Conditional Monitoring using Reliable Reactive Routing Enhancement in IWSN

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***Abstract*- The use of reactive routing protocol in an efficient manner to safeguard the routing in Industrial Wireless Networks (IWSNs) can provide reliable and very efficient communication even in the fading channels. The channel fading is considered to be one of the most challenging factor in routing process. The use of Reliable Reactive Routing Enhancement (R3E) in condition monitoring can increase the link dynamics which is playing a vital role in IWSNs enhancing the existing reactive routing protocol. The robust guide path helps in cooperative forwarding in the route discovery phase of the reactive routing method. Here the guide path follows greedy method to find the destination nodes and also to utilize the location information. Thus the packet delivery ratio and energy efficiency is improved in a considerable amount.**

Index Terms*- Conditional Monitoring, Reliable Reactive Routing Enhancement, Industrial Wireless Sensor networks, Fading Channels and Opportunistic Routing.

I. INTRODUCTION

The recent interest and advancement in wireless sensing technology has given rise to lots of research fields. The most important one among them is the IWSNs which is Industrial Wireless Sensor Networks which is concentrating mainly on the industrial production. There are many challenges that any WSN will encounter while transmission and some of those problems are massive energy waste, localization of the nodes and so on[1]. it is highly important for any IWSNs to overcome all this challenges by choosing the best routing protocol. The most preferable routing protocols that are commonly used are proactive routing protocol and reactive routing protocol.

Proactive Routing protocol:

It is a kind of routing protocol where every node will update the routing information every now and then representing the entire topology of the network. The communication takes place by exchanging the information between the nodes on the regular basis. The main disadvantage of the proactive routing protocol is that it uses resources to communicate routing information, when there is no traffic also.

Reactive routing protocol:

The routing takes place here from the source to destination where the route will only be updated when it is needed. The use of small or no routing table is considered to be one of the most advantageous factor in using this sort of routing table. Instead of static protocol the use of on-demand routing protocol for the AdHoc network is considered to be advantageous in the first place[9]. The two types of on-demand routing protocol are source routing and hop-by-hop routing protocol. The most prominent among those hop-by-hop routing protocol is AdHoc On Demand Distance Vector routing. All nodes in the hop-by-hop routing method maintains a localized routing table also which is scalable also.

There are several advantages when using the IWSN instead of classic wired industrial communication system because of the easy and fastest installation methods used. The maintenance cost in this case is also much lesser when compared to other techniques.

Industrial Wireless Sensor Networks:

Some of the most common IWSN applications are as follows:

Environmental sensing where the WSN application will concentrate mainly on the problems of air, water and pollution. This will also concentrate on the production material which includes pollution monitoring as well. In industry because of heavy competition and security threats, IWSN is taking care of barrier monitoring.

Conditional Monitoring is something that will take care of the proper monitoring on the condition providing the information on the status of the buildings, supply routes or pipelines[2]. This will result in better fixing of the faults that may occur in a system.

Process Automation is one of the most important and also the prominent application of IWSN where the user will be provided with information on resources for the production and also for service provision like the materials, current stock, supply chain status and so on.

There are many causes which will dead to undesirable delay along with extraordinary energy consumption also. Hence the use of opportunistic routing is highly recommended to get an effective cross-layering technique to tackle the fading channels problem. As the sharing takes place in this wireless medium, the node will be able to overhear the data packets sent by its neighbors [5]. The packets are relayed in the network layer with the help of forwarding candidates when the nodes follow the assigned priorities. As the reactive routing protocols can reduce the bandwidth usage and cost for the usage consumed in the first place in table driven protocols, this is chosen[7][8]. This protocols can apply the on-demand procedures to the system and can built a route between a source and destination for the best use of the users. The two different phases of this reactive routing protocol which is playing a very important role is the route discovery which will mainly concentrates on greedy flooding of route request to all the nodes and then the route maintenance which will maintain the routing information in a perfect manner. The routing request sent will be taken as RREQ for the best understanding.

