PAIRWISE DIRECTIONAL PATH DIVERSITY ROUTING BASED ON WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless sensor network consists of a number of sensor nodes connected by wireless links and they are distributed across a geographical area. The nodes can freely move inside the network. The geographical routing is used in the existing system. In geographical routing the 360 degree scope is considered but not effectively used. In this paper, we propose a path diversity routing protocol, which is based on the path of pairwise nodes and the 360 degree scope is satisfied. Thus, path diversity routing increases the packet delivery ratio and energy efficiency.

Keywords:- *Wireless Sensor Network, Path Diversity, Link quality, Multipath Transmission.*

I. INTRODUCTION

Wireless sensor networks are also used for transmitting multimedia data. Video and audio files are transmitted by using wireless multimedia sensor networks. The nodes of the multimedia sensor network contains mini microphone, camera to collect the environmental data. The multimedia sensor networks are also used in the battlefield visual monitoring, safety monitoring and public health care. The wireless multimedia networks do not know about providing the quality of service and reducing end to end delay while meeting bandwidth requirements. Because, processing of multimedia data needs a lot of energy. It also causes high bandwidth and energy consumption.

1.1 Reliability and fault tolerance: Reliability can be improved by 2 ways: The data package can be copied by different routes, and check that if any routes occur fault, can be recovered by other paths. Currently, wireless sensor networks are beginning to be deployed at an accelerated pace. It is not unreasonable to expect that in 10-15 years that the world will be covered with wireless sensor networks with access to them via the Internet. This can be considered as the Internet becoming a physical network. This new technology is exciting with unlimited potential for numerous application areas including environmental, medical, military, transportation, entertainment, crisis management, homeland defense, and smart spaces. Since a wireless sensor network is a distributed real-time system. The most commonly used solutions are contention-based. One general contention-based strategy is for a node which has a message to transmit to test the channel to see if it is busy, if not busy then it transmits, else if busy it waits and tries again later. After colliding, nodes wait random amounts of time trying to avoid re-colliding. If two or more nodes transmit at the same time there is a collision and all the nodes colliding try again later. Many wireless MAC protocols also have a doze mode where nodes not involved with sending or receiving a packet in a given timeframe go into sleep mode to save energy. Messages travel multiple hops it is important to have a high reliability on each link, otherwise the probability of a message transiting the entire network would be unacceptably low. Significant work is being done to identify reliable links using metrics such as received signal strength, link quality index which is based on “errors,” and packet delivery ratio. Significant empirical evidence indicates that packet delivery ratio is the best metric, but it can be expensive to collect.

Video data are split in two streams namely image and audio sub streams. Each stream is given a priority depending on the monitoring context. For that, the authors cite a communication scenario of a fire monitoring application where visual information is more relevant for the application. In this case, the image data should be delivered with minimum transmission delay. Thus, the paths with lower delay are assigned to the higher priority sub-streams, leaving the remaining paths to the lower priority sub streams. [2]Multi hop data forwarding techniques are used for transmission Of data. The route discovery process is used for determining intermediate nodes that should provide a root between the source to destination. To improve the performance load distribution mechanism can be employed and also to distribute the network traffic [2]. [3]Energy consumption of the network includes the transmitting and receiving of energy during simulation. Energy 0can be measured for each successful packet delivery ratio [3].

$$e=E/\eta_{data}$$

The energy consumption can be increased, due to the use of several paths and affects the lifetime of the network. In order to save the energy, the path set with minimum number of paths is chosen as forwarding set [4]. [5] To provide reliability in data delivery, redundancy can be introduced in the form of multiple copies of each packet delivered from source to sink through multiple paths. Each packet header contains the information about the network conditions [5].[6] A novel detection algorithm can be introduced and a reference angle is introduced and denoted by Ɵ. It is also defined by deviation angle. Deviation angles are specified for each individual path’s creation [6]. [7] In HSPREAD system a secret sharing scheme is used to transform secret message into multiple shares. A secret sharing scheme transform secret into N pieces called shadows [7]. [10] Multipath routing is used to establish multiple paths between source and sink pair. It increases the reliability for single flow. It delivers multiple flows in a video sensor node. Video nodes generate redundant packets to increase flexibility for real time video transmissions.

