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An Improved Approach for Tracking in Maneuvering Target Environment

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Abstract **- A Modern sensor networks, we need most important parameter is Self-organizing capacity for tracking maneuvering (non-constant) targets. for performance gained lot of attention to point out the control and coordination problem in self-organizing sensor network environment used flocking based methods. In this paper we are these type two well-known algorithms, namely, the Flocking and the Semi-Flocking algorithms. Although these two algorithms have demonstrated promising performance in tracking linear target(s), they have deficiencies in tracking maneuvering targets. Flocking algorithm is applied for tracking the target in maneuvering environment. In this paper we are analyzing the performances of flocking-based algorithms, both with and without the proposed approach, are examined in tracking both linear and maneuvering targets. Experimental results demonstrate how flocking algorithm yields better tracking of maneuvering targets, and how applying flocking concept on the target tracking process to improves the quality of tracking and increases the speed of convergence.**

Keywords**-Surveillance systems, Mobility control, Flocking Algorithm, Maneuver target, biologically inspired computing, Sensor coordination, Sensor networks.**

I. INTRODUCTION

Wireless sensor networks (WSNs) have gained worldwide attention in recent years, particularly with the proliferation in Micro-Electro-Mechanical Systems (MEMS) technology which has facilitated the development of smart sensors[1] . A target tracking system through WSNs can have several advantages:

- Qualitative and fidelity observations;
- Signal processing accurately and timely and increased system robustness and tracking accuracy.

However, the use of sensor networks for target tracking presents a number of new challenges [3]. These challenges include limited energy supply and communication bandwidth, distributed algorithms and control, and handling the fundamental performance limits of sensor nodes, especially as the size of the network becomes large[4]. Unlike traditional networks, a WSN has its own design and resource constraints. Resource constraints include a limited amount of energy, short communication range, low bandwidth, and limited processing and storage in each node. Design constraints are application dependent and are based on the monitored environment. The environment plays a key role in determining the size of the network, the deployment scheme, and the network Surveillance applications include self-composed mobile sensors[6].

Sensor networks are an emerging field of study that is expected to touch many aspects of our life, such as: military sensing, environment monitoring etc. this paper can be try to introduce the Main objective is develop and experiment solution to achieve the target using mobile sensors having some limit of range. The project focus on a specification, verification and simulation of related situations: target tracking in maneuvering (non-linear) and non-maneuvering (linear) environment using different methods.

Control and coordination problem: Main important challenge in large-scale surveillance systems is portability control and coordination, which manages the ideal development of an arrangement of versatile sensors. Maximizing target coverage is one of the main objectives in mobility control of many surveillance applications[8].
This research work objective is motivated by several use case scenarios. The objective of research is to track the target in the environment where the obstacles and targets are moving with non-constant velocity. And simulation for the interaction between mobile sensors, obstacles and target in maneuvering (non-linear) environment. Consequently, during the simulation and experiment period, there are several objectives need to be achieved:

- Target tracking in static environment: Before directly achieve the main objective rstly go for the target tracking in constant or static environment.
- Developing environment for maneuvering targets: To develop the environment install player-stage 4.2 and perform experiment to predict the next stage of the target using flocking algorithm.

- Developing a technique for tracking algorithms, predicting the next positions of Targets in sensor network.
- Introducing complexity in the environment.
- Testing and Validation of proposed algorithm.
- Comparison of the proposed algorithm with existing algorithms.

II. METHODOLOGY

In this section methodology introduces the considerations, hypothesis and the analytical validation of the proposed results and solution. We talk about the effectiveness of Flocking and Semi-Flocking algorithms in tracking maneu-vering targets in a surveillance application. Assessments showed that flocking based calculations are not ready to track moving targets impeccably, because on the grounds that moving targets change their speed and bearing often and flocking sensors do not have don't have sufficient time to change their speed appropriately.

1. Proposed hypothesis
From the investigation of the fault tolerant flocking algorithm, there are following indicators or requirements that can help to solve fault tolerance in robot flocking.

- To avoid collision: There are two sorts of impacts that should be thought of one as, is crash between robots, the other one is the impact amongst robots and impediments if exist in the condition. Just some of work considers two sorts of impact together.
- To keep robot together: That is robots need to keep the neighboring chart (too sensor or correspondence chart) associated connected the whole execution of the algorithm. In some applications, a flock of robots need to generate a required formation during flocking by organizing by themselves. Also, during moving, all robots required to maintain such formation to finish the define tasks.
- To find the weakest Failure detector: There are many failure detection methods that are explored in traditional distributed systems. Based on different model and assumptions, the execution and implementation of failure or error detection schemes is different but the main object of them is to detect the other robots status (whether they are alive or crash).
- To investigate the weakest system model: When a robot can exchange information or communicate with the other robots by wireless communication or GPS (global position system), and if every robot has its identity, the new control and coordination algorithm will be developed based on such robot ability. However, the information exchange between robots may results the delay and communication is not reliable due to limited range of bandwidth, range and interferences, especially in harsh environments, it will be a difficult to design an effective and efficient flocking algorithm.

