EFFICIENT CONNECTIVITY BASED OPTICAL DAMAGE PATH DETECTION FOR USING MULTI AGENT PATH SELECTION ALGORITHM IN WSN

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Abstract:

In wireless sensor network when a jammer emits jamming signals, based on the strength of the emitted signal, a subset of nodes in the network becomes completely clogged. Therefore, data packets transmitted by these nodes are simply dropped. Also, packets destined for these jammed nodes cannot be delivered. The sender node continuously engage themselves in repeated packet re-transmissions, which eventually results in heavy depletion of energy resource of the nodes and reduction of the network lifetime. Proposed Efficient connectivity based optical damage path detection (ECOP) scheme is used to provide the efficient communication in wireless network. This path performs continuous traffic free routing, this detects the botnet attack, it identifies the block of data packet in path, this improves transmission rate. The traffic occurrence of specific path is detected, and choose alternate path with minimum resource usage. The strong connection is established with two neighbor nodes in network. Multi agent path selection algorithm is used for detecting malicious activities and providing authentication for packet transmission. Check whether node is true or fake node based on packet transmission rate, removes the fake node. Resource usage for optical damage path detection is also presented for identifying and separating the botnet attacker nodes in network. This improves the connectivity ratio, and reduce end to end delay.

Keywords- Efficient connectivity based optimal damage path detection, Multi agent path selection algorithm.

I.INTRODUCTION

Designing a cold chain monitoring application requires special focus on at least two main phases. In [2], we present an example of sensor network for cold chain monitoring where sensors are inside pallets. We proposed energy effi- cient protocols for the transport phase in which the WSN is deployed in trucks with no Base Station (BS) because it would be very expensive to install and maintain Base Stations within each truck. There are a few sensors in the truck. The second phase concerns the product storage in a warehouse where each pallet is handling temperature sensor. This application specifically collects rare events (alarms) to ensure the proper monitoring of the system. If the temperature is over a threshold, an alarm will be generated; this "interesting event" is then sent towards the BS.

Due to the size of a warehouse which hosts large number of pallets, one upon the other, the WSN can reach several hundreds of sensors which collaborate for sending data towards the BS. So, in this environment, the link quality is a key parameter which has many effects on the network performance. In [1], we used up to 50 Moteiv Tmote Sky [3] sensors, in a small experimental platform, including a 2.4GHz ZigBee [4] wireless transceiver (chipcon s CC2420) [5]. On each packet reception, the CC2420 calculates the error rate, and produces a LQI value. To conduct experiments, we used the multiHopLQI routing algorithm along with the Sensornet Protocol (SP) implementation [6]. In this algorithm, nodes sense and send "interesting events" to the BS. Based on the acknowledgement, a sensor decides to retransmit the data or not. If the acknowledgement fails, the sensor selects another node and routes data towards the BS. Under these conditions, the results pointed out that the LQI based routing could have negative effects on the network performance [1].

After all, we think that the link quality might be a key parameter which some routing protocols could rely on in order to increase the network performance. Several works address WSN routing, but only few papers are related to the LQI based routing protocols. Sensors are characterized by their low energy level. Thereby load balancing traffic between different nodes, is also an essential idea to increase the lifetime of nodes and thus of the network. Our work addresses this challenge: improving the LQI based routing protocol by load balancing traffic over multiple paths.

When a sensor has to send data towards the Base Station, the load balancing routing consists to elect several nodes as next hop routers depending on the order of packet transmissions and the nodes previously used as the next hop routers.

The idea is to involve several sensors in the routing effort to minimize the overall energy consumption and then extend the network lifetime. The metric is a property of a route in computer networking consisting of any value used by routing algorithms to determine whether one route should perform better than another. Commonly, the route with the lowest metric is the preferred route. However, in this paper, a metric means the local value associated with a node: for a source node, the highest value, in its neighbourhood, may lead to the selection of such a node as the next hop router.

Remaining part of the paper is planned as follows. Section II indicates a related works. In section III, Describe the details of proposed Efficient connectivity based optical damage path detection (ECOP) scheme is used to provide the efficient path for routing. Section IV provides simulation performance results analysis obtained under various metrics. At last section V concludes the paper with future direction.

