

# Monitoring Moving Target and Energy Saving Localization Algorithm in Wireless Sensor Networks

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## Abstract

Detecting the exact position of a moving target is the most rapidly developing vicinity of wireless sensor networks in which energy consumption is the one of the important aspects. In this paper, we have adapted a selective approach algorithm which is based on one hop neighbor. The scope of the paper is to identify the location of moving targets and to improve the energy of sensors. The energy is saved by the sensors positioned near the moving target only activated using a selective approach algorithm by which lifetime of the network could be extended. At the same time, the accuracy and mobility also calculated and compared with existing method of blind source separation which gives the best performance of the proposed algorithm.

**Keywords:** Energy Efficiency, Localization, Moving Target, Selective Approach Algorithm, Tracking, Wireless Sensor Networks

## 1. Introduction

Wireless Sensor Networks (WSNs) is the fast mounting area which consist of several numbers of nodes or sensors distributed in a cooperative area<sup>1-3</sup>. Each node can communicate with other sensor nodes wirelessly in the premeditated communication assortment. WSNs have a faction of applications like moving target tracking, ambiance monitoring, health check observe, micro surgery, armed forces operations, agriculture, surveillance, trade process manage, child education, observing smart building etc<sup>4-5</sup>. In WSNs, localization means shaping the position of every sensor node. A number of amazing sensor nodes identify their position by fitting Global Positioning System (GPS) device or manual design. These types of nodes are entitled as reference node or anchor node or beacon node. On the other hand, providing GPS in all sensor nodes would be greatly lavish and not practicable because it cannot be monitored in mines and

indoor environments. In view of that, tracking target is the crucial problem in wireless sensor networks<sup>6</sup>.

To deal with this problem numerous localization algorithms are fashioned. Extent based and range free calculations<sup>7</sup> are the two fundamental sorts of localization algorithms. The most important assignment of localization is to accomplish the accurate position of every sensor node in the two dimensional (2D) or three dimensional (3D) plane<sup>8</sup>. The major tracking method of WSNs are tree based, cluster based, prophecy based tracking and Peer to Peer WSN<sup>9-11</sup> for tracking. The employment of sensors in wireless sensor networks can be clustered into two kinds<sup>12</sup>: Physics-based and Geometric based. In Physics-based tactic the sensor is accepted as focuses subject to alluring alternately ghastly powers like Newtons Law of strengths while in Computational geometry based methodology the sensor is anticipated as focuses. Different patterns of employment like Dense or meager deployment, Deterministic or haphazard

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deployment, Virtual Force Based Approach, Enlargement Support Approach, Prototype Based Approach, Replica of Deployment Problem, Strip-based Deployment Pattern, jewel design, etc<sup>13</sup>.

## 2. Node Localization Algorithms

In enormous scale remote sensor system, connectivity, deploying and their elasticity of the sensor nodes is more thoughtfulness from the manufacturing and investigation society. Action which want to serve and support the sensors is the magnification of low power message hardware, microcontrollers, discover the node failure, actuators and integration of systems<sup>14</sup>. In general in sensor networks, high scrutinizing rates of modern advanced sensors are not required. The more fundamental implication of sensors are the power capability and their turn-on and turn-off time.

Subsequent moving focuses with wireless sensors is one of the conspicuous uses of remote sensor systems. To track targets, utilizing a system of sensors with wireless communication capacity empowers both expenditure and implementation successful ways because of the accessibility of a lot of information congregated by sensors<sup>15</sup>. Depending upon the applications, sensors with particular detecting modalities, for instance, acoustic, seismic, infrared, radio, and appealing can be conveyed for following unambiguous sorts of targets. As a rule, information gathered by sensors is total information or mixtures of signals from individual targets. For instance, radio sensor in a field of investment may get signal strength from more than one target. Clearly, tracking targets in view of mixture signals can't be precise when obstruction from targets other than the one of the investment is not unimportant. The signals gathered by the sensors represent a massive test to target-tracking resolution<sup>16</sup>. In WSNs, the realistic declaration to an extensive assortment of applications is to track the moving target. In moving target tracking applications, wisely organize the disasters like energy diminution of sensors, unbalanced communication links, atmospheric circumstance and harmful attacks<sup>17</sup>.

