International Journal of Advanced Information Science and Technology (IJAIST) ISSN: 2319:2682
Vol.4, No.1, January 2015 DOI:10.15693/ijaist/2015.v4i2.278-284

An Energy Aware Reliable Reactive Routing For Wireless Sensor Network

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Abstract— **Providing reliable and efficient communication under fading channels is one of the major technical challenges in Wireless Sensor Networks (WSNs), especially in Industrial WSNs (IWSNs) with dynamic and harsh environments. Proposed system presents the Reliable Reactive Routing Enhancement (R3E) to increase the resilience to link dynamics for WSNs/IWSNs. R3E is designed to enhance existing reactive routing protocols to provide reliable and energy-efficient packet delivery against the unreliable wireless links by utilizing the local path diversity. Proposed a backoff scheme during the route discovery phase to find a robust guide path, which can provide more cooperative forwarding opportunities and reduces the time delay, using the max- min algorithm energy efficient is increased.**

Keywords— Wireless Sensor Networks, Routing Protocols, Energy Efficient Protocols,DSR

I. INTRODUCTION

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver_with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvasting**.** A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created.

The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

Recent technological advancements in micro electronics and wireless communication technologies have enabled manufacturing of small, low cost, battery operated and multifunctional sensor nodes. These sensor nodes measure ambient condition in the surrounding environment that can be processed to reveal the characteristics of the phenomena occurring at the location where the sensor nodes are deployed.. Each sensor node in WSN is capable of communicating with each other and the base station for the purpose of data integration and dissemination. WSN are used mainly in military, civilian and for industrial applications. WSNs applications in the military field include battlefield surveillance, intrusion detection, target field and imaging. However, WSN are now being used in many civilian application areas too, including environment and habitat monitoring, health applications, home automation and traffic control. Traditional wireless communication networks like Mobile Ad hoc Networks differs from WSN. WSN have unique characteristics such as denser level of node deployment, higher unreliability of sensor nodes and severe energy, computation and storage constraints which present many challenges in the development and application of WSN.

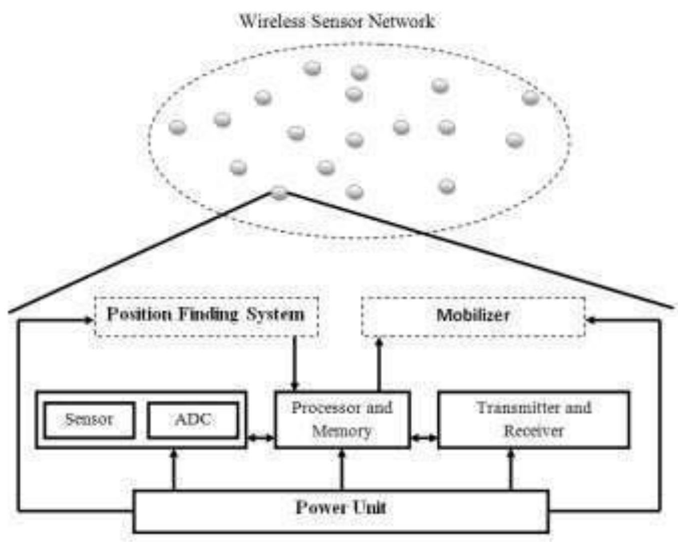

Figure 1: Wireless sensor network

II. RELATED WORKS

A. Ad Hoc On-Demand Distance Vector Routing (AODV)

AODV discovers routes on an as needed basis via a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information. It uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers. An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets. These nodes are notified with RERR packets when the next-hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, RERR packets in AODV are intended to inform all sources using a link when a failure occurs. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves.

B. Dynamic Source Routing (DSR)

DCR is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.Determining source routes requires accumulating the address of each device between the source and destination during route discovery. The accumulated path information is cached by nodes processing the route discovery packets. The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPv6. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. All aspects of the protocol operate entirely on-demand, allowing the routing packet overhead of DSR to scale automatically to only that needed to react to changes in the routes currently in use .The key distinguishing feature of DSR is the use of source routing. That is, the sender knows the complete hop - by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by flooding the network with route request (RREQ)

C. Destination -Sequenced Distance - Vector (DSDV)

The Destination-Sequenced Distance-Vector Routing Algorithm is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements. Every mobile station maintains a routing table that lists all available destinations, the number of hops to reach the destination and the sequence number assigned by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. The stations periodically transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent.

D.MAC Protocol

The MAC sub -layer provides addressing and channel access control mechanisms that make it possible for several terminals or network nodes to communicate within a multiple access network that incorporates a shared medium, e.g .Ethernet. The hardware that implements the MAC is referred to as a media access controller. The MAC sub layer acts as an interface between the logical link control (LLC) sub layer and the network's physical layer.

