

FFA-CONTEXT AWARE ENERGY EFFICIENT ROUTING USING FAST REACTIVE AND ADAPTIVE ALGORITHM

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ABSTRACT

A vital issue of routing is how to efficiently strengthen energy consumption of the whole network and to avoid the energy-hole which leads to node failure or node death; this scenario makes the network to work improperly and leads to network death, Here we proves our hypothesis with linearity between routing and linear principles. Our proposed work effectively utilizes the adaption of Optimized particle swarm algorithm (Fast Reactive and fast adaptive algorithm) in order to solve the routing problem in wireless sensor networks to avoid the energy hole. Our approach effectively defines the node leader based on energy level and path optimization for node traversing using particle swarm which effectively utilizes the solution for problem in linearity into routing problem. Our algorithm FFA redefines the particle swarm rules which are reliable in routing strategies and adapts to the working principle. The optimization in our algorithm is to balance energy level and to withstand for its context. This study proves the accuracy using our algorithm respectively by theoretical survey and analysis with simulated results.

Keywords: WSN, Wireless Sensor Network, Swarm Intelligence, FFA, BCO, ACO

1. INTRODUCTION

In traditional wireless communication model ranges very large scale in energy consumption and high complexity to route the packets (Rong *et al.*, 2005; Visu *et al.*, 2012; Sedighizadeh and Masehian, 2009; Sombuntham and Kachitvichayanukul, 2010; Ruyan *et al.*, 2010; Guo and Jia, 2012). In recent development in wireless communication which yields the sensor node to develop for multi-function (Arif and Rani, 2012) largely in sense of mobility patterns, random mobility, Probabilistic mobility, Controlled mobility, Predictable mobility (Alfawaer *et al.*, 2007).

Because of rapid development in WSN sensor node elements which is coupled with sensor, communication devices, data processing (pre + post) and communication channel are in forward range. Wireless sensor network differs from other wireless network such ad hoc and infrastructure based which enables wide area of research in the sensor networks (Visu *et al.*, 2012;

Sedighizadeh and Masehian, 2009; Sombuntham and Kachitvichayanukul, 2010; Ruyan *et al.*, 2010). Routing and optimality in energy consuming is one of the greatest challenges in the wireless sensor network.

1.1. Source Oriented Approach in WSN

Whenever an event is identified in WSN, the structure of the source node is announced by itself to all the sink nodes which are connected particularly to it base (Rong *et al.*, 2005). This makes the sink node to propagate awareness for whole event and to utilize the resources, querying the availability, node transmission, mobility ratio, packet base aspect. This leads to free mobility of roaming sink base with the routing grid or routing information table (Shirkande and Vatti, 2013; Yong-Chang and Gang, 2008).

1.2. Sink Oriented Approach in WSN

Sink periodically disseminates its location information to the network. This enables sensors to

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direct their sensed information towards sink (Rong *et al.*, 2005; Ruyan *et al.*, 2010; Yong-Chang and Gang, 2008). Sink oriented approaches require periodic location updates to keep sources aware about its information (Yong-Chang and Gang, 2008).

Many new algorithms have been proposed for the routing problem in WSNs (Barabasi and Albert, 1999; Karp and Kung, 2000; Broch *et al.*, 1999; Park and Corson, 1997; Baghyalakshmi *et al.*, 2010; Kennedy and Eberhart, 1995; Shen *et al.*, 2009; Kennedy *et al.*, 2001; Osama *et al.*, 2005). These routing contrivances have taken into consideration the intrinsic topographies of WSNs along with the application and architecture rations. The task of finding and maintaining routes in WSNs is nontrivial since energy restrictions (Guo and Jia, 2012; Shirkande and Vatti, 2013) and sudden changes in node status (e.g., failure) cause frequent and unpredictable topological changes. To minimize latency and energy consumption, routing techniques proposed in this literature employ some well-known routing tactics e.g., data aggregation and clustering (Rao *et al.*, 2003; Baghyalakshmi *et al.*, 2010). Ant Colony Optimization (ACO) algorithm in swarm intelligence is one of the most important heuristics based optimization method which was successfully applied in various complex problems.

