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SURVEY ON UNDERWATER ACOUSTIC SENSOR NETWORKS TO MAXIMIZE TARGET COVERAGE BY USING EFFICIENT CAMERA SELECTION

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Abstract
Cameras have been recently fixed to monitor the targets in the underwater using acoustic sensor networks. Since capturing and processing the targets by cameras needs large amount of battery power also needs to sort out the obstacles in underwater. Due to the lack of battery power cameras are kept in a sleep mode and activated only when the ultrasonic wave detection of the target. The proposed system enhances the relocation of a camera structure in underwater to extend the coverage area of the targets to be monitored with small number of activated cameras in the network. By getting the most of the activated camera orientation and frustum in 3D covered by the sensors which shows the coverage of each acoustic sensor in advance. Whenever the target is detected this information is then used and sent to the other sensors that detected the same target. When compared to floody based approach the proposed solution show that quickly detection of targets with least number of camera movement.

Introduction
Underwater acoustic sensor networks consist of large number of sensors above and below the water that interacts through the acoustic links. When compared to the wireless sensor networks this UWASN also provides the advantages of coverage quality, labor, cost and deployment. In previous research and studies related to the underwater communications describes, the RF signals was not well working in the underwater. The recent research has the main focus on the design of the acoustic network, channel modeling, medium access, sensing and routing issues.

Acoustic sensors with battery operated cameras were working together to perform object sensing and identification using image/video of the object being monitored. Using a mechanism such as pump it moves the sensors and the cameras vertically. It requires large amount of battery power for processing and transmission of multimedia data so that cameras kept in sleep mode and used only when it needed. If an ultrasonic sensor detects the target then it activates the camera to capture the target at certain time. If there is no cameras nearest to the target then it may not capture the target. To solve this problem the depth of the camera needs to be adjusted to go closer to the target. The challenge is that cameras need to be fixed in a distributed manner to cover the maximum coverage area of the target with minimum overlap.

The location and orientation are considered as a central concern of the system. Finding the right location is difficult because it depend on the cost of depth adjustment. Camera orientation is used for detecting the target is fully covered and detecting the overlap coverage. The goal of the present study is to minimize the cost of the total energy which includes depth adjustments and also assuring the maximum coverage area of the target. The alternative solution of having the full coverage area with high cost of large number of overlaps is large coverage area with less overlaps and low power consumption.

The another challenge is that communication delay. Best selection is using 1-hop cameras because the information transmitted from cameras within multi hop is not sufficient to capture the target. There is also chance that the target may leave from the cameras view if the target leaving fast still the camera is altered and moved to right depth of the underwater. The biggest issue in UWASN is propagation delay at most of the time. The problem in this study includes the time to be considered with this. Connectivity is considered as another constraint. There is no proof that the camera is still connected to the rest of the area after adjusting its depth to an optimal location. If the sensors does not work properly then the captured data can transmitted directly. And also camera needs to relocate its position to communication with other sensors which results failing in capturing the target. Therefore the camera and sensors in a particular location provides a guaranteed communication within them.

Literature Review

There are two subsections 1.UWASN coverage and connectivity 2.Camera coverage.

A. UWASN coverage and connectivity

Assume both random and manual node deployment to achieve the full coverage and connectivity in UWASN. The main goal is to examine the sensing of object and communication between the camera and the sensors in the network. There may be the conditions for data transmission to achieve the degree of connectivity and coverage.

There is a problem of attaining a maximal 3D coverage with minimal number of sensors. Here random deployment has been ignored and manual deployment was considered to determine the minimal number of sensors. 3D applications required space filling polyhedrons and the number of sensors and coordinates of the area corresponds to the central control then these are the optimal solutions. The algorithm can be used in distributed manner by selecting the leader node among all nodes requires each node capable of moving to the desired location in 3D space.

In addition coverage improvement has been determined in both distributed and centralized manner. Here the bounds used to check the effectiveness of the random node deployment scheme for UWASN. Sensors were fixed at the bottom of the ocean with gateway nodes. When the sensors captures any information it will sent to the nearest gateways which then forwards the data through vertical communication link to the floating buoys on the surface. After the deployment of the sensors at the bottom of the ocean it needs to adjust the depth to provide 1-coverage. The random initial deployment is based on grid. The central station has the control over the deployed sensors where the sensors to go from the initial position to achieve the 1-coverage.