Thus the request sent will find a destination and then it will return a RREP- route reply to the source containing all the route information that can be used by the source. The information can either be an address or even the hop-by-hop information needed. Here the Reliable Reactive Routing Enhancement (R3E) helps in increasing the link dynamics of the IWSNs. The advantages in opportunistic routing is considered and is helpful in achieving the shortest path between the nodes considering the end-to-end delivery delays also. Thus the high energy efficiency is also obtained without any other steps to be followed.

When the effect of the route discovery is considered, the forwarding performance in a cooperative manner will lead to the solutions to combine and find the reliable route and also the effective cooperative forwarding problems. Thus the vital path can provide the opportunities in route discovery phase also.

The approach that is been coined here can actually deliver the data packets directly to the destination without utilizing the local information also.

II. PRELIMINARY SURVEY

According to V. Gung or and G. Hence [1], it is inferred that the RSSI is been used specially for exploiting in detail regarding the localization of the nodes, estimation of the distance from the current node, and the quality of the links. The variation in the signal strength in the indoor environment helps in revealing the movement of the persons. The time histories of RSSI on multiple links lead to the path to be reconstructed resulting in the monitoring process of the person who is considered to be the area of interest. Thus it helps in effective transmission of nodes to reach the sink node, leading to increased latency and power consumption. The distributed processing is something that will enable the system to autonomously detect and localize the persons in a proper manner. It is actually helpful in finding the problems or faults in a conditional monitoring system where the block in the monitoring done can give the exact location of fault occurred in the system.

From the information given by eun Yoo, P. K. Chong, D. Kim, Y. Huh [2], the real-time constraints which are needed to be taken care of in a target tracking system respond to the transient events in the system though the target is moving in a faster manner also. The real-time design and analysis in large sensor network system done here is actually efficient to the in energy and also in timely manner. Thus the end-to-end tracking that is been done in this system is helpful in understanding the ways in which the nodes in the conditional monitoring can be taken and handled as a whole in the system.

The work of M. Chu, H. Haussecker, and F. Zhao [3], involves two techniques which are information driven sensor querying and constrained anisotropic diffusion routing in the ad hoc network which will change every now and then. The main idea that is been followed here is to get the information to gather the sensor that can be used to extract the query in its perfect manner. The gain is maximized by reducing the latency in the nodes and bandwidth usage. This is achieved by localization and tracking being done.

III. WORK FLOW

The work is been divided into five main categories thus representing the working of the whole system in a much efficient manner to be understood by everyone as follows:

1. Topology Formation
2. Shortest path routing
3. Opportunistic Routing
4. Quality of service Routing
5. Enhancement

1. *Topology Formation:*

The topology is something that will define the arrangements of node in a network. Here in the simulation of our work, there will be a hello packet which will be sent as an advertisement to all the neighboring nodes in a communication range. The response that is been obtained from the neighbor node will be taken and considered to check for the topology of the network. There are four main processes which are handled here they are allocation of network region, creation of the nodes, configuring nodes, mac allocation and routing protocol and finally channel allocation for the communication of the system.

The energy needed for initial communication is supplied for each node. The identification of the neighbor node for every node takes place in a manner keeping track of the neighborhood information [4]. The information of this Hello message which is been sent as advertisement will mostly be the IDs or the addresses of the nodes.

2. *Shortest path routing:*

It is highly important node to choose the path that is efficient in finding the path that is of short distance from the current node [6]. In IWSN, the probability of failures is high when transmission take place resulting in delay of process or control data. In case of industrial applications this sort of delay are highly intolerable and hence the route discovery should be done in an efficient manner leading a path directly to the destination.

3. *Opportunistic Routing:*

The topology is highly changeable, so the idea of maintain information in the nodes is considered to be something that is highly difficult. So the discovery and recovery procedure is something that leads to be time and energy consuming also. When the path breaks, the data packets will be lost or delayed for a long time until the route is reconstructed resulting in interruption of transmission taking place.

4. *Quality of service Routing:*

The improvement in AODV routing performance for utilizing the local path diversity is considered. The route discovery can actually find an efficient primary path and also accumulates the path and find alternative paths that can be achieved in the same cost as before.

