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SEEKING TARGET USING SELF ORGANIZED MSN

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ABSTRACT
Finding target in remote areas is a difficult task as based on the target and the area resources required changes. This paper focuses on an algorithm which is used to guide a Mobile Sensor Node (MSN) in an unknown environment searching for targets. The target in the system is stationary but randomly placed. The MSNs are spread all over the searching area. Any MSN can communicate to any MSN at any time. MSNs have the broadcasting capabilities from which the message can be transferred to all. To find the target is the main aim of all sensor nodes. Appling Particle Swam technique, searching of target is achieved by multiple MSN

***Keywords**: Target, WSN, Particle Swarm, MSN.*

I. INTRODUCTION
The WSN based target system consists of sub-domains in searching the target. First is localization and second is path planning to search Target. In localization MSNs are randomly placed in searching space. And for the path planning MSNs interact with each other and move to acquire searching space. In this application of the system, a mobile sensor needs to navigate between different sensors whose locations are unknown. A lot of complexity is added because the mobile node has to locate a sensor, and plan a path to reach the target, send message and follow the path. Maintaining such a high quality of service in potentially harsh environments becomes a significant challenge hence require efficient navigation algorithm.

II. LITERATURE REVIEW
This work is related to target searching so most of the literature is available using movable robots. Navigating a mobile robot is categorized into two domains localization and navigation [1][2]. Global Positioning System (GPS) is the key element which provides the location and time information of an object anytime anywhere. GPS provides this data with the help of four satellites and a GPS receiver embedded on the object which makes it appear on the line of sight. The time difference of arrivals (TDOAs) and the received data together computes the GPS location [2].

However there's a lot of power consumption for sensors to compute the exact location so a new way was proposed which uses Radio Frequency RF such as RADAR—uses a calibration process based on RF sensors. BAT—uses ultrasonic waves reflection. CRICKET—uses ultrasonic waves with RF sensors combined. SPOT ON-uses an aggregation algorithm for 3-D location sensing based on received signal strength indicator (RSSI) analysis [3].

Some of the great works that uses WSNs to get assistance of mobile robot navigation system uses basic algorithms for an open area covered with sensors with differentiating network strength. The heading searching every two steps algorithm explores all the sensors using a directed antenna.

Mobile robot dose not uses the old traditional ways of locating sensor location from a field of random deployed sensors. It doesn't have any prior knowledge of location or uses any special hardware to any mobile node[4][5].RSSI information and we can use radio propagation models to predict the distance based on the RSSI. Furthermore, the mobile robot knows, in advance, the sequence of the next nodes toward the source node, reducing the search time. Simultaneous Localization and Mapping SLAM is proposed navigation algorithm based on RF and WSN[6][7][8][9]. It uses a triangulation method for the robot to locate itself and then applies a two-step particle filter for building the map. The trilation method estimates its position from the radio sensors. It uses various sensors to acquire data as from high dimensional lasers range finders high dimensional sonar sensors. In our work RSSI used to measure the location using mobile robot and sensor signal.

The remaining paper is organized as follows. Section III carefully defines a problem of proposed system. Section IV explains implementation of work. Section V provides the result and the performance and Section VI gives the conclusion

III. PROPOSED SYSTEM

MSNs and Target (T) are usually placed randomly in the area of the interest.
We make these assumptions here:

1. Each MSN knows their current location using GPS but not the location of the target.
2. Each sensor has a unique ID to help the process of sensor identification.
3. Sensors are deployed in an searching area.
4. Searching area is obstacle free.
5. The target sensors can be stationary.

To implement this system in an enclosed 100M X 100M area. We propose the model which is shown in Figure 1.

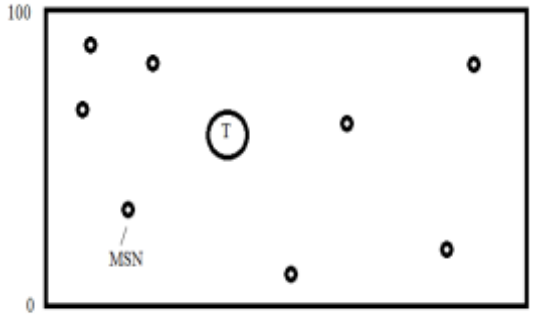

Figure 1: Environment to be implemented

As seen in the figure we have an area of 100X100 in that multiple mobile sensor nodes are placed can communicate with all MSNs but searching range is limited.

All MSNs can communicate with each other by sending their location and about target. Either target found or not found. If target not found by all MSNs then they all searches the target randomly as per their velocity.

The proposed algorithm is as follows:
Assumptions:
Area = 100M X 100M, Target = Static
Communication range of sensors- 100M

Algorithm:
Step 1: Nodes (MSN) & T is randomly placed in area
Step 2: MSN moves randomly and checks if the T is in their searching range or not.
Step 3: If T found in the range by any node, it broadcasts the strength of the signal & its own location to all the other nodes. After sending the message it continues to move randomly.
Step 4: Other nodes moves towards the broadcasted location.
Step 5: While moving if T is found by any other node or the same with more signal strength then the old one then repeat step 3.
Step 6: If the location of the node and the T are same then stop and disable T.
Step 7: after reaching the location if T is not found in the range repeat step 2.
The above proposed algorithm is implemented in the next section.

