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Guaranteed Data Delivery with ACO, ABC and AODV for Wireless Sensor Networks

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ABSTRACT

Most of the researchers focused on the traditional as well as optimized routing of wireless sensor networks. In this concern, ACO and ABC based routing approaches are applied in several working situation, including those which are subjected to disconnection and disruption as well as including the one with long delay. The choice to select a routing algorithm for "WSN using soft optimization techniques" is still under study. The primary aim of routing protocol with optimization techniques is to increase the possibility of deliver a packet (PDF) to receiver, while decrease "end-to-end delay". "soft techniques based routing algorithms" are different from "Mobile ad-hoc network" in the manner that several independent nodes are optimized with rich external helping data available and higher mobility in presence of managed and defined pattern, dynamically alteration of network topology, rapid partitioning of network and different behavior factor of data. Thus, various protocols for "WSN's" have been developed but only few studies were based on how the specific optimized path of data. Optimized based routing protocol can improve the quality of data transfer in a granted way through by increasing the overall packet delivery fraction, throughput, stability of whole networks. The proposed scheme is simulated over NS 2.34 and MATLAB.

Keywords: ACO, ABC, AODV, Wireless Sensor Networks.

1. INTRODUCTION

Now look at the aspect of wireless sensor network is just simply sensing some parameter and then communicating it into remote place. About 98% of the microprocessor or Microcontroller have been manufactured or not used in computer related equipment. They are being used for different applications. Some of these used in household, camera, toys, mobile phones, car etc. So these numbers of devices have a processing capability provided by microcontroller and Microprocessor. When we add communication ability to such devices and also add sensing functions so this produced a different scenario of communication, this is a great motivation to wireless sensor network. We can define a "wireless sensor network" as it is a group of specialized Transducer with communication infrastructure and intended to monitored and record the condition at diverse location. "Data" sense by one sensor "node" is passed on the next one to next one so on. Ultimately send to one end system. Wireless sensor networks are typically composed of a large number of low cost, low powers, multifunctional wireless devices deployed over a geographical area in an Ad-Hoc fashion and without careful planning. Individual sensing devices are resource constrained and therefore are capable of limited amount of processing and communication. However it is the coordinated efforts of these sensing devices that make WSN useful for a wide range of applications. This network is differing from normal computer networks. Here in Wireless sensor network is a collaborated effort where as in normal computer network, there are a one sender and one destination or may be multiple destinations or may be a group of destination as a broadcast. Sender is one, recipient are many but in wireless sensor network this case is reverse, Sender are many but sending to one which is known as sink "node". Due to

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collaboration, resource limited etc makes this network very special and they require special kind of transmission and special kind of routing protocol will be designed. The protocol used in computer communication, they are not very useful in wireless sensor network. That's why wireless sensor network is a new kind of area requires new innovation approaches and it causes very high challenges in design.

2. RELETED WORKS & PRINCIPAL AND MODEL APPROACH

2.1. Releted Works

Author [1] P et al has written an approach about route discovery and route maintenance of routing protocol. "Qualnet "kind of platform is used for simulation. In this paper author consider three protocol for route discovery and route maintenance with the name of "Dynamic source routing", Ad-Hoc demand distance vector and Dynamic MANET on demand routing protocols but there is no optimization is mentioned of different routing matrixes and also need to compare different routing algorithms in simulation section. If the number of "nodes" of the network increases in numbers in terms of mobility so the traffic of data sending from source to destination will also increases. This cause a lot of congestion in the network. Author [2] Lee et al proposed the new idea to overcome of such situation. But in this paper do not mentioned about the how much time a "node" can be consider reaching a particular region. So this may affect the stability of "wireless sensor networks". In routing protocol, Low control overhead and power cost are major issues. Author [3] Barw et al proposed a new approach to REAODV with local route enhancement model for "AODV". Author usages "Tossinm" platform for simulation. But author do not mentioned about the stability and how many packets can be sent from source to destination. Author [4] Xu Zhang et al proposed a new approach which is adoptive in nature and a "node" can sense the power to determine whether to forward a packet or not. Only two matrixes are used for performance analysis like packet delivery fraction and average end to end delay but this paper does not focus about the stability causes and throughput of a network. Author [5] Kim et al explain a novel idea for reliable energy efficient routing protocol. For this author considered end-to-end packet reception rate to transmit data packet. The "Qualnet" simulator is used for simulation. This paper does not focus about energy efficiency of a network. Author [6] Kosa et al proposed a concept of multiple networks and multiple sink within the same geographic region. The proposed method simulated on "Qualnet 4.5.1" and shows different comparisons. There are grid technology used and area has taken by 60X60 meter Sq. The disadvantage of this paper is energy efficiency. Authors do not focus about stability and packet delivery ratio which is important issues of this method

2.2. Principals and Model approach

2.2.1. The ants' colony optimization

The ants' colony optimization is a member of swarm optimization and swarm optimization methods are method developed on observing the dynamics of natural systems like ant or bees.