5. *Enhancement:*

It is such sort of process in which the guide path and actual path are considered. Based on the reliable route discovery and efficient cooperative forwarding problems, a useful path is found linking the source and destination of the nodes in the network. When there is energy depletion of a sensor node resulting in a dead mode then it is unable for the node to communicate with other nodes in the first place resulting in a bottleneck of communication. So this sort of dead node should be leading to unexpected partition. The mobile robot is been employed to avoid this sort situation which will collect all the data sensed so far back to the sink node. The global and local based approach are used to find the nodes in the partitioned network. The failure in this nodes can be found with the upstream node that is been used. The beacon message contains the details on the informer and also on the destination.

IV. STIMULATION RESULT

Fig. 1 shows the simulation of node selection where the user will be able to enter the maximum number of nodes in the network and also the range in which the nodes can be denoted. These node selection method will actually help in starting the communication between the nodes.

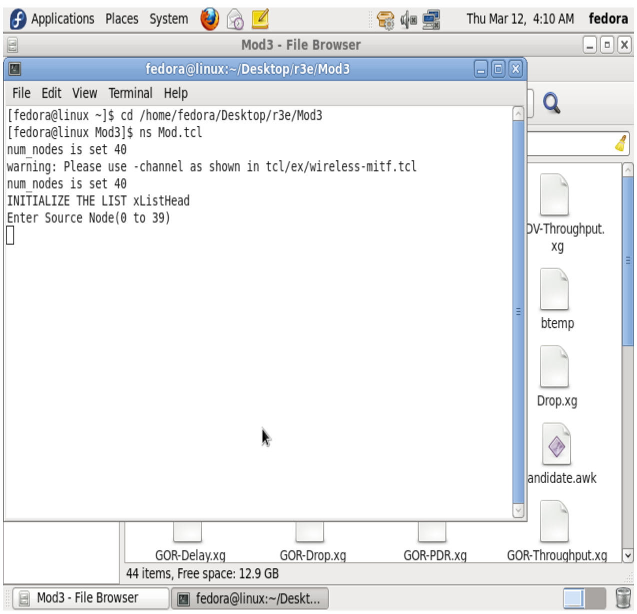

