# Augmentation of Ant Colony Mechanism In Wireless Sensor Network

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**Abstract**

A wireless sensor network (WSN) is a network made up of a large number of self-organizing nodes distributed in ad-hoc fashion. They are popularly used for monitoring and control of environment parameters.. This is known as data dissemination or reprogramming in WSNs. Dissemination protocols are vital because almost all WSNs are deployed in hostile environments and thus manual reprogramming of such nodes is not possible. Many data dissemination protocols have been introduced with time and each one of them help in dissemination of program code, configuration parameters, queries, commands, bulk data etc. In this paper, the objective of the work is to provide a novel and adaptive intelligent routing scheme for wireless sensor networks. The major objective of sensor network researches is to maximize the network lifetime, to achieve the shortest and optimal path between source and destination

## 1. INTRODUCTION

The emerging field of wireless sensor networks combines sensing, computation, and communication into a single tiny device. Through advanced mesh networking protocols, these devices form a sea of connectivity that extends the reach of cyber space out into the physical world. As water flows to fill every room of a submerged ship, the mesh networking connectivity will seek out and exploit any possible communication path by hopping data from node to node in search of its destination. While the capabilities of any single device are minimal, the composition of hundreds of devices offers radical new technological possibilities. The power of wireless sensor networks lies in the ability to deploy large numbers of tiny nodes that assemble and configure themselves. Adaptation mechanisms can respond to changes in network topologies or can cause the network to shift between drastically different modes of operation. The network could then direct workers to the safest path for emergency evacuation. Current wireless systems only scratch the surface of possibilities emerging from the integration of low-power communication, sensing, energy storage, and computation.

### 1.1. Wireless Sensor Network Communication Network Architecture:

The three application classes we have selected are: environmental data collection, security monitoring, and sensor node tracking. We believe that the majority of wireless sensor network deployments will fall into one of these class templates.

A canonical environmental data collection application is one where a research scientist wants to collect several sensor readings from a set of points in an environment over a period of time in order to detect trends and interdependencies. This scientist would want to collect data from hundreds of points spread throughout the area and then analyze the data offline. The scientist would be interested in collecting data over several months or years in order to look for long-term and seasonal trends. For the data to be meaningful it would have to be collected at regular intervals and the nodes would remain at known locations. At the network level, the environmental data collection application is characterized by having a large number of nodes continually sensing and transmitting data back to a set of base stations that store the data using traditional methods. These networks generally require very low data rates and extremely long lifetimes. In typical usage scenario, the nodes will be evenly distributed over an outdoor environment. This distance between adjacent nodes will be minimal yet the distance across the entire network will be significant. After deployment, the nodes must first discover the topology of the network and estimate optimal routing strategies. The routing strategy can then be used to route data to a central collection points. In environmental monitoring applications, it is not essential that the nodes develop the optimal routing strategies on their own. Instead, it may be possible to calculate the optimal routing topology outside of the network and then communicate the necessary information to the nodes as required. Environmental data collection applications typically use tree-based

routing topologies where each routing tree is rooted at high-capability nodes that sink data. Data is periodically transmitted from child node to parent node up the tree-structure until it reaches the sink. With tree-based data collection each node is responsible for forwarding the data of all its descendants. Nodes with a large number of descendants transmit significantly more data than leaf nodes. These nodes can quickly become energy bottlenecks.

Once the network is configured, each node periodically samples its sensors and transmits its data up the routing tree and back to the base station. For many scenarios, the interval between these transmissions can be on the order of minutes. Typical reporting periods are expected to be between 1 and 15 minutes; while it is possible for networks to have significantly higher reporting rates. The typical environment parameters being monitored, such as temperature, light intensity, and humidity, do not change quickly enough to require higher reporting rates.