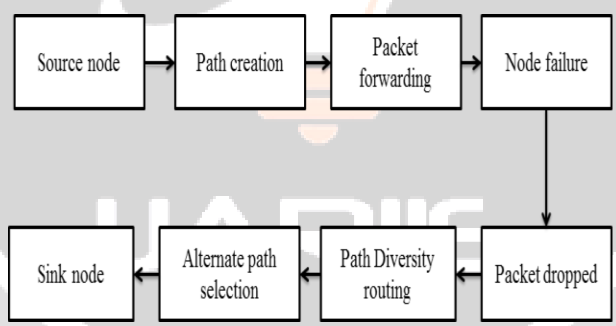


Figure 1.Block Diagram

In figure 1 the source and sink nodes are arranged to send packets within a particular time interval. First the path is created and the packets are forwarded to the destination. If any of the node failure occurred then immediately the packet should be dropped. After that the path diversity routing is used to change the path of the packet to reach destination. The node in which failure occurred is not used for the packet transmission process. The failure node is mentioned by some color to specify its failure. For further transmission the alternate path is selected and packets are transmitted through that path. Finally, the packet reaches the destination within the specified time interval. Here, the packet transmission should be completed in the specified time and before energy of the node is depleted.

II.REACTIVE ROUTING

Many types of reactive routing protocols are available. These protocols have two functions that is route discovery and route maintenance. Route discovery means finding of new routes when they needed. Route maintenance is responsible for the detection of link breaks and repair of the existing routes Here, AODV routing protocol is used to process the nodes and for the packet transmission. AODV is intended for networks that may contain thousand of nodes. Each node maintains a routing table that contains the information of destination node. AODV only maintains the information of next destination, not the entire routing list. Routing table maintains the fields as sequence number, id, hop count, next hop and etc., The message set of the routing table have the route request and reply messages. Using of sequence number leads to avoid the counting to infinity problem. Route request carries a time to live value that states about the message forwarded to number of hops. This protocol creates routes when the nodes are requested by source. If there is no packet transmission is takes place, source node stops its processing. Adhoc on demand distance vector supports both unicast and multicast. The failure of the route also found and route error message is delivered to the source.

III.PATH DIVERSITY ROUTING

In path diversity routing threshold value is set to certain limit. That is the packet size should satisfy the threshold value which should be 45 or within 45. Collection of neighbor nodes are assigned to λ. If the threshold value is less than 45 then packets are delivered to destination. Otherwise the packets contain duplicate values. A route is considered found when the RREQ message reaches either the destination itself, or an intermediate node with a valid route entry for the destination.

Algorithm:

Collection of neighbor nodes λ_{ix}

Source Node Initialization λS_{ix}

Attach Path Routing Discovery η_{th}

{

$\lambda_{ix} = \lambda S_{ix} + \eta_{th}$

}

Packets and Packet ID Denoted P_{ix}

For (P_{ix} =0; P_{ix} <η_{th}; P_{ix} ++)

If (P_{ix}<n)

{

Packets are delivered into Destination

}

Else

{

Packet dropping in particular path

}

Threshold value allocation packet transmissions T_{ix}

If($T_{ix} \leq 45$)

{

$P_{ix} \longrightarrow$ Packets are delivered to Destination

Else if

$P_{ix} \longrightarrow$ are contained as Duplicate Packet

}

End if

End process

IV. RELATED WORK

The sending angle of the ideal coordinates are computed. [1] The source cooperative selection algorithm calculates the ideal coordinates for the source node. The neighbors of the source node are described as N and the distance from the source to coordinates are denoted by d. The time chosen for processing of each node N is denoted by C. That defines the count for the time. Here, geographical location of each node should known by the source and it selects the coordinates by the location. Because the node should be available for the required time. If it is unavailable the node does not present in the coverage area. So, the source can't be able to send packets frequently to the destination due to the unavailability of coordinates. The unavailability of neighbour nodes leads to time delay and complexity in the transmission of packets [1].

Geographic routing is a routing scheme which forwards packets based on the locations of the network nodes. [10] In most position-based routing approaches, the minimum information of a node must have to make useful routing decisions is its position. the position of its neighbors , and the final destination's location. The popular method of forwarding is greedy forwarding. Greedy perimeter stateless routing method is used to make the greedy routing decisions. DGR spreads the path in all directions in the proximity of the source and sink. This method is mainly proposed for increasing the reliability and the fastest transmission.