1.3. Full Description of WSN Routing Algorithm Based on Fast Reactive and Fast Adaptive Approach

The algorithm selects routing through distributing flooding and gradient throughout the whole network. Our approach only needs the local information about the nodes, which emits the Particle Swarm characteristics (Guo and Jia, 2012) of decentralized control and dynamic morphing topologies. Parallely it supports multipath routing which enhances the operability and very less energy consumption during packet transmission (Visu *et al.*, 2012).

1.4. FFA Estimation-Basic Approach

- Step 1: Create a population of agent called particle distributed over the range called X
- Step 2: Assign an objective function and evaluate the position of each particle
- Step 3: Check for position: If the position of the object is best than the previous one update it
- Step 4: Find out the best particle and evaluate it with the previous best one

Step 5: Update the velocity of the particle based on the below stated formulae Equation (1):

$$V_i^{t+1} = V_i^t + \emptyset 1 U_1^t (p b_i^t + x_i^t) + \emptyset 2 U_2^t (g b_i^t + x_i^t) \quad (1)$$

Step 6: Switch the particle to its new position based on the function stated below Equation (2):

$$X_i^{t+1} = x_i^t + V_i^{t+1} \quad (2)$$

Step 7: Repeat the step 2 until it satisfies the basic stopping criteria:

$$X (1) * (2) * \dots *$$

Figure 1 states the inertia function of the particle swarm nodes. Based on the inertia weight parameter each node is investigated. Inertia weight can be changed so that each node in WSN (Kennedy *et al.*, 2001; Osama *et al.*, 2005; Murthy and Manoj, 2004; Lee and Knight, 2005; Alfawaer *et al.*, 2007) can be estimated to find adjacent nodes and partial adjacent nodes. According to She and Eberhart they stated the criterion function as follows:

$$V_i^{t+1} = W V_i^t + \emptyset 1 U_1^t (p b_i^t + x_i^t) + \emptyset 2 U_2^t (g b_i^t + x_i^t)$$

where, W denotes the weight of the nodes.

1.5. Local Field

In traditional old routing in wireless sensor network the node energy, computing capability, node optimization (Kennedy and Eberhart, 1995; Shen *et al.*, 2009; Osama *et al.*, 2005) and storage capacity are very limited due to its old methodology which focuses on detailed view on storing the data's in routing table (Satyanarayanan, 2007) in the whole network and updating the data between each interval of time leads to more complexity and failure of nodes. To overcome these issues in our approach each nodes hold on the information which are necessary about the node on the local field (Shirkande and Vatti, 2013; Yong-Chang and Gang, 2008; Visu and Kannan, 2013; Okdem and Karaboga, 2009; Arif and Rani, 2012). Information such as node id, source transceiver's id, base station, host parameters. Fast adaptive approach adapts to each situation and concentrates on link establishment and residual energy parameter in energy context.

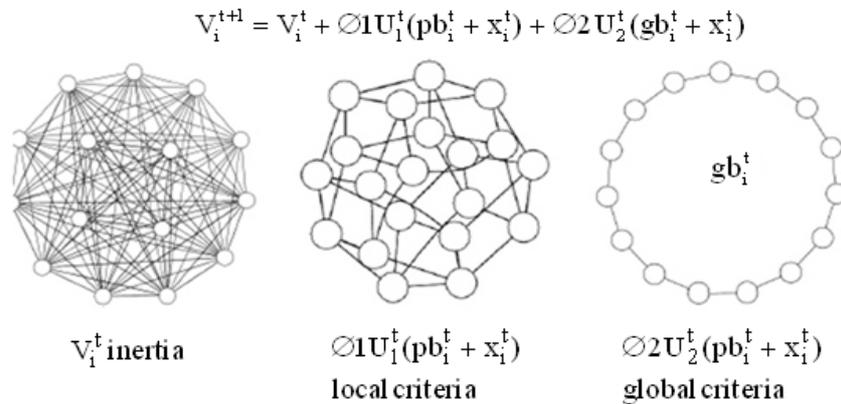


Fig. 1. Basic approach of Particle Swarm Optimization (PSO)

1.6. FFA as Multipath Routing

In our proposed approach each node records the activity between every node. The node calculates the likelihood values that each node is concentrated on particular node then it is evaluated over all the nodes. The node with positive and liable values stands and selects the nodes for the next jump. Hence it supports the multipath routing. Tracking adjacent nodes is denoted as follows:

$$V_i^{t+1} = x \left[V_i^t + \sum_{pk \in \aleph_i} \phi_k U_k^t (pb_k^t + x_k^t) \right]$$

where, V_i^t denotes the velocity grid of the node.

