



# VAMPIRE ATTACKS IN WSN CAN LEAD BY ELOA

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## Abstract:

*Wireless Sensor Networks in today's world are the basic means of communication. An ad hoc network is a group of wireless nodes, in which each node can communicate over multihop paths to any other node without the help of any preexisting infrastructure such as base station or access points. Owing to these feature ad hoc low power wireless networks are capable of sensory and pervasive computing which forms the wireless ad hoc sensor network. The limitations of system are resources like battery power, communication range and processing capabilities. One of the major challenges in Wireless Sensor Networks is the security concerns. The attacks affecting these systems are increasing as they progress. One of the resource depletion attacks called vampire attacks are the major concern. They not only affect a single node but they bring down the entire system draining the power i.e. Battery power. In this paper, the system proposed overcomes this challenge by using the Energy load observing Algorithm (ELOA) and the energy consumption is reduced to a great-extend.*

**Keywords:** Wireless Sensor Networks, Routing, Attacks, Security, Energy consumption, Energy load observing Algorithm (ELOA)

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## 1. INTRODUCTION

A network is composed of nodes each of which has computing power and can transmit and receive message over communication links, wireless or cabled. In Wireless networks each node use radio signal to communicate with other nodes. A wireless ad hoc sensor network consists of a number of sensors spread across a geographical area. Each sensor has wireless communication capability and some level of intelligence for signal processing and networking of the data. The basic characteristic of ad-hoc sensor network is the communication among nodes of network without any pre-existing infrastructure. Wireless Ad hoc Sensor Network have

become very essential in communication environment. Due to distributed nature of these networks and their deployment in remote areas, these networks are Susceptible to several security threats that can adversely affect their proper functioning. Ad hoc sensor network guarantees pervasive computing, instantly deployable communication for military and continuous connectivity, for creating a new application in future.

Resource constrains is one of the main characteristic of a Wireless sensor networks Simplicity in WSN with resource constrained nodes makes them very much vulnerable to denial of service [1], attacks on routing infrastructure, and reduction of quality attacks. Routing techniques are required for sending data between sensor nodes and base station for communication. There are many ways to classify the routing protocols. Almost all of the routing protocols



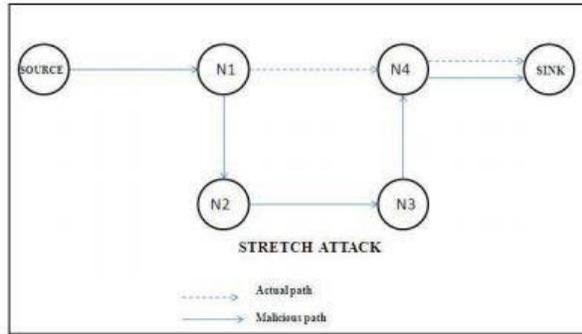


Fig 3. Stretch attack

In our second attack, likewise focusing on source routing, an opponent builds misleadingly long courses, conceivably crossing each node in the network. We depict this stretch attack, since it builds packet way lengths, bringing on correspondence to be prepared by various nodes that is autonomous of bound tally along the briefest way between the opponent and bundle objective

### III. ENERGY DRAINING ATTACKS ON STATELESS AND STATEFUL PROTOCOL

The fardel is on the source to ensure that the route is valid at the time of sending, and that every node in the route is a physical neighbor of the previous route hop. Both the carousel and stretch attacks are evaluated in a randomly generated 30-node topology. It causes delay as well as increase communication overhead and energy consumption in resource limited networks. The effect of denial or degradation of service on battery life and other finite node resources has not generally been a considered securely.

**1) Carousel attack:** In this attack, a malicious node forward a packet with a route included a chain of loops, such that the packets traverse several times in the same route. This strategy can be used to increase the route length beyond the number of nodes in the network an example of this type of route is in Fig.4 the thick path shows the honest path and thin shows the malicious path.

