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AUTOMATIC OPTIMIZATION DELAY AWARE ROUTING PROTOCOL (AODRP) FOR WIRELESS DEVICE NETWORK

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Abstract: Today's wireless networks urge to provide communication in most delay reduced manner. This research work aims to propose a routing protocol AODRP, that is more aware of the delay.Route optimisation is performed mistreatment the hymenopter colony optimisation approach.AODRP inherits the features of AOMDV routing protocol. In the proposed routing protocol AODRP the Performance metrics such as throughput, packet drop, delay time, and memory are used to compare with Fast Time-Dependent Shortest Path protocol (FTSP).Simulations square measure distributed mistreatment NS2 machine and therefore the planned routing protocol AODRP achieves higher performance as a result.

***Index Terms* - Sensor networks, wireless channel, delay, routing, and protocol**

I. INTRODUCTION

Wireless sensor networks (WSNs) are among the thrust research areas in the field of computer science. It has certain pros overconventional communications in today's applications, such as environmental monitoring, homeland security, and health care.
Wireless sensor networks are used for many applications such as military surveillance [8], infrastructure protection [9] and scientific exploration [10]. Most of the existing routing protocols in WSNs designed based on the single-path routing algorithm, without (adequate) consideration of reliability, energy or traffic load each source node selects a single path towards the sink node.
Although the route discovery in these approaches performed with minimum procedure complexness and resource utilization, the restricted capability of one path extremely reduces the realizable network outturn [11]–[14].
In WSN scenario, sensor nodes monitor the atmosphere, gather sensed data, and send the collected data to the destination sensor node. In certain application areas, harsh and complex environments create great challenges in the scheduled and reliable WSN communications. In the work of works of literature [15]–[17], it is mentioned that wireless links in real environments can be extremely unreliable and not tolerant of delay. In addition to that, if when the sensor nodes are not within the transmission range of the destination sensor node, then the other sensor nodes act as relay nodes and deliver data from the source node to the sink node through a single path or multiple paths as a sensed data. Hence, to attain reliable and delay-tolerant wireless communications within WSNs, which are deployed in an ad hoc fashion, it is necessary to have a reliable, delay aware routing protocol that also has scheduling ability.

II. LITERATURE REVIEW

In wireless sensor networks, QoS provision is an emerging field of research and various works of literature are available in this field. Here, we are reviewing in detail about some of the QoS aware routing protocols for wireless sensor networks. In wireless sensor networks, our survey mainly deals with delay and energy-aware reliable routing protocols. T. He et. al proposed a stateless real-time communication protocol called SPEED [1] in WSNs.
By imposing uniform communication speed in each hop within the network through feedback management mechanism and non-deterministic QoS aware geographic forwarding it meets the end-to-end delay.E.Felemban et al.proposed MMSPEED [3], which was modeled as an extension of the SPEED to support multiple communication speeds over the multipath and provides differentiated reliability. Based on velocity Chenyang Lu et al. proposed a Real-time Architecture and Protocols (RAP) [4]. It was designed to provide service differentiation in the timeliness domain by velocity monotonic classification of packets.The required speed is calculated supported destination and packet point.Packets priority is assigned in thevelocity-monotonic order in order that a fast packet may be forwarded before a lower speed one.
Akkaya et al. proposed energy-aware QoS routing protocol [2] to find energy-efficient paths along which end to end delayrequirement can be fulfilled. Each node classifies the incoming packets and forwards the real-time and nonreal time packets todifferent priority queues. The delay requirement is converted into bandwidth requirement. The use of class based priority queuing iscomplicated mechanism and costly for resource constraint sensors. Chipara et al. proposed a Real time Power-aware Routing(RPAR) in [5].This protocol was designed to realize application specific communication delay with low energy price by dynamic adjustment of transmission power routing decisions.The configuration changes oftentimes during this protocol because of dynamicadjustment of transmission power.

