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# PKI Based Scheme for Detection of Node Replication Attack in Mobile Sensor Network

Mrs. Hemlata B Kadam (ME Student),
Department of Computer Engineering,
Sinhagad Institute of technology,
University of Pune.

Prof. Rahul Kulkarni (Assistant Professor ),
Department of Computer Engineering,
Sinhagad Institute of technology,
University of Pune

***Abstract:*** ***In these days, randomly moving sensor networks are used for building up a application in all the areas like industrial, environmental, and medical and so on. There are some disadvantages of this network over the WSN, this network faces the problem regarding the security attack and they create clones of the nodes. They face this problem because of their dynamic nature. There are some solutions for noticing the attack of node replication. The sensor node generally does not assemble with tamper resistant hardware. This permits the circumstances where the competitor can easily compact the sensor node. There are number of approach are done for noticing node replication offense. The methods like localize algorithm, resisting node replication attack in mobile sensor networks. In this paper we introduced PKI based method for detecting node replication attack. This method improved the localized algorithm and settles the node attack. The proposed system consist of localize algorithm for detecting node replication attack and algorithm to protecting the node replication attack with less storage requirement, processing control and communication transparency.***

***Key words: mobile sensor network, replica attack, Public Key Infrastructure.***

## I. INTRODUCTION

The general definition and used of mobile sensor network is that it is made up of partially shared uncontrolled sensors for watching the environmental or physical condition and to kindly send the results to the centralized location. Wireless sensor network are mainly develop to assist the military appliances. Same as WSN the MWSN consist numbers of nodes this nodes are connected to more than one sensor.

These nodes are used for sending the data in packets. Each sensor node has numerous elements like a radio transceiver along with the transmitter inside or sometimes may have an external antenna; network also contains a processing apparatus like micro controller, an electronic circuit which is interface with small sensors and a battery. Sensor nodes have different in design and size. As per from the size and cost of the sensor nodes the nodes are result in compromise the property like energy, memory, computational speed and communication bandwidth.

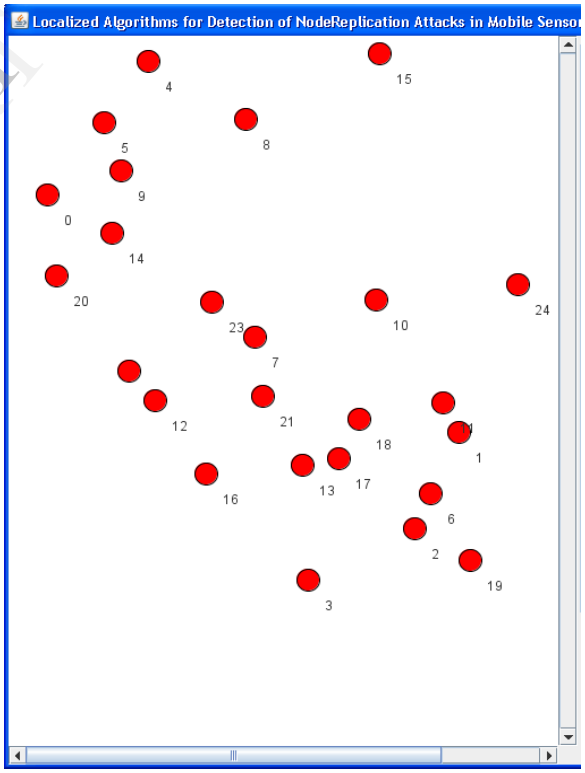



Fig 1: Mobile Wireless Sensor Networks

The advantages of MSN over the WSN are increases due to which the application used MSN. As we discussed the sensor network are used in the application such as monitoring the environment and object tracking. Because of increasing the requirement or growth of robotics, mobile sensor network become viable and relevant. The reason behind the sensor node creating the replica is that the as we

know that the sensor node does not operational with the tamper resistance hardware from this result the opponent detained one sensor node and generate numbers of replica with the same id. After generating the replica the opponent mixed up these clone nodes in the network for doing the malicious activities. This all process is termed as the node replication attack on the sensor network. All the replicas are the clones of the detained node; all these replicas are the part or members of the network. It is found to be complicated to identify clone nodes. This clone attack is very dangerous for the network from the security point, the reason behind this is that the clones have the keys and controlled by the opponent, can easily commence the insider attacks into the system without being detected.