Fig 1(a): Source and destination node selection

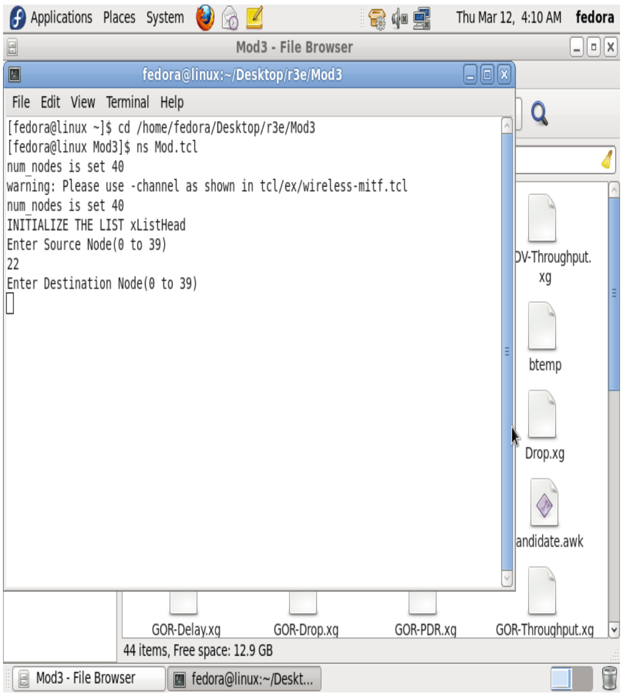

Fig 1(b): Source and destination node selection

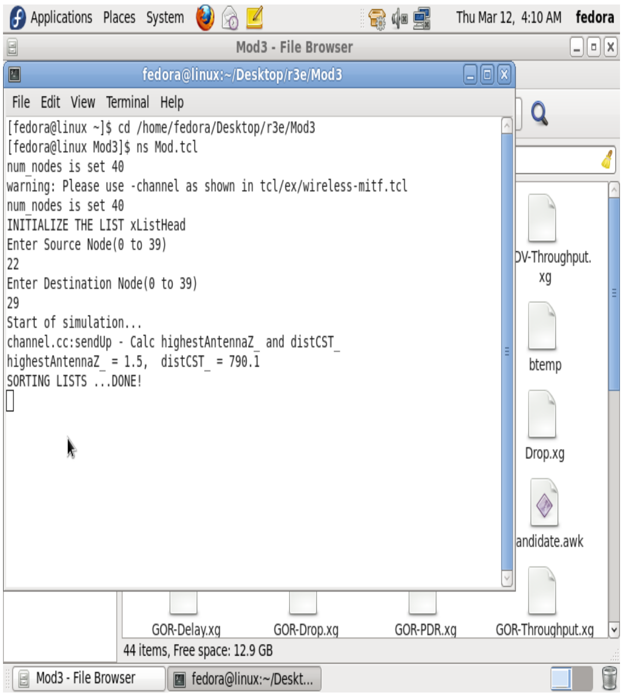

Fig 1(c): Source and destination node selection

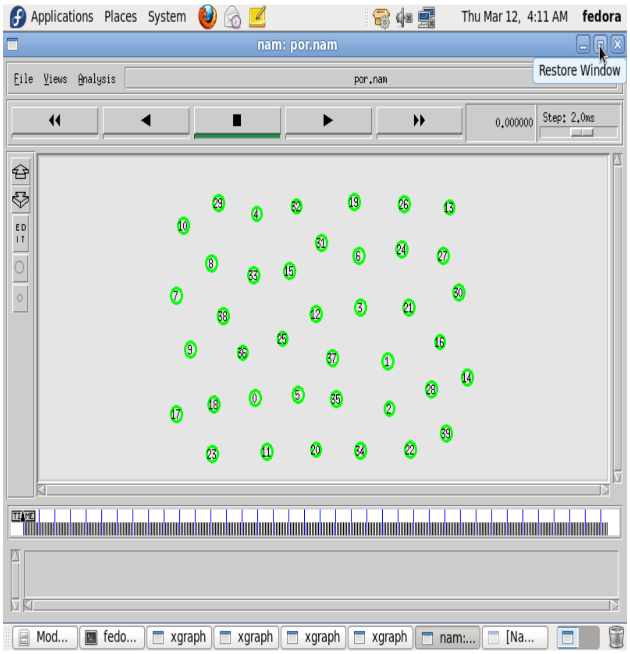

Fig 2: Advertising Neighbor nodes

The Fig. 2 portrays the representation of the hello message which is been advertised by the source node to all the neighbor nodes in the network. This advertisement is the initial step which is providing the base for finding all the important neighbor nodes through which the RREQ can be sent to the destination.

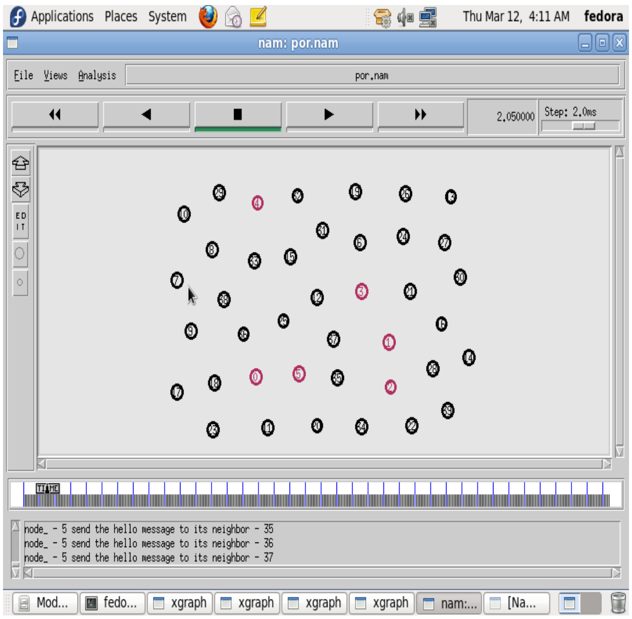

Fig 3: Sending RREQ

The Fig.3 is helping the users to find the neighbor nodes which are occupying the guide path between the source and the destination. Thus the route discovery between the source and the destination is found with the route request and respond that is been obtained from the various nodes in the network itself. The shortest path could be found from the distance that is calculated from the source and the neighbor nodes along the path of the data through which the destination could be reached which is found easily with the response from the actual destination.