II.RELATED WORKS

Y.-F. Wen and W. Liao et al., [7] tackle the Quality of Service (QoS) routing problem in wireless ad hoc CRNs. We consider such factors as available time, frequency bands, transmission range, error rate, primary user (PU) interruption rate and transmission range, and design a new QoS routing metric for wireless ad hoc CRNs. We then evaluate the performance via simulations in terms of the average and maximum end-to-end delays. The results show that our proposed metric outperforms existing solutions, including probability based, bit-rate based, and hop-count based methods.

L. Ding, T. Melodia et al., [8] a cross-layer opportunistic spectrum access and dynamic routing algorithm for cognitive radio networks is proposed, which is called the routing and dynamic spectrumallocation (ROSA) algorithm. Through local control actions, ROSA aims to maximize the network throughput by performing joint routing, dynamic spectrum allocation, scheduling, and transmit power control. Specifically, the algorithm dynamically allocates spectrum resources to maximize the capacity of links without generating harmful interference to other users while guaranteeing a bounded bit error rate (BER) for the receiver. In addition, the algorithm aims to maximize the weighted sum of differential backlogs to stabilize the system by giving priority to higher capacity links with a high differential backlog. The proposed algorithm is distributed, computationally efficient, and has bounded BER guarantees. ROSA is shown through numerical model-based evaluation and discrete-event packet-level simulations to outperform baseline solutions, leading to a high throughput, low delay, and fair bandwidth allocation.

O. Younis and S. Fahmy, et al., [9] a protocol, HEED (Hybrid Energy-Efficient Distributed clustering), that periodically selects cluster heads according to a hybrid of the node residual energy and a secondary parameter, such as node proximity to its neighbors or node degree. HEED terminates in O(1) iterations, incurs low message overhead, and achieves fairly uniform cluster head distribution across the network. We prove that, with appropriate bounds on node density and intra-cluster and inter-cluster transmission ranges, HEED can asymptotically almost surely guarantee connectivity of clustered networks. Simulation results demonstrate that our proposed approach is effective in prolonging the network lifetime and supporting scalable data aggregation.

K. R. Chowdhury et al., [10] In order to evaluate this trade-off, a distributed CR routing protocol for ad hoc networks (CRP) is proposed that makes the following contributions: (i) explicit protection for PU receivers that are generally not detected during spectrum sensing, (ii) allowing multiple classes of routes based on service differentiation in CR networks, and (iii) scalable, joint route-spectrum selection. A key novelty of CRP is the mapping of spectrum selection metrics, and local PU interference observations to a packet forwarding delay over the control channel. This allows the route formation undertaken over a control channel to capture the environmental and spectrum information for all the intermediate nodes, thereby reducing the computational overhead at the destination. Results reveal the importance of formulating the routing problem from the viewpoint of safeguarding the PU communication, which is a unique feature in CR networks.

J. Abolarinwa et al., [11] proposed an energy-efficient, learning-inspired, adaptive and dynamic channel decision and access technique for cognitive radio-based wireless sensor networks. Using intelligent learning technique based on the previous experience, the cognitive radio-based wireless sensor network agent decides which available channel to access based on the energy-efficiency achievable by transmitting using the channel. From simulation results, we found that as the channel packet availability increases, the energyefficiency of the channel increase. This lends credence to the fact that the proposed learning-inspired algorithm is significantly energy-efficient for cognitive radio-based wireless sensor networks.

X. Li, D. Wang et al., [12] technique focuses on channel assignment with awareness of the residual energy of sensors, such that sensors can spend their energy in a balanced way. This helps to prolong the network lifetime, compared to the random channel pairing approach. As all those techniques rely on the estimates of channel states and their performance is tied with the estimation accuracy, we theoretically derive a polynomial-time resolvable expression for the maximum-likelihood (ML) estimator PMF function. In light of this expression, the impact of channel estimation accuracy on network performance is thereby illustrated.

M. e. a. Tabassum et al., [13] It poses significant challenges to the design of topology maintenance techniques due to dynamic primary-user activities, which in turn decreases the data delivery performance of the network as well as it's lifetime. This paper aims to provide a solution to the CRSN clustering and routing problem using an energy aware event-driven routing protocol (ERP) for CRSN. Upon detection of an event, the ERP determines eligible nodes for clustering according to local positions of CRSN nodes between the event and the sink and their residual energy levels. Cluster-heads are selected from the eligible nodes according to their residual energy values, available channels, neighbors and distance to the sink.