X.Hunag and Y.Fang have proposed Multi Constrained QoS Multi Path (MCMP) routing protocol [6] based on certain QoSrequirements such as delay and reliability.In this protocol, the authors have formulated an optimization problem for end-to-enddelay and then, linear programming solves this problem.The protocol utilizes multiple methods to transfer packets with moderateenergy expenditure.To fulfill the QoS demand the protocol prefers to route info through methods having minimum varietyof hops, which leads to more energy consumption. Z.Lei et al. proposed FT-SPEED [7], which is an extension of SPEED protocol.This protocol takes care of routing voids whereas transmittal packets to its destination.Due to routing voids, path length becomeslonger and because of this data, packets may not be delivered to its sink node before its deadline.

III. PROPOSED WORK

It is necessary to estimate delay in wireless device networks so as to perform path improvement. This a part of analysis ab initio evaluates delay in additional acceptable manner. every node within the device network has buffer. the info packets or RREQ packets arrive the buffer with distribution and it's referred by . Hence, the delay of the node will be computed by the subsequent equation.

$$Delay = \frac{\lambda T_2}{2(1-\sigma)} + T_1 \quad (1)$$

- λ is that the incoming rate of knowledge packets to the buffer.
- T1 is that the mean service time needed to transfer an information packet successfully (which additionally includes retransmission delays).
- σ is that the rate occupation that is adequate to λ T1.
- T2 is that the moment of service time distribution.

Automatic optimisation metaheuristic could be a coinciding formula during which a colony of artificial ants cooperates to search out optimized solutions of a given downside. hymenopteron formula was 1st planned by Dorigo et al. as a multi-agent approach to unravel travelling salesman downside (TSP) and since then, it's been with success applied to a good vary of adverse distinct optimisation issues like quadratic assignment downside (QAP) [11], job search planning (JSP) [12], vehicle routing [13], graph coloring [14], consecutive ordering [15], network routing [16], to say a number of few.

Leaving the nest, ants have a totally random behavior. As shortly as they notice a food, whereas walking from the food to the nest, they deposit on the bottom a chemical substance known as secretion, forming during this manner a secretion path. Ants smell secretion. alternative ants area unit attracted by atmosphere secretion, and later on they'll notice the food supply too. additional secretion is deposited, additional ants area unit attracted, and additional ants can notice the food. it's a sort of contact action behavior. during this method (by secretion trails), Associate in Nursingts have an indirect communication that area unit domestically accessible by the ants questionable Stigmergy, a robust tool sanctionative them to be in no time and economical. secretion is gaseous by sunshine and atmosphere heat time by time destroying undesirable secretion methods.

If Associate in Nursing obstacle, of that one facet is longer than the opposite facet cuts the secretion path. At first, ants have random motions to revolve around the obstacle. yet, the secretion of the longer facet is gaseous quicker, very little} by little, ants can convergence to the shorter facet, and hereby, they perpetually notice the shortest path from food to the nest contrariwise. Automatic optimisation optimisation tries to simulate this forage behaviour victimisation the calculable delay. Within the starting, every state of the matter takes a numerical variable named secretion-trail or just pheromone. at the start these variables have an even and really tiny price. hymenopteron colony optimisation is Associate in Nursing reiterative formula. In every iteration, one or additional ants area unit generated. In fact, every artificial hymenopteron is simply an inventory (or Tabu-list) keeping the visited states by the hymenopteron. hymenopteron is placed on the beginning state, and so selects next state employing a probabilistic call supported the worth of secretion trails of the adjacent states. hymenopteron repeats this operation, till it reaches to the ultimate state. during this time, the values of the secretion variables of the visited states area unit accumulated supported the desirability of the achieved answer (depositing pheromone). Finally, all the variables area unit diminished simulating secretion evaporation. By mean of this mechanism ants convergence to the additional optimum solutions.

One of the foremost advantages of Automatic optimisation optimization as compared to the Genetic algorithm is, as said before, indirect communication between ants using the pheromone variables. In contrast to the Genetic algorithm during which decisions are often random and supported the mutation and cross over (many experiences are going to be also eliminated by throwing the weaker chromosomes away), in Automatic optimisation optimization, all decisions are purposeful, and supported τthe experiments of all the previous ants. This indirect communication enables Automatic optimisation optimization to be more preciously and more quickly.