Each of the swarm intelligence systems method that consists the number of candidates, each candidate is searching agents. Each candidate and other searching agents walk randomly through the given space and generate their own set of solutions. Each candidates solution is then optimize based on current value to arrive best solution. Each move of ant can be considered as Markow chain because of probability of move only depends as current value not on the previous value. The important properties of pheromones is the ability to get operated in less time. The concentration of pheromones is the highest in shortest path and ants travelling in the shortest path can travel more number of times between source and ants held and depositing more number of pheromones each of the travel. High concentration of pheromones generally attracts all the ants towards this path and thus makes these paths are optimal solutions connecting to held ants and source. The largest path with least amount of pheromones will delete from source of path. Ants thus forget this path and starts exploring the search based for other directions. This is an important property of ant's colony

optimization and advantages over the other optimization techniques. This helps ants colony algorithms came out the local minima and search for global minima's. The objective function can be considered the total distance travelled and it has to be minimized.

Each of the paths randomly distributed at the pheromones concentration initially. As the large number of ants starts randomly for random cities and they walked through random path, thus genera rating their own sets of solution. Each of their own solution generating based on constraints given. The constraints are given here as data travel through cities to cities.

The probability calculation based the way to searching other cities from given probability function. The probability of chosen next cities J to current cities i is given by

$$p_{ij}{}^{k}(t) = \frac{\tau_{ij}(t)^{\alpha}(\eta_{ij})^{\beta})}{\sum_{i=itok} \tau_{ij}(t)^{\alpha}(\eta_{ij})^{\beta}}. \quad (1)$$

τij is pheromones concentration with edge.

ηij, Represents the heuristic information.ηij = i/d_{ij} is distance between two cities or vertices.

If distance between the two cities are very less then heuristic information is for corresponding path are higher. If the value of alpha =0, then the probability is based on purely heuristic information available connecting the cities I to j. if the heuristic information for the path is higher, it means the cities are very close to each other and in such situation ACO behave like greedy algorithms.

2.2.2. Artificial Bee colony optimization (ABC) model

The ABC algorithm was designed based on the cooperative behavior of natural bees in the swarm. The scout bees evaluate the fitness of the solution (termed nectar amount), and this information is shared with onlooker bees waiting in the hive. After the initial search, all scout bees now become employed bees. The employed bees go to the food sources (solutions) in its memory and determines the neighboring food sources to evaluate the nectar amount. If the neighboring food source contains a better solution, the new position is kept. Otherwise the old position is maintained [4, 11].

The info of the new or existing nectar amount then is relayed to awaiting onlookers when the employed bees return. Onlookers bees then select a food source depend on nectar amount relayed. If the nectar amount increases (solution approaching objective), the probability which that food source is selected is higher. The employed bees which carrying high nectar amount will attract onlookers bees toward it food sources position.

After selecting potential food source from employed bees, the onlooker bee goes toward the direction and evaluate the neighboring food source. Same as employed bees, if the neighboring food source contains a better solution, the new position is kept [4, 18].Otherwise the old position is maintained. The process is repeated between employed and onlooker bees until the food source is finished. Once this happens, scout bees will now be sent to discover new food sources. In ABC, the activation of scout bees is controlled by how many iterations in which no better-quality food sources are discovered [17].

In order to binarize the ABC algorithm, we follow the concept outlined by [5] by representing the bee positions as "probabilities of change" rather than the actual solution.

