SENTIMENTAL ANALYSIS OF FIRMWARE ATTACKS IN WIRELESS SENSOR NETWORKS USING ADAPTIVE ROUTING IN COMPARISON WITH THE NOVEL CENTRALIZED ALGORITHM TO IMPROVE PRECISION

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Abstract

Aim: The Aim of this Research paper is analyzing the security over the Firmware attacks in Wireless Sensor Network by using the Novel Centralized Algorithm and Adaptive Routing algorithm classification Algorithms.
Materials and Methods: The study contains the survey among the Different operating systems such as FreeRTOS, POSIX or WIN32. There are nearly 10 simulators to take a survey among. Here the number of groups is 2 and group1 is Centralized algorithm (87.67%) and group2 is Adaptive Routing (81.25%) and the sample output size is 32.
Result: The performance has been improved in terms of accuracy for the novel Centralized Algorithm with 87.67% while the Adaptive Routing Algorithm has shown accuracy of 81.25%. The mean 87.67, mean accuracy detection is ±1SD and significant value is 0.593 ($p > 0.05$) from an independent sample T test.
Conclusion: The final outcome of the centralized algorithm is found to be more significantly more accurate than the Adaptive routing algorithm.

Keywords: Attack Simulation, Wireless Sensor Network, Power Consumption, Novel Centralized Algorithm, Adaptive Routing Algorithm, CS LEACH Technique.

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1. Introduction

The expanding intricacy and low-Power Consumption requirements of current Wireless Sensor Networks require productive strategies for network recreation and inserted programming execution examination of hubs (Gavel, Raghuvanshi, and Tiwari 2021) . What's more, security is additionally a vital element that must be tended to in many WSNs, since they might work with delicate information and work in antagonistic unattended conditions. In this paper, a strategy for security examination of Wireless Sensor Networks is introduced (Hsueh et al. 2010) . The philosophy permits planning assault mindful implanted programming/firmware or assault countermeasures to give security in WSNs. The proposed technique incorporates aggressor demonstrating and assault recreation with execution examination (hub's product execution time and Power Consumptionutilization assessment). Good environments are heavily material deployed in building, military, health, ecological, industrial, and transportation applications, and others. These environments are mainly based on smart devices that are taking data from the real world, processing and communicating these data to information centers, generating some information based services and, sometimes,producing some deportment in the environment (Sohraby, Minoli, and Znati 2007) . The information used by smart environments is provided by Wireless Sensor Networks (WSNs), which are normally responsible for monitoring and recording physical or environmental conditions and communicating the placid data to an inside location (Pineda et al. 2015). These WSNs are a group of spatially dispersed self powered nodes (Fang et al. 2016) .This type of analysis finally made the awareness among the network security.

From the past 4 years there are about 360 articles from various sources such as Google Scholar, IEEE Xplore and Springer. The various techniques used are: The analysis of the network security using various algorithms and sometimes it would be calculated on bases of the device security mode but as of now we are going the Security analysis by using the Centralized Algorithm on comparing with the comparing with the Adaptive Routing (Komatsu et al. 2021) On using the Centralized algorithm gives more precision and accuracy than the Adaptive routing (Gabsi et al. 2021). This work gives a particular way to simulate WSNs under variegated wade conditions, by giving the effects of these attacks on each node and in the whole network to be calculated (Ramos 2017). The proposed work enables the most rabble-rousing attacks to be unpredictable in order to help design countermeasures to avoid attacks (Kamehama et al. 2017).Our team has extensive knowledge and research experience that has translated into high quality publications(Pandiyan et al. 2022; Yaashikaa, Devi, and Kumar 2022; Venu et al. 2022; Kumar et al. 2022; Nagaraju et al. 2022; Karpagam et al. 2022; Baraneedharan et al. 2022; Whangchai et al. 2022; Nagarajan et al. 2022; Deena et al. 2022)

This tideway is very well designed considering it can be used surpassing network deployment, during the hardware or software design or development phase. It allows developers to diamond increasingly secure systems and introduce countermeasures to give up the effects of the most hair-trigger attacks (Ghous et al. 2021) . In the ongoing process for simulating the attacks over the Wireless sensor networks the research gap should be faced at the nodes depletion while going on the centralized algorithm (Ammari 2009). This sometimes leads to restricting to finding the solutions for the firmware attacks.The main Aim is to detect and give the measures to avoid the firmware attacks amongst the wireless sensor networks.

