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A Review on Different Algorithms for Tracking in Maneuvering Target Environment

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***Abstract* - Self-organizing capacity is the most important need of modern sensor networks; particularly for tracing or tracking maneuvering (non-constant) targets. In this paper we presented the different technique of maneuvering Tracking algorithm & also we are proposing which technique is best for this tracking system. In this research brief literature review of different existing algorithm for maneuvering tracking system and proposed a system for maneuvering tracking system for modern sensor network.**

***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 . A target tracking system through WSNs can have several advantages:

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

However, the use of sensor networks for target tracking presents a number of new challenges. 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. 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 topologic outline about Surveillance applications include self-composed mobile sensors.

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. 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 arterial.

II. LITERATURE REVIEW

In this section the detailed introduction of related literature is given. The capacity of sensors to self-arrange is an essential asset in surveillance sensor networks. To point out the issue of sensor control and coordination in sensor networks. These methodologies are exemplified by the two main algorithms, namely the Flocking algorithm and the Anti-Flocking algorithm.

1 Key Related Research

- **Semi- flocking algorithm development control of adaptable sensors in large-scale surveillance systems.**

Target tracking in different condition, based on whether agents move toward the similar target or toward discrete targets, two kinds of potential functions are introduced to carry out the flocking algorithm. In (Semnani, S. H., Basir, O. A. (2015)) The Semi-Flocking algorithm approaches the issue by assigning a small flock of sensors to each target, while in the meantime leaving few sensors free to explore the environment. Semi-Flocking algorithm, an approach for controlling the development of versatile sensors in surveillance applications. Main aim is decreasing the possibility of missing already detected targets in the Semi-Flocking algorithm, by applying methods that de ne the next positions of targets and afterward direct small flocks of sensors toward such places[1].

- **Flocking algorithm with multiple target tracking for multiple agent systems**.

Multiple targets tracking for multiple agent systems. In (Luo, X., Li, S., Guan, X. (2010)) It is supposed that each target can accept a specific number of agents. Each agent should follow the rules: Cohesion, Separation, and Alignment. Flocking algorithm is used for multiple target tracking. In the algorithm we consider that every agent has interactions with its neighbors within a de ne bounded workspace and knows the location and speed of every target. A collective potential function and a repulsive potential function have been used to resolve the problem. It Make difficult when agents move at the non-constant speed at the time of flocking process[3].

- **Wireless sensor deployment related to distributed flocking algorithm.**

In (Zhang, L., Zhu, Y. (2015, September)) a distributed deployment algorithm for wireless sensor networks. The approach imitates the grouping behavior to move sensors to suitable positions around the target area of interest (TOI). The first approach is based on a potential function, which controls the distance between each pair of flock-mates. Proposed algorithm or method can achieve a more uniform deployment, when the TOI is either linear or non-linear [2].

- **Constrained clustering for flocking-based tracking in non-constant target environment.**

Surveillance applications involve self-organized movable sensors. In a surveillance application, there are two types of targets mainly in consideration based on their motion type: maneuvering (non-constant) and non-maneuvering (constant). Author proposed a Constrained clustering for flocking-based tracking in non-linear target environment, in which K-means algorithm is applied for make much more precise, compact and separate groups. Calculation incredibly builds target scope in running based strategies, particularly to maneuver targets. Key goal is decreasing the chance of missing non-linear targets in flocking-based algorithms by applying methods that estimate the next move of targets and then give direction to the sensors toward such positions by checking the center of clusters to the estimated positions [6].

2 Research gaps

The flocking concept has been introduced in various perspectives. Studies can be found in different disciplines. In non-maneuvering (linear) environment target tracking, chance of missing the target is less. The most of the research is done in in non-maneuvering (linear) environment but when we talk about the maneuvering (non-linear) target environment the chance of missing the target is more due to its speed and direction. So we apply the Flocking algorithm to achieve our desire objectives

3 Problem/Motivation

Mobile sensor network and sensors: mobile sensor network (MSN) is a network which implements lot of autonomous sensors to observe physical or environmental conditions and passes the collection information to a main location. Inside the MSN, there are many devices, named sensor can distinguish events or changes from environment and provides corresponding result. There are many kinds of environment information that a sensor can detect: temperature, humidity, light etc. In recent years, MSN is very useful in environment monitoring, such as: air pollution, forest re detection, landslide detection.

