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An Efficient Routing Algorithm (MASH) in Mesh Networks Using DBVM

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ABSTRACT

In this modern world, there is more development in the field of mesh in WSNs. The interconnection of the network nodes, computer and other devices (i.e.. interconnected with one another) is called the mesh topology. Each and every node has a capability to sends its own signals as well as relays data from other nodes also. Every node is connected to each and every node in the network is known as a true topology of mesh. The wireless networks are widely applying this topology. In this type of mesh topology, the technique of routing or flooding is applied. The concurrent transmission of data from various devices is its main advantage. The high traffic is resisted by this mesh topology. The data transmission gets struck, because there is an option for transmission even if one of the node goes wrong (i.e. fails). In the absence of other nodes, the alteration and enlargement in the mesh topology can be performed. In this research paper, we proposed a new algorithm named as optimized mash routing algorithm (OMRA). we proposes a new topology structure for mesh wireless sensor network for before sending packets, this process helps to make a better way to sending packets and It reduces a Load versus energy oriented routing issues and data loss. It will give a better result compared with Traditional routing protocols. Through this model, from source to destination it firstly focuses on dynamic bird view model (DBVM). From the above view, we are able to get the distance and get the classification of routes which is safer in analyzing by throughput, bandwidth and node behavior. From that view it gives a clear picture in identifying the ideal route by using the behavior of nodes where as it makes more effective in reaching the destination. In addition, it also reduces the data loss and propagation delay.

Keywords: *Optimization of clustering, WSN (Wireless sensor networks), independent dominating set, bird view model.*

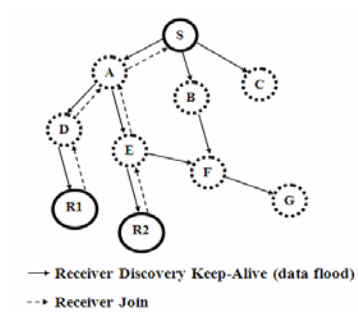
1. LITERATURE REVIEW

In this paper, we analyzed the multicast routing protocols in wireless sensor networks. ADMR (Adaptive Demand-Driven Multicast Routing Protocol) and ODMRP (On-Demand Multicast Routing Protocol).

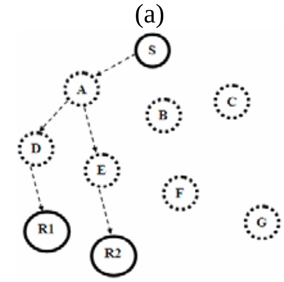
1.1 ADMR (Adaptive Demand-Driven Multicast Routing Protocol)

ADMR [2] is an on-demand source-based protocol. By using the shortest-delay path from the sender node to the receiver members, ADMR uses packet forwarding techniques by using a sequence number to uniquely identify the packets and is generated as a count of all flooded ADMR packets.

In Figure 2, when sender node wants to send data packet to the multicast group, it starts to broadcast the data packet toward the network. Then an ADMR header is added to the data packet and a network flood flag is set. Using this flag will make the data packet to be sent to each node in the network. Otherwise, a tree flood flag is set, where the packet is only sent to each node in the multicast tree. In the form of a Receiver Join packet, the sender node will buffer any subsequent data packets until it receives a right response, from a potential multicast receiver.



(a)



(b)

Fig 1: ADMR Protocol: (a) Route Discovery, (b) The path Selection.

When a node wants to join to the group, it establishes sending join message named *Receiver Join* to makes its way from the receiver node to the sender;

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intermediate routers mark in their routing tables the last hop of the *Receiver Join*. During the original network flood, nodes mark the last hop of the advertisements as their upstream node. This will give the ability to nodes to create multicast routes. Multicast sources continue to flood periodically the data packet to the specific network. When the application layer at the sender stops sending data packets, the sender sends a *Keep-Alive* message to the multicast tree. Sending a *Multicast- Solicitation* message to the entire network, receiver nodes can join a multicast group. If the node has received a lot of *Multicast-Solicitation* messages within a short period of time, group sender replies by advancing the time of the next network flood.