Using concurrent multiple paths in DGR also has an important limitation; i.e., DGR does not work well when a number of VNs send video to the sink simultaneously, as multiple intersecting paths interfere with each other severely. However, due to the limited bandwidth of a VSN, it is reasonable to assume that at any time instance only one VN sends video to the sink. In fact, due to the complexity and higher power consumption of VNs, we expect that among the large number of sensor nodes in a VSN, only a small number of them are VNs, while the rest are less capable low-cost sensor nodes that function as relays, which also have lower power consumption than the VNs. The direction for the nodes should be in the limitation and geographical location also needed to developed[10].

Each node obtains some information regarding its neighbours and broadcasts a fixed number of control packets and records the number of successfully received packets from its neighbors. ETX metric is used to analyse the cost function. Sink node sets its cost to zero and broadcasts this cost to its neighbors. When a node receives this packet, it retrieves the contained cost and saves that as the accumulated ETX cost of the neighbour node to the sink. Then, it updates the cost contained in the packet by adding this cost to the link cos t of the node from which this packet has been received. Load balancing algorithms cannot provide significant improvement in network throughput. This issue is mainly referred to as "route coupling" and severely limits the performance of multipath routing protocols. In sensor networks, wireless channel can have significant channel error. Hence the probability of a packet reaching the sink can be low if the number of hops from source to sink is high. The increase in this probability by introducing redundancy in packets by forwarding copies of packets along multiple paths. Each receiving node has to ascertain the reliability that the source expects it to provide from itself to sink. AOMDV-inspired multipath route protocol is [12] a kind of protocol cross route layer and MAC layer and its establishment of path is similar to that of AOMDV.

AODV is tailored to the use in mobile ad hoc networks and always keeps the freshest route to every destination. A node receiving a path advertisement for a given destination node checks whether the advertisement provides a higher destination. Sequence number, or if it provides an equal destination sequence number and a shorter path to the destination. If it does, the current entry for this destination is deleted and the packet source is taken as new next node towards the destination node. As AODV has been designed for use in mobile ad-hoc networks, in which nodes move in and out of the transmission range of each other, the sequence number condition ensures that a node always uses the path known to be the freshest one.

It uses different route table management strategies to build path with optimal hop to the sink, adds the delay time into route table, and takes nodes of middle nodes with less delay time as next node. Many high-energy gateway nodes are deployed around the sink and each source node first builds the shortest path with the gateway node. At the stage of building path, the shortest path from source to the gateway node is first built. MCMP introduces data redundancy by copying multipath and copies of data to sink. Energy constrained multipath routing is the extended vision of MCMP and it introduces energy optimization problem. Neighbour nodes are selected in paths according to distance. Considering energy efficiency of link, ECMP takes smaller neighbour point set.

Multipath routing protocols are intended to increase network lifetime via balancing energy consumption throughout the network [13][14]. To this aim, these protocols utilize load-balancing algorithms to distribute traffic over multiple paths. Although, energy related issues are considered in protocol design, unfortunately, wireless link properties and their effects on performance are ignored. Therefore, load balancing algorithms cannot provide significant improvement in network throughput. This issue is mainly referred to as “route coupling” and severely limits the performance of multipath routing protocols.

V.EXPERIMENTAL RESULTS

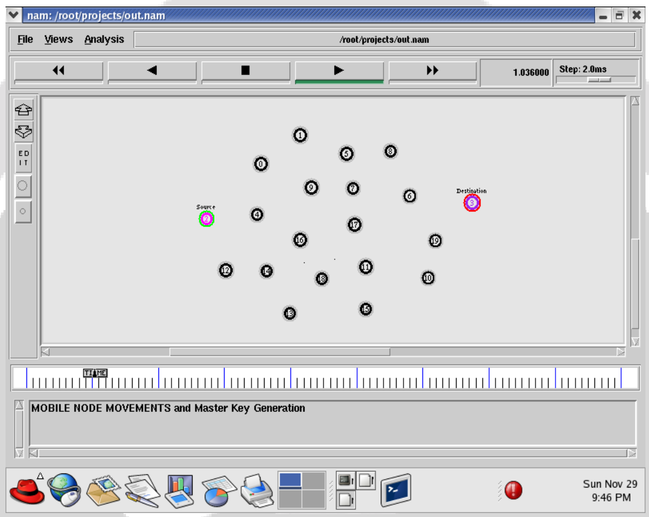


Figure 2.Node deployment

First the nodes are arranged and the source and destination nodes are mentioned. The packets are transmitted from source to destination. Initially the source and destination nodes are mentioned by some color.