2.2.3. Prediction Model

Equation (2), Gives the cost function of pattern i (fi):

$$fi = \frac{1}{N}\sum_{j=1}^{k} d_{toBS}(X_i, P_i(X_i)) \quad (2)$$

The location of a food source represents a possible optimization solution[13], and the pheromone volume of a food source corresponds to the quality (fitness) of relevant solution, calculated by Eq. (3):

$$fit = \frac{1}{1+ fi}. \tag{3}$$

An ant selects a food source according to the associated probability values. These probability values are expressed in P, calculated by Eq. (4).

$$P_{i(\,packet\ reception)} = P_{sd} = e(\frac{\sigma 2\Theta z d_{sd}}{g}). \tag{4}$$

Where Θ is a hardware related threshold, σ represents the noise power, d denotes the distance between node s and d, and γ is the path loss exponent.

3. EXPERIMENT AND RESULT

3.1. Simulation Model

Proposed PPRE scheme is evaluated the performance with AODV, ABC and ACO by using network simulator NS-2[6-7] with incorporation of MIT uAMP [12-11] project (NS2.34Extension). PPRE guarantees the data delivery from source node to base station by using on predictive reception with energy. Implementation of protocols has been written in "TCL" and C++ programming language and "MATLAB" along with the comparisons of ABC and AODV.

3.2. Performance measure

(a) Stability Period: - this period can be defined with respect to time interval when network operation starts and during the operation the death of first node. It is the time interval between these two which refers the stability period. This metrics find out the how many control packets produced by each sensor nodes.

(b) Throughput: - This refers to data rates sent from clustered member to cluster head and further to sink node. So it is measured the total data rates of packets sent from source node to destination node.

a) Energy: Through this metrics calculate the residual energy when it takes to travel from source nodes to the base station/sink

The parameter/size of the network:

N = 50,

the Rayleigh channel parameters were chosen like γ = 2, g = 1, θ = 11, σ2 = 1.

The positions of the nodes were randomly generated according and uniform distributions in the unit square.Results compared with the ACO, ABC and AODV algorithm to the exhaustive solution.

Comparative analysis of energy consumption balance Based on our experiments, we know that using the ACO protocol in the network, the forgoing 20 sec is the network lifetime before the dead nodes have generated.

Fig.1 shows the Data is collected from all the sensor nodes in result the transceivers of the nearest sensor nodes retransmit much more information, and hence there are three techniques used to compare the energy of nodes. And since sensor nodes are usually all of the same type and have equal energy content, artificial bee colony leads to the fact that the nearest sensor nodes fail much later than the other algorithms, and so the former disrupt the work of the rest of WSN can be improve by artificial bee colony and ant colony optimization.

Data collected by all the sensor nodes are usually transmitted to the sink which provides the final processing of all the information collected by the sensor nodes. In general, a WSN includes one or a few sinks and gates which are collecting data from all the sensor nodes and transmitting these data for further processing. At the same time, gate forwards the data from the WSN to other networks. The simulation time of 20 sec it shows in fig 2. That artificial bee colony and ant colony optimization is having better performance over AODV protocol.