2. Mechanism /Algorithms

2.1 Flocking-based algorithms-This area discuses flocking algorithm as flocking-based approaches to mobility control of sensors in reconnaissance applications. Flocking-based algorithms have a few favorable circumstances that make them appropriate for use in sensor administration.

Distributed problem solving, neighborhood communications, low calculation overhead for the sensors, high adaptability and versatility are just a few examples of the upsides of these algorithms. The following assumptions have been taken for this report about the surveillance system and mobile sensors

The observation framework comprises of n versatile sensors sent in a two-dimensional geo-graphical area with width w and length l.

2.2 Communication capacity- Every sensor can speak with all its neighboring sensors by trading messages through a correspondence arrange.

2.3 Detecting ability-Every sensor can detect exact position and speed of the considerable number of focuses on that are set inside separation r from the sensor. Hence, the detecting scope of every sensor is a circle with span r around it. Focuses on that go in close to this range are constantly identified, while focuses outside are never distinguished.

2.4 Movement ability-Every sensor movement is controlled freely be that as it may, facilitated With the movement of different sensors.

3. Flocking-based algorithms
The Flocking algorithm, which is enlivened from the collective nature of birds, is focused on three rules: flock centering, collision ignorance and speed matching. Flock centering object to keep each molecule close to its nearby adjacent. Collision ignorance tries to avoid crash between nearby adjacent and speed matching object to match the speed of each particle with all nearby flock-mates.

Ui = fig + fid +fiy

where fig is the gradient-based term, fid is the velocity consensus term, and fi feedback. Their expressions are of the form:

fig = - qiV (q) = X (z)(qj qi)=z j Ni
Xfid = aij(pj pi)

jNi is the navigation

fi = c1i(qi qtk) c2(pi ptk)

In spite of the fact that the constrained clustering method proposed in this report is a general one, we chose the K-means clustering algorithm and connected characterized requirements on it to obtain constrained clustering. This algorithm was chosen because it is a notable, successful and basic calculation algorithm for large-scale clustering issues.

III.EXPERIMENTS & RESULT

In this section discusses the various experiments pertaining to the proposed hypothesis and their findings.

1. Simulated results

1.1 Experiment 1

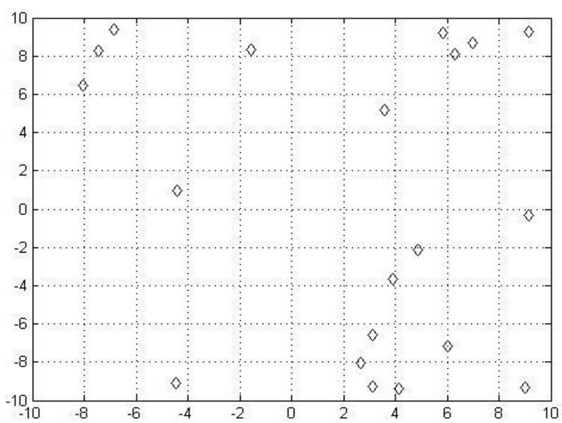

Fig.1 Initial condition.

Parameter settings and Experiment Description

- Creating the vehicle. First we de ne the covariance of the vehicles' odometry which reports distance travelled and change in heading angle.
- Create 10*10 area of volume having 20 stable random searching nodes using MATLAB. Nodes are static in nature.
- Creating the sensor. Firstly de ne the covariance of the sensor measurements which report distance and bearing angle.
- Create the filter. First we need to determine the initial covariance of the vehicle, this is our uncertainty about its pose (x, y, theta).

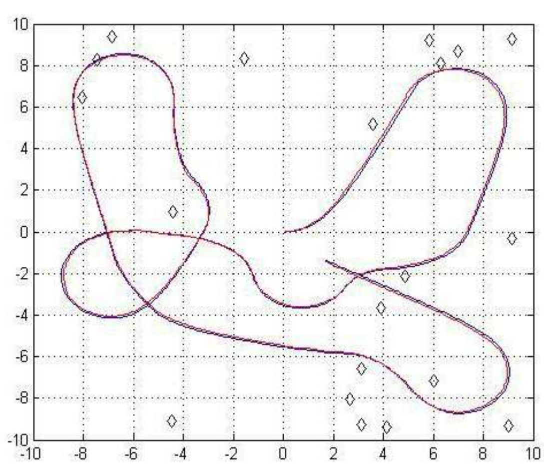

Fig.2 Traversal condition.