From the research it is found that there are very less method are introduced for replication detection for the mobile sensor network. Worst thing is that all this methods are count to impossible statement. Because of the mobile property of the nodes and the distributed nature of sensor network, it is very challenging to have a well-organized method for detecting replica in the MSN.

The existing algorithm like localized algorithm is not sufficient for protecting the WSN. It is compulsory to have a PKI for identifying the trusted identity. With the help of having the public and private keys to all the original sensor nodes in the network.

Rest of the paper will organized as follows: In section II we discussed about the related work of the proposed method with the explanation of two other existing algorithm. In section III we will discussed about the system architecture of the proposed work. In section IV we discussed about the algorithm and mathematical model of the proposed work. In section V we discussed about the Implementation details of the proposed work all the modules of the proposed system are discussed in this section. After that result is discussed in the section VI and VII and VIII section is of conclusion and acknowledgement is discussed.

## II. RELATED WORK

In the recent era the security regarding the wireless sensor network has the main focus of researchers. Because of small in size and deterministic in nature of the sensor nodes, sensor network helpless to defending the attacks such as non repudiation, denial of service, compromised node attacks. For making the system secured and for the security of wireless sensor network numerous methods are proposed. In the distribution method central method is not used. In this method detection is done by neighboring node by using the distributed approach. As we know that the sensor node when come to join the network, the node transmit a signed location assert to its neighbor, most of the existing method take up the witness finding strategy for detecting the replica. The nodes send the gathered signed location, and identify the claims to its neighbor nodes. If the clones are present in the network, the witnesses, according to the received location claims, have opportunity to find the node ID which is used by the clone nodes. The replica which was finding is disqualified. This described scheme was used for MSN but it has some disadvantage like this method required storage is very high.

Another method is centralized detection method. The central sensor node have fixed velocity for all the nodes present in the network from which all the nodes moving with the same velocity. The replica node is not moving with that given velocity; hence replica node is easily detected. This method used the sequential probability ratio test. In this method the base station check if there is a node show out at the two separate locations with the velocity more than the threshold limit. If according to this condition if the node is present in the network then the node is detected as a replica. There are some issues regarding the measurement of speed of node, which are sometime false positive or sometime false negative.

In the another method by proposed by [2] which is Local Information Exchange, in this method when one node communicate with another node, at the time of communication the node exchanged some information like ID, time, location, the lowest order unused key and the signature under the assumption that the each node is preloaded with one way hash chain. In this algorithm synchronization of time is needed. [1] Proposed an algorithm for replica detection in two dimensional i.i.d. mobility models. In this model at the beginning the nodes are placed in the network consistently and arbitrarily. Each node keeps the information like the ID, time, and the location meet in the past. At per move each node transmits their information to the neighboring node. Form this information each node is able to check whether there is a node appearing in two distinct locations at the same time or not.

a. XED

In this method when the two nodes are meets they ask some information to each other. The information can be exchanged to each other if they are meet first time. When the node is not give the information properly or fails to give the information at that time another node of the communication thinks that the node is the replicated node, the node send this information to the server. Explanation of this method with example, if a sensor node a communicate with the sensor node b, a sends random number to b, when a and b node meet again at that time a can find out whether this is the node b by requesting the random number, in XED we suppose that the replicas cannot collude with each other. There are two steps of XED algorithm which are online and offline step. In online step the computation of random value and hash value is done when the nodes meet each other. And in offline step the pre computes the random numbers and hash value before the nodes meet each other.

b. EDD

In this algorithm, as comparing with the XED algorithm the detection of clone node is high. This algorithm contains two steps which are offline and online steps. This algorithm overcomes the drawback of XED algorithm. The drawback of XED algorithm is that the frequency of detecting he node in first meet is very less.

## III. SYSTEM ARCHITECTURE

The general definition of PKI is that it is a set of hardware, software, people, policies, and procedures need to generate, supervise, allocate, utilize, store up, and revoke certificates. In the proposed system each and every node has their public and private key, after the broadcast each genuine node has public key of each node present in the network. As shown in the Fig. 2 there nu of genuine node and replica node also present. Each node contain its own public and private key, it also contains the public key of others. The steps of algorithm and the mathematical module shown in the next section.