Otherwise, it replies by *Keep-Alive* message down the reverse path. A receiver node, receiving a reply from the sender node, responds with a *Receiver-Join* message, therefore completing the three way handshake and activating the multicast routes. This concept is responsible for controlling the forwarding tree for link breaks and fixing the breaking links. Maintenance process starts after the multicast forwarding state is configured. This process will continue as long as the sender application generates packets and there are receivers in the network interested in receiving these packets. ADMR header is the inter-packet time at which new packets should be expected from this sender S for this group G [11]. This field in the ADMR header is initialized by S for each packet originated. This inter packet time is used by members of the multicast forwarding tree to adaptively detect disconnection in the forwarding tree (e.g. Link Breaks), as well as inactive periods during which the source application does not send data temporarily and it will be more resource-efficient to expire the multicast state. When some node C detects broken links, it starts a local maintenance to repair the multicast forwarding tree. At the beginning node C start to sends a *Repair Notification* packet to the other nodes in the sub-tree node C in the multicast distribution tree for group G and sender S. When node sends the repair notification packet, node C will waits for a period of time to start sending REPAIR_DELAY before starting its maintenance proceeding.

1.2 ODMRP (On-Demand Multicast Routing Protocol)

ODMRP is an on-demand mesh based, besides it is a multicast routing protocol, ODMRP protocol can make use of unicast technique to send multicast data packet form the sender nodes toward the receivers in the multicast group. To start sending multicast data packets, ODMRP uses two kinds of control messages: join-query and join-replay, if there is nodes wants to join to the multicast group, it uses join-query. Using of join-reply will be activated when the receiver node accept to receive the multicast data packet. In ODMRP protocol, each source floods a join request *Join-Req.* message periodically in the multicast group. A node receives the *Join-Req.* message uses store the greatest node ID in a *Routing Table*, then it will rebroadcasts the massage. The process continues until reaching the multicast receiver node. Once the receiver node received the *Join-Req.* message, it will declare its joining by broadcasting *Join-Reply* message to the multicasting group. Figure 2; show the *Join-Reply* mechanism in ODMRP protocol, *S1* and *S2* are source nodes and *R1*, *R2*, and *R3*. While broadcasting join- Reply message, if there is any exist field in the routing table, it will be updated with the new fields.

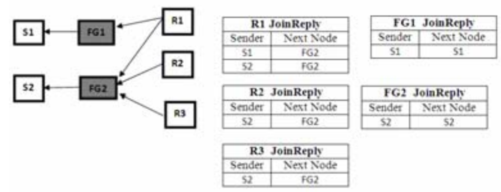

Fig 2: Join- Reply Forwarding in ODMRP.

In Figure 2, a node receiving Join-Reply checks if the next node ID in one of the table's fields equals with its own ID, then it considers itself as a forwarding group (*FG*) node. The reply forwarding process continues until reaching the sender node using the shortest path from building mesh of *FG* nodes.

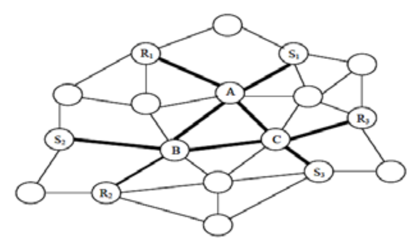

Fig 3: Mesh Configuration in ODMRP.

In Figure 3, there is data transmission between *S1* and *R3*, if node *B* moves the receiver can still receive data through another path via node *C*. ODMRP protocol uses the soft state mesh maintenance approach provides robustness. But this will cause the high expense of control overhead when the packet uses more than one path to reach the multicast receiver node.

2. RELATED WORK

In an area, a wireless sensor nodes set are disseminated in mesh topology wireless sensor network. A fixed resource such as CPU, memory and battery are compiled for the sensor (wireless sensor node). Practical applications such as Smart home (security), smart care, environmental monitoring, automatic manufacturing, and biological detection are in the wireless sensor network (WSN). Maximizing the network lifetime is one of the difficult technical problems and WSN is required to deal with such problem for furnishing the good service. It is

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viewed as an optimization problem in the some literature works. Using distributed algorithm, as an integer linear program the consumption of minimal energy is considered for the coverage problem and the solution is given by this algorithm. For un-clustered the energy consumption is minimized and it is modeled as an integer linear program over the time in WSN.

Due to the shortage of the battery, the lifetime of the nodes may go wrong, when there is change in the sensor network topology. The network of ad-hoc is qualified by this type of development. The distribution of sensors are more dense, the reduction of mobility, the hardware has a lower performance in the mobile ad-hoc network are differ from WSN. The lifetime of the network does not change in the communication routing protocol in the WSN. Sending messages from all sensors or only when an event occurs periodically or continuously is meant for the communications. On such networks the lifetime and performance is the strong impact when the interaction between the network topology and the routing protocol is not independent to each other. The communication may fail due to the poor design of the network topology. There will be wastage in the energy when no well defined routing protocols. In the wireless access medium, the wireless sensor node takes energy about 75%.