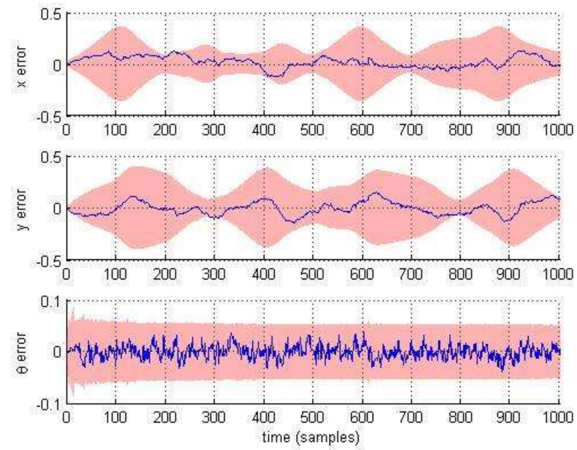

Fig. 3. Result Waveform.

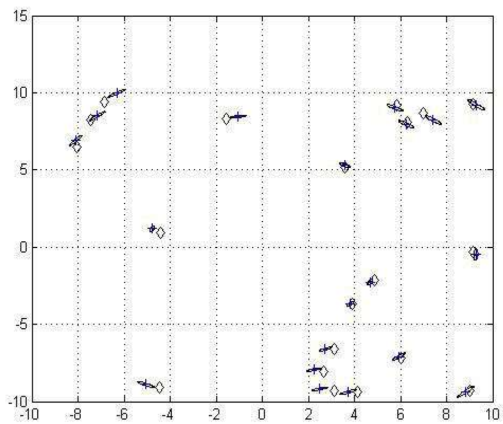

Fig..4 Target Spot condition.

Now we will run the filter for 1000 time steps. At each step the vehicle moves, reports its odometry and the sensor measurements and the filter updates its estimate of the vehicle's pose.All the results of the simulation are stored within the EKF (Extended Kalman filter) object.

1.2 Experiment 2

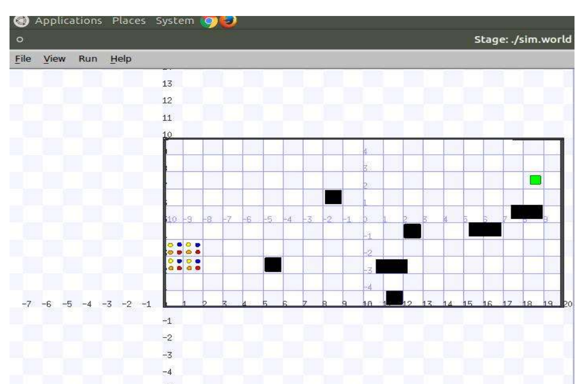

Fig.5 Initial condition.

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Parameter settings and Experiment Description

- create an maneuvering environment having group of sensors (four sensor flock).(Using Player-Stage4.2 and apply Flocking Algorithm)
- Environment consists of 10 dynamic obstacles in different position moving around the area of volume.
- In experiment 2 perform simulation on single target in the environment and the dynamic obstacles are hurdles between flocks and target.

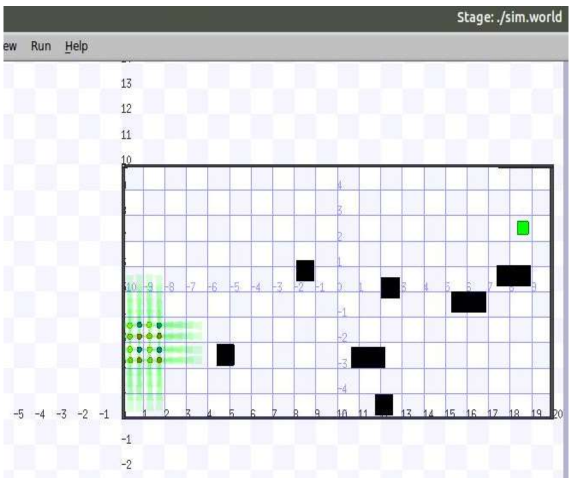

Fig.6 Start Range of Flocks.

- In this stage of result flock sensors are activated having specific range and move towards the target.
- Black blocks are different obstacles are having non constant velocity. We can also change the position of the obstacles; accordingly target tracking time may change.
- In this position of result target is static in nature and it become dynamic in nature in next experiment.