Node-Head selection:

$$V_i^t = Av^t + b1U_1^t(pb^t - x^t) + b2U_2^t(gb^t - x^t)$$

Update the particle velocity rule in addition to the node element, consider the below:

$$E[U_k^t(0,1)] = \frac{1}{2}$$

$$B = \frac{b1 + b2}{2}$$

To prove the routing linearity, considering the states of pb^{t+1} and gb^{t+1} :

$$pb^{t+1} = pb^t + 1, gb^{t+1} = gb^t$$

$$\gamma = \frac{b1}{b1 + b2} pb^t + \frac{b1}{b1 + b2} gb^t$$

Then the solution in terms of linear proposition:

$$V^{t+1} = Av^t + b(\gamma - x^t)$$

Hence V^{t+1} is the velocity rule dominator which determines the node velocity. γ Parameter determines the linearity of single dimension particle swarm value.

1.7. Result Analysis

Figure 2 shows the path optimization where the evaluation is based on each node and its ratio. Each fitness value is based on the estimation of the rows and its interlaced columns.

Experimentally, each iteration is carried on in order to achieve estimation of path parameters which is denoted in Figure 3. Each energy is estimated on Numener value and its estimation with the accuracy rate of 5750 for every k (k in terms of 1000) at each node.

Figure 5 Denotes the simulation of optimal route using FFA. Figure 4 denotes the cost evaluation matrix values for FFA algorithm. Results shows that our proposed algorithm has better efficiency in routing optimal path when compared to other existing algorithm. We achieved the accuracy and results has been justified in Figure 4 and 5 (cost evaluation matrix and in routing simulation).

```
>> FitValue
FitValue =
Columns 1 through 11
    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639
Columns 12 through 22
    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639
Columns 23 through 33
    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639
Columns 34 through 44
    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639
Columns 45 through 55
    2.0639    2.0639    2.0639    2.0639    2.8046    2.0639    2.0639    2.0639    2.0639    2.0639    2.0639
Columns 56 through 66
```

Fig. 2. Path optimization-Fitvalue for FFA Algorithm

```
Number of Nodes:20
Iteration:1
Iteration:2

NumConv =
    15

NumFitCalc =
    7500

FailureRatio =
    0

>> DRoute
DRoute =
    1    15    8    13    6    7    5    11    20

fx >>
```