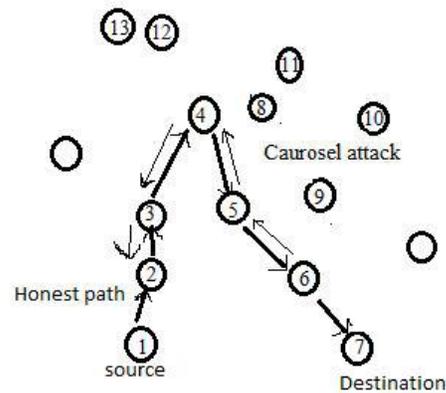


Fig.4 Carousel attack: Thick path shows the honest path and thin shows the malicious path.

**2) Stretch attack:** Another attack in the same layer is the stretch attack, where a malicious node constructs falsely long source routes, causing packets to traverse a longer than optimal number of nodes. In this example given below honest path shown with thick lines and adversary or malicious path with thin lines. The honest path is very less distant but the malicious path is very long to make more energy consumption. Per-node energy usage under both attacks. As expected, the carousel attack causes excessive energy usage for a few nodes, since only nodes along a shorter path are affected.

In contrast, the stretch attack shows more uniform energy consumption for all nodes in the network, since it lengthens the route, causing more nodes to process the packet. While both attacks drastically network-wide energy usage, individual nodes are also noticeably affected, with some losing almost 10 percent of their total energy reserve per message. Two important classes of stateful protocols are linkstate and distance-vector. In link-state protocols, such as OLSR [2], nodes keep a record of the up-or-down state of links in the network, and flood routing updates every time a link goes down or a new link is enabled. Distance vector protocols like DSDV [11] keep track of the next hop to every destination, indexed by a route cost metric, e.g., the number of hops. In this scheme, only routing updates that change the cost of a given route need to be propagated. Routes in link-state and distance-vector networks are built dynamically from many independent forwarding decisions, so adversaries have limited power to affect packet forwarding, making these protocols immune to carousel and stretch attacks.

In GPSR, a packet may encounter a dead end, which is a localized space of minimal physical distance to the target, but without the target actually being reachable. The packet must then be diverted until a path to the target is available. In BVR, packets are routed toward the beacon closest to the target node, and then move away from the beacon to reach the target. Each node makes independent forwarding decisions, and thus a Vampire is limited in the distance it can divert the packet. These protocols also fall victim to directional antenna attacks in the same way as link-state and distance-vector protocols above, leading to energy usage increase factor of  $O(d)$  per message, where  $d$  is the network diameter. Moreover, GPSR does not take path length into account when routing around local obstructions, and so malicious misrouting may cause up to a factor of  $O(c)$  energy loss, where  $c$  is the circumference of the obstruction, in hops.

#### IV. ENERGY LOAD OBSERVING ALGORITHM (ELOA) AGAINST VAMPIRE ATTACKS

This section focuses on the design details of our proposed protocol ELOA. Where energy of a node gets to threshold level it plays a vital role by performing energy intensive tasks there by bringing out the energy efficiency of the sensors and rendering the network endurable. This pattern based on the energy levels of the sensors.

ELOA functions two phases namely.

1. Network configuring phase
2. Communication phase

**1. Network configuring phase:** The goal of this phase is to establish an optimal routing path from source to destination in the network. The key factors considered are balancing the load of the nodes and minimization of energy consumption for data communication.

In this phase the node with threshold level energy (attacked node) sends ENG\_WEG message to all its surrounding nodes. After receiving the ENG\_WEG packets the surrounding nodes send the ENG\_REP message that encapsulates information regarding their geographical position and current energy level. The node upon receiving this stores it in its routing table to facilitate further computations.

Now the node establishes the routing path, first it traces the next node by computing the energy required to transmit the required data packet that is

suitable energy node and less distant node selected as the next forwarding node in this way it establishes the route from source to destination with suitable energy and less distant.