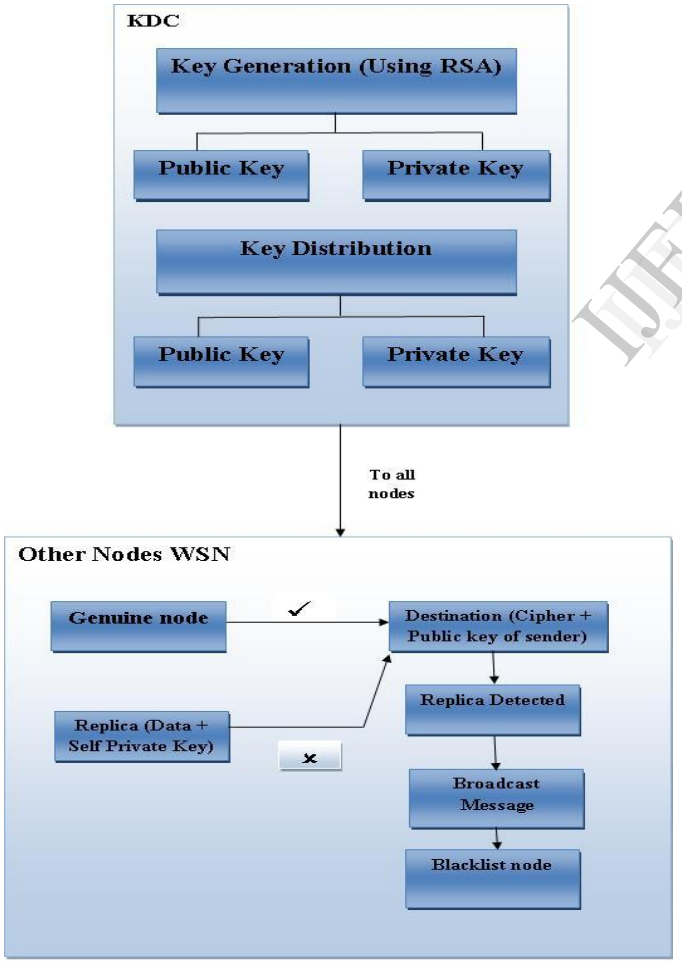



Fig. 2: System architecture of proposed method

## IV. PERFORMANCE EVALUATION

a. PKI Algorithm

The steps of the proposed algorithm are as follows:

1. The public key and private key are distribute to the each and every sensor node in the network.
2. The public key of all the nodes are distributed to each other.
3. The genuine node A sends the encrypted data to the destination node B. B decrypts data by its own public key.
4. C is the replica of A. C behaves like A. C sends the data encrypted by its own private key to B.
5. B tries to decrypt the data by A's public key but fails to decrypt.
6. B tries to decrypt the data by all nodes public key
7. Data decrypted by C's public key.
8. Then it is detected that C is the replica of A

b. Mathematical Model

Mathematical consist of three sections Key Generation, Encryption and Decryption.

*1. Key Generation*

As we know that PKI contains public and private key. Public key is distributed to everyone in the network and it is used for encrypt the message. The keys for this algorithm are generated as follows:

Select any two prime numbers x and y.

These numbers are choose for security purpose and should be of similar bit length. The equation for primary number is as follows:

$$\text{Calculate } v = xy$$

Where v is the modulus for primary and public key and its length shown in bits. 'a' is the term as the public key exponent. 'b' is kept as private key exponent.

*2. Encryption*

Node A sends his public key to node B and takes private key secret. B requested node A to send message. Then A encrypts the message. The general equation of encrypt the message is as follows:

$$C = d^a \pmod{v}$$

Where C is the cipher text converted message and d is the integer value of the original message.

*3. Decryption*

Now node B want to decrypt the message send by node A. Node B decrypt the message by the following equation.

$$d= C^b (\text{mod } v)$$

## V. IMPLEMENTATION DETAILS

*1) Modules*

The proposed application is implemented in the following environment

**Simulation Set**: The application is implemented with the help of java language. Jung libraries are used for the network topology. For generating the sensor nodes and networks the Jung libraries are used.