In <sup>13</sup>, the authors express the wide-ranging of target tracking in wireless sensor networks. The sensor nodes can be all the more reasonably sent with all the more effective and accurately where the scope and combination issue must be nervousness. They investigated plentiful protocols for target tracking and deployment in wireless

sensor networks. Authors<sup>17</sup> estimated a narrative Fault tolerant convention for subsequenting the focus on remote sensor systems. They observed the execution of overheads and adaptable natural life of deficiency tolerant with LEACH algorithm and verified FTTT ingests 25% less vitality than LEACH algorithm. In <sup>18</sup>, the authors demonstrates the broad-spectrum process of target tracking to save energy in wireless sensor networks. To prove this, the sensor nodes are in active which sense the target at the same time the left over nodes are inactive. Authors <sup>19</sup> proposed dynamical object tracking protocol to track a challenger or a wild animal in wireless sensor network. The difficulty, compensation, expansions and the performance comparison of target tracking techniques are investigated in<sup>20</sup>. In <sup>21</sup>, the author projected two low complexity blind source separation systems for integration two signals in a scattered sensor network at low bit rates.

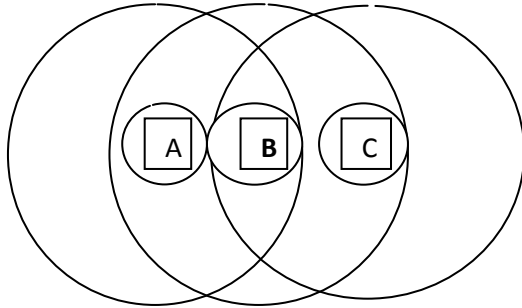
Authors <sup>22</sup> proposed practical force performance to boost the coverage and also estimated probabilistic target localization system used by cluster head. In <sup>23</sup>, the author anticipated scalable tracking using networked sensors for tracking moving objects dilemma. They too projected drain and balance routine for building tracking harms on one dimensional and two dimensional networks. Authors <sup>24</sup> summarized statistical estimation and found the indispensable show breaking points of precision of the target tracking for binary propinquity sensors in a two dimensional field. To weigh the speed of the target they make use of the connections between binary detecting and investigating hypothesis. In <sup>25</sup> the authors resolute on the fashionable vital strength techniques of target tracking. They arranged the effective methods in view of the coordinated effort of correspondence and the detecting subsystem of an introverted sensor. Authors <sup>26</sup> proposed Blind Source Separation (BSS) method. Since this method affect separation performance, it is very crucial to track the target. In <sup>27</sup> the authors investigated the resources and aspects that lessen the network lifetime of networks. A method to develop encryption key management in wireless sensor networks are explicated in<sup>28</sup>.

## 3. Selective Approach Algorithm

To detect the target moving in the given area, an optimized framework has been proposed to determine the position of the sensor nodes. The main goal is to maximize the disclosure of the least exposed area. In the proposed

system we use a Selective Approach Algorithm (SAA)- in which energy is gathered by sleep/awake power in sensor network.

The Selective Approach Algorithm is based on one hop neighbors which mean that the nodes placed in the direct coverage of sensor nodes that nodes called as one hop neighbor node. The one hop neighbor is shown in Figure 1 where A is a one hop neighbor of B, B is one hop neighbor of A and C, C is the one hop neighbor of B.



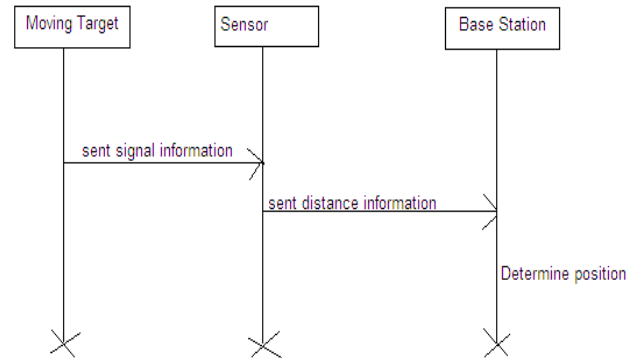
**Figure 1.** One hop neighbor.

When mobile target enters the network, initially all the nodes monitor the target continuously. Using Selective Approach Algorithm, gratuitously nodes far away to the target are not compulsory to be activated all the time. The sensors placed in the region of target monitoring alone go to active mode. Also the nodes will call the one hop neighbors to come to active mode since the network can't predict where the target will move. Then the data is composed of the sensors and that will launch through multi hop communication.

The working principle behind the Selective Approach Algorithm is as follows: i) The node id and position of the source node will be sent to the one hop neighbor. ii) If the one hop neighbor has already received the message or if the message does not contain a node id, then drop the message. iii) Else receive the message. iv) To forward the message, select a set of neighbors based on one hop neighbor information. v) To cover the two hop neighbor the nearest one hop forwarder should be selected.