**1.2 Ant Colony Optimization (ACO)**

This algorithm uses the conduct of the genuine ants while searching for the food. It has been watched that while venturing out from its home to the sustenance, the ants store a certain measure of pheromone in its way. Again while returning, the ants are subjected to follow the same path marked by the pheromone deposit and again deposit the pheromone in its path. In this way the ants following the shorter path are expected to return earlier and hence increase the amount of pheromone deposit in its path at a faster rate than the ants following a longer path. ACO takes motivation from the behavior of the ants. These ants deposit pheromone on the round in order to mark some favorable path that should be followed by other members of the colony. The paths visited by the ants frequently are kept as marked by the pheromone deposit whereas the paths rarely visited by the ants are lost because of the lack of pheromone deposit on that path

The agents are autonomous entities and have capability to adapt, cooperate and move intelligently from one location to the other in the communication network. There are two types of ant agents: FANT- Forward Ants and BANT- Backward Ants

## 2. LITERATURE REVIEW

The optimization of network parameters for WSN routing process to provide maximum service life of the network can be regarded as a combinatorial optimization problem. Many researchers have recently studied the collective behavior of biological species such as ants as an analogy providing a natural model for combinatorial optimization problems. A number of routing algorithms based on ants have already been proposed. Most of them are based on the concept of Ant Colony Optimization Algorithm (ACO), which is a meta-heuristic approach for solving computational problems based on probability techniques.

**2.1 Problem formulation**

Routing is a challenging task in WSNs because of their unique characteristics which makes it different from other wired and wireless sensor networks. Since it need not to possess any infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements, hence routing procedure in wireless sensor networks severely varies from that of conventional routing in fixed networks. In spite of the fact that WSNs are into many applications, still they have few confinements including limited energy supply and limited computation and communication abilities. Due to these contemplations particular to WSNs, many routing schemes using end-to-end devices and MANETs have been declared improper for WSNs. In sensor networks, minimization of energy consumption is considered a major performance criterion to provide maximum network lifetime. While considering energy conservation, routing protocols ought to be outlined to achieve fault tolerance too in communications.

**2.2 Objective**

- The objective of the work is to provide a novel and adaptive intelligent routing scheme for wireless sensor networks.
- The major objective of sensor network researches is to maximize the network lifetime.

To achieve the shortest and optimal path between source and destination

## 3. PROPOSED WORK

In this work, a protocol has been proposed which is based on the behavior of ants foraging for their food. We have observed how ants find routes to their food and back to the nest. Usually the route through which the ants travel is the shortest route from the nest. Ants start from their nest and go in search of food. When an ant finds its food, it travels back to its nest in the same route that it came in. Along the way these ants deposit a substance called pheromone on the ground when they travel. Pheromone is a volatile substance, so its concentration level decreases over time. Other ants sense this pheromone and choose the route that has the highest levels of concentration of pheromone. These ants also deposit pheromone on the way as they travel back.

The concentration level of the pheromone would be higher in the shortest path as more ants would have travelled in this path as compared to other paths. Initially, an ant has no preference on which path to choose and takes each of the paths with equal probability. But after a certain period, the ants would pick the path that has the highest level of pheromone concentration. This would be the shortest path since more ants would have travelled in this path than any

other path in a given time interval. The proposed ant based routing algorithm has several properties which makes it ideal for the above specified requirements.
The proposed approach is as follows:

- First step is to deploy the nodes.
- There exist two types of nodes- Forward ants and Backward-ants.
- The Forward ants are forwarded from Ant Colony to search for the food source.
- This searching process continues till the food resource is reached.
- Now Backward-ant agents start journey towards ant colony.
- Once the Backward agents reach the Ant Colony, then new ants will follow the shortest path to food source.
- This process will give us the shortest path from source to destination.
- If any node in the path is faulty due to any reason like energy drainage, hardware fault etc. then the node which exactly preceding the faulty node will wait for Route Clear Message from Faulty Node.
- If message does not come then it will store the data on the node which forms the alternative shortest path.
- Now data communication will take place using the second path.

## 4. EXPERIMENTAL RESULTS

In this section, the merits of the proposed method have been investigated through simulations done in NS2 and the experimental results are presented. The experimental results are quite justified as the energy consumption is minimized.