The destination node will find the Hello request from the source and will respond with RREP which is the route reply containing the essential information like the identifying addresses of the destination node.

In fig. 4 the destination node could give all the response in a guide path crossing all the neighbor nodes in the network. Using this guide path the routing can take place which will store the path in which propagation of the message is transmitted to the destination.

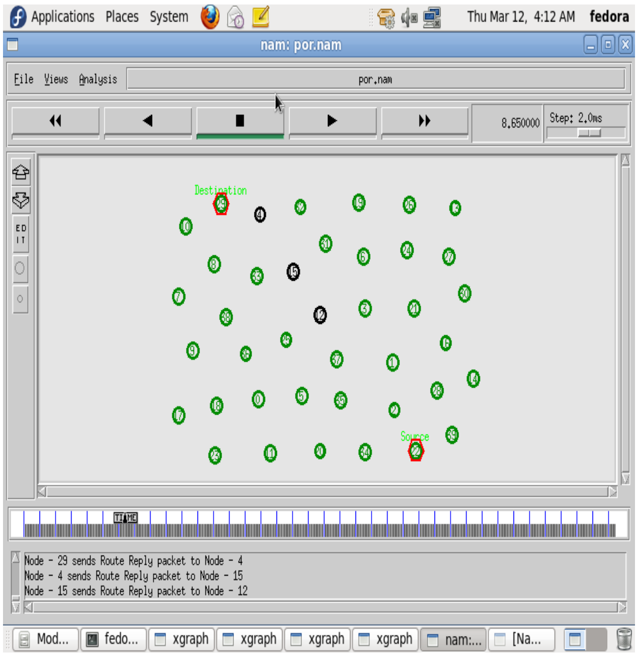

Fig 4: Shortest Path calculation

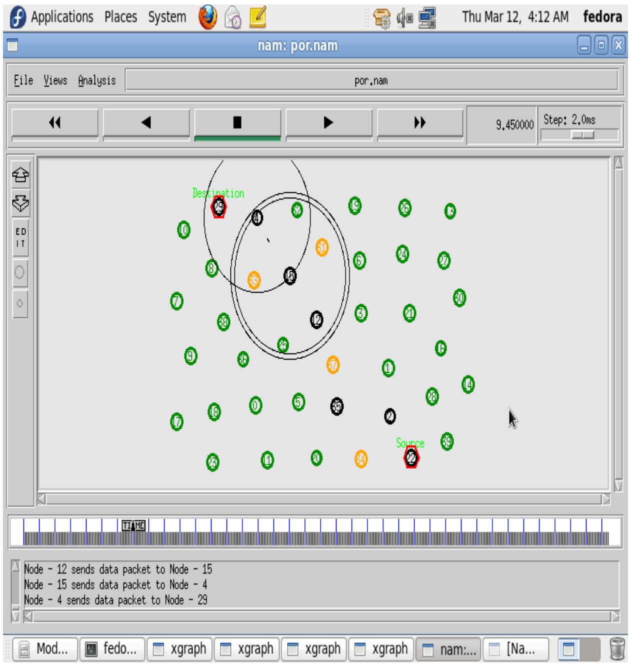

Fig 5: Optimal path selection

In fig 5, the shortest path found through the response from the destination is considered and hence the routing table is updated with the information for the next hop to be done. As this R3E is following reactive routing protocol in a hop-by-hop method is highly important for the route discovery process to store all the neighboring nodes to carry out its next hop without any latency in the system.