**Network**: In the proposed, we built a network system were nodes are organized in a topology used for implementation and simulation. These nodes are dynamically loaded.

There are mainly modules of the proposed system. The introductions of these four modules are as follows:

1. Network Creation

The mobile sensor networks are generated for the implementation and simulation of proposed work. The network contains numbers of sensor nodes and connecting edges. The Jung tool is used for that. The nodes or the network are dynamically loaded.

2. Key Generation

The public key and private key are generate for all the sensor nodes present in the sensor networks. For generating the keys the above mention algorithm is used.

3. Key Distribution

After generating the public and private key for each sensor nodes in the network. The public of each node are distributed to the other nodes present in the network. The key was distributed for the purpose of encryption and decryption.

4. Communication using distributed keys

After generating and distributing the keys, the communication between the nodes is done. The sender sends the encrypted data to the destination node. There are numbers of nodes present in the network. Receiver receives the data and decrypts the data successfully by using the keys.

5. Attack Detection

The last phase is attacker detection. Our main aim of the proposed work is to detect the clone node and replica node. If the data receives by the node and decrypt successfully then it is genuine node. If the data received by the node and data is not decrypt by the senders public key at that time attackers are exist in the network. And the destination node try to find the attacker by decrypting the data by all the public keys.

*2) Hardware Requirement*

- Hard disk : 80 GB
- RAM : 512 MB
- Processor : Intel Pentium4 or above

*3) Software Requirements*

*A. JAVA*

The technology used for designing and implementation of this project is java as a coding language. We use the vector class for implementing the algorithm. The Vector class implements a grow able array of objects. Like an array, it contains components that can be accessed using an integer index. However, the size of a Vector can grow or shrink as needed to accommodate adding and removing items after the Vector has been created. Each vector tries to optimize storage management by maintaining a capacity and a capacity Increment. The capacity is always at least as large as the vector size; it is usually larger because as components are added to the vector, the vector's storage increases in chunks the size of capacity Increment. An application can increase the capacity of a vector before inserting a large number of components; this reduces the amount of incremental reallocation. For the GUI designing uses the swing class. For designing frames used jLabel, jTextFeildInputFile, jButtonBrows, jScrolPane, jButton object are used.

*B. NetBeans IDE*

NetBeans IDE are installed for implementing the java code. NetBeans is an integrated development environment (IDE) for developing primarily with Java, but also with other languages, in particular PHP, C/C++, and HTML5. It is also an application platform framework for Java desktop applications and others. The NetBeans IDE is written in Java and can run on Windows, OS X, Linux, Solaris and other platforms supporting a compatible JVM.

*C. Jung Tool and Library for Forming Networks on the Frame.*

Java Universal Network/Graph Framework is a software library, which is used for visualization, analysis the data which is represented as a graph or network. It is written in java. It is used to design directed or undirected graph, graph with parallel edges, multi-model graph etc. It also implements number of algorithms of graph theory, data mining, social network analysis such as optimization, decomposition, random graph generation, flows, etc. it is designed for to support the variety of representations of entities and their relations. It is also provide a visualization framework that makes it easy to construct the tools for the interactive exploration of network data. It is an open-source library; JUNG provides a common framework for graph/network analysis and visualization.

*4) Network Model*

In the proposed network model, here we form a tree network model in which contain root node which is also called as parent node and next is child node. The end nodes also called as leaf nodes. In tree network model contains different levels like level 1; level 2, etc depend on network model. In network may contain nodes which are denoted as a router, hubs, switches etc in the network. It also contains edges which are represented as a link in a network model. This network model is dynamically loaded and also we assign a weight to the each edge.