P. Dutta et al., [14] This protocol ensures that two nodes will have some overlapping radio on-time within a bounded number of periods, even if nodes independently set their own duty cycle. Once a neighbor is discovered, and its wakeup schedule known, rendezvous is just a matter of being awake during the neighbor's next wakeup period, for synchronous rendezvous, or during an overlapping wake period, for asynchronous rendezvous.

Bhavathankar, P., et al., [15] The alternative paths are chosen with the maximum link quality in order to maintain the Quality of Service (QoS) of the network even after jamming. The work proposes Link-quality Aware Path SElection (LAPSE) algorithm that chooses alternative paths based on the optimal link quality. LAPSE is based on Optimal Decision Rule (ODR) and its design considers the fallible nature of the nodes while choosing/rejecting a particular link. Finally, the performance of the proposed algorithm, LAPSE, is evaluated in terms of the network parameters – packet delivery rate, network throughput, transmission energy, node lifetime, and network lifetime. Results indicate that the performance of LAPSE is significantly better than the existing jamming avoidance algorithms.

III.OVERVIEW OF PROPOSED SCHEME

3.1 Degree of node connectivity

The degree of connectivity of a node, i.e., the number of its neighbors, is also a metric that seems interesting to study because, intuitively, the more neighbors a sensor has, the more it seems to be an appropriate candidate as an achtophorous node since a sensor with a low degree of connectivity might have little information, from its neighbourhood, to forward to the BS. In the initial phase, each sensor is involved in the neighbourhood information exchanges (hello protocol), which allows it to determine its degree of connectivity and the BS position. To select an alternative path based on optimal link-quality in a jammer- affected scenario. LAPSE is horoughly based on ODR in which a subset of the underlying nodes of the WSN comprise the committee of electors and a reduced subset of the set of all potential paths from a source to the destination comprise the set of candidates that are being voted. Every member of the committee votes for every candidate. The votes obtained from every committee member are eventually aggregated to select the path with the optimal link-quality.

The following subsection discusses the detailed mathematical model of LAPSE. The first phase comprises of the selection of the committee of voters. Followed by this, the general pairwise choice framework of the ODR is presented. It specifies the internal details of modeling the payoffs, the decision making skills of every node, and the rationale behind the decision taken by every node. Every committee member votes for each link of a nominated path. The votes of the component links of a nominated path are combined to determine the vote of the path for each committee member. These votes are outcomes of the probabilistic decision making skills of every node as mentioned. The path quality is mathematically computed for every path thereby forming the set of nominated paths, i.e., the set of candidates to be voted. Also, for every nominated path, a metric of "goodness" and "badness" are defined to quantitatively indicate how decisive it is to included the path as the alternative path between a source and a destination. Eventually, the ODR is modeled that aggregates all the votes for all the nominated paths to selection of a single path. This path, between a given source and destination, is the alternative path that is selected for routing and data forwarding in a jammer-affected scenario.

3.2 Efficient connectivity based optical damage path detection scheme

As our proposed approach is event-driven, the path establishment is done reactively only after an event is occurred and thus, there is no need for each node to store the route. Once the clusters are formed, the data packets are routed from event region to the sink node through CHs and gateways. CHs enable intra-cluster communication whereas gateways are intermediate nodes which enable inter-cluster communication among neighboring clusters. There are two possibilities in inter-cluster communication scenario. The current node, which is a Destination for the first scenario, determines sensor nodes that are present in the communication range of both neighboring CHs and are member nodes of the destination cluster. These sensor nodes are referred to as candidate gateway nodes of the current node CH. One of those candidate gateway nodes is elected as the gateway node for the inter-cluster communication and is referred to as primary gateway node. the node can forward data packet to any of the member nodes of the destination cluster. One of these candidate packet forwarder nodes is then selected as the packet forwarder node.

