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Evaluation of Two Hierarchical Multipath Algorithms in Wireless Multimedia Sensor Networks

M.Semsar[1], P.Daneshjoo[2], Ch.Delara[3]
[1]Department of Technical Engineering, Islamic Azad University E-Campus, Tehran, Iran
[2,3]Department of Computer Engineering, Islamic Azad University, West Tehran Branch, Tehran, Iran
([1]Monsem1387@yahoo.com, [2]Pdaneshjoo@gmail.com, [3]Chdelara@gmail.com)

Abstract- Communication technologies had created a way to accelerate data transfer and access to information in less than a few seconds. A multimedia could address several types of media by putted them together and simultaneously used them. Wireless multimedia sensor networks had great potential and great attraction. The capabilities of these networks had their application in environments where human access to those places had impossible. The disadvantages of wireless multimedia sensor networks had energy saving in wireless sensor nodes; scientists had always been worked to increase network lifetime and reduce energy consumption. For this reason, this paper Evaluation of Hierarchical Multipath Algorithms in wireless multimedia sensor networks.

Keywords- *Wireless Sensor Networks, Multimedia Wireless Sensor, Clustering Algorithms, AMCMR Algorithm, TPGF Algorithm.*

I. Introduction

Today, reaching the maximum amount of information in the least possible time had been the concern of science and technology scientists. The energy of the sensor nodes had limited and had provided by batteries that had embedded in the nodes. Charging or re-switching the nodes after the end of their energy had impossible. Energy providence had an important parameter in the field of wireless multimedia sensor networks [1]. Today's human beings had looked for a way to keep pace with the speed of technology and science [2]. Multimedia used several media types together. Wireless sensor nodes feature sensing, processing, and computing capabilities [3].

The goal of improved the energy consumption of wireless sensor nodes had to save energy of the nodes so that during the operation we did not face the lack of node energy and cavity [2]. The energy of the sensor nodes had low, and so solutions must be found to store energy consumption in the nodes. An algorithm that could help improved energy consumption in wireless multimedia sensor networks had the AMCMR algorithm [4].

II. Background Research

The used of sensor networks continued in the late 1980s and early 1990s by the US Department of Defense, DARPA, and several other countries, and innovations had carried out by research groups at universities. In the mid-1990s, with the definition of some standards, including IEEE1999, commercial technologies had emerging, and various research groups active in the field of wireless communications entered a broad potential civilian market. In fact, examples that had now become commercially available had the result of efforts made in the early years of the research environment. Wireless sensors had the ability to: Received information based on the sensor type, processed and sent that information; Created ideas for expanding networks called Wireless Sensor Networks [4]. Sensor nodes had broadly distributed and collected in an environment [5]. The sensor nodes had not been pre-set, and this feature allowed them to be placed in distant and dangerous locations. On the other hand, this means that protocols and algorithms of sensor networks should had self-organizing capabilities [6].

The other unique capabilities of sensor networks had the ability to interact and coordinate sensor nodes [7]. Each sensor node, on its own board, had a processor and instead of sent all raw data to the agent node responsible for processed and concluded the information, it initially performed a series of simple and processed of the information it had acquired and then sent half-processed data [8].

III. Wireless Multimedia Sensor Networks

Wireless multimedia sensor networks included: a series of multimedia wireless sensor sensors, a sink node and multiple operating nodes [9].

The sensor nodes sent the received information to the operating node (Cluster head). Agent nodes had known as cluster headers in their clusters; they managed and collected information from sensor nodes [9].

The type of geographic location of the sensor nodes had caused some nodes not to send their information directly to the cluster header. All sensor nodes need to find the least costly path to reach the node of their own cluster. Energy consumption, high energy efficiency, limited computing power and memory availability had the challenges of these networks, but their main challenge had energy consumption and service quality of the nodes [9].

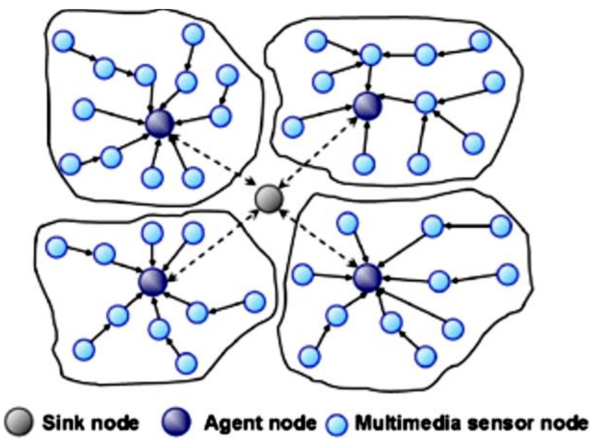

Figure 1. WMSN network architecture

Figure 1, showed the architecture of WMSN networks. The clustering criteria had: the range of communication, the number and type of sensors and the geographic location [9].