III. PROPOSED WORK

The energy efficient effect of route discovery on the cooperative forwarding performance, and combine the solutions to reliable route discovery and efficient cooperative forwarding problems.Proposed system uses energy aware reliable path by implementing max-min algorithm for energy awareness and Back-off scheme for Creating virtual path.Proposed Max-min algorithm provide energy aware routing by considering residual energy of the node.A robust virtual path that can provide more cooperative forwarding opportunities with a low overhead in routing, which not only implements the forward path setup in reactive routing, but also facilitates cooperative forwarding along the discovered path

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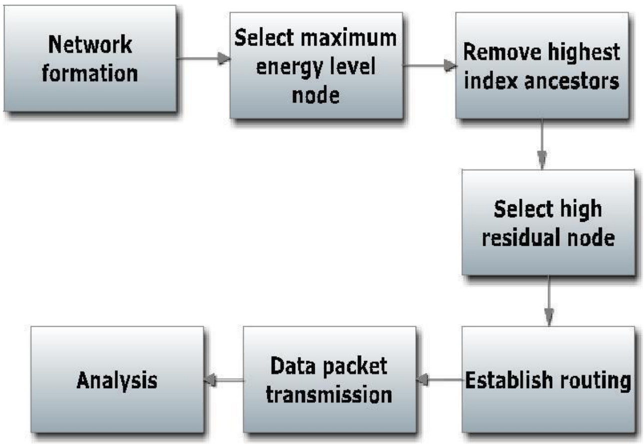

Figure 2: Block diagram

A. Network Formation

Networks are formed with the given range of the sensors. Nodes are grouped automatically depends upon their radio waves Agents are formed for group registration.

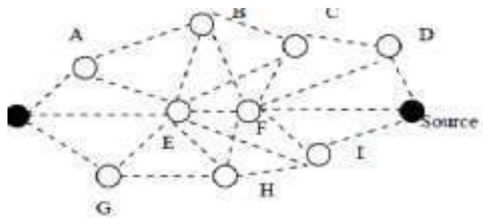

Figure 3: Network connectivity

B. Select Maximum Energy Value

In searching for the longest path need to record the energy levels of each state. We define a function, min (), to prune invalid energy levels from a set of associated n energy levels. The energy levels produced by this function are invalid because strictly lower energy levels cannot produce a longer lifetime. These energy levels are discarded. In order to reduce the complexity, we select the energy level that has the largest minimum value in the tuple as the associated energy level of each state.

C. Remove High Indexed Ancestors

We assign a switching probability, P_{switch} , to each backbone node. At the end of each round, backbone nodes switch statuses according to this probability. This probability is related to the residual energy of the backbone node and its h-hop neighbors. Er is the residual energy of the backbone node, and Er is the mean of the residual energy of its h-hop neighbors. The system presents the change of switching probability with the timeThe rationale is that the probability rapidly increases with the time when the residual energy of the sensor nodes in the h-hop scope is lower

Backbone nodes with lower energy supplies are more ―eager‖ to switch statuses, which helps balance the energy consumption of sensor nodesThere is a threshold ET to stop the replacement when the residual energy is low; replacement becomes too expensive when there is not much energy left in the sensor nodes.

D. Select High Residual Node

The mean of the residual energy of h-hop neighbors is obtained from the information collected from neighbors up to h-hop away, as shown in the pseudo code of Algorithm. The parameter h trades overhead for efficiency. The larger h is, the better the obtained results can be. When the residual energy of the backbone node is greater than the mean of its neighbors, the switching probability is also set to 0.

A backbone node that decides to switch broadcasts a message to ―hold‖ h-hop neighbors, which keeps them awake for a longer time in order to complete the replacementThe backbone node uses distributed algorithms, find its replacement sensor nodes.

E. Energy Aware Routing

We consider a network of *static* (e.g. immobile) energy constrained sensors that are deployed over a flat region with each node knowing its own location. Assume that all nodes in the network are assigned with a unique ID and all nodes are participating in the network and forward the given data. Additionally, these sensor nodes have limited processing power, storage and energy, while the sink nodes have powerful resources to perform any tasks or communicate with the sensor nodes. To allow an increase in the network lifetime additional mechanisms are done in Routing protocols to verify other parameters beyond the hop count that accept a more intelligent route establishment. The energy efficient routing algorithmproposed is used for making a decision on whichneighbor a sensor node should forward the datamessage to. A node is selected to forward the databased on its residual energy level and signal strength.

