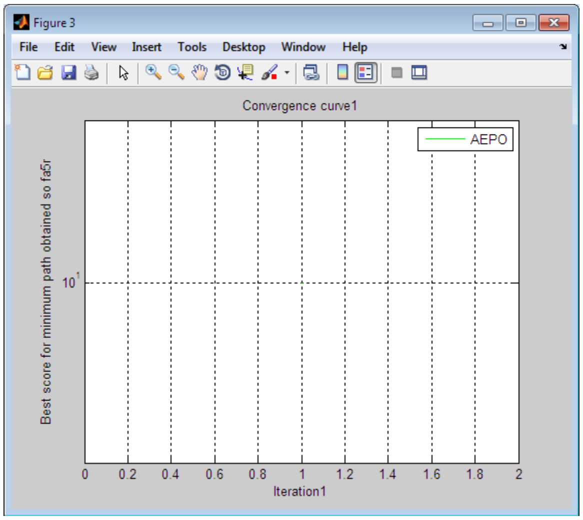


Figure 3: Best score for minimum path obtained of convergence curve

VII.CONCLUSION

This paper addresses vehicle traffic congestion, which is one of the major challenges of metropolises. Congestion is affected by the limited capacity of roads and the high number of vehicles on the road. An ant-based algorithm was combined with map segmentation and the average travel speed prediction of roads in order to derive an improved congestion avoidance system. Segmentation and short-term prediction were used to overcome the dynamicity and quick changes of vehicular environments. Applying an ant-based algorithm to our system required some modifications to the basic and original ACO algorithm. These modifications include map segmentation and layering, new probability function, and new reinforcement and evaporation rules and parameters.

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