The topology of WSN is designed using the graph of communication have some structural properties which is comprised in the cluster-based architecture. As the variation of the independent dominating set problem, the problem in the designing of topology is simulated. The topologies which are having these special properties is computed by means of suggesting heuristics. The suggestion of energy consumption is the two different ways for measuring the topology. The maximum flow is calculated for assessing the energy consumption in the evaluation at the first stage.
The hop average and the number of clusters are the two criteria for measuring the topology at the second stage. There are no explicit communication rules. Each sensors uses the valuable information's about the paths to send messages is furnished by the result of the evaluation.

2.1 WSN (Wireless Sensor Network)

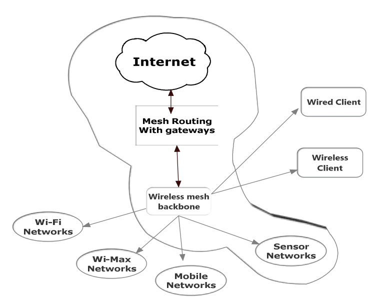
Many new and stimulating applications areas such as monitoring the environment, military, intelligent control, management of the traffic, medical treatment, industry manufacturing is due to the speedy deployment, high sensing, low cost, flexibility, fault tolerance, self organization are the feature of sensor networks. In the architecture of the network WSN's protocols are constructed, (i.e.) Using multiple hops, the sink node is received the data which is send by all the sensor nodes in the flat architecture. For real applications with heterogeneous sensor nodes, large-scale the flat architecture is inapplicable and it should consider the following issues in flat architecture.

a. Between modes, the consumption of energy is unbalance.
b. Robustness and scalability is poor
c. The total failure is due to the failure of the single point.

Owing to above limitation of traditional architecture of WSNs. For endorse the mobility of both sink and nodes, to improve reliability, throughput and scalability of sensor network, our proposed model Optimized Mesh Mash Routing Protocol (OMMRP) along Distributed wireless mobile sensor networks-DWMSNs is designed. The routing in the wireless ad-hoc network and traditional communication is differs in the sensor network by means of the characteristic of routing. There should be suggestion of routing mechanisms for the topology and application of the specific feature of the sensor nodes.

2.2 WMN (Wireless Mesh Network)

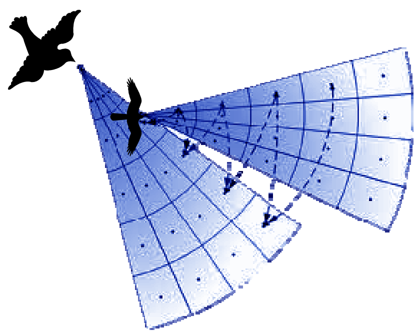
In the recent year, a new architecture of wireless network paid more and more attention is Wireless Mesh Network (WMN). It is the decentralized wireless network, self configured and self organized. The following are the WMN nodes: 1. wandering (mobile) user 2. Router of mesh. The backbone of WMN's is organized by keeping wireless connection and the routers of mesh are automatically established with lower mobility and powerful capacities. Each and every node directly receive and send signal with other node in the network, where the all nodes are interconnected to each other and it is one of the important feature of WMN's. The transmission of the data is more efficient in WMNs because it automatically detects change in the topology and has ability for self adapting when the routing is altered.



Integration of WSN, WMN and an Internet

2.3 Dynamic Bird View Model (DBVM)

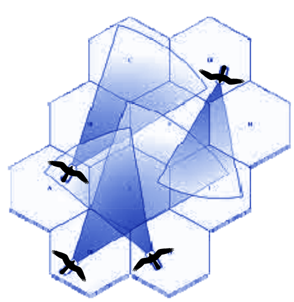
A new bird view model technique for the streaming access points to deals with the uncertainty of node movement and the requirement of seamless service head-off. For each mobile node, like a position of the flying bird, a shape of the virtual fan communication zone is preserved on the direction of the motion. On a particular cell or node, the degree and the volume of communication to be built by the streaming access point of the cell or node is decided by the accumulated virtual illuminance of the bird view and their overlapping area.



The issues in identifying the access points for streaming which is responsible for transmit, the timing and the amount of the data to communicate is solved by the effective and simple by means of the single mechanism called the Bird view model.

