

An Energy Efficiency Routing Scheme using Cluster Technique for Multi-Path Network in WMSN

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Abstract

Objectives: Wireless multimedia sensor network is one of the important sensors used to sense and transfer multimedia data in the network topology. We know that the multimedia data occupies more memory. **Methods:** The existing system of communication topology took the Quality of Service (QoS) as a metric and met the metrics like reliability, throughput and error rates. They used routing protocols like Multi-path and Multi-speed (MMSPEED) and Energy aware Multi-path and Multi-speed (EAMMSPEED) for the transmission of multimedia data. The data is prioritized which based on the important parts and they are sent through the network via multi-path routing. But during high traffic loads the multi-path routing does not fulfil communications effectively. **Findings:** A novel approach is employed to reduce the traffic loads by using multi-path routing based on clustering. Clustering technique is suitable for static network. The implementing technique will focusing on how to reduce the traffic loads in the network and also how to make the consumption of energy in further efficient manner. With the help of clustering technique, we can able to satisfy the desired QoS which effectively needed. **Applications:** Nowadays mostly wireless multimedia sensor networks are deployed to measure the temperature, humidity, pressure. It is also used in military and civil applications.

Keywords: Energy Efficiency, Multipath Routing, Quality of Service (QoS), Wireless Multimedia Sensor Networks,

1. Introduction

Wireless multimedia sensor network is one of the important sensors used to sense and transfer multimedia data in the network topology¹. We know that the multi-media data occupies more memory. Wireless multimedia sensor networks create a great impact in the recent research community. Normally sensors are used to sense the information like temperature, pressure, heat from the environment. WMSN is one of the sensors which interconnect devices in processing videos, sensing audios and to transfer other multi-media data. WMSN is used in many new applications like military surveillance, system monitoring, structural health monitoring, precise agriculture and industrial process control. Hence the impact of WMSN increases day by day. In future there are many fields which are ready to use the multimedia sensor networks. Network topology has two ways of routing scheme namely single-path routing and multi-path

routing. There are many routing protocols were tested to get expected performance which in terms of QoS². By that it is observed that QoS is efficient in multi-path routing and used widely³. The nodes which are mobile will allow the other nodes to come and out of the network whenever it wants. More importance is given to get efficient routing and a good load balancing when the traffic loads are high. Multi-path routing is a routing where a network has many possible routes to reach the receiver end. Comparatively multi-path routing takes over single-path routing in many QoS metrics. Multimedia data like image is transferred through both the routing techniques and found that multi-path is better way for transferring the multimedia data. Multi-path routing uses specific protocols like MMSPEED to send the data in the network. MMSPEED utilized to provide end-to-end QoS⁴. This uses multiple speed layers for the fast delivery of packets. But it again fails to satisfy the energy consumption issues in the network.

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1.1 Multi-Path Routing

Multi-path routing is a routing where a network can find many possible paths to reach the destination. Comparatively multi-path routing takes over single-path routing in many QoS metrics. Multimedia data like image is transferred through both the routing techniques and found that multi-path is better way for transferring the multimedia data. Multi-path routing uses specific protocols like MMSPEED to send the data in the network. MMSPEED are used to provide end-to-end QoS⁵. This protocol uses multiple speed layers for the fast delivery of packets. But it again fails to satisfy the energy consumption issues in the network. Multi-path routing is also helps to get aggregation of bandwidth by splitting data to the same destinations through many paths. The end-to-end delay is decreased and the accuracy is increased. On the other hand, the energy consumption is quite high due to many number of nodes used for the routing. In multi-path routing there are more chances for the redundant packets. This increases the number of packets in the network. It increases the energy consumption. It is necessary to save the energy of the nodes. This also helps to increase the life time of the network. Nowadays, the energy consumption is one of the issues of network which is still able to be achieved effectively⁶. Early, with the help of control techniques in topology is used to reduce of the network size to save energy. But while coming to multi-path routing technique it is not possible to have limited number of nodes. Energy consumption will be more when the load of the network and the traffic in the network path is high.

2. Energy Efficient Routing Scheme for Multi-Path Routing

2.1 Routing Protocol

A routing protocol is one which is about how the communication between the routers takes place and by spreading the information which helps them to choose the routes among the nodes in the network. A routing algorithm will discover the particular route to reach the destination. By this the routers will get the knowledge of the network topology. There are many routing algorithms and many routing protocols were introduced for the development of the sensor networks. Sensor nodes are very small in size and they are constrained with some limited resources. One of the main aims is to implement a protocol in which it must satisfy the network lifetime and also it must have effective energy consumption.

2.2 Classification of Routing Protocol

There are some classifications in the Routing Protocols. They are Data-centric, Hierarchical, Location based and QoS based.