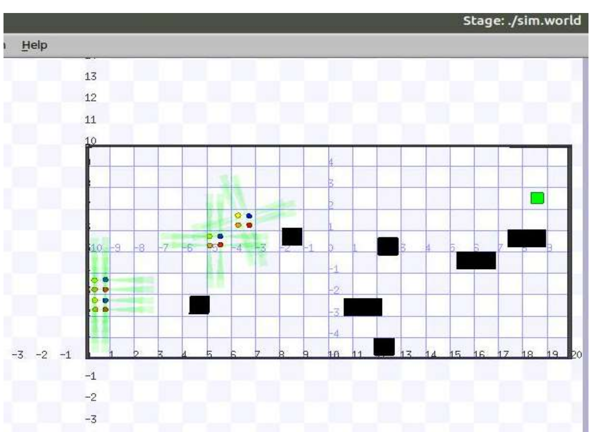

Fig.7 Flocks Target Searching

- Flock of sensor move forward for searching of the target.
- Obstacles situated in the environment. Whenever the flock of sensor hits to the obstacles they change their direction accordingly using minimum distance concept.
- Main condition related to flock of sensor is that they must be in flock, not individually move into the environment

IV.RESULTS AND DISCUSSION

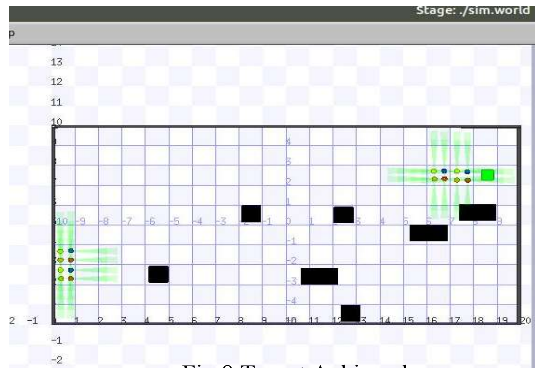

Fig.8 Target Achieved

- Passing through the different hurdles, the flock of sensor finally reaches to the target. When-ever the sensor range reach to the target it automatically stop at that position.
- Due to the position and number of the obstacles the target tracking time duration may be differ.
- The difference of the target tracking time due to movement of hurdles.

1. Experiment 3

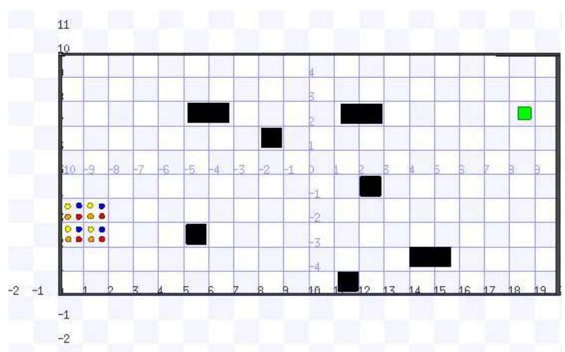

Fig.9 Initial Condition 2

Parameter settings and Experiment Description

- In experiment 3 the parameter and environment is same as
- Experiment 2 .
- The only difference is the position of the obstacles, because it decide the overall target tracking time of the flock of sensor.
- In this stage of experiment 3 the position of hurdles is change as compare to experiment 2

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- Time difference is clear after comparing both the experiment 2 and 3.