Fig. 3. Implementation results of FFA Route Algorithm

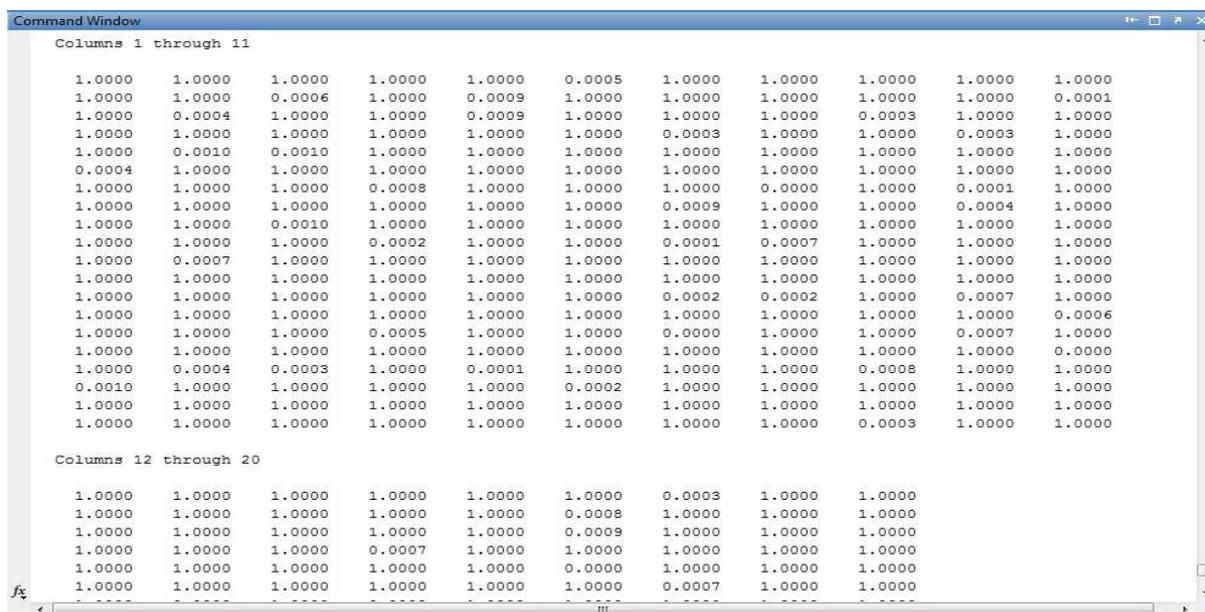


Fig. 4. Implementation results of cost evaluation matrix-FFA route algorithm

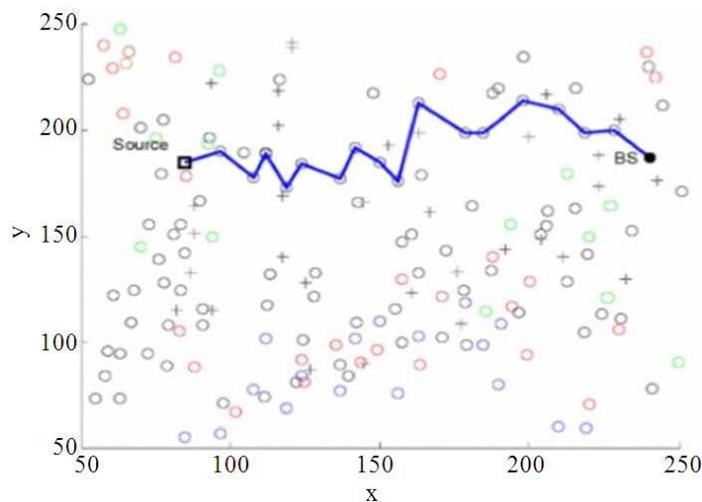


Fig. 5. Simulation result-FFA algorithm

1.8. Comparison and Test Cases

Basically Experimental setup is tested with 20 nodes and achieved accuracy for each in finding optimal path using FFA. Our acquired results has an exponential cut-off of about high accuracy of 11.5 optimality in terms of each iteration for 20 hops Failure estimation is based on each packet miss ratio, at every iteration failure hit is estimated, for every

success failure hit value will be '0'. The optimal prediction of results is achieved and the evaluation parameter is estimated based on real time packets, which the route was clearly defined in Fig. 3 as FFA Route. FFA has wide range of possibility to route the packets in mobile ad hoc networks, since each trackers seeds to provide the large number of packets in actual node (current state) real time example used in (mobile torrents). FFA uses multipath routing since the packets

routed is within the node temp identity even if the node failure occurs, this leads to route the efficient packets (denoted clearly in the section multipath routing).

2. CONCLUSION

In this study we have discussed FFA based model in Wireless sensor network. Energy efficiency is one of the major criteria for deciding the efficacy of the routing protocol. Simulation results shows that the proposed routing methodologies have better optimality than the previous one. Here node header is clearly defined and optimized path is predicted with high accuracy in traversing lane. Figure denotes the accurate result of the proposed algorithm. Finally obtained FFA based routing method is the trade off between optimal measure and energy saving effect which can contribute to improve the robustness of the routing measure.

2.1. Future Enhancement

The main challenge in FFA algorithm is the algorithm route only for the predefined swarm nodes with average fit value, In future we like to combine routing algorithm in order to achieve better results for energy consumption in WSN; each swarm node is combined with hybrid routing in each extension.

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