2.3 Data Centric Protocols

There is a major difference between the wireless sensor nodes and the ad hoc networks. Because these two things have numerous amount of sensor nodes, it is difficult to keep corresponding IDs to each and every sensor nodes. Hence, a Data centric routing protocol has implemented. In this routing technique, the nodes will request and gets the response in basics of queries based on the selected region. Flooding is one of the traditional network routing. It does not have any idea about the network topology and the routing algorithm used in the network. Flooding is developed for the networks with multi-hops. In this flooding, if a node receives a packet it will broadcast that packet to all the neighbours present in the network. Because of this there is a chance for the flooding since all the nodes receiving the packets. Implosion is one of the issues in the flooding technique. This technique allows broadcasting, thus results in the duplicate messages which can be send to neighbour nodes. It makes the model not to distribute the data quickly in the network.

2.4 Hierarchical Protocols

There are many disadvantages in data centric like disconnection between the nodes because of the data overload and also in the increase in the density. These can be resolved by making a hierarchical architecture. In this architecture, the nodes are formed in the clusters. The cluster head maintains the interactions between the cluster members. It is one of the energy efficient protocols. It has three elements as Sensor nodes, Base station and Cluster heads. Some of the hierarchical protocols are Power-Efficient Gathering in Sensor Information Systems (PEGASIS), Low-Energy Adaptive Clustering Hierarchy (LEACH).

2.5 Location Based Protocols

This protocol uses the information about the location to help in discovering the routes and maintenance and also in forwarding the data, directional transmission and also helps to avoid the flood in the information in the whole network. Some of the location based protocols are Geographical Energy Aware Routing (GEAR), Geographic Adaptive Fidelity (GAF) and PRADA.

2.6 QoS Based Protocols

The applications related to multimedia require bandwidth in large amount. It is also needed that it must have low tolerant related to jitters, delays and packets. To fulfil these network requirements the resources has to be maintained. Some of the disadvantages of the QoS are global state information maintenance with distance vector protocol incurs huge control overhead. There is also a delay occurs in Queuing and processing delay among the nodes. Core Extraction Distributed Ad Hoc Routing (CEDAR), Predictive Location-Based QoS Routing protocol (PLBQR) and Timed Behavior Protocol (TBP) are some of the single-path and multi-path QoS based protocols.

2.7 Multi-Path Routing with Multimedia Data

Nowadays, multimedia data requires occupies more space in the network. And it is also needed to make the sensor to have efficiency in the energy. From the study, it is observed that with the cluster technique we can able to meet the expecting QoS metrics in the network through multi-path routing.

3. Proposed Model

The previous system is tested with multi-path routing technique to transfer the multimedia data. Multi-path routing used a protocol namely MMSPEED (Multi-path and Multi-speed) to send those data in many path⁷. In this technique the data is sent with three scenarios. For example if the image is a data, the image is sent with three scenarios. In the first phase, whole data packets are set as first preferences. The second phase, the main parts of the multimedia data are set as high preferences and the other parts of the image are set to be less preference. In the third phase, all the parts of the data are set to less preference. After the evaluations in performance such as prioritization, quality estimation of link and various path selections we came to a conclusion that multi-path routing is prioritized than single path routing. But this routing cannot able to satisfy during high loads traffic in average delay and energy consumption of nodes. The block diagram is given in Figure 1. Wireless Multimedia Sensor networks contain low power sensor nodes. It is also need to make the nodes as energy efficient one. The life time of the network is more important. Clustering is one of the techniques which can be implemented in the

multi-path routing to send the multimedia data⁸. It will reduce the energy consumption of the nodes. In this clustering technique we are giving responsibility to the base station (sink)⁹. A protocol called Cluster base Multipath Routing Protocol is to be implemented to minimize the traffic loads and power used by the network¹⁰. Here, the important sectors of the image will be sent in the packets. It has three phases namely Neighbour discovery, Cluster head formation and data transmission. Neighbour discovery will identify the nearby sensors which were located. Then they will make the clustering of nodes and they will initialize the cluster. After these processes the data transmission will take place.

4. Performance Metrics and Results

This section focuses on the performance of the routing. Here the cluster is created and the multi-media data is sent across the network. The simulation work is done in Omnet++ 4.2 with some packages of Castalia, Video-sensor network, inet.

4.1 Deploying the Sensors

First the number of sensors must be deployed in the area respectively shown in Figure 2. The sensors should be deployed in a way that it can be able to communicate with each other. The sensors will be employed nearby each other in-order to send and receive the data among themselves. Then the handle message will be sent among them to make sure the data

4.2 Formation of Clusters

Cluster head must be initialized within the cluster in Figure 3. Any number of cluster heads can be created but the cluster head must not be neighbour to each other. The cluster heads should have at least some nodes. After creating the cluster the message packets will be sent within the

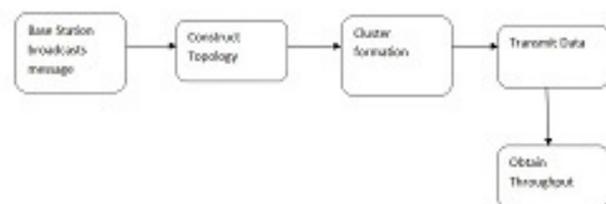


Figure 1. Block diagram.

cluster for the reach ability of the data. Once the data are transferred among the cluster then the data or message will be discarded within the cluster.

