International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

A Survey in Wireless Networks to Enhance An Error Minimization Framework For Localizing Jammers

Sneha V.Tiwari[1] , Trupti Dange[2]

[1]Department of Computer Engineering, RMD Sinhgad School of Engineering, University of Pune, India

[2]Professor, Department of Computer Engineering, RMD Sinhgad School of Engineering, University of Pune, India

Abstract: ***Jammers are demanding to interfare the communication in wireless networks.The jamming attack can be characterized by the protector thus makes possible by the jammer location information. Our aim to design a framework to localize a multiple jammers with minimum error and higher accuracy..For measuring the estimation errors, an evaluation of feedback metric can be explained. Additionally for decreasing the estimated errors utilizing the jammer localization problem as nonlinear optimization issue then global optimal solution is nearby jammer location.***

Keywords: Localization , Jammer attacks , Radio interference

1. Introduction

In wireless sensor network increasing pervasiveness found jamming attacks have become a great disquiet recently. By defining the position of a jamming device it becomes important to provide security actions against the jammer and restore the network communication. In wireless sensor it has not only a sensing component, but also having board processing ,communication and storage competences .Enhancing these , a sensor node is often not only responsible for data collection, but also for in network analysis, fusion and correlation of its own sensor data and data from other sensor nodes. A wsn get formed by co-operatively monitoring sensors on a large physical environment.

1.1. Jammer attacks in wireless network:

An entity as jammer who is purposely tried to get in the way of the physical transmission and reception of wireless communication. A jammer is used to continuously emits RF signal by which a wireless channel get filled so that legitimatus traffic will get completely blocked. The most Commonly all jamming attack get characterized by their communications which are not capable of being acted with MAC protocols.

1.1.1 Models In Jammer Attack: In wireless network jamming attacks are categorized in four groups:
1) Constant jammer
2) Deceptive jammer
3) Random jammer
4) Reactive jammer

Constant Jammer: In this jammer ,it is continuously emitting a radio signal and sending out random bits to the channel. As, It does not following any MAC layer etiquettely and not waiting for the channel to become indolently.

Deceptive Jammer: In this jammer, constantly regular packets get injected to the channel and packets deceiving the Usual nodes and normal nodes just checking the preamble and remaining noiseless.

Random Jammer: In this jammer, it alternately sleeping and jamming after jamming for tj time units of time between them , it turning off its radio and entering into sleeping mode. After going to sleep for ts units of time, it wakes up and resuming jamming constant or deceptive. tj and ts are randomly or fixedly intervals energy conservation.

Reactive Jammer: In this jammer,Jammer stayed quiet when the channel indolent and it starts transmitting a radio signal as soon as it senses activity on the channel.

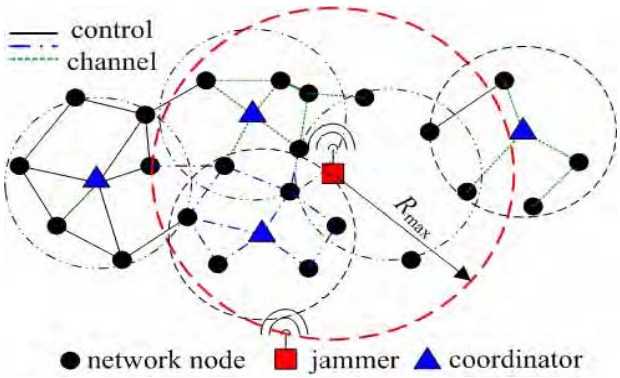

Figure 1: Jamming Attacks

It is not preserving energy because the jammers' is continuously on in order to intellect the channel however it is harder to detect.

1.1.2 Interference Level in wireless sensor network
It is used to define a distance between jammer and nodes. And also defining the relative transmission power of the jammer and nodes. In wireless network the MAC protocols get engaged by the nodes.

1.1.3 Detecting jammer attacks in wireless sensor network

By using strength of signal, carrier sensing time and PDR the jamming attacks can be perceived.

2. Lightweight Jammer Localization

It is totally depended on the basis of gradient descent minimization algorithm principle. The PDR is having lower values while we are moving nearby jammer. Gradient based pattern functioning isolating level of the network topology. for positioning the jamming device it is required.