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IV. IMPLEMENTATION

As shown in the Figure 2. We have an area of 100m X 100M. In this area there are two types of nodes first is the mobile sensor nodes (msn) which can be any wireless and mobile device having capability to communicate. But the communication is restricted over here; the restricted area is the enclosed area i.e. the 100X100 region.

The second nodes are the target nodes. The target sensor nodes have a range of 15 meters i.e. if any of the MSN is within that reach he can sense the target. Similarly the msn also has a sensing region which is near about 10M. In this system msn can talk to all other MSN in the 100X100 area specified.

As the algorithm says the MSN are randomly placed in the enclosed area. They can move randomly in any direction. Also a 1 single or multiple targets are present in the area.

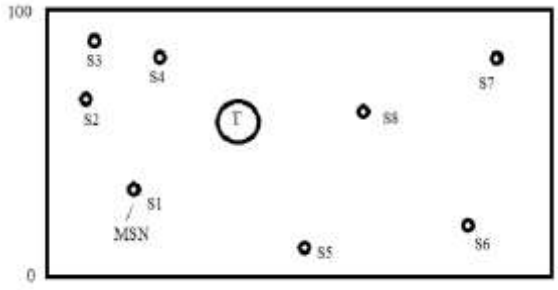

Figure 2: Area with MSN and Target to catch

Both of them are moving at their own pace. Let us assume that MSN S1 has encountered the T in his sensing area. The MSN will create a message in which it will add the location and the sensing strength of the target and will broadcast it to all the other MSN present in the area. After sending the message S1 will follow its own pace.

When all the others find the message they follow the direction given n the message. While moving there is possibility that any other MSN finds the T. In that case if the strength of the sense is higher than the old strength then only the message is again forward to the other nodes now everyone follows the direction of the new node. But if the strength is same or less then the message is not sent. When all the MSN reach the goal position if the target is found they tag the target and disable it. But if the target is not present in the location, all these other nodes start sensing for it again.

V. RESULTS

Simulation is done in Matlab. For simulation 8 MSNs, 12 MSNs and 16 MSNs are considered and are shown in Figure 3, Figure 4 and Figure 5 respectively. Movement of MSN is taken after 5, 30, 70,150 steps. Initially all MSNs moves randomly in searching space. After 5 steps no MSN is in the range of Target so all MSNs moves randomly. After 30 and 70 steps sensors are moving to the location broadcasted by MSN who sends message that target is found. In the movement if some other MSN is closer to T then all other MSN moves towards to the nearer MSN. Closeness is calculated by received signal strength of T. After150 steps all MSNs are in the place of target.

VI. CONCLUSION

Studies conducted on the self-organization of MSN to search target. At present the study has been restricted to an obstacles-free environment. The strategy also does not consider collision avoidance. It is proposed to carry out work in these areas shortly.

Though the study has been restricted to hunting, it is felt that the concept can be extended to investigate environmental parameters, search for survivors, and locate sources of hazards such as chemical or gas spills, toxic pollution, pipe leaks, radioactivity, etc.

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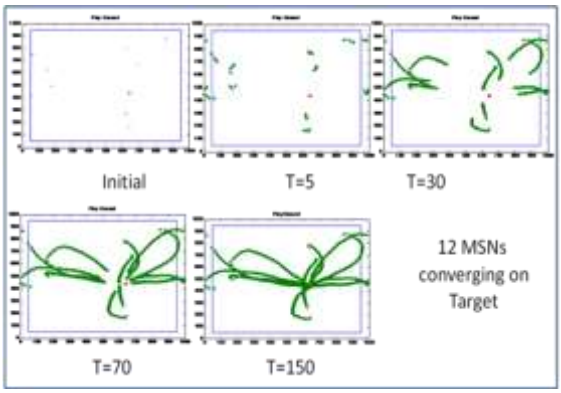

Figure 3. Self organizations of 8 MSNs

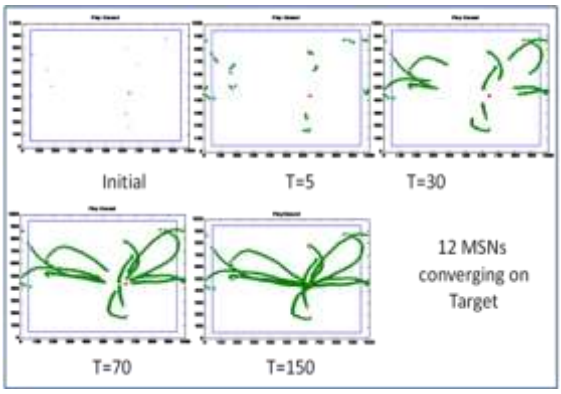

Figure 4. Self organizations of 12 MSNs

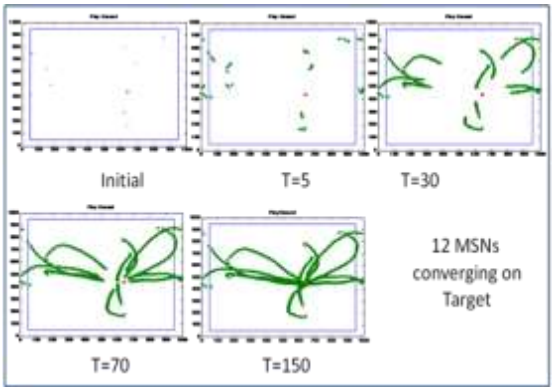

Figure 5. Self organizations of 16 MSNs.

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