Afterwards, the packet forwarder node selects a node from its set of candidate gateway nodes as the secondary gateway node. In Fig. 2, the communication ranges of nodes *L*,*D*,*E* and *F* are lined up by circles around them. In this case, the Destination *L* cannot reach any of the member nodes of the neighboring clusters; but, its member nodes *D*,*E* and *F* can reach some of the members of clusters of CHs *M* and *N*. Thus, Destination *L* can choose one node from *D*,*E* and *F* as the packet forwarder node, which upon receiving a data packet can elect one node of *P*,*Q* and *R* as the secondary gateway to communicate with relay or can elect *S* to communicate with Destination *N* and transfers the packet to the selected gateway. This gateway then simply forwards the packet to corresponding Destination and this process stops when data packet is reached to the sink node.

Note that both the packet forwarder node and Destination use the similar mechanism for selecting the primary or secondary gateway node from their respective set of candidate gateway nodes. Assume the set of candidate gateway node for node *a* is denoted as *CG*(*a*). The weight assigned to the each candidate gateway nodes as a metric to select gateway node.

Algorithm for efficient connectivity based optical damage path detection scheme

Step 1: Analyze the node behavior

Step 2: if {Connection==Success}

Step 3: That path is selected

Step 4: This path is used to perform communication

Step5: else

Step 6: if {Connection==Failure}

Step 7: That path is eliminated

Step 8: This path does not perform communication

Step 9: End if.

3.3 Enhanced Query Arising based Intrusion Detection

According to algorithm, each cluster assigns itself in a disjoint cluster. In each round, clusters beacon the control information like size and common available channels of the cluster and also calculate the cluster-to-cluster distances from their neighborhood nodes. Afterwards, each cluster sends the merge invitation to one of its neighboring cluster based on number of common available channels and the distance between the two clusters. If a cluster receives request from the node which it has sent merge request, they both merge into a new cluster and a new Destination is selected; otherwise only the Destination rotation takes place. In addition, each node periodically executes channel sensing and if, at some moment, a node of some cluster finds that it has no common available channel with the other cluster members, it leaves the cluster and form a new cluster. This process continues until number of clusters in the network is reached to *Kopt.*

Multi agent path selection algorithm

Step 1: Measuring the path capacity.

Step 2: For each choosing multiagent path

Step 3: if {Node==botnet}

Step 4: eliminate botnet, and update the path connectivity

Step 5: else

Step 6: if { Node!=botnet}

Step 7:The mutiagent process is selected

Step 8: improve detection efficiency

Step 9: End for.

Step 10: end if.

VI. Performance Evaluation

A. Simulation Model and Parameters

The proposed ECOP is simulated with Network Simulator tool (NS 2.34). In our simulation, 100 mobile nodes move in a 1070 meter x 1070 meter square region for 48 milliseconds simulation time. Each Mobile node goes random manner among the network in different speed. Mobile nodes have coverage area is 250 meters. CBR Constant Bit Rate provides a constant speed of packet transmission in network to limit the traffic rate. DSDV- Destination sequence vector routing protocol is used to allocate dynamic channel for communication. Table 1 indicates Simulation setup is analyzed.

Table 1: Simulation Setup

No. of Nodes	100
Area Size	1070 X 1070
Mac	802.11
Radio Range	250m
Simulation Time	48ms
Traffic Source	CBR
Packet Size	150 bytes
Mobility Model	Random Way Point
Protocol	DSDV

Simulation Result: Figure 3 show that the proposed ECOP method obtain the energy efficient routing path along wireless nodes is compared with existing LQAP [15]. ECOP provides lesser end to end delay, and higher connectivity rate.

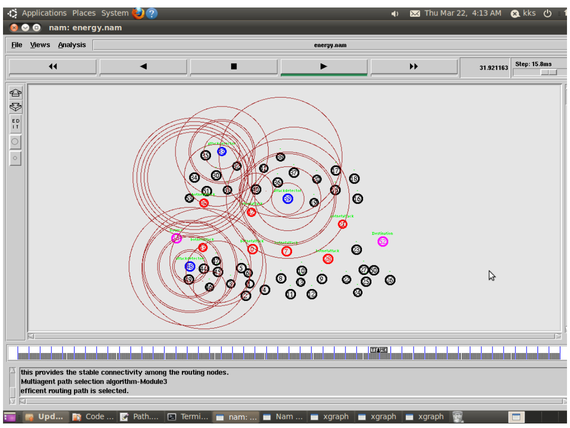

Figure 3: Proposed ECOP Result

Performance Analysis

In simulation to analyzing the following performance metrics using X graph in ns2.34.