4.3 Data Transmission

After the formation of the cluster the data will be transmitted and it is shown in the Figure 4. The multimedia data is high in memory. Here the multimedia data will be sent according to the priority. First the important part of the multimedia data will be transferred first in the network with full priority. It helps to have a good reach ability of the multimedia in the sensor networks. Since it is sent in the cluster it will make the sensor to have good energy efficiency in the network.

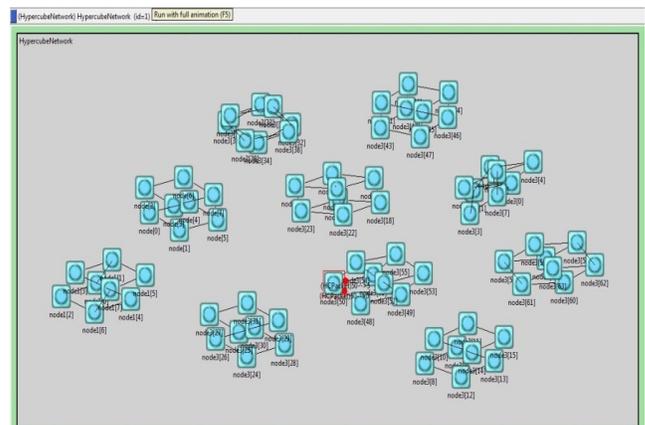


Figure 4. Data transmission.



Figure 2. Deploying sensors.

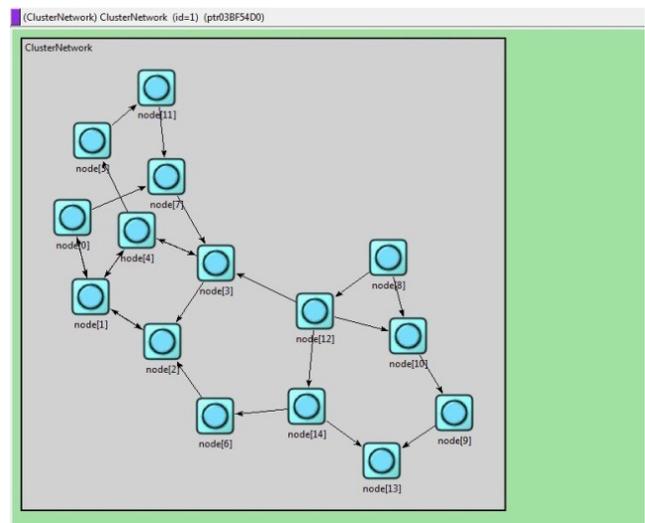


Figure 5. Reformation of sensors.

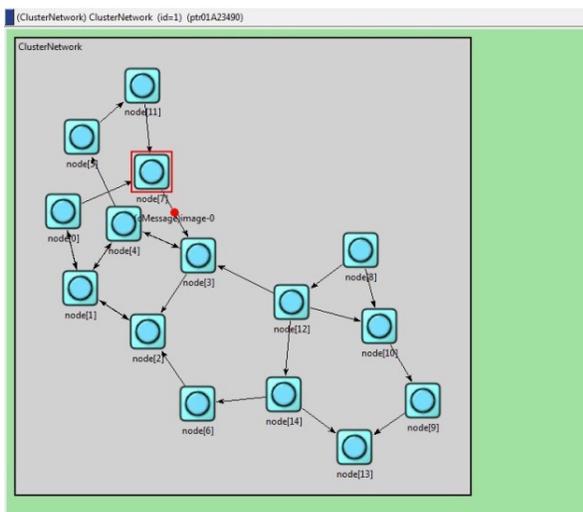


Figure 3. Formations of clusters.

4.4 Reformation of Clusters

The data will be sent through the network to reach the destination. Due to some failures there is a chance in the loss of data. During that time the nodes will reform again and the re-clustering will take place in the network. This again will initialize the cluster head and the data will be transmitted again in the sensor network is shown in Figure 5.

5. Conclusion

Wireless Multimedia Sensor Network is one which is used to send the multimedia data. It should be transferred with a high throughput, with good reliability, less error rates and also it must help to decrease the energy consumption of the sensor nodes. Hence, using this technique it is

expected to achieve these metrics. It is said that multi-path routing cannot be able to satisfy during heavy traffic in the network. By using this clustering technique the nodes can send the data fast among the clusters. This will reduce the loads of the sensor nodes. It also helps in increase in energy consumption of sensors. In future it can be done with live video streaming and also with videos.

6. References

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