At first, a n×n matrix named τ is taken into account as pheromone variables, where n is that the number of tasks within the given task graph. Actually, τ_{ij} is that the desirability of choosing task n_j just after task n_i. All the weather of the matrix initiate with a same and really small value.

Then, the iterative Automatic optimisation algorithm is executed. Each iteration has the subsequent steps:

1. Generate ant (or ants) and estimate the delay.
2. Loop for every ant (until the entire scheduling of the all tasks within the task-graph).

   Select subsequent task consistent with the pheromone variables of the ready-tasks employing a probabilistic decision-making.
3. Deposit pheromone on the visited states.
4. Daemon activities (if applicable)
5. Evaporate pheromone

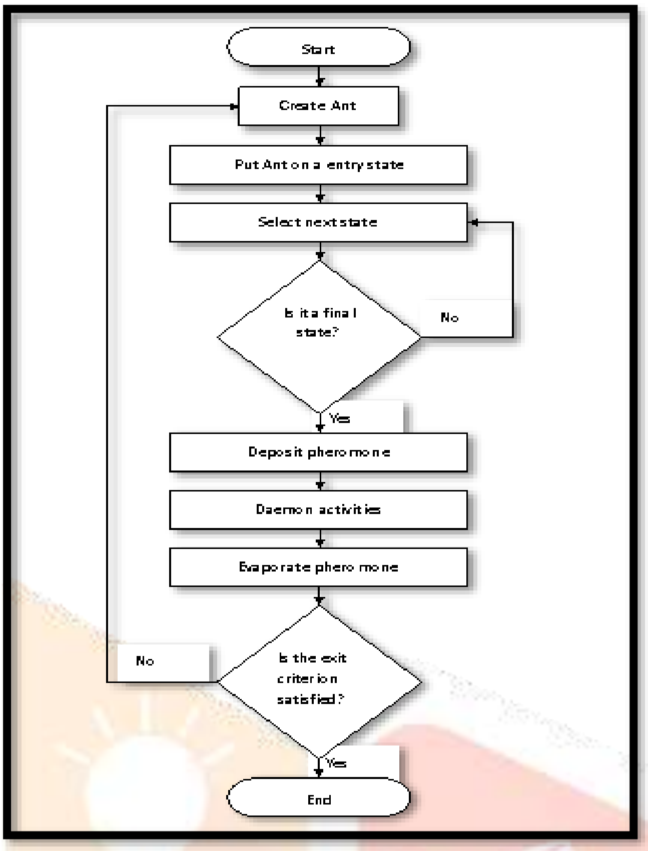

Fig.1 Flow chart of AODRP

A flowchart of those operations with more details is additionally shown in Fig. 1. within the first stage, just an inventory with the length of n, is made as ant. At first, this list is empty, and can be completed during subsequent stage. within the second stage, there's a loop for every ant. In each iteration, the ant must select a task from the ready-list employing a probabilistic decision-making supported the values of the pheromone variables and heuristic values (priorities) of the tasks. The desirability of choosing ij(t) τ task n_j just after selecting task n_i at time instant t is obtained by the composition of the local-pheromone-trail values with the local-heuristic values as follows:

$$a_{ij}(t) = \frac{[\tau_{ij}(t)]^{\alpha}[\eta_j]^{\beta}}{\sum_{l \in N(t)}[\tau_{il}(t)]^{\alpha}[\eta_l]^{\beta}} \qquad \forall j \in N(t) \qquad (2)$$

where $\tau_{ij}(t)$ is that the amount of pheromone on the sting jη(ni, nj) at time instant t, is that the (t)Nheuristic value (priority measurement) of task nj, and are two parameters that control the relative weight of pheromone-trail and heuristic-value (Note that different priority measurementsβ and αcurrent set of ready-tasks (ready-list), α and β like TLevel, BLevel, SLevel, ALAP, and NOO are often used as heuristic values, and therefore the best one should be selected experimentally). For ant k at time instant t, the probability of choosing task nj just after selecting task ni is computed by using (8).

$$p_{ij}^{k}(t) = \frac{a_{ij}(t)}{\sum_{l \in N(t)} a_{il}} \quad (3)$$

Then a random number is generated, and therefore the next task are going to be selected consistent with the generated number (for each ready-task, the larger pheromone-value and therefore the bigger priority, the larger chance to be selected). the chosen task is appended to the ant's list, faraway from the ready-list, and its children ready-to-execute now are going to be augmented to the ready-list.