2.4 Dynamic Bird View Communication Model

The Bird View communicate model is proposed for create a new mesh routing structure in wireless sensor networks environments. On the direction of the motion of user, a shape of the virtual fan communication zone (bird view) likes the position of the flying bird. The communication SAPs (Service Access Pointer) is chosen by means of the SAPs of the node or cell that is coincided with the zone.



3. PROBLEM STATEMENT

In the architecture of the network the routing is highly concerned. With robustness, scalability the architectural model is not yet determined as well for DWMSN. Mobility is adapted by considering the multiple mobile sink nodes; even DWMSN is lack in the routing efficiency. The above ambitious problems are addressed in this paper by concentrating on the following parts:

a. The synchronization of nodes is required and there should be the adoption of mobility due to the strong mobility of nodes, for the changing of topology dynamically and it is supported by our proposed protocol OMMRP with DWMSN.
b. The lifetime of the sensor network is maximized and mobility assuming is proposed by efficient routing protocol (OMMRP).
c. For experimental monitoring, the architectural model of WSN prototype is planned.

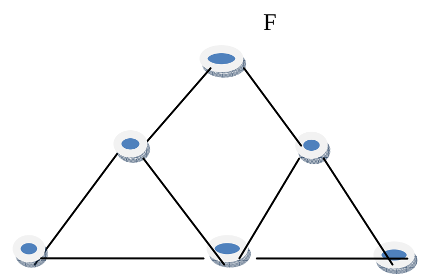
3.1 Energy Optimal Routing

For maintain connectivity or avoiding congestion, the traditional ad-hoc routing algorithms are used when confronted with mobility. The limited energy supply for the network devices are not considered by these algorithms. The routing issue is altered by the limited supply is illustrated in the figure 1 example.

Nodes *B* and *A* first send 50 packets to *B*. Afterwards; *C* sends 100 packets to *F*. The preferred paths are *BEF*, ADF and CEF in the view of the balancing load respectively.

The paths are no longer optimal and they can send only 100 packets due to the energy constrains of the nodes. Surely *E* would have used up 50% of its energy before it can forward packets from *C* to *F*. By choosing the paths BDF, ADF and CEF all the packets could have been delivered in such case. If, instead of *C*, node *D* would have become active, *B* should have used the original path BEF.

4. PROPOSED ARCHITECTURE



4.1 Optimized Mesh Mash Routing Protocol (Efficient Routing Protocol for WSN)

In this proposed process with DWMSN, each node has about M sub nodes and the tree is S levels deep. The total number of nodes is (M^S-1) / (M-1).

The following sample example explains that it is exponential:

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```
                  [NODE (A)]
                   / | \
                  /  |  \
                 /   |   \
                /    |    \
               /     |     \
              /      |      \
             /       |       \
            /        |        \
 [NODE (A1)]  [NODE (A2)] [NODE (A3)]
      / | \
     /  |  \
    /   |   \
   /    |    \
  /     |     \
 A1B1   A1B2   A1B3
```

the total number of nodes for a tree of depth S is (M^(S+1)-

1) / (M-1)... (that is, to the power S+1 rather than just S). Consider our theorem. The above figure explanation is showed as follows:

1 + M^1 + M^2 + ... + M^S = (M^(S+1)-1)/(M-1)
Multiply both sides by (M-1):

(M-1)(1 + M^1 + M^2 + ... + M^S) = M^(S+1)-1.Expand the left side:

M^1 + M^2 + M^3 + ... + M^(S+1) - 1 - M^1 - M^2 - ... - M^S.

All terms M^1 to M^S are cancelled out, which leaves M^(S+1) - 1. The quality is true by our right hand side.

In depth S, the amount of nodes are computed by the following formula: (Given that there are M root nodes) M^S

For every layer, one that needs to do the above is for computing the number of all nodes:

In (1..S) for depth is:

node Count += M ** depth

If there's only 1 root node, subtract 1 from S and add 1 to the total nodes count.

There will be big impact on the number when the amount of leaves is different in one node from the average case. There will be more impact on the further up in the tree.