2. Materials and Methods

This research paper was carried out in the Department of Networking Laboratory of Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences. This study involves 2 groups and group 1 is the novel Centralized algorithm (87.67%) and group 2 is Adaptive Routing algorithm (81.25%). The total number of groups for this are two groups (Liu, Peng, and Zhong 2021). Group one refers to the existing system, and Group two refers to the proposed system. The total number of samples are 32, out of which 16 are the samples for the first group and the remaining 16 are used as samples for the second group. Size was calculated using previous study results (Holt and Huang 2010). The number of samples that are taken are from the previous study by setting confidence interval as 85% and along with g power as 80%.

In addition, it is important to notice that the virtual platform provides estimations that are useful for no-attack cases. The total energy consumption of the linear topology is lower than for the other topologies. The interpretation of the node energy consumption moreover enables the interpretation of the node shower life that is an essential parameter of WSN. The time of all simulations is similar and it is less than 1 min depending on the traffic network. simulation times of the experiments included in this section which are performed in core i5-3470 3.20 GHz with 4 Gb RAM in a Fedora 32 bits. This is a very low simulation time when taking into account that the simulated time is 1 h.

Centralized Algorithm

In the centralized algorithm, a process is chosen as the coordinator, which can be the machine with the highest network address. The coordinator simply doesn't respond, blocking process 2 which is waiting for a response or could send a "permission denied" response.On coming to the implementation of this algorithm in the wireless sensor network it comes to CS LEACH. CS LEACH technique based security protocol tabbed Centralized Secure CS LEACH. The motivation for this project is the need for security and resource efficiency in a WSN protocol (Tajeddine et al. 2015) . When towers use a WSN protocol, it is understood the gateway cannot be compromised considering the network cannot function without a single point to collect data (Gawade and Nalbalwar 2016). To take the wholesomeness of these features,CS LEACH Techniqueutilizes the gateway for key management, and trust management. CS LEACH Technique Builds on the CS LEACH Technique Algorithm by subtracting authentication, confidentiality,integrity, freshness and trust (Xu, Kan, and Zhang 2019) . Like CS LEACH, each sensor node is worldly-wise to directly transmit to the gateway. Using a Key Distribution Center (KDC) approach, each node shares a unique private key with the gateway. CS LEACH Technique Uses single key pre-distribution to share a gateway private key that is used for unconcentrated authentication.

Centralized Algorithm steps

Step 1: Initialize and Begin the algorithm to find mean accuracy of the Novel Attack Simulation.

Step 2: Apply the If loop to compare the Sink node whether it is Direct or Indirect else whether Empty or not empty.

Step 3: Assign the nexthop value to “i” and close the loop.

Step 4: Now begin the for loop to further post increment to find the assigned medium nexthop is valid or equal.

Step 5: Also find the threshold minimum time is greater than the nexthop minimum time.

Step 6: Assign the nexthop to the threshold and end the both if and for loop.

Step 7: If the nexthop is assigned for “i” then further check for the given mrd time and hop time is valid or not. End the if loops and end the program.

Adaptive Routing

Adaptive routing, also called dynamic routing, is a process of determining the optimal path that a data packet should follow through a network to reach a specific destination. Adaptive routing can be compared to a commuter taking a different route to work after learning that traffic on their usual route will be supported. Adaptive routing uses routing algorithms and protocols that read and respond to changes in network topology. Besides Open Shortest Path First, other routing protocols that facilitate adaptive routing include Intermediate System to Intermediate System Protocol for large networks such as the Internet and Routing Information Protocol for local traffic. The most related theory of Adaptive routing protocols was brought up by Perkins (Perkins 2001) DSDV (Dynamic Destination-Sequenced Distance-Vector Routing Protocol). This is a table-driven routing protocol. The memory of every sensor node has a forwarding table and a ventilated one. Forwarding table is a routing table, which contains destination-node field, next node field, hop-number field, sequence-number field and time-adjustment field (Holt and Huang 2010) . Advertised table sustains the records of links (Kim et al. 2020). As long as the status changes, the documents inside the advertised table will vary.Various routing protocols have various methods to update the routing table. In this table the the destination should be started at 1 and carried upto 7 and the next value should be swing between the 3 and 5. Sequence should be started at the ID50-1 and its time is T01-3 and ends up at the sequence ID62-7 and its time is T02-3 (Chabalala, Muddenahalli, and Takawira 2011) .

Adaptive Routing Algorithm Steps

Step 1: Begin the program with a loop of if to check the actual values of D as well as A.

Step 2: Further step forward to mod P-L(j) is minimum for D or A which are equal.