Ideally, the greater the energy in the node and fartherthe node from the previous one, is the more likely tobe selected as the next hop. The nodes which are not selected in this process will move to the sleep state in order to conserve power. The communication is assumed to be bidirectional and symmetric. The protocol replies with a complete route from the source node to the sink quickly, and prepares many route paths to balance the energy of each node. It also enables intermediate nodes to aggregate all the received packets during a short period time and transmit only one aggregated packet to the following node.

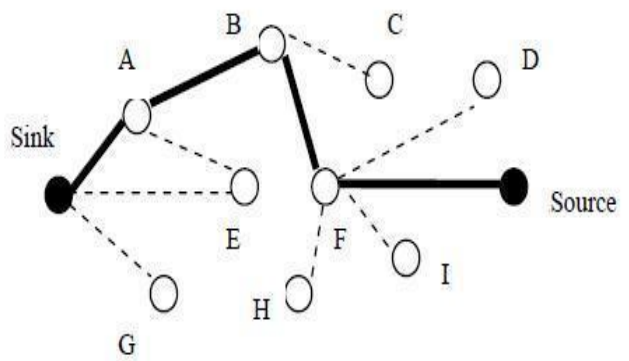

Figure 4 : Path selected in energy aware routing

IV. PROPOSED TECHNIQUES

Proposed system uses energy aware reliable path by implementing max-min algorithm for energy awareness. This algorithm provide energy aware routing by considering residual energy of the node. Proposed system uses a Back-off scheme for Creating virtual path. At the time of link failure ,it will automatically chooses the alternate path to provide a reliable transaction.

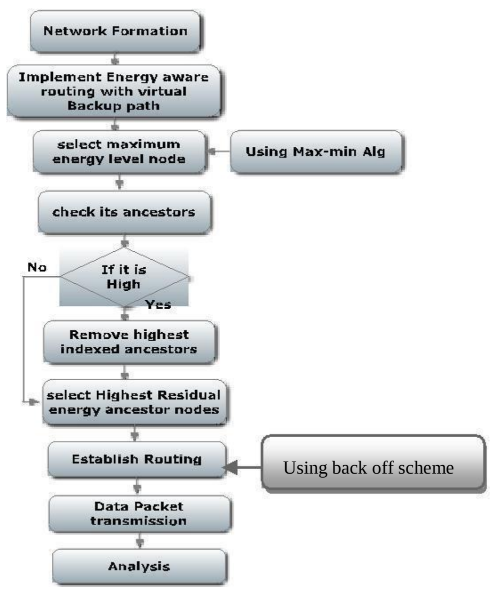

Figure 5: Flow diagram

ALGORITHM
Virtual backpressure and max-min algorithm:

1: int *CUR ROUND Ã* 0;
2: repeat
3: for each state *S* do
4: Get the associated energy levels of *S*;
5: Prune the resultant energy levels using the *min*() function;
6: Select the energy level with the maximal minimum energy value.
7: Set *S*'s energy level to the energy level with the maximum summation among the resultant energy levels;
8: end for
9: *CUR ROUND Ã CUR ROUND* + 1;
10: until All the energy levels of the states in *CUR ROUND* are zero;
11: Return the schedule represented by the path ending in *CUR ROUND*

V. PERFORMANCE ANALYSIS

Theoretical analyses and simulation studies shoes that the proposed scheme is superior to the existing techniques. Basically the comparison is made in between the power consumption of network with and without using the energy efficient routing power management method. The result can be shown by using NS2 simulator the performance is evaluated by considering the QoS parameters like data rate, packet loss ratio, through put, delay, energy.

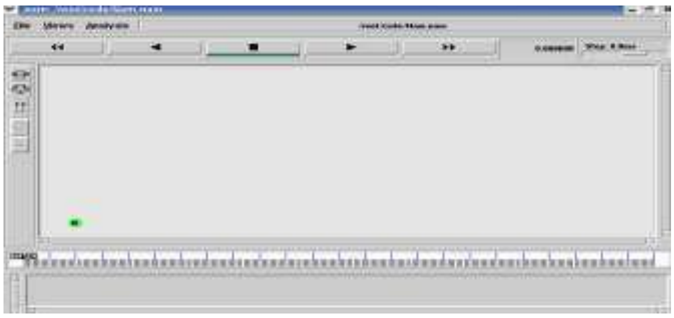

Figure 6

Fig 6 shows that Network formation hypotheses are tested by using either a dynamic model with an increasing network size or by making an agent-based model to determine which network structure is the equilibrium in a fixed-size network.