1) In these process it is examined through enquiry that the jamming effects flow through the network.
2) Lightweighted jammer having no other reforms to the driver of commercial NIC's.
3) It has a gadget and estimated our localization system on 802.11 indoor test bed. It is An effective feature of this process which does not based on special network.

2.2.1. Associative Effort

1) **Signal processing localization method in wsn:** By the use of this technique, we improved extensively deployment of various methods such as (ultrasound, infrared or laser organization).
2) **RSS based localization method in wsn:** RSS measurement is a technique used for discerning the spot of wireless devices certainly the location AP's. As by using these methods, needs of ward driving could be ruminate as centralized algorithm.
3) **Gradient descent minimization in wsn:** Utilization of Gradient based algorithm is for the competent forwarding of probes in sensor network.

2.2.2. Localized Algorithm

The ratio of packet delivery value becomes lower while moving the vicinity of the jammer . By examining an idea to different modification to decline the sensitivity of our Algorithm to local minima by improving its performance.

3. Determining the position of jammer using VFIA

By previewing the matter depending on wireless networks with localizing jammers. By using the jamming effects of two jamming models.

i) Region-based model
ii) Signal-to-noise ratio model

4. Exploiting Jamming-Caused Neighbour Changes

By participating on improvement processes to positioning a jammer by abusing neighbor changes. Here firstly inquiry leads on jamming effect for observing how the connecting range get modified with the jammer's location and transmission power by the procedure of free space model. by determining the neighbour changes produced by jamming attacks the jammer position planning dependable can be manner . In this it is able to solve a Least Squares (LSQ) problem activities for the other new communication range.

4.1. Analysis of Jamming Effects

In this effects able to define the effect of one jammer with an unidirectional antenna on the wireless communication at two stages:

1) Individual communication range level
2) Network topology level

4.2 LSQ-Based Jammer Localization:

Initially, The idea of our LSQ-based algorithm is to focus on the jammer which depends to the newer of a node's hearing range.

4.3 Localizing A Jammer In Reality WSN

In this the recital associated with realistic radio propagation, some challenges get improved after realizing our localization algorithm in preparation which altered the LSQ-based algorithm to define the challenges got encouraged by the complex radio propagation. In this process, it determines our estimated act of LSQ based localization algorithm utilizing the log normal shadowing model . It has been analyzing the effect of a jammer on both a node's hearing range and sending range . The proposed (LSQ) is depended on the localization algorithm which is evaluating the jammer's location by using the fluctuations of neighbour nodes produced by jammer.

5. The Effect of Jamming on Network Topology

In this paper, it has been extended to analyse the impact of jamming from the individual node level to the network level, and the network nodes get classified on the level based of disturbance caused by the jammer. Essentially, in the communication range the changes are caused by the jammers are rejected by the changes of neighbours performed at the network topology level. It has been initiated to utilize the changes of the hearing range, since it becomes easier to get estimated, e.g., estimation is the step only involved while receiving at each node . It has been defined that node B becomes a neighbour of node A if A can receive messages from B. Depending upon the degree of neighbour changes, the network nodes under jamming attacks get divided into the following three categories:

- **Unaffected Node**: The unaffected node can be defined as having a slightly changed in hearing range , though its neighbour list remains unchanged, e.g., it can still hear from all its original neighbours. It has been noticed that the unaffected node can not be define outside the jammer's NLB.
- **Boundary Node**: In boundary node the hearing range of is reduced, and the nodes in number of its neighbor list is also decreased. Intrestingly , it can still receive information from all unaffected nodes within finite steps.
- **Jammed Node**: In jammed node the hearing range has been severely disturbed. It has been defined that a jammed node as the one which does not having any unaffected nodes or boundary nodes in its neighbour list, i.e. , no unaffected nodes or boundary nodes within its hearing range are found. It has been noted, it is possible that a few

jammed nodes are able to hear each other to form a Jammed Cluster. However,due to isolation unable to receive information from the majority of the networks.

6. Localization Formulation

A jammer localization approach essentially works as follows. There is a given set of JSS of every estimated location, where it is able to provide a quantitative evaluation feedback which indicates the distance between both the estimated locations of jamming and their true locations. This idea has been Leveraged in this jammer localization approach which has been comprises in two steps: (a) *JSS Collection* where each boundary node has locally obtained JSS. (b) *Best-Estimation Searching* is based on the collected JSS where a designated node will be obtained by a rough estimation of the jammers positions. After that , it refines the estimated result by searching for positions which minimizes the evaluation feedback metric. The search-based jammer localization approaches have a few challenging subtasks:

1)Evaluate Metric () used to define an appropriate metric which quantifies the accuracy of estimated jammers locations.
2)Measure JSS () used for obtaining JSS even if it may be embedded in regular transmission.
3)Search For Better () has to perform the efficiently searching for the best estimation.