```
   *           *            *       M ** 1
  ***         ***          ***        M ** 2
*** *** ***   *** *** ***   *** *** ***   M ** 3
```

In this process we proposes a new structure for wsn for before sending packets, this process helps to make a better way to sending packets. It reduces a Load versus energy oriented routing issues and data loss.

4.2 Pseudo Code for OMMRP

The following pseudo code explains the steps involved in the proposed algorithm.

Step #1:

According to the energy, throughput and behavior of the node, the source and three possible nodes are chosen.

Step #2:

Once the routing path is chosen, the efficiency of the routing is increased by means of the bird view model. In bird view model, once the three possible nodes are selected for the routing, it goes like the hierarchal structure. i.e. if the source node is represented by A, then the three nodes are presented by means of A1, A2, A3. Again the node A1, have three nodes and it is denoted by A1B1, A1B2, A1B3 and it goes like this.

Step #3:

In this step, if any one of the three nodes fails, it will go for the next node and checks the node behavior for routing. And it enables the multicast routing; because of acknowledgement facility it prevents data loss and confirmation of transmission of the packets. It presents the dynamic bird view for the whole transmission of the packets from the source node to destination node.

Step #4:

The nodes are enabled depends upon the size of the packet that are using for the transmission in the network. During the transmission, different nodes are selected for the different packet size.

Step #5:

Repeat from step #2 to step #4 for all the remaining packets in the network.

5. SIMULATION ENVIRONMENT

For analysis ODMRP (mesh based multicasting protocol) and ADMR (tree based multicasting protocol) implementation are used. For comparison, the multicasting protocols were chosen from one protocol from that type.

5.1 Experimental Setup

For the simulated time of 200 seconds, the 100 wireless mobile nodes wandering comprised in the simulated environment. For both the protocols (ADMR and ODMRP) it can be substituted identically by giving the

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settings that containing all the movement behavior of the wireless sensor networks in advance. For the two protocols, the setting of same traffic and mobility are used and therefore workload is identical.

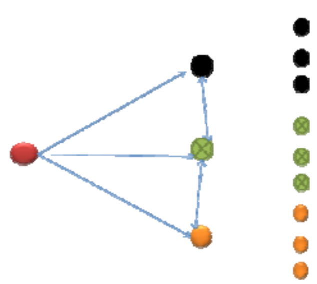
At the commencing of the simulation (1st 30 seconds), a node connects as a multicast member in the group of multicasting and for the entire simulation, it stays as member.

5.2 Performance Metrics

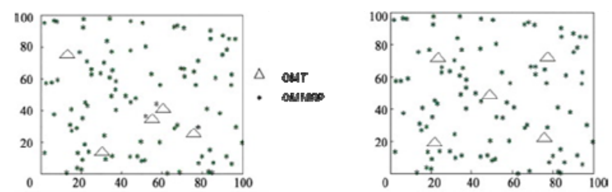
On the basis of the following measures, the performance of ADMR and ODMRP's performance was compared.

- **Packet Delivery Ratio**, from the sender, the total number of packets is sent and the ratio of the multicast data packets received by the destinations. In delivering the data packets to proposed receiver, and the strength of the protocol is demonstrated by this ratio.
- **For delivering per data packet, the Number of data packets is transmitted:** Over the total network, the count of every single transmission of data by every node is called as "Data packets transmitted". The retransmission and finally dropping by the intermediate nodes and this count includes packets transmissions.
- **For delivering per data packet, the Number of control packets are transmitted:** In delivering a packet of data to an meant receiver, the strength in control packets used is showed by means of this measure.
- **For delivering per data packet, the Number of control packets and data packets are transmitted:** In the contention-based link layers, the channel access cost is high and the catching of efficiency of the protocol's channel access is attempts by this measure.

6. RESULT

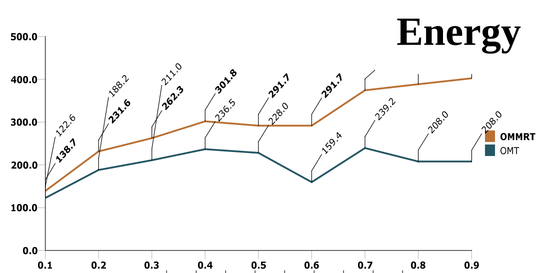


The above diagram shows the result of the bird view model. In mesh topology each and every nodes are interconnected to each other. In first level, there are three possible nodes that covers depend upon the throughput, energy and node behavior from the sink. Likewise, each three nodes further selects the another three nodes and vice versa.