- Control and coordination problem: Main important challenge in large-scale surveil-lance 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. This issue is much all the more di cult when sensors are managing moving focuses on that change their speed and course much of the time and suddenly.
- Foresee the next positions of targets: In non-maneuvering (linear) environment where target has a constant velocity. But in the maneuvering (non-linear) environment where target has different speed and direction. In such case predictions to next place of targets is required and then give direction to the sensors toward such positions.
- Research motivation: As the result, for Surveillance applications Mobile robots cooper-ating in flocks offer several advantages, e.g., redundancy and flexibility, and can sometimes give the results that would be not possible for single robot. So it is not easy to build an application level simulation to create and analyze the potentials as well as the problems before real implementation in environment. For the execution viewpoint, there are various essential inquiries that have enlivened this work:

  a. How do all robots function to fulfill the three standards flock centering, hurdles Avoidance, speed matching in dispersed way?
  b. How do robots in groups perform deterrent avoidance?
  c. How do robots frame into a desired development and keep it during flocking?
  d. What is the base presumption that necessities to make robots run?
  e. What happens if a few robots are crashed?

4 Problem formulation

When we talk about flocking, certain questions may arise that what type of the problems we need to target on flocking, and in what type of methods to solve such problem. Following this concept, in this section, we first out the problems are existing in the flocking environment. Then we introduce many famous system models for wireless robots cooperation. The another question may come into the mind, how a robot knows other robots are crashed or safe, and how the remaining safe (correct) robots effectively coordinate and cooperate with each other. Keep these questions in mind, in the following we implement and analyze the already existing robots flocking algorithm. Then try to find the solution.

III. METHODOLOGY

In this section 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 maneuvering 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.

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

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.

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

2.2 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.

3. Research work flow

- According to the research goals, the report will elaborate the work flow as below:
- Using the flocking algorithm develop the group of sensors (flocks) having range in the area of volume.
- Using player-stage 4.2 create different environment having obstacles, group of sensors, targets.
- Developing and analyzing the flocking algorithm for the coordination and interaction be-tween obstacles, flocks and targets.
- By these de ne algorithms to develop a simulation with different environment and compare with other existing algorithms.

IV. RESULTS

On the basis of the proposed methodology we can draw following Result:

- 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.

V. LIMITATION

The Flocking algorithm is working on three main Reynolds rules:

- Alignment: - Alignment is a behavior that makes a specific operator line up with specialists close by. Flock focusing plans to keep every molecule near its adjacent flock-mates of this exploration.

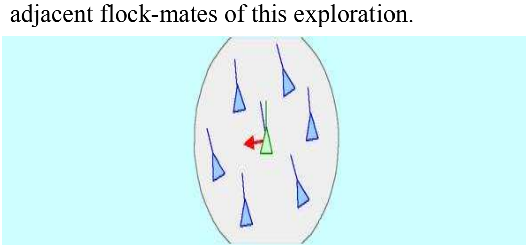

Fig. 1: Alignment

- Cohesion: - Cohesion is a behavior that guides agents to move towards the "center of mass" - that is, the average position of the agents within specific radius. Collision avoidance tries to avoid crash between nearby flock-mates.

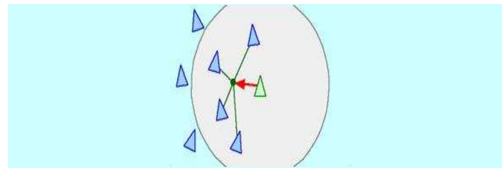

Fig. 2: Cohesion

- Separation:- Separation is the conduct that make an agent to far away from all of its neighbors. The implementation of separation is very similar to that of alignment and cohesion. Speed matching intends to match the speed of each particle with that of all nearby flock-mates.

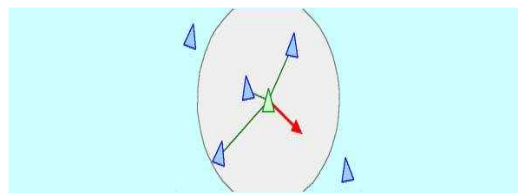

Fig. 3: Separation

VI. CONCLUSION

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. 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.

Flocking-based methodologies are organically inspired techniques that have recently picked significant attention regarding address the control and coordination issue in self-organizing sensor networks. The Semi-Flocking calculations. In spite of the fact that these two calculations have exhibited promising execution in following straight target(s), they have deficiencies in non-constant moving targets. Although the Semi-Flocking algorithm provide good target coverage for linear targets, it is less effective in covering non-linear targets.

We talk about the effectiveness of Flocking and Semi-Flocking algorithms in tracking maneuvering 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.

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