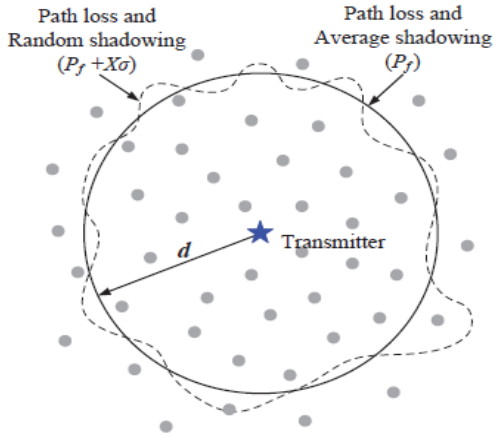

Figure 2: The contour of RSS subject to path loss is a circle centered at the transmitter, and the contour of RSS attenuated by both path loss and shadowing is an irregular loop fluctuating around the path-loss circle.

6.1 Radio Propagation Basics

In wireless network communication, the receiving signal strength attenuated with the increasing distance between the sender and receiver due to path lossing and shadowing, and the constructive and destructive addition of multipath signal components .The attenuation get caused by shadowing at any single location, from the d meters transmitter , which may exhibit variation; the transmitter are roughly the same centered on the circle at the average attenuation and average signal strength .This has been observed as the fundamental basis of our error minimizing framework.

6.2 Localization Evaluation Metric

Reviewing in this section , it has been defined the evaluation metric e_z , and the property of e_z and its calculation.

6.2.1.The property of e_z:

While defining the e_z should have the descriptive property : if the estimation errors of jammers locations are the larger, the e_z is larger. When defining e_z as the estimated standard deviation of X_σ which has been derived from the estimated jammers' locations. Consider the one-jammer case, where the estimated jammer's location are equals the true value, and e_z is the real standard deviation of X_σ , which is relatively smaller. When there is an estimated error defined (the estimated location is e_d distance away from the true location), e_z will be considerably biased and will be larger than the real standard deviation of X_σ. The level of bias is affected by e_d: the larger e_d is, the **Single Jammer.**.

6.3 Problem Formulation:

By the definition of the feedback metric (e_z),it is generalized that jammer localization problem as one optimization problem,
l
Problem 1:
minimize $e_z(z, p)$
z
subject to $p = \{P_{r1} , . . . , P_{rm} \}$; (1)

where z are the unknown variable matrix of the jammer(s), e.g., z is defined as, and $\{P_{ri} \}_{i\in[1,m]}$ are the JSS measured at the boundary nodes {1, . . . , m}.The estimated location(s) of the jammer(s) at which e_z gets minimized, matches for the true location(s) of jammer(s) with small estimation error(s).

7. Finding The Best Estimation

In the jammer localization problem it has been modelled as a non-linearly optimized problem, and to find a good estimated locations of jammers' which is equivalent for seeking the solution which minimizes the evaluation feedback metric e_z . In this paper it has been illustrated the relationship between e_z and e_d (the actual distance between the true jammer's location and the estimated one), which is able to show that greedy algorithms that searching for successively better optimized solutions are unable to found the global optimal value. Instead , using a several heuristically search algorithms which rely on guided randomly processes which approaches the global optimum without converging to minimize locally.

8. Performance Validation

Under this section it has been evaluated the performance of our jammer localization which rely the approaches for the utilization of the error minimizing framework. After studying the three heuristically search algorithms which are able to find the best estimated position of jammers': a genetic algorithm (GA), a generalized pattern search (GPS) algorithm, and a simulated annealing (SA). Evenly if in rare

cases that the jammer is defined outside the network deployed area, the layout of jammed nodes and boundary nodes (e.g. at the boundary of the network) will indicates the jammers regions.