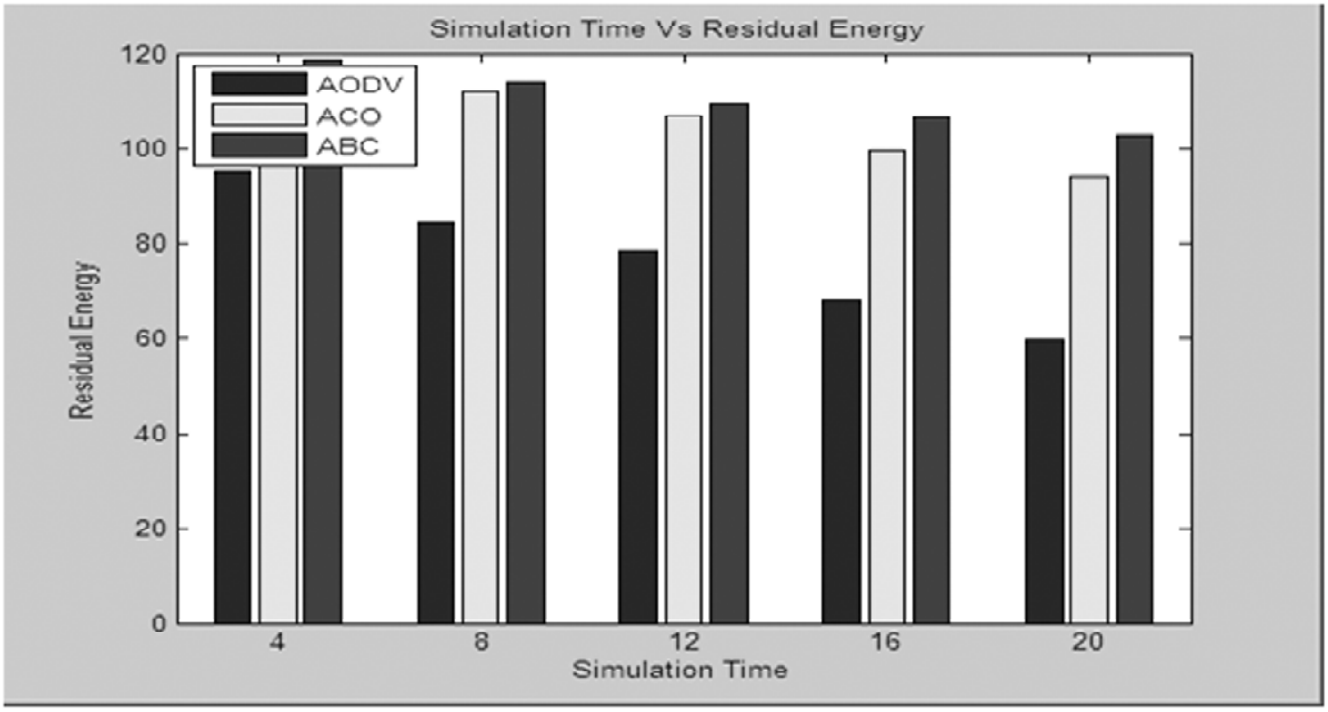

Figure 1: Simulation Time and Energy

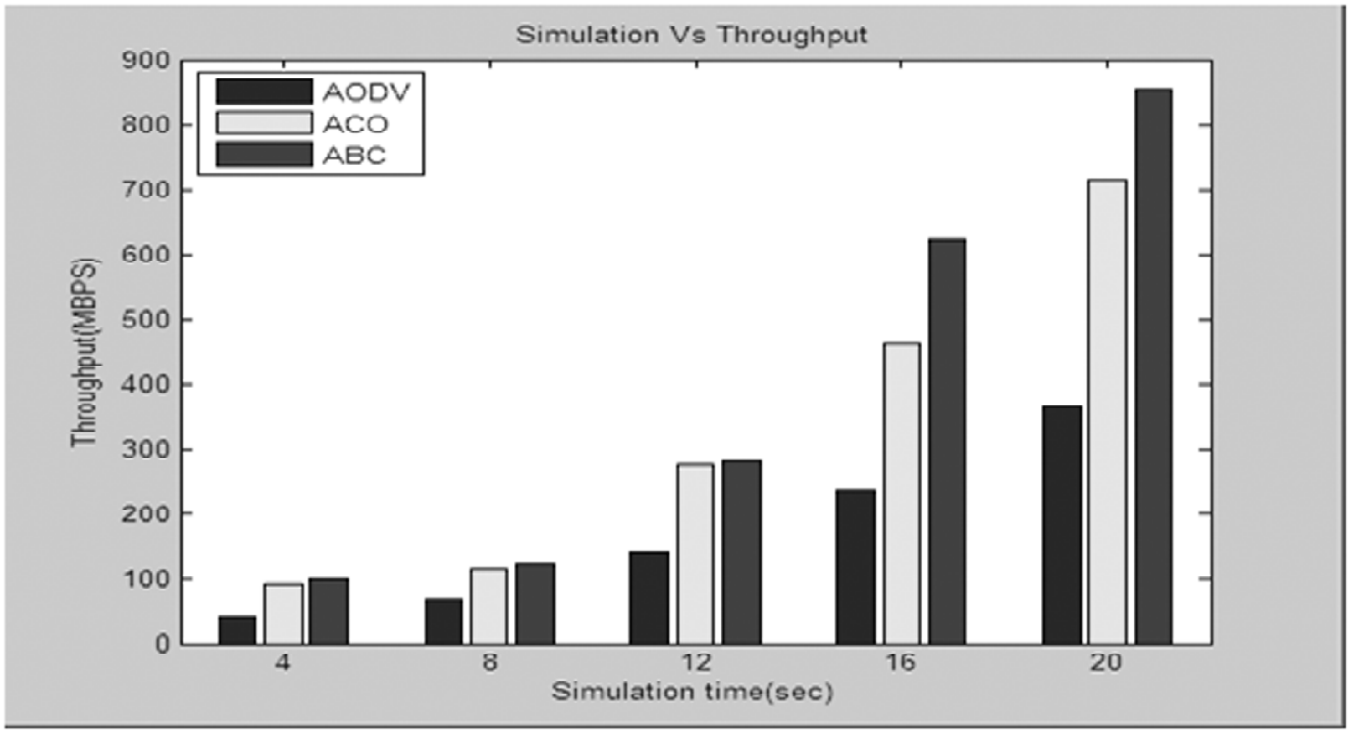

Figure 2: Simulation Time and throughput

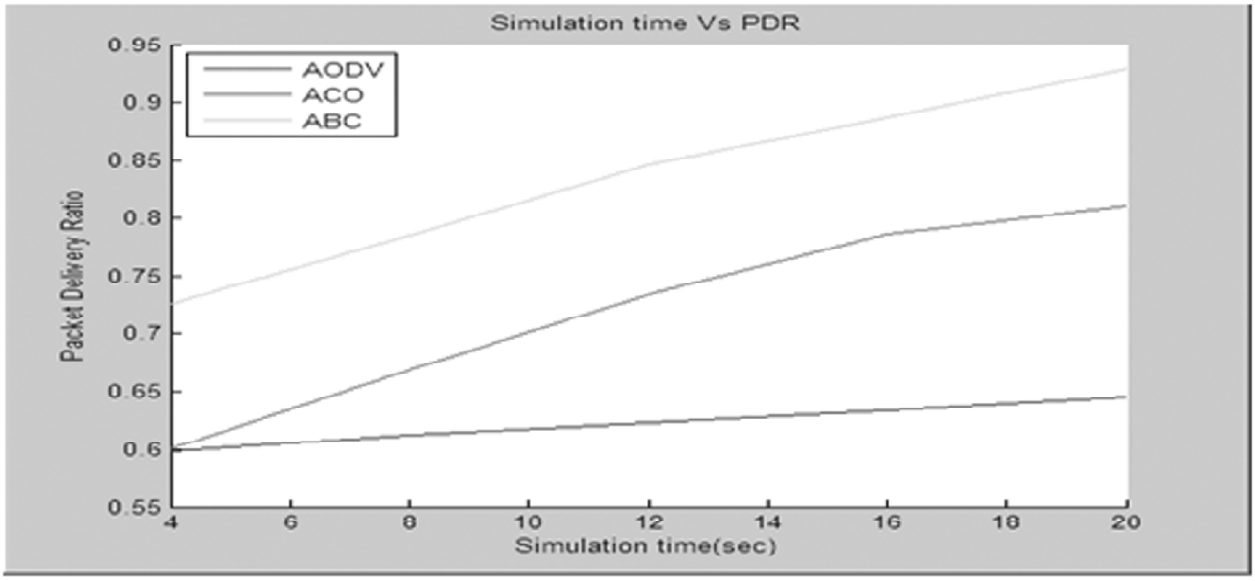

Figure 3: simulation Time and Packet Delivary Ratio

Fig 3 illustrates that if a guaranteed delivery of all the network messages is needed, we can calculate the packet delivery fraction that the WSN needs to transfer a message of some typical fixed length from one point to another, e. g. from a peripheral sensor node to the base station. Above graph shows that the ABC is better packet delivery fraction then the other algorithms like AODV and ACO. On the other hand, we can fix the maximal time of message transfer, and calculate the fraction of messages that are delivered in time. This kind of criterion is preferable for the real-time applications, especially the ones connected with the automatic control of devices, audio and video transfer

4. CONCLUSION

Through this paper, new cluster based approach with name of predictive packet reception with energy (PPRE) has presented. Initially it starts from message broadcast and then clusters formation and data transferring in a guaranteed way. In cluster formation stage, we design a predictive reception packet routing algorithm based on energy consumption. In this algorithm node degree and their distance is fully considered. In data transfer stage by using ant colony optimization and ant Bee colony optimization design the predictive packet reception with energy. And the basic of considering the packet reception and propagation delay, data can be sent in a precise way to sink node. Through proposed algorithm, it can improve the quality of data transfer in a granted way through by increasing the overall packet delivery fraction, throughput, stability of whole networks

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