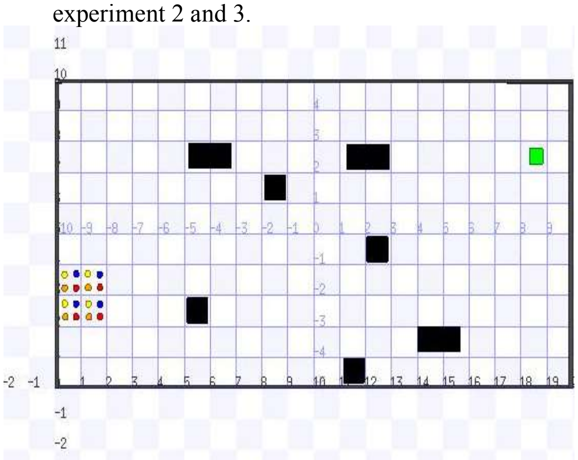

Fig.10 Start Range of Flocks

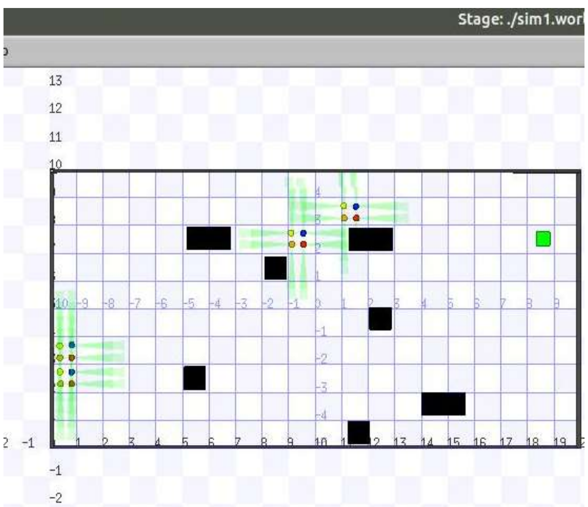

Fig.11 Flocks Target Searching

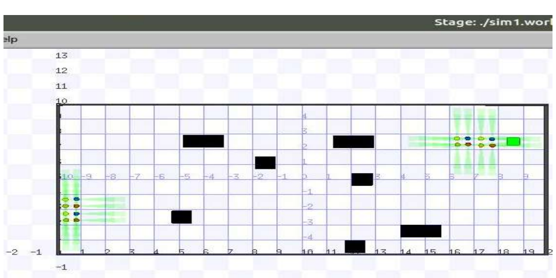

Fig.12 Final Target Tracked.

- In experiment 3 the starting and traversing of the flock of the sensor is same as the experiment 2.
- The position of the obstacles in the xy-plane is different in each stage so we can say that they are dynamic in nature.

2. Results and discussion

Derive conclusion about how far the set gaps were lled and if not, the reason for the deviation. Overall conclusion is that the main objective target tracking in maneuvering environment is achieved using flocking algorithm with the help of player-stage. We performing the two experiments to clear that the target tracking time may di er environment to environment and it depends upon the interaction between flock of sensor and obstacles. On the basis of the work done so far and proposed methodology we can draw following. conclusions

- We are able to present a clear view of effectiveness and efficiency of Flocking and Semi-Flocking algorithms in tracking of non-constant speed maneuvering targets in a surveillance application.
- Flocking algorithms are not that much sufficient to track maneuvering targets perfectly, because non-linear targets change their velocity and direction frequently.
- Clustering methods were added to the Flocking and Semi-Flocking algorithms for tracking both linear and non-linear targets.
- It greatly increases target coverage, local communications, low computation overhead for the sensors, high flexibility and scalability.

Need of reduce the chance of missing maneuvering targets by applying methods and techniques that predict the next positions and place of targets.

3. Compared Result

The below graph compare the performance of all three experiments in different parameter and below table showing the time taken analysis to perform the experiments

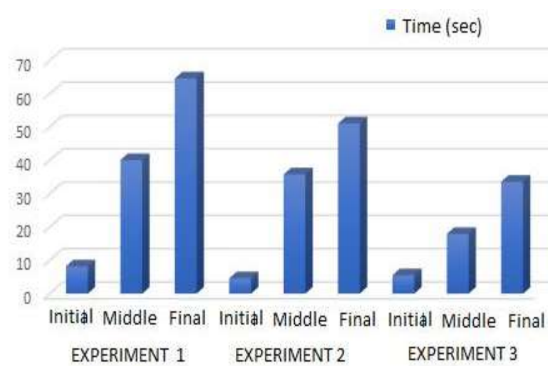

Fig.12 Experiment Comparison.

Table 1 Target Stage Time Comparison

Experiment	Initial	Middle	Final
First	8s 200msec	40s 100msec	1m 4s 600msec
Second	4s 600msec	35s 800msec	51s 100msec
Third	5s 500msec	17s 900msec	33s 600msec

V. CONCLUSION

After performing the several experiments we finally concluded the performances of Target tracking in maneuvering (non-linear) environment is challenging due to it's sensors are managing maneuvering targets that alter their speed and course regularly and suddenly.

- To get the relative results we apply the Flocking Algorithm to develop flock of sensors using Player-Stage4.2.
- Create an maneuvering environment having different obstacle position and reduce the chance of missing non-linear targets in flocking-based algorithms.
- finally conclude different target tracking time in maneuvering environment due to number of obstacles and target.

As a future work, we will consider diminishing the possibility of missing non-linear targets(maneuvering targets) in flocking based method by applying strategies that anticipate the following places of targets and after that guide the sensors toward such positions by coordinating the center point of flocks to the anticipated positions. Additionally, introducing mathematical examination to demonstrate the meeting of the proposed limitation k-mean algorithm is one of the significant works that can be considered as the future work of this exploration

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