a) **Impact of Node Density:** Firstly, observing that GA, GPS and SA all are achieving almost the same accuracy and consistently outperformed Adaptive LSQ algorithm in all the node densities and deployment setups . Nextly ,as there is a increase in network node density , the accuracy of all algorithms get improved.
b) **Impact of the Jamming Power:** During the study of effects on various transmission power of jammers to the localize the performance , it has been examined that networks with 400 nodes in a 300-by-300 m field with the set of jammer's transmission power to {−42, −40, −38, −36} dBm , respectively.
c) **Impact of Propagation Irregularity:** For examining the impact of propagation irregularity on errors localization, it has been used a standard deviation of random attenuation σ for quantifying the propagation irregularity and comparing the algorithm performance in 400-node networks while the standard deviation σ was set to 1.0 and 2.0.
d) **Impact of the Number of Jammers:** While examining the impactful numbers of jammers on the localization errors . And the cases when {1, 2, 3, 4} jammers were emitting signals at −38 dBm , and the network was comparatively of 1600 nodes in a 600-by-600 m sq, whose density is defined to be equivalent to 400 nodes in a 300-by-300 m f. In multiple jammer case, the jammers are placed in such a way that all of them had been overlapping in jammed regions, hence such an arrangement is found difficult while localizing .
e) **Impact of Using Indirect Measurements:** Lastly observed the performance of an error-minimizing framework by using indirect measurements, e.g , hearing ranges. As a hearing range get affected by JSS, so it becomes possible to calculate e_z in the accordance of the measured hearing ranges and finding the estimation jamming' locations which minimize e_z .

9. Conclusion

In this paper, deliberatively finding the issues to minimize the errors while localizing a jammer in wireless networks .The jamming is a wireless device which is used to produce unintentionally interference of radio or maliciously defined jammer which is troubling the network. For reducing the estimated error, further designing a survey on error minimizing based framework for focusing on the jammer.Outlining an evaluated feedback metric which quantifying the estimated error of jammer's position and analyzing the affiliation between the evaluated feedback metric and estimated errors. And also increasing the estimated accuracy by designing an error which minimizes framework to localize jammers .Using this method it can increase the efficiency, packet delivery ratio and decreasing the packet loss, energy spent and delay.

References

[1] K. Pelechrinis, I. Koutsopoulos, I. Broustis, and S.V. Krishnamurthy, "Lightweight jammer localization in wireless networks: System design and implementation," in *Proceedings of IEEE GLOBECOM*, 2009.
[2] H. Liu, Z. Liu, Y. Chen, and W. Xu, "Determining the position of a jammer using a virtual-force iterative approach,"*WirelessNetworks (WiNet)*, vol. 17, pp. 531–547, 2010.
[3] Z. Liu, H. Liu, W. Xu, and Y. Chen, "Exploiting jamming caused neighbor changes for jammer localization," *IEEE TPDS*,vol. 23, no.3, 2011.
[4] Z. Liu, H. Liu, W. Xu, and Y. Chen, "Wireless jamming localization by exploiting nodes' hearing ranges," in *Proceedings ofDCOSS*,2010.
[5] H. Liu, Z. Liu, Y. Chen, and W. Xu, "Localizing multiple jamming attackers in wireless networks," in *Proceedings ofICDCS*, 2011.
[6] Tianzhen Cheng, Ping Li, Sencun Zhu "An Algorithm for Jammer Localization in wireless Sensor Networks," in proceedings of IEEE AINA,2012.
[7] Z.Liu, H.Liu, W.Xu, and Y.Chen, "Error Minimizing Jammer Localization through Smart Estimation of Ambient Noise," in proceedings of IEEE MASS,2012.
[8] W.Xu, W.Trappe, Y.Zhang, and T.Wood "The Feasibility of Launching and Detecting Jamming Attacks in Wireless Networks,"MobiHoc'05, 2005.
[9] Boukerche.A., Oliveira.H.A.B. Loureiro.A.F.A."Localization System for Wireless Sensor Networks", Wireless Communications, IEEE volume 14, 2007.

Author Profile

Sneha Tiwari, Research Scholar RMD Sinhgad School of Engineering Warje, University of Pune .She received B.E. in computer science and engg from Government college of Engg, Nagpur University Currently she is persuing M.E. in computer engineering from RMD Sinhgad School Of Engineering Warje,,University of Pune.

Trupti Dange received the B.E. and M.tech degrees in Computer Engineering from University of Mumbai with four years of experience, respectively and Currently working as Assistant Professor of Computer Engineering Department in RMD SSOE Pune, India.