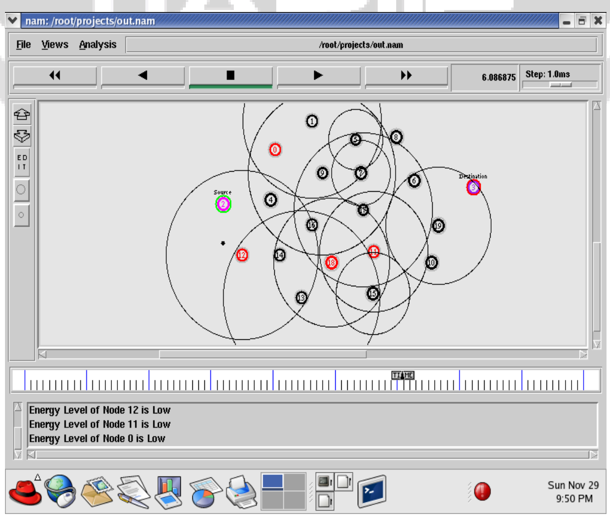
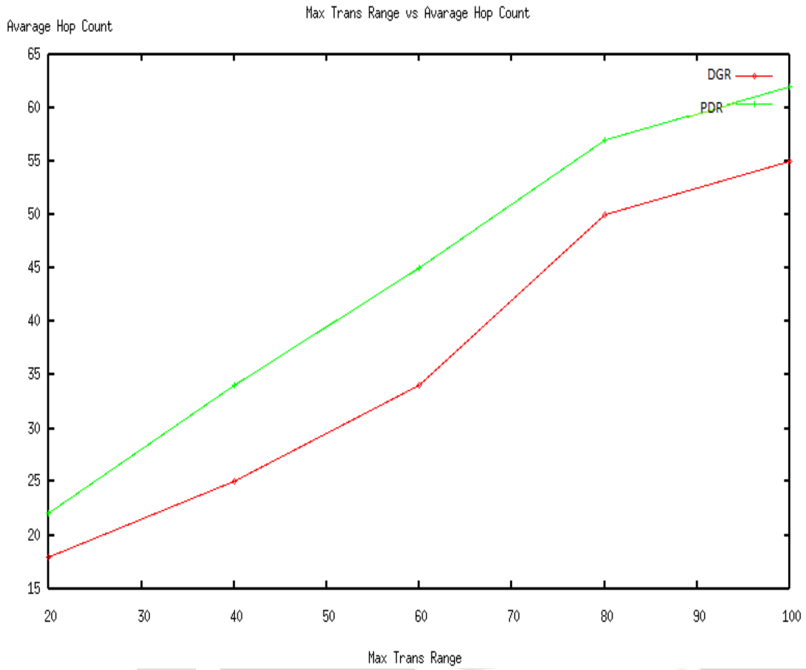


Figure 3.Node failure

The packets are transmitted from the source to destination and the nodes with low energy are mentioned. When the energy of node is low, the packet is dropped and alternate path is selected to reach destination.

VI. PERFORMANCE ANALYSIS



VII. CONCLUSION

Set of nodes deployment and random path was chosen, if the path is failure and choose alternate path immediately. So this process done and the time delay were reduced. Energy level low nodes was identified and mentioned. As a new addition to the cooperative forwarding design space in WSNs/IWSNs, route discovery and cooperative forwarding scheme are also introduced. A route discovery phase introduced to the biased back off scheme, to find the robust path. That provide more cooperative forwarding opportunities. Data packets are greedily progressed toward the destination with the robust guided path and it does not needs any location information. Thus Enhanced R3E remarkably increases the packet delivery ratio, while maintaining high energy efficiency and low delivery latency.

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