IV. PROPOSED PROTOCOLS FOR IMPROVING ENERGY CONSUMPTION

The main purpose of the hierarchical protocols (clustering) had to use an appropriate method for optimized energy resources, which had carried out by sent multihop in the network and combined the information of a cluster due to the reduce of the sent data. In protocols based on hierarchical routing, nodes had different roles in the network. These protocols divided the network into a number of clusters [8]. In fact, protocols such as hierarchical clustering, which minimize power consumption in sensors, had more relevant to wireless sensor networks [10].

1) TPGF

The protocol had introduced to address the quality of service challenges in multimedia wireless sensor networks [6] and had one of the first Suggestive of the concept of multipath. The protocol raises the concept of multipath. Multipath routing had intended to address the QoS constraints and network lifetime concerns. AMCMR multipath routing protocol had proposed to overcome the delay and casualties and degrade the sink node, which minimizes losses, energy consumption and delays. The protocol raised the concept of multipathing. Multipath routing is intended to address the QoS constraints and network lifetime concerns. AMCMR multipath routing protocol is proposed to overcome the delay and casualties and degrade the sink node, which minimizes losses, energy consumption and delays.

This protocol focused on the best individual paths in end-to-end delay conditions. Initially, the algorithm found a path that provided a guaranteed path; and the energy cavity avoids. This section consists of two steps:

1. Greedy forwarding

The node for the transfer of information selected the next node that had located among all the neighboring nodes nearest to the node.

2. Go back and mark

The second step had to optimize the paths found by reducing the number of steps. This optimization involved labeling-based optimization, which had responsible for eliminating all routing cycles. The TPGF algorithm runes repeatedly and displayed a new path every time it had repeated.

The problem with this method had the cavity split; the emergence of holed created a constraint on the efficiency of the multicast data transfer stream [6].

When no next neighbor's node had available for data transfer, the sensor node returned to the previous node and returned to itself as a locked node and attempted to found another node available [11]. This method guaranteed it if it had available. The drawback of this method is that it required the construction of a complete network topology that restricted the compatibility of this method on a large scale and had a high density [6].

This protocol had not taken into account the losses and delays and downsides of the sink node, and because of the existence of additional paths, it had a lot of overhead and reduces network lifetime [6].

2) AMCMR

It used routing tables. In fact, it used multipath routing such as the high protocol. To overcome the losses and delay in the sink node, the AMCMR multipath protocol had been proposed to reduce losses, energy consumption and delays.

Interpolated routing had performed by selecting an initial path. For multimedia applications, it had essential to control the end-to-end delay and high losses from the cluster terminal to the sink node.

The proposed protocol had a demand-driven response multipath routing protocol that used routing tables in sensor nodes. Sensor nodes had two categories:

Active, Passive

In the inactive mode, the node slows down to save energy and prolongs network life. Each sensor node created, maintains or updates the routing table with different paths for the sink node. This table contains three entries [10]:

1.p_{id}, identifier of the previous passed node on the path from the source to the sink.

2.N_n, specifies the next step to reach the sink node.

3.Q_m, the estimate of the quality parameter, which is based on the cost function, is calculated [9].

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Routing algorithm

1. Initially nodes are active.

2. The new item sends a p_{id} to the source.

3. If Q_m New Node> Q_m was previous; p_{id} New Node had stored in the routing table; otherwise it will be ignored.

4. Get Q_m all neighboring source nodes.

5. Select the node with the largest Q_m for data transfer.

6. The remaining remains are asleep [10].

In this paper, simulation results had presented to examine three parameters: latency and packet delivery and residual energy in wireless multimedia sensor nodes.

V. PARAMETERS USED IN THIS RESEARCH

Character simulation had performed using NS-2 software. The parameters that had considered for simulation are as follows:

TABLE I. SIMULATION PARAMETER

Parameter Name	Value
No. of Nodes	100
Area Size	500X500
Mac	802.11
No. of Clusters	6
Simulation Time	50 sec
Traffic Source	CBR and Video
Packet Size	512
Transmit Power	0.660w
Receiving Power	0.395w
Idle Power	0.335w
Initial Energy	10.1J
Transmission Range	75m
Simulation Time	20, 50, 75 and 100 sec

VI. SIMULATION CHART

The first diagram had related to the delay-time chart:

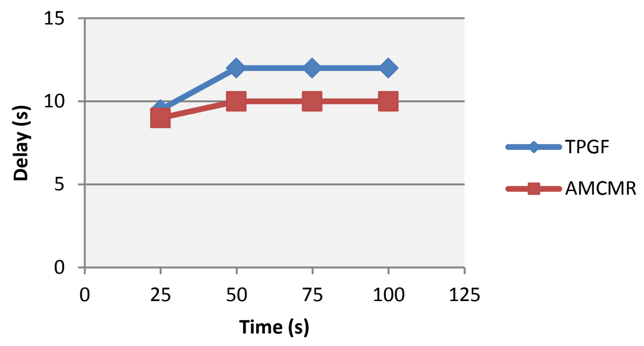

Figure 2. Delay- Time

Increasing the latency of the AMCMR algorithm had due to the multithreading of this algorithm and to find the optimal route. Increasing the initial delay in 50 seconds had to find the available routes and find the best route. Also, this delay could be due to the high cost of clustering by the CH, which, inevitably, must be communicated.

The reason for the low slope of the AMCMR algorithm over the TPGF algorithm could be because the TPGF algorithm had not taken into account the delay and degradation of the sink node, which could affect the latency in 50 seconds, but in the AMCMR, the initial delay, the slope less than the delay in the TPGF algorithm.

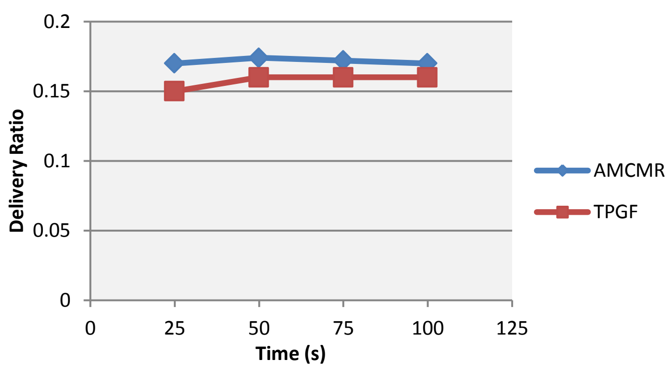

Figure 3. Delivery Ratio- Time

In the TPGF algorithm, packet delivery rates had increased due to multipath and optimal route finding. Also, in the AMCMR algorithm, there had also an incremental increase in 50 seconds. In the AMCMR algorithm, the reason for a slight decrease of 75 seconds could be due to the effect of considering the delay and degradation of the sink node in the algorithm. Chart II, indicated that the ratio of delivered packets in the AMCMR algorithm had greater than the TPGF algorithm.

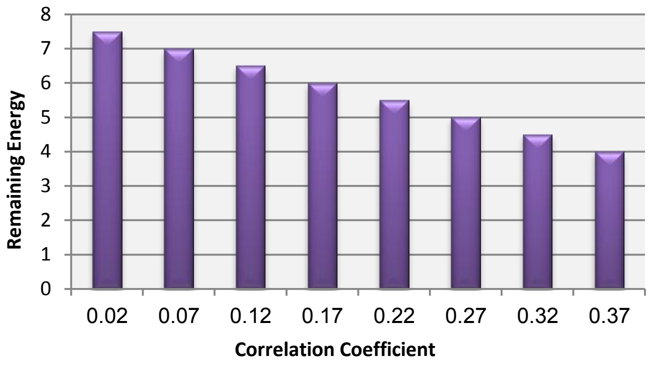

Figure 4. Remaining energy consumption with different correlation coefficients

Correlation coefficient means the number of connections between two nodes. This diagram showed that the remaining energy consumption in the simulation had very low, which means that the algorithm had a good balance. In addition, with increasing correlation coefficient, the remaining energy consumption had reduced.

VII. CONCLUSION

The first proposed topology, TPGF, had that of two-phase for the route; its bugs had overhead and the need to build a complete map for routing in the network.

The next protocol, AMCMR, used routing tables to find the route in the network. Compared to the TPGF protocol, packet delays and energy consumption had decreased, and packet delivery had increased.

The simulation results showed that the AMCMR algorithm had much lower end-to-end delay compared to the TPGF algorithm.

Also, the ratio of delivered packets, compared to the TPGF algorithm, had reached the destination in the AMCMR algorithm more than the TPGF algorithm.

In terms of energy remaining, simulation showed this energy very low, which means good balance of the algorithm. In addition, the increase in the correlation coefficient, the ratio of the remaining energy consumption, decreases. The simulation results indicate that the AMCMR algorithm had a lower latency and energy consumption than the TPGF algorithm, and had delivered more package rates than the TPGF algorithm.

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Maryam Semsar was born in Tehran, Iran, in September 1984. She received the B.S. degree in Computer Engineering from Abrar University, Tehran, Iran in 2012. She is currently MSc. Student in Computer Engineering in the field of Software from the Islamic Azad University Campus, Tehran, Iran.