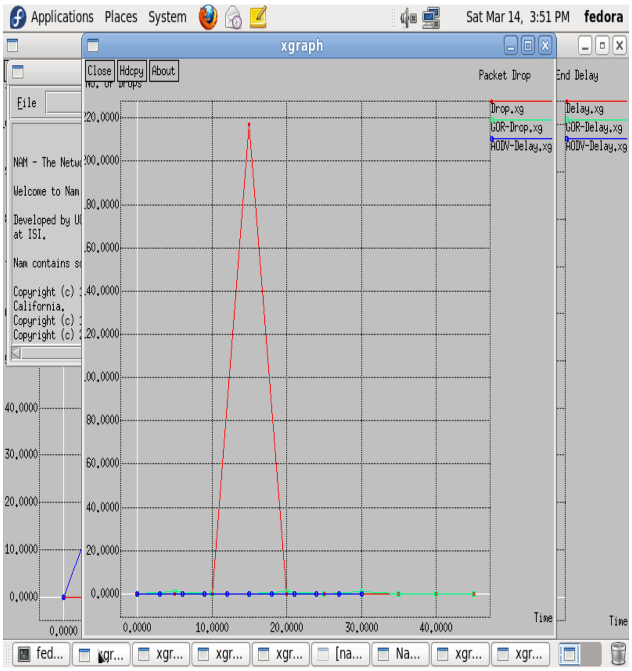

Fig. 6 AODV average packet drop ratio

In fig 6, the use of AODV for the same sort of route discovery and maintenance is shown which has high level of packet drop ration when compared to the packet drop ratio of the R3E algorithm that is been used in the conditional monitoring of the network to pinpoint the fault in a larger network system. Thus the fault can be rectified in a much easier and efficient manner.

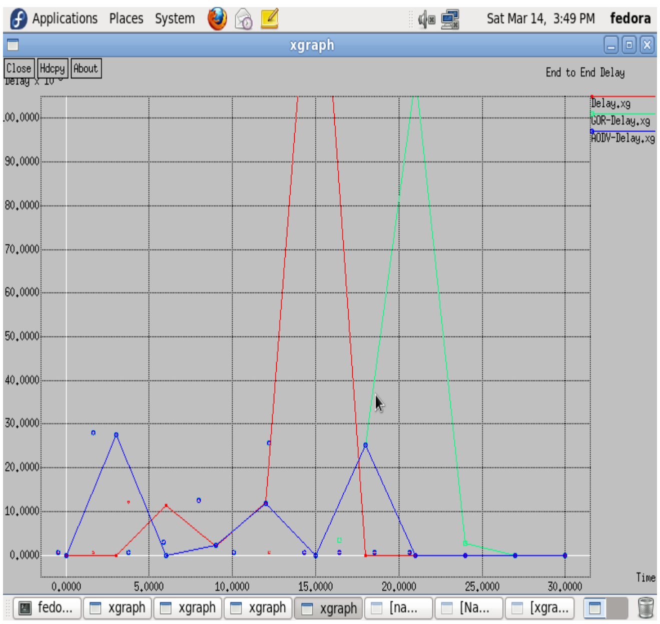

Fig. 7 End-to- End delay Graph

In Fig. 7, the delay of the packet reception both in the AODV and the R3E routing algorithms is used which is highly helpful in finding the best process where the nodes can easily avoid the delay when they are using the R3E protocol over the AODV. Thus the end-to-end delay or latency is also reduced while using the R3E in conditional monitoring of any industrial application in the first place.

V. CONCLUSION

In this simulation work, the whole process depicts mainly on how the energy can be saved and the latency can be avoided when a ISWN is been routed with the help of protocols like R3E. The propagation uses greedy progression, but the localization information and also the virtual path that is been built across the network is actually efficient. The use of opportunistic protocol in routing is also one more advantageous factor in increasing the efficiency of the overall system. Thus it is proved that the use of AODV-R3E together can effectively improve the parameters like robustness of the system, efficiency in the end-to-end energy saving and reducing the overall latency also.

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