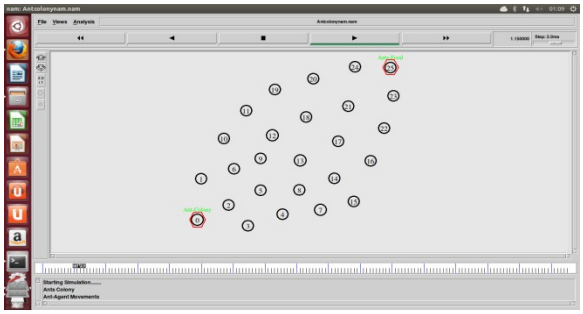
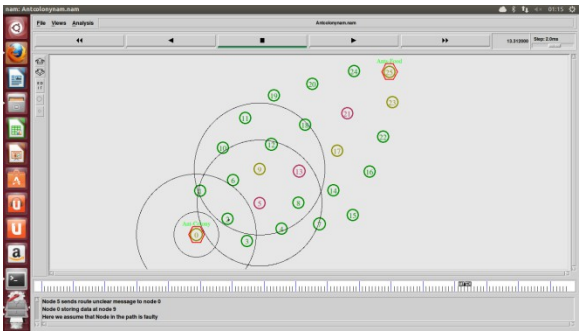


Fig. 1 shows the wireless sensor nodes in a network. The node-0 is taken as Ant Colony and node-25 is taken as the food source. The ant agents have to reach from node-0 to node-25 via shortest path.



In fig. 2 the forward ants are forwarded towards the food source. The routing is taking place.

## 5. CONCLUSION AND FUTURE WORK

Ant Colony Optimization based routing algorithm has been proposed in this work. In WSN, the life time network is depended essentially to the density and the rate of communications of sensors which affect the battery level and so the network.. The main objective of the work is to maintain network life time in maximum, while data transmission is achieved efficiently. This solution improves actively the life time network of the WSN. The experimental results showed that the algorithm leads to very good results in different WSN scenarios. In future work, the proposed routing protocol can be further enhanced successfully for high mobility nodes by deciding some appropriate WSNs parameters, routing network with multiple sink nodes, and topology changes in such energy constrained environment. Besides, the work can be examined in real environment and its performance can be evaluated with various scenarios**.**

## 6 REFERENCES

[1] Fatemeh RismanianYazdi, (2013) "Ant Colony with Colored Pheromones Routing For Multi- Objectives Quality of Services in WSNs", International Journal of Research in Computer Science, ISSN 2249-8265 Volume 3 Issue 1 (2013) pp. 1-9
[2] Anjali & NavpreetKaur, (2013) "Routing Based Ant Colony Optimization in Wireless Sensor Networks", Global Journal of Computer Science and Technology Network, Web & Security Volume 13 Issue 4 Version 1.0 Year 2013
[3] Adamu Murtala Zungeru, Kah Phooi Seng, Li-Minn Ang, and Wai Chong Chia (2013), "Energy Efficiency Performance Improvements for Ant-Based Routing Algorithm in Wireless Sensor Networks", Hindawi Publishing Corporation Journal of Sensors Volume 2013, Article ID 759654, 17 pages
[4] Ajay Jangra, Swati, Richa, Priyanka (2010), "Wireless Sensor Network (WSN): Architecture, Design Issues and Challenges", International Journal on Computer Science and Engineering,Vol. 02, No. 09, 2010, 3089-3094
[5] Adamu Murtala Zungeru, Li-Minn Ang Kah Phooi Seng, (2012) "Classical and swarm intelligence based routing protocols for wireless sensor networks: A survey and comparison", Journal of Network and Computer Applications Vol. 35 (2012) 1508–1536
[6]Atanu Roy Chowdhury, Jason Waterman, "ACO Routing in Wireless Sensor Networks", International Journal of Research in

Computer Science, ISSN 2249-8265 Volume 4 Issue 1 (2014) pp. 1-9

[7] Debasmita Mukherjee, Sriyankar Acharyya, "Ant Colony Optimization Technique Applied in Network Routing Problem", International Journal of Computer Applications (0975 - 8887) Volume 1 – No. 15

[8] Hao Bai, "A Survey on Artificial Intelligence for Network Routing Problems"

[10] Jamal N. Al-Karaki Ahmed E. Kamal, "Routing Techniques in Wireless Sensor Networks: A Survey"