End to End Delay: Figure 4 shows end to end delay is estimated by amount of time spent to transmit packet from starting node to ending node, individual node is traced by IP address. In proposed ECOP scheme End to end delay is minimized compared to existing method LQAP.

$$End\ to\ End\ Delay = End\ Time - Start\ Time$$

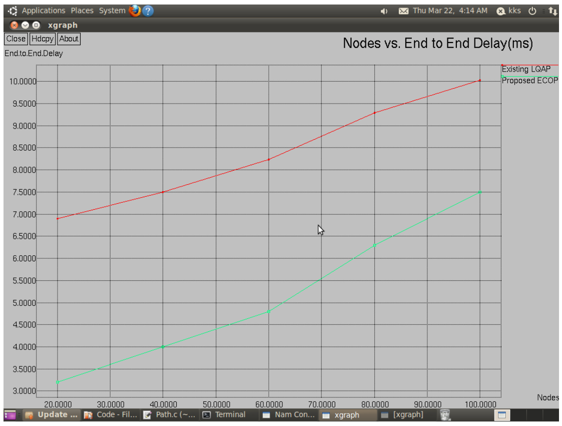

Figure 4: Graph for Nodes vs. End to End Delay

Connectivity ratio: Figure 5 shows Connectivity ratio, weak connectivity between nodes in routing path is removed by efficient connectivity based optical damage path detection scheme, achieve node link as priority based in wsn. In proposed ECOP scheme connectivity ratio is improved compared to existing method LQAP.

$$Connectivity\ ratio = weak\ connection/overall\ connect$$

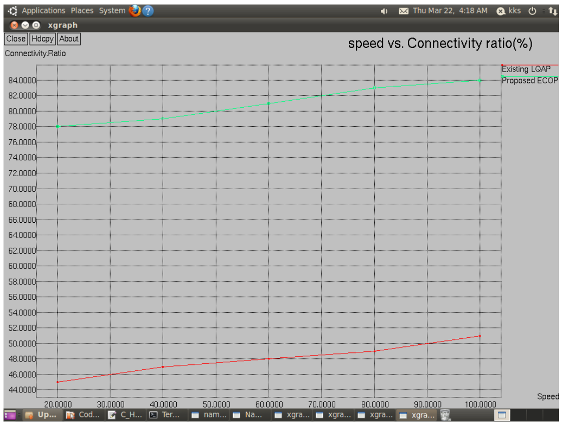

Figure 5: Graph for Speed vs. Connectivity ratio

Packet loss rate: Figure 6 shows that Packet loss of particular communication in network is calculated by nodes loss packet with poor connectivity are avoided by multiagent path selection algorithm. In proposed ECOP scheme Packet loss rate is decreased compared to existing method LQAP.

$$Packet\ loss\ rate = \left(Number\ of\ packet\ \frac{dropped}{Sent}\right) * 100$$

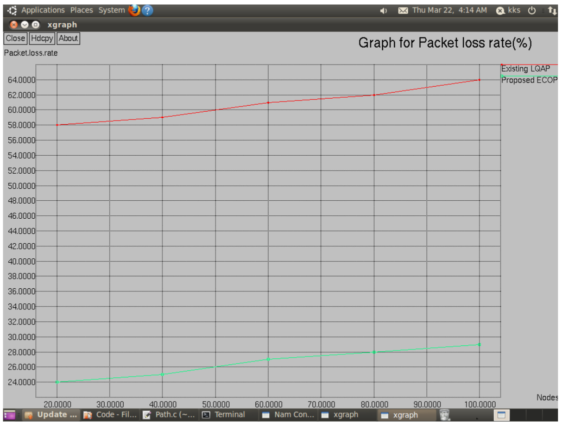

Figure 6: Graph for Nodes vs. Packet loss rate

V. Conclusion

In general the wireless network nodes are totally damaged by attacker occurred, during communication period data packets are lossed, and maximum delay ocuured for the poor link connection between routing nodes in network environment. In presented efficient connectivity based optical damage path detection scheme, achieve node link as priority based in wsn. The multiagent path selection algorithm is constructed to offer better connectivity rate, and minimize the packet loss rate. In future to overcome the vampire attack occurrence in wsn.

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