These operations are repeated, until the entire scheduling of all the tasks, which suggests the completion of the ant's list. In the third stage, tasks are extracted one by one from the ant's list, and mapped to the processors that provide the earliest-start-time. Then, the utmost finish-time is calculated as makespan that's also the desirability of the obtained scheduling for this ant. consistent with this desirability, the number of pheromone, which should be deposited on the visited states, is calculated:

$$\Delta\tau_{ij}^{k} = \frac{1}{L^k} \qquad if\ (n_i, n_j) \in T^k \qquad (4)$$

Where L^k is that the overall-finish-time or makespan obtained by ant k and T^k is that the ij if andτexecuted tour of this ant. Accordingly, should be deposited on every as long as the (ni, nj) exists within the ij will remain unchanged.

In the fourth stage (daemon activity),τ T^k (task nj has been selected just after task ni). Otherwise, to accentuate and to avoid removing the great solutions, the best-ant-until-now (Antmin), is chosen (as the simplest solution), and a few extra pheromone is deposited on the states visited by this ant using

$$\Delta\tau_{ij}^{\min} = \frac{1}{L^{\min}} \quad if\,(n_i, n_j) \in T^{\min} \qquad (5)$$

In the last stage, by using (6), pheromone variables are decreased simulating pheromone evaporation within the real environments. It should be taken to avoid premature convergence and stagnation due to ρthe local minimal.

$$\tau_{ij} = (1-\rho)\tau_{ij} \qquad (6)$$

Where, ρ is that the evaporation rate within the range of [0, 1] should be determined experimentally

IV. SIMULATION SETTINGS AND PERFORMANCE METRICS

The simulation is administered using the NS-2 Simulator. The WSN nodes are uniformly deployed with varied node density of 600 to 1100. The packets are allowed to transfer in constant bit rate fashion.

Parameter Name	Value
Number of nodes	600 to 1100
Initial energy / node	10 joules
Simulation time	1500 seconds
Baseline node power	6mW
Simulation runs	5
Packet size	30 bytes

Table 1. Simulation Settings

It's assumed that each one sensor nodes are homogeneous that have an equivalent ability of communication and know their neighbor nodes and their own location information by GPS. The performance metrics taken are throughput, packet delivery ratio, packet drop, memory and delay. The simulation parameters are shown in Table 1.

V. RESULTS AND DISCUSSIONS

Fig 2 it shows the comparative analysis of the protocols AODRP and FTSP in terms of throughput. Simulation results prove that the proposed AODRP outperforms than that of FTSP.

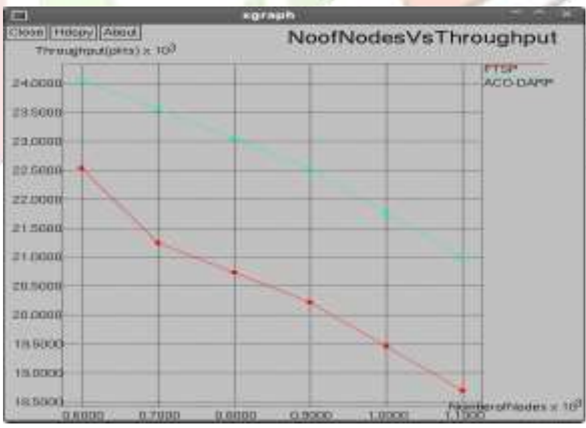

Fig 2. Number of Nodes Vs Throughput

Fig 3 projects the comparative analysis of the protocols FTSP and AODRP in terms of packets drop. Simulation results emphasize that the proposed AODRP outperforms than that of FTSP.