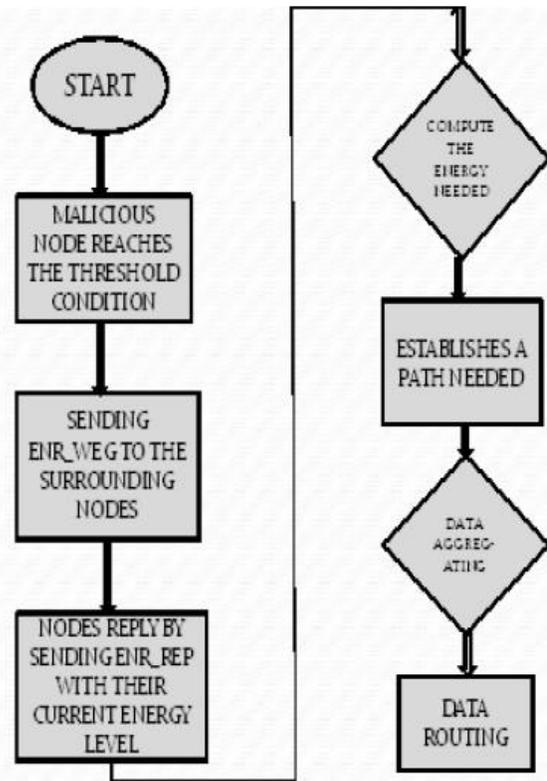


Fig 5. ELOA

Thus energy spent by the allotted node suitable to the data packet sent from the node in this way this algorithm avoids data packet dropping and this allotted forwarding node transmits the packets safely to the destination. This algorithm gives prime importance to achieve balancing of load in the network. The suitable energy node will be assigned as a forwarding node as long as this node as this node has the capacity to handle. In this way a multi hop minimal less distant path is established to bound the network damage from vampire attack.

EWMA avoids the collapsing of entire network by dropping the packets in the network. The load is evenly balanced depending upon the capacity of the nodes. In this way multi hop load balanced network is achieved.

**2. Communication Phase:** The main job of communication phase is to avoid the same data packets transmitting through the same node repeatedly to deplete the batteries vastly and

leads to network death because of vampire attacks.

The process of repeating the packets is eliminated by aggregating the data transmitting within the forwarding node and route the remaining packets safely to the destination. The data aggregation is achieved by first copying the content of the packet that is transmitting through the node. This copied content compares with the data packet that is transmitting through the node if the transmitted packet is same the node stops the data packet transmitting through them. In this way it avoids the redundant packets transmitting through the same node again and protects the depletion of batteries ghastly. Then send the required data packets through the established node safely to the destination.

### V. SIMULATION RESULTS

The simulation environment is implemented in the NS-2, a network simulator that provides support for simulating wireless networks

#### Detection of Vampire Attack

We have evaluated both the carousel and stretch attack. A randomly generated 10 node topology for carousel attack and 16 node topology for stretch attack is taken. A single randomly selected malicious AODV agent, using ns2 network simulator is evaluated. The total energy set is 10J. For the stretch attack the energy consumed by the system is 4.37960 J and for the carousel attack the power consumption is 4.625225 J.

The energy calculated is given by the formula:

$$\text{Energy consumed} = \frac{EI - EF}{EI} \quad (1)$$

EI - Initial Energy

EF - Final Energy

The initial value in both the cases is assumed to be 10J. The simulation is done for 10ms. The data is transmission begins at 5ms and ends at 10ms.

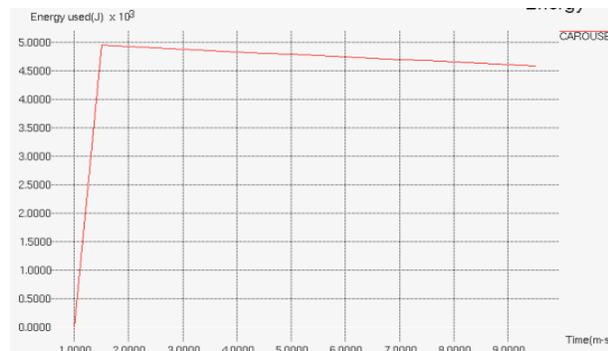


Fig 6. Energy consumption in carousel attack

Figure 6 shows the energy consumption during a carousel attack where the x axis is taken as the Time

(ms) and the y axis is taken as the Energy (J) used that is done by the formula mentioned earlier. Energy consumption is 4.37960J for every 10J. Since the initial energy is 10J the peak rises above and then gradually decreases with the transmission of data and in the presence of carousel attack.