Based on the coverage the adjusted node level is overlap with their neighbor nodes. Nodes were clustered to determine the sensor coverage overlaps and links defined to check any overlap exist between any two nodes. Graph coloring method is applied to each nodes to calculate the new depth for each colors. Eliminate the possible overlap occurred among nodes in different groups. This has a significant improvement in coverage and not a guaranteed connectivity. The ensured connectivity is achieved only within a certain transmission and sensor range. But it cannot provide a guarantee connectivity in all cases also distributed algorithm is proposed to improve coverage in UWASN. Here the nodes are deployed at the top and connected to the floating buoys with wires. After this the nodes depth are adjusted to improve the coverage

UWASN either be stable where the sensors deployed to the bottom of the ocean or floating buoys. In another case fewer nodes pushed and moved to underwater. Due to cost constraints sensor nodes can move freely according to the acoustic environment. Nodes which has a capability of navigation is called underwater autonomous vehicle. UAV populated in the network for localization and data collection. These floating sensor nodes submerged with several number of meters depth underwater to provide the measurements from an oceanic environment. In mobile UWASN cases nodes can move according to the force, surface winds and underwater currents. There are many mobility models for UWASN these are different from the mobility of nodes in the MANET. Tidal current model is one of the UWASN based mobile model according to this model, the tidal changes ruled the motion of the sensor. Ocean current modeled as layers with equal thickness and varying speeds. Sensor nodes would move according to those currents is assumed. Another model presents the group mobility for UWASN. In this model the layers consist of non negligible correlation between them. Underwater mobility model is refer to the meandering current mobility model which depends on mathematical model of the ocean currents. The initial version of MCM deserves the sub surface behavior where as extended version deserves surface mobility. The mobility of UWASN is the combination of random motion resulting from the surface winds and sub surface current induced motion.

Camera Coverage

Target coverage in underwater acoustic sensor network using camera has few simple works. To maintain a full coverage of the object to get a 3D image or video of the object involves two cameras working parallel with each other. Using single camera is not sufficient to cover the object image. Due to the low cost of the sensors the target can be viewed using wireless camera sensors with large number of sensors depend on the field interest. The field of view of the cameras are calculated for 3D objects. There are number of solutions for surveillance system and monitoring areas of the target. To achieve efficient WMSN object related phenomena is used instead of geometrical one. To maintain some constraints make sure monitoring area is controlled by high quality video stream. Cross layer system is designed for wireless multimedia sensor to enhance the video quality.

Based on the video network integration of camera coverage and routing problem is a solution applied for traditional WSN. To design routing more scalable to video based wireless sensor network is suggested. The challenges faced by wireless sensor network is processing time and coverage. Based on energy consumption partial coverage of the target is captured by the participated cameras. Here we are monitoring the full coverage of the target.

Based on the collaboration among multi wireless camera sensors the 3D representation of the target is produced and its exploration and analysis is improved. There is no necessity for this since we set the camera to slept mode unless it detects the target object by acoustic sensors. In 3D environment reducing FOV of cameras, eliminating redundant data is considered. Here target points for reducing camera overlapping with the support of topology and robust algorithm. Since all of these approaches mentioned target location is uncovered here uncovered target location is reachable. The algorithm of coverage defines to select the camera with higher coverage and minimum distance is the best displacement to the target. A mathematical model is used to calculate the distance between the cameras or between camera and the object since there are no papers about the calculation of distance. Since we have not used UAV but it will show the exact distance between them.

Acoustic Sensor Setting

Acoustic sensors are also called as multimedia sensors and is represented as a spherical shape that detects any targets passing through their sensing ranges. The sensor ranges about to 10 meters and according to the topology arrangements. Acoustic sensor build underwater topology since they act as a detector nodes, sending, receiving, calculating results. Collaborative monitoring is performed when they are deployed on the bottom or the floating surface. Here using distributed connected topology called connected dominating set for energy saving purpose by communication between nodes within 1-hop node.

Target Setting

The target is represented as a rectangular prism in a 3D shape 3D underwater environment. The challenge faced by the camera is to maximize the coverage area of the 3D shape object in underwater. The critical points and key points of ASIFT algorithm is used to measure the coverage.

3D target is fully covered in UWASN all the target critical points are covered by the FOV of the 3D based cameras regardless of their orientation. Assume rectangular prism with five critical points, each edge has two points and centroid of the prism which act as a center point of a rectangular prism. Calculate the other four critical points using centroid of the prism. If acoustic sensor m detects the target then these points can be calculated. Here target point act as a centroid. By knowing the centroid position the critical points can be calculated from the centroid.

It is not possible to capture a 3D object alone at one time using by using single 3D camera environment. We need at least two cameras to cover the full coverage of the target object. Many cameras targeted at an object is considered to obtain full coverage is the best scenario. There may be various sizes of objects, testing these in different scenarios produces different results.

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Conclusion

In UWASN, distributed approach has a huge demand because of the nature of the battery powered acoustic and multimedia sensors. The challenging aspect in a 3D environment is monitoring the area coverage includes several things need to be considered.

Here established an algorithm to maximize the camera coverage of an object which is discovered by acoustic sensor in underwater. The proposed algorithm described that the nearest camera to the object moving is maximizes the target coverage. Since the vertical directions of the object movement does not guaranteed full coverage. Otherwise the approach reduces the movement of the cameras. The successful approach is that showing the well located cameras can be activated to cover the object. Assuring full coverage with the worst topology scenario that is dark or low light environment is the future enhancement. UAVS participated in obtaining full coverage involves fault tolerances of messages among topologies.

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