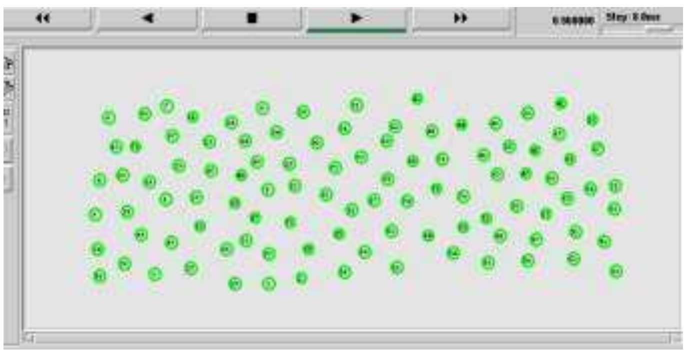

Figure 7

Fig 7 shows that Networks are formed with the given range of the sensors. Nodes are grouped automatically depends upon their radio waves Agents are formed for group registration.

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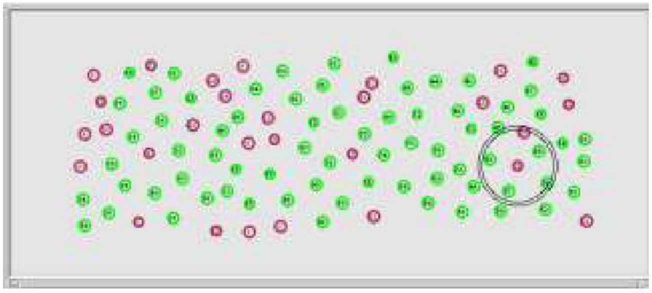

Figure 8

Fig 8 shows The Router Discovery Protocol is an IETF standard protocol used to inform hosts of the existence of routers. It is intended to be used instead of having hosts wire tap routing protocols such as RIP. It is used in place of, or in addition to, statically configured default routes in hosts.The protocol is split into two portions, the server portion which runs on routers, and the client portion that runs on hosts.

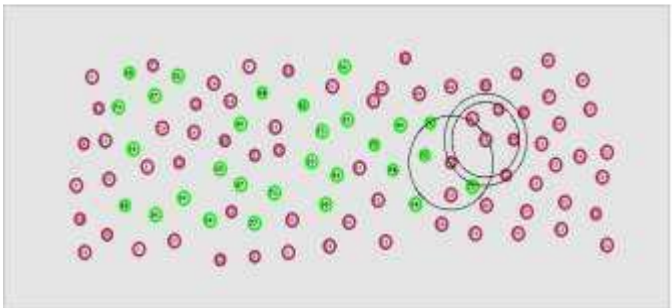

Figure 9

Fig 9 shows that the request is send to each node individually and the node having sufficient energy will send the acknowledgement to the source node.If it find minimum energy node it will discard the current node for route seletion.

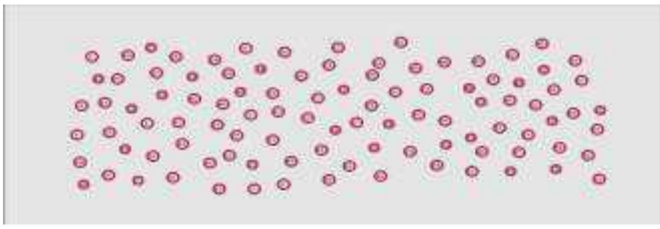

Figure 10

This figure shows that each node receives the request from the source node and it will send packets to establish the path with maximum energy.

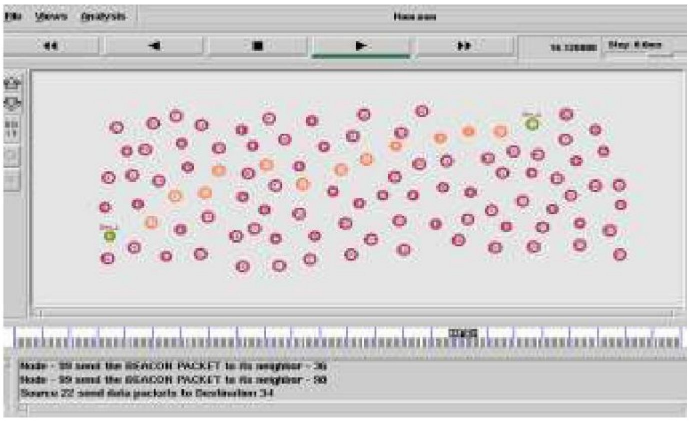

Figure 11

Figure 11 shows that the route establishment has been obtained in this figure.Here ,the strongest path with maximum energy level is indicated in orange colour.