Step 3: If the above steps are not accurate then we start the else to bring the packets and grids closer to their destination or not.

Step 4: Let assume that the X and Y are shl of D and A as well R(x) and R(y) both are not equal to Null.

Step 5: In case of X and Y are equal then the R(x) and R(y) are forwarded to Minimum other case is to X is greater than Y then only R(x) is not equal to null or else forward to R(y)

Step 6: On coming to the last case that is to be forwarded to Z then it will be maximum of x and y. Here the Z belongs to buckets of Z with respect to the First and Second. This is the Steps for initializing the base algorithm for Novel attack simulation.

Statistical Analysis

The data for Security analysis of wireless network sensors were collected from the url website that contains over 60 participants in testing this system. The statistical software used for implementation in IBM SPSS version 21. The independent variables of the data are accuracy, Standard deviation and standard mean error and dependent variables in the

data are Eye aspect ratio of x and y axis as parameters that is considered in the task. The independent sample T test analysis is carried out in this research work.

3. Results

Additionally, the virtual platform estimations are quite accurate. In this example, the estimated error of the virtual platform is only 8%. In terms of Power consumption and execution time,the verism of the results is similar to other novel attack simulation based and Power consumption approaches. Thus,the proposed virtual platform can be used to evaluate the WSN network policies plane when the WSN is not deployed and it is not possible to perform real measurements by using the Novel Centralized algorithm it gives the accuracy of 87.67%.

Table 1 shows the Adaptive routing algorithm forwarding table which shows the Destination, Sequence and Time. The time starts at the T01-3 and ends at T02-3

Table 2 shows the For getting the precision value we have to compare the data description between the proposed and the existing algorithm.

Table 3 shows the comparative study between the Centralized Algorithm and the Adaptive Routing algorithm with precision rate 87.67%.

Table 4 indicates the Group statistics T-Test for existing algorithm Mean (81.2990) and Centralized Algorithm (87.6780) with the sample size 10. There is a statistically slight difference in the SD accuracy of the two algorithms. Centralized algorithm had the highest accuracy and the (4.0542) Adaptive Routing(4.5307).

Table 5 indicates An Independent sample T-test is performed for the two groups for significance and standard error determination. The two-Tailed Significance value is 0.001 ($p<0.05$) and it is statistically significant.

Figure 1 represents the results are used as input into the statistical analysis tool and the graph is plotted using the values.

4. Discussion

From the result, The Novel Centralized algorithm (87.67%) appears to be better than the Adaptive algorithm (81.25%). The values of the Effective precision are analyzed statistically and the difference is found out by plotting the graph against the algorithms. It took changes in Novel Attack simulation and Power Consumption as well.

Similar results related to the Novel Centralized algorithm are significantly more efficient in Novel Attack Simulation on the wireless sensor network of the user compared to the existing algorithm (Mao and Fidan 2009), that is the Adaptive routing algorithm (Rachamalla and Kancherla 2016) . The dataset containing a large number of images is given as input into both the algorithms, and the accuracy rate (Shaikh and Wismuller 2017) of prediction is obtained for the existing and the proposed algorithms. These values obtained are used for analysis and comparison for precision. The findings are implemented by the security analysis on the networking based technologies. If the device or node can be going to effect by the any security issue or the Power Consumption the centralized algorithm will be divide that node information into several nodes and it should be depend on the path distance (Parsapoor and Bilstrup 2013) .So easily the attack will be founded between the nodes and eventually the problem will be solved in a very less time. On coming to the adaptive routing it is only based on the shortest path it would not divide into nodes (Luo et al. 2018). So comparing with adaptive routing centralized algorithms shows more precision.

By going on the process there should be some limitations to avoid the node depletions and some security issues we must stop the node depletion due to it may stop us to reach goal as well as the security issues like securing the normalized sensors after the attacks should be protected must not be violated.On going to the further research among the Security analysis of the wireless network sensor this divide and detection of the attacks make a crucial role which is named as the centralized algorithm (Sohraby, Minoli, and Znati 2007) . By this the detection should become easy and we have to solve those in less time. If the attack is non solved there is another way to solve the attack because the centralized algorithm should be based on the Path Distance. So we easily change the path to divert the Attack issue in the nodes.

5. Conclusion

The research study of Novel Attack Simulation found that the proposed Centralized algorithm shows more precision than the given adaptive routing algorithm.The precision of the proposed centralized algorithm is significantly 87.67%. Hence, Using the proposed centralized algorithm gives better results than the existing algorithm means the centralized algorithm gives the precision of 87.67%.