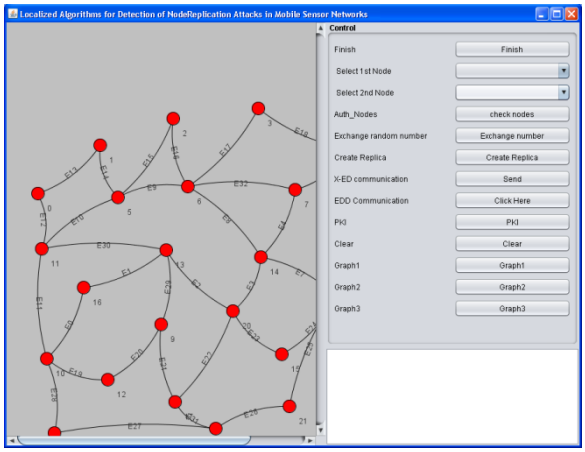
*5) Simulation*

After building tree, we enter a sink node. After that we get a shortest path which is generated by the multipath routing table. And it is used by the cluster head to forward the data towards the sink. Next, we enter the name of the cluster node. After entering the cluster node the cluster will be form. In which contain cluster head which is elected on the basis of highest residual energy and which is closer to the sink node. And remaining nodes which are also called as cluster members. The cluster member forwarded there data to the cluster head and cluster head aggregates this data with own data and after that it calculate the distance between two nodes. The cluster head select the shortest path which is generated by the multipath router and send this aggregate data to the sink. This algorithm shows that this will be help in fast construction, effective energy and dependable WSN applications. And also shows that our approach solution gives outperformance in different situations and in different key characteristics needed by WSNs.

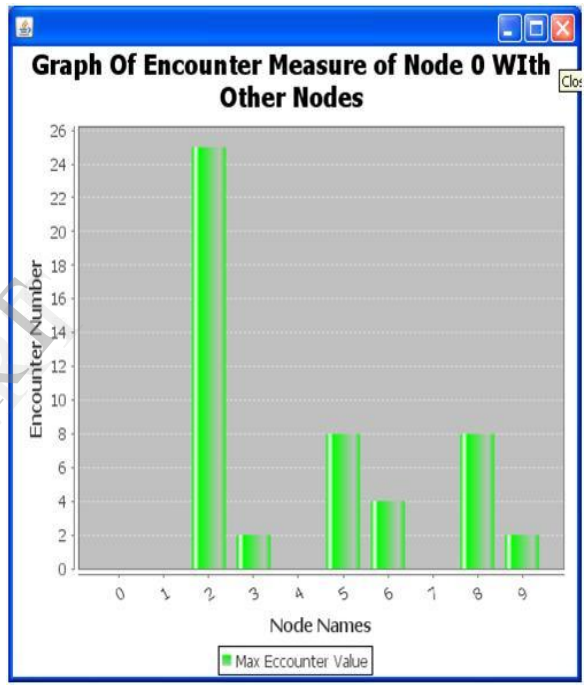
## VI. RESULTS

As comparing with the existing system the simulation result of the proposed work is as follows:

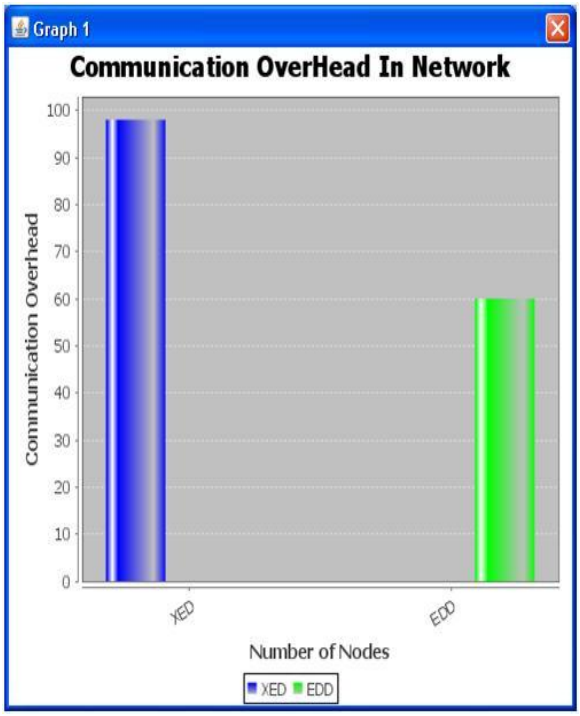
The existing algorithm trying to find the replica nodes but all the existing systems has some disadvantage as we discussed above. The proposed system detects the attacker node frequently with the exact location and with the real identity of the attacker node. After the simulation the following graphs shows the implementation result. We will show the two graphs in the result




Graph 1: Proposed method implementation window




Graph 2: Graph of Encounter Measure of Node 0 with Other Node




Graph 3: Communication Overhead in Network

## VII. CONCLUSION

In the proposed work we overcome the problem faced in the existing methods of localized algorithm for detecting node replication attack. In the proposed system as discussed above we used the public key infrastructure for detecting node replication attack on the mobile sensor network. The existing system like challenge response based method gives the solution for the problem faced during the detecting attack. We successfully detect the replication with high frequency with the help of PKI method.