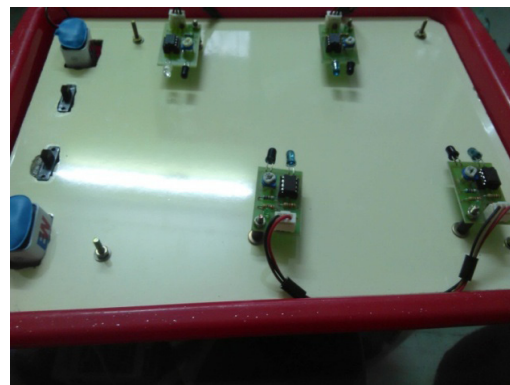
This framework consists of three elements: 1. Deploying the sensor nodes 2. Creating the mobile target 3. Creating a base station node. Primarily the sensor node with the signal of the mobile target node and estimate its distance from the target. Once the distance information is deliberated, then the sensor nodes will pass the information to the base station. The base station will already have the dimensions of the sensors, so it can

easily find the exact position of the mobile targets. The functions of these algorithms are shown in Figure 2. The accuracy of the tracking performance is deliberated by the mean and standard deviation of error distance.



**Figure 2.** Modules of Selective Approach Algorithm.

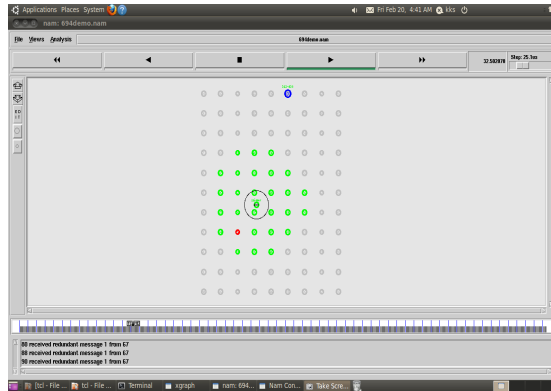
We have used Network Simulator 2 for the proposed algorithm. Also, we have done the hardware setup for tracking the moving target shown in Figure 3. In this conduct test we have used 4 sensors with IC LM358 in a sensor board. When an object comes into the particular area the nearby sensor alone in active mode and sense that object and display the position in the system.



**Figure 3.** Hardware setup.

## 4. Simulation Results

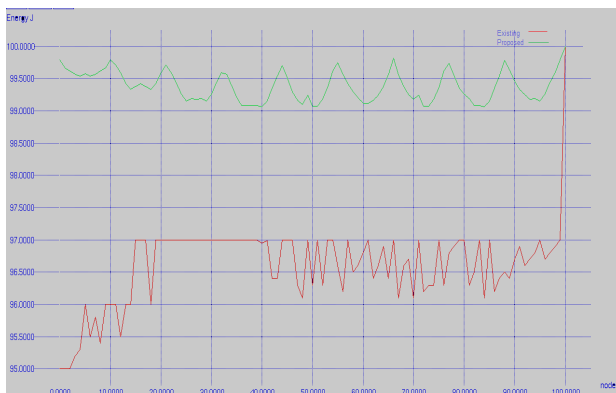
We have organized 101 sensor nodes randomly in a 100m X 100m area in which 101th node as a base station, 100th node as mobile target. Remaining all the other 99 nodes are used for monitoring the mobile target shown in Figure 4. The green color nodes point out the active node and the gray color nodes point out the sleep node. The moving target node position is at (31.2,43.8).



**Figure 4.** The mobile target is at (31.2,43.8).

The energy of each node is considered by deducting the transmitted energy and received energy from the current energy. Figure 5 shows the evaluation graph of energy between the existing method<sup>26</sup> and the proposed system.

The Mobility of all node is deliberated by finding the distance per time. Figure 6 shows the evaluation graph of Mobility between the existing method<sup>26</sup> and the proposed system. The Accuracy depends on mobility and the area



**Figure 5.** Energy Vs Node.



**Figure 6.** Mobility Vs Node.



**Figure 7.** Accuracy Vs Node.

covered by the target. Figure 7 shows the evaluation graph of accuracy between the existing method<sup>26</sup> and the proposed system.

## 5. Conclusion

To improve the energy of sensors and determining or monitoring the moving target localization, we have proposed an optimization framework of a selective approach algorithm in wireless sensor networks. The sensors placed near the region of moving target alone go to active mode. So the energy is saved and accuracy also improved to a large extent which results in better performance.

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