VI .RESULTS

A.Throught:

In figure12 we are comparing the existing and proposed system, regarding the throughput.we have sucessfully achieved the maximum throughput that packet ratio is high

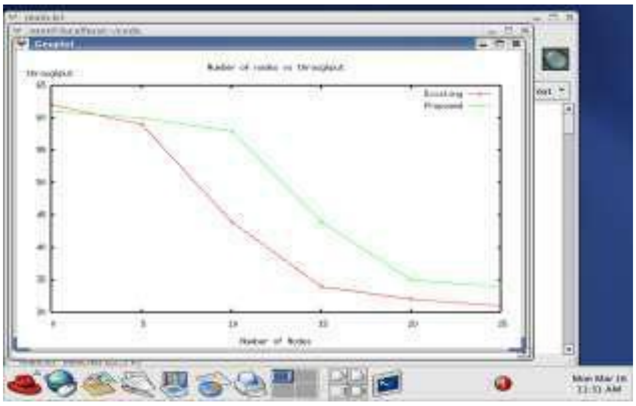

Figure 12: Number of nodes vs Throughput

B.Delay:

Figure 13 shows that delay has been decreased as compared to the existing system.The retransmation of the data is also reduced

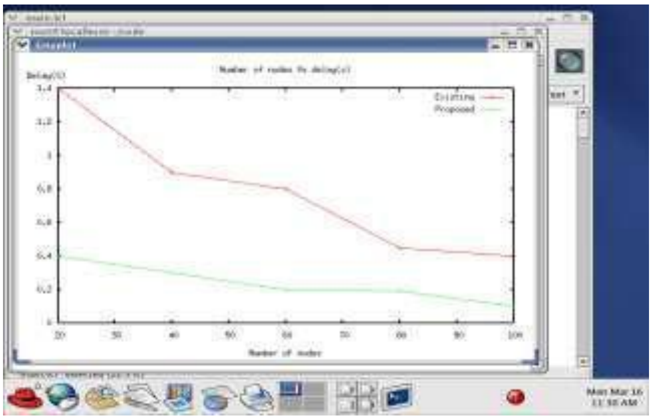

Figure 13:number of nodes vs delay(s)

c.Efficient Energy:

fig 15 shows that the energy is increased for reliable routing using the energy aware routing protocol and the nodes has the sufficient energy for the data transmission

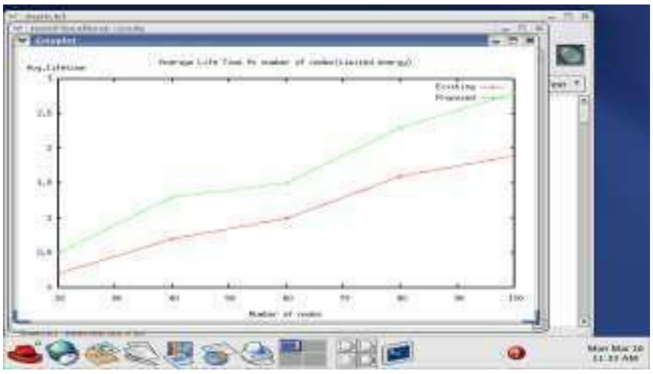

Figure 14:average life time vs number of nodes(limited energy)

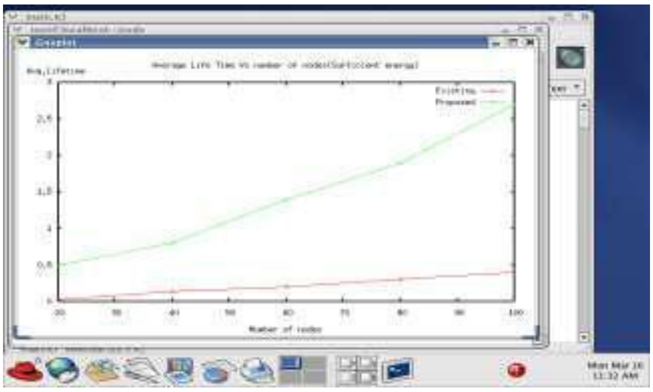

Figure 15:.average life time vs number of nodes (sufficient energy)

VI . CONCLUSION

Proposed routing scheme in WSNs/IWSNs to provide reliable and energy-efficient packet delivery against the unreliable wireless links. Introduced a biased back-off scheme in the route discovery phase to find a robust virtual path with low overhead. Without utilizing the location information, data packets can still be greedily progressed toward the destination along the virtual path. Proposed scheme provides very close routing performance to the geographic opportunistic routing protocol. Extended AODV with Routing scheme to demonstrate its effectiveness and feasibility. Simulation results shows that, Proposed system effectively improve robustness, end-to-end energy efficiency and latency.

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