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## REREFENCES

[1] M. Conti, R. Di Pietro, L. V. Mancini, and A. Mei, *A randomized, efficient, and distributed protocol for the detection of node replication attacks in wireless sensor networks* , Proc.in Proc. ACMInt. Symp. Mobile Ad Hoc Networking and Computing (Mobi-Hoc), Montreal, Canada, 2007,

[2] Chia-Mu Yu, Yao-Tung Tsou, Chun-Shien Lu, *Localized Algorithms for Detection of Node Replication Attacks in Mobile Sensor Networks* , Proc. IEEE, and Sy-Yen Kuo, Fellow, IEEE

[3] B. Zhu, S. Setia, S. Jajodia, S. Roy, and L.Wang, *Localized multicast: Efficient and distributed replica detection in large-scale sensor networks* , IEEE Trans. Mobile Comput., vol. 9, no. 7, pp. 913.926, Jul. 2010.

[4] Y. Zeng, J. Cao, S. Zhang, S. Guo, and L. Xie, *Random-walk based approach to detect clone attacks in wireless sensor networks* , IEEE J.Sel. Areas Commun., vol.28, no. 5, pp. 677.691, Jun. 2010.

[5] ] M. Zhang, V. Khanapure, S. Chen, and X. Xiao *Memory efcient protocols for detecting node replication attacks in wireless sensor networks* , .Proc. IEEE Int. Conf. Network Protocols (ICNP), Princeton, NJ, USA, 2009, pp. 284.293

[6] R. Sarkar, X. Zhu, and J. Gao, *Double rulings for information brokerage in sensor networks* , In IBM Systems Journal,pages 335.352, 2006.

[7] K. Xing, F. Liu, X. Cheng, and D. Du *Real time detection of clone attack in wire- less sensor networks,.* , Proc. IEEE Int. Conf. Distributed Computing Systems (ICDCS), Beijing, China, 2008

[8] ] R. Brooks, P. Y. Govindaraju, M. Pirretti, N. Vijaykrishnan, and M. T. Kandemir *On the detection of clones in sensor networks using random key predistribution*, IEEE Trans. Syst., Man, Cybern. C, Applicat. Rev., vol. 37, no. 6, pp. 1246.1258, Nov. 2007.

[9] H. Choi, S. Zhu, and T. F. La Porta*SET: Detecting node clones in sensor networks,." in Proc. Int. ICST Conf. Security and Privacy in Communication Networks (Securecomm), Nice*, Proc. France, 2007, pp. 341.350.

[10] C.-M. Yu, C.-S. Lu, and S.-Y. Kuo, *Mobile sensor network resilient against node replication attacks* , Proc.IEEE Conf. Sensor, Mesh, and Ad Hoc Communications and Networks (SECON), California, USA, 2008, pp. 597.599, (poster).

[11] ] C.-M. Yu, C.-S. Lu, and S.-Y. Kuo *Efcient and distributed detection of node replication attacks in mobile sensor networks* , Proc. IEEE Vehicular TechnologyConf. Fall (VTC-Fall), Anchorage, AK, USA, 2009, pp. 1.5

[12] J. Ho,M.Wright, and S. K. Das, , *Fast detection of replica node attacks in mobile sensor networks using sequential analysis* , IEEE Int. Conf. Computer Communications (INFOCOM), Brazil, 2009, pp. 1773.1781.

[13] K. Xing and X. Cheng *From time domain to space domain: Detecting replication attacks in mobile ad hoc networks* Proc. IEEE Int. Conf. Computer Communications (INFOCOM), San Diego, CA, USA, 2010, pp. 1.9.