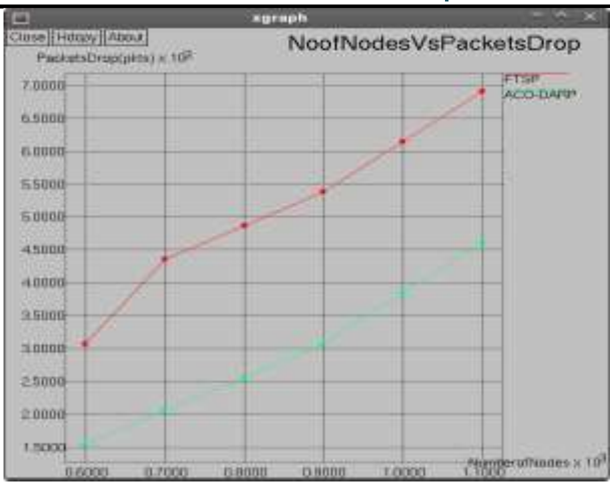

Fig 3. Number of Nodes Vs Packets Drop

Fig 4 shows the comparative analysis of the protocols FTSP and AODRP in terms of delay. Simulation results show that the proposed AODRP outperforms than that of FTSP. Fig 5 shows the comparative analysis of the protocols FTSP and AODRP in terms of memory utilization. A simulation result shows that the proposed AODRP outperforms than that of FTSP.

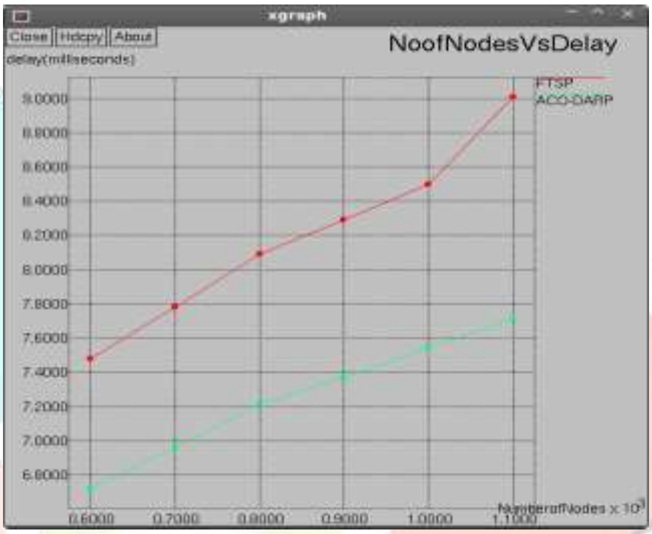

Fig 4. Number of Nodes Vs Delay

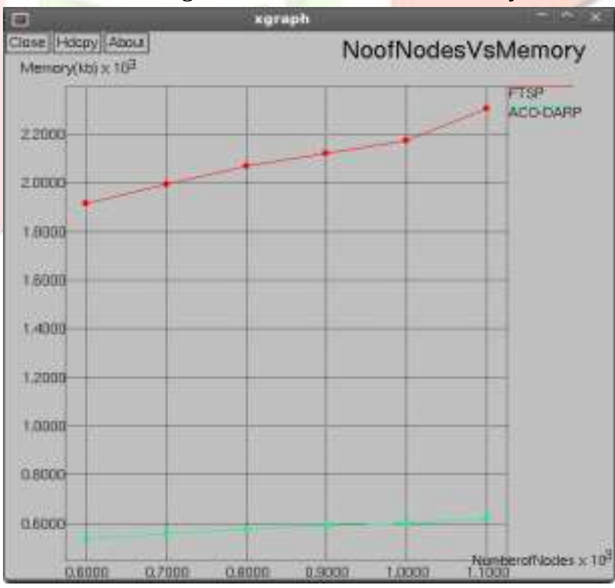

Fig 5. Number of Nodes Vs Memory

VI. CONCLUSION AND FUTURE SCOPE OF RESEARCH

The emergence of wireless networks tends to supply communication with reduced delay. This research work aims to propose a routing protocol AODRP, which is more aware of the delay. Route optimization administered by making use of Automatic optimisation optimization approach. AODRP inherits the features of AOMDV routing protocol. For comparing the proposed routing protocol AODRP with Fast Time-Dependent Shortest Path protocol (FTSP) , performance metrics like throughput, packet drop, delay time, and memory are taken under consideration. Simulations are administered using NS2 simulator and therefore the output shows that the proposed routing protocol AODRP achieves much more performance.

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