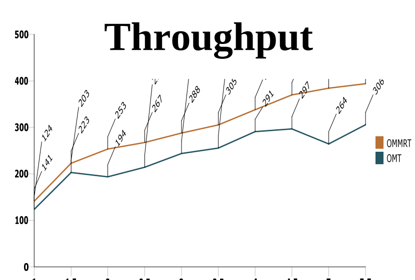
(a) Optimal Mesh Topology (b) Topology of OMMRP

The above graphs show the topology of the mesh and our proposed Optimized Mesh Mash Routing Protocol (OMMRP) [3].



	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
OMMRT	138.7	231.6	262.3	301.8	291.7	291.7	374.3	388.6	402.6
OMT	122.6	188.2	211.0	236.5	228.0	159.4	239.2	208.0	208.0

X-axis and Y-axis of the above graph is Time taken in seconds and Number of packets. The above graph shows the energy level of the OMT and OMMRP according to the delivery of the packets. The tabular column shows that the energy of the nodes in OMMRP is high when compared with the OMT [3].



	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
OMMRT	141	223	253	267	288	305	338	370	384	394
OMT	124	203	194	214	244	256	291	297	264	306

X-axis and Y-axis of the above graph is Time taken in seconds and Number of packets. The above graph shows the throughput of the OMT and OMMRP according to the delivery of the packets from the source to destination in mesh. The tabular column shows that the throughput of the nodes in OMMRP is high when compared with the OMT [3].

7. CONCLUSION

In this paper, we have argued that the mesh topology in wireless sensor network alternation is feasible. We have proposed a new method called Dynamic Bird View Model (DBVM) in mesh topology is used for the transmission of the packets from source to the destination nodes. The transmission is based on the throughput, node behavior and energy of the nodes that are chosen. It prevents the data loss because of its acknowledgement facility i.e. it gives acknowledgement to the source node if any one of the nodes present in the routing is failed. In normal mesh topology network, the transmission from source to destination is confirmed due to the interconnection of nodes with each other. But, the transmission of data in the network does not care about the capacity of the nodes that holds the data. In this type of mesh topology, the throughput, node behavior and energy of the nodes do not considered. So this problem is overcome by introducing the above algorithm in mesh topology in wireless sensor network. Using this topology structure, the transmission of the data in mesh is more efficient when compared to the other topology structure. In future, we can extent this work for cache management in wireless sensor networks to control the dropping of packets and secure issues.

REFERENCES

[1] Canfeng Chen, Jian Ma and Ke Yu "Designing Energy-Efficient Wireless Sensor Networks with Mobile Sinks" in WSW'06 at Sensys'06, October 31, 2006 pp.no 1-5.

[2] Andréa C. Santos, Fatiha Bendali, Jean Mailfert, Christophe Duhamel, Kean-Mean Hou "Heuristics for Designing Energy-efficient Wireless Sensor Network Topologies" in Journal Of Networks, Vol. 4, No. 6, August 2009, pp.no 436-445.

[3] Curt Schurgers and Mani B. Srivastava "Energy Efficient Routing In Wireless Sensor Networks" pp.no 1-5.

[4] Sohrabi, K., Gao, J., Ailawadhi, V., Pottie, G.,"Protocols for Self-Organization of a Wireless Sensor Network" IEEE Personal Communications Mag., Vol.7, No.5, pp.16-27, Oct. 2000.

[5] Rabiner W., Chandrakasan A., Balakrishnan H., "Energy-Efficient Communication Protocol for Wireless Micro sensor Networks" Hawaii International Conference on System Sciences, Maui, HI, pp.10-19, Jan. 2000.

[6] F. L. Lewis "Wireless Sensor Networks" pp.no 1-17.

[7] Ayad Salhieh and Loren Schwiebert "Power Efficient Topologies for Wireless Sensor Networks"

[8] Ian F. Akyildiz, Xudong Wang, Weilin Wang "Wireless mesh networks: a survey" pp.no 445–487.

[9] Chiara Buratti, Andrea Conti, Davide Dardari and Roberto Verdone "An Overview on Wireless Sensor Networks Technology and Evolution" pp.no 6869-6896.

[10] Mohammed R. Baker , M. Ali Akcayol "A Survey of Multicast Routing Protocols in Ad-Hoc Networks" pp.no 451-462.

[11] Jorjeta G. Jetcheva, David B. Johnson "Adaptive Demand-Driven Multicast Routing in Multi-Hop Wireless Ad Hoc Networks" pp.no 33-44.

[12] Sung-Ju Lee, Mario Gerla, and Ching-Chuan Chiang "On-Demand Multicast Routing Protocol" pp.no 1-4.