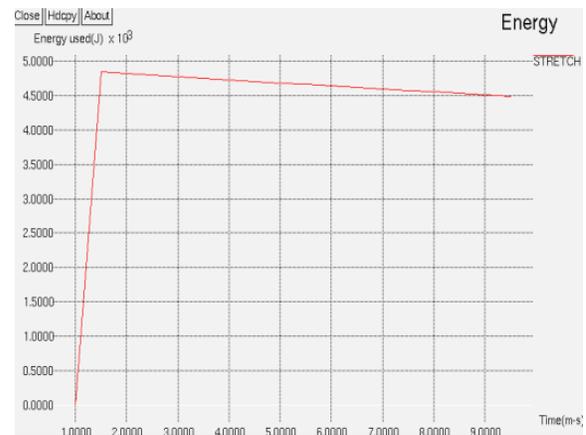


Figure 7 Energy consumption in stretch attack

Figure 7 shows the energy consumption in stretch attack where the x axis is taken as the Time (ms) and the y axis is taken as the Energy (J) used. The energy consumption in this case is 4.625225J for every 10 J. This value increases with the increase in number of nodes.

#### Mitigation of Vampire Attacks

After using the ELOA algorithm the simulation is repeated for the same values.

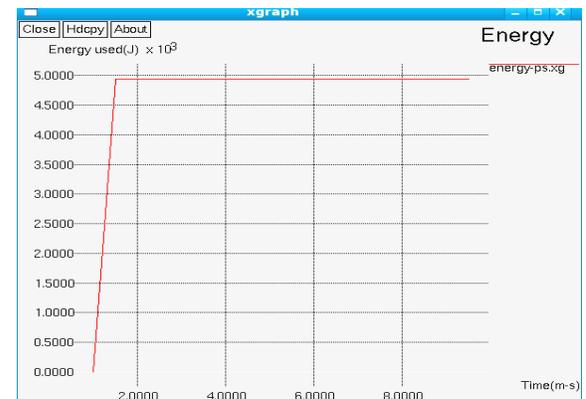


Fig 8 Mitigation of Carousel attack

Figure 8 shows the mitigation of carousel attack. From the analysis of the graph mentioned below the energy consumption is stable.

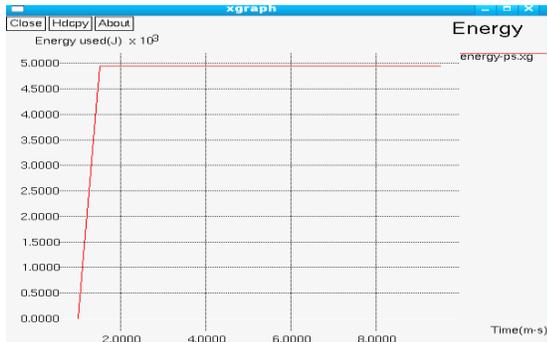


Fig 9 Mitigation of Stretch attack

In figure 9 the mitigation of stretch attack is shown. These analyses show that in case of an adversary present they lead to the death of the nodes energy. But with ELOA we can increase the lifetime of the nodes. This concept increases the overall lifespan of the network by choosing the energy efficient routing path.

## VI.CONCLUSSION

A new class of energy draining attacks that use routing protocols to permanently halt ad hoc wireless sensor networks by depleting nodes' battery power. Vulnerabilities exposed in existing protocols are evaluated. Performance of existing protocols is quantified using small number of adversaries in a randomly generated 30 node topology. Simulation results show the network energy expenditure. The system proposed overcomes this challenge by using the Energy load observing Algorithm (ELOA) and the energy consumption is reduced to a great-extend in order to prevent vampire attacks by verifying that packets make progress towards their destination.

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