Declarations

Conflict of Interest

No conflict of interest in this manuscript

Author Contribution

Author BPK is involved in data collection, data analysis and manuscript writing. Author VK was involved in conceptualization, data validation and critical review of the manuscript.

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Tables and Figures

Table 1. This is the forwarding table for the Adaptive Routing Algorithm.

Destination	**Next**	**Hop**	**Sequence**	**Time**
1	3	1	ID50-1	T01-3
2	5	4	ID36-2	T01-3
3	3	0	ID28-3	T01-3
4	5	1	ID46-4	T01-3
5	5	3	ID15-5	T01-3
6	5	2	ID70-6	T02-3

Table 2. For getting the precision value we have to compare the data description between the proposed and the existing algorithm.

S.No	**Attribute**	**Value**	**Description**
1.	No. of observation	Integer	The number of data used in the system.
2.	Co-ordinates	Integer	The x and y axis coordinates of the eye.

Table 3. Comparative study between the Centralized Algorithm and the Adaptive Routing algorithm with precision rate 87.67%.

S.No	**Centralized Algorithm**	**AdaptiveRouting**
1.	81.75	76.72
2.	82.22	77.21
3.	84.07	79.35
4.	86.34	76.42
5.	87.22	78.32
6.	88.32	80.55
7.	90.47	83.73
8.	92.67	84.27
9.	91.68	86.76
10.	92.02	89.21

Table 4. Group statistics T-Test for existing algorithm Mean (81.2990) and Centralized Algorithm (87.6780) with the sample size 10. There is a statistically slight difference in the SD accuracy of the two algorithms.

Pair 1	**N**	**Mean**	**Std. deviation**	**Std.Error Mean**
Adaptive Routing Algorithm	10	81.2990	4.53070	1.43273
Centralized Algorithm	10	87.6780	4.05478	1.28223

Table 5. An Independent sample T-test is performed for the two groups for significance and standard error determination. The two-Tailed Significance value is 0.001 ($p<0.05$) and it is statistically significant.

		Levene's Test for Equality of Variance		**T-test for Equality of Means**						
	Equal Variance	**F**	**Sig**	**t**	**df**	**Sig(2-tailed)**	**Mean Difference**	**Std.Error Difference**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
Efficiency	**Assumed**	.296	.593	-3.318	18	.004	-6.37	1.92	-10.4	-2.33
	Not Assumed			-3.318	17.783	.004	-6.37	1.92	-10.4	-2.33

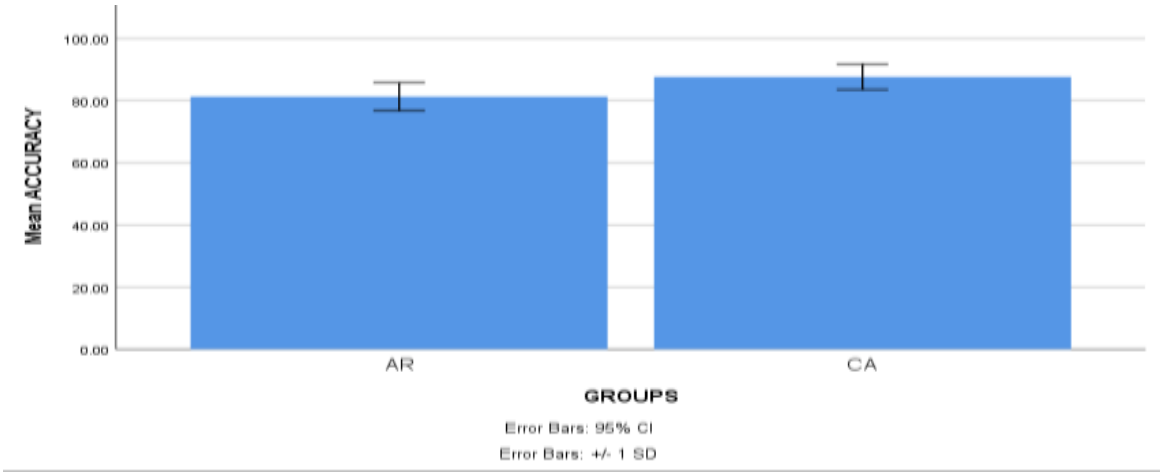

Fig. 1. Bar chart representation of the comparison of mean accuracy of the proposed and the existing algorithm. The accuracy of the prediction of the proposed algorithm is found to be 87.67% and the proposed algorithm gives better results compared to the existing algorithm that has accuracy of 81.29% the mean accuracy detection is ±1 SD.